More Impacts of Economic Reform in Poland: Welfare Changes within a Consistent Framework

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Working Paper 01-WP 271
March 2001

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Abstract

The costs of shortages and rationing are not captured by standard consumer price indices. In this study, virtual prices for the rationed goods are used to calculate a new cost-of-living index (CLI). The results for Poland show that from 1987 to 1992 the CLI that ignores the rationing effects is biased upward from 3.6 to 6.99 percentage points per year. Compared to the welfare loss calculated by neglecting the rationing effects in the prereform period, the welfare loss that reflects the rationing is only 25 percent as large using external virtual prices, and only 15 percent as large using Hausman virtual prices.

MORE IMPACTS OF ECONOMIC REFORM IN POLAND: WELFARE CHANGES WITHIN A CONSISTENT FRAMEWORK

Introduction

Many Central and Eastern European (CEE) nations (Poland, for example) transitioned from centrally planned to market economies during the early 1990s. Murphy, Shleifer, and Vishny and Boycko have provided analysis of the reform process for these planned economies that highlights problems of policy uncertainty, timing, partial government ownership, and other factors that led to the associated economic decline. In an empirical study, Blanchard and Kremer have shown that aggregate output declined 40 to 70 percent in industries across the republics of the former Soviet Union over the 1989-1994 period, with the larger declines in sectors having more complex production processes.

During the transition from a centrally planned to a market economy for CEE nations, the supply and demand for consumption goods changed. Trade barriers were reduced, and changes in domestic production resulted in increased variety and availability of goods and services. The opportunity set for consumers after the reform was constrained only by income and prices. Over the transition period, prices rose, relative prices changed (due to removal of prereform distortions and improved terms of trade), and real income for the majority of households fell (Milanovic). Some of the expected benefits of freeing prices quickly surfaced. For example, queues for basic foodstuffs disappeared. Consequences of removing nonprice rationing for food and other goods and services affected general household consumption patterns and consumer welfare.

Because of the rationing of important consumer goods and services, estimates of welfare decline using data on reported prices in the Consumer Price Index (CPI) are overestimated. The queuing and rationing under central planning resulted in shadow prices being much larger than reported prices. The effects on consumer welfare of removing the rationing constraint in a transition economy is closely related to the effect on consumer welfare in a market economy of the introduction of new consumer goods

(Hausman 1997a, 1997b, 1998). In both cases, using data on reported prices overestimates the increase in the true cost of living and results in an underestimate in the increase in welfare. The omission of new goods and services in a market economy and neglecting the effects of rationing in a transition economy imparts a significant upward bias to the CPI. Because CPI is used for making policy decisions, the bias distorts these decisions and gives misleading real magnitudes of changes in real income and economic welfare in the U.S. economy or in a transition economy.

This study sheds new light on these issues. Welfare implications of the transition are derived from a model of household consumption that explicitly reflects the effects of rationing. The empirical analysis is conducted for Poland, using quarterly household expenditure data and a complete demand system. Artificially low prices for selected goods and services in the pretransition period created shortages. Virtual prices, the prices at which the consumers would voluntarily choose to consume the ration levels of goods and services, provide a more precise and useful way to calculate the cost-of-living indices (CLI) and to estimate welfare impacts. The results show that from 1987 to 1992 the CLI that ignored the rationing effects was biased upward from 3.6 to 6.99 percentage points per year. More fully reflecting rationing and incorporating the effects of rationing before the reform yielded estimates of welfare loss with orders of magnitude lower than those commonly reported. Compared to the welfare loss that neglected the rationing effects in the prereform period, the welfare loss that reflected the rationing is only 25 percent as large with external virtual prices, and only 15 percent as large using Hausman's virtual prices.

Transition in Poland

Pretransition Period

Under centrally planned systems in the CEE nations, many consumer goods were rationed. The public could obtain available goods with artificially low prices only by waiting in long queues or by joining long waiting lists. Consumers could not buy the desired quantities of goods at government-controlled prices. According to the World Bank, rationing of meat resulted in free-market prices three to four times higher than the official prices in state shops in Poland during 1988 and 1989 (Atkinson and

Micklewrigth). Rationing distorted consumers' behavior because consumers could not buy the desired quantities at government-controlled prices, given the available supplies.

Housing is another example of a rationed good under socialism. Given the available supply, the excess demand for housing was produced by underpricing, which was made possible by huge subsidies. The artificially low (relative) prices stimulated housing service demand and discouraged supply. People were generally not happy with their housing service, which was provided by a mix of private and public ownership under complex controls on occupancy and disposition. Many families waited for a decade or longer for cooperative housing after having made a down payment. Some families lived with their parents or with others. A lack of available housing often kept families from moving to areas with greater employment opportunities. Quality, distribution, price, and access created serious problems. Urban housing shortages slowed down the rural-urban migration necessary for rapid industrialization and hence slowed down economic growth. Because the housing shortage was so severe, people were willing to accept new apartments, which were frequently substandard or shoddily constructed. Apartments were sometimes provided unfinished in buildings situated in the far suburbs of large cities without roads and sidewalks or nearby food stores and schools.

Transition

Poland was the first country in Central and Eastern Europe to reestablish a market economy. Table 1 presents selected macroeconomic indicators for key years of the Polish transition. The economic and political transformation in Poland commenced at the beginning of 1990. The goal of the first market-determined reform package, often called the Balcerowicz Plan, was macroeconomic stabilization, rapid price liberalization, and sharp reductions of subsidies (Wosniak). The Polish economy rapidly made the transition from relatively tightly controlled prices to nearly no control of prices.[1] The opening of the economy to international competition and the collapse of the Council for Mutual Economic Assistance led to a massive contraction of output and a sharp increase in unemployment.

TABLE 1. Selected macroeconomic indicators for Poland, 1989 through 1994

	Unit	1989	1990	1991	1992	1993	1994
GDP (annual change)	percent	n.a.	-11.6	-7.0	1.9	4.0	5.0
Real GDP per capita	1990 $US	1,824	1,633	1,506	1,538	1,590	1,670
Unemployment rate	percent	n.a.	6.3	11.8	13.6	15.5	16.0
Consumer Price Index (annual change)	percent	251.0	586.0	70.0	43.0	37.0	32.2
Exchange rate (annual average)	zl/$	1,446	9,500	10,582	13,631	18,200	24,400
Government budget deficit (% of GDP)	**percent**	**-3.0**	**0.4**	**-3.8**	**-6.0**	**-2.8**	**-2.7**

Sources: Central Statistical Office of Poland 1994 and Strong, Reiner, and Szyrmer, p. 256-61.

These effects of the reform were of shorter duration and sharper than in neighboring transition economies. Economic growth resumed in 1992 when the economy started to rebound, spurred by the rapid expansion of a private sector that accounted for 52 percent of gross domestic product (GDP) in 1994 compared to 18.8 percent of GDP in 1988 (Strong, Reiner, and Szyrmer). Economic growth has continued in Poland since 1992.

During the transition, the income inequality in Poland increased. Declines in real income[2] have resulted for all centrally planned economies, but the burden of these declines has not been carried equally among population segments. Real income fell in the first year after the introduction of the reforms for nearly all of the socioeconomic groups for which information is available. However, it is apparent from examining simple partitions of households that the reform impact varied for different population segments. Table 2 shows the changes in real income (changes in nominal personal incomes deflated by CPI) from 1989 to 1991 for the four different sources—wages, social transfers, farmer income, and other. The main impact during the years following the reform was for wages and farmer income, while the incomes from social transfers and other sources actually rose during the period.

Due to increased unemployment compensation and accelerated retirements, social transfers were increasing. Agricultural incomes fell significantly when input subsidies were withdrawn and more liberal import policies were established. During the transition, the Polish government ended consumer and producer subsidies and most agricultural export subsidies. The farmers faced sharply lower real output prices, escalating real input

TABLE 2. Annual percentage changes in real incomes by source in Poland, 1989-1991

	1989	1990	1991
Total incomes	+6.0	-14.7	+5.9
Wages	+6.3	-32.3	-6.6
Social Transfers	+8.6	-14.3	+29.3
Farms = income	+13.5	-49.9	-18.7
Other incomes	+5.3	+19.2	+16.5

Source: Euromonitor PLC 1994.

prices, and difficulties marketing their products mainly from the loss of external markets within the former Soviet Union and a weak domestic market.

The hardships caused by a large drop in real purchasing power at the beginning of the transition were not experienced uniformly across the whole population. Certain groups with low and fixed nominal incomes, e.g., unemployed and retired people, found themselves in a much worse situation than before. Other households were able to earn good wages in the private sector or become successfully self-employed.

Rationing, Virtual Prices, and Consumer Demand

Rationing

Research on quantity rationing has been primarily concerned with how the demands for nonrationed market goods were affected by the rationing. Tobin and Houthakker described how rationing of consumer goods could create a short-run disequilibrium for a related Hicksian composite good. Neary and Roberts extended the work of Tobin and Houthakker by deriving the properties of the demand systems under rationing and then comparing them to properties without rationing. This implies that knowledge of unrestricted demand functions can be used to explain behavior under rationing. The fundamental contribution of Neary and Roberts was to popularize the concept of virtual prices in demand theory under rationing. The concept of "virtual prices" is a crucial tool to show the equivalence between the demand models with and without rationing. The virtual price p_1^V for the rationed good x_1 at which the consumer optimally and voluntarily chooses the rationed level X_1 is

$$X_1 = x_1^c(U_0, p_1^V, p_2). \tag{1}$$

The virtual price is defined as an implicit function of the rationed quantity and prices of the nonrationed good. Given that the virtual price p_1^V exists, the Hicksian demand functions with rationing must be equal to the Hicksian demand functions without rationing:

$$x_2^{Rc}(U_0, p_1, p_2, X_1) = x_2^c(U_0, p_1^V, p_2), \tag{2}$$

where p_1^V is defined above.

Led by Deaton and Muellbauer (1980b), empirical studies have followed for developed and socialist economies. Deaton presented techniques for generating rationed demands from nonrationed demands and applied it to an extended version of the Linear Expenditure System (LES) and Almost Ideal Demand System (AIDS). Bettendorf and Barten refined the virtual price approach and applied the Neary and Roberts model for rent controls. Recent work of Hausman (1997a) examines the impact of new goods on consumer welfare. Given the demand function, Hausman solves for the virtual price that causes the demand for the new good to be equal to zero in the preintroduction period. Based on an example of a new cereal brand, Hausman finds that the CPI may be overstated for cereal by about 25 percent because of its neglect of new cereal brands. To date, however, no application has focused on transition economies and the power of the virtual price concept for revealing more information about consumption and welfare changes.

Virtual Prices and Consumer Demand

The virtual price demand system presented below is developed using modification of the AIDS cost function and draws on previous work by Deaton and Muellbauer (1980a). The virtual price form of the AIDS cost function in logarithmic form is

$$\log C(U_0, p_1^V, p_2) = (1 - U_0)\log[a(p_1^V, p_2)] + U_0 \log[b(p_1^V, p_2)] \tag{3}$$

where $C(U_0, p_1^V, p_2)$ is the cost function, p_2 is an *h*-vector of market prices, p_1^V is a *k*-vector of virtual prices (prices of rationed goods), where $h+k=n$, and U_0 is the utility level. For $a(p_1^V, p_2)$ and $b(p_1^V, p_2)$ specific functional forms are given, which are

positive, linearly homogeneous, and concave in prices. Following Deaton and Muellbauer (1980a), a translog flexible functional form is chosen for $a(p_1^V, p_2)$ which depends both on market and virtual prices. That is,

$$\begin{aligned}\log a(p_1^V, p_2) = a_0 &+ \sum_{j=1}^{k} a_{Vj} \log p_{1j}^V + \sum_{j=k+1}^{n} a_j \log p_{2j} \\ &+ 1/2[\sum_{i=1}^{k}\sum_{j=1}^{k} g^*_{ViVj} \log p_{1i}^V \log p_{1j}^V \\ &+ \sum_{i=k+1}^{n}\sum_{j=k+1}^{n} g^*_{ij} \log p_{2i} \log p_{2j} \\ &+ \sum_{i=1}^{k}\sum_{j=k+1}^{n} g^*_{Vij} \log p_{1i}^V \log p_{2j} \\ &+ \sum_{i=k+1}^{n}\sum_{j=1}^{k} g^*_{iVj} \log p_{2i} \log p_{1j}^V].\end{aligned} \tag{4}$$

Compared to the standard AIDS model, the linear portion here contains an extra term, $\sum_{j=1}^{k} a_{Vj} \log p_{1j}^V$, involving virtual prices, and the quadratic part includes extra cross-product terms. The function $b(p_1^V, p_2)$ is defined as

$$\log b(p_1^V, p_2) = \log a(p_1^V, p_2) + \prod_{j=1}^{k} p_{1j}^{V\, b_j^V} \prod_{j=k+1}^{n} p_{2j}^{b_j}. \tag{5}$$

Substituting the expressions for $a(p_1^V, p_2)$ and $b(p_1^V, p_2)$ into the cost function (3) and applying Shephard's lemma yields the budget shares (Deaton and Muellbauer 1980b). Note that these shares are derived from the virtual cost function (3). Therefore, they are themselves conditional on the vector of virtual prices, in addition to being functions of market prices and utility. Substituting the expression for utility from the cost function into the virtual share equations gives

$$\begin{aligned}w_i|_{p_1^V} = a_i &+ \sum_{j=1}^{k} g_{iVj} \log p_{1j}^V + \sum_{j=k+1}^{n} g_{ij} \log p_{2j} \\ &+ b_i \log[I^V / a(p_1^V, p_2)], \text{ for } i = 1 \text{ to } n\end{aligned} \tag{6}$$

where $g_{ij} = 1/2(g^*_{ij} + g^*_{ji})$, and $g_{iVj} = 1/2(g^*_{ViVj} + g^*_{VjVi})$. If log $a(p_1^V, p_2)$ is replaced by the Stone index $\log P(p_1^V, p_2) = \sum_{l=1}^{k} w_l \log p_{1l}^V + \sum_{j=k+1}^{n} w_j \log p_{2j}$, the virtual share equations become linear, i.e.,

$$w_i|_{p_1^V} = a_i + \sum_{j=1}^{k} g_{iVj} \log p_{1j}^V + \sum_{j=k+1}^{n} g_{ij} \log p_{2j} + b_i \log[I^V / P(p_1^V, p_2)], \text{ for } i = 1 \text{ to } n. \tag{7}$$

Qualitative demographic and other "translating" variables can be introduced into the demand systems model to examine effects for households with different observable characteristics, e.g.,

$$w_i|_{p_1^V} = a_i^{**} + \sum_{j=1}^{k} g_{iVj} \log p_{1j}^V + \sum_{j=k+1}^{n} g_{ij} \log p_{2j} + b_i \log[I^V / P(p_1^V, p_2)], \tag{8}$$

where $a_i^{**} = a_{i0} + \sum_{s=1}^{S} d_{is} D_s$, and D_s are the translating variables.

The restrictions on the parameters assuming the theoretical properties for utility maximization are homogeneity $\sum_{j=1}^{k} g_{iVj} + \sum_{j=k+1}^{n} g_{ij} = 0$ *for* $\forall i$; symmetry $g_{iVj} = g_{jVi}$ and $g_{ij} = g_{ji}$; and adding up $\sum_{i=1}^{n} a_i^{**} = 1, \sum_{i=1}^{n} d_{is} = 0, \sum_{i=1}^{k} g_{iVj} + \sum_{i=k+1}^{n} g_{ij} = 0$ *for* $\forall j$, and $\sum_{i=1}^{n} b_i = 0$.

For the analysis of the transition in Poland, two demand systems were estimated—one using the virtual prices for the prereform period for the rationed goods and actual for the postreform period, and the other using the actual prices throughout. The final specification of the equations for estimation of the AIDS with virtual prices is

$$w_{it}|_{p_1^V} = a_{i0} + \sum_{s=1}^{S} d_{is} D_{st} + \sum_{j=1}^{k} g_{iVj} \log p_{1jt}^V + \sum_{j=k+1}^{n} g_{ij} \log p_{2jt} + b_i \log[I_t^V / P(p_{1t}^V, p_{2t})] + u_{it}, \tag{9}$$

where $i = 1, ..., n$ goods, and $t = 1, ..., T$ observations. For comparison, the related specification for the standard demand system is

$$w_{it} = \tilde{a}_{i0} + \sum_{s=1}^{S} \tilde{d}_{is} D_{st} + \sum_{j=1}^{n} \tilde{g}_{ij} \log p_{jt} + \tilde{b}_i \log[I_t / P_t(p_{1t}, p_{2t})] + \tilde{u}_{it}. \qquad (10)$$

If the additive disturbance terms $u_{i\,t}$ in equations (9) and (10) satisfy the usual stochastic assumptions (the errors are independently and identically distributed with zero mean and constant variance), ordinary least squares can be applied to estimate the expenditure share equations. However, if the errors are contemporaneously correlated across equations, then the generalized least squares procedure is used to gain an asymptotic efficiency. The widely used estimator for sets of expenditure share equations is the Seemingly Unrelated Regressions (SUR) method. The SUR method results in consistent and asymptotically more efficient parameter estimates and is asymptotically equivalent to the maximum likelihood estimation (Barten). The latter results are invariant to the equation dropped or residually computed to accommodate the singularity of the error covariance matrix. The share equation for "other goods" was dropped and its parameters were recovered using the adding-up restrictions. The share equations were estimated using the statistical software package SAS, release 6.12, and the SUR method.

Calculation of Virtual Prices and Data

Calculation of Virtual Prices

The correct price to use for the rationed goods in the prereform years is the virtual price, which sets demand equal to the rationed quantity. Calculating virtual prices is critical to the results of the analysis. The size and the evolution of the virtual prices will show the economic impacts of rationing. We took two approaches to calculate the virtual price. First, a practical approach used external (Germany) relative prices for rationed goods. Germany and Poland are geographically close; and Germany is a major trading partner with Poland. From 1987 to 1989, the unregulated prices in Poland and Germany moved together, and a high positive correlation existed between the relative prices of clothing (nonrationed good) of the two countries. This provides some evidence that if the

prices move together, the markets are not separated (Mundlak and Larson). Also, for 1993 to 1998, we compared prices of some food items in Germany and Poland and found a high positive correlation between the relative prices of sugar, milk, and bread.[3] By using the relative prices, quality differences due to the higher incomes in Germany are likely to be eliminated. Given these assumptions and choices, the task is to construct a measure of how much the relative prices of rationed goods were distorted in Poland.

Food, alcohol, clothing and footwear, housing**,** electricity and gas, communication, and transportation were goods consumed both in Poland and Germany. The Polish goods were divided into two groups. In group I, we placed the rationed goods—food and housing. In group II, we placed the nonrationed goods—alcohol, clothing and footwear, electricity and gas, communication, and transportation. To derive the relative price effect of rationing on food we computed as follows:

$$\ln RP_F = \ln[(p_F^G/p_{OG}^G)/(p_F^P/p_{OG}^P)], \tag{11}$$

where p_F^G/p_{OG}^G and p_F^P/p_{OG}^P are the relative prices of food with respect to the other goods for Germany and Poland, respectively. $\text{Ln}RP_F$ is the proportional increase in the relative price of food in Germany compared to Poland. The virtual food price in Poland was then defined as $(1 + \ln RP_F)$ multiplied by the actual Polish food price.

The relative price for housing was computed using the same procedure:

$$\ln RP_H = \ln[(p_H^G/p_{OG}^G)/(p_H^P/p_{OG}^P)], \tag{12}$$

where p_H^G/p_{OG}^G and p_H^P/p_{OG}^P are the relative prices of housing with respect to the other goods in Germany and Poland respectively. The housing virtual price in Poland was then defined as $(1 + \ln RP_H)$ multiplied by the actual Polish housing price index.[4]

Second, we follow Hausman's (1997a) method of calculating virtual prices. The virtual prices are computed from an estimate of the complete demand system ignoring rationing. Virtual prices are calculated for food and housing. Here, the preferences for a complete demand system (AIDS) with actual prices for the period 1987-92 were first estimated. Next, using these estimated coefficients, we back out the implied prices that

support the prereform data. These prices are then averaged across households in each prereform year.

Data

The data for the analysis of the Polish transition are a subsample from the original Polish Household Budget Survey conducted by the Social and Demographic Statistics Division of the Central Statistical Office of Poland during the years 1987-1992. The survey is part of a long series of annual household budget surveys in Poland, consisting of both cross-section and panel data. The survey provides extensive information on household size, household composition, age, gender, occupational status of household members, sources of income, and expenditure patterns. The survey is conducted quarterly, but each household is surveyed only once per year (Gorecki and Peczkowski). The expenditure data are from quarterly surveys. Detailed information on the survey data is given in Adam.

For the present analysis, the period 1987, 1988, and 1989 was classified as the "prereform" period (18,682 observations), and the period 1990, 1991, and 1992 was classified as the "postreform" period (14,303 observations). A limitation of the data is that the sample was not fully representative of the population. Specifically, the sample was designed to represent the population of nonprivately employed individuals, and information on entrepreneurs was not available from this survey; all individuals who privately own a business or who are non-agriculturally self-employed were removed from the sample.

In the application of the almost ideal demand system, the dependent variables are the budgeted shares for the six expenditure groups—food (including the value of self consumption); alcohol and tobacco; clothing and footwear; housing (actual implicit rental); fuel, electricity, and communication (i.e., household utilities), and transport; and other. Expenditure covers household spending on all consumption goods and services. In the prereform years, food and housing are assumed the rationed goods. The independent variables for the AIDS model are logarithms of prices (virtual prices for the rationed goods and actual prices for nonrationed goods), and total household expenditure.

The main source for the prices of different commodities and services in Poland was the Polish Statistical Yearbook 1993 and 1994, published by the Central Statistical Office of Poland. The yearbooks recorded regional price variation for food items before and after the reform. The main source for German prices of goods and services was the German Statistical Yearbook 1991 and 1992 (Statistisches Bundesamt 1991, 1992). We used the available information on the shares of different food items and other goods and services from the survey of total expenditures from "Understanding Poverty in Poland" (World Bank 1995, Table A2.3, p. 154, "Expenditure Categories for Price index" [percentage] for 1993). Regional price indices were constructed for food using the available price information for the following food items: bread, pork, milk, and sugar.5 All price indices are 100 at the end of 1990 (fourth quarter). Quarterly price indices were constructed using the data on quarterly inflation rates in Poland for 1987 to 1992, obtained from the GUS.

Cost-of-Living Indices

Cost-of-living indices are calculated using the estimated parameters from the complete demand system. The cost-of-living index measures computed were the relative costs of reaching a given standard of living for the two different regimes, the pre- and postreform years. The most commonly used measure of cost of living is the CPI, which is essentially a Laspeyres price index—$L(p^1, p^0) = 3p_1x_0/3p_0x_0 = 3\ p_1x_0/I_0$, where p_0 and p_1 are the prices under the two different regimes, and x_0 is the quantity for the base regime. The Laspeyres price index gives an upward biased estimate of the cost of living, because in keeping constant weights for the base period basket of goods it does not account for substitution among commodities due to relative price changes (Deaton and Muellbauer 1980b). In short, the CPI is a relatively crude instrument for measuring the impact of inflation on individual welfare.

The true cost-of-living index more completely invokes the theory of consumer demand. It is the ratio of the minimum expenditures, under two different price regimes, necessary to maintain a constant utility level as opposed to a constant basket of goods as in the Laspeyres price index. The base-weighted true cost-of-living index is

$$P(p^0, p^1, U^0) = C(U^0, p^1)/\ C(U^0, p^0), \tag{13}$$

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 p^1 is a vector of market prices at current period. As previously indicated, the base period was defined to represent the prereform years. The true cost-of-living index number can be calculated if we know the cost function C(U, p). After estimation of a complete system of demand equations we can find the cost function. Using the estimated parameters from the virtual AIDS model, we can calculate the indirect utilities from the functional forms in equations (4) and (5) and, finally, the virtual cost-of-living indices from equation (13). The cost-of-living indices show the impacts of price liberalization on households' welfare in a transition economy. Using the cost-of-living indices calculated for available sample partitions, the impacts of price changes on households with different demographic characteristics can be estimated.

With the estimated coefficients from the virtual AIDS and the standard AIDS we can calculate indirect utility. The compensating 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 evaluated directly.[6] Positive differences indicate that the household experienced a welfare loss as a result of the price liberalization. Finally, the change in real total income/expenditure can be used to show the total welfare change during the transition in the Polish economy.

The Incidence of Impacts of Transition for Selected Household Groups

The main goal of the estimation of the Polish household demand system was to determine the magnitude of household welfare change as a result of the transformation from a centrally planned to a market economy. To achieve this goal, the AIDS model was first fitted to quarterly data for 1987 to 1992, ignoring rationing effects (using the actual prices for the rationed goods). Some of the results were inconsistent with theory, i.e., giving a positive sign for compensated own-price elasticity for housing (Table 3). Hence, the model ignoring rationing did not conform to predictions from economic theory, suggesting misspecification of the model of household demand.

The coefficients from the initial estimate of the AIDS model, however, were used to obtain the Hausman virtual prices for food and housing for the prereform years. For 1987

TABLE 3. Estimated demand elasticities: AIDS with actual prices

Group[a]	Food	Alcohol	Clothing	Housing	Fuel	Other
			Marshallian Elasticities			
Food	-0.34 (0.02)	0.04 (0.01)	-0.06 (0.01)	-0.19 (0.01)	-0.13 (0.01)	-0.001
Alcohol	0.44 (0.17)	-2.84 (0.27)	1.35 (0.28)	1.55 (0.16)	-0.10 (0.06)	-0.49
Clothing	-0.54 (0.06)	0.36 (0.08)	-0.38 (0.09)	-0.34 (0.06)	-0.34 (0.02)	-0.01
Housing	-1.38 (0.06)	0.45 (0.05)	-0.40 (0.03)	0.03 (0.13)	-0.30 (0.04)	0.07
Fuel	-0.88 (0.03)	-0.03 (0.01)	-0.35 (0.02)	-0.25 (0.03)	-0.32 (0.02)	0.55
Other	-0.32	-0.31	-0.02	0.07	0.40	-1.14
			Hicksian Elasticities			
Food	-0.001 (0.01)	0.06 (0.005)	0.02 (0.01)	-0.12 (0.01)	-0.05 (0.01)	0.10
Alcohol	0.99 (0.08)	-2.81 (0.29)	1.47 (0.28)	1.66 (0.16)	0.02 (0.05)	-0.33
Clothing	0.08 (0.09)	0.40 (0.04)	-0.24 (0.08)	-0.21 (0.07)	-0.21 (0.02)	0.18
Housing	-0.62 (0.06)	0.50 (0.05)	-0.23 (0.04)	0.19 (0.13)	-0.13 (0.04)	0.30
Fuel	-0.25 (0.03)	0.01 (0.01)	-0.21 (0.02)	-0.12 (0.03)	-0.18 (0.02)	0.74
Other	0.34	-0.27	0.13	0.20	0.54	-0.94
	Income Elasticities				**Mean Shares**	
Food	0.68 (0.003)				0.50	
Alcohol	1.10 (0.015)				0.03	
Clothing	1.25 (0.009)				0.11	
Housing	1.53 (0.012)				0.10	
Fuel	1.27 (0.009)				0.11	
Other	1.31				0.15	

Note: Figures in parentheses are the estimated standard errors of elasticities.
[a]Alcohol includes tobacco. Clothing includes footwear. Fuel includes electricity, transportation, and communication.

and 1988, the Hausman virtual price for food was very similar to the actual price, while for 1989 it was higher. For housing, the Hausman virtual price was higher than the actual price for all prereform years. The actual and virtual prices for food and housing using both approaches (external source and Hausman) are shown in Figures 1 and 2, respectively.

Next, the AIDS model with virtual prices for the rationed goods was fitted to quarterly data for 1987 to 1992, using both sets of virtual prices. Tables 4 and 5 present our best estimates of the own- and cross-price elasticities of prereform household demand. 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, housing, and fuel are less than one, whereas for alcohol and clothing they are greater than one, suggesting elastic demand. The estimates derived from the virtual AIDS model gave plausible values for price and income

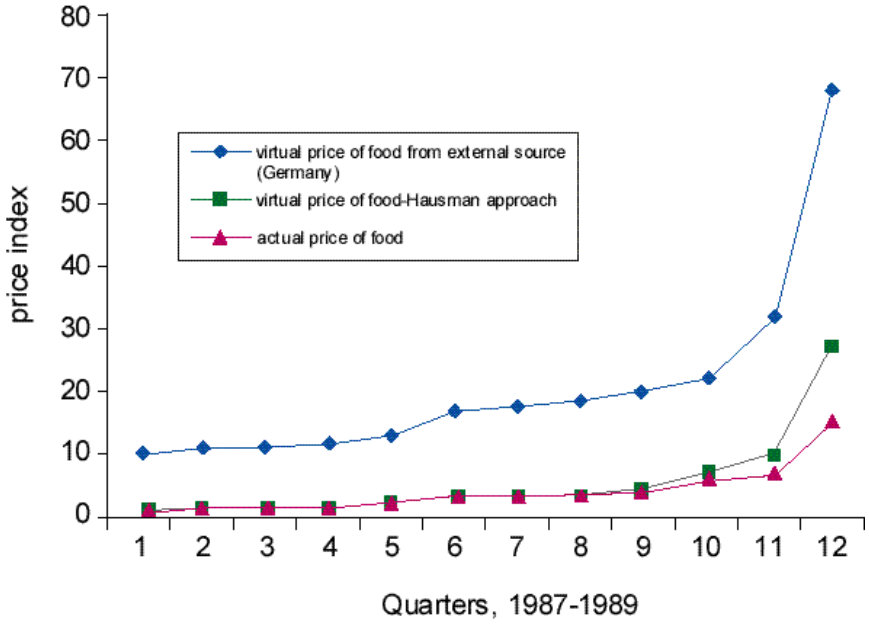

FIGURE 1. Virtual and actual price of food, Poland

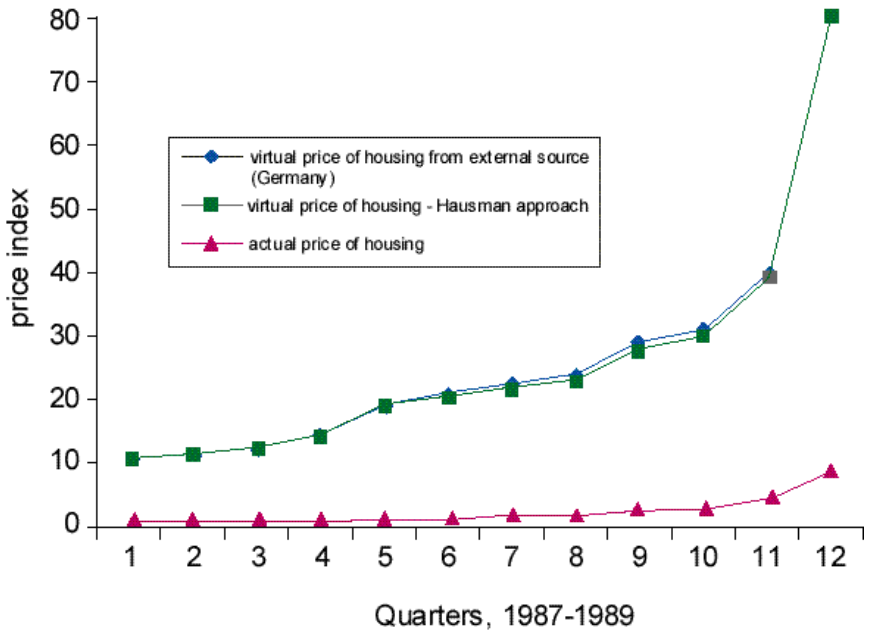

FIGURE 2. Virtual and actual price of housing, Poland

TABLE 4. Estimated demand elasticities: AIDS with virtual prices from external source

Group[a]	Food	Alcohol	Clothing	Housing	Fuel	Other
			Marshallian Elasticities			
Food	-0.59 (0.01)	-0.001(0.003)	-0.07 (0.01)	-0.01 (0.01)	-0.07 (0.004)	-0.01
Alcohol	-0.26 (0.18)	-1.79(0.27)	1.67 (0.28)	-0.53 (0.08)	-0.25 (0.07)	0.04
Clothing	-1.08 (0.10)	0.55(0.09)	-1.40 (0.14)	0.39 (0.05)	-0.82 (0.05)	1.09
Housing	-0.54 (0.05)	-0.09(0.01)	0.15 (0.02)	-0.66 (0.05)	0.04 (0.02)	-0.49
Fuel	-0.81 (0.04)	-0.07(0.02)	-0.08 (0.04)	0.13 (0.03)	-0.11 (0.03)	-0.31
Other	-0.47	0.004	0.24	-0.75	0.21	-0.63
			Hicksian Elasticities			
Food	-0.13 (0.01)	0.01(0.003)	-0.03 0.006)	0.10 (0.01)	-0.01 (0.005)	0.06
Alcohol	0.42 (0.08)	-1.77 (0.27)	1.74 (0.277)	-0.38 (0.07)	-0.16 (0.07)	0.14
Clothing	-0.31 (0.06)	0.58 (0.09)	-1.33(0.136)	0.57 (0.05)	-0.72 (0.049)	1.21
Housing	-0.43 (0.05)	-0.05 (0.01)	0.24 (0.019)	-0.44 (0.05)	0.16 (0.02)	-0.34
Fuel	-0.05 (0.04)	-0.04 (0.02)	0.001 (0.04)	0.31 (0.03)	-0.01 (0.03)	-0.20
Other	0.38	0.03	0.33	-0.55	0.32	-0.51
	Income Elasticities			**Mean Shares**		
Food	0.75 (0.003)			0.61		
Alcohol	1.11 (0.014)			0.02		
Clothing	1.27 (0.010)			0.06		
Housing	1.58 (0.011)			0.14		
Fuel	1.24 (0.010)			0.08		
Other	1.39			0.09		

Note: Figures in parentheses are the estimated standard errors of elasticities.
[a]Alcohol includes tobacco. Clothing includes footwear. Fuel includes electricity, transportation, and communication.

TABLE 5. Estimated demand elasticities: AIDS with virtual prices—Hausman approach

Group[a]	Food	Alcohol	Clothing	Housing	Fuel	Other
			Marshallian Elasticities			
Food	-0.73 (0.005)	-0.001(0.001)	-0.04 (0.003)	0.01 (0.003)	-0.04 (0.003)	0.01
Alcohol	-0.06 (0.14)	-1.17(0.29)	1.81 (0.31)	-0.32 (0.08)	-0.51 (0.09)	-0.63
Clothing	-0.23 (0.08)	0.49(0.08)	-3.20 (0.16)	0.73 (0.05)	0.09 (0.06)	1.19
Housing	-0.39 (0.01)	-0.09(0.01)	0.49 (0.02)	-1.02 (0.01)	-0.21 (0.02)	-0.46
Fuel	-0.31 (0.01)	-0.16(0.03)	-0.08 (0.056)	-0.21 (0.02)	-0.47 (0.03)	-0.003
Other	-0.11	0.14	0.92	-0.37	-0.003	-1.37
			Hicksian Elasticities			
Food	-0.36 (0.004)	0.02(0.001)	-0.05 (0.003)	0.12 (0.002)	0.04 (0.003)	0.12
Alcohol	0.37 (0.018)	-1.14 (0.29)	1.91 (0.309)	-0.20 (0.07)	-0.42 (0.08)	-0.51
Clothing	0.22 (0.012)	0.52 (0.08)	-3.10 (0.158)	0.86 (0.04)	0.18 (0.056)	1.32
Housing	0.42 (0.007)	-0.04 (0.01)	0.68 (0.015)	-0.79 (0.01)	-0.04 (0.015)	-0.22
Fuel	0.20 (0.012)	-0.13 (0.02)	0.20 (0.06)	-0.06 (0.02)	-0.36 (0.03)	0.15
Other	0.41	-0.11	1.04	-0.22	0.11	-1.22
	Income Elasticities			**Mean Shares**		
Food	0.79 (0.003)			0.48		
Alcohol	0.88 (0.011)			0.03		
Clothing	0.93 (0.007)			0.11		
Housing	1.68 (0.012)			0.14		
Fuel	1.06 (0.008)			0.10		
Other	1.08			0.14		

Note: Figures in parentheses are the estimated standard errors of elasticities.
[a]Alcohol includes tobacco. Clothing includes footwear. Fuel includes electricity, transportation, and communication.

elasticities. Comparing the Hicksian elasticities with virtual prices using both approaches, the elasticities in absolute value are larger using the Hausman approach.

Finally, using the coefficients from the AIDS model with actual prices (Table A.1), AIDS with external virtual prices (Table A.2), and AIDS with Hausman-virtual prices (Table A.3), we estimated the CLI from equation (13). The CLI is shown in Figure 3. The CLI in the first quarter of 1987 is 1. The CLI with actual prices, which ignores the rationing effects of food and housing in the prereform period, suggests that from 1987 to 1992, prices increased by 39 percent, or an average increase of 5.73 percent per year. The CLI constructed using external virtual prices increases by 12 percent over the whole period, or an average 2.13 percent per year. Finally, the CLI using Hausman virtual prices decreased 7 percent over the period by an average of 1.26 percent per year. Thus, the bias in the CLI ignoring the rationing effects equals approximately 3.6, or 6.99 percentage points per year.

The total welfare loss for different family groups is reported in Table 6. We draw three calculations for comparison; two allow for rationing—external, and Hausman approaches—and a third ignores rationing. We report the welfare changes measured with

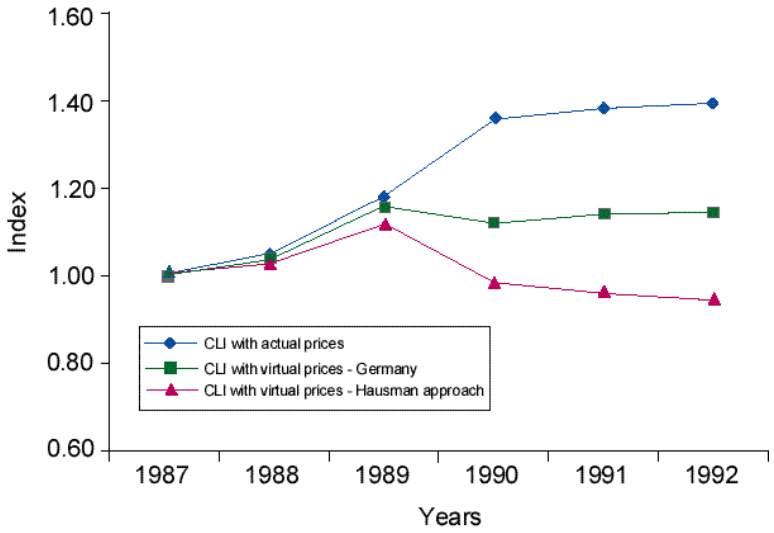

FIGURE 3. Cost-of-living index (CLI) with actual and virtual prices, Poland, 1987-92

TABLE 6. Welfare losses and household group (in million zlotys)

Variable	Families w/o children	Families with 1 child	Families with 2 children	Families with 3 children	Families 4 or more children	Single Parent with child	Other
	Loss with Rationing Effects						
Virtual prices from external source							
Compensating Variation	1.75	2.35	2.52	2.83	2.97	1.55	2.04
Total expenditure in 1992	11.28	14.72	16.10	15.22	18.22	10.01	11.95
Virtual real total expenditure in 1987	11.92	15.30	16.24	17.89	18.65	10.78	13.34
Virtual expenditure change[a]	-0.64	-0.58	-0.14	-2.67	-0.43	-0.77	-1.39
Total loss[b]	2.39	2.93	2.66	5.50	3.40	2.32	3.43
Relative loss[c]	**20.05%**	**19.15%**	**16.38%**	**30.74%**	**18.23%**	**21.54%**	**25.71%**
Virtual prices Hausman approach							
Compensating Variation	-0.15	-0.20	-0.21	-0.23	-0.23	-0.17	-0.13
Virtual real total expenditure in 1987	12.23	15.98	16.82	17.86	17.96	10.46	13.67
Virtual expenditure change[a]	-0.95	-1.26	-0.72	-2.64	0.26	-0.45	-1.72
Total loss[b]	0.80	1.06	0.51	2.41	-0.49	0.28	1.59
Relative loss[c]	**6.54%**	**6.63%**	**3.03%**	**13.49%**	**-2.73%**	**2.71%**	**11.63%**
	Loss without Rationing Effects						
Compensating Variation	10.65	14.52	14.46	16.50	16.46	10.04	12.14
Real total expenditure in 1987	14.49	19.50	20.68	22.00	21.94	13.71	16.35
Expenditure change[d]	-3.21	-4.78	-4.58	-6.78	-3.72	-3.70	-4.40
Total loss[e]	13.86	19.30	19.04	23.28	20.18	13.74	16.54
Relative loss[f]	**95.65%**	**98.97%**	**92.07%**	**105.82%**	**91.98%**	**100.21%**	**101.16%**
Number of families	543	320	435	151	66	101	1063

[a]Mean real expenditure of the family group in 1992 less mean virtual real total expenditure for the family group in 1987 at 1992 prices.
[b]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 group in 1992 less mean real expenditures of family group in 1987 at 1992 prices.
[e]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.

compensating variation for seven household types. However, to compute the welfare change we need to know how much income changed. Table 6 shows this as measured virtual expenditure change. For the case that ignores rationing, this is the actual expenditure change. Finally, the ratio of total welfare loss to the 1987 real total expenditures was computed for all household groups. The group most affected by the economic reform in Poland was families with three children, which has the highest welfare loss over the transition.

Next, we compare the welfare loss over the period 1987 to 1992. Depending on the approach to virtual prices, the loss was three to four times higher when ignoring rationing than when allowing for rationing using the external virtual prices. The magnitude of the losses using Hausman virtual prices is much smaller. With both virtual price methods, virtual prices were much larger than the actual or reported prices for the rationed goods during the prereform period. Furthermore, the actual prices for the goods experiencing prereform rationing increased much more than the virtual prices with the reform. Therefore, using the CPI overestimated the welfare loss during the transition.

Conclusions

Poland was the first country in Eastern Europe to reestablish a market economy. The new government introduced a number of dramatic economic reforms, including the elimination of most of a large state sector, ending the state control of prices and trade liberalization. These economic reforms affected the availability of goods, commodity prices, and family incomes, implying changing consumption patterns and total expenditures. As subsidies were withdrawn, prices rose rapidly and the Polish living standard declined.

Estimates from a virtual AIDS model and a standard AIDS model were used to calculate cost-of-living indices for 1987-1992, and to show that the CLI when ignoring the rationing effects is biased upward by 3.6 to 6.99 percentage points per year.

The problem of rationing is similar to the problem caused by the introduction of new goods in a market economy, i.e., a good that is unavailable because it has not as yet been discovered and marketed is effectively rationed at a zero quantity to consumers. Hence, the

U.S. CPI and the true cost-of-living index are overestimated by the standard treatment of new goods. Accurately assessing the effects of Poland's transition to a market economy requires careful analysis of consumption patterns, total expenditure, rationing, and prices. The virtual prices were much larger than the actual or reported prices for the rationed goods during the prereform period. Most evaluations of the welfare impacts of reform have ignored the impacts of rationing, both for Poland and for the other transition economies. More fully reflecting rationing and incorporating the effects of rationing before the reform yielded estimates of welfare loss that were orders of magnitude lower than those commonly reported. Compared to the welfare loss that neglects the rationing effects in the prereform period, the welfare loss that reflects the rationing is only 25 percent as large with external virtual prices, and only 15 percent as large with Hausman virtual prices.

GDP in real terms divided by the population greatly overestimated the welfare loss for Poland and likely does so for the other transition economies. Specifically, the welfare loss estimates exaggerated by several times the changes in the true cost of living. Perhaps this is why the transitions in Poland and other Central and Eastern European economies occurred relatively peacefully. The populations were actually much better off than those who used crude measures to chronicle the reforms knew or understood. Incorporating the effects of consumer rationing not only improves our understanding of transition processes but also provides results that can improve the basis for targeting compensation packages.

Endnotes

1. Prices of a few items such as coal, fuel, and rental housing remained under price control, but periodic increases were permitted (Shen).

2. These changes in real income have been estimated by crude proxies, usually GDP deflated by CPI.

3. With the available prices for some food items in Germany and Poland, we created relative prices of pork and bread with respect to the price of sugar for 1990 to 1994, and relative prices of milk and sugar with respect to the price of butter for 1993, 1994, 1996, and 1998. We found a large positive correlation between the relative prices of milk in Germany and Poland (the correlation coefficient is 0.684), between the relative prices of bread (the correlation coefficient is 0.683), and between the relative prices of sugar (the correlation coefficient is 0.963). A positive but smaller correlation existed for the relative price of pork (the correlation coefficient is 0.16).

4. From equations (11) and (12) we found how much higher the relative price of food and housing was in Germany than in Poland. The resulting ratios for food were 4.85; 5, and 4.56 for 1987, 1988, and 1989; for housing the ratios were 6.01, 6.87, and 6.52 for 1987, 1988, and 1989. These ratios were comparable to other anecdotal evidence. According to a World Bank study for Poland, the rationing of meat was associated with free-market prices of three to four times higher than the official prices in state shops for 1988 and 1989 (Atkinson and Micklewrigth).

5. From a World Bank study of Poland, it was evident that bread, pork, milk, and sugar are the most important food items in terms of budget shares. Specifically, the expenditure shares in 1993 were bread, 33 percent; pork, 33 percent; milk, 17 percent; and sugar, 17 percent.

6. See Banks, Blundell, and Lewbel for a similar procedure.

Appendix

TABLE A.1. Demand system parameter estimates and t-ratios: AIDS with actual prices

Variables	Food	Alcohol	Clothing	Housing	Fuel
Constant	2.002 (125.03)	-0.003 (-0.62)	-0.204 (-18.07)	-0.392 (-28.84)	-0.156 (12.87)
Food price	0.250 (34.59)	-0.015 (5.90)	-0.046 (-9.98)	-0.112 (-17.45)	-0.082 (-26.22)
Alcohol price	-0.015(5.90)	-0.055 (-6.42)	0.041 (4.84)	0.047 (9.77)	-0.003 (-2.03)
Clothing price	-0.046 (-9.98)	0.041 (4.84)	0.071 (7.40)	-0.034 (-4.73)	-0.035 (-14.98)
Housing price	-0.112 (-17.45)	0.047 (9.77)	-0.034 (-4.73)	0.109 (8.27)	-0.024 (-6.34)
Fuel price	-0.082 (-26.22)	-0.003 (-2.03)	-0.035 (-14.98)	-0.024 (-6.34)	0.087 (36.74)
Ln expenditure	-0.160(-114.46)	0.003 (6.79)	0.028 (27.91)	0.053 (43.61)	0.030 (28.08)
Adult equivalents	0.057 (61.85)	-0.002 (-6.79)	-0.001 (-1.71)	-0.019 (-23.91)	-0.012 (-17.69)
Age	0.003 (9.85)	2E-04 (2.78)	6E-04 (0.32)	-0.002 (-9.42)	-7.8E-04 (-3.92)
Age squared	-2E-05 (-7.53)	-7E-06 (-8.44)	-6E-06 (-3.27)	2E-05 (10.01)	1E-05 (6.66)
Education	0.012 (32.45)	0.002 (18.84)	5E-04 (1.86)	-0.001 (-4.14)	-0.003 (-10.07)

Note: All prices are in logarithms.

TABLE A.2. Demand system parameter estimates and t-ratios: AIDS with virtual prices from external source

Variables	Food	Alcohol	Clothing	Housing	Fuel
Constant	1.906 (108.46)	0.007 (-3.16)	-0.070 (-10.10)	-0.663 (-38.63)	-0.045 (-4.77)
Food price	0.158 (21.40)	-0.004 (-2.34)	-0.055 (-16.10)	-0.026 (-3.80)	-0.053 (-17.95)
Alcohol price	-0.004 (-2.34)	-0.016 (-2.93)	0.034 (6.06)	-0.010 (-7.22)	-0.005 (-3.52)
Clothing price	-0.055 (-16.10)	0.034 (6.06)	-0.023 (-2.83)	0.026 (8.45)	-0.048 (-16.21)
Housing price	-0.026 (-3.80)	-0.010 (-7.22)	0.026 (8.45)	0.059 (9.27)	0.012 (4.56)
Fuel price	-0.053 (-17.95)	-0.005 (-3.52)	-0.048 (-16.21)	0.012 (4.56)	0.077 (34.74)
Ln expenditure	-0.154 (-98.39)	0.002 (7.86)	0.016 (26.28)	0.081 (53.24)	0.019 (22.84)
Adult equivalents	0.056 (55.15)	-0.002 (-8.46)	-0.002 (-4.10)	-0.027 (-27.81)	-0.009 (-16.37)
Age	0.003 (10.53)	2E-04 (4.58)	1E-04 (1.15)	-0.003 (-9.59)	-6.6E-04 (-4.30)
Age squared	-3E-05 (-9.02)	-5E-06 -10.00)	-4.5E-06 (-4.04)	3E-05 (9.76)	9E-06 (6.20)
Education	0.011 (27.45)	0.001 (15.67)	-4E-04 (-2.46)	-0.002 (-5.21)	-0.002 (-10.55)

Note: All prices are in logarithms.

TABLE A.3. Demand system parameter estimates and t-ratios: AIDS with virtual prices—Hausman approach

Variables	Food	Alcohol	Clothing	Housing	Fuel
	1.379	0.064	0.165	-0.822	0.085
Constant	(80.71)	(16.17)	(16.57)	(-39.15)	(8.32)
	0.079	-0.003	-0.029	-0.009	-0.028
Food price	(37.27)	(-6.25)	(-21.45)	(-8.66)	(-21.42)
	-0.003	-0.005	0.054	-0.010	-0.016
Alcohol price	(-6.25)	(-0.59)	(5.83)	(-5.00)	(-5.92)
	-0.029	0.054	-0.243	0.080	0.009
Clothing price	(-21.45)	(5.83)	(-13.90)	(16.82)	(1.43)
	-0.009	-0.010	0.080	0.010	-0.020
Housing price	(-8.66)	(-5.00)	(16.82)	(5.04)	(-9.43)
	-0.028	-0.016	0.009	-0.020	0.063
Fuel price	(-21.42)	(-5.92)	(1.43)	(-9.43)	(17.87)
Ln	-0.102	-0.002	-0.007	0.095	0.006
expenditure	(-73.42)	(-11.24)	(-9.22)	(55.80)	(7.49)
Adult	0.039	-1.8E-04	0.008	-0.028	-0.006
equivalents	(32.97)	(-0.65)	(11.63)	(-18.92)	(-8.52)
	0.001	4E-04	8E-04	-0.003	-3E-04
Age	(3.94)	(4.82)	(3.99)	(-6.88)	(-1.47)
	-4E-06	-8.6E-06	-2E-05	3.5E-05	6.5E-06
Age squared	(-1.22)	(-10.66)	(-7.74)	(7.97)	(3.11)
	0.015	0.002	-0.002	0.001	-0.004
Education	(30.67)	(13.97)	(-5.20)	(1.87)	(-11.98)

Note: All prices are in logarithms.

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