1999

Changes of household consumption behavior during the transition from centrally-planned to market-oriented economy

Sonya Kostova Huffman
Iowa State University

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor MI 48106-1346 USA
313/761-4700 800/521-0600

Changes of household consumption behavior during the transition from centrally-planned to market-oriented economy

by

Sonya Kostova Huffman

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Economics

Major Professor: Stanley R. Johnson

Iowa State University

Ames, Iowa

1999

UMI Number: 9924723

UMI
300 North Zeeb Road
Ann Arbor, MI 48103

Graduate College
Iowa State University

This is to certify that the Doctoral dissertation of

Sonya Kostova Huffman

has met the dissertation requirements of Iowa State University

Signature was redacted for privacy.

Major Professor

Signature was redacted for privacy.

For the Major Program

Signature was redacted for privacy.

For the Graduate College

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my major professor, Dr. Stanley R. Johnson, for his guidance, encouragement and financial support during my study at Iowa State University. I want to thank the rest of my committee, Dr. Peter Orazem, Dr. Helen Jensen, Dr. Alicia Carriquiry and Dr. Yannis Bilias, for their valuable suggestions and comments. I am thankful to Emmanuel Jimenez, Wlodzimierz Okrasa and Qing-Hua Zhao from The World Bank who let me use the Polish Household survey data and provided me with additional survey documentation. I am grateful to Debra Bailey from Syracuse University for sending me the data sets and more information about the data.

I want to express my greatest appreciation to my husband Wally for his encouragement and helpful discussions and ideas for my dissertation. I would also like to express my appreciation to my daughter Nadia for her patience and to my parents and my brother for their support during my studies in the United States.

CHAPTER 1. INTRODUCTION

Under the centrally-planned system in the Central European nations (and Poland as an example), many goods were rationed to the consumer. The consumer prices were fixed by the government: some goods were subsidized. Available goods with artificially low prices were frequently allocated through waiting time in long queues and waiting lists.

During the transition from a centrally-planned to market economy the supply and demand for consumption goods changed. How did households adjust their behavior when the opportunity sets of consumption goods change? How did consumption patterns change in response to increased variety of goods? Were the households better-off or worse-off under the new system?

This study will focus on the consequences of removing non-price rationing for demands of food and other goods and for the household consumption patterns generally, and then on welfare. Economic reforms were affecting the availability of goods, commodity prices, family incomes and other socio-demographic factors which implied a changing structure of consumption. Enlightening development policy requires information that can be acquired by modeling household behavior and estimating price and income elasticities.

In answering the question of how consumption patterns change we have to consider the following:

- increased availability of consumption goods: quantity and variety.
- what did household's "resources buy" before and after the reforms.
- change in the household's budget constraint.

Under the centrally-planned economy consumers' patterns of purchases were dictated by the availability and rationing of goods. One of the features of socialist society was shortage of commodities. Consumer goods ranging from necessities such as housing, to luxuries, such as cars were rationed or in short supply. Rationing distorted consumers' behavior since consumers could not buy the desired quantities at government controlled prices. Podkaminer (1982, 1986, 1988) analyzed the disequilibrium in Polish consumer markets, and he found that the consumer markets in Poland suffered from distortions in relative prices. Food appeared to be overpriced as compared to its market equilibrium price, and the observed food shortage was caused by the spillovers from markets of rationed but underpriced housing, cars, services. Rationing may have lead to increased demand for the goods which could be purchased freely because consumers spent less than desired on the rationed goods, and this may have spillover between rationed and non-rationed good markets.

Before the reforms many goods were not available. The opportunity set of households for consumption goods was quite limited. The consumers constantly encountered shortages. The "deficit goods" such as cars, telephone station, housing etc. kept destructing consumption patterns. Shortages caused loss and inconvenience to consumers. They often had to wait for supply, to queue up, and were forced to be happy with commodities different from their original wish. Sometimes they could not cover their particular demand at all.

With the reforms, the trade barriers were removed and with the improved domestic production, the variety and availability of commodities have increased. The opportunity set for

consumers after the reforms was constrained only by the income and prices. Under the market economy, queues are gone and a much wider range of goods is available at free market prices. During the economic transformation, prices rose, relative prices changed due to removal of pre-reform distortions and due to better terms of trade after the reforms, but real incomes for the majority of households fell indicated by GDP per capita implying a significant change in purchasing behavior. Various social groups may have had differentiated consumption patterns in terms of quality and quantity, and experienced different impacts of the reform in terms of standards of living.

In answering the question of how consumption patterns change, we have to consider the changing role of status in purchasing goods and services. Before the reforms, purchases involved cash income which was relatively equal across households and noncash resources such as status in the communist party, connections, bribes which affected the access to goods and services. After the reforms, cash income became relatively more important relative to noncash resources.

Artificially low prices for some goods in the pre-transition period created product shortages. The cost of these shortages can not be captured by standard consumer price indices. One result is that measures of inflation from rationed to unrationed regimes exaggerate true price changes. Virtual prices are a more precise and useful way to characterize a welfare change associated with a change in the rationing of goods. In this study virtual prices will be used to calculate the consumer price indices for the pre-reform period, making it possible to construct pre- and post-reform welfare comparisons.

Are the households better-off or worse-off under the new system? The hardship caused by a large drop in real purchasing power in the beginning of the transition was not experienced uniformly across the whole population, certain groups with low and fixed nominal incomes such

as unemployed and retired people likely found themselves in a worse situation than before. Some households were better placed to be able to earn good wages in the private sector or become successfully self-employed. In addition, some households may have been able to replace lost purchasing power through home production.

The Consumer Goods Shortages Under the Centrally-Planned Economy

In developed market economies, economic policy is oriented to satisfy consumers' needs and wants. Equilibrium is achieved and maintained through the market. Under centralized economy as the name suggests production and distribution were planned. Investments were directed by plan in order to produce the state's desired commodities and services. Consumer prices and wages, determined by the central planners, were kept low. Therefore, the resulting resource allocation had been highly inefficient and created many distortion throughout the economy. Relative prices of goods were not a result of the demand and supply. Market pricing was replaced by the state's determination of the values. The market was short of many goods and rationing of essential items was the rule rather than an exception. The consumers could purchase only what was supplied at given prices. Anything beyond that had to be obtained on the black market with higher free market prices. According to a World Bank study for Poland, rationing of meat was associated with the emergence of three to four times higher free market price than the official price in state shops for 1988 and 1989 (Atkinson 1992).

One example for a rationed good under socialism was housing. The excess demand for housing was produced by underpricing which was made possible by huge subsidies. The

artificially low prices stimulated demand and discouraged supply. People were not happy with their housing, which had been a mixture of private and public ownership with control on occupancy. Many families waited for a decade and longer on lists for cooperative housing after having made a down payment. Some people could not move even if they no longer had a job because there was no housing where jobs existed. Quality, distribution, price, and access created serious problems. Housing shortages slowed down the rural-urban migration which was necessary for rapid industrialization. Because of the severe housing shortage, families were willing to accept new dwellings regardless of their condition. These new apartments were delivered unfinished in buildings situated in far suburbs of large cities, without roads and sidewalks, or food stores and schools.

Under the previous system one family was allowed to use no more than one unit--an apartment or a house. Rents were based on the size of apartments and their technical standards. They were supposed to cover the cost of maintenance, but not to allow for any profit for property owners. However, rents remained below this cost which resulted in forced owner's subsidies, gradual financial and physical decapitalization. Housing in Poland has been composed of four sectors: public sectors--(1) municipal, (2) cooperatives, and (3) state enterprises, and private sector--(4) the individual (Table 1.1).

The implications of the resulting shortages from the government controls on prices and setting them so low that supplies of goods were exhausted depend on how goods were allocated. Queuing and waiting lists were considered as a fair process (Elster 1991). However, first, some of the sales were discriminatory where not all buyers were treated equally. The privileged, e.g. political leaders, could purchase commodities in closed shops unavailable for others. Second,

Table 1.1 Housing Stock in Poland 1988 (percent)

Type of ownership	Total	Urban	Rural
Public sector	56.5	76.3	18.4
local authority	19.6	27.8	3.4
cooperative	24.3	36.7	0.7
company	12.6	11.8	14.3
Private sector			
individual ownership	43.5	23.7	81.6

Source: Golebiowski 1994

shortages led to secondary markets with much higher prices which occurred through direct sales of goods outside the official sector or through resale of goods bought at official prices. Third, places in queuing could be purchased and sold. It has been suggested that old pensioners undertake paid queuing on the behalf of others (Atkinson 1992).

All rationing systems affect the distribution of income. It gives preference to some members of society over others. The consequences of disequilibrium and rationing of non-food commodities such as housing, cars, other services may imply overtaxation of the majority of people with the greatest burden on the lowest income groups, and oversubsidization of well-off residents who have easier access to luxuries.

Official calculations of price indices are of considerable interest in to the study of distributional issues for pre- and post-reform periods. Changes in real households' incomes may be used to indicate an improvement or decline of living standards. However, the existent shortages of consumption goods in the centrally-planned economy have important implications for the calculation of price indices. Historically prices in the centrally-planned economies were

fixed by the central governments. Due to the operation of black markets and other unofficial channels, the transition prices were in practice higher. However, the prices used in computing the official price indices were the centrally fixed prices. In the situation of shortages and secondary/black markets, the appropriate price index must include official and secondary market prices in addition to the official prices. Not including the secondary market prices in the price index in the pre-reform period can be expected to cause price inflation to be overstated.

Under the centrally-planned economy prices of staple foods, transportation and municipal services were set at very low levels well below their cost. In addition, central and local governments had provided large subsidies essential commodities such as food, coal and rent. Prior to the reforms prices were either administered, regulated or subsidized. The size of a subsidy for a given commodity was a function of its relative importance to consumers, and government priorities. Prices as a response to market did not exist.

Price subsidies may cause shortages which may bias official calculations of consumer prices and increase the significance of non-wage benefits. According to the World Bank (1989), subsidies were very important in Poland, and consumption subsidies represented some 11 percent of GDP for 1987 year, including: food-3.4 percent; housing-2.9 percent; transport-1.6 percent; energy-1.3 percent; health and medicine-0.9 percent.

An Overview of the Poland's Economy and Recent Consumption Trends

Poland was the first country in Eastern Europe to reestablish market economy. Table 1.2 presents selected macroeconomic indicators for the years of transformation. The economic and political transformation in Poland commenced at the beginning of 1990. The goal of the first

Table 1.1 Macroeconomic Indicators for Poland

	Unit	1989	1990	1991	1992	1993	1994
GDP (annual change)	%	n.a.	-11.6	-7.0	1.9	4.0	5.0
Industrial output (annual change)	%	n.a.	-24.2	-11.9	3.9	7.4	11.9
Agricultural output (annual change)	%	n.a.	-2.6	-1.6	-12.7	6.8	-9.3
Unemployment rate	%	n.a.	6.3	11.8	13.6	15.5	16.0
Consumer Price Index (annual change)	%	251.0	586.0	70.0	43.0	37.0	32.2
Trade balance (current account)	$ml	3189	4794	-618	-2726	-2700	-800
Exchange rate (annual average)	zl/$	1446	9500	10582	13631	18200	24400
Sectoral share of GDP (current prices)							
Agriculture	%	11.8	7.3	6.2	6.8	6.5	6.2
Food Industry	%	6.8	8.2	9.6	9.2	9.4	9.4
Employment share in GDP							
Agriculture	%	26.4	26.8	27.3	27.0	26.9	26.0
Food Industry	%	4.9	5.3	4.5	4.9	5.0	5.0
Government budget deficit (% of GDP)	%	-3.0	0.4	-3.8	-6.0	-2.8	-2.7

Source: GUS (Main Statistical Office) 1994 and Strong et al. 1996, p.256-261

market-determined reform package often called the Balcerowicz Plan was macroeconomic stabilization, rapid price liberalization and sharp reductions of subsidies. From the end of 1989 the food prices were first permitted to rise without government control. In January 1990 the price of bread rose by 147 percent, electrical energy by 370 percent, and furnace fuel, central heating and hot water by 400 percent. By mid-1990, more than 90 percent of the prices of all goods and services in Poland had been liberalized. The Polish economy had made the transition from relatively tightly controlled prices to nearly no control.[1] The opening of the economy to the forces of international competition and the collapse of the Council for Mutual Economic Assistance initially led to massive contraction of output and a sharp increase in unemployment, that were shorter and sharper than in other transition economies.

Economic growth resumed in 1992 when the economy started to rebound, spurred by the rapid expansion of a private sector that accounts for 52 percent of GDP in 1994 compare to 18.8 percent of GDP in 1988 (Strong et al. 1996). The acceleration of economic growth has been continuing in Poland since 1992 and by 1995 the country's output was back above the pre-reform level. GDP grew by 5 percent in 1994. Good prospects for the continuation of economic growth are based on the following developments observed in 1994:

- the rate of growth of investments in productive fixed assets is higher than the rate of growth of GDP;
- the number of unemployed has declined since 1994, the rate of unemployment decreased from 16 percent in 1994 to 15 percent in 1995, which is lower than in Spain and close

[1]The prices of a few items such as coal, fuel and rental housing were still under some form of price control but periodic increases were permitted (Shen 1992).

to the figure for Belgium;

- inflation is still one of the main concerns of the Polish government. The rate of inflation is declining but at lower rate from 37 percent in 1993 to 32.2 percent in 1994. One of the major factors contributing to relatively high rates of inflation is the fast growth of prices of agricultural and food products at the end of 1994;
- in 1994 Poland experienced fast growth of exports and imports, however, trade balance remained negative;
- average real wage increased in 1994 by 1.7 percent, but still remained below 1990 level.
- the structure of Poland's economy has changed considerably over the past seven years. The share of services in the economy has risen from 35 percent to 53 percent, while that of industry and consumption goods has shrunk from 52 percent to 39 percent. Agriculture's contribution to GDP has fallen from 12 to 6 percent. But farm employment still represents one-quarter of total employment, reflecting low productivity.

During the past years the Polish households have been exposed to the consequences of economic reform--from the output downfall when introducing the stabilization program with price liberalization to the recovery afterwards. The Poland's transition presents an interesting case for studying behavior of households during the transition from centrally-planned to market-oriented economy.

The price liberalization led to an improvement in the range and quality of goods and services, because prices had been maintained at artificially low levels. Some of expected benefits of freeing prices appeared quite quickly--queues for the basic foodstuffs disappeared.

Even up to the late 1980's the expenditure on food was 50-60 percent of total household

outlays (against 20-25 percent in developed Western European countries and 10 percent in USA). The shares on housing, health and education were very low compare to Western standards, a result of subsidies by the state (housing share was 15-17 percent, while in most developed countries was 30 percent). Table 1.3 shows the expenditure shares in Poland for the period from 1974 to 1986 for the following four main groups "food", including alcohol and tobacco, "clothing", including footwear, "rent", including heating and durables, and "rest", including health, education, leisure, culture, etc.

Estimates of the average monthly per capita consumption of basic food items is summarized in Table 1.4. The consumption of dairy products, including butter have been declining. Consumption of eggs, sugar, meat, and potatoes and vegetables in 1994 have been declining also compared to 1989. Only consumption of fruits has been increasing.

The economic reforms brought the biggest changes in the areas of food, housing, health and education. A study published by the Warsaw School of Economics (1996) analyzed the changes in consumption patterns based on household surveys conducted by the Central Statistical Office in 1988 and 1994. This study pointed out that there were new trends in the Polish households' consumption behavior since 1988. One is the growing demand for housing and durables. Changing patterns of consumption need to be evaluated when analyzing changes in a particular consumption category. The consumption patterns in Poland changed significantly during 1989-1994. There was a big drop in the share spent on food, clothing and footwear, while the expenditures on housing, health, education, and transport rose. Since 1988 the number of passenger cars increased by half and that of telephone lines by a third. In 1995, every second Polish family possessed a car and telephone.

The shock therapy of the early 1990s changed the "problem" from shortages of housing

Table 1.3 Expenditure Shares in Poland 1974-1986 (percent)

Year	Food	Clothing	Rent	Rest
1974	51.6	15.9	14.0	18.5
1975	52.0	16.0	15.0	17.0
1976	53.0	15.0	14.0	18.0
1977	51.0	14.0	16.0	19.0
1978	54.0	13.0	15.0	18.0
1979	50.0	12.0	13.0	25.0
1980	50.0	11.0	13.0	26.0
1981	51.0	12.0	12.0	25.0
1982	60.0	9.0	13.0	18.0
1983	56.0	10.0	13.0	21.0
1984	55.0	10.0	14.0	21.0
1985	52.0	14.0	16.0	18.0
1986	53.0	11.0	17.0	19.0

Source: Data used from Podkaminer 1982, 1988

Table 1.4 Average Monthly Per capita Consumption in Poland

Food item	1989 (kilogram)	1994 (kilogram)	Change (percent)
Flour	1.14	0.95	-16.7
Bread	6.92	6.90	-0.3
Potatoes	8.01	6.84	-14.6
Vegetables	5.06	5.00	-1.2
Fruits	3.00	3.39	13.0
Meat	5.01	4.51	-10.0
Fish	0.46	0.42	-8.7
Oil and fats	1.58	1.41	-10.8
Butter	0.73	0.33	-54.8
Milk (liters)	7.26	5.53	-23.8
Cheese	0.92	0.72	-21.7
Eggs (units)	15.80	12.74	-19.5
Sugar	2.06	1.66	-19.4

Source: Kubaj and Kowalik 1995

stock to inadequate funding for housing. The data on real household incomes and unemployment reveal that the major barrier to the development of housing was the scarcity of effective demand. The prices of building materials and construction services were liberalized and rose dramatically while household incomes declined in real terms in the first years of the transformation of the economy.

In the post-reform years buying an apartment was practically the only way to acquire dwelling. New apartments and houses are very expensive. Access to cooperative housing required membership in a given cooperative and a long waiting list for future housing. Cooperatives rely on contributions from members waiting for units instead of applying for bank credits. The new dwellings were of a very high quality but are beyond the reach of consumer with average incomes. Charges for electricity and gas, hot water, central heating, and waste removal, have grown sharply since 1989. The total cost of housing maintenance also has grown quickly. A general housing shortage has driven up the prices of second-hand dwellings.

With the political and economic reforms society also changed. The privilege of getting housing disappeared. The problems of the previous regime, having to wait long time for dwelling without the possibility of choice, have been forgotten. Between 1988 and 1995, the average size of dwelling increased from 59.1 to 63.9 square meters, or 9.2 percent. During this period standard of housing improved significantly. Housing amenities in urban areas such as central heating, indoor plumbing, bathrooms, and washing machines, increased by several percentage points, while in rural areas they increased by 10 to 20 percent.[2]

During the transition a dramatic increase in ownership of household durables from

---

[2]This data is from Strong et al. (1996).

washing machines to computers was observed. These increases were recorded by all household groups, including pensioners and farmers. Growth of purchases of modern durables such as home computers, CD players, satellite or cable TV, and microwave ovens were significant. After liberalization of prices in the post-reform period shares on goods and services such as rents on apartments, electricity, gas, fuel and central heating, health services and education have increased (Warsaw School in Economics 1996).

The consumption patterns are differentiated among various social groups in terms of both quality and quantity. Some shares have risen due to new private forms of provision such as private clinics and private schools which function along with public facilities but the quality of service is better.

During the transition the income inequality increased. A decline in real incomes[3] has been recorded for all centrally-planned economies but the burden has not been spread equally. The household's real income fell in the first year after stabilization. However, the reform impact varies for different social groups. Table 1.5 shows the changes in real income[4] from 1989 to 1992 for the four different social groups: wage-earners, social transfer income, farmers, and other income. The main victims in all years after reforms were wage-earners and farmers while the incomes of social transfer and other groups actually rose. Due to increases in unemployment compensation and accelerated retirements the recipients of social transfers were not severely hurt.

---

[3]The changes in real income were estimated by crude proxies. We are using the term as in descriptive literature but loosely. The CPI is relatively crude instrument for measuring the impact of inflation on individuals. It did not include the costs of shortages before the reforms, and the decline in real income will be overstated.

[4]Changes in nominal personal incomes deflated by CPI.

Table 1.5 Changes in Real Incomes 1989-1992 (percent)

	1989	1990	1991	1992
Total incomes	+6.0	-14.7	+5.9	n.a.
Wages	+6.3	-32.3	-6.6	-12.4
Social Transfers	+8.6	-14.3	+29.3	-3.1
Farms' income	+13.5	-49.9	-18.7	n.a.
Other incomes	+5.3	+19.2	+16.5	n.a.

Source: Euromonitor PLC 1994

A poll surveyed citizens about the conditions which are better today than in 1989 and which are worse (Strong et al. 1996). A majority pointed out that in the post-reform period there is more crime, more corruption, more hostility between people, greater gap between rich and poor, and a weakened safety net. On the positive side, the majority noted that after the reforms started there is more political freedom, more opportunities for individual initiative, and independence from foreign power. Compare to five years ago, 55 percent considered themselves worse off, while only 18 percent found themselves better-off. Asked whether individual freedom or equality with minimal class differences is more important, 43 percent chose equality and 36 percent chose individual freedom.

Previous Studies of Consumer Behavior in Poland

There are several empirical studies of consumer behavior in Poland before the reforms. In the first study Podkaminer (1982) estimated notional demands of Polish households for consumer goods and services 1965-1978 using demand system estimates for Italy and Ireland.

He chose these countries because they were at the same level of economic development as Poland, the per capita consumption bundles in 1971-1980 were close to those in Poland and the nations have the same Catholic culture. The author aggregated the commodities into four groups--food, clothing, rent and rest.[5] Estimates of equilibrium prices and supply for the Polish consumer market were obtained by application of Extended Linear Expenditure System to the historical data on Poland. The actual food consumption was explained as a result of spillovers from the under-supplied goods"rent" and "rest". Thus, at given supplies and prices the queues for food were observed because of the housing and various services which were really lacking. The lines appeared and some consumers were unable to purchase enough food because customers were induced to buy more than they would if they had other possibilities to spend their money. Those who did not get up early in the morning faced empty shelves. Those who faced full shelves purchased more then they really would if they had guarantee a success next time. Therefore, the Polish consumer market suffered from relative price distortions and that the two groups "food" and "clothing" were overpriced at the existing quantities while "rent" and "rest" groups were underpriced or under-supplied. The observed higher (by comparison) consumption of "food" was a result of spillover from under-supplied other goods. Thus, market equilibria would exist if "food" supplies were lower at the reported prices, which required increase in supplies of the "rent" and "rest" commodities at reported prices or increase of prices of "rent" and "rest" without decreasing their supply.

The weaknesses of this approach of Podkaminer was that the Polish consumer faced quantity constraint and budget constraint while the Western consumers had only budget

---

[5]These groups were discussed on page 11 .

constraint, and consumer expenditures were disaggregated only into four commodity groups which limited the microeconomic analysis.

In the later paper, Podkaminer (1988) found that price distortions still existed after 1978, the period with rapid increase in prices and wage, falling supplies, rationing of most food items, expanding black markets. He estimated the equilibrium prices and supplies by using econometrically estimated demand functions for Ireland, Italy, West Germany, and Britain. The new results supported the previous hypothesis about spillovers due to relative price distortions of main commodity groups. Observed food shortages embodied spillovers from underpriced housing and services. The budget distribution showed that under the rationing system, Polish households allocated small expenditure shares to living necessities such as housing, fuel, gas, which had low prices and rationed quantities. Rationing was an important factor affecting consumption behavior in Poland.

In this study the author considered the available official statistics on free and black market prices, which on the surface supported the hypothesis of relative food overpricing and the evidence that there existed black markets on non-food goods. During 1970 new car brought 50-100 percent profit, and in 1980 from 200 to 400 percent. Profit was the difference between the regulated purchase price and the free/black market price. Profits were made on washing machines, TV sets, refrigerators, etc. Large profits (about 1000 percent) were gained by the sellers of apartments since waiting time was less than 15-18 years. The price reforms that were introduced in 1970, 1976, and 1980 provided substantial increase of food prices combined with some compensatory decrease in non-food prices and some increase in income. These reforms had the opposite consequences instead to restore the equilibrium (Podkaminer 1988).

More recent studies by Milanovic (1996), Okrasa (1994) have focused on understanding

the poverty in Poland, who were the poor people and how they were affected by the transition. Focusing on the same subject of the distributional effects of Poland's transition but just in the case of the pensioners (retired people), Leven (1996) showed that the pensioners were not the major victim of the transition. Rather, their incomes had actually fallen less than that fall of full time workers and their consumption patterns were not significantly different from the averages in the country.

Objectives of the Study

The objectives of this study are as follows:

1. Construct a theoretical model of consumption decisions during the transition. The model tries to explain how the households make decisions in the presence of quantity rationing.

2. Develop a theoretically consistent econometric model of household consumption with nonprice rationed goods. Formulate testable hypotheses about the relationship between consumer behavior and causal variables. Econometrically test these hypotheses using micro data from Poland.

3. Discuss the welfare implications of the estimates from a model that can explicitly reflect effects of rationing, and determine whether households are better or worse off after the transformation of the economy from centrally-planned to market-oriented.

Organization of the Study

The outline of this study is as follow: Chapter 2 reviews literature on rationing and develops model of household's decisions under rationing and unavailability of goods before the reforms and the household's decisions during the transition when rationing ended. The third chapter discusses different econometric specifications and estimation procedures. Issues concerning the data are addressed in Chapter 4. The next chapter presents empirical results and discusses some welfare implications. The final chapter presents summary and conclusions of the study.

CHAPTER 2. LITERATURE REVIEW AND A MODEL OF CONSUMPTION WITH RATIONING

This chapter will present a consistent model of how households make consumption decisions under rationing of some goods. The representative household maximizes its utility subject to budget constraint and good-ration constraint.

The first section reviews the demand models under rationing. The second section develops the three cases of consumption model with rationing--first, when the ration constraint is not binding; second, when the constraint is strictly binding; and third, when a portion of the goods are not available. The third section discusses the dual approach and the concept of virtual price as a price of a rationed good at which the consumer would voluntarily choose the rationed level of that good. Finally, some welfare implications are presented.

Literature Review

Researchers in the area of quantity rationing have been concern primarily with how the demands for unrationed market goods were affected by the rationed levels. Tobin and Houthakker (1951) described how rationing a market good could create a short-run disequilibrium for a related Hicksian composite good. They presented elasticities of income,

prices and ration levels of the demand for market goods under a partial rationing regime in terms of corresponding elasticities from the completely unrationed regime.

Neary and Roberts (1980) extended the work of Tobin and Houthakker (1951) who derived the properties of the demand functions under rationing and compared them with unrationed outcomes. Tobin and Houthakker (1951) used the direct utility function to derive the rationed demand functions and the properties of their derivatives. Neary and Roberts (1980) used a virtual price framework to characterize consumption demand under rationing and derived the Slutsky equation analogue for a change in ration on a good.

Wales and Woodland (1983) and Lee and Pitt (1986a) have suggested methods for estimation of consumer demand systems with binding non-negativity constraints. Failure to consider zero expenditure when estimating the demand systems gave inconsistent and biased estimates of the parameters. Wales and Woodland considered two econometric models of consumer demand which took into account zero expenditures. The first one was based on the Kuhn-Tucker conditions with a random direct utility function. The second one was an extension of the limited dependent variable model for the case of a single equation (Tobin) and for a set of equations (Amemiya) with non-random utility. Both econometric models were estimated for a sample of data on meat consumption in Australia on three broad groups--beef, lamb and other meats.

The dual approach to the zero corner solution problem using stochastic specification of direct and indirect utility functions and virtual prices was applied by Lee and Pitt (1986a). They derived the likelihood function using the virtual price concept. The advantage of the dual approach for obtaining the empirically estimable demand functions under rationing used by Deaton (1981), Neary and Roberts (1980), and Lee and Pitt (1986) over the primal approach of

Wales and Woodland (1983) is that it is easier to specify indirect utility function. In applying their methods, Lee and Pitt used the translog indirect utility function to derive by the Roy's identity the share equations and the virtual prices:

$$V(v; \theta, \varepsilon) = \sum_{i=1}^{N}\alpha_i \ln v_i + 1/2\sum_{i=1}^{N}\sum_{j=1}^{N}\beta_{ij}\ln v_i \ln v_j + \sum_{i=1}^{N}\varepsilon_i \ln v_i$$

where v is a vector of normalized market prices, and ε is a N-dimensional vector of normal variables $N(0, \Sigma)$. Using normalization for $\sum_{i=1}^{N}\alpha_i = -1$ and $\sum_{i=1}^{N}\varepsilon_i = 0$, the notional share equations are:

$$v_i q_i = (\alpha_i + \sum_{j=1}^{N}\beta_{ij}\ln v_j + \varepsilon_i)/(-1 + \sum_{i=1}^{N}\sum_{j=1}^{N}\beta_{ij}\ln v_j).$$

For the case when $x_1 = 0$, and $x_i > 0$ for $i = 2,..., N$, the virtual price p_1^* is a function of $v_2,..., v_N$, is: $\ln p_1^* = -(\alpha_1 + \sum_{j=1}^{N}\beta_{ij}\ln v_j + \varepsilon_1)/\beta_{11}$.

Lee and Pitt (1986a) estimated a model with only three goods because both of their random specifications involved multiple numerical integrals which complicated very much estimation for models with more than three goods. In later paper, Lee and Pitt (1986b) estimated using the method of maximum likelihood, a seven-good food demand system involving many zero demands. They estimated a linear expenditure system.

In the literature, there are not too many theoretically complete empirical estimates of implications of rationing. A large volume of theoretical literature addressing the subject of rationing and transition has been published (Neary and Roberts, Lee and Pitt, Podkaminer, etc.). Unfortunately these studies provided only theoretical analysis and contained no empirical verification of the effect of rationing. Lead by Deaton and Muellbauer (1980) empirical studies have followed on the effects of rationing on the demand for market goods in developed and socialist economies.

Important issues in constructing an econometric model with rationing are whether or not

each household is constrained, if the impact of rationing is observed or not, if the rationing is constant or variable across households. Deaton (1981) presented technique for generating rationed from unrationed demands and applied them to extended versions of the Linear Expenditure System (LES) and Almost Ideal Demand System (AIDS).

The LES model is very restrictive due to the form of the underlying utility function which is additive, and produced share equations are linear in parameters. An application of direct additivity implies that all goods must be substitutes. Additivity is a reasonable assumption only if applied to very broad aggregates of goods. Also price effects are imposed by the additive structure of the model. Hence, economists use the LES or with highly aggregated commodity groups or in situations where price data are very limited. Deaton extended the AIDS model to include rationing.

Deaton estimated rationed model under the strong assumption that every individual in the sample experienced rationing. Deaton applied the rationed AIDS model to the British data on eight commodities, one of which was the rationed housing. He estimated share equations for each of seven unrationed commodities.

This approach was used by Wang and Chern (1992) to estimate a complete demand system incorporating rationing in China using the Linear AIDS model. They estimated the effects of housing, food grain, and fuel rationing on the consumption of other goods and services by Chinese urban households during the period of economic reforms and explained the consumption behavior. The model with rationing performs much better than the model without rationing in terms of tests of the theoretical properties of the demand functions. The rationing of housing has had a significant impact on demand for nonstaple food and durables.

Consumption Model with Rationing

Let R represent household's preferences over commodity bundles. Assuming the preferences are complete, reflexive, transitive, continuous and strongly monotonic, then there exists an utility function U.

Before the reforms, we assume that the household maximizes its utility subject to its budget constraint and good-ration constraint:

$$\max._{x1,x2} \ \Phi = U(x_1, x_2) \text{ subject to } p_1x_1 + p_2x_2 \le I$$

$$\text{and} \quad x_1 \le X_1,$$

where U is a strictly quasi-concave utility function; x_1 is a vector of rationed goods quantities; x_2 is a vector of unrationed goods quantities; p_1 is a vector of prices for x_1; p_2 is a vector of prices for x_2; X_1 is a vector of ration levels for goods x_1; I is household total expenditure. In this model we maintain the assumption that any constraint the household encounters is entirely beyond its influence. Note that the graphs in this section consider the case of two goods--one rationed x_1 and one unrationed x_2 (Figure 2.1). The Lagrangian for the utility maximization problem can be written as:

$$L = U(x_1, x_2) + \lambda(I - p_1x_1 - p_2x_2) + \mu(X_1 - x_1),$$

where λ is a Lagrange multiplier for the marginal utility of income and μ is a vector of Lagrange multipliers for the shadow price of the X_1 constraint.

The Kuhn-Tucker conditions for the maximum are:

$$\partial L/\partial x_1 = \partial U/\partial x_1 - \lambda p_1 - \mu \le 0 \qquad (2.1a)$$

$$x_1\partial L/\partial x_1 = 0 \text{ and } x_1 \ge 0;$$

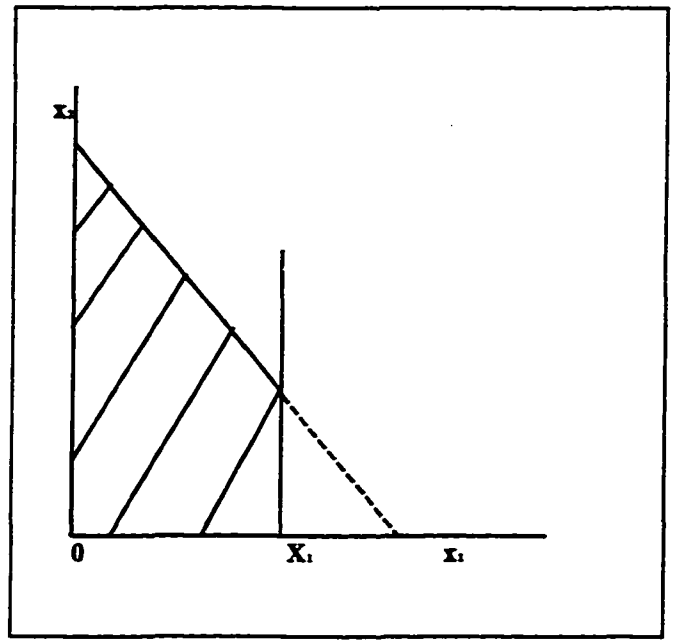


Figure 2.1 Feasible Consumption Set

$$\partial L/\partial x_2 = \partial U/\partial x_2 - \lambda p_2 \leq 0 \qquad (2.1b)$$

$$x_2 \partial L/\partial x_2 = 0 \text{ and } x_2 \geq 0;$$

$$\partial L/\partial \lambda = I - p_1 x_1 - p_2 x_2 \geq 0 \qquad (2.1c)$$

$$\lambda \partial L/\partial \lambda = 0 \text{ and } \lambda \geq 0;$$

$$\partial L/\partial \mu = X_1 - x_1 \geq 0 \qquad (2.1d)$$

$$\mu \partial L/\partial \mu = 0 \text{ and } \mu \geq 0.$$

First case: when $\lambda > 0$ and $\mu = 0$, when the ration constraint is not binding, i.e. this case is equivalent to the case with no constraint, then $X_1 \geq x_1^* > 0$ and $x_2^* > 0$ (Figure 2.2).

From (2.1a) and (2.1b) we have $MU_{x1}/MU_{x2} = p_1/p_2$, or the marginal rate of substitution between x_1 and x_2 is equal to the ratio of their market prices, or $MU_{x1}/p_1 = MU_{x2}/p_2$ the marginal utility divided by price is the same for both goods. The Marshallian demand functions $x_i^* = x_i^*(p_1,p_2,I)$, for i=1,2 are obtained by solving the first order conditions (FOCs) and the indirect utility function, obtained by substituting of the demand functions, is $U(x_1^*, x_2^*) \equiv V(p_1, p_2, I)$.

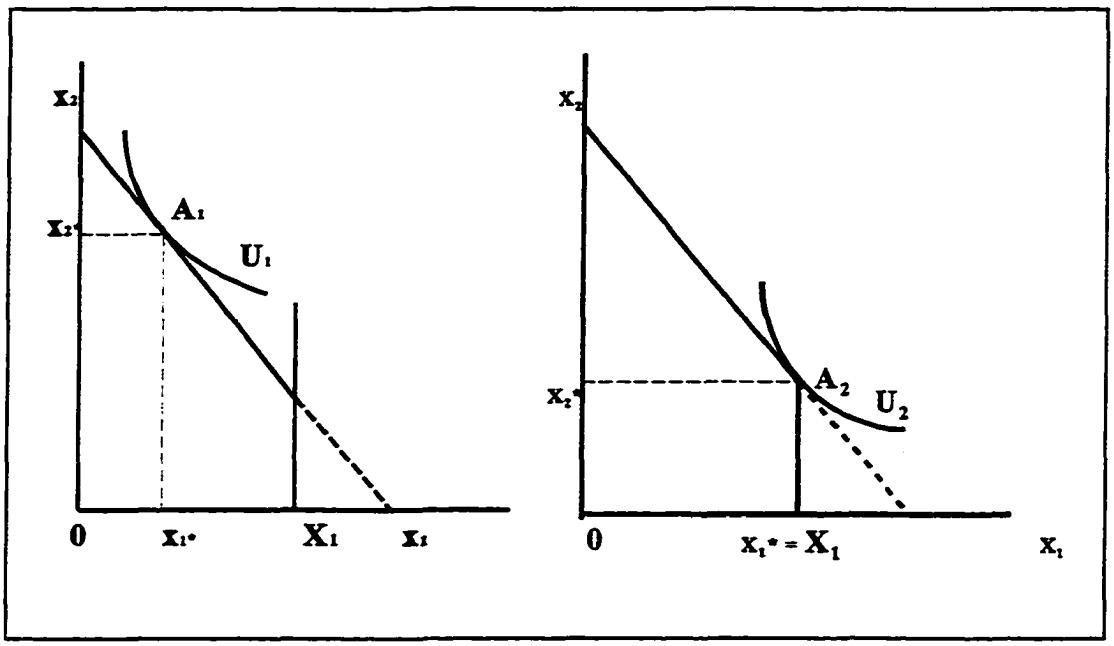


Figure 2.2 Nonbinding Rationing

Another possibility is that the household choses X_1 without rationing. If it is optimal for the household to purchase the ration X_1 then the rationed Marshallian demand for x_2 is $x_2^* = x_2^*(p_2, I-p_1X_1, X_1)$.

Second case: when $\lambda > 0$ and $\mu > 0$, or the constraint is strictly binding, then $x_1^* = X_1 > 0$ and $x_2^* > 0$ (Figure2.3).

From (2.1a) and (2.1b) we have $MU_{x1}/MU_{x2} = (\lambda p_1 + \mu)/\lambda p_2$, or $MRS_{1,2} = (\partial U/\partial x_1)/(\partial U/\partial x_2) > p_1/p_2$. When $(\partial U/\partial x_1)/p_1 > (\partial U/\partial x_2)/p_2$, household can increase utility with the same budget expenditure by reallocating expenditures from x_2 to x_1. Hence, the household would be willing to give up some amount of x_2 in order to purchase more from the rationed good x_1 but the constraint on x_1 will not allow it. Hence, the marginal rate of substitution between goods for a household (MU_{x1}/MU_{x2}) is not equal to the economic rate of exchange of x_1 to x_2, which is (p_1/p_2). Under the non rationing, the household would have purchased more than the ration X_1. The Marshallian rationed demand function for x_2 under these conditions is obtained by solving

the FOCs: $x_2^{R^*} = x_2^{R^*}(p_1, p_2, I, X_1) = x_2^{R^*}(p_2, I-p_1X_1, X_1)$ and the indirect utility function is $U(X_1, x_2^*) \equiv V(p_1, p_2, I, X_1)$.

How is behavior changed if the rationed level is changed? The change in the ration level has two separate effects: an income effect through the budget constraint ($I-p_1X_1$) because income corrected for the cost of rationing will be changed, and a substitution effect through the utility function.

Under the separability assumption, the direct utility function is $U(x_1, x_2) = U^*(x_1, u(x_2))$. In this case the maximization of $U(x_1, x_2^*)$ is equivalent to the maximization of $u(x_2)$ and there is no substitution effects. These effects will be discussed in detail in the next section with the dual approach.

In the situation under the second case, the household is worse-off compare to the unrationed situation (Figure 2.3), where point A is the unrationed optimal solution and U is a higher utility level. When there are not savings, underconsumption of some goods is combined

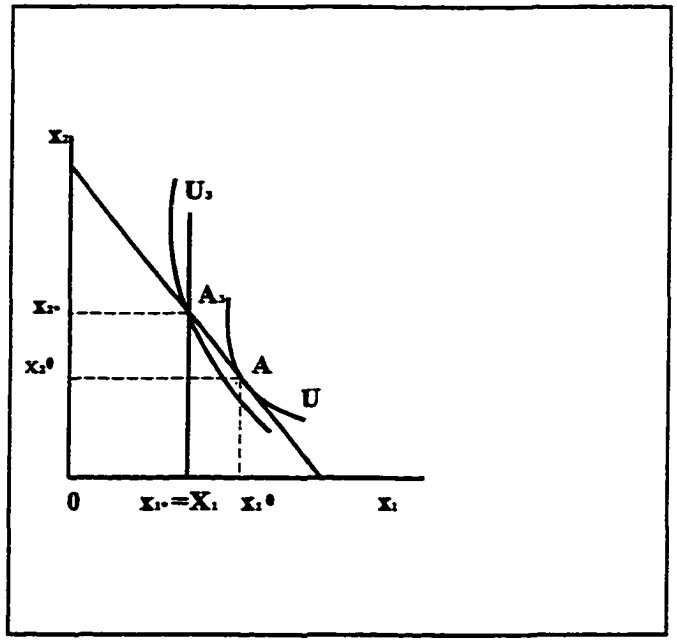


Figure 2.3 Binding Rationed Good

with overconsumption of others, i.e. $x_1^* = X_1 < x_1^0$ and $x_2^* > x_2^0$ where x_1^0 and x_2^0 are the optimal quantities under the unrationed situation.

The key to specifying a theoretical model which generates rationed and unrationed demands is the concept of virtual prices[6] that support the rationed quantity. P_1^* is the price of good x_1 at which the consumer would voluntarily choose the ration X_1. Thus the virtual price p_1^* is the solution to $X_1 = x_1^*(p_1^*, p_2, I)$. The virtual prices are function of prices of unrationed goods, the ration level and the income: $p_1^* = p_1^*(p_2, I, X_1)$. Figure 2.4 shows the virtual price of the ration X_1. The virtual price at the optimal solution for goods x_1 can be defined as a shadow price:

$$p_1^*(p_2) = [\partial U(x^*)/\partial x_1]/\lambda.$$

Using the virtual prices the Kuhn-Tucker conditions can be written as:

$$p_1^* > p_1 \text{ and } p_2^* = p_2.$$

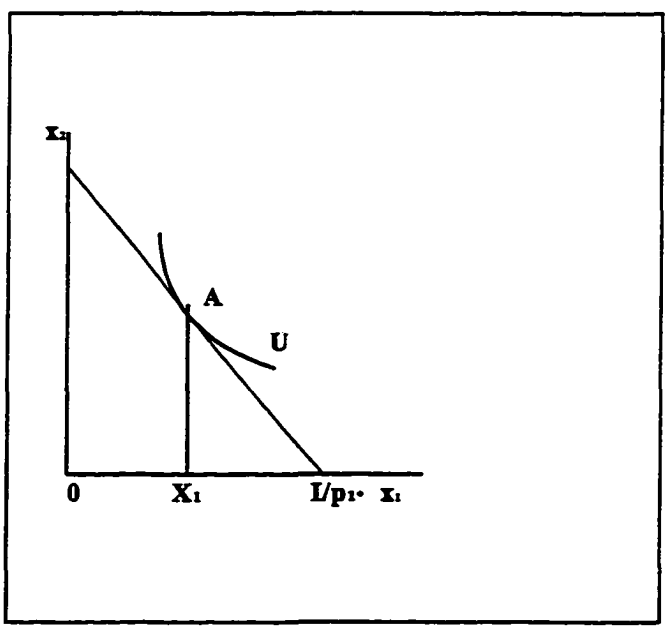


Figure 2.4 The Virtual Price of Ration X_1

[6]The virtual price was presented first by Rothbarth (1941) and later used by Neary and Roberts (1980).

Substitute for the virtual price into the rationed Marshallian demand function for x_2 to obtain:

$$x_2^{R*}(p_2, I-p_1X_1, X_1) = x_2^{R*}(p_1^*(p_2, I, X_1), p_2, I).$$

The rationed demand functions can be found given that the virtual prices can be derived.

In all cases the assumption of quasi-concavity guarantee that second-order conditions are satisfied at any point at which the first-order conditions are satisfied. The observable Marshallian demands generated as a result of the household's utility maximization subject to total expenditure constraint, can be recovered from the indirect utility function by using Roy's identity: $x_i = -(\partial V/\partial p_i)/(\partial V/\partial I)$ for $i = 1, 2$. This retriavability of preferences is the fundamental theorem of duality in neoclassical consumption theory.

Third case: Another interesting case arises when x_1 is not available, i.e. $X_1 = 0$, so the household will be at a corner solution involuntarily and allocate all of its income to x_2, i.e. the Marshallian demand function is $x_2^* = I/p_2$ when $x_1 \equiv 0$.

First, we examine the implications for consumption decisions of voluntary non consumption of good. Let $V(p_1, p_2, I, \theta)$ be the indirect utility function such that $V(p_1, p_2, I, \theta) = \max_q \{U(q, \theta)/pq = I\}$, where $V(p_1, p_2, I, \theta)$ is a strictly quasi-concave function, θ is a vector of unknown taste parameters. The notional demand functions can be recovered by applying Roy's identity:

$$q_i = [\partial V(p_1, p_2, \theta, I)/\partial p_i]/[\partial V(p_1, p_2, \theta, I)/\partial I] \text{ for } i = 1,2.$$

Since the maximization problem does not contain nonnegativity constraints, the notional demands can be negative. By applying Roy's identity for unavailable goods x_1, we obtain:

$x_1 = -(\partial V/\partial p_1)/(\partial V/\partial I)$ and equating it to zero, we obtain:

$$0 = -(\partial V/\partial p_1)/(\partial V/\partial I).$$

We can solve for the prices p_1, which are the virtual prices of the unavailable goods, i.e.

$p_1^* = p_1^*(p_2, I)$, price that support exactly zero demand of x_1 good. Above or at this price, the household will not consume this good. In this case, the virtual price is function of the market prices of the consumed goods and expenditures. The market prices p_2, which exactly support the observed positive demands of x_2 goods are also virtual prices. The actual demands of the chosen goods x_2 can be computed by using the virtual price instead of market price for unavailable good p_1^*. The Kuhn-Tucker conditions for the demands of x_1 and x_2 where $x_1 = 0$ and $x_2 > 0$ are:

$$\partial L/\partial x_1 = \partial U/\partial x_1 - \lambda p_1 \leq 0 \tag{2.2a}$$

$$\partial L/\partial x_2 = \partial U/\partial x_2 - \lambda p_2 = 0 \tag{2.2b}$$

$$\partial L/\partial \lambda = I - p_1 x_1 - p_2 x_2 = 0. \tag{2.2c}$$

The virtual price at the optimal solution for unavailable goods x_1 can be defined as:

$$p_1^*(p_2) = [\partial U(x^*)/\partial x_1]/\lambda = p_2[\partial U(x^*)/\partial x_1]/[\partial U(x^*)/\partial x_2] \tag{2.3}$$

and for the chosen goods: $p_2^* = [\partial U(x^*)/\partial x_2]/\lambda$. With virtual prices the Kuhn-Tucker conditions can be written as: $p_1^* \leq p_1$ and $p_2^* = p_2$.

The virtual prices are shadow prices or they have been alternatively called reservation prices. Goods are consumed if their reservation price exceeds their market price and they are not consumed if the reservation price is equal to or lower than the actual price. From Figure 2.5 the slope of the budget line is p_1/p_2 and when the price of x_1 is reduced holding p_2 constant until the tangent point is on the axis of x_2, we have the relative virtual price of x_1--p_1^*/p_2. In the case of involuntary nonconsumption (Figure 2.6) the virtual price is larger than the actual($p_1^* > p_1$).

The derived rationed Marshallian demand functions have the following properties: (1) the demand for any good is a single-valued function of prices, income and the rationed level; (2) they are homogeneous of degree zero in prices and income, that is, if all prices and income change in the same proportion, the quantity demanded remain unchanged.

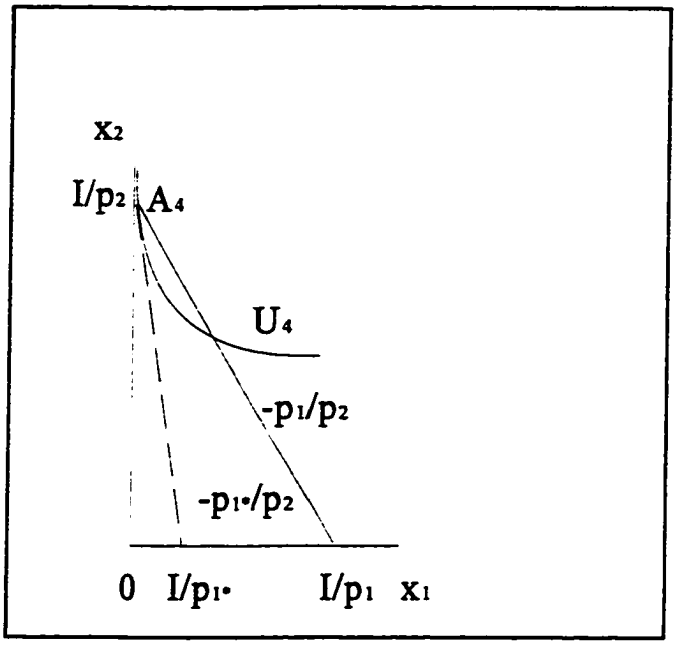


Figure 2.6 Virtual Prices: Involuntary Nonconsumption

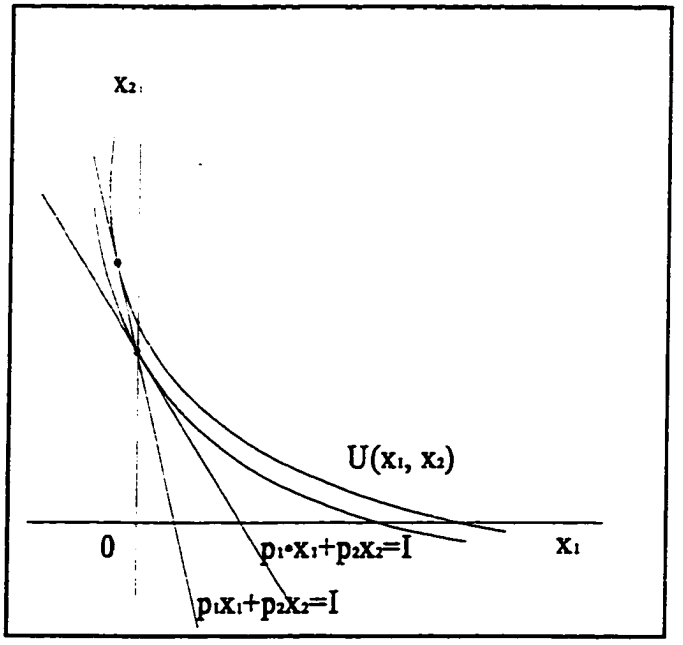


Figure 2.5 Virtual Prices: Voluntary Nonconsumption

Now consider household decision making under the transition (Figure 2.7).

Under the new system the household's problem is:

$\max_{x1,x2} \Phi = U(x_1, x_2)$ subject to $p_1x_1 + p_2x_2 = I$.

The Lagrangian for the utility maximization problem is:

$$L = U(x_1, x_2) + \lambda(I - p_1x_1 - p_2x_2).$$

The first-order conditions for the maximum are:

$$\partial L/\partial x_1 = \partial U/\partial x_1 - \lambda p_1 = 0$$

$$\partial L/\partial x_2 = \partial U/\partial x_2 - \lambda p_2 = 0$$

$$\partial L/\partial \lambda = I - p_1x_1 - p_2x_2 = 0.$$

We have the usual condition that $MU_{x1}/MU_{x2} = p_1/p_2$, or the marginal rate of substitution between x_1 and x_2 is equal to the ratio of their market prices. The Marshallian demand functions may be obtained by solving the FOCs, $x_i^* = f(p_1,p_2,I)$, i=1,2. The second-order conditions are guaranteed by the convexity assumption of the utility.

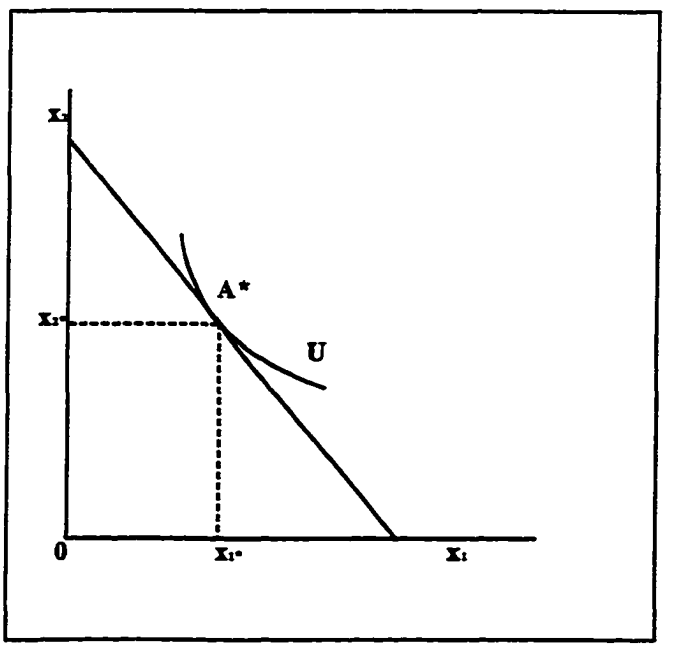


Figure 2.7 Unrationed Case

Dual Approach

The household minimizes the cost of achieving a fixed level of utility U_0 given prices p_1 and p_2, and ration quantity X_1. The household cannot alter the constraint and would like to consume more of the rationed goods. The household's problem under these assumptions is:

$\min_{x2}\ p_1X_1 + p_2x_2$ subject to $U(X_1,x_2) \geq U_0$.

The Lagrangian for the cost minimization problem is:

$L = p_1X_1 + p_2x_2 - \gamma[U(X_1,x_2)-U_0]$.

The first-order conditions for the minimum are:

$\partial L/\partial x_2 = p_2 - \gamma \partial U/\partial x_2 = 0$

$\partial L/\partial \gamma = [U(X_1,x_2)-U_0] = 0$.

The rationed Hicksian demand function is obtained by solving the first-order conditions and the rationed expenditure (cost) function is $C^R = C^R(U_0, p_1, p_2, X_1)$. Selected properties of the expenditure function include nondecreasing and concave in prices, and homogeneous of degree one in prices. The derivatives of the rationed expenditure function with respect to p_2 and p_1 give the rationed Hicksian demand function for $x_2(x_2^{Rc})$ and the ration level X_1 respectively:

$$C^R(U_0,p_1,p_2, X_1)/\partial p_2 = x_2^{Rc}(U_0,p_2,X_1) \quad (2.5a)$$

$$\partial C^R(U_0,p_1,p_2,X_1)/\partial p_1 \equiv X_1. \quad (2.5b)$$

From equation (2.5b) the partial derivatives of $\partial C^R/\partial p_1$ with respect to U_0, p_1 and p_2 are zero:

$$\partial C^R(U_0,p_1,p_2,X_1)/\partial p_1\, \partial i = 0 \ \text{ for } \ i = U_0,p_1,p_2. \quad (2.6)$$

Given I, income to spend, then $I = C^R$ and indirect utility function $V(p_1, p_2, I, X_1)$. To obtain Marshallian demand functions from Hicksian demand functions, substitute $V(p_1, p_2, I, X_1)$ into $x_2^{Rc}(U_0, p_1, p_2, X_1)$ and get rationed Marshallian demand $x_2^R(V(p_1, p_2, I, X_1), p_1, p_2, X_1)$.

Assuming that the consumer buys the ration level X_1 for the ration goods, the rationed expenditure function can be written as:

$$C^R(U_0,p_1,p_2,X_1) = p_1X_1 + \min_{x2} \{p_2x_2 \text{ st. } U(X_1, x_2) \geq U_0\}$$

$$= p_1X_1 + \gamma(U_0, X_1, p_2). \quad (2.7)$$

The function $\gamma(U_0, X_1, p_2)$ has the usual properties of an expenditure function (Deaton 1981).

In rationing problems, the use of Rothbarth's virtual prices as we noted before is useful:

$$p_1^* = f(U_0, X_1, p_2). \quad (2.8)$$

The virtual price is a function of the ration level and prices of unrationed goods. P_1^* is the price of good x_1 at which the consumer would voluntarily choose the ration X_1,or

$$X_1 = x_1^c(U_0, p_1^*, p_2), \quad (2.9a)$$

$$\text{and } x_2^{Rc}(U_0, p_1, p_2, X_1) = x_2^c(U_0, p_1^*, p_2). \quad (2.9b)$$

The virtual price will always exist if the utility function is strictly quasi-concave, continuous and strictly monotonic (Neary and Roberts 1980). The virtual price can be found by setting the unrationed demand for x_1 equal to the rationed level X_1:

$$\partial C(U_0,p_1^*,p_2)/\partial p_1 \equiv X_1 \quad (2.10)$$

where $C(U_0, p_1^*, p_2)$ is the unrationed expenditure function given prices p_1^* and p_2.

The minimum expenditure of achieving U_0 will be the same independent of the ration X_1:

$$C^R(U_0, p_1^*, p_2, X_1) = C(U_0, p_1, p_2), \text{ when } p_1^* = p_1 = f(U_0, X_1, p_2). \quad (2.11)$$

Neary and Roberts (1980) and Deaton (1981) used the duality theory and the "virtual prices" concept in deriving the properties of the rationed demand functions in terms of the unrationed demand functions. From (2.7) and (2.8) is obtained the following main result from their studies, which shows the relationship between unrationed and rationed expenditure

functions:

$$C(U_0, f(U_0, X_1, p_2), p_2) = X_1 f(U_0, X_1, p_2) + \gamma(U_0, X_1, p_2) \quad (2.12)$$

$$= X_1 f(U_0, X_1, p_2) + C^R(U_0, p_1, p_2, X_1) - p_1 X_1, \text{ then rearranging, we obtain:}$$

$$C^R(U_0, p_1, p_2, X_1) = [p_1 - f(U_0, X_1, p_2)]X_1 + C(U_0, f(U_0, X_1, p_2), p_2)$$

$$= [p_1 - p_1^*]X_1 + C(U_0, f(U_0, X_1, p_2), p_2). \quad (2.13)$$

Note that when $p_1 = p_1^*$ then $C^R(U_0, p_1, p_2, X_1) = C(U_0, f(U_0, X_1, p_2), p_2)$. Differentiating (2.13) with respect to X_1, yields:

$$\partial C^R(U_0, p_1, p_2, X_1)/\partial X_1 = p_1 - p_1^* \quad (2.14)$$

which provides an explicit measure of welfare change associated with a change in the ration level of x_1.

Deaton and Mauelbauer (1980) have derived the impact of the rationed good on the demand for other goods:

$$\partial C^R(U_0, p_1, p_2, X_1)/\partial p_2 = x_2^{Rc}(U_0, p_2, X_1) \quad (2.15)$$

and if $X_1 = x_1^c(U_0, p_1, p_2)$, then

$$x_2^{Rc}(U_0, p_2, x_1^c(U_0, p_1, p_2)) = x_2^c(U_0, p_1, p_2). \quad (2.16)$$

Differentiating equation (2.16) with respect to p_1, he obtains:

$$[\partial x_2^{Rc}/\partial X_1].[\partial x_1^c/\partial p_1] = \partial x_2^c/\partial p_1$$

$$\text{or } [\partial x_2^{Rc}/\partial X_1] = [\partial x_2^c/\partial p_1]/[\partial x_1^c/\partial p_1] \quad (2.17)$$

where x_1^c and x_2^c are unrationed Hicksian demand functions.

If the cross-price substitution term $\partial x_2^c/\partial p_1 > 0$ given that $[\partial x_1^c/\partial p_1]$ is always negative then $[\partial x_2^{Rc}/\partial X_1] < 0$, which means that an increase in the ration quantity X_1 will decrease the demand for substitute goods. If the cross-price substitution term $\partial x_2^c/\partial p_1 < 0$, then $[\partial x_2^{Rc}/\partial X_1] > 0$, which means that increase in the ration quantity X_1 will increase the demand for goods that

are complements.

Neary and Roberts (1980) derived Slutsky type equations decomposing the derivatives of the rationed demand into income and substitution effects. Following Neary and Roberts, the next derivations and results will show these effects. Hicksian and Marshallian rationed demands are equal when the total cost is equal to the minimum cost needed to reach utility level U_0 and the prices are p_1 and p_2, and the ration quantity X_1:

$$x_2^R(p_1, p_2, X_1, C^R(U_0, p_1, p_2, X_1)) = x_2^{Rc}(U_0, p_1, p_2, X_1). \tag{2.18}$$

Differentiating (2.18) with respect to the ration level X_1 and using (2.14), we obtain a Slutsky type equation which decomposes the total effect of the change in the level of the rationed good on unrationed demand into substitution and income effects:

$$\partial x_2^R/\partial X_1 = \partial x_2^{Rc}/\partial X_1 - (\partial x_2^R/\partial I)(p_1 - p_1^*). \tag{2.19}$$

The substitution effect was discussed before with equation (2.17). The income effect is defined as the difference between the actual and the virtual prices of the rationed good multiplied by the marginal utility of income and arises from the reduced expenditure to obtain the initial utility level as X_1 increases.

From (2.13) we can obtain the expenditure necessary to reach utility level U_0 when the household faces virtual prices p_1^* and p_2 which is equal to the actual rationed expenditure function $C^R = I$ and the additional household compensation for the ration $[p_1^* - p_1]X_1$:

$$C(U_0, p_1^*, p_2) = I + [p_1^* - p_1]X_1.$$

The rationed and unrationed Marshallian demand functions are equal when minimum cost to reach utility level U_0 is $C(U_0, p_1^*, p_2)$ and the unrationed demand function is evaluated at the virtual prices p_1^* :

$$x_2^R(p_1, p_2, X_1, I) = x_2(p_1, p_2, I+[p_1^* - p_1]X_1), \tag{2.20}$$

and $X_1 = x_1(p_1^*, p_2, I+[p_1^* - p_1]X_1)$. (2.21)

Differentiating (2.20) with respect to income I, yields:

$$\partial x_2^R/\partial I = \partial x_2/\partial I - (\partial x_2^{Rc}/\partial X_1)(\partial x_1/\partial I). \quad (2.22)$$

The effect of a change in total expenditures can be decomposed into the normal effect without rationing and a spillover effect of rationing. The sign of the latter depends on the substitute or complement relationship for normal goods. If all goods are normal, an increase in income will increase the demand for substitute goods and decrease the demand for complement goods.

Differentiating (2.18) with respect to p_1 and p_2 and using (2.5a) and (2.5b), yields:

$$\partial x_2^{Rc}/\partial p_2 = \partial x_2^R/\partial p_2 + (\partial x_2^R/\partial I)x_2^R, \quad (2.23)$$

and $$\partial x_2^{Rc}/\partial p_1 = \partial x_2^R/\partial p_1 + (\partial x_2^R/\partial I)X_1. \quad (2.24)$$

A change in the price of the rationed good p_1 does not affect the quantity demand for x_2 when utility is hold constant from (2.6). An increase in the price of the rationed good has only an income effect which decreases the demand for normal unrationed goods because the household pays more for the given ration level X_1:

$$\partial x_2^{Rc}/\partial p_1 = -(\partial x_2^R/\partial I)X_1. \quad (2.25)$$

The last important result Neary and Roberts (1980) derived is the relationship between the own price derivative of demand for the rationed goods to the own price derivative of demand for the unrationed goods. Differentiating (2.9b) with respect to p_2 and using (2.9a), yields:

$$\partial x_2^{Rc}/\partial p_2 = \partial x_2^c/\partial p_2 - (\partial x_1^c/\partial p_2)(\partial x_2^{Rc}/\partial X_1). \quad (2.26)$$

Price changes with rationing have a direct and an indirect effect. From (2.17) and using that $\partial x_1^c/\partial p_2 = \partial x_2^c/\partial p_1$, the symmetry of Slutsky substitution matrix, and substituting in (2.26), yields:

$$\partial x_2^{Rc}/\partial p_2 - \partial x_2^c/\partial p_2 = -(\partial x_1^c/\partial p_2)(\partial x_1^c/\partial p_1)^{-1}(\partial x_1^c/\partial p_2) > 0. \quad (2.27)$$

Because $(\partial x_1^c/\partial p_1) < 0$ and $(\partial x_1^c/\partial p_2)$ is squared then $\partial x_2^{Rc}/\partial p_2 > \partial x_2^c/\partial p_2$, the absolute size of substitution effect is reduced under rationing. Rationing reduces the responsiveness of demand for any unrationed commodity to its own price.

Empirically this approach was used by Bettendorf and Barten (1995) to calculate the virtual prices for rent using the estimated coefficients from a Rotterdam model under rationing with Belgium data for the Inter war period. The equivalences between restricted and unrestricted demand models is given in equations 2.17, 2.22, and 2.26, and together with estimation results provide the necessary components to calculate the virtual prices. The following derivatives $[\partial x_2^{Rc}/\partial X_1]$, $[\partial x_2^R/\partial I]$, and $[\partial x_2^{Rc}/\partial p_2]$ can be expressed as functions of the estimated coefficients of the restricted Rotterdam demand model estimated with data for 1920-1939. The same procedure is applied to estimates of the unrestricted Rotterdam model estimated with data for 1953-1993.

The practical aspects of Bettendorf and Barten approach is to obtain the virtual price as the value that minimizes the sum of the square of the deviations between the left hand side and the right hand side of equations 2.17, 2.22 and 2.26. They made the strong assumption that there are not drastic taste changes so that the estimated demand model for 1953-1993 years can describe the unrationed consumer behavior in the Interwar period.

Welfare Implications

Our model can be applied to post-reform household behavior. Before the reform when quantity supplied and demanded are not in equilibrium, social inefficiencies generally existed. When the price to consumers is set artificially low, the excess demand results in long waiting

lines, black markets, loss in time. After the reform, the rationing ended and both the variety of goods increased and the average quality of goods available improved. There are many different kinds of goods. In the pre-reform situation, the goods were relatively homogeneous. In considering the attributions of a transition, a change in quality and availability seem likely to occur.

If the income and relative prices change, the household could be better- or worse-off. Initially the household is at point B_0 (Figure 2.8). If the income increases and the relative price stays unchanged, the household is going to be better-off, it will have higher utility and it can afford the initial bundle and chooses to consume more--point B_1". If the income falls, the budget constraint moves inward and the household cannot buy the initial consumption bundle--point B_1'. Hence, the household has less utility and is worse-off.

When goods become available, the household chooses to purchase a larger quantity of them. After the reforms, the relative price for the rationed goods increases. If the income stays the same or falls, the household will be worse off. If the income increases and the relative price increases, the household can either be better-off, worse-off or equally well-off compare to the pre-reform situation (Figure 2.8).

Under socialism most of household income was from wages paid to employees working in state-owned enterprises or government, pensions paid from the budget to retired people, and in Poland, private sources of income in agriculture. Social services, free public health care and education were taken for granted but now available quantity of publicly provided goods and services has declined significantly. Overall the income distribution was more egalitarian with the exception of benefits and different forms of implicit income received by the high level communist leaders. Cash social transfer were distributed almost equally per capita. Pensions

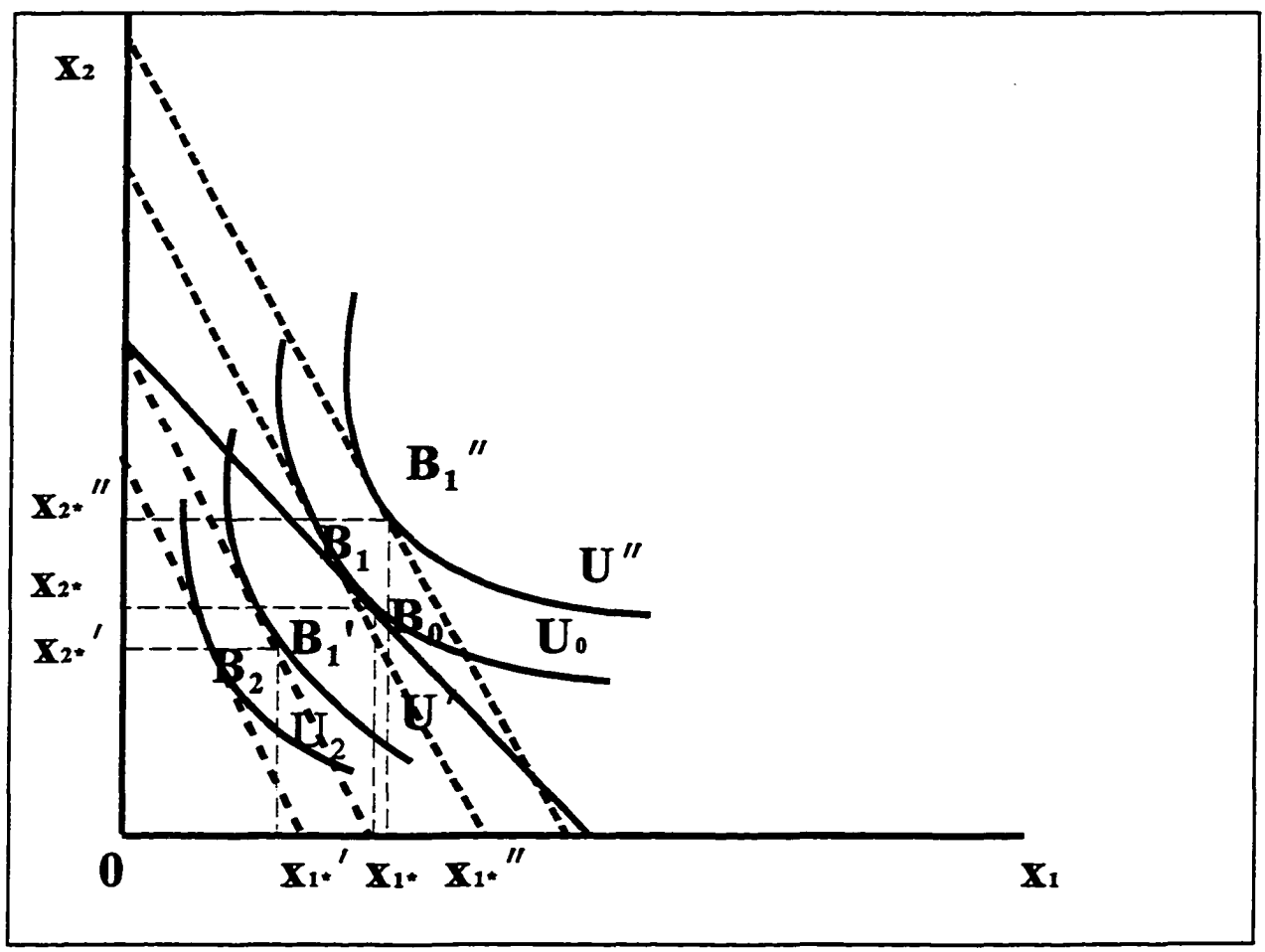


Figure 2.8 Welfare Changes

were slightly more in favor for higher income individuals, who received larger pensions. Decreases in output due to transition to market economy are translated into decrease in household's earnings and income, higher inequality and greater poverty. The decline in real incomes is an indicator of the hardship suffered by the population.

The composition of household disposable income also changed during the transition, which includes labor income, cash social transfer, and self-employment and other private sector income. The redistribution policies under previous system were mostly designed to maintain some level of balance or equality among social groups. In transition period, average real income of some social groups have declined. The self-employed people, who receive income from their labor and capital invested, are more likely to be well-off.

CHAPTER 3. EMPIRICAL SPECIFICATIONS AND ESTIMATION

The econometric model will capture the consumption decision of household under rationing. We will first introduce the demand system with virtual prices. Then the procedure for calculating the virtual prices will be presented. Using the estimated coefficients from the AIDS model with virtual prices, cost of living indices will be computed to show the impact of price liberalization on households' welfare in transition economy. Finally, the hedonic method of imputing the rental value of housing for house owners will be introduced.

Demand System with Virtual Prices

The AIDS model offers a flexible functional form for an unrestricted cost function. The advantages of AIDS model are:

1. It gives an arbitrary first-order approximation to any demand system.
2. It satisfies exactly the axioms of choice.
3. Aggregates perfectly over consumers allowing for nonlinear Engel curves. The piglog functional forms represent market demands as they were the outcomes of a representative consumer.
4. It is simple to estimate.

5. It can be used to test the theoretical restrictions of homogeneity and symmetry.

Virtual price Demand System presented below is based on modification of AIDS cost function. The virtual price form of the AIDS cost function in logarithmic form is:

$$\log C(U, p, p^V) = (1\text{-}U) \log[a(p, p^V)] + U \log[b(p, p^V)] \tag{3.1}$$

where $C(U, p, p^V)$ is the cost function, p is a vector of market prices, p^V is a vector of virtual prices (prices of rationed goods), and U is the utility level. Next for $a(p, p^V)$ and $b(p, p^V)$ specific functional forms are given, which are positive linearly homogeneous concave functions of prices. Following Deaton and Muellbauer, a translog flexible functional form is chosen for $a(p, p^V)$ which depends on market and virtual prices:

$$\begin{aligned}\log a(p, p^V) = \alpha^0 &+ \sum\sum_j \alpha_j \log p_j + \sum_j \alpha_{vj} \log p^V_j \\ &+ 1/2[\sum_i\sum_j \gamma_{ij}^* \log p_i \log p_j \\ &+ \sum_i \sum_j \gamma_{vivj}^* \log p^V_i \log p^V_j \\ &+ \sum_i\sum_j \gamma_{ivj}^* \log p_i \log p^V_j \\ &+ \sum_i\sum_j \gamma_{vij}^* \log p^V_i \log p_j].\end{aligned} \tag{3.2}$$

Compare to the standard AIDS model, the linear part here contains an extra term $\sum_j \alpha_{vj} \log p^V_j$ involving virtual prices and the quadratic part includes extra cross-product terms in virtual prices and cross-product terms in market and virtual prices. The function $b(p, p^V)$ is defined as:

$$\log b(p, p^V) = \log a(p, p^V) + \prod p_j^{\beta j}. \tag{3.3}$$

Substitute the expression for $a(p, p^V)$ and $b(p, p^V)$ into the cost function (3.1). Virtual budget shares are then obtained by using Shephard's lemma from $\partial \log C / \partial \log p_i = w_i$. These shares are derived from the virtual cost function. Therefore, they are functions of virtual prices, market prices and utility level. Next, substitute an expression for utility from the cost function into the virtual share equations to obtain:

$$w_i \mid_{pV} = \alpha_i + \sum_j \gamma_{ij} \log p_j + \sum_j \gamma_{iVj} \log p^V_j + \beta_i \log [\, I^V / a(p, p^V)], \quad (3.4)$$

where I^V is the virtual total expenditure, and $\gamma_{ij} = 1/2(\gamma_{ij}^{\bullet} + \gamma_{ji}^{\bullet})$, and $\gamma_{iVj} = 1/2(\gamma_{ViVj}^{\bullet} + \gamma_{VjVi}^{\bullet})$. When the price index $\log a(p, p^V)$ is replaced by the Stone index $\log P(p, p^V) = \sum_i w_i \log p_i$, then the virtual share equations become linear:

$$w_i \mid_{pV} = \alpha_i + \sum_j \gamma_{ij} \log p_j + \sum_j \gamma_{iVj} \log p^V_j + \beta_i \log [\, I^V / P(p, p^V)]. \quad (3.5)$$

Consumer choices are affected by demographic, social and economic factors. Next, we incorporate a set of demographic variables into a demand system model to examine how demand is affected by demographic profile (household size, age, education, etc.). Demographic characteristics enable us to account for differences in tastes. There are several approaches of incorporating demographic characteristics into the model--translating, scaling, Gorman and reverse Gorman, and "modified" Prais-Houthakker procedures. Introducing the demographic variables by translating the intercept term into AIDS model, we obtain:

$$w_i \mid_{pV} = \alpha_i^{\bullet\bullet} + \sum_j \gamma_{ij} \log p_j + \sum_j \gamma_{iVj} \log p^V_j + \beta_i \log [\, I^V / P(p, p^V)] \quad (3.6)$$

where $\alpha_i^{\bullet\bullet} = \alpha_{io} + \sum_{s=1}^{S} \delta_{is} D_s$ for $s = 1, \ldots, S$ and D_s are demographic variables.

The restrictions on the parameters in order to satisfy theoretical properties of utility maximization are:

Homogeneity $\quad \sum_j \gamma_{ij} = 0$ and $\sum_j \gamma_{iVj} = 0 \quad (3.7)$

Symmetry $\quad \gamma_{ij} = \gamma_{ji}$ and $\gamma_{iVj} = \gamma_{jVi} \quad (3.8)$

Adding up $\quad \sum_i \alpha_i^{\bullet\bullet} = 1,\ \sum_i \delta_{is} = 0,\ \sum_i \gamma_{ij} = 0,\ \sum_I \gamma_{iVj} = 0$ and $\sum_i \beta_i = 0. \quad (3.9)$

All variables used in the demand analysis are described in Table 3.1.

In the almost ideal demand system the dependent variables are the budgeted shares of the six commodity groups--food; alcohol and tobacco; clothing and footwear; housing; fuel, electricity, transport and communication; and other. The key independent variables in the model

Table 3.1 Definition of Variables Included in the Demand Analysis

Variable	Definition
Endogenous Variables	
wfood	Expenditure share on food
walcohol	Expenditure share on alcohol and tobacco
wcloth	Expenditure share on clothing and footwear
whousing	Expenditure share on housing
wfuel	Expenditure share on fuel, electricity, transport, and communication
wother	Expenditure share on other goods
Exogenous Variables	
Pfood	Price of food
Palcohol	Price of alcohol and tobacco
Pclothing	Price of clothing and footwear
Phousing	Price of housing
Pfuel	Price of fuel, electricity, transport, and communication
lnexpend	Logarithm of total expenditure
equinum	Household adult equivalent number
age	Age of the head of household, in years
agesq	Square of age
educ	Education of the head of household, highest grade of school
reg1	Central/Capital region
reg2	North-east region
reg3	North region
reg4	South region
reg5	South-east region

Table 3.1 (Continued)

Variable	Definition
reg6	Central-east region
reg7	Central region
reg8	Central-west region
reg9	South-west region
R1	Warsaw city
R2	Bialystok city
R3	Gdansk city
R4	Katowice city
R5	Krakow city
R6	Lubin city
R7	Lodz city
R8	Poznan city
R9	Wroclaw city
R10	Rest
fam1	Married without children
fam2	Married couple with 1 child
fam3	Married couple with 2 children
fam4	Married couple with 3 children
fam5	Married couple with 4 or more children
fam6	Father and 1 or more children
fam7	Mother and 1 or more children
fam8	Other
tnsiz1	Town size of 100,000 or more residents
tnsiz2	Town size between 20,000 and 100,000 residents
tnsiz3	Town size of less than 20,000 residents

Table 3.1 (Continued)

Variable	Definition
tnsiz4	Village
dwell1	Owner of house
dwell2	Owner of house occupied also by others
dwell3	Tenant cooperative
dwell4	Owner cooperative
dwell5	Tenant, independent
dwell6	Tenant, not subreliant
dwell7	Sub-tenant
dwell8	Other
qrt1	First quarter
qrt2	Second quarter
qrt3	Third quarter
qrt4	Forth quarter
spr	Average space or living space divided by number of rooms
rooms	Number of rooms
waters	Water supply
waterc	Water closet
bathr	Bathroom
hotw	Hot water
gas	Gas
gasb	Gas from bottle
heats	Heating stove
heater	Electric heater

are logarithms of prices and total household expenditures. Household composition is taken into account by using the adult-equivalent scale, which is based on the Organization for Economic Co-operation and Development (OECD) scale. According to this scale the first adult is equal to one adult, other adults to 0.7 adult, and children under 14 years of age to 0.5 adult. Other demographic variables used in the estimation of the demand system are age, age squared and education level of the head of the household.

Calculation of Virtual Prices

Calculating the virtual prices is important for the following reasons. First, the size and the evolution of the virtual prices show the real economic impact of rationing. Second, Neary and Roberts (1980) used the virtual prices for welfare analysis since the difference between the actual and the virtual price measures the benefit/loss to the consumer of a change in ration level.

Because we do not have quantity data, it is difficult to estimate the virtual prices of rationed goods. Hence, we took a practical approach, arguing that prices in Germany provided a good measure of unrationed prices of goods consumed in Poland. The two countries are geographically close. Germany is a major trading partner under free trade. The unregulated prices in Poland and Germany moved together during 1987-89.[7] The basic issue is to construct an estimate of how much the relative price of rationed goods were distorted in Poland.

Let x_1 to x_{12} are goods consumed both in Poland and Germany where x_1 is bread, x_2 is pork, x_3 is milk, x_4 is sugar, x_5 is wine, x_6 is clothing, x_7 is shoes, x_8 is electricity, x_9 is gas, x_{10} is

[7]The relative price for clothing decreased in Germany and Poland in 1989. The quality differences due to the higher incomes in Germany will largely cancel when relative prices are considered.

communication, x_{11} is transport and x_{12} is rent. The Polish goods are divided into two groups. In group I, we place the rationed goods x_1, x_2, x_3, x_4, x_{12} (food and housing). In group II, we place the unrationed goods x_6, x_7, x_8, x_9, x_{10}, x_{11}. To derive the relative price effect of rationing on food we compute:

$$\ln RP_F = \ln[(p_F^G/p_{OG}^G)/(p_F^P/p_{OG}^P)] = (\sum_{i=1}^{4}\alpha_i^P \ln p_i^G - \sum_{j=5}^{11}\alpha_j^P \ln p_j^G) - (\sum_{i=1}^{4}\alpha_i^P \ln p_i^P - \sum_{j=5}^{11}\alpha_j^P \ln p_j^P)$$

$$= \sum_{i=1}^{4} \alpha_i^P \ln(p_i^G/p_i^P) - \sum_{j=5}^{11} \alpha_j^P \ln(p_j^G/p_j^P), \qquad (3.10)$$

where $\sum_{i=1}^{4}\alpha_i^P = 1$, $\sum_{j=5}^{11}\alpha_j^P = 1$, p_F^G/p_{OG}^G and p_F^P/p_{OG}^P are the relative price of food with respect to the other goods for Germany and Poland respectively. The prices for good i for Germany and Poland are respectively p_i^G and p_i^P, and α_i^P are the relative expenditure shares in the Polish food category, and α_j^P are the relative expenditure shares for unrationed goods. $\ln RP^F$ is the proportional increase in the relative price of food in Germany compare to Poland. The virtual food price in Poland is then defined to be $(1 + \ln RP^F)$ multiplied by the actual Polish food price.

The relative price number for housing is computed using the same procedure:

$$\ln RP_H = \ln[(p_H^G/p_{OG}^G)/(p_H^P/p_{OG}^P)] = (\ln p_H^G - \sum_{j=5}^{11}\alpha_j^P \ln p_j^G) - (\ln p_H^P - \sum_{j=5}^{11}\alpha_j^P \ln p_j^P)$$

$$= \ln(p_H^G/p_H^P) - \sum_{j=5}^{11}\alpha_j^P \ln(p_j^G/p_j^P), \qquad (3.11)$$

where $\sum_{j=5}^{11}\alpha j^P = 1$, p_H^G/p_{OG}^G and p_H^P/p_{OG}^P are the relative price of housing with respect to the other goods in Germany and Poland respectively. The housing virtual price in Poland is then defined to be $(1 + \ln RP^H)$ multiplied by the actual Polish housing price index.

Cost of Living Indices

Next, the cost of living indices, which can be calculated after estimating the virtual price demand system, will be discussed. The cost of living index measures the relative costs of

reaching a given standard of living under two different situations, in our case the pre- and post-reform years. The cost of living index will differ among different households too.

The most commonly used measures of cost of living index is the Consumer Price Index (CPI), which is essentially Laspeyres price index--$L(p^1, p^0) = \sum p_1x_0/\sum p_0x_0 = \sum p_1x_0/I_0$, where p_0 and p_1 are the prices under the two different regimes, and x_0 is the quantity under the base regime. The Laspeyres price index gives an upward biased estimate of the cost of living, because in keeping constant weights the base period basket of goods, it does not account for substitution among commodities due to relative price changes, which is one of the basic assumption of the theory--consumers will look for available substitutes when the prices rise. Another concern with CPI is that over time the quality of some goods and services tends to rise while the prices tend to drop or remain the same. Consumers often find themselves getting more and paying the same or less, when measured over time. Thus, the CPI is relatively crude instrument for measuring the impact of inflation on individuals.

The true cost of living index is based on the theory of consumer demand. It is the ratio of the minimum expenditures under two different price regimes necessary to maintain a constant level as opposed to constant basket of goods in the Laspeyres price index. Cost of living index will be constructed using the estimated parameters from the complete demand system. The base-weighted true cost of living index from the cost function (3.1) is written as:

$$\log P(p^0, p^1, U^0) = (1-U^0) \log [a(p^1)/ a(p^0)] + U^0 \log[b(p^1)/ b(p^0)] \qquad (3.12)$$

where U^0, the base utility level is equal to $\log [I^{V0}/a(p^0)]/\log [b(p^0)/a(p^0)]$, p^0 is a vector of market and virtual prices at base period, and I^{V0} is the virtual income at base period. In this study the base period will be the pre-reform year. Across different households facing the same prices U^0 is a linear function of I^{V0}. Using the estimated parameters from the virtual AIDS model we can

calculate the indirect utilities from the functional form in equations (3.2) and (3.3) and, finally, the virtual cost of living indices from equation (3.12). Then the cost of living indices will vary with the standard of living of the household. The cost of living indices will show the impact of price liberalization on households' welfare in transition economy. Using the individual cost of living indices, the impact of price changes on households with different demographic characteristics will be considered.

With the estimated coefficients from the virtual AIDS before the reforms and AIDS after the reforms we can calculate indirect utilities both before and after the reforms. The compensated variations given by the differences in cost function or $CV = C(p^1, U^0) - C(p^0, U^0)$ for each household can be found. Positive difference will indicate that the household experiences a welfare loss as a result of the price liberalization. Finally, the change in real total income/expenditure will be considered to show the total welfare change during the transformation of the Polish economy.

Estimation

The final specification of the equations for estimating of the demand system with virtual prices is:

$$w_{it}|_{pV} = \alpha_{io} + \sum_s \delta_{is} D_{st} + \sum_j \gamma_{ij} \log p_{jt} + \sum_j \gamma_{iVj} \log p^V_{jt} + \beta_i \log[I_t^V / P(p_t, p_t^V)] + u_{it} \qquad (3.13)$$

where i = 1, ..., n goods, and t = 1, ..., T observations.

The final specification for estimating of the standard demand system is:

$$w_{it} = \alpha_{io}^* + \sum_s \delta_{is}^* D_{st} + \sum_j \gamma_{ij}^* \log p_{jt} + \beta_i^* \log (I_t/P_t) + u_{it}^*. \qquad (3.14)$$

The general stochastic version of these equations is:

$$Y_i = X_i \theta_i + u_i \tag{3.15}$$

where Y_i is a (T x 1) vector of dependent variables, X_i is a (T x K) matrix of explanatory variables, θ_i is a (K x 1) vector of parameters, and u_i is a (T x 1) vector of disturbance terms. Expression (3.15) is a system of T expenditure equations. If the disturbance terms u_i in equation (3.15) satisfy the usual stochastic assumptions, such as $E(u_i) = 0$ for all i, $E(u_i^2) = \sigma_{ii}$, $E(u_i u_j) = \sigma_{ij}$, $E(u_{it} u_{js}) = 0$ for all i and $t \neq s$, or the errors are normally distributed with zero mean and constant variance, ordinary least squares (OLS) can be applied to each expenditure share equation separately. The OLS estimator is unbiased and has a minimum variance in the class of linear and unbiased estimators. However, $E(u_{it} u_{js}) \neq 0$, or the errors are likely to be correlated across equations, then the generalized least square (GLS) procedure is used to gain efficiency.

Since the sum of the budget shares is equal to one, then the contemporaneous covariance matrix is singular. Barten (1969) has shown that full information maximum likelihood estimates of the parameters can be obtained by deleting one equation, and that the properties of the estimators are invariant to which equation is deleted if the cross equation restrictions are imposed. The parameters of the dropped equation can be recovered using the adding up restrictions. To avoid singularity one equation (the last one) can be dropped and we have:

$$Y_i = X_i \theta_i + u_i \tag{3.16}$$

where i = 1,..., M and M = n-1. Stacking the M equations yields:

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_M \end{bmatrix} = \begin{bmatrix} X_1 & 0 & \cdots & 0 \\ 0 & X_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & X_M \end{bmatrix} \begin{bmatrix} \theta_1 \\ \theta_2 \\ \vdots \\ \theta_M \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_M \end{bmatrix}$$

Alternatively,

$$Y = X\theta + u, \tag{3.17}$$

where Y is a (TM x 1) vector of dependent variables, X is a (TM x MK) matrix of explanatory variables, θ is a (MK x 1) vector of parameters, and u is a (TM x 1) vector of disturbances. The errors are distributed with zero expectation and a contemporaneous var-covariance matrix V. When the disturbances are contemporaneously correlated with variances σ_{ij}, i, j = 1,..., M, then:

$$E(u\,u') = \Sigma \otimes I_T \equiv V \tag{3.18}$$

$$\Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \cdots & \sigma_{1M} \\ \sigma_{21} & \sigma_{22} & \cdots & \sigma_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{M1} & \sigma_{M2} & \cdots & \sigma_{MM} \end{bmatrix}$$

where and I_T is identity matrix, and $\otimes$ is Kronecker product. The off diagonal elements in Σ are contemporaneous correlation between errors across equations. The errors are likely to be correlated across equations in the demand system, which has been derived from household maximization behavior. With this correlation, Generalized Least Square (GLS) procedure provides better estimates and they are more efficient then OLS estimates.

Because V in (3.18) is typically not known, it has to be estimated from OLS residuals. The associated Seemingly Unrelated Regression (SUR) results are consistent parameter estimates and asymptotically equivalent to the maximum likelihood estimation procedure which is invariant to the equation being dropped. Zellner suggested iterating the estimation procedure until the estimates converge and the covariance matrix must be estimated. The system of share equations was estimated using the SYSLIN procedure in the statistical software package SAS release 6.12 and the method of SUR. Because of the error variance-covariance matrix of the full model is singular, the share equation for "other goods" was dropped from the estimation and its

parameters were recovered using the adding up restrictions.

Consumption demand system derived from utility maximization over convex budget sets with kink points are nonlinear simultaneous equation systems with multi variate limited dependent variables. The estimation of multi variate tobit models by the classical maximum likelihood method is known to be computationally inefficient, since the computation of multi variate normal probabilities of high dimensions is difficult.[8]

One way of solving this problem is using the Instrumental Variable (IV) technique.[9] An IV estimation procedure has been introduced by Amemiya (1974) for the estimation of a multi variate regression model with all its dependent variables being truncated normally. The IV method is computationally simple in that the computation of truncated multi variate probabilities can be completely avoided.

Heckman's (1976, 1979) two-step estimator calculated by the probit maximum likelihood and least squares methods is widely used in econometric models with sample selection biases. Nawata and Nobuko (1996) showed that Heckman's estimator performed poorly in some cases. Their model consists of the following two equations:

$$y_{1i} = x_i'\beta + u_i$$

$$y_{2i} = w_i'\alpha + v_i \quad \text{for } i = 1, \ldots, N$$

where $d_t = 1$ when $y_{2i} > 0$ and 0 otherwise. Only d_t is observable, y_{2i} is not observable; y_{1i} is observable when $d_t = 1$; u_i and v_i have the joint normal distribution with mean zero, variances (σ_1^2, 1) and covariance σ_{12}.

---

[8]Lee and Pitt (1986a) estimated only three good demand system.

[9]Blandell and Walker (1981) used the instrumental variable method in estimating the household supplies and commodity demands model.

The conditional expectation of y_{1i} given that $d_t = 1$ can be written as following:

$$E(y_{1t} | d_i = 1) = x_t'\beta + \sigma_{12}\lambda(w_i'\alpha)$$

where $\lambda = f/F$ with f and F are the density and distribution functions for a standard normal variable, respectively and λ is the inverse of Mill's ratio.

Given $d_t = 1$ then:

$$y_{1i} = x_i'\beta + \sigma_{12}\lambda(w_i'\alpha) + \epsilon_i$$

This equation can be used to estimate β since $E(\epsilon_i | d_i = 1) = 0$. Heckman suggested to estimate first α by the probit maximum likelihood method and then estimate β by OLS method. Nawata and Nobuko (1996) used several empirical examples in the field of labor economics to show that when x_i contains variables which are not included in w_i and the degree of multicollinearity between $w_i\alpha$ and x_i is not high, the Heckman's estimator performs well.

The properties of the estimator are dependent on the normality assumption, on which is based the alternative procedure of the probit method of Heckman (1979). One potential limitation of these methods is their sensitivity to the assumed parametric distribution of the unobserved error terms in the model. Later "semi parametric" methods for selection models have been developed which do not impose parametric forms on error distributions. Newey, Powell and Walker (1990) used semi parametric methods to reanalyze data on the labor supply of married women, first studied by Mroz (1987) using parametric methods. When the joint distribution of the error terms is misspecified, the parameter estimator will be inconsistent generally. To obtain consistent estimator of the parameters the authors relaxed the parametric restrictions on the functions F(.), the cumulative distribution function of u, and λ(.), and used non parametric regression methods to estimate F(.) and the parameters. The conclusion they made from the results was that "specification of the regression function and set of instrumental

variables appears to be more important than specification of the error distribution for these data".

To estimate the model in (3.13) and (3.14) we used a sample of households from the Polish Household Budget survey 1987-1992. The selected sample has 18,682 observations for the pre-reform period 1987-1989 and 14,303 observations for the post-reform period 1990-1992. We have 24 quarterly price points, plus food prices for ten different regions in Poland for both periods, and regional prices for alcohol and tobacco, and housing for the post-reform years. The systems considered above are estimated for the six groups--food; alcohol and tobacco; clothing and footwear; housing; fuel, electricity, transportation and communication; and other goods, imposing homogeneity by expressing all prices relative to the price of "other" goods.

Economists are often concern with how demanded quantity changes in response to the changes in prices and incomes. To answer this questions we will compute the elasticities. The elasticities will be functions of the estimated coefficients α_i, γ_{ij}, γ_{iVj} and β_i from the estimated standard and the virtual AIDS models. The virtual uncompensated expenditure elasticity of demand for good i is:

$$\epsilon_E^V = \beta_i/w_i + 1. \tag{3.19}$$

The virtual uncompensated price elasticity with respect to the market price is:

$$\epsilon_{ij}^V = -\delta_{ij} + (\gamma_{ij} - \beta_i w_j)/w_i \tag{3.20}$$

where δ_{ij} is equal to 1 when i = j and 0 otherwise, ϵ_{ij}^V is the elasticity of good i with respect to the market price of good j, w_i and w_j are the mean budget shares of goods i and j.

The virtual uncompensated price elasticity with respect to the virtual price is:

$$\epsilon_{iVj}^V = -\delta_{ij} + (\gamma_{iVj} - \beta_i w_j)/w_i. \tag{3.21}$$

The virtual compensated price elasticities are:

$$\epsilon_{ij}^{V*} = \epsilon_{ij}^V + w_j \epsilon_E^V \text{ and } \epsilon_{iVj}^{V*} = \epsilon_{iVj}^V + w_j \epsilon_E^V. \tag{3.22}$$

Assuming that the mean level of shares are non stochastic and given the elasticities become simple linear combinations of parameters. The standard errors are approximations obtained from the estimate of the variance of an elasticity which is a linear function of the variances and covariances of parameters.

Hedonic Approach to Impute the Rental Value of Housing

The simple hedonic procedure was applied to impute the rental value of housing for the house owners. Implicit in the hedonic price framework is the assumption that the varieties of particular commodity are composites of a smaller number of characteristics.

The data set includes eight different categories for status of dwelling tenure. We grouped the different categories into two groups. In group I we placed house owners including owner of house occupied by owner only, owner of house occupied also by others, owner of cooperative housing and other (includes under-lease group). In group II we placed tenants including tenant of cooperative housing, tenant-independent, and tenant not subrelient.

The hedonic housing rental equation was assumed to have the following form:

$$\ln(\text{Rental}) = \beta_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \sum_{l=1}^{m} \delta_l D_l + \mu \qquad (3.25)$$

where x_2 is the square meter of total space divided by the number of rooms or it is the average space per room, x_3 is the number of rooms in apartment or house, x_4 is the town size, $D_l = 1$ if state "A" occurs, and $D_l = 0$ otherwise. As dummy variables are included for some of the most important characteristics of housing in Poland: $D_1 = 1$ for running water supply, $D_2 = 1$ for water closet, $D_3 = 1$ for bathroom, $D_4 = 1$ for running hot water, $D_5 = 1$ for gas from the network, $D_6 = 1$ for gas from the bottle, $D_7 = 1$ for heating stove and $D_8 = 1$ for electric heater. In addition,

quarterly dummy variables were included to allow for inflation in rental rates over the year.

This equation is to be estimated separately for 1990, 1991 and 1992, and for the pooled data for the three years. It is to be fitted to data for the households in group II status, tenants. The stochastic version of the rental equation is $Y_i=X_i\beta_i+u_i$ for i=3. The unrestricted model is λ:

$$\begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix} = \begin{bmatrix} X_1 & 0 & 0 \\ 0 & X_2 & 0 \\ 0 & 0 & X_3 \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \end{bmatrix} + \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \end{bmatrix}.$$

The restricted model (ω) is:

$$\begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix} = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} \underline{\beta} + \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \end{bmatrix}.$$

To decide which coefficients to use to impute the rental values of housing we used the Chow test, assuming that the variances across samples are equal:

$$\hat{F} = \frac{\left[SSE(\omega) - SSE(\hat{\lambda})\right]/(m-1)k}{SSE(\hat{\lambda})/(\sum_{i=1}^{m} n_i - mk)},$$

where $SSE(\hat{\omega})$ is the sum of squares error of the unrestricted model, $SSE(\lambda)$ is the sum of squares error of the restricted model, m is the number of samples, k is the number of estimated coefficients, and n is the number of observations.

CHAPTER 4. DATA DESCRIPTION

The data for the present study is a sub sample of the original Polish Household Budget Survey conducted by the Social and Demographic Statistics Division of the Central Statistical Office of Poland (GUS) during 1987-1992 years. The survey was conducted every year with quarterly rotation methodology. The survey is part of a long tradition of annual household budget surveys in Poland, consisting of both cross-sectional and panel data. These surveys were meant to provide representative data on the four main socioeconomic groups in Poland: worker households, farmer households, mixed households, and pensioners households. The survey was funded by the central budget of Poland. The reason for the sub sample is that the entire sample was not surveyed in consecutive years.

The main focus of the survey is to measure household income, expenditures, food consumption, durables, housing conditions, and demographic characteristics. The principle users of the data are social policy makers, scientific researchers, and government statisticians. Estimators of price indicators and some cost of living indicators have been defined on the basis of results of Household Budget Survey.

This section describes the survey methodology and presents some characteristics of the surveyed population.

Sample Size and Design

The data for the study is from 1987 to 1992 with two and three year panels from the surveys carried out in each year. There are the following overlapping panels:

1. 1987-88 with 10,342 observations/households;
2. 1988-90 with 4,180 observations/households;
3. 1990-91 with 4,899 observations/households;
4. 1991-92 with 4,703 observations/households.

The survey does not cover households with self-employed heads or professionals, households with heads employed in the private non agricultural sector or military, or police institutions.

The sampling design was a geographically stratified, two stage probability sample. In the first stage, the census enumeration regions for different statistical regions, containing at least 250 dwellings, were used as a frame for selecting Primary Statistical Units (PSU) with probabilities proportional to the size of the unit. Statistical regions with less than 250 dwellings were joined with neighboring regions to form one PSU. In the second stage, 150 dwellings were selected from each PSU to answer a questionnaire on household size, sources and amount of monthly income, education level of head, and acreage of the individual's farm. This information was used to stratify the respondents by household's source of living (employee, farmer, employee-farmer, retired person), then by the number of persons living in the household, and then by household per capita income. The questionnaires, stratified then grouped and arranged within groups, are the basis for compiling the registers of households for the selection in each PSU. From these registers six random households are selected quarterly, four of which are

permanent for four years and two of which participate for only one quarter.

The sample was selected in 1985 and was not adjusted for socio-demographic changes to 1992. The Statistical Office uses simple weighting system--two for urban, and one for rural. The survey was weighted to adjust for survey under/over representation of certain population groups and to ensure that the sum of the survey weights represented independent population estimates from Economic Activity of Polish Households (survey given in 1990). That is the original survey is biased toward certain groups and weights were added to be more representative of the population.

Geographic location is based on the resident of the respondent household, the smallest unit of analysis being the "voivodship" or administrative unit. Voivodships are grouped into regional categories (north, north-east, south, south-east, central, central-east, central-west, and capital-central). Households have also been categorized by the size of population within a city/community (below 20,000, 20,000-100,000, and above 100,000).

The most important problem regarding the quality of the data collected in this survey is that the sample is not representative of the whole population because:

a) the sample was designed to represent the population of non privately employed individuals.

b) information on entrepreneurs is not available from this survey. All individuals who privately own a business or who are non agriculturally self employed are removed from the sample.

Characteristics of the Population in the Survey

The surveys provide extensive information on household size, household composition, age, gender, occupational status of household members, sources of income, and expenditure patterns. The surveys are conducted quarterly, but each household is surveyed only once per year. The expenditure data are quarterly. The years covered by the survey are from 1987 to 1992. The period including 1987, 1988 and 1989 is the pre-reform period, and the period including 1990, 1991 and 1992 is the post-reform period.

Tables 4.1 through 4.14 summarize the real total income (see footnote 3), real total expenditure, and demographic characteristics of the sample households. Table 4.1 summarizes household income and expenditure for 1987-1992.

Table 4.1 Selected Household Summary Statistics. Poland (million zlotys per quarter)

Variable	1987	1988	1989	1990	1991	1992
Real Total Income	7.56	8.52	12.96	6.52	6.23	6.10
Per Capita Real Income	2.33	2.67	4.11	2.08	1.98	1.96
Real Total Expenditure	6.84	7.16	7.23	5.52	5.56	5.37
Per Capita Real Expenditure	2.11	2.24	2.45	1.76	1.77	1.73

Table 4.1 shows the average real total and per capita real household income, average real total and per capita real household expenditures. As seen from Table 4.1, the average real total and per capita real income exceed the average real total and per capita real expenditures which is a result of household savings. In our study, total expenditures is used as a measure of household resources available for consumption purposes.

Households can be classified by the occupation of the head of the household. Four major groups are defined:

1. Employees, including manual and non-manual workers employed in state or cooperative owned enterprises and farms;

2. Farmers, except agricultural workers (almost all of the farms in Poland were private and were never collectivized);

3. Farmer-workers, including households of two occupational heads;

4. Pensioners, or the retired population.

Table 4.2 highlights the four socioeconomic groups in Poland.

Table 4.2 Socioeconomic Groups (percent of households)

Socioeconomic groups	1987	1988	1989	1990	1991	1992
State worker	54.6	53.0	52.3	50.6	47.2	43.9
Farmer	9.6	9.2	8.9	8.5	8.5	8.2
Worker-farmer	10.0	9.6	9.2	8.9	8.0	7.8
Pensioner	26.8	28.2	29.6	32.0	36.3	40.1

In 1987, 54.6 percent of the heads were state workers, 9.6 percent were farmers, 10 percent were worker-farmers, and 26.8 percent were pensioners. Small changes in this distribution occurred during 1987-89, but during the post-reform period, the share of heads who were state workers declined significantly and reached 43.9 percent in 1992. The share of household heads as pensioners rose significantly and reached 40.1 percent in 1992. One of the reasons for increasing the retired population was the retiring at earlier ages. A small decrease

occurred in the share of farmers and worker-farmer.

Table 4.3 summarizes the pattern of household expenditure on various broad categories of items. Expenditure covers household spending on all consumer goods and services, the money value of goods and services bought on credit or received for free. Total household expenditures are classified into six broad categories. Food expenditure includes household consumption of food at home and in restaurants and bars, and it covers both purchased goods as well as consumption of self-produced items and food commodities received as a gift. The second group is expenditure on alcohol and tobacco. The third group is "clothing and footwear" which includes goods as well as services. The fourth group "housing" includes household goods such as furniture, etc. and services, and rent. The fifth group "fuel, electricity, transport and communication" includes all the related goods such as gas, electricity, cars, etc. and services related to them. And the final sixth group "other" includes all the remaining goods and services such as education, culture, health, etc. Food is the most important expenditure category for all years: it accounts for about 43 percent to 47 percent during 1987-89, increases up to 51 percent in 1990, and decreases after that to 45 percent in 1991 and 42 percent in 1992. The second most important expenditure share before the reforms is clothing and footwear which is about 16

Table 4.3 Household Expenditure Patterns (share of total expenditures)

Expenditure Group	1987	1988	1989	1990	1991	1992
food	0.46	0.43	0.47	0.51	0.45	0.42
alcohol &tobacco	0.04	0.04	0.04	0.03	0.03	0.03
clothing &footwear	0.14	0.15	0.16	0.10	0.09	0.08
housing	0.12	0.12	0.12	0.10	0.10	0.10
fuel, elec, tr, com	0.09	0.10	0.08	0.11	0.15	0.17
other	0.15	0.16	0.13	0.15	0.17	0.20

percent. The shares for housing, fuel, electricity, transport and communication are smaller. The actual reported expenditures were subject to subsidies and price controls and did not reflect the relative scarcities of these items in the pre-reform period.

The expenditure share for alcohol and tobacco, clothing and footwear, and housing are lower post-reform but the shares for fuel, electricity, transport and communication, and other are larger. Facing declining real incomes, consumers tried to maintain their level of food consumption by increasing the share of income spent on food. During the 1987-1992 food prices increased each year by less than the CPI, except in 1989. Because of the considerable increase in prices of housing rents, electricity, gas, water and central heating, and health care, households were not able to increase the share on food in total expenditure as it was in 1989-1990. As a result, food consumption in 1991 declined by 6 percent and by 9 percent in 1992 compare to 1990. As the average level of food consumption is still high, the nutritional consumption is not a problem, while the hardship of the lowest income group has been increased. Tables 4.4 and 4.5 include the main summary statistics for the six expenditure shares used in the estimation of the demand system. In addition, Appendix C includes the Engels curves and the distributions of the six budget shares before and after the reforms.

Household size Most Polish households are not large in size. The average size of household surveyed was 3.24 in 1987, 3.19 in 1988, 3.15 in 1989, 3.13 in 1990, 3.15 in 1991, and 3.11 in 1992. The groups considered in the study are household size equal to 1, 2, 3, 4, 5, 6, 7, and 8.

Tables 4.6 and 4.7 show the relationship between household size and real total income and real per capita income distributions; and the relationship between household size and real total and per capita expenditures before and after the reforms. It is evident from these two tables

Table 4.4 Selected Statistics Before the Reforms

Expenditure Group	Mean	Std Dev	Selected Percentile 5%	25%	50%	75%	95%
food	0.497	0.149	0.256	0.394	0.495	0.597	0.747
alc&tob	0.039	0.037	0.000	0.012	0.031	0.057	0.109
cloth&foot	0.136	0.093	0.090	0.066	0.122	0.192	0.309
housing	0.104	0.104	0.007	0.035	0.072	0.138	0.307
fuel,elec,tr,com	0.085	0.085	0.014	0.034	0.060	0.106	0.238
other	0.138	0.096	0.037	0.073	0.113	0.175	0.328

Table 4.5 Selected Statistics After the Reforms

Expenditure Group	Mean	Std Dev	Selected Percentile 5%	25%	50%	75%	95%
food	0.501	0.142	0.279	0.400	0.497	0.598	0.745
alc&tob	0.030	0.031	0.000	0.006	0.023	0.044	0.086
cloth&foot	0.084	0.066	0.001	0.033	0.072	0.120	0.208
housing	0.091	0.087	0.005	0.033	0.067	0.120	0.257
fuel,elec,tr,com	0.135	0.095	0.030	0.067	0.112	0.178	0.313
other	0.159	0.097	0.044	0.087	0.136	0.209	0.349

Table 4.6 Income and Expenditure for Different Household Sizes Pre-reform (million zlotys per quarter)

Household Income and expenditure	size =1	size =2	size =3	size =4	size =5	size =6	size =7	size =8
Number Households	3443	6789	5163	5941	2822	1298	491	301
Real Total Income	3.22	6.63	9.81	11.20	12.17	14.10	15.07	16.55
Per Cap Real Income	3.22	3.32	3.27	2.80	2.43	2.35	2.15	2.07
Real Total Expenditure	2.94	5.46	7.83	8.74	9.15	10.47	10.97	11.16
Per Cap Real Expenditure	2.94	2.73	2.61	2.19	1.83	1.75	1.57	1.40

Table 4.7 Income and Expenditure for Different Household Sizes Post-reform (million zlotys per quarter)

Household Income and expenditure	size =1	size =2	size =3	size =4	size =5	size =6	size =7	size =8
Number Households	2111	3887	2657	3083	1473	640	262	192
Real Total Income	2.41	5.08	7.07	7.77	8.09	8.92	10.30	10.46
Per Cap Real Income	2.41	2.54	2.36	1.94	1.62	1.49	1.47	1.31
Real Total Expenditure	2.42	4.46	6.05	6.77	7.03	7.69	8.32	8.19
Per Cap Real Expenditure	2.42	2.23	2.02	1.69	1.41	1.28	1.19	1.02

that while household size increases with total income, the reverse is true for the relationship between per capita real income and household size (except for household size of 1). This is true for both periods. The greatest concentration of households is within the household sizes of 2, 3, and 4, with total income range of 6.6 million zlotys per quarter to 11.2 million zlotys, and per capita income range of 2.8 million zlotys to 3.3 million zlotys before the reforms. After the reforms total income ranges from 5 million zlotys to 7.7 million zlotys, and per capita income ranges from 1.9 million zlotys to 2.5 million zlotys for the household sizes of 2, 3, and 4. Pre-reform, per capita real income for household of size 1 is 3.22 million zlotys, but only 2.07 million zlotys for household of size 8. Post-reform, per capita real income is 2.41 million zlotys for household of size 1, but only 1.31 million zlotys for household of size 8. Hence, holding household size constant, "approximated" per capita real income[10] fell significantly post-reform compare to pre- reform. Holding household size constant, total and per capita real income, or per capita real expenditure decline after reforms.

Tables 4.8 and 4.9 summarize the expenditure shares for the six expenditure groups across different household sizes before and after the reforms. Total and per capita expenditures are positively related to household size. Pre-reform, the largest expenditure share is for food varying from 46 percent to 55 percent. It is bigger for households of size 1, 2, 7, or 8 while it is smaller for households of size 3, 4, 5, or 6. For the remaining expenditure shares there is not too much variation across different household sizes. Expenditure on clothing and footwear constitutes the second most important category of expenditure, accounting for about 10 to 15.5 percent of total expenditure. It is quite a bit smaller than that of food. Housing share increases

[10]We use defective CPI. See footnote 3.

Table 4.8 Expenditure Shares and Household Size Before the Reforms (percent)

Expenditure group	size =1	size =2	size =3	size =4	size =5	size =6	size =7	size =8
Number	3443	6789	5163	5941	2822	1298	491	301
Food	54.2	52.0	46.6	46.0	48.7	49.8	50.4	55.0
Alc& tobacco	2.5	4.0	4.3	4.1	4.1	4.0	3.7	3.6
Cloth&footwear	10.2	12.0	15.1	15.5	15.5	14.9	15.0	15.4
Housing	9.7	10.1	10.5	10.6	10.0	11.2	12.2	10.0
Fuel, elec, trans	9.3	9.2	8.6	8.5	8.1	8.2	8.0	6.4
Other	14.1	12.7	14.9	15.3	13.6	11.9	10.7	9.6

Table 4.9 Expenditure Shares and Household Size After the Reforms (percent)

Expenditure group	size =1	size =2	size =3	size =4	size =5	size =6	size =7	size =8
Number	2111	3887	2657	3083	1473	640	262	192
Food	51.9	51.2	48.2	47.6	50.9	52.9	54.3	58.1
Alc& tobacco	1.7	3.1	3.4	3.3	3.2	2.9	2.8	2.7
Cloth&footwear	6.6	7.2	9.2	9.4	9.5	9.6	9.5	9.1
Housing	9.9	9.0	9.1	9.1	8.6	8.7	8.2	6.6
Fuel, elec, trans	14.5	14.5	13.2	13.1	12.4	12.2	11.6	10.3
Other	15.4	15.0	16.9	17.5	15.4	13.7	13.6	13.2

with household size (except for household size 5 and 8). The share for fuel, electricity, transport and communication decreases with household size. This is true for both periods. Post-reform there is not significant changes in the expenditure pattern. The largest expenditure share is for food for all household sizes. The food share decreases for household of sizes 1 and 2 but for the rest of households this share increases post-reform compare to pre reforms. The shares for alcohol and tobacco, clothing and footwear decrease while the shares for fuel, electricity, transport and communication, and other increase for all different household sizes. The share for housing decreases for all groups with the exception of household of size 1 where the increase is quite small 0.2 percent.

Household composition The following eight groups were considered: married couple without children; married couple and 1 child; married couple and 2 children; married couple and 3 children; married couple and 4 or more children; father with 1 or more children; mother with 1 or more children; and other.

Tables 4.10 and 4.11 summarize the expenditure shares for six groups for households with different family composition before and after the reforms. Pre-reform, the largest share is for food for all households. Among the households with different family composition the largest food share is for married couple without children but for married couple with 1, or 2, or 3 children, and mother with 1 or more children the food expenditure share falls. For married couple with 4 or more children, and father with 1 or more children the food expenditure share increases. The expenditure share on alcohol and tobacco is similar for all households with the exception of mother with 1 or more children which is smaller. The expenditure share on clothing and footwear is quite smaller for married couple without children compare to the other households. The housing share is similar among households but for father with 1 or more

Table 4.10 Expenditure Shares and Family Composition Before the Reforms (percent)

Expenditure group	Family w/o child	Family with 1 child	Family with 2 child	Family with 3 child	Family 4 more child	Dad with child	Mom with child	Other
Number	5151	2850	4378	1676	743	34	1064	10352
Food	52.4	44.7	45.4	48.8	52.6	49.4	47.8	50.9
Alc& tobacco	4.3	4.4	4.2	4.1	3.6	4.1	2.5	3.6
Cloth&footwear	11.4	15.1	15.3	15.2	14.5	16.5	15.9	13.5
Housing	10.1	10.3	10.5	9.8	10.2	6.7	9.8	10.5
Fuel, elec, trans	9.6	9.1	8.5	7.8	6.9	8.8	6.8	8.7
Other	12.2	16.4	16.1	14.3	12.2	14.4	17.2	12.8

Table 4.11 Expenditure Shares and Family Composition After the Reforms (percent)

Expenditure group	Family w/o child	Family with 1 child	Family with 2 child	Family with 3 child	Family 4 more child	Dad with child	Mom with child	Other
Number	2977	1399	2310	810	361	24	479	5945
Food	51.8	45.9	46.8	51.3	56.5	46.0	48.0	51.3
Alc& tobacco	3.2	3.5	3.4	3.1	2.5	3.0	2.0	2.7
Cloth&footwear	6.9	9.3	9.5	9.3	9.2	11.3	10.3	8.1
Housing	8.9	9.6	9.2	8.3	7.2	10.2	9.1	9.2
Fuel, elec, trans	14.7	13.2	13.0	11.9	10.4	13.2	11.1	13.8
Other	14.5	18.5	18.1	16.1	14.2	16.3	19.5	14.9

children is smaller then the others. During the post-reform period there are not significant changes in the expenditure patterns. The largest expenditure share is on food from 45.9 percent for married couple with 1 child to 56.5 percent for married couple with 4 or more children. The food expenditure share decreases in the second period for the married couple without children and father with 1 or more children while for the rest groups it increases. The expenditure shares on alcohol and tobacco, clothing and footwear decrease while the expenditure shares on fuel, electricity, transport and communication, and other increase for all different family composition groups in the second period. The share for housing decreases for all groups with the exception of father with 1 or more children group.

Tables 4.12 and 4.13 compare the expenditure shares for different socioeconomic groups before and after the reforms. Pre-reform, the major expenditure differences across groups are for the households with head pensioners versus the households with head state worker, farmer, and worker-farmer. The pensioners have the largest food share 55.2 percent and the smallest share on alcohol and tobacco 2.9 percent, for clothing and footwear 10.4 percent, for fuel, electricity, transport and communication 9.5 percent, and for housing 9.5 percent compare to the other households. Post-reform, the largest food share is for the farmer group 55.3 percent and the smallest is for the household with the head state worker 46.9 percent. For the remaining expenditure groups there are not significant changes across socioeconomic groups. The food share for the families with head state worker, farmer and worker-farmer increases in the second period but for the pensioners it decreases. Post-reform, the shares for alcohol and tobacco, clothing and footwear, and housing decrease while the shares for fuel, electricity, transport and communication, and other increase for all different socioeconomic groups.

Table 4.14 represents the housing ownership structure in Poland for the pre- and

Table 4.12 Expenditure Shares and Socioeconomic Groups Before the Reforms (percent)

Expenditure group	State worker	Farmer	Worker-farmer	Pensioner
Number households	13940	2434	2538	7336
Food	45.8	52.3	49.3	55.2
Alc& tobacco	4.2	4.6	4.4	2.9
Clothing& footwear	15.3	13.5	15.8	10.4
Housing	10.5	10.8	11.3	9.5
Fuel, elec, trans, com	8.2	9.2	8.8	9.5
Other	16.0	9.6	10.4	12.5

Table 4.13 Expenditure Shares and Socioeconomic Groups After the Reforms (percent)

Expenditure group	State worker	Farmer	Worker-farmer	Pensioner
Number households	6836	1198	1206	5065
Food	46.9	55.3	51.8	52.9
Alc& tobacco	3.3	3.5	3.3	2.3
Clothing& footwear	9.5	8.3	9.4	6.6
Housing	9.5	7.3	8.4	9.1
Fuel, elec, trans, com	12.8	12.6	13.9	14.7
Other	18.0	13.0	13.2	14.4

Table 4.14 Structure of Housing Ownership in Poland (percent)

	1987	1988	1989	1990	1991	1992
Private ownership (total)	**46.2**	**46.4**	**48.2**	**63.3**	**62.2**	**62.7**
owner of house	32.0	31.9	32.7	38.2	40.2	41.1
owner of house occupied also by other	10.5	11.6	11.2	2.3	1.2	1.8
owner cooperative	2.3	1.6	3.2	19.3	17.2	17.1
other	1.4	1.3	1.1	3.5	3.6	2.7
Tenants (total)	**53.8**	**53.6**	**51.8**	**36.7**	**37.8**	**37.3**
tenant cooperative	24.4	23.3	21.3	6.9	8.9	8.5
tenant independent	27.6	28.5	28.6	27.4	27.3	27.3
tenant not subreliant	1.8	1.8	1.9	2.4	1.6	1.5

post-reform years. Before the reform the share of tenants are larger than the share of house owners. While the opposite is true for the post-reform years, the share of private owners is larger than the share of tenants. The share of private ownership increases from 46.2 percent in 1987 to 62.7 percent in 1992 while the share of tenants decreases from 53.8 percent in 1987 to 37.3 percent in 1992.

Construction of Variables for Estimation

In this section the construction of variables needed for estimating the demand models in chapter 3 is discussed. These variables are expenditures on goods and services consumed, their prices and variables representing household characteristics, e.g. household adult equivalent

number, age and education of household head.

The household survey collects information on a large number of items. Econometrically we cannot analyze all of the detail of the totally dissagregated data. Usually items are combined into broad groups and the analysis is conducted in terms of these aggregates. In the survey all goods and services were aggregated into nine groups--food; alcohol and tobacco; clothing and footwear; housing; fuel and electricity; personal hygiene; entertainment; transport and communication; and other. In this study all the items that were covered in the survey were aggregated into six broad groups: food; alcohol and tobacco; clothing and footwear; housing; fuel, electricity, transport and communication; and other, including personal hygiene, entertainment, etc.

Construction of price indices The main source for the prices of different commodities and services is the Polish Statistical Yearbook 1993 and 1994, published by the Polish Central Statistical Office (GUS). We used the available information on the share of different food items and other goods and services from the total expenditures from "Understanding Poverty in Poland", a World Bank country study (1995), Table A2.3, p.154, "Expenditure Categories for Price index" (percent) for 1993.

The consumer price indices in the Polish Statistical Yearbook are from a Laspeyres type index. Before 1991 the weights are obtained from retail turnover or the sale of retail goods and services for final consumption. Since 1991 the source for the expenditure weights has been the budget household survey, covering total population. The weights refer to the annual structure of expenditure in the previous year and they are changed every January. The CPI indices expresses the rate of change of prices rather than of absolute values. Yearly the price indices are

derived as an arithmetic mean of the twelve monthly prices. The aggregate price index for a commodity group at a higher level is the arithmetic weighted average of expenditure according to the Laspeyres formula.

Construction of the price indices involved several steps. Regional prices existed for only major food items. They were the average retail prices for nine main cities in 1990, 1991 and 1992. From a World Bank study of Poland (1995) it was evident that the most important food items are bread, pork, milk and sugar. The expenditure shares in 1993 were bread, 33 percent; pork, 33 percent; milk, 17 percent; and sugar, 17 percent. These four items were used in constructing the food price index. We also derived a "rural price" for these four food commodities. The "rural" price is the average price outside the main cities.

Define $P_{it} = \sum_{r=1}^{10} g_r p_{rit}$, where P_{it} is the Polish national average price of food commodity i in period t, g_r is the population share for region r, p_{rit} is the price in region r for commodity i at period t. Then $P_{10it} = (P_{it} - \sum_{r=1}^{9} g_r p_{rit})/g_{10}$ is the "rural" price. The regional price index for food is defined as: $\ln P_{rft} = \sum_{i=1}^{4} s_{rit} \ln p_{rit}$, where P_{rft} is the price index for food in region r at period t, s_{ri} is the share for commodity i in region r, p_{rit} is the price in region r for commodity i at period t. All price indices are 100 at the end of 1990 (IVth quarter 1990).

Because we did not have any price data on these four food items for 1987 to 1989, we created regional food price indices for these years as follows. First, we assumed that the national average rate of inflation for all food items was a good predictor of the rate of change in each region's food price. Second, we assumed the spatial relative price pattern for 1990 extends back to 1987. Then, we used the average inflation rate for 1987 to 1990 to create each of the regional food price indices for 1987 to 1989. Regional prices for alcohol and tobacco, and for housing were created for the post-reform years from the World Bank study of Poland (1995) which

reported the relative regional prices by expenditure category for 1993.

Two types of price indices were constructed and used in estimation of the complete demand system. In estimating the demand system in the pre-reform period the Törnqvist price index, defined as $\log P(p^t, p^{t-1};T)=\sum_k 1/2(w_{t,k}+w_{t-1,k})\log(p_{t,k}/p_{t-1,k})$, where $w_{t,k}$ and $w_{t-1,k}$ are the budget shares for good k in two different periods t and t-1 was constructed. The price index for alcohol and tobacco; clothing and footwear; housing; fuel and electricity; hygiene and health care; entertainment; transport and communication were constructed using the expenditure shares for these groups calculated from the Poland's household budget survey 1987-1992 and the Polish price indices for these goods and services from the Polish Statistical Yearbook. Using the relationship $\log P(p^t, p^{t-1}; T) = \sum_{k=1}^{9} 1/2(w_{t,k}+w_{t-1,k})\log(p_{t,k}/p_{t-1,k})$, where $P(p^t, p^{t-1})$ is the CPI for period t, the price of "rest" group was calculated. Thus:

$$\log(p_{t,9}) = [\log P(p^t, p^{t-1} T) - \sum_{k=1}^{8} 1/2(w_{t,k}+w_{t-1,k})\log(p_{t,k}/p_{t-1,k})]/1/2(w_{t,9}+w_{t-1,9}).$$

Selected groups were aggregated such as fuel, electricity, transport and communication into one group, and hygiene, health care, entertainment and rest as group "other". The price indices for larger groups were calculated using expenditure shares and price indices for the smaller groups.

In the post-reform years the Laspeyres index was constructed. The price index for alcohol and tobacco; clothing and footwear; housing; fuel, electricity, transport and communication were constructed using the expenditure shares of these groups calculated from the household budget surveys and Polish price indices for these goods and services from the Polish Statistical Yearbook. Given $P_t = \sum_{g=1}^{6} w_{gt}p_{gt}$, where P_t is the CPI for period t, w_{gt} is the share of group g at period t, and p_{gt} is the price index for group g at period t, the price for the "other goods" category was derived as:

$$P_{6t} = (P_t - \sum_{g=1}^{5} w_{gt}p_{gt})/w_{6t}.$$

Next, quarterly price indices were constructed using the data on quarterly inflation rates in Poland for 1987 to 1992, obtained by GUS. The increase of prices from IVth quarter to the next IVth quarter with IVth quarter in 1986 equal to 100 were found. The quarterly shares for the annual increase in prices for all years from 1986 to 1992 were calculated. These quarterly shares were used as scale numbers to get the quarterly prices for the six groups. The Polish average price for each commodity and year from the Polish Statistical Yearbook are assumed to be the IVth quarter prices. Using these prices and the quarterly shares, the Polish average prices for each quarter were obtained.

CHAPTER 5. EMPIRICAL RESULTS

This chapter presents the empirical results from fitting the demand system developed in chapter 4. The results are divided into four parts. Part one reports the estimated coefficients of the AIDS model before political and economic reforms, ignoring the complications from rationing of some goods. Part two presents pre-reform estimates after incorporating rationing for food and housing. For the rationed commodities, virtual prices are used in place of actual prices. After the reforms no rationing is assumed to exist, and estimation is with actual prices. The third part discusses the market price and expenditure elasticities after the reforms. The last part presents welfare implications.

Price and Expenditure Elasticities Before the Reforms

The standard unrationed AIDS model for the years before the reforms ignoring rationing was estimated with imposing the theoretical parameter restrictions of demand–homogeneity and symmetry. Parameter estimates assuming no effective rationing are presented and used to compute demand elasticities.

Table 5.1 presents the Marshallian and Hicksian own and cross-price elasticities from this estimation. The diagonal elements present the own-price elasticities. The Marshallian own-

Table 5.1 Estimated Demand Elasticities: AIDS Before the Reforms[a]

Group[b]	Food	Alcohol	Clothing	Housing	Fuel	Other
		Marshallian	Elasticities			
Food	-0.13 (0.02)	0.06 (0.01)	-0.31 (0.02)	-0.31 (0.02)	-0.28 (0.02)	0.30
Alcohol	0.49 (0.12)	10.03 (1.84)	-35.04 (4.80)	20.46 (2.66)	-1.17 (0.62)	4.15
Clothing	-1.35 (0.08)	-10.01 (1.37)	25.30 (3.76)	-13.36 (2.10)	0.40 (0.45)	-2.12
Housing	-2.02 (0.11)	8.16 (1.06)	-18.78 (2.94)	8.95 (1.70)	1.62 (0.43)	0.44
Fuel	-2.11 (0.12)	-0.60 (0.31)	0.66 (0.79)	2.03 (0.53)	-4.58 (0.45)	3.20
Other	0.75	1.18	-2.15	0.35	1.82	-3.30
		Hicksian	Elasticities			
Food	0.20 (0.02)	0.08 (0.01)	-0.22 (0.02)	-0.24 (0.02)	-0.23 (0.02)	0.40
Alcohol	1.03 (0.12)	10.07 (1.84)	-34.89 (4.80)	20.57 (2.66)	-1.09 (0.63)	4.30
Clothing	-0.78 (0.08)	-9.97 (1.37)	25.46 (3.76)	-13.25 (2.10)	0.49 (0.45)	-1.96
Housing	-1.20 (0.10)	8.23 (1.07)	-18.55 (2.94)	9.11 (1.70)	1.75 (0.43)	0.67
Fuel	-1.41 (0.12)	-0.54 (0.31)	0.86 (0.79)	2.17 (0.53)	-4.47 (0.45)	3.40
Other	1.42	1.23	-1.96	0.48	1.93	-3.11

	Budget	Mean Shares
Food	0.67 (0.004)	0.50
Alcohol	1.08 (0.006)	0.04
Clothing	1.14 (0.004)	0.14
Housing	1.63 (0.002)	0.10
Fuel	1.40 (0.007)	0.08
Other	1.34	0.14

Notes: [a]-Figures in parenthesis are the estimated standard errors of elasticities
[b]-Alcohol includes tobacco, Clothing includes footwear, Fuel includes electricity, transport and communication

price elasticities for alcohol and tobacco, clothing and footwear, and housing had positive sign. The Marshallian own-price elasticities are quite large. The Hicksian own-price elasticities for food, housing, alcohol and tobacco, clothing and footwear had the "wrong" or positive signs. The violation of the negative signs for the Hicksian own-price elasticities for these goods and services in the pre-reform period truly reflects the inability of the households to maximize their utility given market distortions due to extensive administrative controls in the economy, and the existence of rationing system in Poland for food and housing. The non diagonal elements in Table 5.1 are the estimated cross-price elasticities.

All expenditure elasticities are positive indicating that all commodities are normal goods whose consumption will increase with increased income. All goods with the exception of food are income elastic since their expenditure elasticities are bigger than one suggesting that they are luxuries. Housing has the highest expenditure elasticity of 1.63; fuel, electricity, transport and communication has the second highest of 1.43, while food has the lowest one of 0.67.

The standard AIDS model with no rationing goods for the pre-reform period produces very high compensated own price elasticity for clothing and footwear 25.46, for alcohol and tobacco 10.07, and for housing 9.11 with positive or wrong sign for the above goods and for food 0.1.

The next step was to adjust expenditure on housing of home owners. A hedonic housing rental equation (3.25) was estimated separately for 1990, 1991, and 1992, and for the pooled data for these three years.[11] The coefficients of the average space per room, number of rooms, town size are positive over all observed values of variables. All the housing attributes

[11]The coefficients of the fitted hedonic rental equations are given in Appendix B Table B.1.

have positive effects on the rental dependant variable for the 1990 equation. For the 1991 equation all the housing attributes, with the exception of heating stove and electric heater, have positive effects on rental. For the 1992 equation only the indicators for bottle gas and electric heater have negative effect on the dependant variable. Data for 1990-1992 were pooled together, and hedonic house rental equation fitted. Here all of the housing attributes with the exception of electric heater have positive effect on housing rental.

In order to choose which coefficients to use in imputing the rental value for house owners before the reforms we performed some statistical tests. One hypothesis is that coefficients on the same variable are equal across years, a type of Chow test. The calculated F statistic for this null hypothesis is 42.86 which is larger than the tabled value $F_{0.05,\,30,\,\infty} = 1.46$. We rejected at 5 percent significance level the equality of coefficients which implies heterogeneity of coefficients across years. We used the coefficients from the 1990 data equation to impute the rental for house owners for the years before the reforms. For the years after the reforms, we used the estimated coefficients from the separate equations for 1990, 1991 and 1992. The housing expenditures and the total expenditure for house owners were adjusted using the predicted housing rental.

Finally, the pre-reform AIDS model ignoring rationing, was estimated with the expenditure adjusted for the house owners. Table 5.2 reports the estimated coefficients and price and income effects. The results are very close to the results of the standard AIDS for the pre-reform years with very high compensated own-price elasticities and positive or "wrong" signs for food, alcohol and tobacco, clothing and footwear, and housing.

Table 5.2 Estimated Demand Elasticities: AIDS Before the Reforms with Predicted Rent[a]

Group[b]	Food	Alcohol	Clothing	Housing	Fuel	Other
		Marshallian	Elasticities			
Food	-0.11 (0.02)	0.06 (0.01)	-0.30 (0.02)	-0.34 (0.02)	-0.29 (0.02)	0.31
Alcohol	0.55 (0.12)	9.98 (1.83)	-35.28 (4.78)	20.64 (2.64)	-1.12 (0.62)	4.15
Clothing	-1.28 (0.08)	-10.08 (1.36)	24.90 (3.74)	-13.03 (2.09)	0.44 (0.45)	-2.09
Housing	-1.94 (0.10)	7.49 (0.96)	-16.64 (2.66)	7.68 (1.54)	1.48 (0.39)	0.39
Fuel	-2.13 (0.12)	-0.57 (0.31)	0.74 (0.79)	2.03 (0.53)	-4.64 (0.45)	3.16
Other	0.76	1.18	-2.12	0.34	1.80	-3.30
		Hicksian	Elasticities			
Food	0.21 (0.02)	0.09 (0.01)	-0.21 (0.02)	-0.27 (0.02)	-0.23 (0.02)	0.41
Alcohol	1.08 (0.12)	10.02 (1.83)	-35.13 (4.78)	20.76 (2.65)	-1.04 (0.62)	4.30
Clothing	-0.72 (0.08)	-10.04 (1.37)	25.06 (3.74)	-12.90 (2.09)	0.53 (0.45)	-1.93
Housing	-1.18 (0.09)	7.55 (0.96)	-16.42 (2.66)	7.85 (1.54)	1.60 (0.39)	0.61
Fuel	-1.44 (0.12)	-0.52 (0.31)	0.93 (0.79)	2.19 (0.53)	-4.53 (0.45)	3.36
Other	1.42	1.23	-1.93	0.49	1.91	-3.11

	Budget	Mean Shares
Food	0.67 (0.004)	0.49
Alcohol	1.08 (0.006)	0.04
Clothing	1.14 (0.004)	0.14
Housing	1.54 (0.021)	0.11
Fuel	1.41 (0.007)	0.08
Other	1.34	0.14

Notes: [a]-Figures in parenthesis are the estimated standard errors of elasticities
[b]-Alcohol includes tobacco, Clothing includes footwear, Fuel includes electricity, transport and communication

Virtual Price and Expenditure Elasticities Before the Reforms

To incorporate the effects of rationing on consumption of food and housing, we employ the virtual price model. We assume the prices in Germany, as discussed before, provide a good proxy for unrationed relative prices of goods consumed in Poland. From equations (3.10) and (3.11) we found how much the relative price of food and housing in Germany is higher than Poland. The resulting ratios for food are 4.85; 5 and 4.56 for 1987, 1988 and 1989; for housing the ratios are 6.01, 6.87 and 6.52 for 1987, 1988 and 1989. The virtual prices for food and housing were constructed by multiplying the actual Polish price of food and housing in 1987, 1988, and 1989 by the respective ratio.

The AIDS with the virtual prices was estimated,[12] and the parameters from the share equations used to compute a new set of demand elasticities.[13] Table 5.3 presents the own- and cross-price elasticities. In Table 5.3 all the compensated and uncompensated own-price elasticities are negative, and their standard errors are relatively small with the exception of fuel, making them significant at the conventional levels. The own-price elasticities for food and fuel are less than one while for alcohol, clothing , housing and other goods are bigger than one, suggesting elastic demand.

Negative signs for the Marshallian cross-price elasticities show that the commodities are gross complements, and negative signs for the Hicksian cross-price elasticities show that the commodities are net complements, while positive signs indicate gross or net substitutes. The

---

[12]Six percent of the observations were deleted based on extreme large values for any of the six expenditure shares. These deleted observations were concentrated in the clothing and footwear, alcohol and tobacco, and fuel, electricity, transport and communication shares.

[13]The parameter estimates and their t statistics are presented in Appendix A Table A.1.

Table 5.3 Estimated Demand Elasticities: AIDS Before the Reforms with Virtual Prices[a]

Group[b]	Food	Alcohol	Clothing	Housing	Fuel	Other
		Marshallian	Elasticities			
Food	-0.64 (0.02)	0.01(0.002)	-0.03 (0.01)	-0.20 (0.02)	-0.04 (0.01)	0.08
Alcohol	0.27 (0.13)	-1.91(0.82)	1.18 (0.85)	-0.57 (0.28)	2.93 (0.43)	-3.16
Clothing	-0.80 (0.09)	0.32(0.23)	-2.03 (0.29)	1.88 (0.18)	-0.51 (0.17)	-0.20
Housing	-1.22 (0.06)	-0.04(0.02)	0.45 (0.04)	-1.30 (0.09)	0.02 (0.05)	0.60
Fuel	-1.29 (0.13)	1.32(0.20)	-0.83 (0.28)	0.21 (0.31)	-0.04 (0.46)	-0.65
Other	0.97	-0.92	-0.21	2.60	-0.39	-3.34
		Hicksian	Elasticities			
Food	-0.08 (0.01)	0.02(0.002)	0.01 (0.01)	-0.05 (0.02)	-0.02 (0.01)	0.11
Alcohol	1.14 (0.13)	-1.90(0.82)	1.23 (0.85)	-0.34 (0.28)	2.96 (0.44)	-3.10
Clothing	0.12 (0.09)	0.34(0.24)	-1.97 (0.29)	2.13 (0.18)	-0.48 (0.17)	-0.14
Housing	-0.19 (0.06)	-0.02(0.02)	0.52 (0.04)	-1.03 (0.09)	0.06 (0.05)	0.66
Fuel	-0.40 (0.13)	1.34(0.20)	-0.78 (0.28)	0.44 (0.31)	-0.01 (0.46)	-0.59
Other	1.86	-0.90	-0.15	2.83	-0.36	-3.28

	Budget	Mean Shares
Food	0.82 (0.003)	0.69
Alcohol	1.26 (0.019)	0.01
Clothing	1.33 (0.014)	0.04
Housing	1.49 (0.013)	0.18
Fuel	1.28 (0.020)	0.03
Other	1.27	0.04

Notes: [a]-Figures in parenthesis are the estimated standard errors of elasticities
[b]-Alcohol includes tobacco, Clothing includes footwear, Fuel includes electricity, transport and communication

cross-price elasticities in the food equation are quite small and negative with respect to the price of housing and fuel, indicating complementary relationships but positive with respect to the prices of alcohol and clothing, indicating substitutability. In the alcohol equation, cross-price elasticities are large and positive with respect to the prices of food, clothing and fuel, suggesting substitution relationship. In the housing equation the cross-price elasticities with respect to the prices of food and alcohol are small and negative, while for clothing and fuel are positive. The expenditure elasticities are positive and larger than one for five of the commodities but food, which accounts for the largest share of household expenditures, it is less than one.

Market Price and Expenditure Elasticities

The AIDS model was estimated for the years after the reforms 1990, 1991 and 1992.[14] Table 5.4 presents the Marshallian and Hicksian own- and cross-price elasticities.[15] The diagonal elements present the own-price elasticities. All own-price elasticities are negative as expected and their standard errors are relatively small, making all of them significant at the conventional levels. The own-price elasticities for alcohol and tobacco, clothing and footwear, housing, and other, are larger than one, while the price elasticity of demand for food and fuel, electricity, transport and communication are the lowest of all commodities. This is expected considering the importance of these items in the Poland's consumer basket. The demand for food and fuel, electricity, transport and communication is price inelastic, while the rest of commodities are

[14] Seven percent of the observations were deleted based on extreme large values for the expenditure shares for clothing and footwear, housing, and fuel, electricity, transport and communication.

[15] The parameter estimates and their t statistics are presented in Appendix A Table A.2.

Table 5.4 Estimated Demand Elasticities: AIDS After the Reforms[a]

Group[b]	Food	Alcohol	Clothing	Housing	Fuel	Other
		Marshallian	Elasticities			
Food	-0.62 (0.02)	-0.01 (0.01)	-0.08 (0.02)	0.01 (0.02)	-0.14 (0.01)	0.16
Alcohol	-0.43 (0.15)	-1.70 (0.36)	1.07 (0.46)	0.27 (0.37)	-0.20 (0.20)	-0.20
Clothing	-0.85 (0.10)	0.40 (0.17)	-2.95 (0.49)	1.34 (0.22)	-0.19 (0.19)	0.92
Housing	-0.32 (0.11)	0.08 (0.12)	1.18 (0.20)	-1.70 (0.28)	-0.28 (0.10)	-0.39
Fuel	-0.75 (0.04)	-0.04 (0.05)	-0.10 (0.11)	-0.16 (0.07)	-0.42 (0.05)	0.39
Other	0.07	-0.05	0.45	-0.23	0.26	-2.02
		Hicksian	Elasticities			
Food	-0.27 (0.02)	0.01 (0.01)	-0.03 (0.02)	0.07 (0.02)	-0.05 (0.01)	0.26
Alcohol	0.18 (0.15)	-1.67 (0.36)	1.16 (0.47)	0.38 (0.37)	-0.04 (0.20)	-0.01
Clothing	-0.17 (0.10)	0.44 (0.17)	-2.85 (0.49)	1.46 (0.22)	-0.02 (0.19)	1.13
Housing	0.41 (0.11)	0.13 (0.12)	1.30 (0.20)	-1.57 (0.28)	-0.10 (0.10)	-0.16
Fuel	-0.19 (0.04)	-0.01 (0.05)	-0.01 (0.11)	-0.07 (0.07)	-0.28 (0.05)	0.56
Other	0.84	-0.002	0.57	-0.09	0.46	-1.78

	Budget	Mean Shares
Food	0.68 (0.004)	0.51
Alcohol	1.20 (0.008)	0.03
Clothing	1.35 (0.008)	0.08
Housing	1.42 (0.026)	0.09
Fuel	1.09 (0.004)	0.13
Other	1.51	0.16

Notes: [a]-Figures in parenthesis are the estimated standard errors of elasticities
[b]-Alcohol includes tobacco, Clothing includes footwear, Fuel includes electricity, transport and communication

price elastic. Food was the most price inelastic, while clothing and footwear were the most price elastic. This indicates that an uniform percentage decrease in prices of all commodities would elicit a greater demand for clothing and footwear than for other commodities. The non diagonal elements in Table 5.4 are the estimated cross-price elasticities. Negative signs for the Marshallian cross-price elasticities show that the commodities are gross complements, and negative signs for the Hicksian cross-price elasticities show that the commodities are net complements, while positive signs indicate gross or net substitutes. Most of cross-price elasticities are small. The lower values of cross-price effects indicate that consumers are more responsive to own-price rather than prices of other commodities. The own-price elasticities after the reforms for unrationed goods are larger compare to the pre-reform ones which confirms the theoretical result that the rationing reduces the responsiveness of demand for any unrationed commodity to its own price.

Table 5.4 also presents the expenditure elasticities. All expenditure elasticities are positive indicating that all commodities are normal goods whose consumption will increase with increased income. The income elasticity of demand for food is 0.68. All other goods have income elasticity larger than one, suggesting that they are luxuries. The most expenditure elastic goods are other goods and housing. These findings suggest that as income increases consumers spend proportionally less on food and more on other goods.

We turn now to effects of other variables on demand. Household adult equivalent number has a positive effect on "food", and negative effect on the rest of the budget shares. The negative sign of the coefficients of household adult equivalent number suggests economies of size. Age and education level of the head of household variables have small effects on the budget shares.

Welfare Analysis

One of the main goals of the Polish household demand study is to show whether the households are better- or worse-off as a result of the transformation from the centrally-planned to market economy.

With the estimated coefficients from the virtual prices AIDS before the reforms and AIDS after the reforms, the cost of living indices from equation (3.12) were calculated for eight different household types. The resulting index numbers using the 1987 utility level as a base and expressed as annual rates of growth, are shown in Table 5.5. The cost of living index is increasing over 1987-1992 reaching 3.029 relative to 1987 for father with children and 3.069 relative to 1987 for a family with four or more children. The cost of living index is increasing over time by a similar rate for all eight household types, but it increases the most for family with four or more children and the least for father with children.

Table 5.5 Virtual Cost of Living Indices for Eight Household Types

Year	Family w/o child	Family with 1 child	Family with 2 child	Family with 3 child	Family 4 more child	Dad with child	Mom with child	Other
Number families	543	320	435	151	66	5	96	1063
1988	0.669	0.675	0.677	0.677	0.680	0.667	0.669	0.670
1989	1.929	1.928	1.927	1.927	1.926	1.930	1.929	1.929
1990	2.144	2.155	2.158	2.159	2.163	2.141	2.145	2.147
1991	2.682	2.702	2.708	2.709	2.718	2.677	2.684	2.687
1992	3.034	3.054	3.059	3.061	3.069	3.029	3.036	3.039

Tables 5.6 and 5.7 show the cost of living indices for eight household types and two different expenditure levels. The households were divided into two groups--one group with total expenditure less than the mean expenditure in 1987 and the other group with total expenditure bigger than the mean expenditure. The virtual cost of living index increased faster for households having expenditures larger than the mean expenditures in 1987 than those having less than the mean expenditure. It ranges between 3.011 and 3.041 for the poor households and between 3.055 and 3.079 for the rich households. The highest index value was for family with four or more children and the lowest index was for "other" family in the group of poor, and respectively for family with four or more children, and father with one or more children in the group of the rich households. The largest effect of price changes were for family with four or more children.

With the estimated coefficients form the virtual AIDS before the reforms and the standard

Table 5.6 Virtual Cost of Living Indices for Eight Household Types and Total Expenditure Less Than the Mean Expenditure

Year	Family w/o child	Family with 1 child	Family with 2 child	Family with 3 child	Family 4 more child	Dad with child	Mom with child	Other
Number families	416	165	186	62	16	4	71	618
1988	0.665	0.669	0.670	0.670	0.671	0.665	0.665	0.661
1989	1.931	1.929	1.929	1.929	1.929	1.931	1.931	1.932
1990	2.138	2.145	2.147	2.149	2.148	2.138	2.138	2.131
1991	2.671	2.683	2.688	2.687	2.689	2.671	2.671	2.659
1992	3.023	3.035	3.039	3.039	3.041	3.023	3.023	3.011

Table 5.7 Virtual Cost of Living Indices for Eight Household Types and Total Expenditure Bigger Than the Mean Expenditure

Year	Family w/o child	Family with 1 child	Family with 2 child	Family with 3 child	Family 4 more child	Dad with child	Mom with child	Other
Number families	127	155	249	89	50	1	25	445
1988	0.681	0.682	0.682	0.682	0.683	0.675	0.681	0.682
1989	1.926	1.926	1.926	1.925	1.925	1.927	1.926	1.925
1990	2.165	2.166	2.166	2.167	2.168	2.156	2.165	2.168
1991	2.720	2.723	2.723	2.725	2.727	2.704	2.720	2.726
1992	3.072	3.074	3.074	3.076	3.079	3.055	3.072	3.077

AIDS after the reforms we can calculate the compensating variations (CV) given by the differences in cost function or $CV = C(p^1, U^0) - C(p^0, U^0)$ for each household in the final year, IVth quarter of 1992. The base period is the IVth quarter of 1987. We calculated indirect utilities for the period before the reforms. The compensating variation is the income change necessary to compensate the household for the price change. The calculated compensating variations are positive for every family which indicates that each household type experienced welfare loss at given utility as a result of the price liberalization. We plot the compensating variations for each household in Figure 5.1.

The welfare losses in million zlotys per quarter are plotted against the households total expenditures. All households suffer positive welfare losses at given utility, and these losses increase with total expenditures. Therefore, the highest spending households and experience the highest compensation variation measure of welfare losses with the exception of several household types who suffered smaller losses.

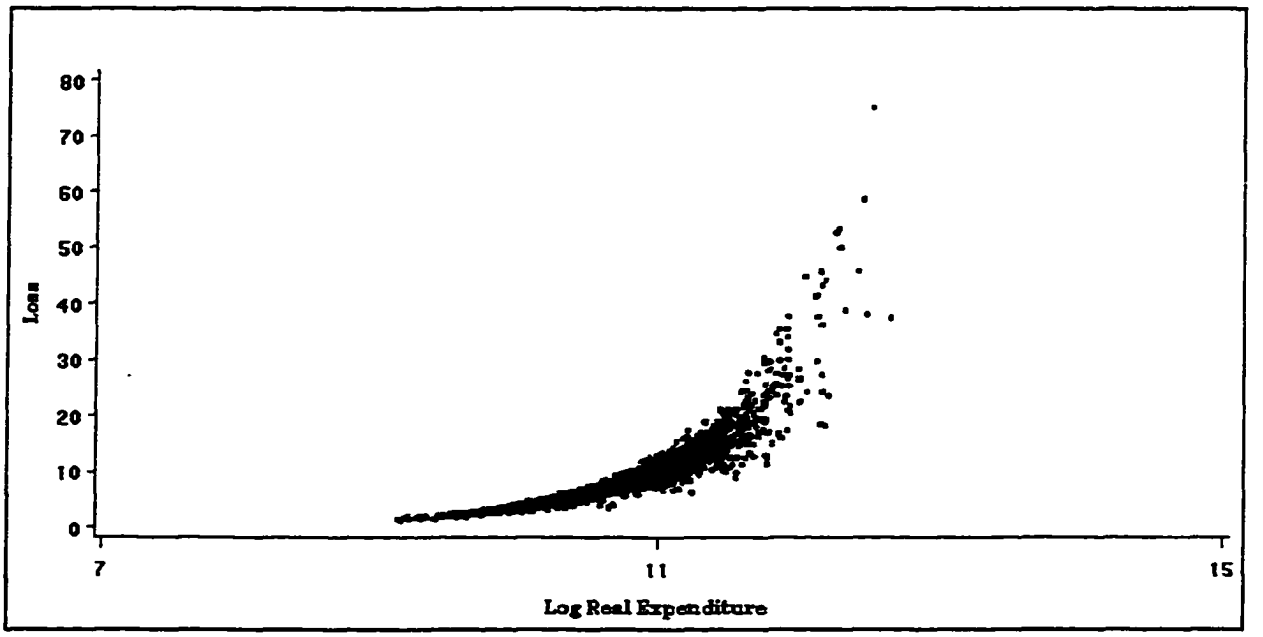


Figure 5.1 Welfare Loss due to Price Liberalization

The total welfare loss for different family types are computed and reported in Table 5.8. We make two comparisons, one allowing for rationing and the second ignoring rationing. The welfare losses increase with the number of children in the family. The highest losses of 12.92 million zlotys per quarter are for the family with four or more children. The lowest welfare losses are for the father with children and mother with children 6.54 and 7.25 million zlotys per quarter, respectively.

However to know whether the household is better- or worse-off after the reforms, we need to know how much income is changed at the new prices. Table 5.8 shows this as virtual expenditure change. For the case which ignores rationing, this is expenditure change. Finally, the ratio of total welfare loss to the 1987 real total expenditures was computed for all household types. The most affected by the economic reforms in Poland are the families with three children, who have total welfare loss of 15.04 million zlotys, or 84 percent of 1987 average income. The least affected group by changes are fathers with one or more children, who have total welfare

Table 5.8 Welfare Losses and Family Type (in million zlotys)

Variable	Family w/o child	Family with 1 child	Family with 2 child	Family with 3 child	Family 4 more child	Dad with child	Mom with child	Other
Loss With Ration Effects								
Compensating Variation	8.04	10.47	11.14	12.37	12.92	6.54	7.25	9.11
Virtual expenditure change[a]	-0.64	-0.58	-0.14	-2.67	-0.43	4.95	-1.07	-1.39
Total loss[b]	-8.68	-11.05	-11.28	-15.04	-13.35	-1.57	-8.32	-10.50
Relative loss[c]	0.73	0.72	0.69	0.84	0.72	0.16	0.77	0.79
Loss Without Ration Effects								
Compensating Variation	26.82	36.42	38.72	41.29	41.18	22.42	25.46	30.47
Expenditure change[d]	-3.21	-4.78	-4.58	-6.78	-3.72	2.59	-4.03	-4.4
Total loss[e]	-30.02	-41.20	-43.30	-48.07	-44.90	-19.83	-29.49	-34.87
Relative loss[f]	2.07	2.11	2.09	2.19	2.05	1.62	2.14	2.13

Notes: [a]-Mean real expenditure of the family type in 1992 less mean virtual real total expenditure of family type in 1987 at 1992 prices

[b]-We define total measured loss = - CV + change in virtual real total expenditure at 1992 prices

[c]-Total welfare loss relative to virtual real total expenditures in 1987 at 1992 prices

[d]-Mean real expenditures of the family type in 1992 less mean real expenditures of family type in 1987 at 1992 prices

[e]-We define total measured loss = - CV + change in real total expenditure at 1992 prices

[f]-Total welfare loss relative to real total expenditures in 1987 at 1992 prices.

loss of 1.57 million zlotys, or 16 percent of 1987 average income for this family type.

Next, we compare the welfare loss over 1987 to 1992. The loss is three to four times higher when ignoring rationing than allowing for it. The total welfare loss is between 19.83 million zlotys and 48.07 million zlotys when we do not consider rationing effects versus 1.57 million zlotys and 15.04 million zlotys when allow for rationing.

Table 5.9 reports the Stone price index with virtual and actual prices. The price inflation is exaggerated in the transition period when ignoring rationing.

Table 5.9 Stone Price Index

Variable	1987	1988	1989	1990	1991	1992
Actual Prices	2.40	3.86	14.59	100.00	167.34	244.20
Virtual Prices	9.73	15.64	60.34	100.00	167.34	244.20

CHAPTER 6. SUMMARY AND CONCLUSIONS

Since the beginning of 1990 Poland has been on the road to a market economy. Poland was the first country in Eastern Europe to re-establish market economy. The new government of Poland has introduced a number of economic reforms and new policies for transforming the old centrally-planned economy into a new market-oriented economy. These includes eliminating the big state sector and the distortions in the economy, ending the state control of prices and price liberalization. The opening of the economy to the forces of international competition initially led to massive contraction of output and a sharp increase in unemployment, that were shorter and sharper than in other transition economies. Economic growth resumed in 1992 when the economy started to rebound, spurred by the rapid expansion of a private sector that accounts for more than half of GDP in 1994. The acceleration of economic growth has been continuing in Poland since 1992 and by 1995 the country's output was back above the pre-reform level. The rate of unemployment decreased, and the average real wage increased.

The economic reforms associated with the transition have had profound effects on Poland's society. As subsidies have been withdrawn, prices have risen rapidly and Polish living standards have declined. Economic reforms are affecting the availability of goods, commodity prices, family incomes and other socio-demographic factors, which imply a changing structure of consumption. Assessing the effects of these new policies requires careful analysis of

household consumption in transition economies. We have shown that the virtual prices are much larger than the actual prices for the rationed goods in the pre-reform period. Most studies have ignored that in assessing the effects of the reforms in transition economies. Allowing for rationing and incorporating the effects of rationing before the reforms need to be considered for accurate welfare policy formulation. GDP in real terms divided by the population is an over estimate of welfare loss in transition economies.

The most important objective of this study was to examine econometrially how economic and social factors affect the household behavior during transition and to determine whether households are better or worse off after the reforms. This study contributes to the previous literature on transition economies by estimating a complete demand system for six commodity groups with rationing before the reform. With disaggregated commodity groups, it is possible to estimate the effect of price liberalization and relaxation of rationing on each of these groups.

This study has developed a consistent model of decision making under rationing in a centrally-planned economy when some goods are in short supply. The household maximizes its utility subject to a budget and good-ration constraint. In the years after the reforms the rationing is eliminated and the household maximizes its utility subject only to a budget constraint.

First, we estimated the AIDS model for the pre-reform years, ignoring rationing. Some of the compensated own-price demand elasticities had "wrong" signs (positive) or implausible magnitudes due to the price distortions in that period. Artificially low prices for some goods such as food and housing in the pre-transition period created product shortages. The costs of these shortages were not captured by standard consumer price indexes, and thus measures of inflation from rationed to unrationed regimes will exaggerate true price changes. Virtual prices are more precise and useful way to characterize the effective prices of rationed goods. Virtual

prices are not perfect. They just improve the estimates.

Second, the AIDS model with virtual prices was estimated. The demand elasticities have the right sign (negative) for the compensated own-price elasticities and reasonable magnitudes. The estimates from the virtual AIDS gave plausible values for price and income elasticities. The own-price elasticities after the reforms are larger which confirms the theory that lifting rationing increase the responsiveness of demand for any unrationed commodity to its own price.

Finally, the estimates from the virtual AIDS model were used to calculate the consumer price indexes for pre-reform period in making pre- and post-reform comparisons. The cost of living index was increasing over time by a similar rate for all eight household types, but it increases the most for family with four or more children and the least for father with children.

The compensating variation measure of welfare change associate with reforms was positive and sizeable. It was largest for the pre-reform highest spending households and large for most households. The virtual cost of living index increased faster for households having expenditures larger than mean expenditures in 1987 than those having less than mean expenditure and for families with four or more children.

The total welfare loss measured the sum of the compensated variation and the change in real total expenditures in 1992 prices. The most affected groups by the political and economic reforms in Poland were the families with three children. They had total welfare loss of 15.04 million zlotys, or 84 percent of 1987 average income. The least affected group was fathers with one or more children, who have total welfare loss of 1.57 million zlotys, or 16 percent of 1987 average income for this family type. The total welfare loss is sizeable for all types households. Ignoring rationing effects gives the welfare loss which is exaggerated three to four times.

After the reforms, the expenditure share for food, clothing and footwear decreased, while

the expenditure share for fuel, electricity, transport and communication, and expenditure share for other goods, including education, health services increased. Food is still the most important expenditure category. The demand for high quality products and services increased.

An understanding of consumer behavior is essential for understanding what happened during reforms and for formulating good policies. The estimates from the model can be used by the government to predict how the post-reform government income and trade policies affect household consumption. An understanding of the nature of adjustments to consumption is important for guiding policies which aid the poorest in the society and which provide a social safety net for those most adversely affected by economic change. Disaggregated demand estimates can be used to predict the welfare implications of the new trade policy (joining the European Union) on major demographic groups. Disaggregated demand projections are also essential for improved development planning and effective policy making. Forecasts of demand growth for each commodity group can be made using the model and then distributed to the private sector industries to help them plan for future capacity needs as the economy grows and develops.

This study provided plausible measures of demand elasticities that are necessary for an accurate and complete policy analysis. But the analysis has its limitations and can be improved in several ways. The estimates are based on a sample that did not cover the employees in the private sector and the study has ignored the issue of persistence in consumption. Including the group of the privately employed people will make the comparisons more interesting because these households are more likely to be better-off or less adversely affected by the reforms while in our study all households suffer significant welfare loss as a result of the reforms.

APPENDIX A. DEMAND SYSTEM PARAMETER ESTIMATES

Table A.1 Demand System Parameter Estimates and t-Ratios: AIDS with Virtual Prices

	Food	Alcohol	Clothing	Housing	Fuel
Constant	1.902	-0.025	-0.215	-0.292	-0.019
	(71.53)	(-3.16)	(-11.15)	(-7.25)	(-0.96)
Pfood	0.160	0.005	-0.025	-0.160	-0.030
	(16.03)	(3.47)	(-6.22)	(-14.67)	(-8.74)
Palcohol	0.005	-0.011	0.015	-0.006	0.036
	(3.47)	(-1.11)	(1.40)	(-1.84)	(6.71)
Pclothing	-0.025	0.015	-0.045	0.086	-0.022
	(-6.22)	(1.40)	(-3.46)	(10.69)	(-2.91)
Phousing	-0.160	-0.006	0.086	-0.038	0.006
	(-14.67)	(-1.84)	(10.69)	(-2.24)	(0.72)
Pfuel	-0.030	0.036	-0.022	0.006	0.027
	(-8.74)	(6.71)	(-2.91)	(0.72)	(2.16)
lnexpend	-0.125	0.003	0.015	0.089	0.007
	(-59.66)	(13.85)	(23.90)	(38.53)	(13.92)
equinum	0.043	-0.002	-0.003	-0.003	-0.003
	(32.31)	(-11.42)	(-7.87)	(-10.26)	(-10.26)
age	0.003	-4E-05	-6E-05	-0.003	-9E-05
	(7.68)	(-0.97)	(-0.53)	(-6.74)	(-1.01)
agesq	-3E-05	-1E-06	-2E-06	3E-05	2E-06
	(-6.71)	(-3.17)	(-1.89)	(-6.74)	(2.54)
educ	0.009	0.001	-2E-04	-0.005	-0.001
	(16.84)	(12.59)	(-1.30)	(-8.57)	(-7.23)

Table A.2 Demand System Parameter Estimates and t-Ratios: AIDS After the Reforms

	Food	Alcohol	Clothing	Housing	Fuel
Constant	2.031	-0.034	-0.203	-0.229	0.031
	(75.56)	(-4.38)	(-15.77)	(-11.59)	(1.63)
Pfood	0.111	-0.010	-0.054	-0.009	-0.091
	(9.27)	(-2.24)	(-6.94)	(-0.92)	(-18.21)
Palcohol	-0.010	-0.021	0.032	0.009	-0.005
	(-2.24)	(-1.96)	(2.33)	(0.78)	(0.84)
Pclothing	-0.054	0.032	-0.154	0.110	-0.012
	(-6.94)	(2.33)	(-3.94)	(6.19)	(0.80)
Phousing	-0.009	0.009	0.110	-0.060	-0.020
	(-0.92)	(0.78)	(6.19)	(-2.40)	(-2.23)
Pfuel	-0.091	-0.005	-0.012	-0.020	0.092
	(-18.21)	(0.84)	(0.80)	(-2.23)	(13.13)
lnexpend	-0.165	0.006	0.028	0.038	0.011
	(-67.34)	(8.47)	(23.90)	(20.89)	(6.52)
equinum	0.066	-0.003	-0.002	-0.019	-0.009
	(45.41)	(-8.19)	(-15.77)	(-17.93)	(-8.52)
age	0.003	4E-04	-2-04	-0.001	-0.001
	(6.91)	(3.30)	(-0.83)	(-4.90)	(-3.12)
agesq	-2E-05	-8E-06	-1E-06	1E-05	1E-05
	(-5.81)	(-7.30)	(-0.71)	(4.74)	(4.89)
educ	0.013	0.002	4E-04	-0.002	-0.004
	(-18.21)	(12.65)	(1.39)	(-5.55)	(-10.25)

Notes: All prices are in logarithms

APPENDIX B. HEDONIC EQUATION PARAMETER ESTIMATES

Table B.1 Estimates of the Hedonic Rental Equation[a]

	1990	1991	1992	Pooled data
Constant	9.38 (42.22)	10.50 (55.01)	11.31 (52.18)	11.06 (88.01)
Town size 1[b]	0.35 (5.96)	0.28 (5.33)	0.30 (5.19)	0.32 (9.86)
Town size 2	0.41 (7.04)	0.28 (5.45)	0.28 (5.00)	0.34 (10.42)
Town size 3	0.33 (5.15)	0.27 (4.98)	0.33 (5.60)	0.32 (9.31)
spr	0.02 (3.45)	0.02 (6.66)	0.02 (5.40)	0.02 (8.55)
rooms	0.28 (12.86)	0.27 (14.95)	0.25 (12.52)	0.27 (22.99)
waters	0.19 (1.80)	0.28 (2.78)	0.004 (0.04)	0.16 (2.56)
waterc	0.09 (1.26)	0.15 (2.40)	0.28 (3.79)	0.16 (4.08)
bathr	0.08 (1.20)	0.15 (2.64)	0.21 (3.14)	0.15 (3.91)
hotw	0.07 (1.53)	0.15 (4.15)	0.01 (0.22)	0.07 (2.85)
gas	0.15 (2.67)	0.21 (4.73)	0.07 (1.45)	0.15 (4.94)
gasb	0.06 (0.99)	0.07 (1.51)	-0.04 (-0.78)	0.03 (1.13)
heats	0.59 (3.40)	-0.10 (-0.78)	0.05 (0.29)	0.17 (2.04)
heater	0.15 (0.90)	-0.26 (-1.99)	-0.20 (1.24)	-0.11 (-1.18)
1st quarter	-0.75(-16.36)	-0.48(-12.76)	-0.36 (-8.60)	-2.17(-51.53)

Notes: [a]-The dependant variable is in logarithm; t-values are in parentheses
[b]-Town size 1 is 100,000 or more, town size 2 is 20,000- 100,000, and town size 3 is less than 20,000

Table B 1 (Continued)

	1990	1991	1992	Pooled data
2nd quarter	-0.45 (-9.61)	-0.10 (-2.53)	-0.11 (-2.53)	-1.87(-43.84)
3rd quarter	-0.24 (-5.04)	-0.01 (-0.30)	-0.01 (-0.14)	-1.67(-38.32)
4th quarter				-1.42(-32.79)
5th quarter				-1.04(-23.86)
6th quarter				-0.65 (-14.59)
7th quarter				-0.57 (-12.86)
8th quarter				-0.56 (-12.59)
9th quarter				-0.36 (-8.35)
10th quarter				-0.12 (-2.62)
11th quarter				-0.02 (-0.37)
R^2	0.4062	0.4454	0.3477	0.6739
Adj. R^2	0.4007	0.4394	0.3407	0.6722
N	1736	1511	1511	4758

APPENDIX C. ADDITIONAL FIGURES

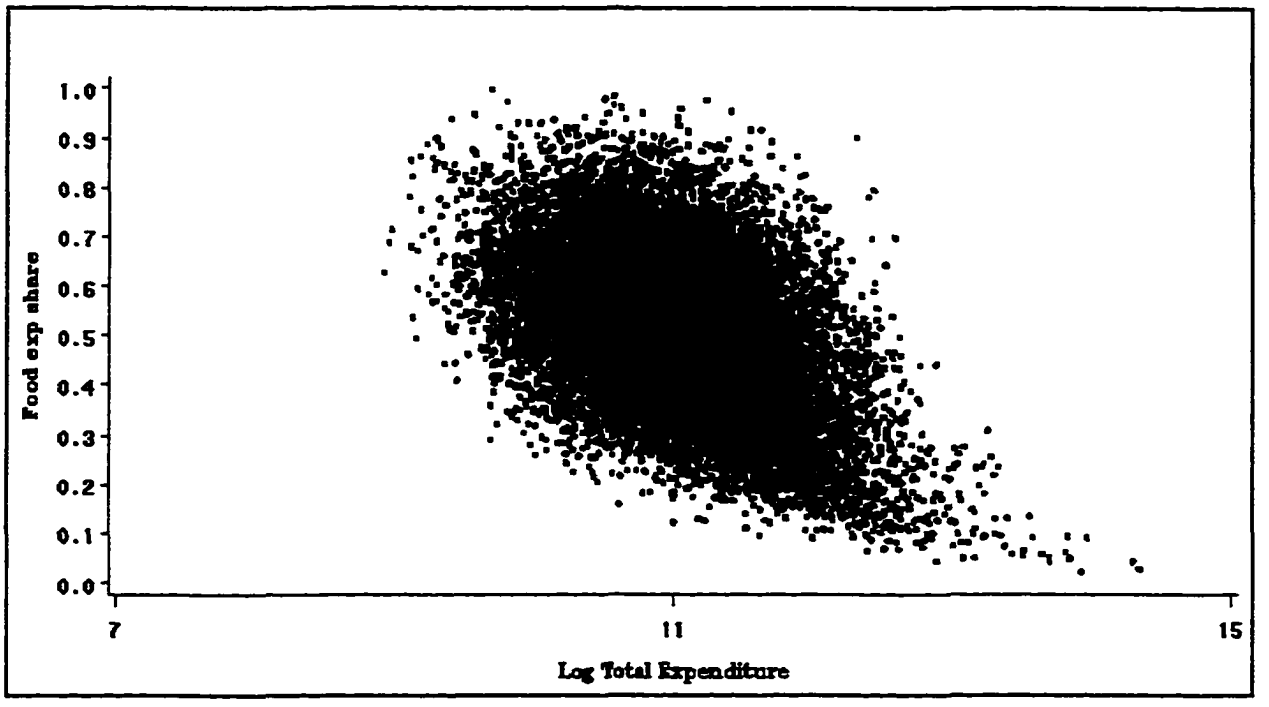


Figure C.1 Engel Curve: Food Share Before the Reforms

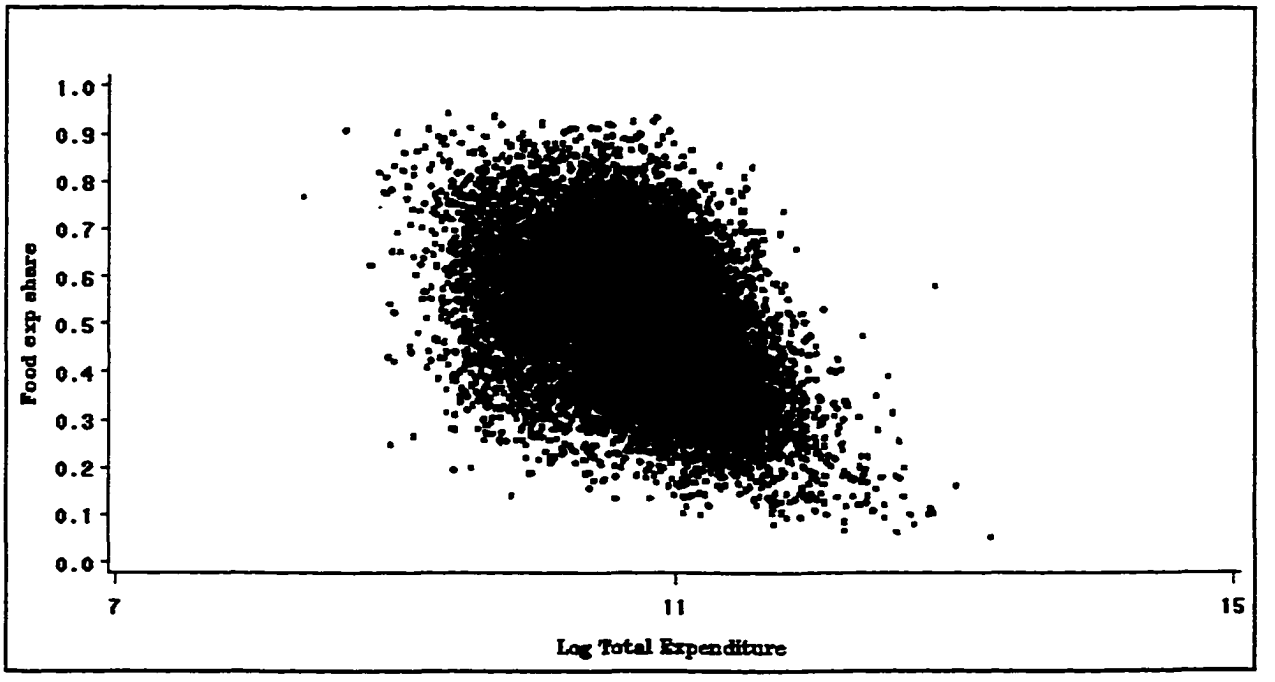


Figure C.2 Engel Curve: Food Share After the Reforms

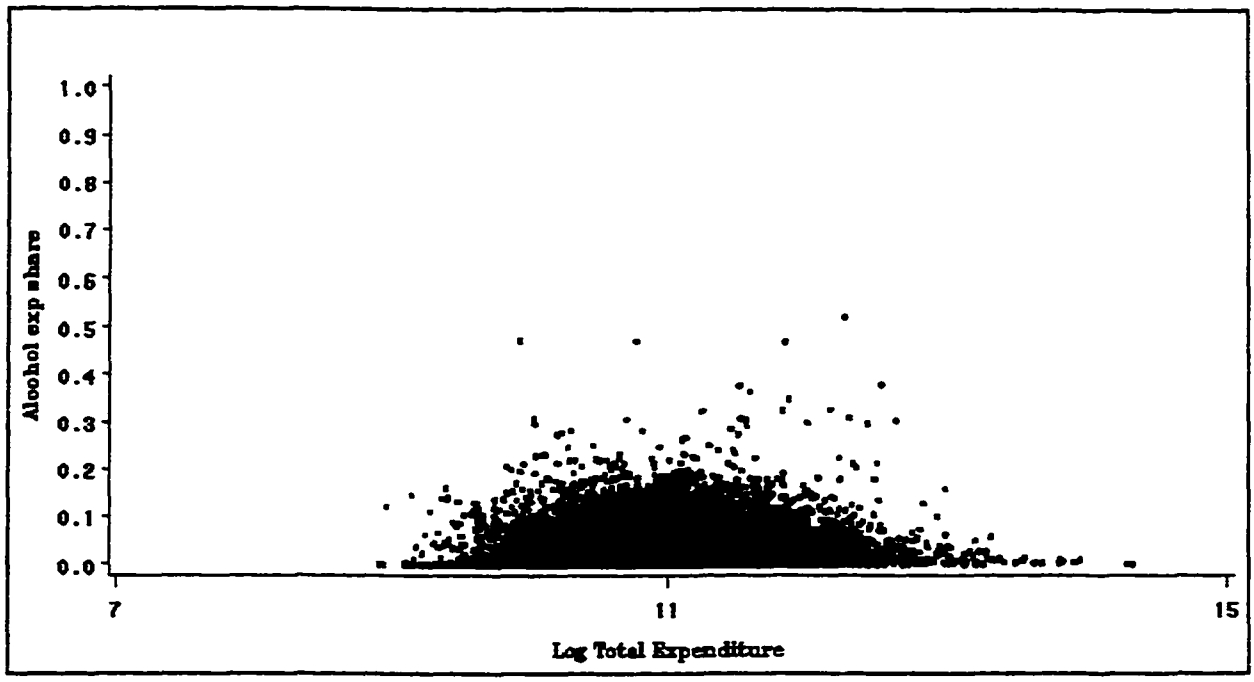


Figure C.3 Engel Curve: Alcohol and Tobacco Share Before the Reforms

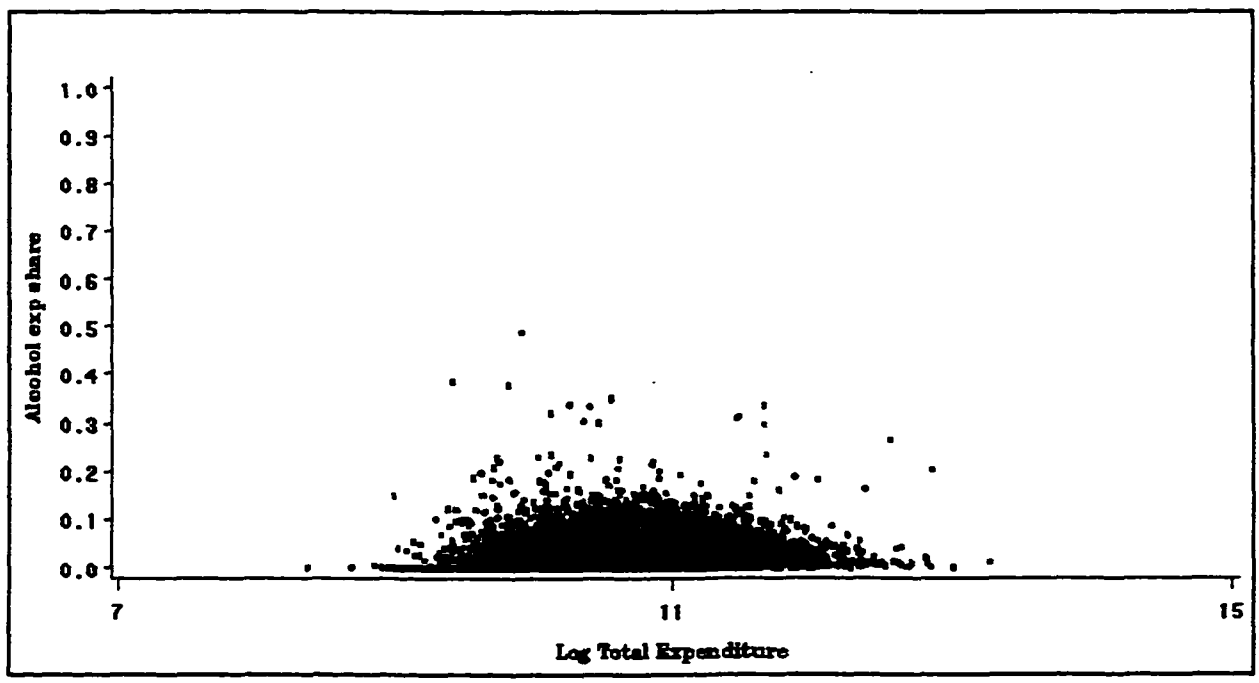


Figure C.4 Engel Curve: Alcohol and Tobacco Share After the Reforms

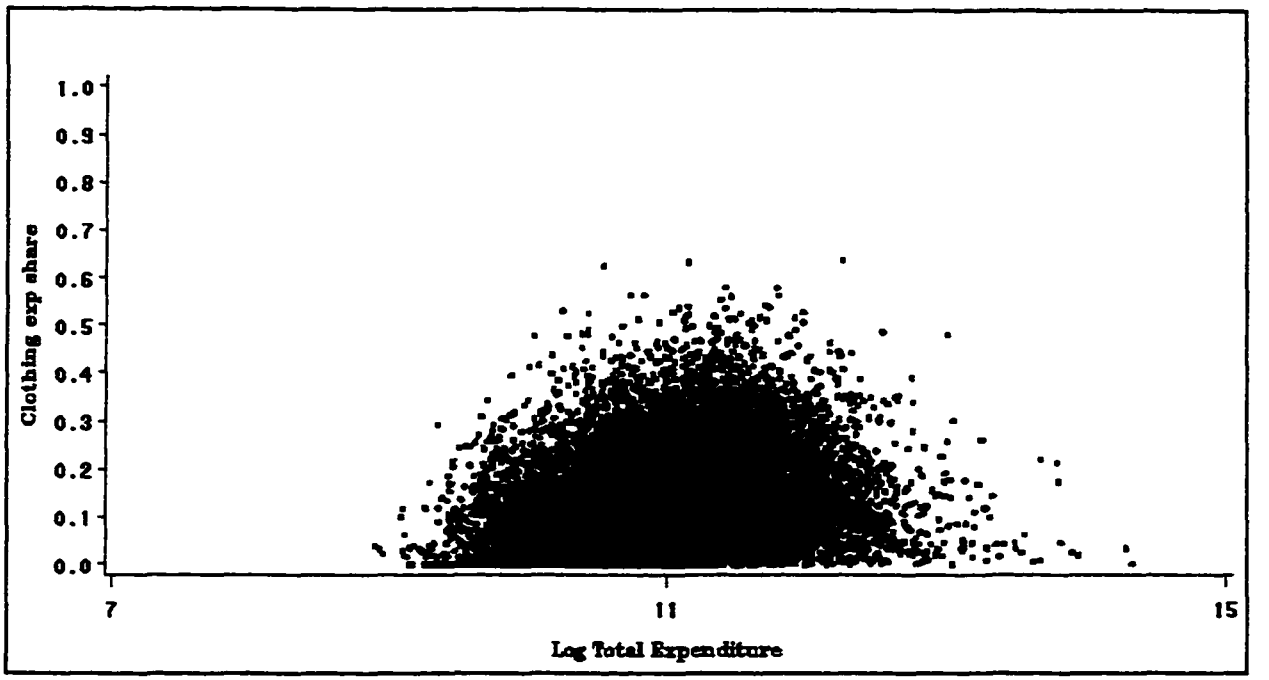


Figure C.5 Engel Curve: Clothing Share Before the Reforms

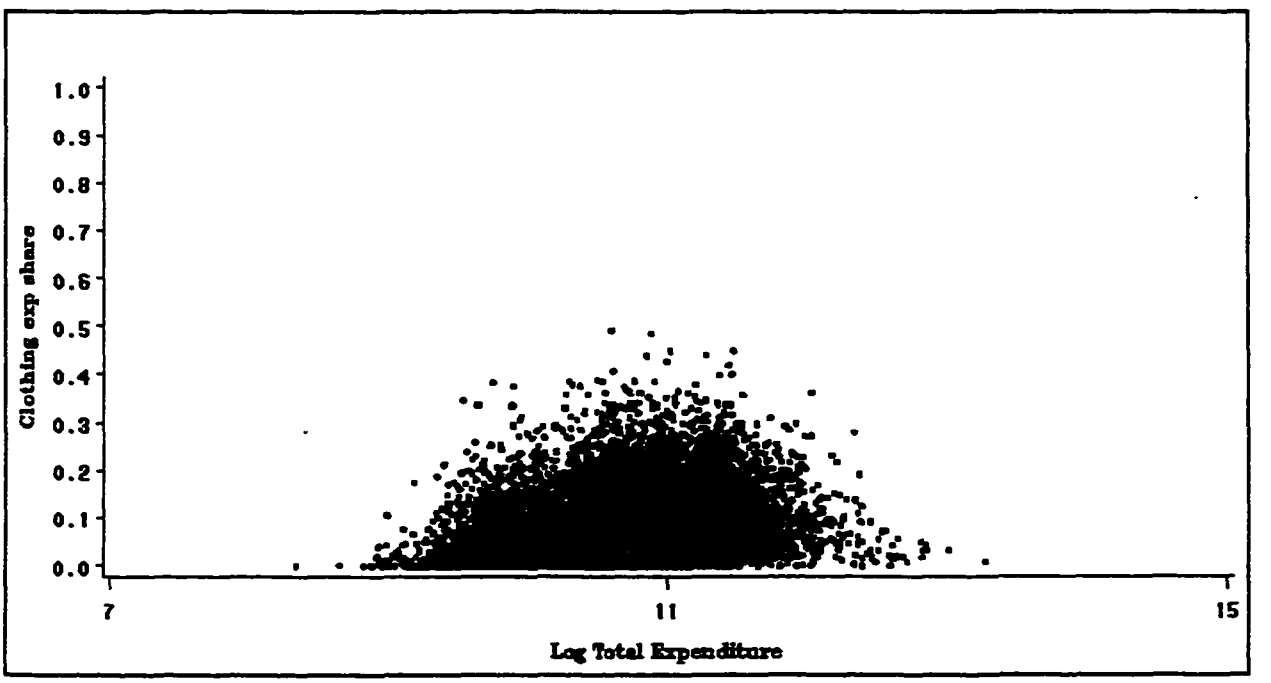


Figure C.6 Engel Curve: Clothing Share After the Reforms

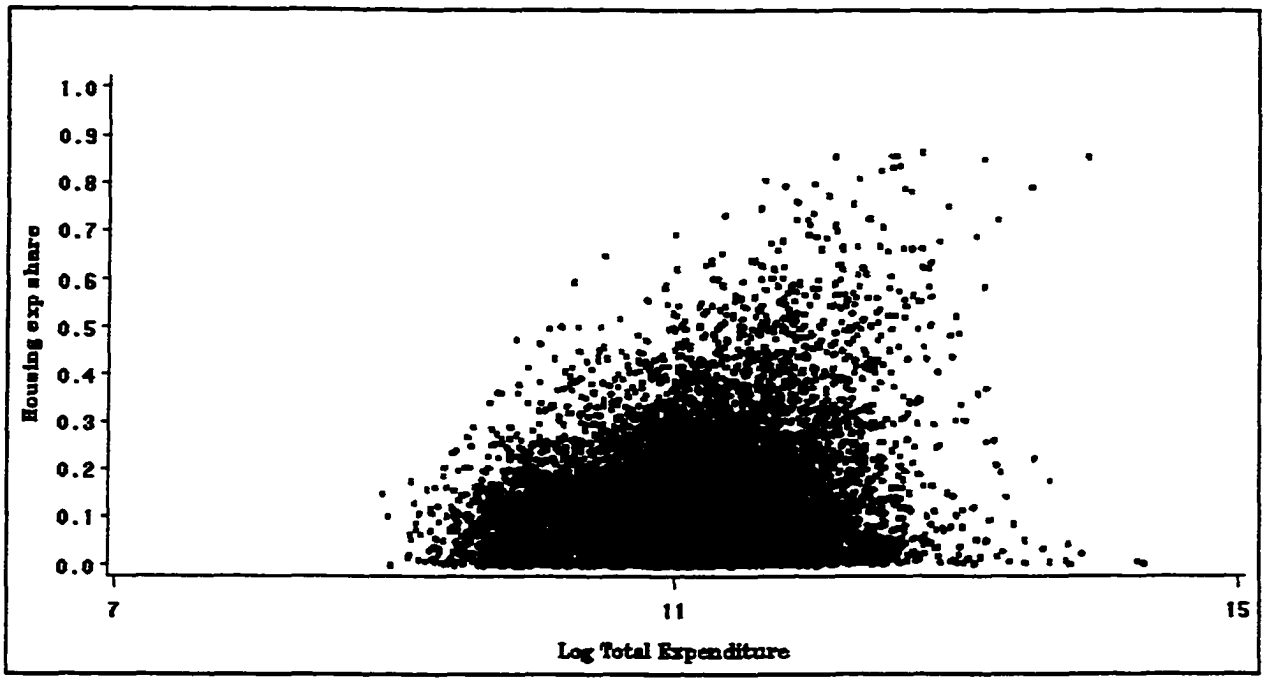


Figure C.7 Engel Curve: Housing Share Before the Reforms

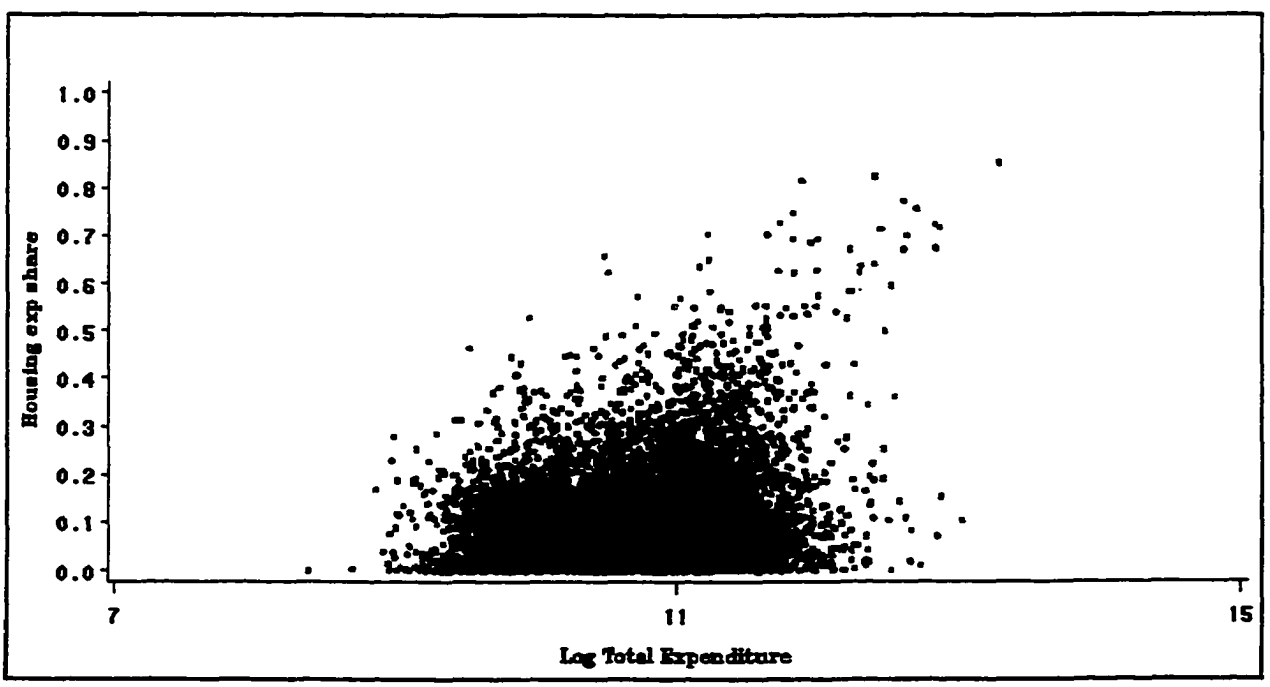


Figure C.8 Engel Curve: Housing Share After the Reforms

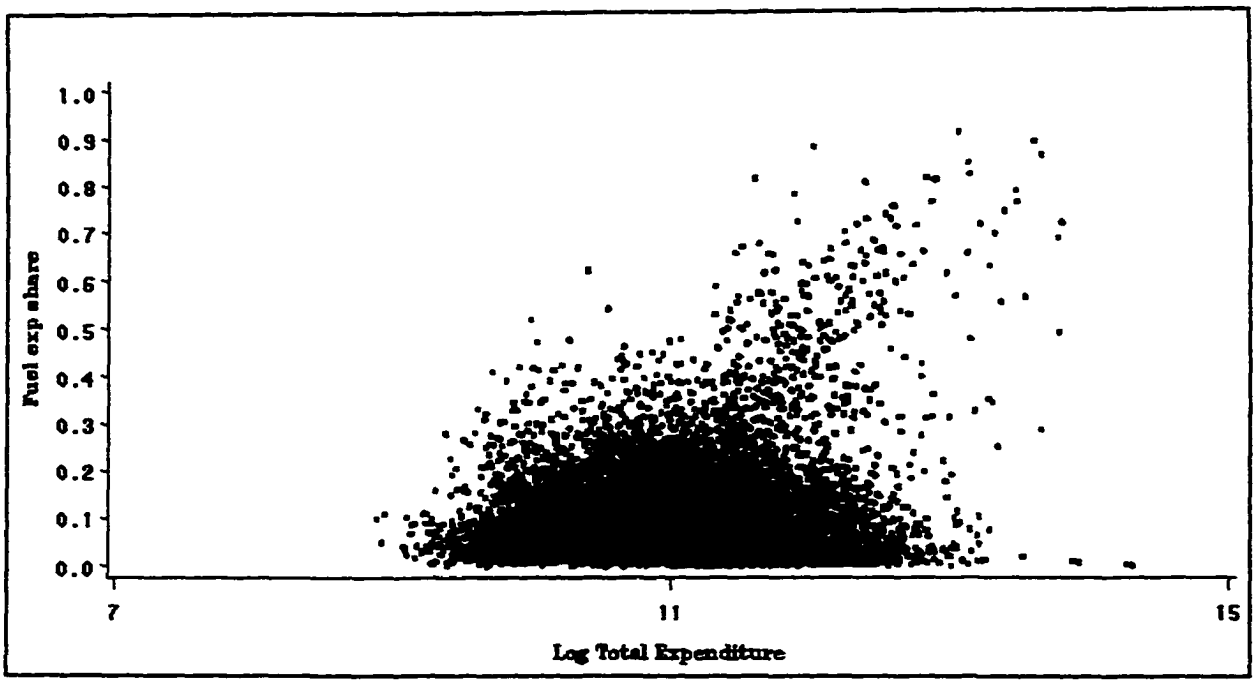


Figure C.9 Engel Curve: Fuel Share Before the Reforms

Figure C.10 Engel Curve: Fuel Share After the Reforms

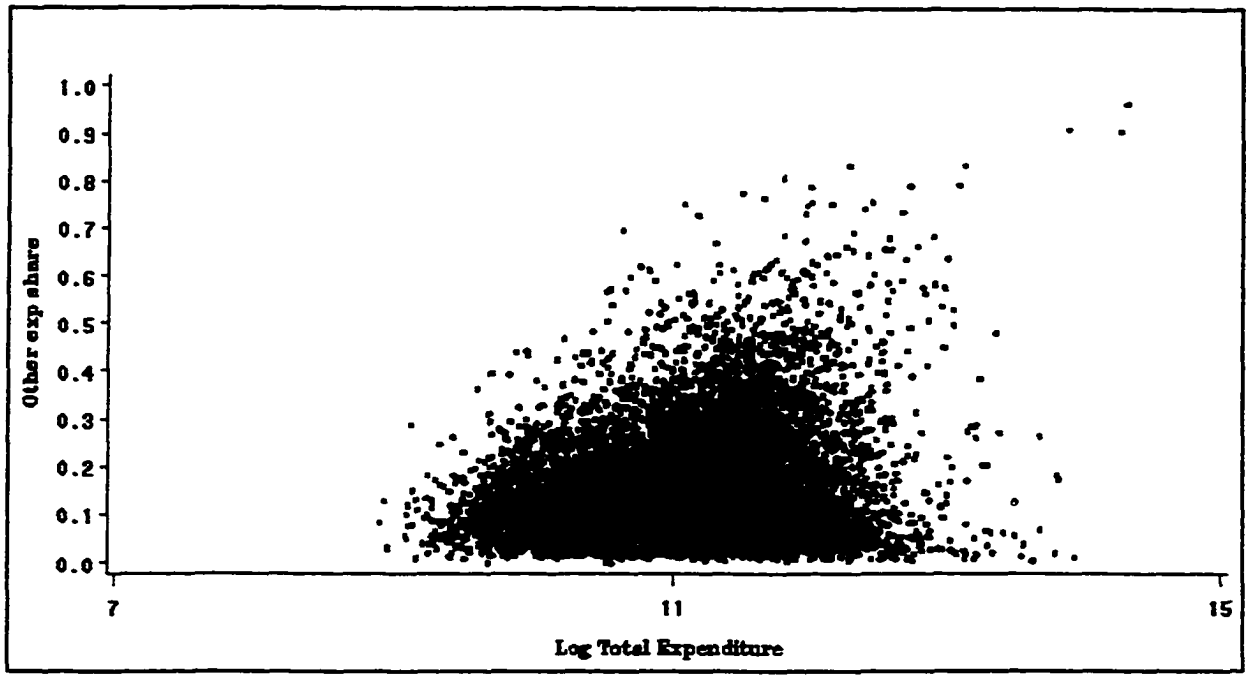


Figure C.11 Engel Curve: Other Goods Share Before the Reforms

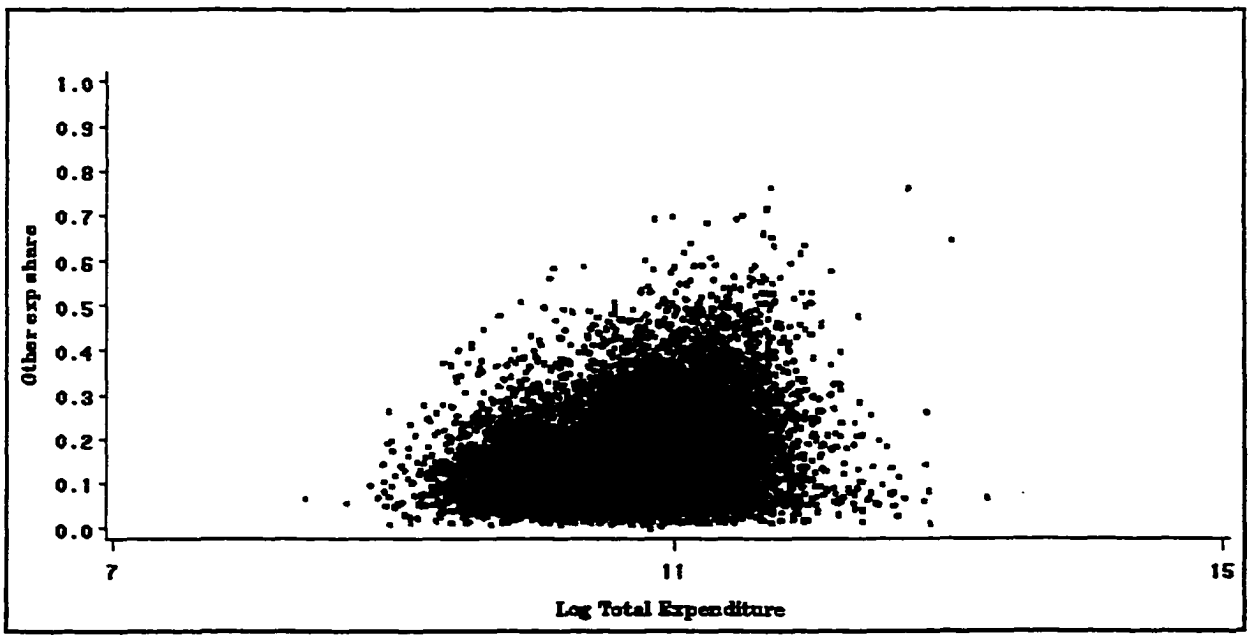


Figure C.12 Engel Curve: Other Goods Share After the Reforms

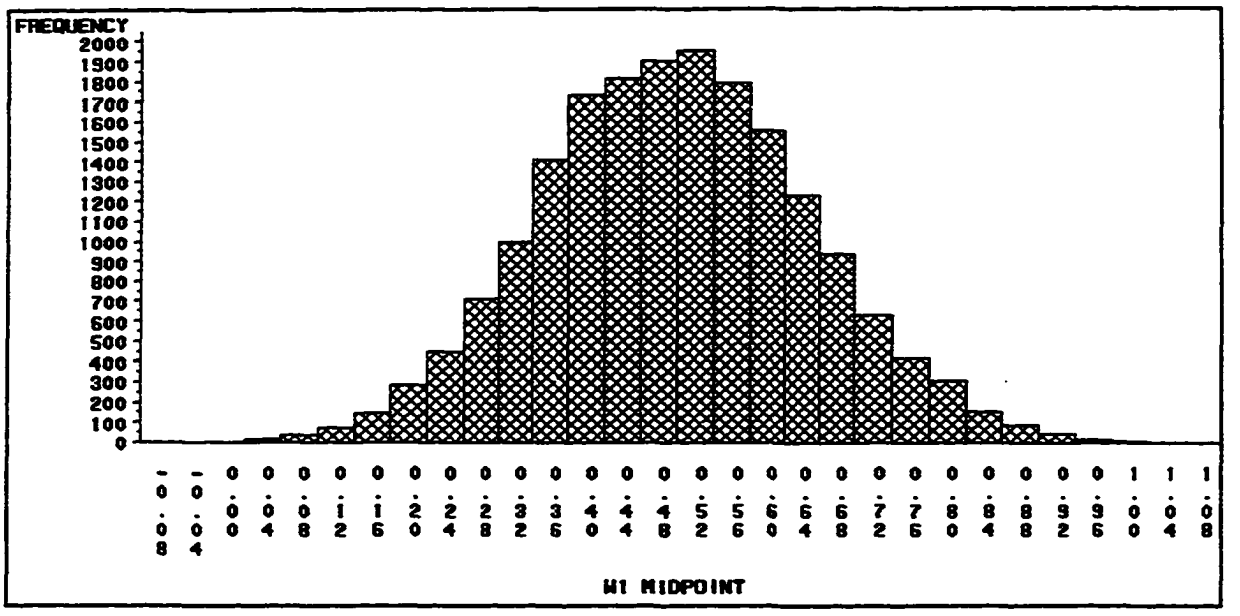


Figure C.13 Distribution of Food Share Before the Reforms

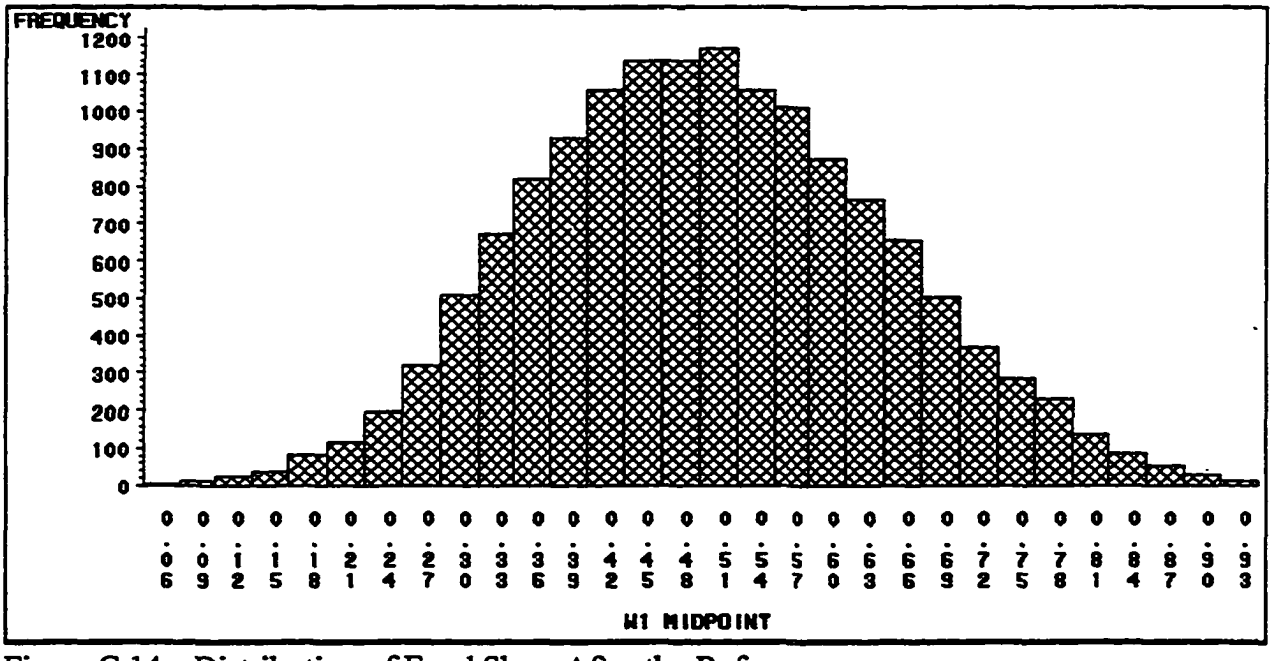


Figure C.14 Distribution of Food Share After the Reforms

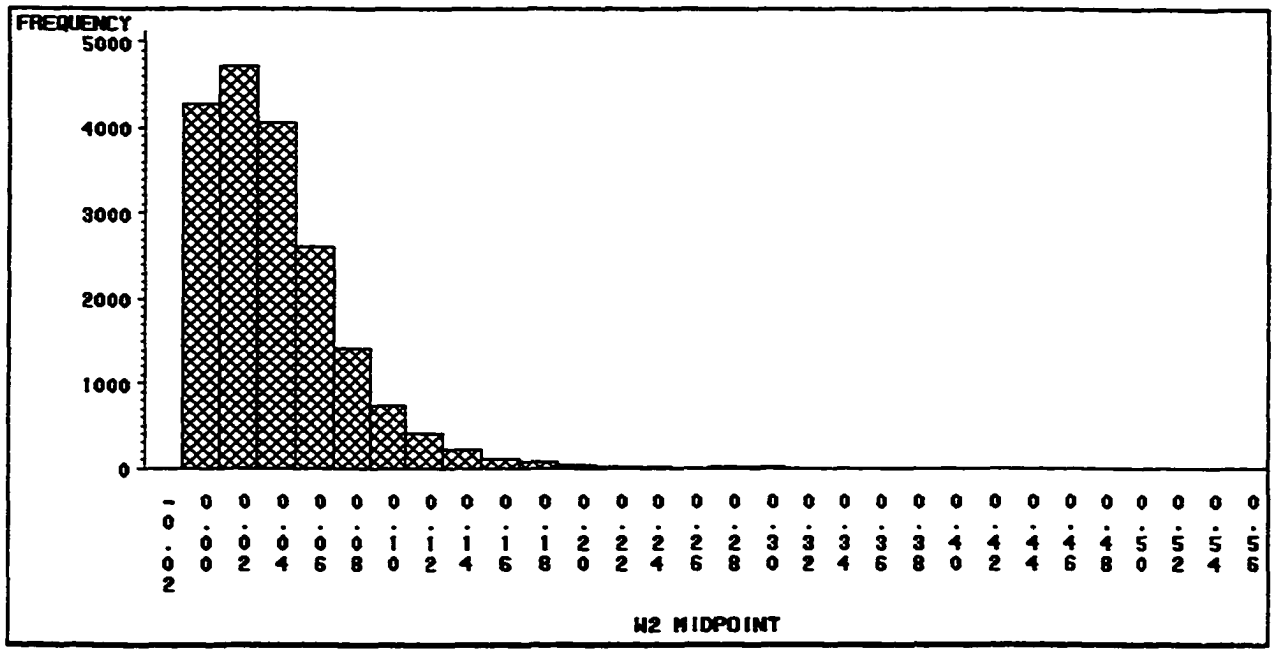


Figure C.15 Distribution of Alcohol and Tobacco Share Before the Reforms

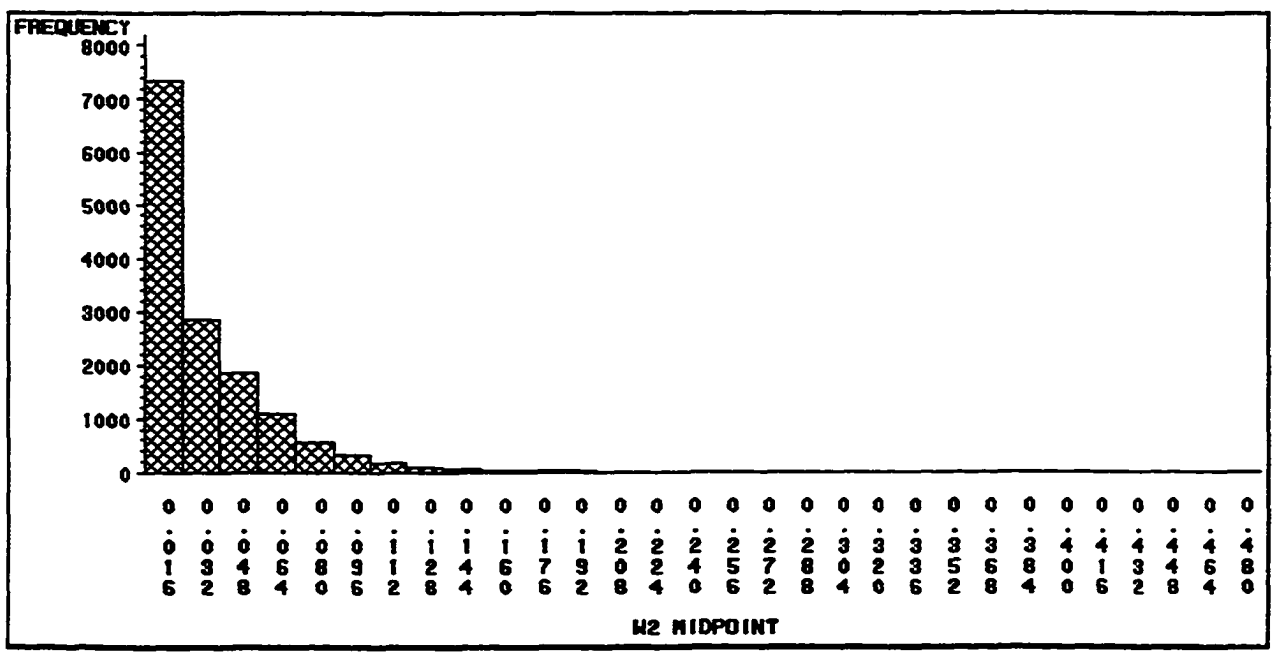


Figure C.16 Distribution of Alcohol and Tobacco Share After the Reforms

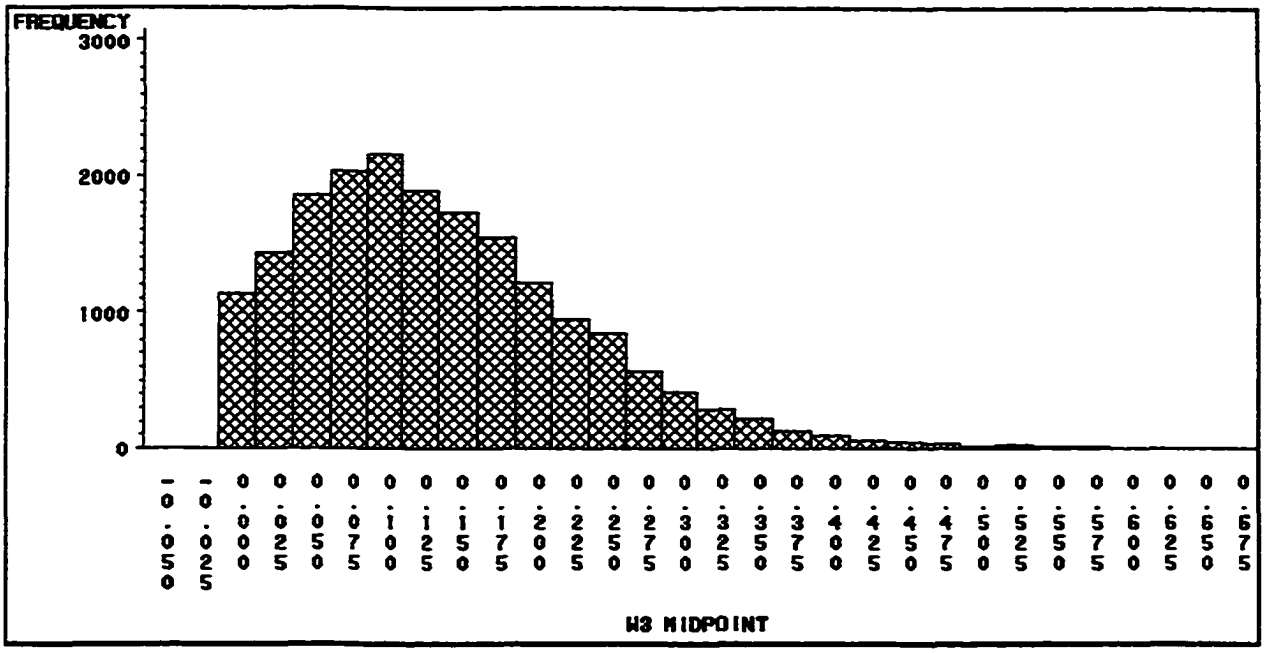


Figure C.17 Distribution of Clothing Share Before the Reforms

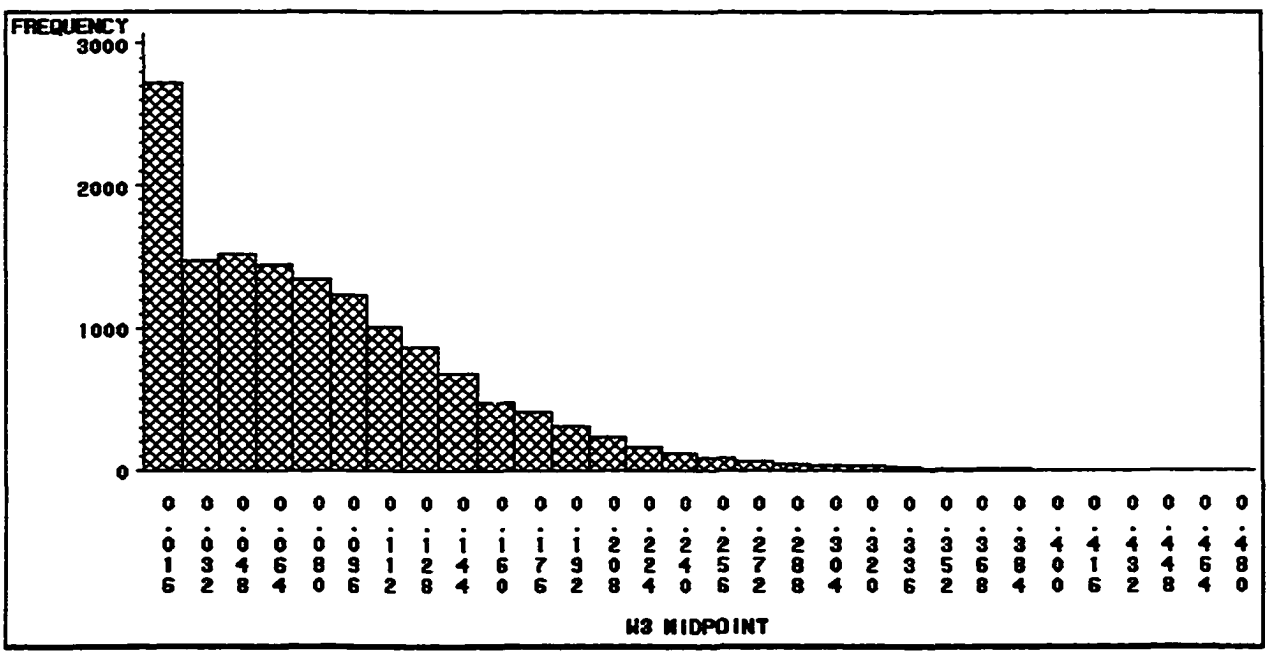


Figure C.18 Distribution of Clothing Share After the Reforms

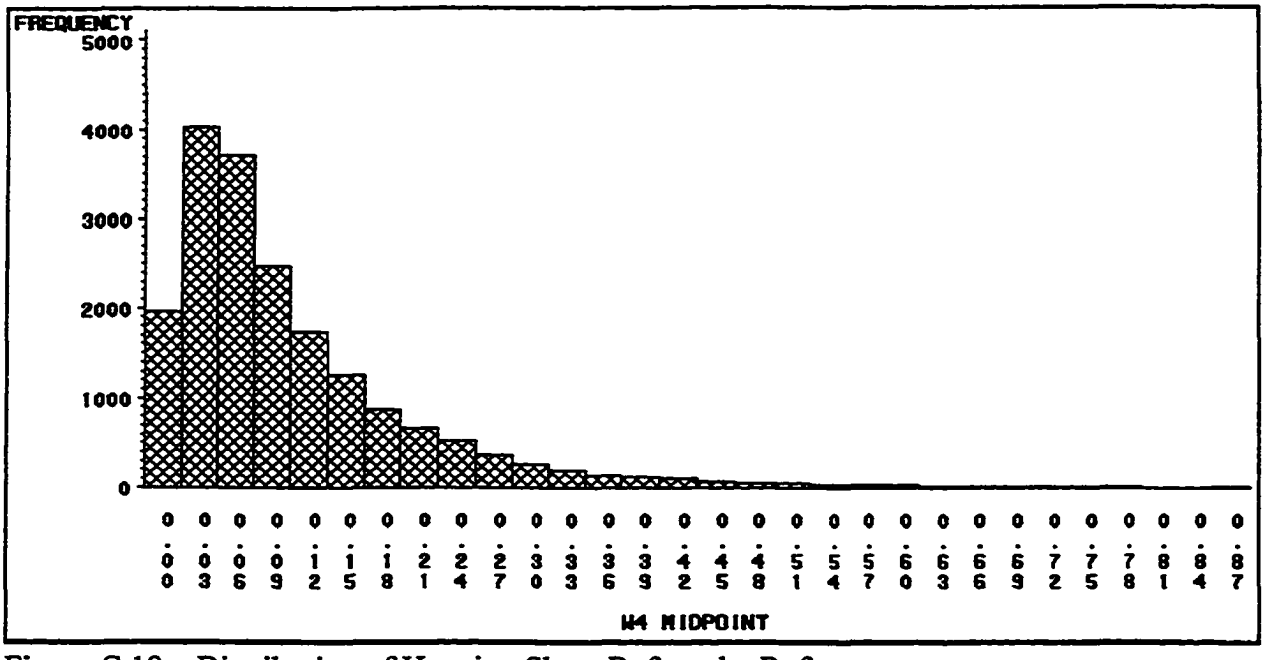


Figure C.19 Distribution of Housing Share Before the Reforms

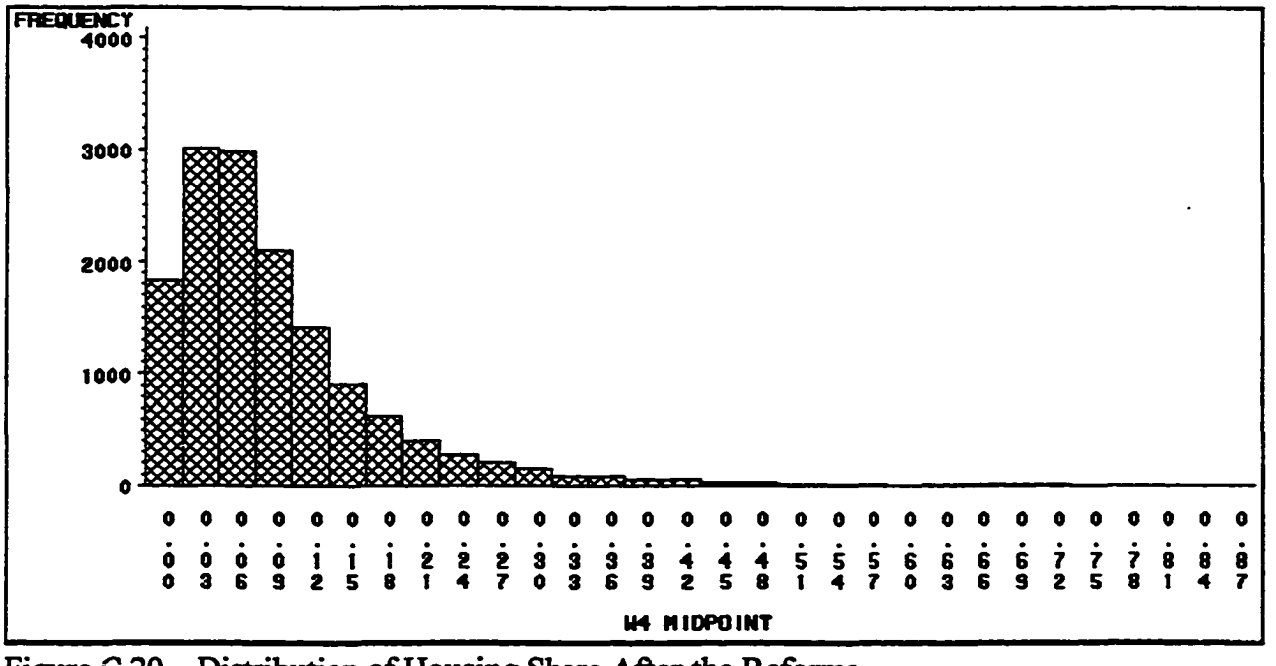


Figure C.20 Distribution of Housing Share After the Reforms

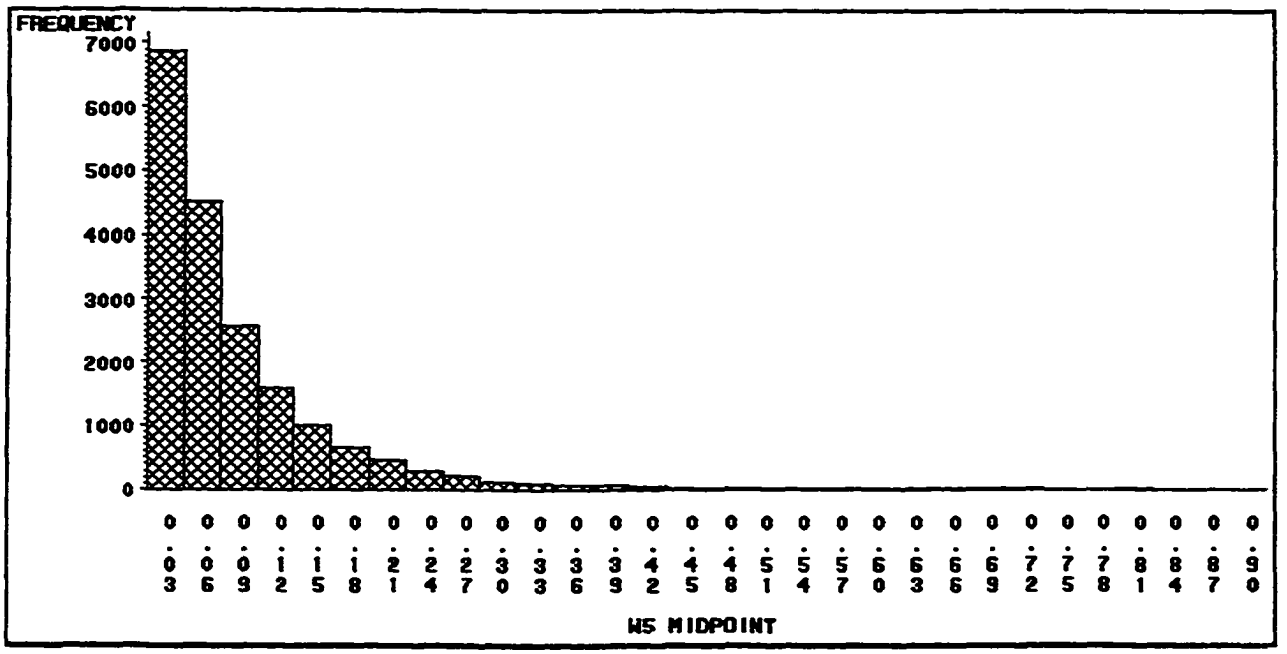


Figure C.21 Distribution of Fuel Share Before the Reforms

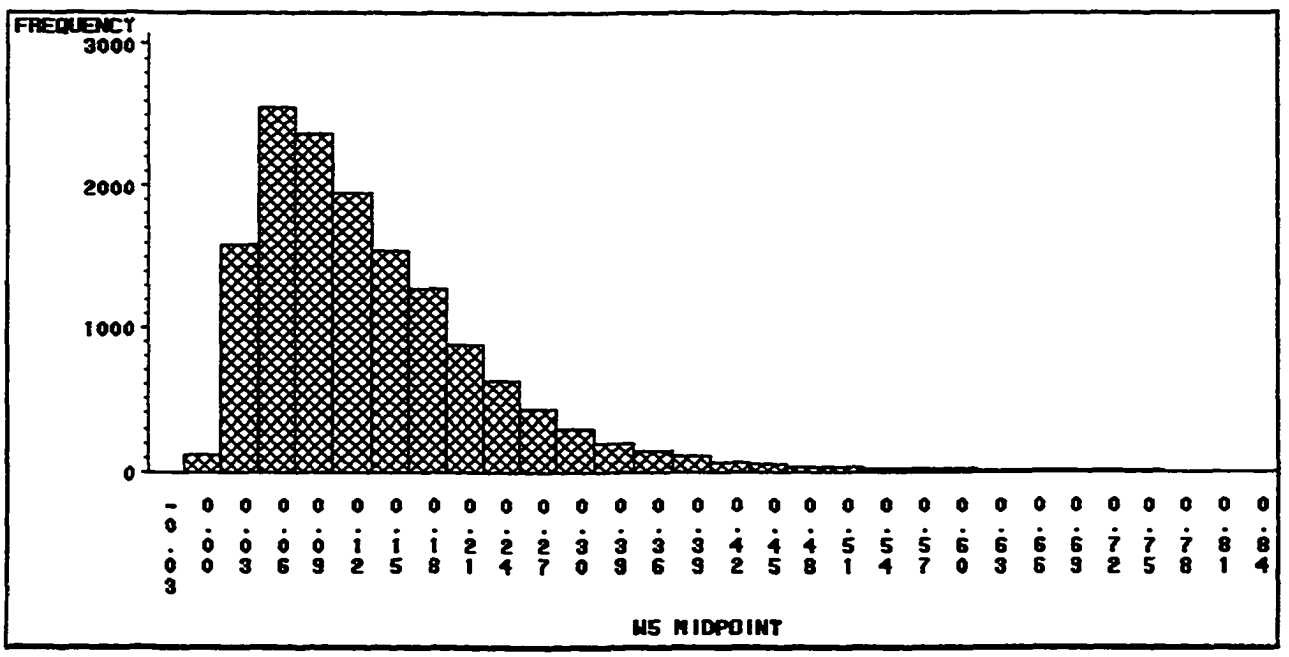


Figure C.22 Distribution of Fuel Share After the Reforms

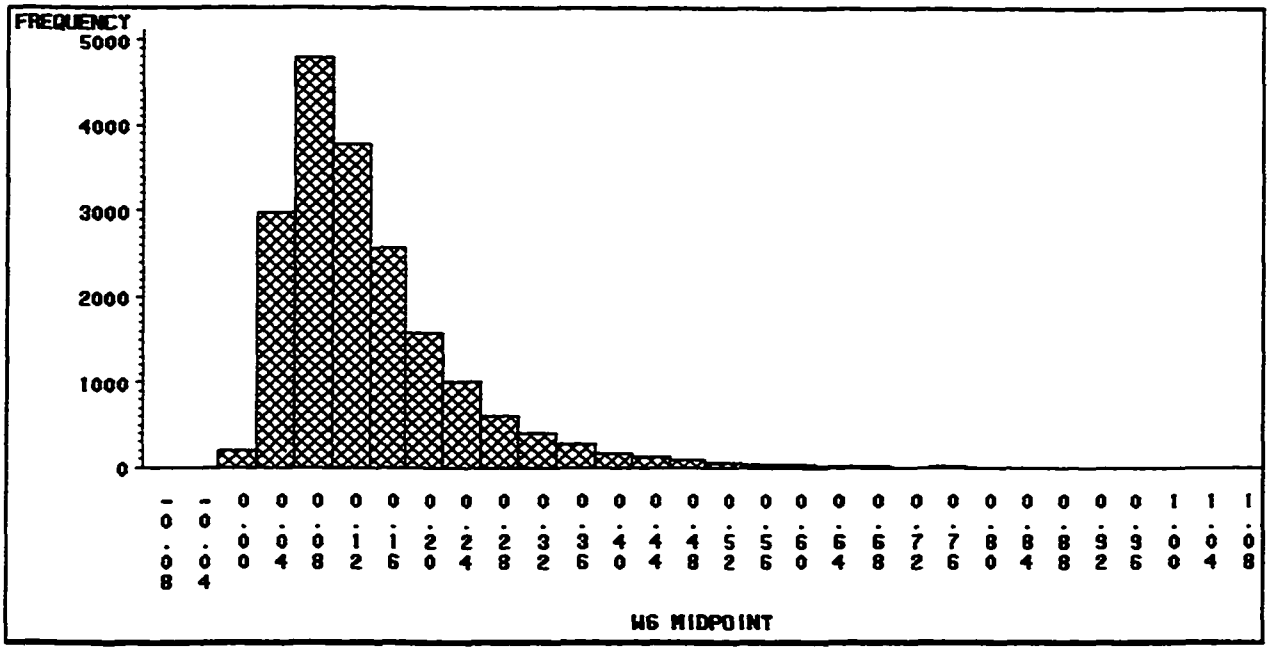


Figure C.23 Distribution of Other Goods Share Before the Reforms

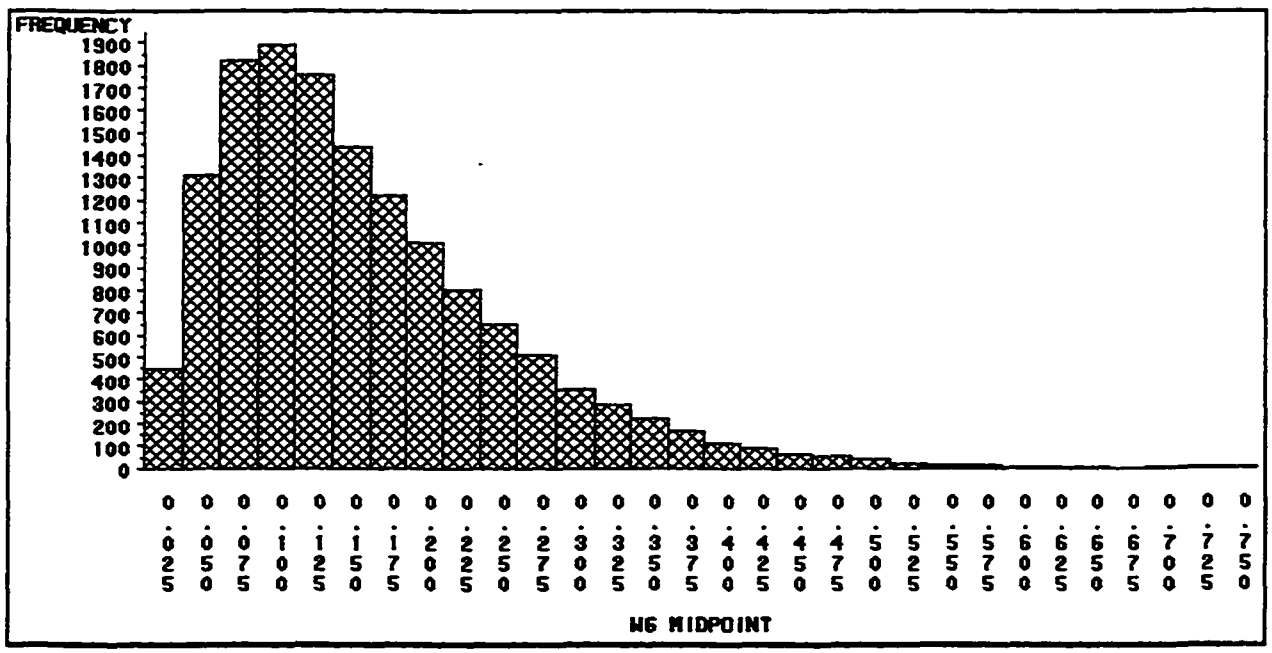


Figure C.24 Distribution of Other Goods Share After the Reforms

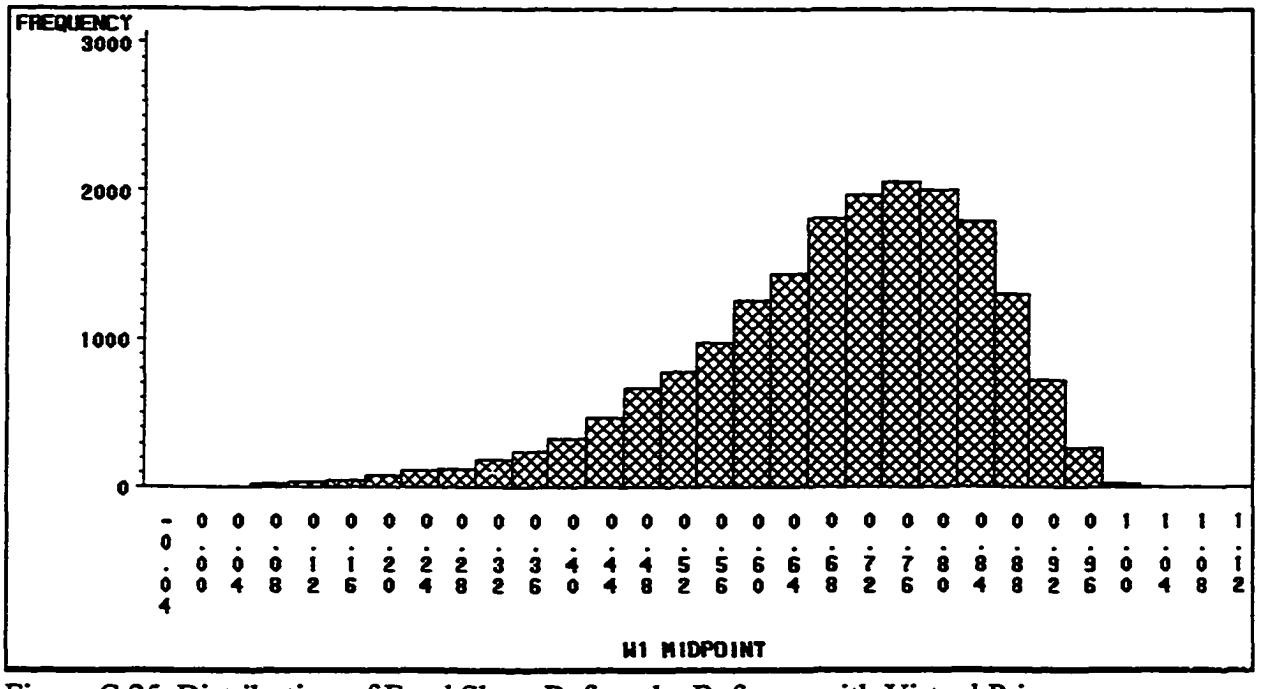


Figure C.25 Distribution of Food Share Before the Reforms with Virtual Prices

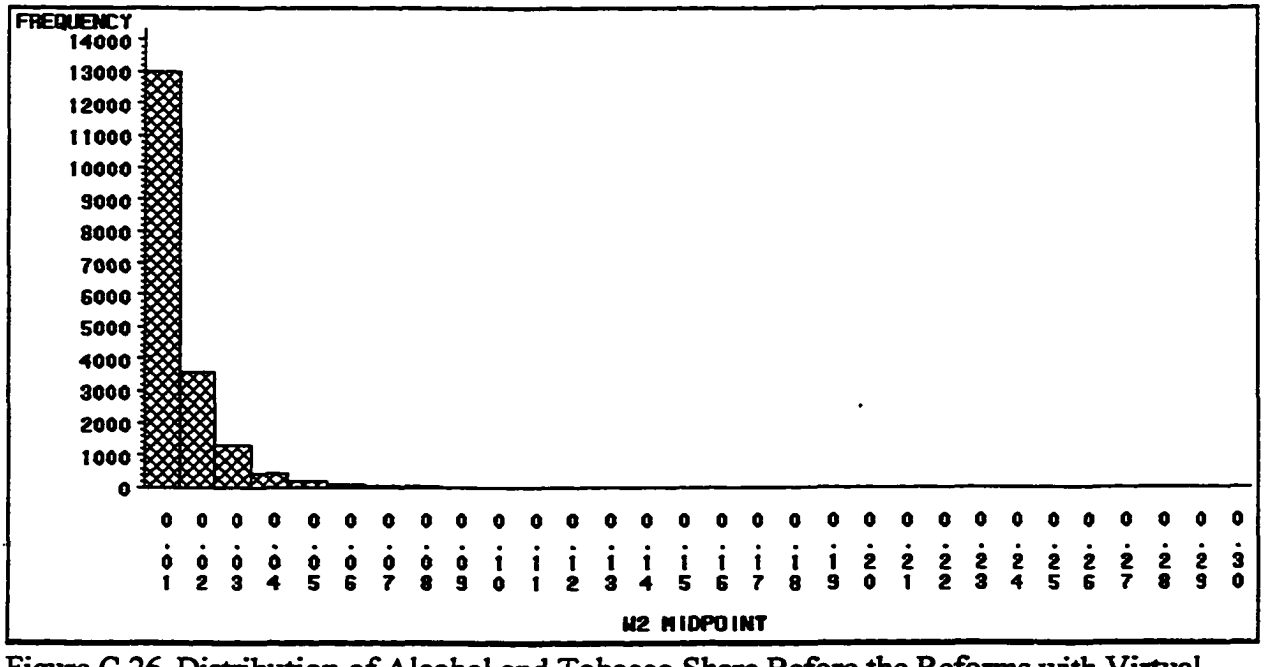


Figure C.26 Distribution of Alcohol and Tobacco Share Before the Reforms with Virtual Prices

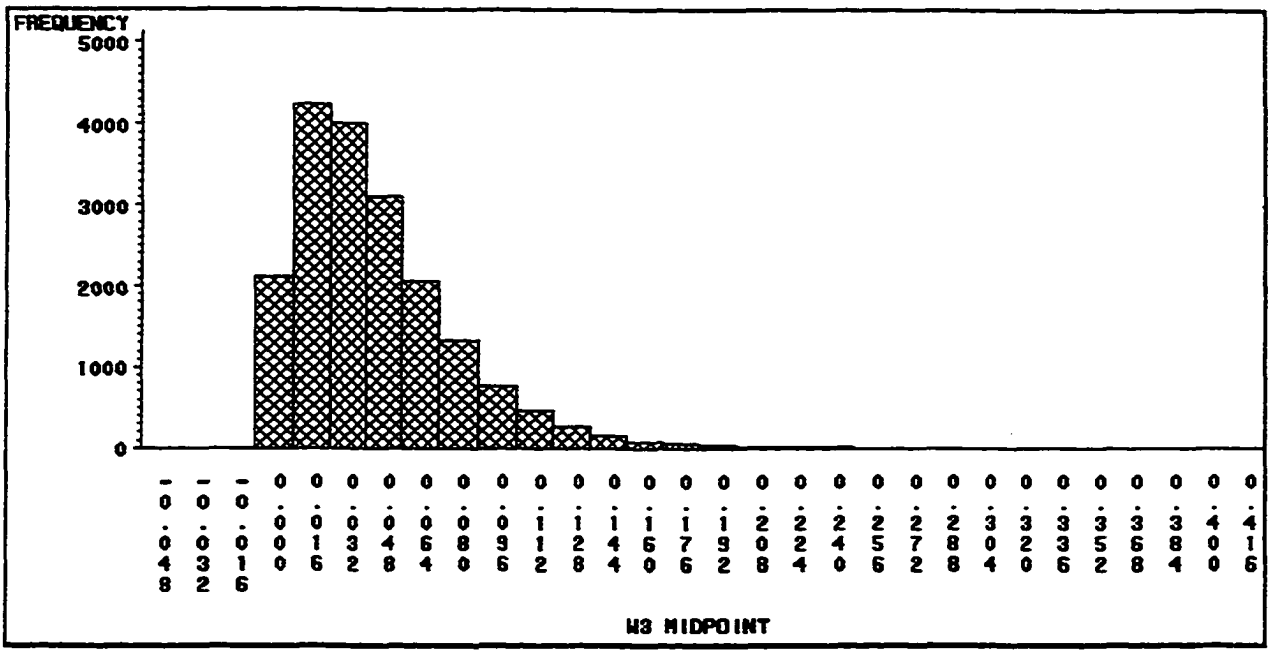


Figure C.27 Distribution of Clothing Share Before the Reforms with Virtual Prices

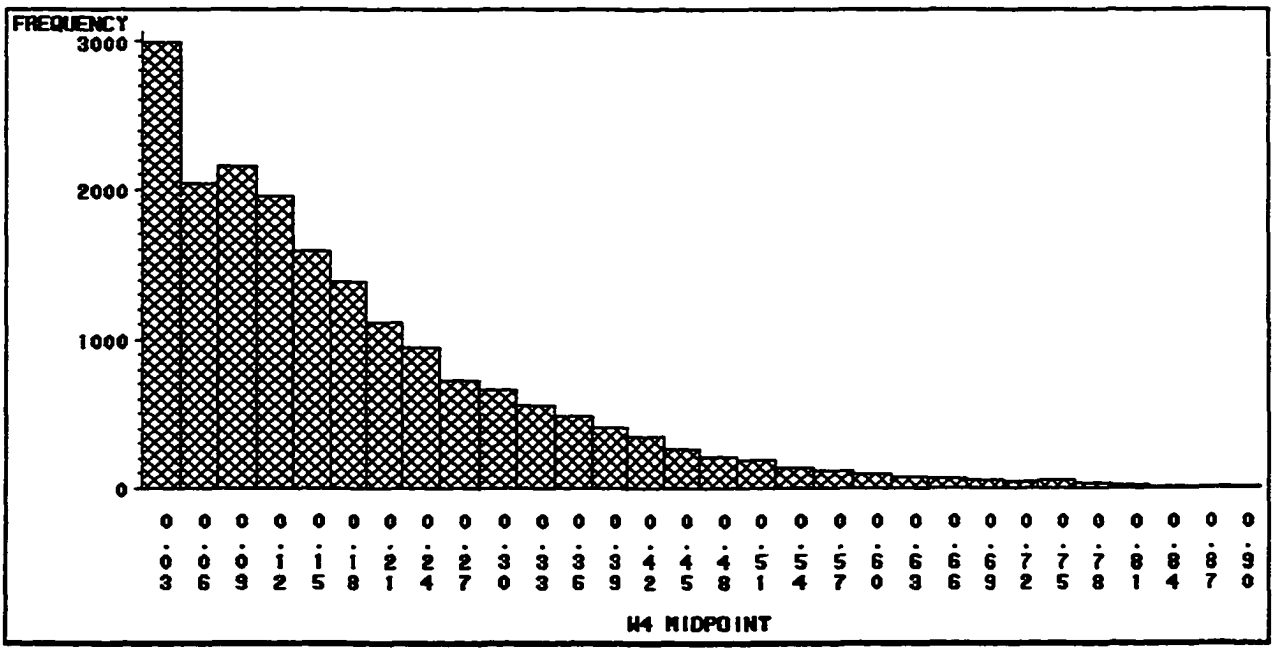


Figure C.28 Distribution of Housing Share Before the Reforms with Virtual Prices

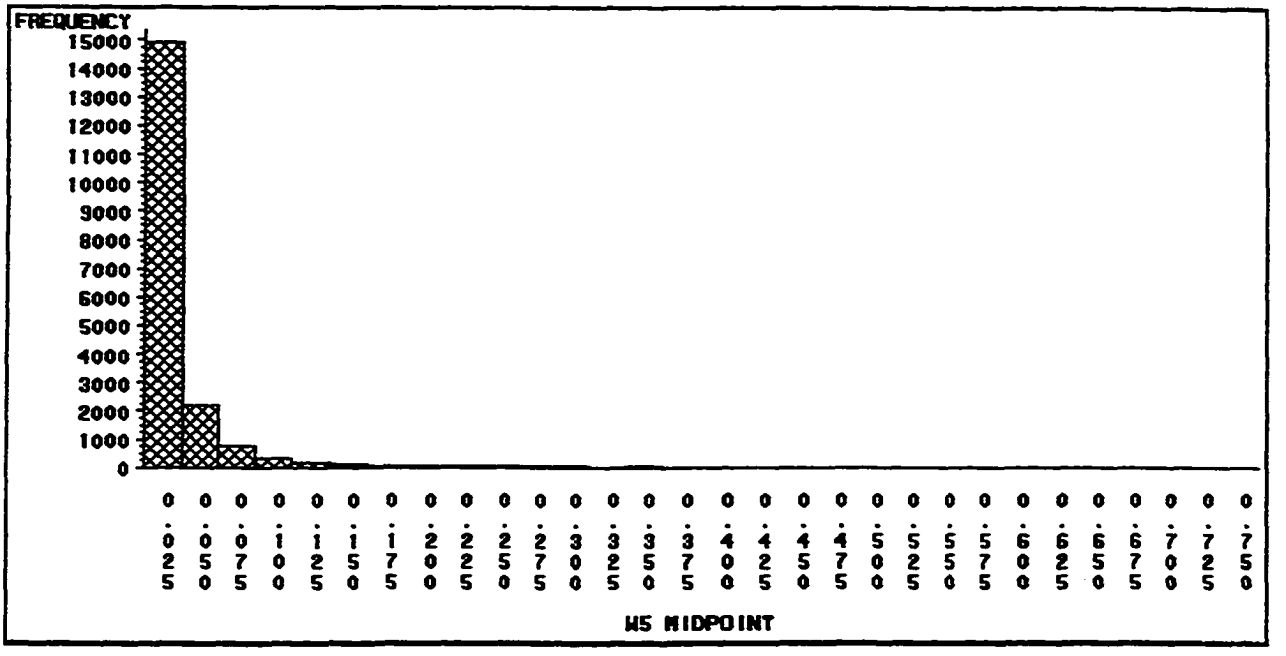


Figure C.29 Distribution of Fuel Share Before the Reforms with Virtual Prices

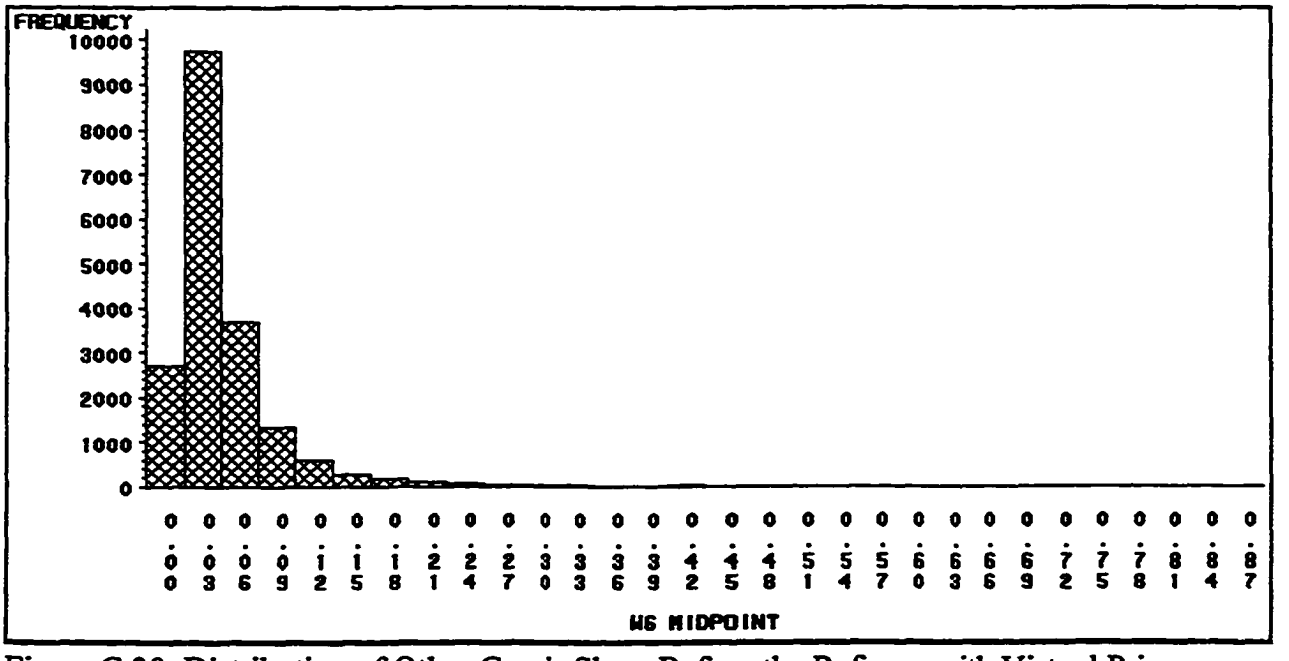


Figure C.30 Distribution of Other Goods Share Before the Reforms with Virtual Prices

REFERENCES

Amemiya, T. (1973) "Regression Analysis When the Dependent Variable is Truncated Normal," *Econometrica* 41, 997-1016.

Amemiya, T. (1974) "Multivariate Regression and Simultaneous Equation Model When the Dependent Variables are Truncated Normal," *Econometrica* 46, 1193-1205.

Atkinson, A., and J. Micklewrigth (1992) *The Economic Transformation in Eastern Europe and the Distribution of Income*, Cambridge: Cambridge University Press.

Bailey, D. (1995) "Luxemburg Income Study Questionnaire on Survey Content and Procedures, 1992 Polish Household Budget Survey," Syracuse University.

Banks, J., R. Blundell, and A. Lewbel (1997) "Quadratic Engel Curves and Consumer Demand," *The Review of Economics and Statistics*, Volume LXXIX, No 4, 527-539.

Barten, A. P. (1969) "Maximum Likelihood Estimates of a Complete System of Demand Equations," *European Economic Review* 1, Fall 1969, 7-73.

Bettendorf, L., and A. Barten (1995) "Rationnement dans les Systemes de Demande: Calcul des Prix Virtuels," *Economie and Prevision* 121, 101-108.

Bettendorf, L., and E. Buyst (1997) "Rent Control and Virtual Prices: A Case Study for Interwar Belgium," *The Journal of Economic History*, vol.57, No.3, 654-673.

Blejer, M., and M. Škreb (1997) *Macroeconomic Stabilization in Transition Economies*, Cambridge: Cambridge University Press.

Blundell, G., and I. Walker (1982) "Modelling the Joint Determination of Household Labor Supplies and Commodity Demands," *Economic Journal* 92, 351-364.

Buckwell, A.E., J. Davis, S. Davidova, and S. Petranov (1993) "Food Consumption During Economic Transition in Bulgaria," Paper presented at VI International Conference of the EAAE, in Stressa, Italy.

Collier, I. (1986) "Effective Purchasing Power in a Constraint Economy: An Estimate for German Democratic Republic," *Review of Economics and Statistics* 68, 1:24-32.

Deaton, A. S.(1981) "Theoretical and Empirical Approaches to Consumer Demand Under Rationing," in A.S.Deaton, ed., *Essays in the Theory and Measurement of Consumer Behavior*, Cambridge: Cambridge University Press, 55-72.

Deaton, A. S.(1988) "Quality, Quantity and Spatial Variation of Price," *American Economic Review 78*, 418-430.

Deaton, A. S. (1996) *Microeconomic Analysis for Development Policy*, Baltimore: John Hopkins University Press.

Deaton, A. S., and J. Muellbauer (1980) *Economics and Consumer Behavior*, Cambridge: Cambridge University Press.

Deaton, A. S., and J. Muellbauer (1980) "An Almost Ideal Demand System," *American Economic Review*, 70, 312-326.

Elster, J. (1991) "Local Justice: How Institutions Allocate Scarce Goods and Necessary Burdens," *European Economic Review*, Vol.35, 273-92.

Euromoney Publications (1998) *The 1998 Guide to Poland*, London.

Euromonitor PLC (1991) *European Marketing Data and Statistics 1991*, London.

Euromonitor PLC (1994) *Consumer Eastern Europe 1994*, London.

Fomby, T., R. C. Hill, and S. R. Johnson (1984) *Advanced Econometric Methods*, New York: Springer-Verlag.

Golebiowski, J. (1994) *Transforming the Polish Economy*, Warsaw: Warsaw School of Economics.

Green, W. H. (1993) *Econometric Analysis*, New York: Macmillan Publishing Company.

Gorecki, B., and M. Peczkowski (1992) "Polish Household Panel," Paper presented at Workshop on Polish Household Panel in Warsaw, Poland, November 1992.

GUS (1994) *Rocznik Statystyczny*, Warsaw: Główny Urząd Statystyczny.

Hanemann, W. M. (1984) "Discrete/Continuous Choice Models of Consumer Demand," *Econometrica* 46, 403-426.

Heckman, J. (1976) "The Common Structure of Statistical Models of Truncated, Sample Selection Bias and Limited Dependent Variables and a Simple Estimator for Such Models," *Annals of Econometric and Social Measurement*, 5, 475-492.

Heckman, J. (1979) "Sample Bias as a Specification Error," *Econometrica*, vol.47, 153-162.

Henderson, J. M., and R. E. Quandt (1980) *Microeconomic Theory: a Mathematical Approach*, New York: McGraw-Hill Book Company.

Johnson, N., and S. Kotz (1972) *Distribution in Statistics: Continuous Multivariate Distributions*, New York: John Wiley & Sons.

Johnson, S. R., Z. Hassan, and R. Green (1984) *Demand Systems Estimation, Methods and Applications*, Ames: Iowa State University Press.

Kubaj, M., and K. Kowalik (1995) "Who is Responsible for Postcommunist Successes in Eastern Europe?," *Transition* vol.6, No. 7-8, 7-8.

Lee, L. (1993) "Multivariate Tobit Models in Econometrics," in Maddala, G.S., C.R. Rao and H.D. Vinod, eds., *Handbook of Statistics*, New York: Elsevier, Vol.11, 145-173.

Lee, L.-F., and M. M. Pitt (1986a) "Microeconomic Demand Systems with Binding Non-negativity Constraints: the Dual Approach," *Econometrica* 54, 1237-1242.

Lee, L.-F., and M. M. Pitt (1986b) "Specification and Estimation of Consumer Demand Systems with Many Binding Non-negativity Constraints," Discussion Paper, Center for Economic Research, University of Minnesota.

Lee, L.-F., and M. M. Pitt (1987) "Microeconomic Models of Rationing, Imperfect Markets, and Non-negativity Constraints," *Journal of Econometrics* 36, 89-110.

Leven, B. (1997) "Distributional Effects of Poland's Transition, The Status of Pensioners," Paper presented at AEA Meetings in New Orleans, January 1997.

Milanovic, B. (1996) "Income, Inequality and Poverty During the Transition," Research Paper Series, Paper Number 11, March 1996.

Nawata, K., and N. Nagase (1996) "Estimation of Sample Selection Bias Models," *Econometric Reviews*, 15(4), 387-400.

Neary, J. P., and K. W. S. Roberts (1980) "The Theory of Household Behavior Under Rationing," *European Economic Review* 13, 25-42.

Newey, W., J. Powell, and J. Walker (1990) "Semiparametric Estimation of Selection Models: Some Empirical Evidence," *The American Economic Review*, vol.80, No. 2, 324-328.

OECD (1992) *Short-Term Economic Statistics, Central and Eastern Europe*, Paris: Organization for Economic Cooperation and Development.

OECD (1995) *Review of Agricultural Policies: Poland*, Paris: Organization for Economic Cooperation and Development.

OECD (1995) *Short-Term Economic Indicators, Transition Economies: Sources and Definitions*, Center for Co-operation with the Economies in Transition, Paris: Organization for Economic Cooperation and Development.

Okrasa, W. (1994) "The Poor Before and During the Transition: A Panel Study of Temporal Aspects of Poverty in Poland, 1987-92," Mimeo, The World Bank, Washington, DC.

Pan, S., and S. R. Johnson (1992) "Chinese Urban Consumption Behavior Under the Current Mixed System of Planning and Markets," Working Paper, Center for Agricultural and Rural Development, Iowa State University.

Podkaminer, L. (1982) "Estimates of Disequilibrium in Poland's Consumer Markets: 1965 - 1978," *Review of Economics and Statistics* 64, *3*:423-431.

Podkaminer, L. (1986) "Persistent Disequilibrium in Poland's Consumer Markets: Some Hypothetical Explanations," *Journal of Comparative Economics* 28, *3*: 1-16.

Podkaminer, L. (1988) "Disequilibrium in Poland's Consumer Markets: Further Evidence on Intermarket Spillovers," *Journal of Comparative Economics* 30, 4: 43-60.

Podkaminer, L. (1989) "Macroeconomic Disequilibria in Centrally Planned Economies: Identifiability of Econometric Models Based on the Theory of Household Behavior Under Quantity Constraints," *Journal of Comparative Economics* 31, 1: 61-84.

Prais, S. J., and H. S. Houthakker (1955) *The Analysis of Family Budgets*, Cambridge: Cambridge University Press.

Pudney, S. (1989) *Modeling Individual Choice-The Econometrics of Corners, Kinks and Holes*, Cambridge: MA, Blackwell.

Ransom, M. R. (1987) "A Comment on Consumer Demand Systems with Binding Non-negativity Constraints," *Journal of Econometrics* 34, 355-360.

Riaz, K. (1994) "Food Consumption Patterns in Rural Pakistan," Ph.D. Thesis, Iowa State University.

SAS Institute (1989) *SAS Language and Procedures: Usage*, Version 6, Cary, NC.

SAS Institute (1993) *SAS/ETS Software: Applications Guide 2*, Version 6, Cary, NC.

Shen, R. (1992) *The Polish Economy: Legacies from the Past, Prospects for the Future*, Praeger.

Srinivasan, T. C. (1989) "Corner Solution Approaches to Modeling Choice," Ph.D. Thesis, Department of Management, Vanderbilt University.

Srinivasan, T. C. and R. S. Winer (1994) "Using Neoclassical Consumer Choice Theory to Produce a Market Map from Purchase Data," *Journal of Business and Economic Statistics*, vol.12, No.1.

Statistisches Bundesamt (1992) *Statistisches Jahrbuch 1992 fur die Bundesrepublik Deutschland*, Wiesbaden.

Statistisches Bundesamt (1991) *Statistisches Jahrbuch 1991 fur die Bundesrepublik Deutschland*, Wiesbaden.

Strong, A. L., T. A. Reiner, and J. Szyrmer (1996) *Transitions in Land and Housing: Bulgaria, The Czech Republic, and Poland*, New York: St. Martin's Press.

Tobin, J., and H. S. Houthakker (1951) "The effects of Rationing on Demand Elasticities," *Review of Economic Studies* 18, 140-153.

Struyk, R. J. (1996) *Economic Restructuring of the Former Soviet Bloc, The case of Housing*, Washington, D.C.: The Urban Institute Press.

Wales, T. J., and A. D. Woodland (1983) "Estimation of Consumer Demand Systems with Binding Non-Negativity Constraints," *Journal of Econometrics*, 21, 263-285.

Wang, Z., and W. S. Chern (1992) "Effects of Rationing on the Consumption Behavior of Chinese Households during 1981-1987," *Journal of Comparative Economics*, 16, 1-26.

Warsaw School of Economics (1996) *Poland, International Economic Report/World Economy Research Institute*, Warsaw.

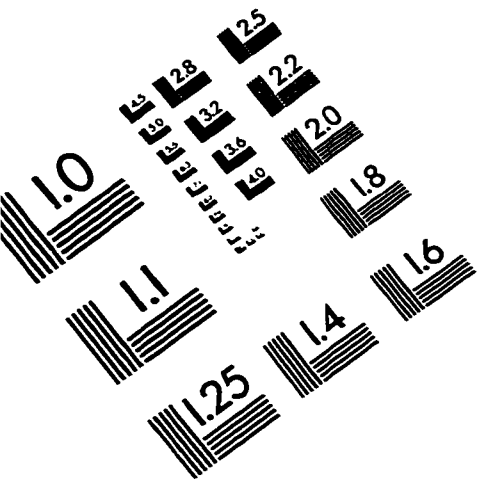
World Bank (1987) "Poland: Reform, Adjustment and Growth," Volume 1 Main Report: The Economic System, Washington, D.C.

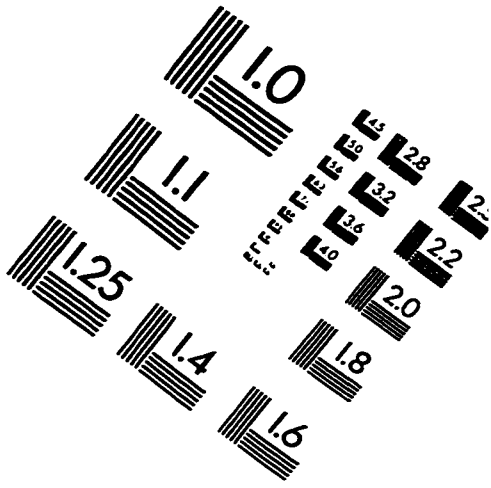
World Bank (1989) "Poland: Subsidies and Income Distribution," Report No. 7776-POL, Washington, DC.

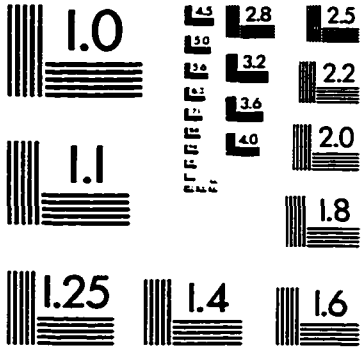
World Bank (1995) "Understanding Poverty in Poland," A World Bank Country Study, The World Bank, Washington, D.C.

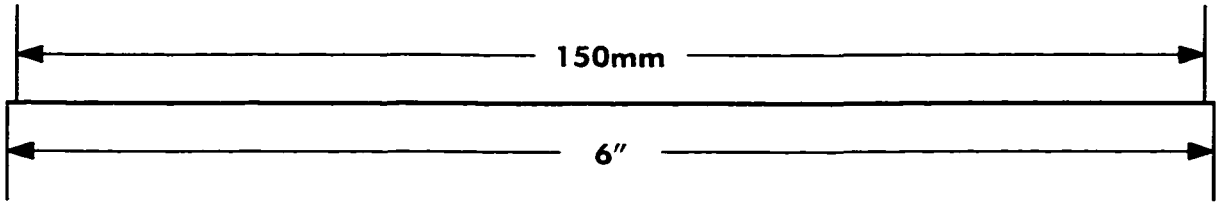
Wozniak, P. (1998) "Relative Prices and Inflation in Poland, 1989-97," Policy Research Working Paper 1879, The World Bank, Washington, D.C.

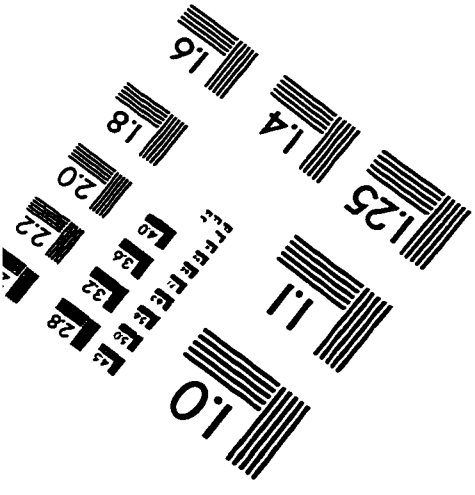
IMAGE EVALUATION
TEST TARGET (QA-3)

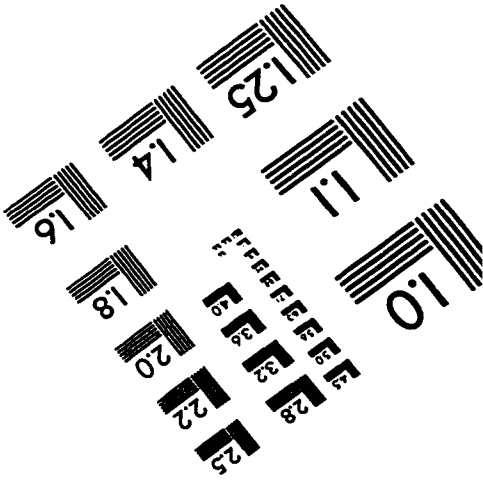












APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989