Intrahousehold Resource Allocation in Developing Countries
Other Books Published in Cooperation with
the International Food Policy Research Institute

_Agricultural Change and Rural Poverty: Variations on a Theme by Dharm Narain_
Edited by John W. Mellor and Gunvant M. Desai

_Crop Insurance for Agricultural Development: Issues and Experience_
Edited by Peter B. R. Hazell, Carlos Pomareda, and Alberto Valdés

_Accelerating Food Production in Sub-Saharan Africa_
Edited by John W. Mellor, Christopher L. Delgado, and Malcolm J. Blackie

_Agricultural Price Policy for Developing Countries_
Edited by John W. Mellor and Raisuddin Ahmed

_Food Subsidies in Developing Countries: Costs, Benefits, and Policy Options_
Edited by Per Pinstrup-Andersen

_Variability in Grain Yields: Implications for Agricultural Research and Policy in Developing Countries_
Edited by Jock R. Anderson and Peter B. R. Hazell

_Seasonal Variability in Third World Agriculture: The Consequences for Food Security_
Edited by David E. Sahn

_The Green Revolution Reconsidered: The Impact of High-Yielding Rice Varieties in South India_
By Peter B. R. Hazell and C. Ramasamy

_The Political Economy of Food and Nutrition Policies_
Edited by Per Pinstrup-Andersen

_Agricultural Commercialization, Economic Development, and Nutrition_
Edited by Joachim von Braun and Eileen Kennedy

_Agriculture on the Road to Industrialization_
Edited by John W. Mellor
Contents

List of Figures and Tables  ix
Preface  xi
1 Introduction: The Scope of Intrahousehold Resource Allocation Issues  1
   LAWRENCE HADDAD, JOHN HODDINOTT, AND HAROLD ALDERMAN

PART I  Modeling Intrahousehold Resource Allocation

2 Specification and Estimation of the Demand for Goods within the Household  19
   MARK M PITT

   PIERRE-ANDRÉ CHIAPPORI

4 The Policy Implications of Family Bargaining and Marriage Markets  53
   MARJORIE B MCELROY

5 Separate-Spheres Bargaining and the Marriage Market  75
   SHELLY LUNDBERG AND ROBERT A POLLAK

6 Separate Spheres and the Conjugal Contract: Understanding the Impact of Gender-Biased Development  95
   MICHAEL R CARTER AND ELIZABETH G KATZ

7 Endowments and Assets: The Anthropology of Wealth and the Economics of Intrahousehold Allocation  112
   JANE I GUYER

PART II  Measuring the Outcomes of Intrahousehold Resource Allocation

8 Testing Competing Models of Intrahousehold Allocation  129
   JOHN HODDINOTT, HAROLD ALDERMAN, AND LAWRENCE HADDAD
Contents

9 Incomes, Expenditures, and Health Outcomes: Evidence on Intrahousehold Resource Allocation 142
DUNCAN THOMAS

10 The Application of Anthropological Methods to the Study of Intrahousehold Resource Allocation 165
JOEL GITTELSOHN AND SANGEETA MOOKHERJI

11 Inequality in the Intrafamily Distribution of Food: The Dilemma of Defining an Individual’s “Fair Share” 179
HOWARTH E. BOUIS AND CHRISTINE L. PEÑA

12 Gender Bias in Intrahousehold Nutrition in South India: Unpacking Households and the Policy Process 194
BARBARA HARRISS-WHITE

13 Finding the Ties That Bind: Beyond Headship and Household 213
JUDITH BRUCE AND CYNTHIA B. LLOYD

PART III The Policy Relevance of Intrahousehold Resource Allocation

14 Family Resources and Gender Differences in Human Capital Investments: The Demand for Children’s Medical Care in Pakistan 231
HAROLD ALDERMAN AND PAUL GERTLER

15 Gender Asymmetries in Intrahousehold Resource Allocation in Sub-Saharan Africa: Some Policy Implications for Land and Labor Productivity 249
JENNIE DEY ABBAS

16 Gender Coalitions: Extrafamily Influences on Intrafamily Inequality 263
NANCY FOLBRE

17 Policy Issues and Intrahousehold Resource Allocation: Conclusions 275
HAROLD ALDERMAN, LAWRENCE HADDAD, AND JOHN HODDINOTT

References 293

List of Contributors 325

Index 329
Figures and Tables

Figures

4.1 Relationships among partial-equilibrium models of family decisions 61
4.2 Baseline case 64
4.3 Case 1 versus baseline case 67
4.4 Case 2 versus baseline case 68
4.5 Case 3 versus case 2 and baseline case 70
5.1 The household Nash bargaining solution 82
5.2 The marriage market and division of the child allowance 91
6.1 Equilibrium Z-good labor supply (transfer level fixed at θ) 100
6.2 Conjugal contract and Z-good labor supply 101
6.3 Conjugal contract and intrahousehold welfare 102
10.1 Nepali terminology and the concept of “household” 169
10.2 Multidimensional scale of pile sort data: foods commonly given to weaning-age children in Kulari village, The Gambia (N = 11 mothers) 172
11.1 Deviations from 1.0 of proportions of nonstaples over proportions of calories, by food group and type of household member 188
11.2 Deviations from 1.0 of proportions of nutrient intakes over proportions of calorie intakes, by type of nutrient and household member 190

Tables

2.1 Differential effects of infant illness on household activities of daughters, sons, and mothers relative to home care 27
2.2 Effects of calorie consumption, activity level, and pregnancy status on weight-for-height 33
2.3 Effects of personal characteristics on individual calorie consumption 36
3.1 Tests of the consumption models 48
Figures and Tables

9.1 Distribution of income within the household by total, labor, and nonlabor incomes: means and standard errors 148
9.2 Sample summary statistics 150
9.3 Effects of male and female income on budget shares: quadratic model with interactions, effects evaluated at mean 154
9.4 Effects of male and female income on nutrient demand: quadratic model with interactions, effects evaluated at mean 158
9.5 Effects of male and female income on child anthropometric outcomes: linear model 160
9.6 Restricted samples: effects of income on demand, two-stage least squares, nonlabor income as instrument 162
10.1 The anthropological toolbox 166
11.1 Food expenditures, food prices, and kilograms consumed, by expenditure quintile and food group 183
11.2 Calorie intakes per adult equivalent and calories purchased per peso of expenditure, by expenditure quintile and food group 184
12.1 Individualism in research on gender and seasonal biases in nutrition using ICRI SAT data 206
13.1 Percent of children living away from mothers, by age 218
13.2 Percent of a child's years spent in female-headed households, by household type 220
14.1 Descriptive statistics of data used in this analysis 241
14.2 NMNL model of medical care provider choice, estimate coefficients, and t-statistics 244
14.3 Arc price elasticities by income and gender 245
14.4 Arc income elasticities of demand by demand and gender 246
14.5 Predicted probability of choosing a provider by income and gender 247
Preface

The study of intrahousehold allocation—that is, understanding how rights, responsibilities, and resources are allocated among household and family members—is a relatively new field of study. The “new household economics” movement of the 1970s expanded the set of individual and household decisions that were examined by economists. The 1980s witnessed a growing chorus of dissenter}s when it came to treating all household members as if they behaved as one—as represented by a “unitary” model of household decisionmaking. Specifically, the dissenter}s argued that both altruism and conflict needed to be incorporated into household models for realistic predictions of individual behavior in response to prevailing incentives. The 1990s have, so far, seen four new developments. First, use of the unitary model to study intrahousehold issues increased. Second, there was a boomlet of alternative economic models of the household, or “collective” models of household decisionmaking. Third, a range of new methods—quantitative and qualitative—was developed to operationalize these new models. Finally, the relevance of intrahousehold issues for policymaking began to be articulated.

This book attempts to lead the reader through this sequence of events up to early 1997 in intrahousehold models, methods, and related policy applications, especially in the areas of poverty, agriculture, food security, and nutrition—aeras that are critical to the mandate of the International Food Policy Research Institute (IFPRI). It also reviews those areas in which future research would be most valuable.

Although the writing of this book was not always conflict free, we did manage to draw upon enough altruism and cooperation to fill many household black boxes. Many individuals have contributed to the book’s successful completion, and we are grateful to them all. A special note of thanks is due to those listed here.

First and foremost, we thank Roger Slade of the World Bank. This book is based on a three-day workshop organized by IFPRI and the World Bank and held in Washington, D.C., in February 1992. Roger deserves much of the credit
for making that workshop happen through his intellectual, moral, and financial support.

The workshop was organized by Julia Addae-Mintah, Kimberly Chung, Laurie Goldberg, Rajul Pandya-Lorch, and Lisa Smith. Serving as discussants at the workshop were Jere Behrman, Lynn Bennett, Margaret Bentley, Sara Berry, Angus Deaton, Barbara Herz, Ravi Kanbur, Sandra Rosenhouse, Irene Tinker, and Patrick Webb. Other key participants included Mayra Buvinic, Anil Deolalikar, Raghav Gaiha, Marito Garcia, Margaret Grosh, Naila Kabeer, Eileen Kennedy, Shubh Kumar, Helzi Noponen, Michael Paolisso, Beatrice Rogers, and Ben Senauer.

We are grateful to the following individuals who served as reviewers for the individual book chapters: Ruth Alsop, Simon Appleton, Richard Blundell, Patrice Engle, Robert Evenson, Gillian Hart, Peter Hazell, Susan Horton, Christine Jones, Laurence Kotlikoff, Michael Lipton, Judith McGuire, Andrew McKay, Mark Montgomery, Jonathan Morduch, Martin Ravallion, Helena Ribe, Mark Rosenzweig, David Sahn, Amartya Sen, and Frances Woolley. Their input strengthened the volume considerably.

We are also grateful to two anonymous reviewers who plowed through the entire volume and generously shared their insights and thoughts with us.

Superlative word processing and editing were provided by Jay Willis at all stages of the volume. Uday Mohan copyedited an earlier version of the volume, Mary Snyder helped with the graphics, Peter Strupp of Princeton Editorial Associates performed the final edit, and Heidi Fritschel managed the book’s production for IFPRI.

Financial and other support for the workshop and for the book has been generously provided by the Office of Women in Development at the United States Agency for International Development under Contract No. FAO-0100-G-00-5020-00 on Strengthening Development Policy through Gender Analysis: An Integrated Multicountry Research Program and under Contract No. BOA-4111-B-00-9112; the (then) Women in Development Division of the Department of Health and Human Resources at the World Bank; the Ford Foundation; and the Rockefeller Foundation.
Intrahousehold Resource Allocation in Developing Countries
1 Introduction: The Scope of Intrahousehold Resource Allocation Issues

LAWRENCE HADDAD, JOHN HODDINOTT, AND HAROLD ALDERMAN

Most development objectives focus on the well-being of individuals. For example, policy targets are often related to the percentage of individuals that can read, are free from hunger, are in good health, can find gainful employment, and will avoid death from disease or violence. Although it is widely recognized that the welfare of an individual is, in large part, based on a complex set of economic and social interactions, development policies do not always acknowledge these. These interactions can affect, and be affected by, the creation, existence, and dissolution of institutions within which the individual is situated: family, household, business, club, or commune, to name a few. For the first two institutions in this list, both the processes by which resources are allocated among individuals and the outcomes of those processes are commonly referred to as "intrahousehold resource allocation."1

Taking this broad definition, this book surveys a diverse body of theory and evidence on intrahousehold allocation. In doing so, it seeks to achieve four objectives. First, it seeks to convince the reader that understanding the process by which household allocations occur is important for policy and project design. This point is discussed implicitly in many of the contributions to the first two parts of the book and is the dominant theme of Part III. Second, there is much confusion regarding the theoretical models that can be brought to bear on these issues, as exemplified by two common misunderstandings:

1. It is sometimes claimed that models in which the household is posited to act as a single decisionmaker (the "unitary" model) are silent on the issue of intrahousehold distribution. As discussed in this chapter and in the chapters by Pitt and Alderman and Gertler, this is simply wrong.

1. Models used for examining how resources are allocated among a group of individuals are most usefully employed if they can be applied to the group that exhibits the greatest social and economic interdependence. They can be characterized in a number of ways: coresident, eating from a common "pot," and blood relatives, to name three. Of equal importance to the usefulness of intrahousehold models is some knowledge of how the group of individuals came together in the first place. These issues are discussed in Chapter 8.
2. The suggestion that an alternative to the unitary model is a "bargaining" model neglects the important fact that there are at least four variants of these models (broadly termed "collective" models), as outlined here by Chiappori, McElroy, Lundberg and Pollak, and Carter and Katz.

Thus a second goal of the volume is to clarify the various theories that can be brought to bear on intrahousehold allocation. Part I of the book is devoted to outlining current thought on a variety of theoretical models.

A third objective is to indicate that, although substantial progress has been made on the theoretical front, a number of major measurement and econometric issues remain unaddressed. This point is emphasized in Part II of the book. The fourth objective is to suggest that further work on intrahousehold allocation will benefit substantially from interaction among researchers across a number of disciplines. For example, Guyer (Chapter 7) suggests that economics and anthropology appear to be heading toward a "new convergence of concern" around the nature and use of assets. Gittelsohn and Mookherji (Chapter 10) and Bouis and Peña (Chapter 11) illustrate how the measurement of intrahousehold allocations can be enhanced by drawing on techniques from anthropology and nutrition.

Certain topics relevant to this volume have been recently covered in detailed reviews (Hart 1995; Strauss and Beegle 1995; Strauss and Thomas 1995; Behrman 1996). As there should be, there has been much interplay between these reviews; we have benefited from having read them while preparing this overview. This volume is to be regarded as a complement to, not a substitute for, these works. In particular, more attention is devoted in this volume to a comparison of different collective models, to policy issues, and to the possibilities for collaboration across disciplines. In addition, by virtue of having worked with 19 contributors, we have been able to appreciate much of the breadth of the literature. In contrast, less attention is paid to detailed models of allocation within a unitary context, nor is there an attempt to provide a detailed review of the empirical literature in this area—fine reviews of these subjects can be found in Behrman and the two readings coauthored by Strauss. Such an emphasis should not be interpreted as a bias in favor of any one model of intrahousehold allocation, but rather as an illustration of how economists, sociologists, and anthropologists have begun to forge new tools to deal with the perceived inadequacies of existing methodologies.

A comment is also in order regarding the focus on developing countries. Many innovations in the theory of intrahousehold allocation have been formulated with developing countries in mind. Moreover, many of the empirical applications pertain to issues prevalent in low-income countries (for example, Pitt and Rosenzweig 1985, Jones 1986, and Thomas 1990). Since a function of this book is to provide a survey of this literature, it is natural that it
draws heavily on this material. But as should be clear, there is much that economists and other social scientists whose geographic focus lies in the United States, Britain, and other developed countries can learn from these discussions.

The purpose of this chapter is twofold. The primary goal is to outline the models, methods, and policy tools associated with the analysis of intrahousehold resource allocation. In doing so, we explain how the individual chapters in this volume contribute to a better understanding of these issues. We have tried to convey the diversity of the theoretical approaches that can be taken, the degree of mathematical sophistication, the scope of intrahousehold issues, and the policy recommendations that can be made. In doing so, we seek to demonstrate that there is a range of models and tools that can address specific aspects of the broad question of how families and households allocate resources among members.

Models

Unitary Approaches to Intrahousehold Allocation

The idea that the household represents a locus of economic activity dates back at least to Chayanov’s study of Russian peasants, first published in 1926 (Chayanov 1986). However, the economics of the family and the household was fully brought into the mainstream by Gary Becker, the 1992 Nobel Prize winner in economics, in the mid-1960s. The essence of Becker’s approach was that, in accordance with a single set of preferences, the household combines time, goods purchased in the market, and goods produced at home to produce commodities that generate utility for the household (Becker 1965).

Until fairly recently, most economists have shared this view of the household. Though this approach originates in standard demand analysis, it has been extended to include the determinants of education, health, fertility, child fostering, migration, labor supply, home production, land tenure, and crop adoption. Particularly important in the context of developing countries has been the work by Singh, Squire, and Strauss (1986), who provide a joint model of production and consumption decisions. In Alderman et al. (1995), such models are called the “unitary” approach. They are sometimes referred to as the “common preferences” model, the “altruism” model, or the “benevolent dictator” model. The unitary model is so named because this label describes how the household acts (as one), whereas other such labels tend to reflect the means by which the household is hypothesized to act as one.

The unitary model offers a number of important theoretical perspectives on the question of intrahousehold distribution. Consider parental investment in children. Assume the existence of a welfare function that reflects parental
preferences, defined over their own consumption, the adult income of each child, and the size of transfers made to each child (Behrman 1996). This is maximized, subject to two constraints: a parental budget constraint and the earnings production function for each child, itself a function of human capital investments made in that child by parents and that child's initial endowment. Behrman (1996) refers to this very general framework as the "parental altruism model." Placing restrictions on this general approach yields several models of intrahousehold resource allocation.

One restriction, originally due to Becker and Tomes (1976), assumes that parents are concerned solely with their children's total level of wealth and exhibit equal concern for each child. Human capital investments are made in children best placed to generate a higher rate of return on these. That is, parents invest in their children in such a way as to reinforce differences in child endowments. Transfers are made to more poorly endowed offspring in order to equalize children's wealth. Behrman (1996) refers to this approach as the "wealth model." A second approach is the "separable earnings-transfers model" (Behrman, Pollak, and Taubman 1982). By assuming that children's income as adults and parental transfers to children are separable within the parental welfare function, attention can be focused on the determinants of investment in children. These are guided by two concerns. First, parents may be interested in ensuring that all children are equally well off. Alternatively, they may have preferences for particular children; for example, boys over girls, firstborn over latter born, their own children over those whom they raise as foster children. These can be called "equity" concerns, though it is entirely possible that parents prefer unequal outcomes among their children. As in the wealth model, parents also desire to maximize the return on the investment in their children. These are "efficiency" concerns.

Suppose parents care only about equity and have no concerns regarding efficiency. Such preferences imply that they will seek to equalize their children's future earnings but do not imply that all children will be treated equally. Consider the case of parents who want their daughter and son to receive equal earnings but recognize that the daughter will face discrimination in the labor market; specifically, her wages will be less than those of her comparably qualified brother doing the same work. Here parents will devote more resources to their daughter (for example, by providing her with more education) in order to equalize future earnings. Conversely, where parents seek to maximize the total future earnings of their offspring, they invest relatively more in those children with the best future prospects. In the example considered here, parents would invest more in their son than in their daughter. That is, parents "reinforce" existing inequalities in child endowments. It is also possible to construct intermediate cases in which both equity and efficiency concerns play a role.

Mark Pitt's chapter is situated within this literature. Pitt asks how the allocations to one household member affect the allocations to others. Concep-
tually, demand for each good (including home-produced goods such as health) for each individual can be treated as demand equations conditional on the demand for goods allocated to other individuals. However, identification of such models is hampered by the fact that there are more person-specific goods than there are prices, and identification restrictions are required. Pitt illustrates two approaches. One involves cross-individual restrictions on parameters. The other estimates individual endowments that assist in identification of individual caloric demand if the errors in health production functions are uncorrelated with those in the reduced-form demand equations.

**Collective Approaches to Intrahousehold Allocation**

Fundamental to the unitary model is the assumption that there exists a parental, or household, welfare function and that all resources—capital, labor, land, and information—are pooled. Although most researchers acknowledge that the problem of how the common actions come about is not solved, many argue that the unitary model is a useful approximation and that an exploration of the underlying decisionmaking process yields no additional useful information. Others are more troubled by this assertion. These concerns have spawned a set of approaches—the "collective" approaches (Alderman et al. 1995)—which are examined in this section. However, it is important to be clear about the distinction between these approaches. As Alderman and Gertler (Chapter 14, this volume) note, even if a collective approach is used, it is still necessary to explain why a particular household member chooses to invest more in one child than another. The dispute thus centers on whether the unitary model is sufficient to account for all aspects of intrahousehold distribution.

If individual household members have different preferences, the assumption of a household welfare function requires that these differing preferences be aggregated. How can this be accomplished? One possibility, outlined by Samuelson (1956), is that the household welfare function reflects a consensus among members. In a similar vein, Evenson, Popkin, and King-Quizon (1979) have suggested that the household welfare function means that the household members agree to follow certain rules when distributing resources within the household. However, this definition does not indicate how such a consensus is to be reached.

A second approach applies Sen's (1966) model of cooperatives to the household. Here family welfare is the weighted sum of the net utility of all members. But in the absence of a dictator, or "symmetric sympathy," it is unclear how these weights are to be determined. In addition, the aggregate household weights will not be equivalent to a welfare function unless they are independent of prices and incomes, a very strong assumption. Other solutions include assortative mating and internal household market equilibria at implicit pricing (Becker 1973). But assortative mating is less appealing with respect to shared preferences across generations. Moreover, a model of implicit
contracting within a household must still address the problems of monitoring and incentives related to such agreements.

One additional attempt to resolve the problems of aggregation and enforcement is Becker's (1974b, 1981) "rotten-kid theorem." Becker considers the case of a household with two members, a benefactor and a recipient. The recipient is selfish in that he or she derives utility solely from his or her own consumption. The benefactor, as an altruist, can increase his or her own utility by transferring some of his or her own consumption to that of the recipient. Now suppose the recipient undertakes some action that raises his or her own consumption but lowers that of the benefactor. The benefactor could respond by lowering transfers to the recipient, so much so that the recipient's new level of consumption is below his or her original level. Consequently, the recipient will not behave rottenly in the first place. Thus the preferences of the altruist and the preferences of the household converge. This is an attractive result; the preferences of the altruist become the preferences of the household; the household's maximand becomes the utility function of the altruist. However, the rotten-kid theorem only holds under restrictive circumstances.

First, the benefactor must be altruistic over all levels of the consumption of others. If consumption by others is either an inferior or a luxury good, the threat of reduced transfers may not be credible over all levels of consumption. Moreover, the theorem assumes that any attempt by the recipient to disrupt the given distribution of consumption is small relative to that available to the altruist. That is, a kid could not be so rotten that he reduces the altruist's consumption below his initial endowment while raising his own above its previous (endowment plus transfer) level. Furthermore, not only must the resources of the altruist be larger than those of any one individual, they must also be larger than those of any coalition of household members. If this were not the case, it might be possible for a group of individuals to behave rottenly, increasing their collective consumption at the expense of others. (Pollak [1985] discusses these issues more formally.)

Hirshleifer (1977) has suggested that Becker's result is dependent on who makes the last move. If the rotten kid can act after the benefactor has transferred consumption (as in King Lear), he can behave selfishly without fear of retribution. Bernheim and Stark (1988) and Bruce and Waldman (1990) develop a line of criticism known as the Samaritan's Dilemma. Assume there are two household members who live for two periods. One is altruistic whereas the other is selfish. Both consume a portion of their endowment in the first period. In the second period, the altruist divides her remaining resources between herself and the other person. The selfish member consumes the rest of his endowment and the transfer from the altruist. However, because the selfish agent knows that the altruist will make a transfer to him, he consumes more in the first period than he would have in the absence of a transfer. The altruist can prevent such behavior by consuming more in the first period than she would
otherwise, but, in doing so, reduces her utility. Bergstrom (1989) generalizes these results and shows that the rotten-kid theorem collapses when a second commodity is introduced. Only under the strong condition of transferable utility does it continue to hold.

Concerns over the theoretical underpinnings of the unitary model have given impetus to a number of approaches that focus on the individuality of household members and explicitly address the question of how individual preferences lead to a collective choice. They do not require any unique household welfare index to be interpreted as a utility function, thereby allowing the index to be dependent on prices and incomes, as well as “tastes.” Though many of these approaches are referred to as bargaining models, the more generic label of “collective” models is preferred, partly because some important collective models do not explicitly address bargaining and because the phrase can be neatly juxtaposed with the term “unitary” models. The collective approach to the household can be subdivided into two broad categories: those models that rely on cooperative solutions to bargaining among individuals and those that rely on noncooperative game theory. It is possible to show that the unitary model is a special case of the collective class of models.

The cooperative approach begins by noting that individuals form a household when the benefits associated with doing so exceed those obtainable from remaining alone. This situation could occur because of the existence of economies of scale associated with the production of certain household goods, or because there are some goods that can be produced and shared by married couples but not single individuals. In any case, household formation generates a surplus that will be distributed across the members. Much of this description is in common with that of unitary models; the point of departure comes from the rule governing this distribution.

Broadly speaking, there are two types of cooperative approaches. Models in the first category suppose only that household decisions are always efficient in the Pareto sense (Apps 1981, 1982; Apps and Rees 1988; Chiappori 1988b, 1992; Kooreman and Kapteyn 1990; Browning et al. 1994; Browning and Chiappori 1995). In particular, nothing is assumed a priori about the nature of the decision process, or equivalently, about the location of the final outcome on the household Pareto frontier. As Pierre-André Chiappori explains in his chapter, even if evidence were to suggest that the unitary approach (which he calls the “traditional” approach) were not correct, this mere fact does not support any particular alternative model. The only way to support a particular collective setting empirically is to derive from that framework conditions that potentially can be, but are not actually, falsified by empirical observation. Chiappori argues that the household’s income-sharing rule will depend on the income of individual A, the income of individual B, and income received collectively by the household. Then the ratio of the impact of A’s income upon the demand for commodity $i$ and the impact of B’s income upon the demand for commodity $i$
should be identical for all goods. These restrictions can be tested by incorporating them into a demand function that permits the coefficients on income from individual A and individual B to vary by commodity. Using a sample of French households in which both the husband and the wife work full time, and a sample of nine consumption goods, Chiappori finds that the restrictions implied by the collective model cannot be rejected.

A second category of cooperative models differs from this approach by imposing more structure by representing household allocations as the outcome of some specific bargaining process and applying to this framework the tools of game theory (Manser and Brown 1980; McElroy and Horney 1981; McElroy 1990). Marjorie McElroy begins her chapter by briefly outlining this approach. Suppose two individuals are considering forming a household. They both have a level of personal utility within marriage based on consumption of household public goods, individual consumption of goods, and leisure. Similarly they have levels of personal utility for their unmarried state that reflect both their endowments and “extrahousehold environmental parameters” (EEP), factors that shift individuals’ threat points. They include measures of the relevant marriage and remarriage markets, laws concerning alimony and child support, changes in tax status associated with moving between marital states, and the ability of each person to receive assistance from his or her own family (itself perhaps a function of parental wealth). Both individuals gain from household formation when their utility within marriage exceeds that outside it. The critical question becomes the mechanism by which these gains are apportioned.

In McElroy’s model, these individuals maximize the product of the gains in utility from marriage (a “Nash” solution) for both individuals, subject to a joint full-income constraint. The resultant Marshallian demand functions include, as arguments, all prices, nonlabor income, and EEPs. As McElroy emphasizes, the unitary model is a special case of this Nash model, with the parameters on nonlabor income and EEPs set equal to zero. Note that McElroy’s use of a Nash solution differentiates her approach from that taken by Chiappori (1988a), who advocates a more general approach. An attractive feature of McElroy’s model is that policy interventions enter directly into demand functions by way of the EEPs. Furthermore, the use of a Nash cooperative solution is not especially restrictive. As she notes, it can emerge from a number of noncooperative frameworks. Yet at another level reliance on the Nash solution is troubling—the failure of an empirical model to differentiate between competing approaches could reflect the genuine absence of a difference or merely the inappropriateness of the bargaining model adopted.

An innovative aspect of McElroy’s chapter is her demonstration of the complementarity of the partial-equilibrium Nash bargaining models with general-equilibrium marriage market models. McElroy shows that the predic-
tions of the marriage market model complement the predictions of the Nash bargaining models. Specifically, if an increase in women’s ability to maintain themselves outside marriage does not come at the expense of the ability of men to maintain themselves outside marriage, this generally increases and never decreases the income of married women. However, when the increased ability of women to maintain themselves comes at the expense of men, this generally increases (never decreases) women’s income and generally decreases (never increases) men’s income. For policies that, unintentionally, increase men’s control over income while simultaneously undercutting women’s control, the marriage model indicates that this leads directly to the long-term deterioration of the well-being of women. Even policies that promote market gains for women that are not at the expense of men may well be resisted by men, since under these policies their long-term share of marital income would decline.

In McElroy’s model, the issue of enforcement is resolved in several ways. The threat of marital dissolution is a possibility in the context of long-term decisions but, as she notes, “In the context of small daily decisions, it is not credible for either spouse to threaten to leave the marriage.” She suggests that decisions regarding short-run issues can be motivated by time preferences (the loss associated with delays in settling disagreements).

Shelly Lundberg and Robert Pollak take issue with the divorce-threat version of the Nash bargaining model in their chapter. They argue that the divorce threat is not always credible and that the outcome of marital non-cooperation can take some other form. They lay out what they call a “separate-spheres” model of the household. Like the divorce-threat version of the Nash bargaining model, the model is a bargaining model that views marriage as a cooperative game, but with a threat point that is a noncooperative equilibrium within marriage, based on traditional gender roles. They show how a child allowance scheme has no distributional implications in a two-parent family under the unitary or divorce-threat version of the Nash bargaining model, but does under their separate-spheres model. However, their work shares an important similarity with that of McElroy. In both chapters, attention is drawn to the importance of the effects of policy in a general equilibrium setting. In McElroy’s model, policies (such as child-care subsidies in cases in which women always obtain custody of children on divorce) that improve an individual’s allocation within the household also improve his or her opportunities outside it. In Lundberg and Pollak’s model, the payment of child allowances to women initially improves the intrahousehold distribution of resources in favor of women. But they point out that, if household formation is preceded by some form of binding agreement (such as a prenuptial contract) that includes the promise of transfers from husband to wife (net transfers in the Carter-Katz model, discussed later, are an example of this), husbands may reduce their transfers by an amount equivalent to the shift in child allowances.
In contrast to cooperative models, the noncooperative approach does not assume that members necessarily enter into binding and enforceable contracts with each other. Examples of this approach include Leuthold (1968), Ashworth and Ulph (1981), Ulph (1988), Woolley (1988), Kanbur (1991), and the chapter by Michael Carter and Elizabeth Katz. They assume that individuals within the household not only have differing preferences but also act as autonomous subeconomies. The household is depicted as a site of largely separate gender-specific economies linked by reciprocal claims on members’ income, land, goods, and labor. They consider a two-person household in which each individual controls his or her own income and purchases commodities, subject to an individual (nonpooled) income constraint. A net transfer of income between individuals establishes the only link between them. Each individual has a utility function of goods he or she exclusively consumes and a good consumed in common, conditional on the level of net transfers. When making decisions, each person takes net transfers as given and chooses the goods he or she will exclusively consume in order to maximize his or her own utility, subject to the constraint that purchases are less than own-income plus net transfers. This yields a demand function for the goods consumed, which is a function of prices and net transfers. The Nash equilibrium (no household member has an incentive to deviate from his or her set of actions given that no other member deviates) is the level of goods consumed by both individuals that satisfies both demand functions simultaneously. An attractive aspect of this approach is that it is not assumed that income is pooled—a feature in agreement with many of the empirical studies reviewed later in this chapter.

An anthropologist has the last word in Part I of this volume. If the first section of the volume has so far been devoted to a comparison of different economic models, Jane Guyer begins to expand on the potential for multidisciplinary research on intrahousehold issues, specifically from a measurement point of view. Guyer ends this section by exploring some of the intellectual bases for the different approaches economists and anthropologists use when studying and measuring the same household phenomena. In addition, Guyer suggests that economics and anthropology appear to be heading toward a “new convergence of concern” around the nature and use of assets or endowments. Guyer argues that economists should be more concerned with the process of endowment or asset formation instead of regarding it as exogenous and static. Even when economists do use dynamic models, the focus tends to be on asset management from year to year, rather than asset creation, destruction, or delegitimatization, sometimes beyond an individual’s own life cycle. Having established the importance of assets to economists and anthropologists—although important in different ways—Guyer emphasizes that the study of assets will help economic models be more open to the incorporation of the anthropological view of “endowment.” In this way, she adds, the anthropology of value could be similarly opened up to the economics of investment.
Methods

Part II begins with a critical evaluation of the empirical evidence—both informal and formal—that casts doubt on the unitary model. We examine the results of a series of tests of restrictions implied by the unitary model: Is unearned income pooled? Is income pooled across genders or generations? Are cross-wage labor supply effects identical across gender? Do parents manipulate their adult children? Are male heads of household altruistic? How convincing is the empirical evidence? We note that evaluation is hindered by the fact that much observed behavior lends itself to interpretations consistent with more than one household model. Indeed, a classic exchange in the literature on intrahousehold allocation between Folbre (1984) and Rosenzweig and Schultz (1984) centered on the interpretation of the relationship between gender differences in expected wages and gender bias in child mortality. Both sets of authors accepted the existence of a relationship; they differed on whether this reflected efficiency concerns by parents or relative bargaining power in household decisions—both of which are presumed to parallel wage rates. Indeed the difficulty in distinguishing between “endowment” effects and “bargaining” effects has yet to be satisfactorily resolved. It is also an area in which interaction between the unitary approach (in which the identification of endowments is central) and collective models may prove fruitful. Mindful of this and a number of other caveats, we argue that the existing evidence should be seen as shifting the burden of proof to an approach in which assumption of income pooling is defended rather than maintained.

In the next chapter, Duncan Thomas discusses this further, using data from Brazil; in so doing, he addresses some of the econometric issues raised in reply to his earlier papers on the topic. Using nonlabor income data, Thomas rejects the income-pooling hypothesis. For example, an additional crusado in the hands of a woman raises the share of the household budget spent on education, health, and household services (mostly domestic services) by a factor of between three and six compared with an additional crusado in the hands of a man. In addition, the income of women is associated with higher per capita calorie and protein intake. When Thomas restricts his analysis to those households composed of an intact couple, there is still some evidence suggesting that income effects differ between men and women. If, however, the sample is further restricted to those couples in which both members participate in the labor force, then there is no evidence that treating these households as a single agent is an invalid empirical strategy. This approach suggests that this understanding of household resource allocation may be improved if household composition and labor supply choices are simultaneously taken into account.

Joel Gittelsohn and Sangeeta Mookherji outline how anthropological techniques can be used to lay the foundation for quantitative work on intrahousehold allocation by anthropologists and economists. However, Gittelsohn
and Mookherji note that although qualitative research can lay the foundation for quantitative research, economists should not regard this as its sole purpose. They provide specific examples in which anthropological methods can be applied: improvements in survey design, insight into community interventions, and measurement and monitoring of changes over time. They conclude by noting that anthropologists have been less successful in predicting patterns of intrahousehold allocation of such resources as food, and that this is a potentially fruitful area of collaboration with economists.

Even if appropriate methods for collecting food consumption data exist, Howarth Bouis and Christine Peña suggest that current measures of discrimination focus too much on calories. They propose a new indicator for examining discrimination in the intrahousehold distribution of food. They argue that inequality among household members in terms of intake relative to requirements is least likely to be manifested in calorie adequacy or hunger. Rather it is the allocation of micronutrients, associated with higher-status foods, that will be unequally distributed. Bouis and Peña propose an indicator of inequality that is the ratio of an individual's proportion of household micronutrient intake to his or her proportion of household calorie intake. A ratio exceeding one indicates either favoritism or strong bargaining power for a particular household member. For a Philippine sample, Bouis and Peña find no discernible differences in these ratios between girls and boys, but they do find that preschoolers of both sexes are favored in the intrahousehold distribution of food. This is a conclusion different from that reached by comparing only calorie adequacy levels—both unadjusted and adjusted for activity patterns.

Barbara Harriss-White provides a cautionary tale on the measurement of intrahousehold food allocation. Harriss-White assesses the policy recommendations that emerge from five studies of intrahousehold nutrient distribution, each of which uses data collected from the same set of study households in southern India. The studies differ in their conclusions for a number of reasons: the individual classifications of data (for example, different age group classifications), different treatments of seasonality, different nutrients studied (see the discussion of the previous chapter), different aggregations of households (for example, different hectare cutoffs on what constitutes a smallholder), and, finally, different groups of individuals studied. Harriss-White notes that the disagreements among the studies are not trivial in magnitude, and that a policymaker would be "right to be intervention-averse," but she concludes that even if a unified message were to have emerged from the five studies, how it would feed into the policy process is unclear. She concludes that "not only do households need unpacking, so does the policy process."

Judith Bruce and Cynthia Lloyd conclude the section on measurement issues by pointing out that when households are unpacked, a clearer picture of other family relationships might emerge. Their chapter underscores the need for policy to look beyond households to family relationships. They argue that
the poverty of mothers and children may be determined less by their normatively ascribed household type than by the degree to which fathers—regardless of marital or residential arrangements—contribute economically to children. They stress that living arrangements or household structures alone may be insufficient to explain children’s welfare status. In doing so, they emphasize that households and families contain overlapping, but not necessarily identical, memberships. As such, measurement exercises that focus on, say, households may miss important contributions made by family members not resident in the household.

Policy

Even if policymakers are agnostic about the usefulness of any specific household model, unitary or collective, they neglect patterns of intrahousehold inequalities at their peril. Consider a common policy situation: a government attempts to target a program to individuals by age or gender, rather than to households. Many examples exist in which governments assume either (1) that amelioration of household poverty is sufficient for the alleviation of individual poverty or (2) that individual poverty can be alleviated without regard to the actions of other household members. These assumptions will lead to policy failure, irrespective of the choice of resource allocation model.

Consider a nonwelfarist approach to raising the food consumption of undernourished individuals through an in-kind transfer to undernourished households. Haddad and Kanbur (1990) demonstrate that the undernourishment rankings of various socioeconomic and geographic household groups can change when individual-level food consumption information is used instead of household-level information. For example, although individual-level data may indicate that individuals from certain households are an important food poverty group, a reliance on household-level data might imply that they are not an important group. This result occurs when patterns of intrahousehold inequality differ between different household groups. If inequality were similar in all groups, food poverty rankings would be identical, whether or not individual-level data were used to target the transfer.

Two other studies explicitly dispel the notion that the improvement of household nutrition is sufficient for the improvement of preschooler nutrition. Pelletier, Msukwa, and Ramakrishnan (1991) test the hypothesis that the nutrition status of older household members is strongly reflected in that of young children and that associated socioeconomic factors are the same for both age groups. The study shows that, in a Malawian sample, the first assumption is

---

2. A welfarist approach to poverty assumes that the level of income indicates the welfare of the individual or household in question, regardless of how that income is spent. A nonwelfarist approach focuses on the consumption of one or more goods or services without direct invocation of the household's own assessment of the utility of consuming that commodity.
more valid than the second, but then only during acute food shortages. Work by Senauer and Garcia (1992) in the Philippines arrives at similar conclusions: if intrahousehold food allocation patterns are inequitable relative to requirements, then targeting preschoolers based on household-level indicators may be a very costly way of raising preschooler food intake.

Programs that do rely on individual-level data for targeting purposes are prone to another type of error of neglect of household decisionmaking. These programs often confuse the need to isolate the individual outcome with the assumption that the food allocation mechanism within the household can be ignored. Suppose there is concern regarding the nutrition of children. A possible policy response is the implementation of a school meals program in which children who are recorded as being particularly undernourished receive extra food. The success of this intervention cannot be ascertained in the absence of information on the pattern of food allocation among household members. Households might respond to this program by reducing the amount of food the targeted child receives at home (and increasing the amount of food consumed by other household members). Indeed this was the conclusion of Beaton and Ghassemi's (1982) review of international experience with supplementary feeding programs (see also Kennedy and Alderman 1987). Ironically, the naive approach to targeting individuals in isolation from the household is an extreme version of a child as a "separate sphere" and thus is inconsistent with the unitary model, among others. Although these examples pertain to nutrition programs, the issue is more general. For example, Apps and Savage (1989) show that welfare orderings of Australian households are very sensitive to the neglect of intrahousehold inequality. Moreover, the rankings are also sensitive to the method of measuring intrahousehold resource allocation. This finding has implications for the design of a tax and welfare system.

The issue is not confined to either gender inequalities or the welfare of young children. Many countries have designed programs to meet the needs of the elderly. Few of these programs are fully financed from individual contributions (World Bank 1994). The appreciable wage taxes that are earmarked for such programs represent a transfer from one generation to another. However, too little is known about either the poverty of the elderly or how their needs are met by intrafamily transfer to be able to access fully the implications of various social security policies. The full impact of targeting programs to the elderly can only be effectively assessed if the responses of other family members are taken into consideration (Cox and Jimenez 1992).

Within this context, Part III of the book considers a number of policy issues in the context of intrahousehold allocation. Harold Alderman and Paul Gertler argue that price policy is not silent on intrahousehold health-seeking behaviors in Pakistan. They find that there is a tendency to use high-quality providers (private doctors) more often for males than for females. These differences, though, disappear as income rises. The authors argue that although
the differences in health care are not dramatic, they pertain to an environment in which the price of health care is low. Moreover, most of the illness incidents from which their estimates are derived are the general day-to-day ailments to which children are susceptible. They suggest that the comparatively high price for life-threatening treatments that often require more expensive hospitalization may lead to more gender discrimination and possibly fatal delays in seeking care.

At the program level, Jennie Dey Abbas also emphasizes the importance of knowing intrahousehold resource allocation patterns prior to intervention design. Using a Gambian case study, she points out that any evaluation of a project or policy to raise male and female labor productivity in agriculture must take into account differences in rights to accompanying resources, as well as unobserved labor obligations to other household members. The obligations of women to men are usually asymmetric, and they afford ample scope for male opportunism.

Nancy Folbre picks up the theme of asymmetric rights and obligations in a more general way, arguing that most discussions of public policy and intrahousehold inequality tacitly assume that policymakers are able to abstract themselves from societal biases. Such a view is at odds with new political economy theories that emphasize how policies are shaped by activities undertaken by political coalitions (though she is cautious about carte blanche application of these models to family and social policy). Folbre provides evidence that public policy in many countries, but especially in the developing world, reinforces intrahousehold and intrafamily inequality. Folbre calls for additional research on extrahousehold factors that shape, and are shaped by, intrahousehold processes—family law and social entitlements, for instance.

The final chapter of Part III concludes the book. The chapter acknowledges that the unitary model is a powerful tool that can be readily adapted to explain complex patterns of intrahousehold inequality. Is the investigation of alternative models, then, merely a matter of academic intrigue? We argue that the intrahousehold issues are as relevant to policymakers as they are to researchers. Specifically, at least four types of policy failures that will be precipitated by neglect of intrahousehold decisionmaking processes are identified.

The first concerns the effect of public transfers made to the household. The unitary model predicts that the impact of such transfers is unaffected by the identity of the recipient, because all household resources are pooled. For a household that behaves in a manner consistent with a collective model of the household, the welfare effects of a transfer may be quite different if the recipient is, say, a man as opposed to a woman. Second, not only is the identity of the recipient important, the response of nonrecipients must be considered. The extent to which public transfers are mitigated or enhanced by changes in private behavior is determined by whether intrahousehold interactions are best described as intergenerational altruism (a form of the unitary model) or a
collective model with exchange motives. Third, at the project level, the unitary model implies that it does not matter to whom policy initiatives are directed. This "information source independence" arises because the unitary model assumes that not only is nonlabor income pooled, so too is information. However, the assumption that the self-declared head of household has detailed knowledge of the activities of other relevant household members will invariably lead to such policy failures as (1) the nonadoption of particular policies and (2) unintended costs arising from policies that are adopted. Failure to facilitate the adoption of new technology or of practices that retard environmental degradation, or the adoption of projects that make the target group worse off, exemplifies faulty policy assumptions.

The final and perhaps most important drawback of relying on the unitary model for policy guidance is that a number of potentially powerful policy handles are disabled. Under the unitary model, policymakers affect intrahousehold resource allocation primarily through changes in prices. Some collective approaches suggest that additional policy handles, often with a very long reach, are available to the policymaker. Examples of these policy handles include changes in access to common property resources, credit, public works schemes, and a general strengthening of legal and institutional rights.

The importance of collective models in policy analysis does not imply that the indiscriminate adoption of a model simply because it is a member of the collective class is advocated. Despite numerous rejections of income pooling and of polar cases of altruism within a family, to date no one model of collective behavior has dominated the alternatives posed. In fact, most arguments for the policy relevance of model choice are based on the failings of the unitary model rather than the strengths of a particular collective model. Put another way, collective models may resolve a number of the anomalies that have accrued under the unitary model, but further work is necessary to improve their predictive power. The final chapter concludes by outlining where such work might be most fruitful.
PART I

Modeling Intrahousehold Resource Allocation
2 Specification and Estimation of the Demand for Goods within the Household

MARK M. PITT

There is a large empirical literature in which household or individual data are used to estimate the demands for both market goods and nonmarket goods, such as health and human capital. For example, Pitt and Rosenzweig (1985) have estimated the effect of food prices and access to health programs and clean water on the health of individuals (as measured by recent morbidity) and on the quantity of food nutrients consumed by households in Indonesia. Studies such as these inform policymakers how changes in food prices and program provision affect the health of individuals. If separate demand equations are estimated for different types of individuals, perhaps differentiated by age and gender, even more is learned about the distribution of the effects of policy changes. Pitt and Rosenzweig found that the effects of price changes on recent morbidity differed between male heads of household and their spouses in Indonesia. As useful as such studies may be, they tell almost nothing about how households allocate resources among their members. As demonstrated in this chapter, it is quite difficult to estimate the demand for goods within the household.

A useful way of approaching the problem is to formulate it in terms of intrahousehold conditional demand equations. Such equations ask how the allocations provided to one household member affect the allocations of others. For example, how does one person’s health, time allocation, or food consumption affect that of another? And how does the allocation of each of these goods affect the allocation of the others?

I begin with a restatement of the simple model of demand in which a single consumer chooses among a set of market goods. The concept of a conditional demand equation, first considered by Pollak (1969), is introduced in this simple framework before multiperson households and nonmarket goods are considered. I stress the problem of finding believable and theoretically justified restrictions that enable the researcher to identify cross-person demand relationships within the household statistically, and I show why it is, in general, impossible to identify these demand relationships based upon the usual
exclusion restrictions. Some approaches to estimation are considered, and examples drawn from my work with Mark Rosenzweig are used to illustrate these methods.

**Conditional Demand in a Simple One-Person Household**

Consider the simplest possible case of a one-person household with fixed (exogenous) income, \( M \), and a utility function having only market goods, \( x_i \), as arguments. The household’s problem is

\[
\max U = U(x_1, x_2, \ldots, x_K), \quad \text{subject to } \sum_{i=1}^{K} p_i x_i = M \tag{2.1}
\]

where \( p_i \) is the market price of good \( i \), taken parametrically by the household. The uncompensated (Marshallian) demand equations resulting from this problem are

\[
x_i = d_i(p_1, p_2, \ldots, p_K, M), \quad i = 1, \ldots, K \tag{2.2}
\]

Dual to this problem is the problem of minimizing the cost, \( c \), of obtaining a given level of utility, \( U \):

\[
\min c = c(p_1, p_2, \ldots, p_K, U) \tag{2.3}
\]

The partial derivatives of the cost function are the compensated (Hicksian) demand equations:

\[
\frac{\partial c}{\partial p_i} = x_i = q_i(p_1, p_2, \ldots, p_K, U), \quad i = 1, \ldots, K \tag{2.4}
\]

Consider the problem of this single-person household if the allocation of one or more goods is rationed and the ration is binding. That is, given the household’s income and the prices it faces, it would wish to consume at least as much as the rationed quantity if it could freely choose consumption levels. In this case, consumption of the rationed good exactly equals the ration amount. For simplicity, good \( x_1 \) will be treated as the rationed good, and the rationed quantity is \( \bar{x}_1 \). The consumer’s problem is now

\[
\min c^1 = c^1(\bar{x}_1, p_1, p_2, \ldots, p_K, U) \tag{2.5}
\]

where \( c^1 \) denotes the cost of utility, conditional on consumption of the rationed quantity \( \bar{x}_1 \). One can view the consumer’s problem as choosing consumption levels of all goods except \( x_1 \) so as to maximize utility subject to consuming \( x_1 = \bar{x}_1 \) and to having income of \( M - p_1 \bar{x}_1 \) to spend on the other \( K - 1 \) goods. Formally the rationed household’s problem is
\[
\begin{align*}
\max U &= U(x_1, x_2, \ldots, x_K), \quad \text{subject to } \sum_{i=2}^{K} p_i x_i = M - p_1 \bar{x}_1 \quad (2.6)
\end{align*}
\]

From the rationed problem equation (2.6), it can be seen that the only way in which the price of the rationed good \( p_1 \) affects demand is through the term \( p_1 x_1 \) on the right-hand side of the budget constraint. A fall in the price of the rationed good just increases the income available for purchasing all other goods, that is, the price change only induces an income effect. There is no substitution effect resulting from changing the price \( p_1 \) as long as the ration remains binding. Thus the derivatives of the conditional cost function, equation (2.5), which are the conditional compensated (Hicksian) demand equations, do not depend on \( p_1 \):

\[
\frac{\partial c^i}{\partial p_1} = x_i = q_i(x_1, p_2, p_3, \ldots, p_K, U), \quad i = 2, \ldots, K \quad (2.7)
\]

where \( q_i \) is the demand for good \( i \), conditional on the ration \( \bar{x}_1 \).

If the rationed good is food these conditional demand equations tell how a change in the consumption of food alters the consumption of the other goods, such as time allocation and nonfood goods consumption. In the absence of actual rationing, the conditional demand equation (2.7) would never have to be estimated. The integrability of demand systems means that everything about preferences that can be learned is learned by estimating the unconditional demand equation (2.4). The parameters of the conditional demand equations can be constructed from the parameters of the unconditional demand equations. Furthermore the reverse is also true: the unconditional cost function can be recovered from the conditional cost function (Browning 1983).

Nonetheless consider how to estimate empirically the effect of changing the level of consumption of one good in a single-person household on the demand for all other goods. This is exactly the problem of estimating the conditional demands, equation (2.7), in the absence of rationing. To make the problem realistic, assume that estimation will use data from single-person households having heterogeneous preferences. If the preference heterogeneity results in additive stochastic terms appended to the conditional demand equations, least squares estimation will result in heterogeneity bias. The level of observed consumption of the good conditioned upon \( x_1 \) is a regressor that will likely be correlated with this preference-based error. Consumers with above-average preferences for good \( x_1 \) will consume more of it and consequently have less income remaining to spend on all other goods. One obvious approach to estimating models with endogenous regressors is to use instrumental variable methods. From equations (2.4) and (2.7) there is a single, theoretically justified exclusion restriction, the price \( p_1 \), that is a determinant of \( x_1 \) in equation (2.4) but does not appear in the demand equation (2.7) conditional on \( x_1 \). It is
straightforward to extend this example by conditioning on more than one good. Conditioning on the quantity of more than one good consumed results in conditional demand equations that exclude the prices of all conditioned goods as arguments (regressors), thus assuring exact identification of exclusion restrictions for instrumental variable estimation.

**Conditional Demand in a Multiperson Household**

The problem for a multimember household analogous to the one described in equation (2.1) is

$$\text{max } U = U(x_{11}, x_{12}, \ldots, x_{1J}, x_{21}, x_{22}, \ldots, x_{2J}, \ldots, x_{KJ}),$$

subject to $\sum_{j=1}^{J} \sum_{i=1}^{K} p_i x_{ij} = M$ (2.8)

where $x_{ij}$ is the consumption of good $i$ by household member $j$ in a household composed of $J$ members. The key difference between the single-person and multimember household models is not the larger number of person-specific goods but the fact that there are more goods than there are prices. There are $K$ market goods and $J$ household members yielding $KJ$ person-specific goods, but still only prices for $K$ goods.\(^1\) The cost function, conditioning on the consumption of one good by one member of the household, is then

$$c^{11} = c^{11}(x_{11}, p_1, p_2, \ldots, p_K, U)$$  \hspace{1cm} (2.9)

where indexes are innocuously chosen such that the cost function $c^{11}$ is conditional on the consumption of good 1 by household member 1 ($x_{11}$). In the multimember household, unlike the single-person household, a reduction in the price of the rationed good $p_1$ can have substitution effects on demands for all other goods. To see this, note that the household’s problem is to allocate $KJ - 1$ person-specific goods so as to maximize utility subject to consuming $x_{11} = \bar{x}_{11}$ and remaining income $M - p_1 \bar{x}_{11}$:

$$\text{max } U = U(\bar{x}_{11}, x_{12}, x_{13}, \ldots, x_{1J}, x_{21}, x_{22}, \ldots, x_{2J}, \ldots, x_{KJ}),$$

subject to $\sum_{j=1}^{J} \sum_{i=2}^{K} p_i x_{ij} + p_1 \sum_{j=2}^{J} x_{ij} = M - p_1 \bar{x}_{11}$ (2.10)

---

1. Of course, restrictions placed on the utility function can lead to the aggregation of goods across persons, reducing the excess number of “goods” relative to prices, but cannot eliminate the excess number altogether, except in the limiting case.

Time is one good that likely has person-specific prices (wages). This fact has been exploited by Rosenzweig (1986a) and others to estimate intrahousehold cross-wage effects. It is difficult to think of important classes of other market goods for which person-specific prices exist, although the shadow prices of goods produced in the household, such as health, are likely to vary across or within a household. These issues are addressed later in the chapter.
In equation (2.10) the price $p_t$ still appears on the left-hand side of the budget constraint as it reflects the prices for the $J - 1$ "unconstrained" goods $x_{12}, x_{13}, \ldots, x_{1J}$. The derivative of the conditional (and unconditional) cost function with respect to a price $p_t$ is not the compensated demand for a person-specific good as it was in the single-person household, because $p_t$ is the common price of $J$ (or $J - 1$ for $p_t$) person-specific goods in equation (2.10). The conditional demand for person-specific good $x_{ij}$ is

$$x_{ij}^{11} = q_{ij}^{11}(x_{1i1}, p_1, p_2, \ldots, p_K, U)$$

(2.11)

In this case identifying exclusion restrictions are not available to carry out instrumental variable estimation, since the price $p_t$ of the conditioned good $x_{u1}$ is not excluded from the conditional demand equation. All the goods $x_{it}$ have the same price. Furthermore one cannot infer the conditional demand equations by estimating the unconditional demand equations. The unconditional demand equations for person-specific goods are themselves not identifiable because person-specific prices do not exist for all goods.

The problem of the multimember household can now be generalized to include home-produced goods, such as health, and the time allocation of household members. The household's problem is now

$$\max U = U(x_{11}, x_{12}, \ldots, x_{1J}, x_{21}, x_{22}, \ldots, x_{2J}, \ldots, x_{KJ}),$$

subject to

$$h_j = h_j(x_{ij}, x_{j2}, \ldots, x_{jK}, l_1, l_2, \ldots, l_J, z, \mu_j), j = 1, \ldots, K$$

and

$$\sum_{j=1}^{J} p_j x_{ij} + \sum_{j=1}^{J} w_j l_j + \sum_{j=1}^{J} p_j z_j = v + \sum_{j=1}^{J} w_j T$$

(2.12)

where

- $l_j =$ home time of household member $j$,
- $h_j =$ quantity of home-produced good $h$ (health) allocated to person $j$,
- $w_j =$ market wage of member $j$,
- $z =$ an input into the production of the home-produced good,
- $p_z =$ its price, and
- $v =$ nonearnings (exogenous) income.

The term $\mu_j$ represents person-specific endowments, such as innate healthiness, which are fixed and not changeable by the household. The health production functions given in equation (2.12) are general in that they allow for the technology producing $h$ to be different for every household member and for own-consumption of the market goods $x$ and the home time $l$ of every household member to be inputs into the production of $h$. But by treating home time as a household public good—that is, by not distinguishing among the allocations of person $j$’s time to the production of each household member’s home good—the treatment of home time in the technology is not perfectly general. If home time were a private good allocatable to each person, there would be $F^p$
home time allocations and home time demand equations. In that case even the wage would not be a good-specific price, since the price of the home time of the $j$th person devoted to the production of each of the household's $J$ members would be identically $w_j$.

Consider the nature of the conditional demand equations corresponding to equation (2.12) in the case of a single-person household. Even though the $h$ good is not a market good, there is a market good $z$ that does not provide utility directly but only enters into the unconditional demand equations through its effect on $h$. The price of this good acts as the "price of health." Conditioning on $h = \bar{h}$, the conditional demand equations for the single-person household do not depend on $p_z$, and thus $p_z$ is available as an identifying exclusion restriction for the instrumental variable estimation of the conditional demands. If there is a vector of health inputs like $z$, then there are overidentifying restrictions.

Unfortunately, as in the case with only market goods available, in a multimember household when the price $p_z$ is not person-specific, $p_z$ does not disappear from demand equations that condition on the level of $h$ provided by any one household member or subset of household members. Thus, except in the case of time allocation, the problem of more person-specific goods than prices precludes the estimation of person-specific unconditional demand equations as well as the use of instrumental variable methods to estimate intrahousehold conditional demand equations.

**Some Approaches to Estimation**

In spite of this gloomy theoretical outlook, many studies have indeed estimated intrahousehold conditional demand equations. Four approaches have been followed.

*Ignoring Unobserved Heterogeneity*

One approach is essentially to ignore the problem, treating the conditioned-upon behaviors as exogenous. In some of the literature the labor supply of women has been regressed on the number of children or their health without regard to the possible effects of unobserved heterogeneity on the estimates.

---

2. In this discussion, I assume interior solutions for time allocation—that is, the opportunity cost of time is the market wage. If no time is spent in the market, the market wage is not the shadow price of time and there is one less exogenous variable in the demand equations. Estimation of demand systems with corner solutions is essentially the estimation of conditional demand equations with binding rations of zero (Lee and Pitt 1986).

3. It is likely that there are some "Z goods" that are only inputs into the production of the home-produced good $h$ for certain types of household members. For example some inputs into the care of infants (diapers, infant formula, certain inoculations) are not also inputs into the care of older household members. There may be gender-specific health inputs reflecting the different biologies of men and women. In practice these prices are not often measured and more than one household member is of the same type.
Identification with Exclusion Restrictions

A second approach is to make exclusion restrictions necessary for the use of instrumental variable methods, even though, as demonstrated previously, it is difficult to find such restrictions that are not inconsistent with a general theory of household behavior. Pitt and Rosenzweig (1985) estimate the way in which the health of male heads of farm households in Indonesia affects their labor supply. They use the prevalence of health programs, such as public health clinics and sanitation facilities, as identifying instruments (corresponding to \( p_i \)). A Hausman-Wu test "confirms" the endogeneity of health in this conditional labor supply equation. But in these multimember households health programs and facilities must also affect the health of the head's wife and other household members. Interpreting these estimates as the supply of labor conditional on own-health, as Pitt and Rosenzweig do, requires either that health prices affect the health of the household head but not that of other household members, or that the health status and time allocation of other household members have no effect on the head's labor supply (as in the single-member household); neither of these situations is very believable.

Identification through Cross-Person Restrictions on Demands

A third approach is to put additional structure on the model that, although not necessarily consistent with a general model of household behavior, involves restrictions less onerous than the zero exclusion restrictions of the second approach. Pitt and Rosenzweig (1990) use this method to estimate the effects of infant mortality on the allocation of time in Indonesian households. The linearized demand equations for the home time of two household members, \( i \) and \( j \), conditional on the health of family member \( k \), are

\[
l_i = \alpha_{0i} + \alpha_{1i}p_i + \alpha_{2i}p_2 + \ldots + \alpha_{Ki}p_K + \beta_{1i}w_1 + \beta_{2i}w_2 + \ldots + \beta_{ji}w_j + \gamma_i + \lambda_i h_k + \varepsilon_i \tag{2.13}
\]

and

\[
l_j = \alpha_{0j} + \alpha_{1j}p_1 + \alpha_{2j}p_2 + \ldots + \alpha_{Kj}p_K + \beta_{1j}w_1 + \beta_{2j}w_2 + \ldots + \beta_{jj}w_j + \gamma_j + \lambda_j h_k + \varepsilon_j \tag{2.14}
\]

where \( \varepsilon_i \) is an error term that includes the effects of the \( J \) health endowments \( \mu_1, \ldots, \mu_J \), and the remaining Greek letters are unknown parameters. Pitt and Rosenzweig impose the restriction that \( \gamma_i = \gamma_j \). The plausibility of this restriction depends on the characteristics of the individuals \( i \) and \( j \). If behavior is age dependent then the restriction is plausible if the individuals \( i \) and \( j \) are of approximately the same age. If behavior is gender dependent then the restriction is more plausible if \( i \) and \( j \) are of the same gender. Unconditional demand equations that demonstrate differences in price response by gender do not necessarily invalidate this restriction, since gender differences in price
response in unconditional demand do not necessarily imply a different price response when conditioned on infant health (or any other behavior). In Pitt and Rosenzweig’s study this equality restriction is made for three member types: the mother of the infant whose health status is conditioned and the infant’s male and female teenage siblings.

Time allocation is measured as principal activity in the week prior to the date of the survey, the 1980 National Socioeconomic Survey of Indonesia (SUSENAS). Four mutually exclusive principal activities are distinguished: work, school, home care, and leisure. The linearized conditional demand equation for family members in a household containing a mother and her teenage son and daughter is

\[
\ell_i = (\alpha_i + \delta_i D_j) A_i + (\gamma_i + \delta_i D_j) h^* + (\beta_i + \delta_i D_j) X + Z \lambda_i + \epsilon_i
\]  

(2.15)

where

\(\ell_i\) = level at which household member _i_ undertakes activity _i_, 

\(D_j = 1\) in the equation for _j_ and 0 otherwise in the son and daughter equations, 

\(h^*\) = the endogenous health of the mother’s infant child, 

\(A\) = a vector of member-specific exogenous variables, and 

\(X\) and \(Z\) are vectors of household-specific exogenous variables, to be distinguished later.

The Greek letters, except \(\epsilon\), represent parameters to be estimated, and \(\epsilon_i\) represents error terms having a multivariate distribution with zero means and covariance matrix \(\Sigma\). The vector of exogenous variables \(Z\) is that for which equality restrictions are imposed:

\[\lambda_i = \lambda_k \quad i \neq k; i, k = \text{member type}\]  

(2.16)

The vector \(Z\) consists of two subsets of regressors: 26 prices or price indexes for goods and a set of 16 community characteristics, including health facilities and programs, public waste facilities, and drinking water sources.

Neither \(h^*\) nor the activity variable \(\ell_i\) is observed in the data, only sets of dichotomous indicators indicating whether an infant had been sick or not and the primary time activity of the household member. The model was estimated using an instrumental variable household fixed-effects method (Chamberlain 1980). The fixed-effects procedure greatly reduces the computational burden, reduces the effects of heterogeneity across households, and eliminates the sample selection problem under suitable assumptions. It does not, however, permit identification of the parameters \(\lambda_{ij}\), and only the differential effects \(\delta\) are identified for the regressors \(X\) and \(h^*\). But the parameters \(\delta\) are required to test the hypothesis about intrahousehold distribution, and the parameters \(\lambda_{ij}\) are
TABLE 2.1 Differential effects of infant illness on household activities of daughters, sons, and mothers relative to home care

<table>
<thead>
<tr>
<th>Household Pair/Infant Illness</th>
<th>Alternative Activity to Home Care</th>
<th>Labor Force</th>
<th>School</th>
<th>Leisure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exogenous</td>
<td>Endogenous</td>
<td>Exogenous</td>
<td>Endogenous</td>
</tr>
<tr>
<td>Daughter versus son</td>
<td>2.84</td>
<td>-1.25</td>
<td>3.21</td>
<td>-1.07</td>
</tr>
<tr>
<td></td>
<td>(1.40)</td>
<td>(2.23)</td>
<td>(1.58)</td>
<td>(2.03)</td>
</tr>
<tr>
<td></td>
<td>[3.23]</td>
<td></td>
<td>[2.85]</td>
<td></td>
</tr>
<tr>
<td>Daughter versus mother</td>
<td>-.348</td>
<td>.072</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>(1.87)</td>
<td>(0.49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.60]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Son versus mother</td>
<td>-3.19</td>
<td>1.32</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>(1.57)</td>
<td>(2.32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[3.20]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


*a* Asymptotic t-ratios are in parentheses.

*b* Asymptotic t-ratios corrected for use of stochastic regressors, estimated from first stage, are in parentheses.

*c* Uncorrected t-ratios computed directly from information matrix are in brackets.

maintained not to affect time allocation differentially and thus are of little interest.

Table 2.1 presents estimates of the $\delta_0$ parameters, which capture differential activity effects of child illness relative to the household care activity. These parameters were estimated from maximizing a single multinomial logit fixed-effects likelihood containing predicted values of infant health from a first-stage maximum-likelihood binary logit regression. In the first-stage equation, the sets of regressors upon which identification rests—area-level food prices ($\chi^2[26] = 80.6$), programs and health facilities ($\chi^2[7] = 17.6$), and water supplies ($\chi^2[5] = 18.4$)—are statistically significant.

Parameters from two specifications are presented in Table 2.1: those from a single-stage multinomial fixed-effects logit that treats infant health as exogenous in the differential allocation of time, and one in which instrumental variable methods are applied. The two sets of estimates are not directly comparable since actual health is a dichotomous indicator of morbidity, whereas predicted morbidity is a continuous estimate of a latent variable. Nonetheless the signs of the parameters differ in every case. Treating infant health as exogenous results in the (false) inference that there is no statistically different effect of infant health on the activity responses of teenage siblings. In the consistent instrumental variable estimates, infant health does significantly influence differential time allocation. The hypothesis that the responses of sons
and daughters to own-age, infant illness, and the number and sex composition of household teenagers are identical is strongly rejected ($\chi^2[15] = 73.6$). However, the hypothesis that the responses of daughters and mothers are not different cannot be rejected ($\chi^2[6] = 14.5$), whereas it is rejected in a comparison of sons and mothers ($\chi^2[6] = 69.3$). The differential responses are thus based more on gender than on age.

Interpretation of the parameters is somewhat complicated since they represent the effect of a change in infant health on the allocation of time to one activity relative to another activity (home care) for one person-type relative to another. The consistently estimated parameter in the first row, second column of Table 2.1 (−1.25) indicates that increases in the latent illness of an infant reduce the daughter's time in the labor force, as compared with home care, more than the son's. Furthermore, increases in latent infant illness also reduce schooling and leisure time (relative to home care) for daughters more than for sons. These results suggest that reductions in infant morbidity would reduce gender-based inequality among teenagers in Indonesia. Assessing the quantitative importance of the level as opposed to the differential effect of latent infant illness requires at least one additional restriction. In Pitt and Rosenzweig (1990) quantitative estimates of level effects are obtained under the assumption that teenage boys do not alter their time devoted to household activities in response to the illness of an infant sibling.  

The “Endowment Method”

The fourth approach to identifying intrahousehold conditional demand equations relies on treating the endowment $J_A$, as an implicit person-specific “price” for the home-produced good $h$ in equation (2.12). To see this, note that

---

4. Recently I have implemented a somewhat related approach that permits the identification of all the level regression parameters without placing cross-equation restrictions on regression parameters (Pitt 1996). The approach is a generalization of the methods developed by Chamberlain (1977a, 1977b) and Chamberlain and Griliches (1975) that identify models of the returns to schooling through the imposition of error covariance restrictions across a set of schooling, earning, and occupational choice behaviors for siblings. In Pitt (1996) the idea is to place a factor-analytic structure on the residuals of a set of sex-specific regressions for weight, height, and arm circumference for siblings of both sexes and the residuals of the choice equations of their father's and mother's decision whether to participate in a group-based credit program in Bangladesh. The model allows individual-specific error components to be correlated across children within the family without loss of identification. The imposition of the factor-analytic structure alone is sufficient to identify separately the effect of credit program participation by gender on the health outcomes of boys and girls. Estimation is essentially maximum likelihood generalized least squares with a restricted covariance matrix. This estimation is fairly complex since eight equations are estimated simultaneously—three nutritional outcomes separately for boys and girls plus credit program participation for men and women. This estimation involves not only a large number of regression parameters of the usual sort but also a rather large number of parameters describing the correlation structure of the residual variance-covariance matrix. In addition, the number of boy and girl children in each household varies across households, resulting in an “unbalanced” design. The likelihood is tailored to include all sampled children and not just a fixed number per household.
the shadow price associated with an allocation ("ration") of a home-produced good to household member 1 is

$$p_{h1}^* = \frac{\partial U}{\partial h_1}$$

(2.17)

where $p_{h1}^*$ is the shadow price of the allocation $h_1 = h_1$, and $v$ is, as before, non-earnings income. The shadow price of $h_1$ is the reduction in the (minimum) cost of obtaining the prior level of utility as a result of the increase of health by one unit. The shadow price associated with an increase in the endowment $\mu_1$ of household member 1 is similarly

$$p_{\mu1}^* = \frac{\partial U}{\partial \mu_1} = \frac{(\partial U/\partial h_1)(\partial h_1/\partial \mu_1)}{\partial U/\partial v}$$

(2.18)

If the endowments $\mu_j$ are additive in the household technologies (equation [2.12]), then $\partial h_i/\partial \mu_1 = 1$ and $p_{\mu1}^* = p_{i1}^*$. Simply put, a unit increase in the endowment $\mu_j$ implies a unit increase in $h_j$ when all input allocations are unchanged. The $\mu_j$ are exogenous person-specific determinants of the shadow price of $h_j$ and thus are valid instruments for the estimation of demand equations conditional upon the household allocation of the $h$ good among its members.

In practice none of the studies that have used the endowment method has estimated conditional demand equations with $\mu_j$ as an identifying instrument. Instead they have estimated reduced-form demand equations with the estimated $\mu_j$ added to the set of exogenous regressors. These are unconditional demand equations, but now with an individual-specific exogenous component to health, $\mu_j$, as an implicit person-specific price. The conditional demand equations can thus be fully recovered from the full set of unconditional demand equations. Regularity conditions of demand theory imply that the sign on $\mu_j$ in a reduced-form (unconditional) demand equation for the $i$th input provided person $i$, $x_{ij}$, must be the same as the sign on $h_j$ in a conditional (on $h_j$) demand equation for $x_{ij}$, with $\mu_j$ as an identifying instrument. In particular, regularity requires that

$$\frac{\partial h_j}{\partial \mu_j} = \sum \left( \frac{\partial h_j}{\partial x_{ij}} \frac{\partial x_{ij}}{\partial \mu_j} \right) + \frac{\partial h_j}{\partial \mu_j} \geq 0$$

(2.19)

which implies that an individual's health is never made worse by the acquisition of exogenous health. The household may "tax" away some of the exogenous health by reducing health inputs $x_{ij}$ but will not tax away more than all of it.

The problem with any empirical methodology that estimates cross-person effects using endowments is that the $\mu_j$ is not directly observed. However, if the technology is known, it can be calculated as $\mu_j = h_j - h_j(\cdot)$, where $h_j(\cdot)$ is shorthand for the technology found in equation (2.12) and additive
endowments are assumed. In practice the technology is not known but must be specified and consistently estimated from nonexperimental data, subject to errors of measurement and other sources of stochastic variation.

Consider the (trivial) case of the single-person household and the problem of determining the effect of an exogenous increase in the health of an individual on that individual’s demand for the single health input \( z \). If the health technology and health input demand equation are linear in the parameters, the result is

\[
\begin{align*}
    h_j &= \alpha + \beta z_j + \mu_j + \varepsilon_j \\
    z_j &= \pi p_j + \gamma \pi \mu_j + \lambda_j \mu_j + \varepsilon_j
\end{align*}
\]

where \( \mu_j \) is the health endowment of person (household) \( j \), \( p_j \) is the price of a market good that does not affect health, and \( \varepsilon_j \) and \( \varepsilon_j \) are random errors for which \( E(\varepsilon_j, \mu_j) = 0 \), \( E(\varepsilon_j, \mu_j) = 0 \), and \( E(\varepsilon_j, \mu_j) = 0 \). These restrictions on the error components imply that the only source of error correlation in the two equations (2.20) arises from the health endowments. The covariance between the residuals of these equations is thus \( \text{cov}(\mu + \varepsilon, \lambda \mu + \varepsilon) = \lambda \sigma^2_j \) and is straightforward to estimate. Since \( \sigma^2_j \) is nonnegative, the sign of this term is the sign of \( \lambda \). A negative \( \lambda \) implies compensatory behavior on the part of the household—an exogenous increase in health induces a reduction in health input demand, which would not be a very surprising result. Identification of the magnitude of \( \lambda \) requires knowledge of \( \sigma^2_j \).

Knowledge of the signs of person-specific \( \lambda s \) is of more interest in the multiperson household framework, where reinforcing behavior is more likely (Pitt, Rosenzweig, and Hassan 1990), but identifying these signs becomes problematic even if strong restrictions are placed on the error covariances (as above) and on the health technologies. Consider the simple case of a two-person household in which both person-types (\( j \) and \( k \)) have identical health technologies,

\[
\begin{align*}
    h_j &= \beta z_j + \mu_j + \varepsilon_j \\
    h_k &= \beta z_k + \mu_k + \varepsilon_k
\end{align*}
\]

and the demand equations for health input provided persons \( j \) and \( k \) would be estimated

\[
\begin{align*}
    z_j &= \pi p_z + \gamma \pi \mu_j + \lambda_{kj} \mu_k + \varepsilon_j \\
    z_k &= \pi p_z + \lambda_{kj} \mu_j + \lambda_{kj} \mu_k + \varepsilon_k
\end{align*}
\]

from a sample of households (where the household subscript is dropped for simplicity). The parameter \( \lambda_{kj} \) represents the effect of person \( k \)'s exogenous health on person \( j \)'s allocation of good \( z \). If, as before, the only source of residual covariance is through the \( \mu_s \), and if \( E(\mu_j, \mu_k) \neq 0 \), as seems likely, identification of the three \( \lambda s \) requires knowledge of the variances and covariances of the \( \mu s \).
Assuming that $\sigma^2_r = 0$ for both $j$ and $k$—that is, that the residual variance of the health technologies is identical to the variance of the endowment (no measurement error exists)—is sufficient for identifying the $\lambda$s. Rosenzweig and Schultz (1983), the first to apply the endowment method to the estimation of intrahousehold demand equations, treated the estimated residuals from the health technology as measured-with-error estimates of the endowments $\mu_j$ and included them as regressors in the demand equations (2.21).\(^5\) Under the assumption that the “measurement error” $e_j$ was uncorrelated with the error $e_r$, classical errors-in-variable bias results: parameters are biased toward zero. Thus Rosenzweig and Schultz interpret their estimates as lower bounds on the true absolute values of the regression coefficients.

The problem is that there is often reason to believe that this measurement error is not orthogonal to the errors $e_j$ of the demand equations. If the source of the error $e_j$ is only measurement error on health or human capital outcome $h_j$, then the orthogonality condition is not unbelievable. But if the source of the measurement error arises from the input $z_j$, then a very difficult form of bias arises in the estimation of the conditional demand equation (2.21). To see this problem consider the linear health-production function for person $j$ in equation (2.21) as consisting of measured-with-error output $h_j$ and input $z_j$. The true (measured-without-error) endowment is

$$h_j^* = \mu_j - z_j^* \beta$$

(2.23)

where $h_j^*$ and $z_j^*$ are the (unobserved) true values of health and the health input, respectively. If both health and the input $z$ have measurement errors $\eta_j$ and $\nu_j$, with classical errors-in-variables properties, that is,

$$h_j = h_j^* + \eta_j$$

(2.24)

$$z_j = z_j^* + \nu_j$$

(2.25)

where $E(h_j^*, \eta_j) = 0$, $E(z_j^*, \nu_j) = 0$, and $E(\eta_j, \nu_j) = 0$, then the estimated endowment, $\hat{\mu}_j$, is

$$\hat{\mu}_j = (h_j + \eta_j) - (z_j + \nu_j) \hat{\beta}$$

$$= \mu_j + \eta_j - \nu_j \hat{\beta}$$

(2.26)

where $\hat{\beta}$ is a consistent estimator of $\beta$. Thus the health endowment measurement error is $\eta_j - \nu_j \hat{\beta}$ and the demand for the good $z$ by person $j$ is

$$z_j = \pi_j p_z + \lambda_j \hat{\mu}_j + \lambda_k \hat{\mu}_k + (\nu_j + e_j)$$

(2.27)

---

5. Pagan (1984) has shown that ordinary least squares estimates of regression equations having an estimated residual as a regressor provide consistent estimates of the parameter covariance matrix as long as the estimated residuals are orthogonal to the regression residuals.
If the marginal product of the health input is positive ($\hat{\beta} > 0$), then the measurement errors of $v$, and $v$ are systematically negatively correlated with the error of the person-specific input demand equation (2.27). Simply put, any error in the measurement of a production function input will impart a proportional measurement error to the estimated endowment. A subsequent regression of this input on estimated endowments will have spurious correlation arising from their common measurement error.

Consistent parameter estimates in the presence of measurement error in the regressors can be obtained by instrumental variable methods. Notice that estimation of the health technology typically requires instrumental variable estimation anyway, as long as there is any endowment heterogeneity ($\sigma_u > 0$) and household allocations are influenced by differential endowments ($\lambda_r \neq 0$, $\lambda_u \neq 0$). Prices for health inputs ($p_z$), including foods and medical care, are appropriate identifying instruments. However, prices are not valid instruments for $\hat{\mu}$, in the estimation of the demand equation (2.27), since they are by construction uncorrelated with the endowments. The only instruments possible are repeated (noncontemporaneous) measures of health and health inputs, inclusive of noncontemporaneous alternative measures of health. The validity of these instruments requires that the period-specific measurement errors be uncorrelated across periods. This was the approach followed by Pitt, Rosenzweig, and Hassan (1990) in their study of the intrahousehold allocation of food in rural Bangladesh.

In that study weight-for-height endowment measures were estimated for all members of a sample of Bangladeshi households and used to study the intrahousehold allocation of calories. The study explicitly modeled and estimated the link among food consumption, health, labor-market productivity, occupational choice, and individual heterogeneity. Table 2.2 presents estimates of weight-for-height production functions, estimated with a sample of 1,737 individuals. Inputs include measured (not reported) calorie consumption over a 24-hour period, measures of the energy intensity of effort, age, age squared, age-sex interaction, dummy variables for pregnancy and lactation, and the quality of drinking water. Calorie consumption, energy intensity of effort, and pregnant/lactating status are considered endogenous in the two-stage least squares estimates. Instruments include household head’s age and schooling level, landholdings, and the prices of all foods consumed, interacted with individual age and sex variables, land, and head’s schooling and age. The first column of Table 2.2 presents (inconsistent) ordinary least squares (OLS) estimates of the production function. A comparison with the consistent two-stage least squares (2SLS) estimates of the second column reveals the importance of heterogeneity bias. Using OLS, the calorie elasticity is seriously underestimated and the effects of the energy intensity of effort are opposite in sign to the 2SLS estimates. The 2SLS estimates reveal the important effect of calorie consumption on weight-for-height and the depleting effect of active occupations.
### TABLE 2.2 Effects of calorie consumption, activity level, and pregnancy status on weight-for-height

<table>
<thead>
<tr>
<th>Variable</th>
<th>Ordinary Least Squares Estimates</th>
<th>Two-Stage Least Squares Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calorie consumption&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.0295 (4.09)</td>
<td>0.136 (3.37)</td>
</tr>
<tr>
<td>Very active occupation&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.0859 (5.34)</td>
<td>-0.0119 (0.23)</td>
</tr>
<tr>
<td>Exceptionally active occupation&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.0668 (3.43)</td>
<td>-0.0817 (1.26)</td>
</tr>
<tr>
<td>Pregnant&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.262 (7.69)</td>
<td>0.326 (1.34)</td>
</tr>
<tr>
<td>Lactating&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.144 (9.28)</td>
<td>0.513 (4.65)</td>
</tr>
<tr>
<td>Age</td>
<td>0.284 (16.6)</td>
<td>0.0987 (1.90)</td>
</tr>
<tr>
<td>Age squared</td>
<td>-0.00456 (1.44)</td>
<td>0.0174 (2.37)</td>
</tr>
<tr>
<td>Sex (male = 1)</td>
<td>0.00196 (0.08)</td>
<td>-0.0578 (1.81)</td>
</tr>
<tr>
<td>Age x sex</td>
<td>0.0152 (1.74)</td>
<td>0.0687 (4.04)</td>
</tr>
<tr>
<td>Water drawn from tube well</td>
<td>-0.0478 (3.13)</td>
<td>-0.0406 (2.10)</td>
</tr>
<tr>
<td>Water drawn from well</td>
<td>-0.0720 (4.11)</td>
<td>-0.0693 (3.15)</td>
</tr>
<tr>
<td>Water drawn from pond</td>
<td>-0.0460 (2.30)</td>
<td>-0.0649 (2.55)</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.56 (52.4)</td>
<td>-3.12 (13.9)</td>
</tr>
<tr>
<td>(N)</td>
<td>1,737</td>
<td>1,737</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.775</td>
<td>\ldots</td>
</tr>
<tr>
<td>(F)</td>
<td>395.1</td>
<td>\ldots</td>
</tr>
<tr>
<td>(H_0): No influence of calcium, carotene, thiamine, and riboflavin consumption ((F))</td>
<td>\ldots</td>
<td>1.23</td>
</tr>
<tr>
<td>(H_0): No difference in effect of calorie consumption by sex ((F))</td>
<td>\ldots</td>
<td>2.16</td>
</tr>
</tbody>
</table>

**SOURCE:** Pitt, Rosenzweig, and Hassan (1990), p. 1150.

<sup>a</sup>All variables in logs, except sex, water sources, and activity level.

<sup>b</sup>Asymptotic \(t\)-ratios in parentheses.

<sup>c</sup>Endogenous variable; instruments include household head's age and schooling level, landholdings, and prices of all foods consumed, used in interaction with individual age and sex variables, land, and head's schooling and age.
The individual endowments were estimated based on the technology parameter estimates and the actual resources consumed or expended by each individual. In order to deal with the possibility of systematic measurement error in the measured endowments, a longitudinal subsample of households that were surveyed in four rounds over a 12-month period was used for the estimation of the intrahousehold calorie allocation equations. In addition to repeated measures of weight and height, individuals also had measurements of midarm circumference and skinfolds taken in every round. Production functions for these health outcomes were estimated by two-stage least squares containing the same regressors and instruments as the weight-for-height production function. The instruments for an individual’s weight-for-height endowment in any period are the estimated endowments of the three health attributes averaged over all other periods. The estimated effect of an individual’s own endowment on his or her calorie allocation was found to be negative without using instruments for measurement error. The effect became positive when instrumental variable methods were applied. These results clearly support the existence of systematic measurement error in the estimated endowments.

A problem that arises in the specification of demand models that include cross-person effects is that households are of different size and demographic composition. If households had only two individuals, each of a different type (for example, male and female), then it would be easy to specify the demand for goods by person \( j \) as a function of the person-specific prices, endowments, and observed exogenous characteristics of family member \( k \) as well as own characteristics and prices. But samples of households with differing numbers of individuals by type are unbalanced in that the attributes of a second son, for example, can only influence allocations in households that have a second son. Pitt, Rosenzweig, and Hassan (1990) handled this problem in two ways. First the intrahousehold distribution of exogenous characteristics was summarized as moments of distributions. Regressors included the mean weight-for-height endowments, mean age, proportion of male family members, and variance of ages of family members. Higher moments did not significantly improve the fit. Cross-gender effects were estimated by introducing the mean weight-for-height endowment separately for males and females. Only in same-sex households are cross-effects not estimable.\(^6\)

\(^6\) Estimation of a “true” cross-effect would require that the calculated moments of the intrahousehold distributions not include own characteristics. If they do, the estimates conform to the experiment in which a transfer of characteristics (endowment, age, gender) occurs within the household that leaves mean endowment unchanged.

A fully parameterized model would require estimation of demand equations for each demographic mix characterizing households in the sample. If the slopes of demand equations were thought to vary only with gender, then, even in households of four persons, there would be five possible demand regimes corresponding to the number of females or males that can be found in households of four persons. In households with differing numbers of members, there would be
Second, a household fixed-effects two-stage generalized least squares estimation was applied to the sample of individuals, divided by gender. The advantage to the household fixed-effects procedure is that it deals perfectly with cross-person effects, since the demographic composition of a household is a fixed effect to each household member.\textsuperscript{7} Table 2.3 presents parameter estimates of individual calorie consumption equations estimated with this method. Interestingly the parameter estimates diverge little from those obtained by specifying cross-effects separately for males and females, using moments of the distribution of ages and endowments. Columns 2 and 4 of Table 2.3 allow the parameters to vary by both age and gender. The pattern of estimated own endowments matches up well with the pattern of activities that individuals of these age and gender groups predominantly perform. Young children (less than 6 years of age) are not economically productive and thus there is no (current) labor market (productivity) return on additional calorie consumption for them. As a consequence calorie compensation dominates—part of the better health derived from a higher endowment is taxed away via a reduction in calorie allocations.

Male and female children 6–12 years of age exhibit calorie reinforcement. During these ages both genders have the ability to choose among activities of varying levels of energy intensity (and economic return) for which there are apparent returns to health. A 10 percent increase in the health (weight-for-height) endowment increases calorie consumption by 9.2 percent for males and 18.6 percent for females. This is consistent with activities data that show that girls have a greater diversity of activities as characterized by energy intensity of effort than boys. Adult males have the greatest calorific reinforcement of all household member-types, whereas adult females, with limited choices of activity, have an endowment response that is essentially zero.

Not many data sets contain information on person-specific health inputs, in particular food intake. Individual-level food intake data are seldom collected because of the great difficulty and cost of doing so. When they are collected, enumerators most often ask respondents to recall their consumption of a list of common foods during the prior 24 hours (as in the village surveys of the International Crops Research Institute for the Semi-Arid Tropics). Estimation of health production functions (typically using anthropometric measures of health as dependent variables) using data collected in this way, have not always

\textsuperscript{7} Although treating household composition as a fixed effect seems less arbitrary than trying to specify parsimonious functional forms, such as moments of distributions, it is valid only if the underlying parameters of the individual-specific demand equations are themselves not functions of the demographic composition of the household.
TABLE 2.3 Effects of personal characteristics on individual calorie consumption

<table>
<thead>
<tr>
<th>Variable</th>
<th>Endowment Effects</th>
<th>Endowment Effects Vary with Age</th>
<th>Endowment Effects</th>
<th>Endowment Effects Vary with Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Constant</td>
<td>Vary with Age</td>
<td>Constant</td>
<td>Vary with Age</td>
</tr>
<tr>
<td>Own endowment</td>
<td>0.447</td>
<td>-0.0278</td>
<td>0.447</td>
<td>-0.0278</td>
</tr>
<tr>
<td></td>
<td>(3.58)</td>
<td>(0.15)</td>
<td>(3.58)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>Age &lt; 6</td>
<td>...</td>
<td>-0.435</td>
<td>...</td>
<td>-0.314</td>
</tr>
<tr>
<td></td>
<td>(1.35)</td>
<td>(0.46)</td>
<td>(1.35)</td>
<td>(0.46)</td>
</tr>
<tr>
<td>6 ≤ age &lt; 12</td>
<td>...</td>
<td>0.923</td>
<td>...</td>
<td>1.86</td>
</tr>
<tr>
<td></td>
<td>(2.29)</td>
<td>(2.13)</td>
<td>(2.29)</td>
<td>(2.13)</td>
</tr>
<tr>
<td>Age ≥ 12</td>
<td>...</td>
<td>1.21</td>
<td>...</td>
<td>0.0894</td>
</tr>
<tr>
<td></td>
<td>(2.69)</td>
<td>(0.13)</td>
<td>(2.69)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Age</td>
<td>1.44</td>
<td>1.31</td>
<td>1.34</td>
<td>1.35</td>
</tr>
<tr>
<td></td>
<td>(22.9)</td>
<td>(14.9)</td>
<td>(18.1)</td>
<td>(17.9)</td>
</tr>
<tr>
<td>Age squared</td>
<td>-0.201</td>
<td>-0.170</td>
<td>-0.199</td>
<td>-0.206</td>
</tr>
<tr>
<td></td>
<td>(16.7)</td>
<td>(9.16)</td>
<td>(13.4)</td>
<td>(13.7)</td>
</tr>
<tr>
<td>N</td>
<td>429</td>
<td>371</td>
<td>371</td>
<td>371</td>
</tr>
<tr>
<td>$\chi^2$ (no individual error components)</td>
<td>46.5</td>
<td>48.35</td>
<td>32.36</td>
<td>26.17</td>
</tr>
<tr>
<td>Individual error variance/total error variance</td>
<td>0.287</td>
<td>0.300</td>
<td>0.258</td>
<td>0.282</td>
</tr>
</tbody>
</table>

SOURCE: Pitt, Rosenzweig, and Hassan (1990), p. 1152.

a All variables in logs.

b Asymptotic t-ratios in parentheses.

c Instrumental variables used are means of individual and family endowments for weight-for-height, skinfold thickness, and arm circumference calculated over all survey rounds, excluding the round from which observation was drawn.

been successful. In the Nutrition Survey of Rural Bangladesh, used by Pitt, Rosenzweig, and Hassan (1990), trained female enumerators resided with each household and physically weighed and measured the food consumption of each household member over a 24-hour period. These data seem "better" than recall data in that they are statistically significant determinants of weight-for-height, but they still suffer from at least two drawbacks (besides the cost of data collection). First, the typical reference period of 24 hours is rather short, so that even if enumerators measured the day's consumption without error, food consumption on other days would be unlikely to be the same. A single day's observation may be a noisy measure of even a short-term level of food intake. This is perhaps less of a problem for investigating the determinants of weight-for-height, an indicator of short-run health, than for other measures of health,
such as morbidity. The second problem is that inserting an enumerator into a household to weigh and measure each individual’s food intake, certainly an intrusive procedure, may cause the household to alter the level and allocation of food intake in order to please the enumerator. Recent evidence from the Philippines, where enumerators physically measured the food consumption of each individual in sampled households for a 7-day period, suggests that households consumed much higher levels of high-cost status foods, such as eggs and milk, during the first days of an enumerator’s observations, but substantially less as the week wore on.

In Pitt and Lavy’s (1995) study of the allocation of preventive medical care in Ghana, endowment measures derived from a morbidity technology, rather than from a nutritional status (weight-for-height) technology, are more likely to capture those components of innate healthiness associated with medical care decisions. Anthropometric measures, such as weight-for-height, are specified as inputs capturing the effects of individual-specific food consumption on morbidity. Weight-for-height is thus treated as an aggregator of the food intakes in the health technology, with the assumption that food consumption affects morbidity only through weight-for-height. Weight-for-height is expected to suffer much less from the measurement error problems associated with individual-level food consumption information.

One might ask how it can be claimed that it is in general “impossible” to find theoretically justified restrictions that can identify intrahousehold conditional demand relations, yet the endowment method seems to do just that. Although it is true that the endowment method is consistent with the theory of the household presented previously, a strong restriction (in the sense of not being very believable) is nonetheless required for the statistical consistency of estimates based on the use of estimated endowments. Essentially the restriction is that the researcher know the correct specification of the technology from which inputs are to be estimated. If the wrong functional form is chosen or if relevant inputs are omitted, the use of estimated endowments will not estimate the intrahousehold demands without bias. Since one can seldom claim to know the “true” functional form for any structural relationship, functional form misspecification is not an issue peculiar to this problem. The problem of omitted inputs is a much more difficult one to brush aside. Go back to the simple example of the single-person household having a linear health technology with a single input as in equation (2.20), but now allow for a second input, \( q_p \), unmeasured or unknown to the researcher:

\[
\begin{align*}
    h &= \alpha + \beta z + \gamma q + \mu + \varepsilon \\
    z &= \pi p + \delta p + \gamma p + \lambda \mu + \varepsilon 
\end{align*}
\]

(2.28)

---

8. The endowment method has been applied in new and interesting ways in Rosenzweig and Wolpin (1991), Behrman, Rosenzweig, and Taubman (1994), and Filmer (1995).
where \( p_q \) is the price of input \( q \). It is clear that the production function (2.28) estimated without \( q_j \) as a regressor will have residuals that include the effects of \( q_j \) as well as the bias to the other parameters caused by its omission, since it is likely that \( z_q \) and \( q_j \) are correlated. Bias will result, for the estimated endowments obtained from those residuals will now be correlated with the prices in the demand equation for \( z_q \), since the demand for \( q_j \), like the demand for \( z_q \), depends on the price of inputs. The endowment method thus relies on a covariance restriction for identification: the errors of the production function are uncorrelated with those of the reduced-form demand equation. An omitted variable makes that correlation nonzero and the restriction invalid. Any reasonable application of the endowment method must make a convincing case that it has reasonably complete data on production inputs.

Summary

This chapter has set out the problem of specifying and statistically identifying the demand for goods within the household, making use of the concept of conditional demand introduced by Pollak (1969). Essentially the identification problem arises from the absence of prices for most person-specific goods. These prices are required to estimate demand equations having cross-person effects. Two methods for estimating intrahousehold demands were discussed. One method called for restrictions on parameters that may be inconsistent with a general model of household behavior. It was suggested that cross-person restrictions on parameters might be less onerous than the usual exclusion restrictions. The second method, known as the endowment method, involved making covariance restrictions, which, although not at odds with a theory of behavior, required rich data on individual-specific inputs. Both methods were illustrated with empirical examples, using data from developing countries.

---

9 The instrumental variable method for dealing with measurement error in the endowments is not applicable here, since the omitted variable is omitted in every period.
In the traditional approach of microeconomic theory, households are considered elementary decision units. They are modeled as "consumers" in the usual sense, characterized by a single utility function that is maximized under a budget constraint. This amounts to assuming either that the topic of intrahousehold resource allocation is irrelevant or that it can be conveniently addressed within the fiction of a dictatorial decisionmaking process.

This view has been recently challenged by a number of authors who claim that households should be understood as collective decision units, that intrahousehold decisionmaking processes are complex phenomena deserving particular attention, and that the single-utility hypothesis is essentially an ad hoc justification for disregarding these issues. As a consequence, collective models of household behavior have been developed.1 My first goal in this chapter is to discuss the kinds of models that have been offered and emphasize the (sometimes technical) differences between them. My second goal is to present a particular approach to understanding intrahousehold decisionmaking, based upon the general concept of "sharing rule." The basic principle behind this concept will be reviewed and then the empirical consequences discussed. The dispute between the traditional and the collective approaches must not remain within the field of theory; empirical issues are also involved. But what can data tell us about the empirical relevance of the two classes of models? This question will be answered in the last part of the chapter.

Collective Models: Some Basic Distinctions

Collective versus Traditional Approaches

The first and most basic distinction among models is the one between collective and traditional approaches. Either one assumes that households behave as if they were single consumers and then works within the traditional, single-utility framework, or one explicitly recognizes the existence of several decisionmaking units, with potentially different preferences that do not systematically aggregate into a unique household utility function, and works in the collective line.

Clear as this separation may seem, two remarks must be made at this point. First, the fundamental discrepancy does not involve the number of decisionmakers within the household. Some models belonging to the traditional line—for example, Becker’s “altruistic” models or Samuelson’s collective welfare index—are compatible with the existence of several decisionmakers. However, aggregation theory says that a group does not behave as a single person, apart from highly peculiar cases. As McElroy (Chapter 4, this volume) notes, the reconciliation of the existence of several individuals with a unique utility function requires strong assumptions. Second, the specific assumption of the traditional approach is not the maximization (under budget constraint) of a unique welfare index. Indeed many collective frameworks, including bargaining models, imply such a maximization (and, in a sense, many reasonable decisionmaking processes share this property). The specificity of traditional settings lies in the fact that this maximand can be interpreted as a utility function; it is independent of prices and incomes—the latter appearing only in the budget constraint. In all collective models, conversely, the maximand is price dependent. In particular, in single-utility models, wages or nonlabor incomes can affect behavior only through usual income and substitution effects, whereas much more complex influences can be taken into account within a collective framework.

Cooperation versus Conflict

First consider the class of cooperative collective models. Here “cooperation” should be understood in the sense of game theory. Cooperative decision-making processes have outcomes that are Pareto efficient; thus the central assumption is that households will never adopt a decision that is Pareto dominated. This class of models includes, in particular, bargaining models, at least when information asymmetries are assumed away. Conversely one may think of several kinds of collective processes that are formally different from bar-

2. In particular, all such models are particular cases of “price-dependent preferences.” The difficulty, however, is to generate testable restrictions, a goal that obviously implies some restrictions on the form of the maximand.
gaining, yet still always generate Pareto-efficient outcomes (this is the case, for instance, for "matching" models of the marriage market; see McElroy [Chapter 4, this volume]). Thus though Nash bargaining models are nested within the set of cooperative models, the converse is in general not true.

Two avenues can be explored. One is to stick to the sole-efficiency assumption and try to derive testable restrictions upon behavior; this line has been followed by, among others, Chiappori (1988b, 1992), Bourguignon et al. (1993), Browning et al. (1994), and Browning and Chiappori (1995). Or, following Manser and Brown (1980) and McElroy and Horney (1981), a priori further restrictions can be imposed upon the decisionmaking process—typically a particular bargaining concept, for instance Nash—and the additional implications this specification introduces can be investigated.

These lines of study have given rise to two related but different research programs. Although these programs may converge in the future this has not yet happened. The advantages of the first approach, in terms of generality and comprehensiveness, must be traded off against the increased predictive power that should typically result from more restrictive assumptions. Again the comparison of empirical consequences turns out to be a central issue.

Assumptions on Commodities and Preferences

Quite apart from the formalization of decisionmaking processes, models may differ in the particular assumptions they make regarding the form of preferences and/or the nature of the commodities. For instance it may be assumed that some goods are privately consumed whereas others are "public" within the household. But it may be argued that even private consumption by one of the members will generally enter the utility function of the other—say, because the latter is altruistic or because externalities are generated. Though these assumptions are in a sense rather technical, they still should be considered with care, because the properties of the model—that is, its ability to generate testable restrictions or the identifiability of the structural framework—will crucially depend on the particular formulation adopted.

To be a little more specific consider a household of two members, A and B, with respective preferences, $U^A$ and $U^B$. The household can consume $n + N$ goods, among which $n$ are consumed privately by each member, whereas $N$ are public goods for the household. Let $x^A = (x^A_1, \ldots, x^A_n)$ and $x^B = (x^B_1, \ldots, x^B_n)$ denote the respective private consumption bundles of A and B, and $X = (X_1, \ldots, X_N)$ denote the household consumption of public goods. Hence, $U^A$ and $U^B$ map $\mathbb{R}^{n+N}$ to $\mathbb{R}$ and can be written, respectively, as $U^A(x^A, X)$, $U^B(x^B, X)$. A polar case, considered for instance, by Chiappori (1988b), is $N = 0$; all goods are privately consumed, and preferences are said to be egoistic. At the other extreme one might assume, as in McElroy and Horney (1981), that the total consumption of any member enters both members' utility function; that is, all consumptions are public goods within the household. Then the preferences will
be said to be altruistic and take the form \( U^A(x^A, x^B, X), U^B(x^A, x^B, X) \). Of course the altruistic setting is more general. Not surprisingly the price paid for this generality is that it is less testable, and the uniqueness of the structural model underlying a given demand function is more difficult to guarantee. In particular it can readily be seen that altruistic models encompass, as particular cases, single-utility frameworks (just take \( U^A = U^B \)). This is not true, however, for egoistic models, since these exhibit a separability property between each member’s private consumption bundle.

An intermediate case of interest is Becker’s notion of caring. Here each member is assumed to maximize a welfare index that depends on both his or her own “egoistic” utility and his or her companion’s; technically the preferences are of the form \( W^A[U^A(x^A, X), U^B(x^B, X)], W^B[U^A(x^A, X), U^B(x^B, X)] \). Interestingly enough the properties of the “caring” framework are, at least under the assumption of Pareto-efficient decisions, much closer to the egoistic than to the altruistic case. The basic reason is that the set of Pareto-efficient allocations of the “caring” model is a subset of that of the “egoistic” model.

A last distinction relevant for private consumption is that among exclusive, assignable, and nonassignable goods. A good is exclusive when it is consumed by only one member; a typical example is labor supply (or leisure), at least insofar as it is not a public good for the household. A nonexclusive good is assignable when each member’s consumption can be observed independently; otherwise it is nonassignable. The existence of either an assignable good or a pair of exclusive goods typically increases the predictive power of models. Note as well that the observation of two exclusive consumptions will in general yield more information than that of an assignable good; this is because the prices of the exclusive goods will be different, whereas the assignable good has a single price, whatever the number of consumers.

In the notation that follows, \( p \in \mathbb{R}^n \) denotes the price vector of the private (and public, \( p \in \mathbb{R}^m \)) goods, and \( y \) denotes the household’s total income, so that the overall budget constraint is

\[
p(x^A + x^B) + PX = y \tag{3.1}
\]

In some cases, each member’s income can be independently observed; that is

\[
y = y^A + y^B \tag{3.2}
\]

**The Sharing Rule Interpretation**

When preferences are of the egoistic or caring type the efficiency hypothesis can be given a nice, intuitive interpretation. Specifically if \( x^A(p, P, y) \),

---

3. For a detailed discussion see Chiappori (1988b, 1990a). The intuition is that although the set of altruistic utility functions contains that of egoistic ones, it is by far much larger. Hence testable properties that are fulfilled by all functions of the smaller set may not exist for some function of the larger. In addition uniqueness may be true within the subclass of egoistic preferences but not within the general class of altruistic utilities.
\( \bar{x}^B(p, P, y) \) is the chosen consumption bundle, then there exists a sharing rule \( \theta(p, P, y) \) such that

\[
\begin{align*}
\bar{x}^A(p, P, y) & \text{ is the solution of max } U^A(x^A, \bar{x}), \quad p^A x^A = \theta(p, P, y) \\
\bar{x}^B(p, P, y) & \text{ is the solution of max } U^B(x^B, \bar{x}), \quad p^B x^B = y - PX - \theta(p, P, y)
\end{align*}
\]

For the proof, see Bourguignon et al. (1993).

The interpretation is as follows. Once the household has decided upon the expenditures, \( PX \), for public goods, the remaining income, \( y - PX \), must be allocated among the members’ private consumptions. Then the efficiency assumption implies that members agree upon the respective amount each of them is allowed to spend. This is exactly what is meant by a sharing rule. Note that the rule will in general depend on all prices and incomes, and that, at least in the general framework, no assumption is made about the form of the rule—it is simply assumed that such a rule does exist. Each member will allocate the amount thus defined so as to maximize his or her utility.4

The sharing rule property is quite general: it can be used, with egoistic or caring preferences, to interpret any efficient decisionmaking process.5 Conversely any arbitrarily chosen rule will generate efficient decisions when preferences are egoistic. This, however, does not hold in the “caring” case for “too unfair” sharing rules.6 Remember as well that the Nash bargaining approach is embedded within this framework. With caring preferences, Nash bargaining models essentially generate additional restrictions upon the sharing rule.

Finally an attractive property of the sharing rule interpretation is that it provides a description of the decisionmaking process that is independent of the particular, cardinal representation of preferences; that is, the demand functions it generates are not modified when \( U^A \) is replaced by \( F[U^A] \), where \( F \) is some nondecreasing mapping (and \( X = A \) or \( B \)). This is especially convenient

4. Note that the choice of the private consumption bundle will in general be made conditionally on the choice of public goods, because the latter does enter the utility function. This effect can be avoided by assuming that private consumptions are separable from public consumptions within each member’s utility; that is, \( U^i(x, x_i, X) = U^i(u(x_i), X), i = A, B \). Then,

\[
\begin{align*}
\bar{x}^A(p, P, y) & \text{ is the solution of max } U^A(x^A), \quad p^A x^A = \theta(p, P, y) \\
\bar{x}^B(p, P, y) & \text{ is the solution of max } U^B(x^B), \quad p^B x^B = y - PX - \theta(p, P, y)
\end{align*}
\]

5. With altruistic preferences, however, the sharing rule interpretation is no longer equivalent to efficiency in general. In that case all individual consumptions are public goods—they all enter both utility functions. However, decentralized decisions will not generally be efficient because the effect upon the other member’s welfare will not be adequately taken into account. Of course the fact that the sharing rule idea is not compatible with efficiency does not necessarily imply that it is irrelevant; see for instance Lundberg and Pollak (Chapter 5, this volume).

6. The idea is that, when the allocation prescribed by the rule is highly unequal, reducing inequality by departing from the rule may increase both welfare levels; indeed, the favored member, being caring, will be made better off as well.
because it is very difficult to distinguish empirically between ordinally equivalent but cardinally different utility functions.

**Nash Bargaining**

Here the first step is to define for each member a "reservation utility" or "threat point," $V^X(p,P,y)$ ($X = A,B$), representing the minimum welfare level $X$ could obtain in any case (and especially if no collective agreement could be reached). Of course, this will depend on the economic environment, that is, prices (including wages) and incomes. Then the surplus arising from cooperation is shared geometrically between the members; that is, the household maximizes $[U^A - V^A][U^B - V^B]$ under budget constraint.

Several problems must be solved at this point. One is the choice of threat points. Should one take utilities when divorced, as in McElroy (1990), or rather noncooperative equilibrium within the household, as argued by Ulph (1988) and Lundberg and Pollak (Chapter 5, this volume)? In both cases estimating the model is by no means an easy task. Simultaneous estimation of preferences and threat points from data on married couples may be quite difficult.

One solution, advocated by McElroy (1990), might be to estimate threat points from data on the behavior of divorced individuals. But the problem here is that, in contrast with the sharing rule approach discussed earlier, the concept of Nash bargaining equilibrium requires a cardinal representation of preferences. The latter concept is not invariant through an increasing transformation of utilities, threat points, or both. Indeed the Nash bargaining equilibrium concept amounts to assuming that the gains obtained through the agreement, with respect to some given reference point (the threat point), are shared "equally" in some sense. But the gains are expressed in utilities; if the evaluation of one member's welfare is changed—and this is exactly what the transformation would do—the allocation of the surplus will be modified as well. Empirically this is bad news, because such a transformation does not affect preferences, hence observed behavior (at least in the absence of uncertainty). In other words, for any given consumption or labor supply function, the choice of a particular cardinal representation (among the infinity compatible with observed behavior) is essentially arbitrary; the conclusion will then crucially depend on this choice.\(^7\)

Despite these technical difficulties, however, the Nash bargaining approach may (once adequately designed) provide useful insights into the conse-

\(^7\) Assume that member A's utility when divorced is of the form $U^A - s^A(p,P,Y)$ (that is, that divorce has a cost per se—not an unrealistic assumption). Then $s^A$ cannot be identified from data on divorced individuals but will clearly play a key role in the Nash bargaining procedure. The same is true, more generally, for preferences of the form $F(U^A,p,P,y)$; the argument is very similar to the analysis of equivalence scales in Blundell and Lewbel (1991). Another solution would be to use direct information on preferences collected from interviews or experiments (Kapteyn and Kooreman 1992).
quences of taking into account intrahousehold decisionmaking processes. For instance Haddad and Kanbur (1992, 1993) emphasize the impact of intrahousehold allocation issues for the targeting of welfare policies. The design of an optimal, in-kind benefit will crucially depend on who exactly in the household receives the benefits. Targeting a food supplement to, say, children between the ages of 3 and 10 is meaningless if the corresponding increase is offset by a reduction in the child’s share of food at home. Another consequence is that the scope of a given policy may be much broader than that suggested by the number of people who actually receive it. A minimum wage, for instance, will typically modify the threat point for nonworking spouses and thus, according to the bargaining ideas, influence the sharing rule, even in households that do not seem directly concerned by the regulation.

Last it must be emphasized that the spirit of bargaining processes can be captured, even in the absence of a specialized model, by introducing within the general Pareto framework some specific and testable assumptions. The sharing rule approach is especially convenient for this purpose. For instance any variable that is likely to be positively correlated with the bargaining power of one spouse (say, his or her wage or nonlabor income) should have a positive effect on the latter’s share; conversely any factor that favors the partner’s threat point should have a negative effect. Such conclusions can readily be empirically tested in the collective framework, as argued in the next section.

**Testable Implications of the Sharing Rule Approach**

As McElroy and Horney (1981), Horney and McElroy (1988), Schultz (1990), and Thomas (1990, 1992) have emphasized, the single-utility approach has consequences that can readily be tested. In addition to well-known properties that have been repeatedly analyzed in the literature, such as homogeneity or Slutsky relations, these authors have concentrated upon an important consequence of the traditional approach, namely income pooling. Whenever incomes do not affect preferences but only the budget constraint, then only total income, and not income composition, should matter. Empirical evidence suggests that this property does not hold (see Hoddinott, Alderman, and Haddad, Chapter 8, this volume).

However, these results must be interpreted carefully. They must definitely not be seen as supporting the collective approach in general or, even worse, some of its particular versions. Although any evidence against income pooling does suggest that the traditional approach is not correct, this finding does not support any particular alternative model. There are certainly hundreds of ad hoc assumptions that could explain the observed results within the traditional approach and thousands of more or less funny alternative models that could

---

8. For instance endogeneity bias or differences in volatility of various income sources.
justify them outside it. The only way to support empirically the collective setting is to derive, from the collective framework itself, conditions that can potentially be, but are actually not, falsified by empirical observation. This requirement should be kept in mind when constructing the model.

Hence the next question: is it possible to derive testable restrictions from the sharing rule framework? The answer is essentially positive. To elaborate on this point two particular settings will be considered: general demand systems on cross-section data (in which the emphasis is put on income effect, thus generalizing the income pooling literature) and general demand systems on panel or pseudo-panel data (in which attention is concentrated upon price effects).

Cross-Section Data and Income Effects

The simplest presentation of the argument is given in Browning et al. (1994). Assume that income can be decomposed into three exogenous sources, \( y = y^A + y^B + y^o \), according to whether it is received by member A, by member B, or collectively by the household. The decision process will in general be a function of \( y^A, y^B, \) and \( y^o \); by a simple change in variables, it can be expressed as a function of \( y^A, y^B, \) and \( y \).

If Pareto efficiency is assumed, demands are a solution of a problem of the form

\[
\text{max } \theta U^A(x^A, x^B, X) + (1 - \theta)U^B(x^A, x^B, X) \quad \text{subject to } px = y \tag{3.3}
\]

where \( \theta(y^A, y^B, y) \) represents member A's "weight" in the process.

Now the key idea is that the specific effects of individual incomes \( y^A \) and \( y^B \) operate exclusively through the "weighting factor," \( \theta \). In particular, they should have similar properties across goods. Assume, for instance, that it is observed that an additional dollar given to the husband decreases some given consumption—say, health care—by the same amount as 50 cents withdrawn from the wife (remember that total income \( y \) is held constant, so that \( y^o \) must decrease or increase accordingly). This means that within the decision process the husband's implicit weight is modified (say, decreased) in exactly the same way by both transfers and, in addition, that the wife's propensity to consume health care is larger than the husband's. Whereas the latter conclusion is specific to the good, the former is not; that is, it should be observed that an additional dollar given to the husband has the same effect, upon any (nonassignable) consumption, as 50 cents withdrawn from the wife. Technically this property can be translated for all goods as follows:

\[
\frac{\partial x_i}{\partial y^A} = \frac{\partial \theta}{\partial y^A}
\]

\[
\frac{\partial x_i}{\partial y^B} = \frac{\partial \theta}{\partial y^B}
\]

Specifically the new approach should have unexpected empirical implications—consequences that must be true under the new theory but false under the old one.
where the right-hand side is independent of \(i\). Note that this conclusion does not require any assumption whatsoever regarding preferences; it stems from the sole efficiency assumption. Hence this is a simple and powerful test of the collective approach. It should also be emphasized that \(y^A\) and \(y^B\) could be replaced by any exogenous variable that may affect the decision process, such as laws on divorce, market for marriage, or minimum wages.

**Empirical Test**

This property can clearly be tested empirically. As an illustration Bourguignon et al. (1993) consider the following polynomial functional form for household demand:

\[
x_i = a \cdot y + \gamma_1 [b y^2 + c y^A + d y^B + e (y^A)^2 / 2 + f (y^B)^2 / 2 + g y^A y^B] \tag{R2} (3.5)
\]

where \(z\) includes sociodemographic variables like age, education, the presence of one child, the living area, or home ownership status. In that framework, testing the pooling hypothesis is equivalent to testing that all the coefficients of terms, including the variables \(y^A\) and \(y^B\), are zero. Indeed for any given value of total income \(y\), individual incomes should not matter. Note, incidentally, that one could have taken \(y^A\), \(y^B\), and \(y^o\) (instead of \(y^A\), \(y^B\), and \(y\)) as variables; the pooling hypothesis would then have implied that only the sum mattered.

When estimating this model, a technical difficulty arises because substitution effects between leisure and consumption must be avoided. Indeed if individual incomes result from an endogenous labor supply decision, higher income may reveal more working hours, which, in turn, will affect consumption through substitution effects, so that the income pooling conclusion is not guaranteed. So incomes must be exogenous. Several solutions can be considered. Thomas (1990, 1992), for instance, considers various sources of nonlabor incomes. In the Bourguignon et al. (1993) model considered here, \(y^r\) is taken as member \(i\)'s labor income, but a sample of French households in which both members work full time is used. Then labor supply is constrained at the legal maximum, so that the number of hours is taken to be exogenous. Table 3.1 gives the unrestricted ordinary least squares estimates obtained for the nine goods included in the analysis, as well as the results of the log-likelihood ratio test of the hypothesis that all coefficients \(c, d, e, f,\) and \(g\) are equal to zero. This amounts to 45 restrictions and the corresponding \(\chi^2\) value leads to the clear rejection of the pooling hypothesis.

In order to test the cooperative hypothesis, it is first necessary to derive the restriction on the coefficients implied by the general restrictions stated previously. The latter can actually be shown to imply that demand must take one of the two following forms:

\[
x_i = a \cdot y + \lambda_i [y^A + k y^B + Ky^2] + \mu_i [(y^A + k y^B)^2 + Ly^2] \tag{R1} (3.6)
\]

or
Table 3.1 gives the log-likelihood ratios corresponding to the restriction equations (3.6) and (3.7) imposed on the ordinary least squares estimates of the nine consumption equations. The corresponding $\chi^2$ tests involve 33 and 40 degrees of freedom, respectively, and they are both above the critical 5 percent probability level. So it cannot be rejected that the data satisfy the cooperative hypothesis.

Another interesting consequence is that most conclusions stemming from bargaining ideas can be empirically tested along this line from readily available data. For instance a threat point interpretation implies that, when total income is kept fixed, $\Theta$ should increase with $y^A$ and decrease with $y^B$; hence the ratios of partials of $\Theta$ with respect to $y^A$ and $y^B$ should be negative. But from the developments mentioned previously, the same should then be true for the partial ratios of $x_i$ as well. This latter conclusion can be tested from any data set with different income sources. (Incidentally, the ratios appeared to be always nonnegative and, in several cases, significantly positive in the Bourguignon et al. [1993] estimation.)

**Price Effects**

As is well known, the "unitary" models have precise implications for the effects upon demands of price changes; specifically the Slutsky matrix of compensated price effects must be symmetric. This conclusion, however, is regularly rejected on household data (see for example Browning and Meghir [1991]). Usually this rejection has either been seen as a rejection of utility theory or been attributed to technical problems (inadequate functional forms, inappropriate separability assumptions, misspecification of the stochastic structure, and so on). Thus it has been concluded either that utility theory is false or that it is untestable. The collective approach, however, suggests a
different interpretation: the repeated rejections of substitution symmetry in empirical work may occur because household decisions cannot be stuffed into an overly restrictive unitary framework. This remark immediately leads to a basic question: can one derive restrictive, testable implications of the collective framework for demand functions that could be seen as the counterpart, or more precisely the generalization, of Slutsky symmetry and negativeness in the unitary case?

This problem is solved by Browning and Chiappori (1995). They consider a very general framework. For example, any commodity may be either public, or private, or both, and individual private consumptions are assumed to be unobservable. Similarly no particular assumption on individual preferences is introduced—except that they can be represented by conventional utility functions. This approach allows for intrahousehold consumption externalities, for any form of altruism, and so on. Despite this explicitly minimalist set of assumptions, the authors show that one can make very specific predictions about household behavior.

The principal theoretical result of the Browning and Chiappori (1995) paper is the following. Let $x_i(p,y)$ be the observed demand function (where $y$ denotes household income and $p$ the price vector; note that different income sources are no longer needed). Define, as usual, the Slutsky matrix $S = s_y$ by

$$S_y = \frac{\partial x_i}{\partial p_j} + x_i \frac{\partial x_i}{\partial y}$$

Then the collective framework has the following implication: $S$ is the sum of a symmetric, negative matrix $\Sigma$ and a matrix $R$ that has at most rank 1. That is, it can be written in the form

$$S = \Sigma + uv'$$

where $u$ and $v$ are $n$ vectors and $R = uv'$.

In the unitary framework, $S$ was symmetric, which corresponds to the particular case $R = 0$. Hence this “symmetric plus rank one” (SR1) condition is a straightforward generalization of Slutsky. A geometric interpretation of SR1 is the following. Note first that for any given pair of utilities the budget constraint defines the Pareto frontier as a function of the price-income bundle; then $\theta$ determines the location of the final outcome on the frontier, as in (3.3). Assume now that prices and income are changed. This action has two consequences. For one thing, the Pareto frontier will move. Keeping $\theta$ constant, this would change demand in a way described by the $\Sigma$ matrix. Note, however, that

---

10. It should be remembered that axiomatic models of bargaining with symmetric information generally generate efficient outcomes (this is the case, for instance, with all models developed so far in the Nash bargaining literature); hence the collective framework encompasses all cooperative models existing in the literature. As a consequence the conditions derived from the efficiency assumption alone do apply, a fortiori, to all these models as well.
this change will not violate Slutsky symmetry, that is, its nature is not different from the traditional, unitary effect. The second effect is that \( \theta \) will also change; this effect will introduce an additional move of demand along the (new) frontier. This change (as summarized by the \( R \) matrix) does violate Slutsky symmetry. But moves along a one-dimensional manifold are quite restricted. For instance, the set of price-income bundles that lead to the same \( \theta \) is likely to be quite large in general; indeed, under the smoothness assumption, it is an \((n - 1)\)-dimensional manifold. Considering the linear tangent spaces, this means that there is a whole hyperplane such that, if the (infinitesimal) change in prices and income belongs to that hyperplane, then no deviation from Slutsky symmetry can be observed. In other words, the SRI condition is a direct consequence of the fact that, in a two-person household, the Pareto frontier is of dimension 1, whatever the number of commodities.

Testing for SRI is an interesting problem. The basic idea is that a matrix \( S \) is SRI if and only if the matrix \( M = S - S' \) is of rank at most 2. The empirical strategy is thus the following:

- Estimate demands functions.
- Derive an estimation of \( M \).
- Test for the rank of \( M \).

Browning and Chiappori (1995) provide a first test on Canadian data. They divide the sample of households without children into three subsamples: single males, single females, and couples. They find that Slutsky symmetry is strongly rejected for couples, but not for singles—quite an interesting result, since it is probably the first time the property is tested on a sample of consumers (as opposed to households). In addition the SRI conditions are not rejected for couples, a finding that indicates that the collective model may indeed help understand the rejection of Slutsky symmetry.

Estimating the Model: The Case of One Assignable Good

Finally estimation issues should be considered. Stronger assumptions are needed for this purpose; essentially preferences must be either “egoistic” or “caring,” and private consumption must be separable, so that the sharing rule interpretation does apply. It is assumed here that one good (say, good \( A \)) is assignable. In that case, the effect of member \( i \)'s income upon member \( j \)'s consumption can be directly recorded. In fact not only do new conditions appear, but the sharing rule itself can be recovered up to an additive constant. To see why, note that if good 1 is assignable, then:

\[
\frac{\partial x_i^A}{\partial y^A} = \frac{\partial x_i^A}{\partial y^A} \frac{\partial \theta}{\partial y^A} \]

(3.8)

\[
\frac{\partial x_i^A}{\partial y^B} = \frac{\partial x_i^A}{\partial y^B} \frac{\partial \theta}{\partial y^B} \]

(3.9)
and

\[
\frac{\partial x^B_i / \partial y^A}{\partial x^B_i / \partial y} = \frac{-\partial \Theta / \partial y^A}{1 - \partial \Theta / \partial y} \tag{3.10}
\]

\[
\frac{\partial x^B_i / \partial y^B}{\partial x^B_i / \partial y} = \frac{-\partial \Theta / \partial y^B}{1 - \partial \Theta / \partial y} \tag{3.11}
\]

Then \( \partial \Theta / \partial y^A \), \( \partial \Theta / \partial y^B \), and \( \partial \Theta / \partial y \) can be recovered, and \( \Theta \) is known up to an additive constant. The intuition is that by looking at the assignable good it can be directly observed how changes in the various components of income affect each member’s consumption (rather than the sum of the two). Given that any variation of member A’s consumption that results from, say, an increase in his or her share must correspond to a decrease in member B’s share, and hence to a specific response in terms of member B’s consumption, a number of insights about the sharing rule become available. In fact the way in which the sharing rule varies in response to changes in incomes can be exactly identified. The only remaining ambiguity concerns the initial level (the constant) from which these variations take place.

The strong conclusion is that identification of one assignable good is sufficient for recovering the entire decision process. Under the specific assumptions that have been made—that is, egoistic or caring preferences, Pareto efficiency, and different exogenous income sources—each member’s total consumption in private goods can be deduced. As a matter of fact each member’s consumption of each private good can be ascertained—by simply observing how the consumption of one single private good is distributed within the household. Even stronger results can be established. For instance it can be shown that the observation of one member’s private consumption of some exclusive good is sufficient for recovering the sharing rule up to a constant (see Browning et al. 1994). For an empirical application, see Browning et al. (1994).

**Conclusion**

The set of “collective” approaches to household behavior developed so far is the starting point of a general and coherent research program. In traditional, single-utility models, households are black boxes, formally identical to individuals. Behavior depends, in particular, only on total income. The first step has been to establish empirically that the black box was functioning in a more complex way than suggested by traditional models—and that the distribution of income also mattered. Much progress has recently been made in this direction. There are now serious reasons to believe that the standard approach may miss some essential aspects of household behavior. The second step is to open the black box. Here the question is: can one define theoretically, and
recover empirically, some kind of stable structural pattern that underlies (collective) household behavior? The concept of the sharing rule is proposed as a candidate for this purpose.

In any case the most urgent task now is to test empirically the various collective models at stake. It should then be possible to draw policy conclusions. However, this step cannot be taken before completion of the second step—a goal that is far from being achieved. Although a few estimations have been performed, most of the work is still ahead.
Recent studies have raised doubts that the economic progress of women in the labor market translates into progress in their well-being at home (see Goldin [1990:211-13] for a succinct review of U.S. evidence and Schultz [1990] for a review of development policies and the status of women in developing countries). More generally how does economic progress in conjunction with a variety of policies translate into changes in the well-being of individual family members? When do the gains accrue primarily to wives, to husbands, or to children?

To date most of the analysis of intrahousehold distributions has rested on partial-equilibrium models of optimizing individuals or households. The partial-equilibrium analysis includes the work of Becker (1981 and elsewhere) based on altruism; the use of cooperative-bargaining models by Manser and Brown (1980), McElroy and Horney (1981), and others; work on collective decisions by Chiappori (1988a) and coauthors; and the use of noncooperative models by Lundberg and Pollak (Chapter 5, this volume), Ulph (1988), and others.

In contrast little analysis has been based on the appropriate general-equilibrium framework, the marriage market. In Becker's (1973, 1974a) seminal work on marriage markets, the emphasis was on assortative mating (who marries whom), rather than on the allocation of the gains from marriage (who gains what). Although Becker analyzed the core of the marriage market (the set of all equilibrium-allocation markets), there has been, to this author's knowledge, no work on the comparative statics of the allocation of the gains from marriage. Moreover, apart from a sentence or two in Becker (1981), there exists virtually no discussion of the formal links between partial- and general-equilibrium approaches to intrahousehold distributions.

This research was supported by National Science Foundation grant SES-91-02331. I thank Pierre-André Chiappori and John Hoddinott—as well as other participants in the World Bank–IFPRI conference “Intrahousehold Resource Allocation,” held in Washington, D.C., February 12–14, 1992—for their comments.
One reason for this inattention is undoubtedly the nonuniqueness of core solution allocations. In this chapter I take a first step toward the comparative static analysis of intrahousehold distributions in a general-equilibrium setting. The key is to define "sympathetic" solutions, a class of unique marriage market solutions that respond in predictable ways to changes in the economic opportunities outside marriage. Under sympathetic solutions, an individual's allocation within marriage directly reflects that individual's opportunities outside marriage. Many of the unique marriage market solutions found in the game theory literature are sympathetic precisely because sympathetic solutions embody certain notions of "fairness."

An interesting result emerges from this analysis. Under sympathetic solutions, anything that makes an individual better off outside marriage tends to increase (and never decreases) that person's equilibrium "price" or share of marital income. There is a well-known parallel result from partial-equilibrium cooperative-bargaining models: anything that makes the individual better off outside marriage increases that person's bargaining power within the marriage and thereby increases that person's utility within the marriage. Therefore there exists a deep complementarity between general-equilibrium sympathetic-marriage market models and partial-equilibrium cooperative models of family decisions. Each reinforces the conclusions of the other: the distribution of well-being among family members reflects their individual economic opportunities outside that family.

The first section of this chapter reviews several competing partial-equilibrium models of family decisions. A new analysis is presented of intrafamily distributions based on a general-equilibrium marriage market model. The deep complementarity between models of Nash-bargained family decisions and marriage market models is demonstrated. For simplicity this chapter discusses only two-person husband-wife families, although in many cases more general results are available.

Partial-Equilibrium Models of Family Decisions

Family Utility Models

Family utility models are defined here as models in which family decisions are observationally equivalent to decisions made by a single utility-maximizing agent subject to a family budget constraint. Although there exist several formal justifications for this model, the only satisfactory economic rationale is put forward by Becker (1973, 1974a, 1981). Other rationales for assuming that a family behaves as if guided by a single utility function are that (1) family members have identical preferences, (2) a family welfare function and a particular rule for the intrafamily distribution of income exist, and
(3) one family member is a dictator. Although technically correct, none of these rationales for a single utility function is economically justified.¹

Becker’s approach is based on a particular form of altruism. In his setup a single commodity is to be distributed between husband and wife. Each cares about his or her own consumption of this commodity and also about the utility derived from the consumption of his or her spouse. The family commodity endowment of each spouse is determined in the marriage market.² These endowments play a crucial role. If one spouse has a sufficiently high endowment relative to the other, then, owing to altruistic preferences, there may be scope for a Pareto move in which the relatively well-endowed spouse transfers commodity income to his or her partner. Becker described this process as an “effective altruist” transferring income to his or her “beneficiary.” The transfer is complete when no further Pareto moves are possible, that is, when, subject to the family budget constraint, the altruist’s utility is maximized.

Under certain assumptions, effective altruism solves the coordination problem and thereby allows separate analysis of family production and consumption.³ Hence it is in the interest of all family members to produce and, in general, act so as to maximize family income regardless of the consequences for their own individual incomes. What influences each individual’s welfare is (1) how far out the family budget constraint can be pushed and (2) how much the effective altruist values each beneficiary’s welfare. There is nothing in the

---

¹ At least four other names for family utility models appear in the literature. The first is “reduced form neoclassical models” or simply “neoclassical models” (for example, McElroy and Horney 1981). Adoption of this terminology was motivated by the nesting of “neoclassical models” within Nash-bargained models. As pointed out by an irritated referee who persuaded this author to switch from “neoclassical” to “altruistic,” bargaining models should not be contrasted with “neoclassical models” because bargaining models are in the neoclassical tradition. The other names include “altruistic models” in McElroy (1990) and “family utility models” (Lundberg 1988), which hark back to the labor supply literature; the value-laden term “dictatorial model” (Lundberg and Pollak, Chapter 5, this volume); and “unitary preference model” or “unitary model,” as used by Schultz (1990), Thomas (1990), and Alderman et al. (1995). The latter avoids the criticisms of the preceding terminologies and seemed to be the consensus of participants at the World Bank–IFPRI conference, including the author. In retrospect, however, the phrase conjures up images of a family whose members have identical and thereby nonconflicting preferences. Therefore, I have defected from the consensus.

I prefer the term “family utility model” because it subtly reminds one that the concept, sans Becker’s rationale, makes no economic sense, and also because it links it to the labor supply literature, the place where such models have received the most use.

² The wife’s endowment is “the [commodity] income that would be imputed to \( w \) [the wife] by the marriage market if she had married a selfish person otherwise identical to \( h \) [her husband].” The husband’s endowment is determined analogously (see, for example, Becker 1981:172–173).

³ Bergstrom (1989) showed that Becker’s “rotten-kid theorem” requires transferable utility. He also exhibited a class of utility functions that are necessary and sufficient for transferability to obtain. In the one-commodity world assumed here, transferable utility automatically obtains.
model that forces the effective altruist to be "generous" or "egalitarian" or "kind" to beneficiaries. Nor does the model preclude such characterizations. It accommodates "stingy" effective altruists who provide just enough to each family member to coordinate efficient production and consumption as well as "generous" effective altruists who value the consumption by beneficiaries almost as much as or as much as (but no more than) their own consumption.

In this setup, how does the economic progress of women in the labor market translate into improvements in their well-being at home? Consider a "small" increase in women's wages—small enough so that the optimal sorting in the marriage market remains unchanged, and small enough so that comparative advantages in market and home production do not switch. Such a wage increase would increase the full family income of each family by swinging out the budget constraint. It would cause some wives to enter the labor force and (assuming positive supply elasticities) other wives to work a little more in the market. In these women's families, goods would be substituted for time in home production, and commodity output would rise. This increase in commodity output would be distributed among family members according to the preferences of the altruistic head. It would not be distributed any differently than would an equivalent increase in commodity output due to an increase in the wage rate or the nonwage income of any other family member. Each member of a working woman's family would be at least a little bit better off. However, wives themselves are not predicted to benefit relatively more or less than would other family members.

It is precisely this wide latitude of the effective altruist that makes this model an impenetrable black box with respect to the intrafamily distribution of income. Suppose that family income increases because of the purposeful activities of, good luck of, inheritance of, rise in wages for, or government transfer to the wife. This increase is divided among family members solely according to the dictates of the effective altruist. Unless the wife is the effective altruist, no nontrivial increase in her well-being is guaranteed. The same holds for every member. More generally, for a small rise (fall) in wages, the altruist would allocate any resultant increase (decrease) in commodity output in a manner that is independent of who earned it. Similarly, for a small increase (decrease) in unearned income, the altruist would allocate any resultant increase (decrease) in commodity output in a manner that is independent of who received it.

The preceding analysis applies to small exogenous changes that result in small changes in interior solutions. Such changes are either consistent or inconsistent with one-person constrained utility maximization. If consistent, then behavior may be rationalized via an effective altruist, but the identity of the effective altruist and the effects on intrafamily distributions go unanalyzed. If inconsistent, then changes in the identity of the altruist and/or alternative models of family behavior must be considered. In contrast, sufficiently large
changes can lead to changes in the identity of the family altruist (for example, a switch from husband to wife) and even a new and different matching in the marriage market. Although such switches are a logical possibility, when an investigator invokes altruism and specifies a single utility function for a family, that investigator is examining small changes, thereby precluding identification of the altruist and of the intrafamily distribution of income and well-being.

Cooperative Bargaining Models

Very recently, especially in development economics, attention has shifted from altruistic models to bargaining models. Here the most highly developed model is the Nash cooperative-bargaining model of family behavior, introduced independently by Manser and Brown (1980) and McElroy and Horney (1981). The comparative statics of this model generalize those of a one-person neoclassical constrained utility maximization. Changes in demand result not only from shifts and twists in the budget constraint but also from changes in the objective function due to relative changes in power. These changes are determined by opportunities of each family member outside the family.

In the Nash bargaining model, two individuals, \( m \) and \( f \), solve a joint allocation problem. The Nash model maintains that \( m \) and \( f \) jointly allocate the commodity \( x \) so as to maximize the product of their individual gains from marriage:

\[
N = \left[ U^m(x) - V_0(p_0, p_m, w_m, I_m; E_m) \right] \left[ U^f(x) - V_0(p_0, p_f, w_f, I_f; E_f) \right]
\]  

subject to full household expenditures equaling full household income,

\[
p_0 x_0 + p_m x_m + p_f x_f + w_f I_f + w_m I_m = (w_m + w_f) T + I_m + I_f
\]

Here \( x_m \) is a good consumed by \( m \), \( x_f \) is a good consumed by \( f \), \( I_m \) is the leisure time of \( m \), \( I_f \) is the leisure time of \( f \), and \( x_0 \) is a household good (a Samuelsonian pure public good within the household); \( p_0, p_m, p_f, w_m \), and \( w_f \) are the corresponding prices. \( I_m \) and \( I_f \) are \( m \) and \( f \)'s respective and separate nonwage incomes. Nonwage income, in turn, is all income that is independent of the allocation of time between market work and other activities. The vectors \( E_m \) and \( E_f \) are "extrahousehold environmental parameters" (EEPs) and are discussed shortly. Finally, \( V_0(p_0, p_m, w_m, I_m; E_m) \) is \( m \)'s threat point as determined by his maximized indirect utility (in the unmarried state); \( V_0(\cdot) \) is analogously defined. The reader is referred to McElroy (1990:5–10) for details.

The solution to maximization of equation (4.1) subject to equation (4.2) is a system of demand equations (for goods and leisure):

\[
\begin{align*}
x_i &= h_i(p, I_m, I_f, E_m, E_f), & i = 0, m, f \\
l_i &= g_i(p, I_m, I_f, E_m, E_f), & i = m, f
\end{align*}
\]  

4. Other cooperative-bargaining models were proposed by Clemhout and Wan (1977), who used a Lindahl solution, and Manser and Brown (1980), who explored a Kalai-Smorodinsky solution.
The arguments of these demand functions include all prices, separate measures of nonwage income for \( m \) and \( f \), and the EEPs, \( E_m \) and \( E_f \).

McElroy (1990) gave a comprehensive statement of the empirical content of Nash-bargained household behavior, including the comparative static results for EEPs. EEPs are pure threat-point shifters. They include, for example, measures of the size of the relevant marriage or remarriage market for an individual, which, in turn, could include rural-urban dummies; the sex ratio for the relevant age group; dummies for religion, caste, and unusual traits (deviant height, IQ greater than 160, and so forth); and measures of mobility. EEPs would also include wealth or permanent income and productivity outside marriage. In addition to own wages and nonwage income, these measures would include measures of employability (for example, dummies for various degrees of prohibition on market work by gender) and measures of wealth of one’s family of origin. They would also include parameterizations of variations in the rules for property settlements and of the rules governing marriage and divorce that help to determine child support, custody, and alimony. For example, individual states in the United States may be characterized as permitting no-fault divorce or requiring mutual consent for divorce (H. E. Peters 1986). Finally, all taxes and transfers that are conditioned on marital status can be used as EEPs, as well as variations in child allowances and in the subsidization of child care. In cross-state or cross-country comparisons, even the unit of taxation (family versus individual) may play the role of an EEP.

This menu of potential EEPs is long, and a few comments are in order. First, it may be augmented with the more detailed examples of comparative static marriage markets mentioned later in this chapter. As noted in the introduction, changes in EEPs are precisely those changes whose effects one analyzes in studying the comparative statics of marriage markets. Second, this listing of EEPs is certainly not exhaustive of all parameters that affect the welfare of individuals outside marriage. Rather it indicates the types of variables that may serve as EEPs in empirical work. Third, empirical work requires variation in these variables. But, in any given cross-section or time-series data for a given locale, most of these variables remain fixed. Finally, interpreting the coefficients associated with EEPs is often a delicate business. There are issues of endogeneity (for example, nonwage income is the result of past decisions) and identification (for example, parental wealth plays a role in marital selection as well as in intrafamily income distributions). For a more comprehensive discussion of EEPs, see McElroy (1990:566–568).

In the Nash model, the threat points of \( m \) and \( f \) play a key role. As noted above, \( f \)'s threat point \( (V_f) \) is the maximal level of utility that \( f \) can obtain outside the marriage. This level, in turn, depends on the prices of \( f \)'s goods, the wage rate for her labor, her nonwage income, and her EEPs; \( m \)'s threat point is analogously determined. An increase in the threat point of either spouse results in family demands that more strongly reflect the preferences of that spouse.
Hence the demand functions in equation (4.3), inheriting their arguments from the threat points, include as arguments not just all prices and wages but the nonwage income of each spouse (as opposed to the spouses' pooled nonwage income), as well as the EEPs.

Some Relationships between Noncooperative and Cooperative Models

Cooperative-bargaining models require that the threat points represent credible threats. In the context of small daily decisions, it is not credible for either spouse to threaten to leave the marriage. Ultimately only credible threats ensure that the cooperative solution agreement is enforceable. Ulph (1988), explicitly, and Lundberg and Pollak (Chapter 5, this volume), implicitly, recognize this point by producing noncooperative models of family decisions. In particular, both made the interesting point that the noncooperative solution could be used as the threat points for a cooperative Nash game.

Ulph's proposal dovetails with the game-theoretic results of Binmore, Rubinstein, and Wolinsky (1986). They showed that the cooperative Nash solution is the limiting (as time between offers goes to zero) subgame perfect equilibrium for a noncooperative game of alternating offers. Hence the enforceability of the cooperative Nash agreement follows from the self-enforcing property of an appropriately specified noncooperative game.

Binmore, Rubinstein, and Wolinsky (1986) showed that the appropriate specification of the threat points in the underlying noncooperative game depends on the players' motives (risk aversion or time preference) to settle. For Nash-bargained household decisions, this insight distinguishes models of short-run decisions from models of long-run decisions.

Short-run family decisions can be thought of as responses to small serial shocks. For these decisions, time preference motivates the spouses to settle. Here the solution to a noncooperative game such as that of Ulph (1988) emerges as the natural specification of the status quo as threat point. In contrast, for long-run decisions, the loss of the opportunity to marry in the first place and the risk of one partner's leaving the marriage motivate the specification of threat points that reflect each spouse's best opportunities outside the marriage.

Threat points reflecting opportunities outside marriage are in line with those currently specified in Nash bargaining applications. These specifications measure men's and women's independent economic viability and marriage or remarriage prospects. Hence one would expect these outside opportunities embedded in the threat point to explain long-term, "marriage-cycle" decisions such as fertility, investments in the health and human capital of children, and

---

5. Harsanyi and Selten (1988) provide support for the Nash cooperative-bargaining approach by arguing that the Nash cooperative criterion function emerges naturally under a wide range of interesting noncooperative setups.
the joint allocation of time between the market and household production. These threat-point specifications should not be expected to work well in explaining evolving responses to small serial shocks.\(^6\)

In sum, unlike family utility models, Nash-bargained household decisions translate women's increased economic independence directly into increased welfare within their families. This increase in welfare should be observable in terms of long-term, "marriage-cycle" decisions, but not in responses to small serial shocks.

**Other Approaches**

In addition to the family utility and bargaining models, at least two other types of models deserve mention. The first is Pollak's (1985) "transactions cost approach" to family decisions. The other is a Pareto-only approach by Chiappori (1988b; Chapter 3, this volume). Neither the transactions cost approach nor the Pareto-only approach was designed to focus on the link between women's economic independence and their well-being within families. However, such linkage would be consistent with both models.

**The Relationships among Models**

Figure 4.1 depicts the relationships among static, partial-equilibrium models of family decisions and intrafamily distributions. (The shapes and sizes of the sets are not to scale!) The largest rectangle represents the set of all possible models of household decisions. It contains the largest circle, representing the set of all bargaining models of household behavior, including cooperative and noncooperative models. The largest square also contains the rectangle that is meant to suggest an open book, with a left-hand page and a right-hand page. This rectangle intersects the circle. The entire rectangle (including both "pages") represents the set of all possible models resulting in Pareto-optimal allocations within families. The right-hand page represents all Pareto-optimal models that exclude the effects of EEPs; this would include Chiappori's (1988b) model. The left-hand page represents all Pareto-optimal models that include the effects of EEPs. Continuing to work inward, the book contains the ellipse that represents the set of all Nash cooperative models.

The relationship between Chiappori's model and the Nash bargaining model is interesting. Formally, Chiappori's model contains the Nash bargaining model so long as EEPs are identified as determinants of the bargaining rule. However, his model lacks a compelling economic rationale for EEPs as he does not analyze the sources of bargaining power. Hence the Nash bargaining

---

\(^6\) The author owes both the Binmore, Rubinstein, and Wolinsky (1986) reference and this distinction between the threat points for short-term and long-term decisions to Peter Cramton and Kenneth Kletzer and, in turn, to T. Paul Schultz, who arranged for them to discuss an earlier paper of mine at a Yale University conference.
model complements his approach by giving an economic rationale for EEPs and thus insight into their empirical specification.

Returning to the ellipse, which represents the set of all Nash cooperative models, some of these include EEPs and lie on the left-hand page and some of them may exclude EEPs. In the world of testing, excluding EEPs means that the highest available utility levels outside a particular marriage are unresponsive to EEPs \( (\partial V/\partial E_k = 0 \text{ for } k = m,f, \text{ and likewise for all higher derivatives}) \) and, therefore, EEPs do not appear as arguments in family demands for goods and leisure \( (E_l \text{ and } E_m \text{ may be excluded from the arguments of equation } [4.3]) \). It is still possible, however, that income pooling may not hold. If, in addition, income pooling is imposed, then the Nash cooperative model collapses to the family utility model. This is shown as the triangle on the right-hand side of the ellipse. The family utility model is clearly the least general of all of the classes of models under discussion.

**Marriage Markets**

The altruism and bargaining models share a common feature. Both models are conditioned on the existence of a given family unit. Becker (1981) tied
his altruism model directly to the marriage market by conditioning the initial (pre-redistribution via altruism) "endowment" of each spouse; these initial endowments are the allocations imputed to each one in the marriage market (see note 3). But the connection of both altruism and bargaining models to the marriage market is weak because neither deals, either implicitly or explicitly, with the fact that marriage markets do not in general yield unique solutions, but rather a set of solutions, the core. In linking the economic independence of women to their well-being in families, this connection is a key issue.

The analysis presented in this section by no means solves this problem of nonuniqueness. Nor does it provide an entirely satisfactory link between bargaining models and the core. It does, however, provide some insight into this link. For whatever justification there may be for the Nash bargaining model using opportunities outside the marriage as credible threats vis-à-vis long-run decisions, this justification must be ultimately grounded in marriage market analysis. What emerges from this section is a picture wherein the conclusions of Nash and marriage market models reinforce each other: for both, the economic independence of husband and wife has a direct effect on their respective incomes within the marriage.

The remainder of this section derives novel and important comparative static results that link the economic independence of women (and their marriageability) directly to their share of the intrafamily distribution of income and, therefore, to their welfare as wives. The setting is the monogamous marriage market of Becker. The theoretical underpinnings come from the pure game-theoretic theorems of Demange and Gale (1985). Although this section employs an extremely simple example, the results hold quite generally.

Setup

Marriage markets are so-called "two-sided" markets (for example, of firms and workers, of buyers and sellers, or, in our case, of women and men). Participants on both sides of the market are motivated by potential gains that can be realized only by being matched with (for example, marrying) someone from the other side. Marriage markets answer two questions: (1) who is matched with whom (and who remains unmatched) and (2) how is the total surplus from each marriage allocated between the spouses.

In a marriage market of men and women, the gains to each participant take the form of commodity income. Commodity income is measured in terms of a single Beckerian commodity, $z$, which is produced from purchased goods and household time. As in national income accounting, all output is consumed by individuals, and in this context it is called income. A participant’s gain from the marriage market is the income that person receives over and above what he or she would receive if he or she did not participate. It is assumed that participants act to maximize their own individual incomes.
For purposes of exposition, assume that there are only two men, \( M_1 \) and \( M_2 \), and two women, \( F_1 \) and \( F_2 \). Without loss of generality, assume that if \( M_i \) (or \( F_j \)) remains single, his (her) commodity income is zero (this normalization is inessential to the results of the analysis). Furthermore, assume that if \( M_i \) and \( F_j \) marry, their total gain (or surplus) in marriage is given by \( z_{ij} \), and that these gains are arrayed as follows:

<table>
<thead>
<tr>
<th>Baseline case</th>
<th>( F_0 )</th>
<th>( F_1 )</th>
<th>( F_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( M_0 )</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>( M_1 )</td>
<td>0</td>
<td>( z_{11} )</td>
<td>( z_{12} )</td>
</tr>
<tr>
<td>( M_2 )</td>
<td>0</td>
<td>( z_{21} )</td>
<td>( z_{22} )</td>
</tr>
</tbody>
</table>

This array indicates, for example, that if \( M_1 \) marries \( F_2 \), their total commodity output would be \( z_{12} \). If \( M_1 \) remains unmarried (that is, marries \( F_0 \)), his commodity income is normalized to be 0.

In this simple setup, there are only two possible matchings. One is the diagonal matching, in which \( M_1 \) marries \( F_1 \) and also \( M_2 \) marries \( F_2 \). It is denoted by \((1,1),(2,2)\). The other is the off-diagonal matching; it is denoted by \((1,2),(2,1)\). Without loss of generality, assume that the indexes were chosen so that the diagonal matching is the equilibrium matching. In the present example, this amounts to assuming that

\[
z_{11} + z_{22} \geq z_{12} + z_{21}
\]

If \( M_i \) and \( F_j \) marry, let \( m_{ij} \) and \( f_{ij} \) indicate their respective incomes. Then if the diagonal matching is the equilibrium matching, it must be feasible, that is,

\[
m_{11} + f_{11} = z_{11}
m_{22} + f_{22} = z_{22}
\]  \hspace{1cm} (4.4)

Furthermore, the marriage is rational for each individual only if

\[
m_{11} \geq 0, \quad f_{11} \geq 0
\]
\[
m_{22} \geq 0, \quad f_{22} \geq 0
\]  \hspace{1cm} (4.5)

Finally, this matching is stable only if

\[
m_{11} + f_{22} \geq z_{12}
m_{22} + f_{11} \geq z_{21}
\]  \hspace{1cm} (4.6)

7. Formally, for convenience, the “dummy” participants, \( F_0 \) and \( M_0 \), were created. Then if \( M_i \) is “matched” with \( F_0 \), this is interpreted as \( M_i \) being single, with normalized income of zero, and so forth.

8. A theorem from linear programming applies to this problem whereby (1) the primal solution is the matching that maximizes the grand total income as found by summing over all couples and (2) the dual solution is the set of core allocations (see, for example, Roth and Sotomayor 1990).
The first inequality in equation (4.6) is interpreted thus: suppose $M_1$ is married to $F_1$ and receiving $m_{11}$, and $F_2$ is married to $M_2$ and receiving $f_{22}$. Stability requires that the total of their incomes $(m_{11} + f_{22})$ must be at least as great as what they could get if they married each other $(z_{12})$. Otherwise it would pay them to leave their respective marriages and marry each other. Using equation (4.4), these stability conditions may be reexpressed as

$$m_{22} \leq (z_{22} - z_{12}) + m_{11}$$

$$m_{22} \geq (z_{21} - z_{11}) + m_{11} \quad (4.7)$$

A solution is a matching along with an allocation of the marital outputs that is feasible, individually rational, and stable. Hence if the diagonal matching is the solution matching, the solution allocation $(m_{11}, f_{11}, m_{22}, f_{22})$ must satisfy equations (4.4), (4.5), and (4.7).

Figure 4.2 graphs the set of core allocations for a particular array of $z_{ij}$s, given by

$$Z = \begin{bmatrix} 8 & 4 \\ 9 & 7 \end{bmatrix}$$

9. This numerical example coincides with that used by Becker.
Here, $O_m$ is the origin for the men and $O_t$ is the origin for the women. An allocation of $z$ is given by $(m_1, f_1, m_{22}, f_{22}) = (m_{11}, z_{11} - m_{11}, m_{22}, z_{22} - m_{22})$. Hence any point in the rectangle between $O_m$ and $O_t$ represents a unique, feasible, and individually rational allocation (that is, it satisfies equations [4.4] and [4.5]). Stability (equation [4.7]) adds an upper and a lower bound for $m_{22}$, represented by the two bold diagonal lines. With no further structure, the solution to the marriage market problem is not unique.\(^{10}\) Hence every point in or on the bold polytope in Figure 4.2 is a solution. It is the core.

Any such core has what is called a lattice structure. This property guarantees that there is a best solution for the men that coincides with the worst solution for the women. Conversely there will also be a best solution for the women that coincides with the worst solution for the men. Figure 4.2 labels these so called M-optimal and F-optimal points as M and F.

"Sympathetic" Solutions

The M- and F-optimal points play a key role in mechanisms that select a unique solution from among all the possible core solutions. For example, one well-known solution, "split the difference," would draw a line connecting M and F and then implement the allocation corresponding to the midpoint. Other schemes implement the F-optimal and M-optimal points. Crawford and Knoer (1981) showed that these can be implemented via an "English auction." If, for example, Sotheby's employed its usual procedures and auctioned off the men to the women, the final equilibrium would be (to a well-specified approximation) the F-optimal point. Since this is the best possible outcome for each woman there, no woman would have any incentive to manipulate the auction by misrepresenting her preferences.

The English auction is one of a class of auction schemes designed to solve the classic difficulties of nonuniqueness and manipulability. The traditional game-theoretic approach considers these difficulties to be "solved" when a mechanism for implementing the desired unique solution is found that cannot be successfully manipulated.\(^{11}\) Although these are insightful solutions in the context of auctions and other asymmetric buyer-seller problems, they are less than satisfactory in the more symmetric context of monogamous marriage markets of men and women.

Note, however, that the split-the-difference solution, the English auction, and other solutions, all share a common feature: the final utility of the men is nondecreasing in the M-optimal point and nonincreasing in the F-optimal point. Because of the lattice property, this result implies that the final utility of

\(^{10}\) For markets with more than two men and two women, in general, the matching is also not unique.

\(^{11}\) There are several other, more sophisticated, solutions satisfying uniqueness and non-manipulability. See Roth and Sotomayor (1990) or Demange and Gale (1985).
the women is nondecreasing in the F-optimal point and nonincreasing in the M-optimal point. To indicate that the final utilities of participants on both sides of the market move in a predictable way with the M- and F-optimal points, this chapter terms implementation schemes with this property "sympathetic" implementation schemes.

Henceforth it is assumed that the actual mechanism for selecting a unique solution from the core is sympathetic. Under this assumption it is sufficient to analyze the comparative statics of changes in the M- and F-optimal points.

**The Comparative Statics of "Sympathetic" Marriage Markets**

The economic independence of women or men is defined as their economic ability to maintain themselves (and possibly their children) outside marriage. Changes in economic independence can occur in many ways, including increased wages; increased nonwage income via inheritance or good luck; government taxes and transfers; changes in the laws regarding marriage, divorce, alimony, and child support; or any changes in legal or social rules that promote the ability of men or women to maintain themselves outside marriage. This section assumes that such changes can be monetized. As the analysis shows, it is crucial to distinguish portable from nonportable changes. A portable increase is defined as one that is carried from the single to the married state. Nonportable changes cannot be so carried.

**Case 1: Nonportable Increases in Women's Economic Independence.** Consider the core illustrated in Figure 4.2 as the baseline case. Now consider an exogenous increase in the incomes of single women of amount $c$. Assume this income is lost upon marriage and is therefore nonportable. This increase raises the normalized single incomes of women from 0 to $c > 0$. Since this increase is not portable into the married state, the $z_8$s remain the same. The array of possible outputs now looks like this (with $c > 0$):

<table>
<thead>
<tr>
<th>Case 1</th>
<th>$F_0$</th>
<th>$F_1$</th>
<th>$F_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_0$</td>
<td>0</td>
<td>$c$</td>
<td>$c$</td>
</tr>
<tr>
<td>$M_1$</td>
<td>0</td>
<td>$z_{11}$</td>
<td>$z_{12}$</td>
</tr>
<tr>
<td>$M_2$</td>
<td>0</td>
<td>$z_{21}$</td>
<td>$z_{22}$</td>
</tr>
</tbody>
</table>

Since the $z$s are unaltered, the feasibility conditions (equation [4.4]) and the stability conditions (equation [4.7]) remain unchanged. However, individual rationality (equation [4.5]) now requires

$$m_{11} \geq 0, \quad f_{11} \geq c$$

$$m_{22} \geq 0, \quad f_{22} \geq c \quad (4.5')$$

Hence the women's individual rationality rules out allocations in the cross-hatched northeast border in Figure 4.3, reducing the core to the shaded polytope ($F'M'Q'P'$).
Notice that by equation (4.5') the M-optimal point decreases from M to $M'$ while the F-optimal point remains at $F = F'$. Hence the M-optimal solution moves from M to $M'$ (increasing both $f_{11}$ and $f_{22}$ by $c$ and thereby decreasing both $m_{11}$ and $m_{22}$ by $c$), the equal-split solution moves from $E$ to $E'$ (increasing both $f_{11}$ and $f_{22}$ by $c/2$ and thereby decreasing $m_{11}$ and $m_{22}$ by $c/2$), and the F-optimal solution remains unchanged (at $m_{11} = 0, m_{22} = z_{21} - z_{11}$). Note that the change in final allocations under a split-the-difference solution is exactly halfway between the changes incurred under the M-optimal and F-optimal solutions. This pattern is associated with the nonportability of the increase in the women’s single incomes from the unmarried to the married state.

**CASE 2: PORTABLE DECREASES IN WOMEN’S ECONOMIC INDEPENDENCE.**

The first case considered a nonportable increase in women’s independence. This second case considers a portable decrease in women’s income. Again, consider the core in Figure 4.2 as the baseline case. Denote the decline in the economic independence of women as a fall in their normalized single incomes from 0 to $c < 0$. Since this decline is portable into marriage, the new total married incomes are given by

$$z_{ij}' = z_{ij} + c < z_{ij}, \quad i,j = 1,2$$
The array of possible incomes is now (with \( c < 0 \))

<table>
<thead>
<tr>
<th>Case 2</th>
<th>( F_0 )</th>
<th>( F_1 )</th>
<th>( F_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( M_0 )</td>
<td>0</td>
<td>( c )</td>
<td>( c )</td>
</tr>
<tr>
<td>( M_1 )</td>
<td>0</td>
<td>( z_{11} + c )</td>
<td>( z_{12} + c )</td>
</tr>
<tr>
<td>( M_2 )</td>
<td>0</td>
<td>( z_{21} + c )</td>
<td>( z_{22} + c )</td>
</tr>
</tbody>
</table>

As in the first example, individual rationality (equation [4.5]) becomes (4.5'), only in this case \( c \) is now a negative number. Since the women’s economic loss is portable into the marriage, the feasible set shrinks from equation (4.4) to

\[
\begin{align*}
  m_{11} + f_{11} &= z_{11} + c < z_{11} \\
  m_{22} + f_{22} &= z_{22} + c < z_{22}
\end{align*}
\]

Figure 4.4 superimposes the core for case 2 on the baseline case of Figure 4.2. Since total married income has decreased by \( |c| \) for each couple, both dimensions of the available set go down by \( |c| \). Holding the \( F \) origin fixed (\( O_f = O'_f \)), this is shown as the translation of the \( M \) origin from \( O_m \) to \( O'_m \). In
addition, since the single incomes of women have decreased by $|c|$, the set of allocations that satisfy individual rationality now includes the hatched border along the north and east edges. If each husband drove his wife to indifference between marriage and bachelorhood, and if the stability conditions were not binding, the men could get to $R$ in the extreme northeastern corner, where each wife would receive $c < 0$. Since the (lower bound on) stability is binding, however, the best the men can do is $M'$, the new M-optimal point. Conversely, the best the wives can do is to get all of the marital output at $F'$, the new F-optimal point. The case 2 core is the shaded polytope $F'M'P'Q'$. Despite the reduction in marital surpluses, it is as large as the baseline core (the bold polytope) because the loss of income to single women converts some previously unstable allocations (involving negative, normalized incomes for women as small as $c < 0$) into stable allocations. These allocations are in the intersection of the hatched border and the shaded core.

In moving from the baseline case to case 2, both the F-optimal and the M-optimal points respond to the portable decrease in women’s incomes. Hence all three sympathetic marriage market equilibria respond as well. The M-optimal solution moves from $M$ to $M'$ (maintaining a constant distance from the M origin but moving relative to the F origin). Hence each husband suffers neither loss nor gain, while each wife absorbs the entire loss in her portable income (that is, her income declines by $|c|$). Similarly the F-optimal solution moves from $F$ to $F'$ (getting closer to the F origin while maintaining a constant distance from the M origin). Once again the entire loss is absorbed by the wives (each wife’s income declines by $|c|$) and each husband’s income remains unchanged. Finally, the split-the-difference solution moves from $E$ to $E'$ (closer to the F origin, but a constant distance from the M origin). Yet again, each wife absorbs the entire loss to her marriage and her husband’s income remains unchanged.

Note that the M- and F-optimal solutions represent two extremes for the intrafamily distribution of income and the split-the-difference solution lies midway between. Nonetheless the response of all three sympathetic equilibria to a decrease in women’s portable income is the same: the wives absorb the entire loss; their husbands remain unaffected.

**CASE 3: PORTABLE INCREASES IN MEN’S ECONOMIC INDEPENDENCE IN COMBINATION WITH A DECREASE IN WOMEN’S ECONOMIC INDEPENDENCE.** Suppose, as in case 2, the single incomes of all women decreased by $|c|$, where $c < 0$, and, in addition, the single incomes of all men increased by $b > 0$. Furthermore suppose both types of income changes are portable into marriage. The array of possible incomes becomes (with $b > 0$, $c < 0$)

<table>
<thead>
<tr>
<th>Case 3</th>
<th>$F_0$</th>
<th>$F_1$</th>
<th>$F_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_0$</td>
<td>0</td>
<td>$c$</td>
<td>$c$</td>
</tr>
<tr>
<td>$M_1$</td>
<td>$b$</td>
<td>$z_{11} + (b + c)$</td>
<td>$z_{12} + (b + c)$</td>
</tr>
<tr>
<td>$M_2$</td>
<td>$b$</td>
<td>$z_{21} + (b + c)$</td>
<td>$z_{22} + (b + c)$</td>
</tr>
</tbody>
</table>
FIGURE 4.5 Case 3 versus case 2 and baseline case

As in the last example, stability (equation [4.7]) is unchanged. Feasibility (equation [4.4]) becomes

\[ m_{11} + f_{11} = z_{11} + (b + c) \]
\[ m_{22} - f_{22} = z_{22} + (b + c) \]  \( (4.4") \)

Finally, individual rationality (equation [4.5]) becomes

\[ m_{11} \geq b, \quad f_{11} \geq c \]
\[ m_{22} \geq b, \quad f_{22} \geq c \quad \text{for } b > 0, \ c < 0 \]  \( (4.5") \)

Figure 4.5 superimposes the core of this case over that of case 2 from Figure 4.4, which, in turn, was superimposed on the core of the baseline case in Figure 4.2. (All of the labels from Figure 4.4 were carried over to Figure 4.5.) To produce a simple graph, assume that \( b = |c| \). Holding the \( F \) origin fixed at \( O_f'' = O_f' = O_f \), the increase in mens' incomes by \( b \) is shown as the translation of the \( M \) origin from \( O_m' \) to \( O_m'' = O_m \). However, since the single incomes of men have increased by \( b \), the set of allocations that satisfy individual rationality for the men now excludes the cross-hatched border along the south and west edges. If each wife drove her husband to indifference between marriage and
bachelorhood, and if the stability conditions were not binding, wives could get only to the point \((b,b)\), not all the way to \(O_m''\). Since (the lower bound on) stability is binding, the best the wives can do is only \(F'' = F'\), the new F-optimal point. Conversely, if each husband drove his wife to indifference between marriage and bachelorhood, and if the stability conditions were not binding, husbands could get all the way to \(R\) in the extreme northeast corner. Since (the lower bound on) stability is binding, however, the best the husbands can do is \(M''\), the new M-optimal point. The case 3 core \(F''M''P''Q''\) coincides with the case 2 core \((F'M'P'Q')\). Owing to the increase in each husband’s portable income, every allocation in the case 3 core represents his gain of \(b\) over his corresponding allocation in the case 2 core.

In moving from case 2 to case 3, the M-optimal point responded to the portable increase in men’s incomes: the distance between the M origin and the M-optimal point increased by \((b,b)\) (that is, the distance from \(O_m''\) to \(M''\) is larger—by \((b,b)\)—than the distance from \(O_m'\) to \(M'\)). Hence if the M-optimal solution is implemented, each husband captures the entire increase in his portable income; each wife neither gains nor loses. The distance between the F-optimal point likewise responded to the portable increase in men’s incomes (that is, the distance between the M origin and the F-optimal point increased by \([b,b]\)). Hence if the F-optimal solution is implemented, again each husband captures the entire increase in his portable income; each wife neither gains nor loses. Finally the case 3 split-the-difference solution is at \(E''\), midway between \(M''\) and \(F''\). Comparing this with the case 2 solution at \(E'\) reveals the effect of the portable increase in men’s incomes: each husband captures his entire increase and each wife neither gains nor loses. As before, the M- and F-optimal solutions represent two extremes of the intrafamily distribution of income; the split-the-difference solution lies in between. Nonetheless all three solutions respond the same way to an increase in the men’s portable income: each husband captures his entire gain; the wives gain nothing.

Now the net effect of a portable increase in men’s economic independence in combination with a portable decrease in women’s economic independence can be seen by comparing the core and solutions in Figure 4.2 (the baseline case) with those in Figure 4.5 (case 3). Figure 4.5 illustrates case 3 when \(c = -b\), and hence there is no change in family income \((z_j + b + c = z_j)\). For any of the three sympathetic solutions considered, the net result is the same: the women lose on two counts. First they lose \(|c|\) because their economic independence has declined, and then they lose \(b\) because their husband’s economic independence has risen. Conversely the men gain \(|c|\) and \(b\) for the same reasons. Note that even if there is a net gain in family income (that is, if \(b > |c|\)), women still incur a two-part loss \((-b + c < 0)\) and men still receive a two-part gain \((b - c > 0)\).

To sum up, all three examples illustrate the defining property of sympathetic implementation schemes: an increase (decrease) in the economic
independence of one gender generally increases (decreases) and never decreases (increases) the married incomes of that gender. Distinctions between portable and nonportable changes in economic independence play a key role.

Finally, as case 3 illustrates, systematic gains in the economic independence of one gender that come at the expense of the economic independence of the other can be deceptively harmful. Although such changes may increase family income or leave it unchanged, the resulting large changes in the intrafamily distribution of income will nonetheless systematically help one gender at the expense of the other. A seemingly benign increase in family income may represent a double gain to one gender, but a "double whammy" to the other.

A note on the level of generality is appropriate here. Many additional cases can be analyzed. With appropriate sign changes, gains can be converted into losses and vice versa. The roles of the men and the women can be interchanged. The gains or losses need not be the same for each member of each gender. Moreover, gains and losses could be only partially portable or super-portable (diminishing or gaining in size upon marriage). Furthermore, many of these results for the two-by-two example presented here will generalize to a marriage market with $m$ men and $n$ women (see Demange and Gale 1985).

**Some Policy Applications**

Many policy issues can be illuminated with this simple marriage market model. For example, suppose a government subsidizes single mothers and their children, but not married mothers. For simplicity, let the size of the subsidy be $c > 0$. This example fits case 1. One oft-bemoaned effect of such subsidies is the marriage disincentive represented by the reduction in the size of the core in Figure 4.3. One previously unrecognized effect of such subsidies is that (under any sympathetic implementation scheme that is less extreme than the M-optimal one) the existence of welfare payments for unmarried mothers will increase the incomes of married mothers who are potential welfare recipients. This occurs because the welfare cushion shifts the intrafamily distribution of income in the mother's favor. This effect is stronger the smaller the mother's share would be in the absence of welfare (the closer the implemented marriage market solution is to the M-optimal solution). At a minimum, the wife must capture a gain from marriage equal to her potential welfare payment.

As a second example, suppose government policies or traditions restrict the education of women, thereby making them less productive both as single individuals and as wives. For simplicity suppose that the decrease in each woman's productivity, whether single or married, is represented by $c < 0$. Then $c$ is a portable decrease in each woman's income and the effect of this policy fits case 2. The prediction is that women's incomes are lowered both inside and outside marriage.

As a third example, take some development policies for poor rural regions that foster the development of crops for the market (such as rice) in order to
raise family incomes. Sometimes such policies systematically remove land from the control of wives (who raised subsistence crops) and turn it over to their husbands to raise cash crops, often using improved technologies such as fertilizer and irrigation (see, for example, Boserup 1970 and Schultz 1989). Such examples fit case 3. Husbands gain on two counts, because they now have more resources and because their wives have less. Their wives suffer doubly. Note that compensating the wives will not help them unless that compensation is portable outside the marriage.

As a fourth example, take comparable worth, implemented in such a way as to raise women's wages without lowering men's. These wage increases are portable into marriage (simplistically assuming the women do as much market work married as they would if single). This fits case 2 except that $c > 0$ replaces $c < 0$. Under any sympathetic marriage market solution, the predicted result is that the wives gain $c$ and the husbands gain nothing. As in the previous example, family income increases but the increase is not shared between the genders.

More realistically, assume that comparable worth were implemented by paying women more and men less. Reversing the roles of women and men, this fits case 3. A similar analysis holds for affirmative action or quotas. Men would have an obvious motive for resisting a decline in their economic independence—immediate market wage and income losses. But would they still be motivated to resist if they were married to a working wife whose benefit from the policy exceeded their loss? Sympathetic solutions to marriage markets predict they would resist. After all, a husband's equilibrium share of married income is predicted to decline both because his income is down and because his wife's income is up.

As a fifth class of examples, take child-care subsidies, family allowances, or any government transfer that is targeted to benefit children. To make a clean case, assume that upon divorce mothers always obtain custody, and that upon divorce or separation the benefit is fungible. Let the size of the benefit be $c$ and let it be received by the couple if married and by the mother if divorced. Then $c$ is a portable increase in the woman's income, increasing both her single income and the marital surplus to be split. Accordingly (this fits case 2, except that now $c > 0$), under all three sympathetic solutions, the mother is expected to capture the entire benefit.

This fifth class of examples can be made more interesting by assuming that the subsidies are paid for by a poll tax. Moreover, suppose the amount of the subsidy is $S$ and the poll tax is $T$, and that $S = 2T$ so that families neither gain nor lose income (that is, $z_g + S - 2T = z_g$). However, unmarried mothers gain $S - T = T$, whereas unmarried fathers lose $T$. This fits case 3, with $b = -c = T$.

---

12. The question of who pays for such an increase is ignored here.
except that the roles of the sexes have been interchanged. Hence it is concluded that under any of the three sympathetic marriage market solutions examined in this chapter, the tax-subsidy policy causes each husband’s income to decline by $S = 2T$ and each wife’s income to increase by $S = 2T$. This analysis reveals why such subsidies are often considered “women’s issues.”

**Conclusion**

As the previous section of the chapter demonstrates, certain marriage market models share a key feature with cooperative-bargaining models of family decisions: in the long run, the intrahousehold distribution of income reflects the outside opportunities of household members. These outside opportunities vary systematically with individual nonwage incomes and other variables. In the context of Nash-bargained family decisions, these other variables that parameterize shifts in these outside opportunities have been termed extra-household environmental parameters or EEPs. In both partial- and general-equilibrium contexts, they provide an analytical vehicle for analyzing the impact of the social and economic environment on household decisions and the intrafamily distribution of income. Moreover the complementarity of the partial-equilibrium cooperative-bargaining models with the general-equilibrium marriage market models gives rise to the conjecture that individually bargained household allocations may be aggregated in a consistent way up to a marriage market equilibrium. Although much work remains to be done, at both the theoretical and the empirical levels, and especially at their intersection, empirical evidence is emerging that EEPs may play a crucial role in the intrafamily distribution of income, especially where interest focuses on the long run.
The expectation that family policies will affect distribution within marriage is implicit in much popular discussion. For example, child-care subsidies and child allowances are often regarded as women's issues. Women's groups are outspoken advocates of such programs, and women are expected to be among their primary beneficiaries. This linking of women's and children's welfare with child-based subsidies is rooted in the gender assignment of child care: mothers expect and are expected to assume primary responsibility for their children.\(^1\) Yet the distributional implications of these policies are far from clear. Child-conditioned subsidies would certainly transfer resources to the heads of single-parent families, who are predominantly women. But what effect, if any, would such programs have on distribution between women and men in two-parent families?

Using a new model of marital bargaining, we analyze the distributional effect of such programs in two-parent families, focusing on an analytically tractable special case. We compare two child allowance schemes: in the first, a cash transfer is paid to the mother; in the second, it is paid to the father. In the event of divorce, we assume that under both schemes the mother becomes the

---

1. As Crawford and Pollak (1989) point out, it is often asserted that mothers are primarily responsible for child care in three senses: it is mothers who find a child-care provider and make the arrangements; it is mothers who take time off from work when a child is sick or when child-care arrangements collapse; and it is mothers who “pay” child-care expenses from their discretionary incomes.
custodial parent and receives the child allowance. The comparison we propose
is simpler than those involving more familiar programs such as child-care
subsidies because the alternative policies we consider involve neither price
effects nor tax incentive effects.

The two leading economic models of intrafamily allocation imply that
these alternative child allowance schemes have identical implications for
distribution in two-parent families. In the altruist model (Becker 1974a,
1981), the equilibrium is the point in the feasible consumption set that maxi-
mizes the altruist's utility; that point is independent of which parent receives
the child allowance because the feasible consumption set is identical under the
two child allowance schemes. In the bargaining models of Manser and Brown
(1980) and McElroy and Horney (1981), the equilibrium is determined by the
feasible consumption set and a threat point that is interpreted as the utility of
remaining single or of getting divorced. The equilibrium is independent of
which parent receives the child allowance because the feasible consumption
set and the well-being of single and divorced individuals are identical under the
two child allowance schemes.

Many participants in the public debate concerning actual government
transfers take it for granted that intrafamily distribution will vary systemati-
cally with the control of resources. When the British child allowance system
was changed in the mid-1970s to make child benefits payable in cash to the
mother, it was widely regarded as a redistribution of family income from men
to women and was expected to be popular with women: “Indeed so convinced
did some Ministers become that a transfer of income ‘from the wallet to the
purse’ at a time of wage restraint would be resented by male workers, that they
decided at one point in 1977 to defer the whole child benefit scheme” (Brown
1984:64).

In this chapter, we propose the “separate-spheres” bargaining model, a
new model of distribution in two-parent families. The separate-spheres model
differs from the divorce-threat model in two ways. First, the threat point is not
divorce but a noncooperative equilibrium defined in terms of traditional gender
roles and gender role expectations. Second, the noncooperative equilibrium,
although it is not Pareto optimal, may be the final equilibrium because of the
presence of transaction costs. We show that in the separate-spheres bargaining
model, cash transfer child allowance schemes that pay the mother and those
that pay the father can—but need not—imply different equilibrium distribu-
tions in existing marriages. The separate-spheres model is thus not inconsistent
with the view, popular among noneconomists, that distribution between
women and men in two-parent families will depend on which parent receives
the child allowance payment.

In the long run, the redistributive effects of child allowances depend on
the feasibility of making contractual arrangements in the marriage market. The
marriage market will wholly undo any redistributive effects if prospective
couples can make binding, costlessly enforceable, prenuptial agreements to transfer resources within the marriage; dowry and bride-price can, under certain circumstances, be interpreted as examples of practices that facilitate such Ricardian equivalence. If binding agreements cannot be made in the marriage market—and we think that this is the relevant case for advanced, industrial societies—child allowances may have long-run distributional effects.

The analysis of alternative cash transfer child allowance schemes is analytically tractable because it does not require us to consider policies that affect prices (for example, subsidizing child care) or policies that affect the well-being of single or divorced individuals (for example, Aid to Families with Dependent Children and other welfare programs). Cash transfer schemes such as child allowances are the policies most likely to be undone in the short run by bargaining within existing marriages and in the long run by adjustments in the marriage market. The effects of other policies, such as child-care subsidies, on distribution between women and men in two-parent families are thus likely to be greater than this comparison of alternative child allowance schemes suggests.

We begin by presenting an overview of the problem of intrafamily distribution and then develop several versions of the separate-spheres bargaining model. Next we show that in the long run the marriage market can completely undo any redistribution effects of child allowances if binding, costlessly enforceable, prenuptial agreements can be made. We then consider the case in which individuals cannot make binding, costlessly enforceable agreements in the marriage market; it is shown that in this case the redistributive effects of child allowances may induce changes in the equilibrium number of marriages, as well as changes in distribution within particular marriages. The final section is a brief conclusion.

Models of Intrafamily Distribution

Economic models of household behavior have generally ignored distribution within the family. Samuelson's (1956) consensus model provided the first formal justification for this neglect. Samuelson was concerned not with explaining distribution within the family but with identifying the conditions under which consumer demand analysis could proceed without doing so. In the consensus model, each member of the family behaves as if there were a family utility function that all attempt to maximize; this assumption allows the family to be analyzed as a single unit. Because the incomes of individual family members are pooled in the joint budget, the effect of lump-sum payments (for example, property income or government transfers) is independent of which family member receives the payment. As Samuelson made clear in his original article, as a theory of distribution within the family the consensus model is a nonstarter.
The economist's standard model of distribution within the family is Becker's (1974a, 1981) altruist model. Becker postulates that the family contains one "altruistic" individual—the husband, father, patriarch, dictator—whose preferences reflect his concern for the welfare of other family members. Becker argues that the presence of one altruist who makes positive transfers to each member of the family is sufficient to induce purely selfish but rational family members to maximize family income. The resulting distribution is the one that maximizes the altruist's utility function subject to the family's resource constraint. Becker's "rotten-kid theorem" (Becker 1974b, 1981) embodies this result; Pollak (1985), Bergstrom (1989), and Johnson (1990) articulate the conditions under which the conclusion of the rotten-kid theorem holds. The source of the altruist's power in Becker's model is not his concern with the welfare of others but rather his assumed ability to confront others with take-it-or-leave-it choices; altruism in the sense of caring about the welfare of others is required only to explain why the altruist chooses a distribution that allows other members of the family a positive surplus (that is, more than their reservation levels of utility). The altruist model implies that an increase in family resources, within certain limits, will have the same effect on intrafamily distribution regardless of which spouse receives the resources. It therefore implies that a government program of child allowances would have identical effects on distribution regardless of whether the payments went to mothers or to fathers. According to both the altruist model and the consensus model, the family behaves as if it were maximizing a single utility function. This approach implies restrictions on observable outcomes that the data fail to support.\footnote{A survey by McElroy (1981) concludes that there is little empirical support for these restrictions. Lundberg (1988) empirically rejects a simple version of the consensus model as a foundation for the labor supply behavior of husbands and wives.}

Bargaining models of marriage (Manser and Brown 1980; McElroy and Horney 1981) treat marriage as a cooperative game: spouses with conflicting interests or preferences are assumed to resolve their differences in a manner prescribed by the Nash or some other explicit bargaining solution. A distinguishing feature of bargaining models is that family demand behavior depends not only on total family resources but also on the resources controlled by each spouse individually. Individual control of resources matters because bargaining outcomes depend on threat points as well as on the feasible consumption set. The threat point in a cooperative game is usually described as reflecting the outcome that would obtain in the absence of agreement. Manser and Brown (1980) and McElroy and Horney (1981) specify the threat point as the individuals' maximal levels of utility outside the family—that is, the value of divorce. The more attractive are an individual's opportunities outside the
family, the more strongly that individual’s preferences will be reflected in the intrafamily distribution of resources.³

The dependence of intrafamily distribution on the well-being of divorced individuals provides a mechanism through which government policy can affect distribution within marriage in divorce-threat bargaining models. An increase in the child allowances paid to divorced mothers will increase the expected utility of divorced women and cause a reallocation of family resources in two-parent families toward goods and services more highly valued by wives. An increase in child allowances paid to all mothers would affect distribution in two-parent families through the divorce-threat effect and through an income effect. Under the assumption that, in the event of divorce, the mother gets the children and the child allowance, both husbands and wives would be indifferent between a child allowance scheme that paid mothers and one that paid fathers: an increase in child allowances paid to married mothers and a decrease in child allowances paid to married fathers creates neither divorce-threat effects nor income effects.

Although divorce may be the ultimate threat available to both spouses and is a possible destination for marriages in which bargaining has failed, it is not the only possible threat point from which bargaining could proceed.⁴ Following a suggestion made by Woolley (1988), we consider a noncooperative Cournot-Nash equilibrium within marriage as an alternative threat point.⁵ Within an existing marriage, a noncooperative equilibrium corresponds to a utility-maximizing strategy in which each spouse takes the other spouse’s strategy as given. Under some circumstances, this equilibrium more accurately represents the outcome of marital noncooperation than does the costly and time-consuming alternative of divorce.

What distinguishes a noncooperative marriage from a pair of independently optimizing individuals? Joint consumption economies are an important source of gains to marriage, and even noncooperative family members enjoy the benefits of household public goods. If individual family members can supply public goods consumed by the entire household, then the noncooperative

---

³. As McElroy (1990) emphasizes, this dependence of household demands on the external alternatives available to individual family members is a testable implication of the bargaining framework. Empirical evidence consistent with family bargaining has been accumulating. For example, unearned income received by husbands and wives has been shown to have different effects on outcomes such as time allocation and fertility (Schultz 1990) and child health and survival (Thomas 1990).

⁴. We ignore the threat and the actuality of family violence, although we think that the relationship between family violence and intrafamily distribution deserves more attention. For an interesting discussion, see Tauchen, Witte, and Long (1991).

⁵. Because Nash's name is associated with both the cooperative and the noncooperative equilibrium concepts we use, we have tried to avoid the phrase "Nash equilibrium."
family equilibrium is analogous to the voluntary provision of public goods model analyzed by Bergstrom, Blume, and Varian (1986). As one might expect, public goods are undersupplied in this noncooperative equilibrium, and there are potential gains to cooperation. Additional gains can be expected if coordination of individual contributions is required for efficient household production. In the absence of cooperation and coordination, the effective quantity of public goods and services such as meals and child care will be less than the amounts that could be produced from the individual contributions. Specialization in the provision of such goods reduces the need for complex patterns of coordination, and traditional gender roles serve as a focal point for tacit division of responsibilities.

Specialization by gender is a pervasive aspect of family life. In the United States, though market work by married women has increased enormously in recent decades, men continue to carry most of the responsibility for earning income in two-parent families, while women continue to carry both the responsibility for and the actual work of supplying household services. Carried to extremes, the traditional division of labor and responsibilities suggests a "separate-spheres" equilibrium in the family. When husband and wife each bear the responsibility for a distinct, gender-specific set of household activities, minimal coordination is required because each spouse makes decisions within his or her own sphere, optimizing subject to the constraint of individual resources. If binding, costlessly enforceable agreements regarding transfers can be made prior to marriage, such agreements may involve a "housekeeping allowance" for the wife or "pocket money" for the husband. If binding agreements cannot be made, the level of transfers may be zero, or it may be determined by custom or social norms.

In a noncooperative marriage, a division of labor based on socially recognized and sanctioned gender roles emerges without explicit bargaining. In the separate-spheres bargaining model, this voluntary contribution equilibrium is the threat point from which bargaining proceeds. Cooperative bargaining is distinguished by the ability of the players to make binding agreements within marriage. The negotiation, monitoring, and enforcement of such agreements give rise to transaction costs, which may vary over husband-wife pairs. The

---

6. Pahl (1983) describes four types of financial management in husband-wife households, three of which are consistent with the "separate-spheres" equilibrium. Under the "whole-wage" system one partner, usually the wife, manages all family income and is responsible for all expenditures, except for the personal spending money of the other partner. This system is characteristic of low-income families in Britain and other European countries. Under the "allowance" system, the husband pays the wife a set amount and she is responsible for specific items of expenditure. With "independent management," separate incomes are used to finance expenditures within each partner's "sphere of responsibility." In all empirical studies cited, these three systems are together more prevalent than the fourth—"shared management."

7. Caution: We are concerned here with the ability of the spouses to make binding agreements within marriage. Their ability to make binding agreements before marriage plays a crucial role in determining long-run effects.
Separate-Spheres Bargaining and the Marriage Market

noncooperative default allocation avoids these costs; the voluntary contribution equilibrium is maintained by social enforcement of the obligations corresponding to generally recognized and accepted gender roles. It will be optimal for couples with high transaction costs or low expected gains from cooperation to remain at the stereotypical noncooperative solution.

The distributional implications of the separate-spheres bargaining model differ from those of the divorce-threat bargaining model. As Warr (1983) and Bergstrom, Blume, and Varian (1986) have shown, the control of resources among the potential contributors to a public good in a voluntary provision model affects neither the equilibrium level of the public good nor the equilibrium utility levels of the potential contributors, provided that each potential contributor makes a strictly positive contribution. These invariance properties do not hold, however, at corner solutions. In the noncooperative, voluntary contribution equilibrium in the family, gender specialization generates corner solutions and hence the equilibrium distribution may depend not only on total family resources but also on who controls those resources.

Household Public Goods and Bargaining

We first consider distribution within a particular marriage. The preferences of the husband, $h$, and the wife, $w$, are represented by the von Neumann–Morgenstern utility functions $U^h(x_h, q_1, q_2)$ and $U^w(x_w, q_1, q_2)$, where $x_h$ and $x_w$ are private goods consumed by the husband and wife, and $q_1$ and $q_2$ are household public goods jointly consumed by the husband and wife. Thus we assume that interdependence in the marriage operates only through consumption of the public goods: there is no “altruism” in the sense of interdependent preferences, although it would be a straightforward extension to allow $i$’s utility to depend directly upon $j$’s private consumption or $j$’s utility. Cooperative solutions to the family’s distribution problem have been extensively analyzed elsewhere. With Nash bargaining, the equilibrium values of $x_h$, $x_w$, $q_1$, and $q_2$ are those that maximize the product of the gains to cooperation; these gains are defined in terms of a threat point representing the utility each spouse would achieve in the absence of agreement. Figure 5.1 depicts the threat point, the feasible set, and the Nash bargaining solution in the utility space. An alternative

8. This is, of course, a cop-out. By appealing to the social enforcement of gender roles, we beg the question of how “norms” of any type are established and maintained. Elster (1989) and Sugden (1989) discuss this issue and provide references to the literature.

9. Although child allowances may affect fertility, we ignore this complication. Instead we assume that all marriages produce the same number of children, thereby avoiding the issues of endogenous fertility and stochastic fertility.

10. Nash (1950) shows that a system of four axioms uniquely characterizes the Nash bargaining solution: Pareto optimality; invariance to linear transformations of individual von Neumann–Morgenstern utility functions; symmetry (that is, interchanging the labels on the players
The characterization of the Nash bargaining solution is as the point in the feasible set that maximizes a “social welfare function” that depends on the threat point. More precisely, the Nash social welfare function is a symmetric Cobb-Douglas function, where the origin has been translated to the threat point: 

\[ N = (u^h - T^h)(u^w - T^w) \]

It follows immediately that the utility an individual receives in the Nash bargaining solution is an increasing function of the utility the individual receives at the threat point: thus, for example, an increase in the threat point utility of \( h \) and a decrease in that of \( w \) will cause an increase in the Nash bargaining solution utility of \( h \) and a decrease in that of \( w \).

We write the threat point as \( [T^h(p_1, p_2, I_h, I_w), T^w(p_1, p_2, I_h, I_w)] \), where \( T^h(p_1, p_2, I_h, I_w) \) is the indirect utility function, \( p_1 \) and \( p_2 \) are the relative prices of the public goods (we assume that the prices of \( x_h \) and \( x_w \) are equal and we normalize them to 1), and \( I_h \) and \( I_w \) are the exogenous incomes received by husband and wife.\(^\text{11}\)

\(^\text{11}\) Instead of treating income as exogenous, we could treat wage rates as exogenous and focus on labor-leisure choices, with leisure as a private good.

---

*FIGURE 5.1 The household Nash bargaining solution*
To derive the demand functions for the public and private goods, we maximize the Nash social welfare function

$$N = \left[ U^h(x_h, q_1, q_2) - T^h(p_1, p_2, I_h, I_w) \right] \left[ U^w(x_w, q_1, q_2) - T^w(p_1, p_2, I_h, I_w) \right]$$

subject to the constraint that joint expenditure equal joint income:

$$x_h + x_w + p_1q_1 + p_2q_2 = I_h + I_w$$

This yields the demand functions

$$x_i = g^h(p_1, p_2, I_h, I_w) \quad i = h, w$$

$$q_k = g^w(p_1, p_2, I_h, I_w) \quad k = 1, 2$$

Incomes received by the husband and wife enter these demand functions separately because they affect not only the feasible set but also the threat point. If the threat point depends on other parameters representing the extramarital environment, then these parameters will also enter the demand functions of two-parent households. So far we have been silent about the interpretation of the threat point: it could correspond to divorce, to violence or the threat of violence, or to a noncooperative equilibrium within marriage.

A noncooperative marital equilibrium provides an interesting alternative to divorce as a specification of the threat point. If divorce involves substantial transaction costs or can be dominated by sharing public goods within an intact but noncooperative marriage, then the voluntary contribution equilibrium offers a more plausible alternative to divorce as the threat point from which bargaining may proceed. Replacing an “external” threat point with an “internal” one and introducing transaction costs will affect final household allocation in two ways: it will influence cooperative-bargaining outcomes via the threat point for each spouse, and it may be an equilibrium allocation in marriages for which transaction costs outweigh the potential gains to cooperation. Until otherwise noted, we assume that divorce is impossible or prohibitively expensive so that the relevant threat point is the noncooperative, voluntary contribution equilibrium within marriage.

We begin with a simple Cournot equilibrium in the provision of public goods by husband and wife, assuming that socially prescribed gender roles assign primary responsibility for certain activities to the husband and others to the wife. The implications of household separate spheres are straightforward; they generate corner solutions and thus nonneutrality in the provision of public goods. We then show how these results are modified when we allow cash transfers or binding premarital agreements between husband and wife.

Suppose that the public good, $q_1$, falls within the husband’s traditional sphere so that, in the absence of a cooperative agreement, the husband decides unilaterally on the level of $q_1$ consumed by the household. Similarly, suppose that $q_2$ falls within the wife’s sphere. In a noncooperative marriage, husband
and wife decide simultaneously on the levels of $q_1$ and $q_2$ they will contribute to the household. This exclusive assignment of public goods reflects a socially sanctioned allocation of marital responsibilities and is independent of preference or productivity differences between husband and wife in a particular marriage.\footnote{12}

The husband chooses $x_h$ and $q_1$ to maximize $U^h(x_h, q_1, q_2)$ subject to $x_h + p_1 q_1 = I_h$, where $\bar{q}_2$ is the level of public good chosen by the wife. This decision leads to a set of “reaction functions,”

\begin{align*}
x_h &= f^{x_h}(p_1, I_h, \bar{q}_2) \\
q_1 &= f^{q_1}(p_1, I_h, \bar{q}_2)
\end{align*}

Similarly the wife’s demand functions for $(x_w, q_2)$ will depend upon $\bar{q}_1$. The Cournot equilibrium is determined by the intersection of the public goods demand functions. For a simple example, consider the Klein-Rubin-Stone-Geary utility functions:

\begin{align*}
U^h &= \alpha_h \log(x_h - x_h') + \beta_h \log(q_1 - q_{1h'}) + (1 - \alpha_h - \beta_h) \log(q_2 - q_{2h'}) \\
U^w &= \alpha_w \log(x_w - x_w') + \beta_w \log(q_2 - q_{2w'}) + (1 - \alpha_w - \beta_w) \log(q_1 - q_{1w'})
\end{align*}

Because these utility functions are separable, the reaction functions are independent of the quantity of the public good provided by the spouse, and demands take a very simple form:

\begin{align*}
x_h &= x_h' + \alpha_h I_h' \\
q_1 &= q_{1h'} + \frac{\beta_h}{p_1} I_h' \\
x_w &= x_w' + \alpha_w I_w' \\
q_2 &= q_{2w'} + \frac{\beta_w}{p_2} I_w'
\end{align*}

where $I_h'$ and $I_w'$ are the husband’s and wife’s supernumerary or discretionary expenditures, which are defined as

\begin{align*}
I_h' &= I_h - x_h' - p_1 q_{1h'} \\
I_w' &= I_w - x_w' - p_2 q_{2w'}
\end{align*}

Substituting the reaction functions into the direct utility functions yields indirect utility functions of the form $V^h_0(p_1, p_2, I_h', I_w')$ and $V^w_0(p_1, p_2, I_h, I_w)$. The husband’s utility depends upon the resources of his wife through his consumption of “her” public good and vice versa.

\footnote{12. Household production models, on the other hand, explain specialization by gender as a response to pervasive and persistent differences in home and market productivities of the husband and wife in a particular marriage, while recognizing that these individual productivity differences may reflect past investments in specific human capital. Average differences in preferences or productivities may help to explain the evolution of gender roles, but individuals take gender roles and gender role expectations as given.}
In the separate-spheres model with a Cournot threat point, the alternative child allowance schemes imply different household allocations: the non-cooperative equilibrium depends on the individual resources of husband and wife, and thus on which parent receives the child allowance payment. A change in child allowance policy that affects the threat point will also affect the cooperative equilibrium. Thus distribution between men and women in two-parent families can be affected by policy changes that have no effect on the relative well-being of divorced men and women.

This nonneutrality result is sensitive to our assumptions. If the model is altered by removing the separate-spheres assumption, then household allocation will be invariant to changes in the child allowance policy whenever positive contributions to each public good are made by both husband and wife. If the model is altered by allowing additional mechanisms for reallocation between spouses, such as cash transfers or binding premarital agreements, then household allocation will be invariant under some conditions. We examine these two modifications in the next version of the model, in which the wife specializes in the provision of a single household public good, \( q \), which we describe as child services, and the husband specializes in the provision of money income, some portion of which he may transfer to his wife.

In the model with transfers, we assume that the process determining the distribution of the marital surplus occurs over two periods. In period 1, marriage contracts are made. When these contracts are made, the parties do not know the actual values of individual incomes, \( I_h \) and \( I_w \), though the distributions from which they are drawn are common knowledge to all marriage market participants. We assume that prospective couples can make binding, costlessly enforceable, prenuptial agreements that specify a minimum transfer, \( t \), which will be paid from husband to wife in period 2. The agreed minimum transfer cannot be contingent on future income realizations; it may be voluntarily augmented by the husband in period 2, or it may be superseded by cooperative bargaining. If binding agreements are not possible, then all marriages that form will be based on a contractual transfer level of zero, although all marriage market participants recognize that voluntary supplementary transfers may be made in period 2. We discuss marriage market effects later in this chapter.

In period 2, the husband’s and wife’s incomes are realized and the husband may voluntarily make a supplementary transfer, \( s > 0 \), in order to increase his consumption of \( q \). We suppose that the husband acts first, choosing \( x_h \) and \( s \) to maximize \( U_h(x_h, q) \) subject to the budget constraint \( x_h = I_h - t - s \) and the wife’s reaction function \( q(s) \). The wife takes the husband’s supplementary transfer as given and chooses \( x_w \) and \( q \) to maximize \( U_w(x_w, q) \) subject to \( x_w + pq \)

---

13 There will be no marital bargaining in period 2 if complete contingent contracts can be made in the marriage market.
= I_w + t + s, where p is the relative price of child services. Consider the case of Klein-Rubin-Stone-Geary utility:

\[ U^h = \alpha_h \log(x_h - x_h') + (1 - \alpha_h) \log(q - q_h') \]

\[ U^w = \alpha_w \log(x_w - x_w') + (1 - \alpha_w) \log(q - q_w') \]

where, to simplify the algebra, it is assumed that \( q_h' = q_w' = q' \).

The discretionary expenditures of each spouse are given by

\[ \hat{I}_h = I_h - x_h' \]

\[ \hat{I}_w = I_w - x_w' - pq' \]

The supplementary transfer to the wife will be positive when

\[ \hat{I}_h - t > \alpha_h (\hat{I}_h + \hat{I}_w) \]

When \( s > 0 \),

\[ x_h = x_h' + \alpha_h (\hat{I}_h + \hat{I}_w) \]

\[ x_w = x_w' + \alpha_w (1 - \alpha_h) (\hat{I}_h + \hat{I}_w) \]

\[ q = q' + \left[ \frac{(1 - \alpha_w)(1 - \alpha_h)}{p} \right] (\hat{I}_h + \hat{I}_w) \]

yielding indirect utility functions (and threat points) of the form \( V'(p, \hat{I}_h + \hat{I}_w) \).

If the equilibrium is one in which positive supplementary transfers are made from husband to wife, then the value of the noncooperative solution to each spouse depends only on the total resources of the family, and not on the separate sources of income. Redistributions from husband to wife will be offset dollar for dollar by adjustments in the supplementary transfer, \( s \).

If the realizations of \( I_h \) and \( I_w \) are such that the condition for positive supplementary transfers is not met, however, individual incomes affect the noncooperative equilibrium. If \( s = 0 \), the husband spends his entire uncommitted income, \( I_h - t \), on his private good, \( x_h \), and the wife allocates her total income, \( I_w + t \), to her private good and child services. The utilities corresponding to this voluntary contribution equilibrium are

\[ V^h(p, \hat{I}_h - t, \hat{I}_w + t) \]

\[ V^w(p, \hat{I}_w + t) \]

In the separate-spheres bargaining model with transfers, the alternative child allowance schemes have identical effects if supplementary transfers are positive when the child allowance is paid to the mother. But if the family is at a corner solution—that is, if \( s = 0 \) when the child allowance is paid to the

---

14 Allowing \( q'_h \) and \( q'_w \) to differ complicates the algebra but does not substantially alter the results.