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

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Abstract—The costs of shortages and rationing are not captured by standard consumer price indices. Thus the change in real GDP per capita is an overestimate of welfare losses in transition economies. In this study virtual prices are used to calculate new cost-of-living indices (CLIs). The results for Poland show that from 1987 to 1992 the CLI ignoring the rationing effects is biased upward from 1.53 to 3.71 percentage points per year. Compared to the estimates of welfare loss that neglect the rationing effects during the prereform period, the estimated welfare losses that reflect the rationing are reduced by 50% using Hausman's virtual prices and by 75% using external proxy virtual prices.

I. 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 (1992) and Boycko (1992) have provided analysis of the reform process for these formerly planned economies, highlighting problems of policy uncertainty, timing, partial government ownership, and other factors that lead to an associated economic decline. In an empirical study, Blanchard and Kremer (1997) have shown that aggregate output declined 40%–70% in industries across the republics of the former Soviet Union over the 1989–1994 period, with the larger declines in sectors having 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. The trade barriers were reduced and domestic production changed, resulting 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, prices rose, relative prices changed (due to removal of prereform distortions and improved terms of trade), and the real incomes of the majority of households fell (Milanovic, 1996). 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, and artificially low report prices for these goods, estimates of welfare decline using data on reported prices in the consumer price index (CPI) are overestimated. The queuing and rationing under central planning could have resulted in shadow or imputed prices being much higher than reported prices. The effects on consumer welfare of removing the rationing constraints during a transition economy are 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, rather than virtual prices, overestimates the increase in the true cost of living and underestimates the increase in welfare. The omission of new goods and services available in a market economy and neglecting the effects of rationing in a transition economy imparts a significant upward bias to the CPI. Because the CPI is used for making policy decisions, the bias can give misleading magnitudes for changes in real income and economic welfare.

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 rationed levels of goods and services, provide a more precise and useful way to calculate the cost of living indices (CLIs) and to estimate welfare change. The results show that over 1987 to 1992 the CLI, ignoring the rationing effects, is biased upward from 1.53 to 3.71 percentage points per year. More fully reflecting rationing and incorporating the effects of rationing before the reform yielded estimates of welfare loss that are orders of magnitude lower than those commonly reported. Specifically, compared to the estimates of welfare loss that neglect the rationing effects during the prereform period, the estimated welfare losses that reflect the rationing are reduced by 50% using Hausman's virtual prices and by 75% using external proxy virtual prices.

II. Transition in Poland

A. *Pretransition Period*

Under the centrally planned systems in the CEE nations, many consumer goods were rationed. The public could obtain available goods only by waiting in long queues or by joining waiting lists. Consumers could not buy the desired quantities of goods at the 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 & Micklewright,

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TABLE 1.—SELECTED MACROECONOMIC INDICATORS FOR POLAND, 1989 THROUGH 1994

Indicator	Unit	1989	1990	1991	1992	1993	1994
GDP (annual change)	%	n.a.	−11.6	−7.0	1.9	4.0	5.0
Real GDP per capita	1990 US $	1824	1633	1506	1538	1590	1670
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
Exchange rate (annual average)	zl/$	1446	9500	10582	13631	18200	24400
Government budget deficit (% of GDP)	%	−3.0	0.4	−3.8	−6.0	−2.8	−2.7

Sources: GUS (Main Statistical Office) (1994) and Strong et al. (1996, pp. 256–261).

1992). 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 the pretransition regime. Given the available supply, the excess demand for housing was produced by underpricing, which was made possible by large 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. The lack of available housing often kept families from moving to areas with greater employment opportunities. Quality, distribution, price, and access all created serious problems. Urban housing shortages slowed down the rural-urban migration necessary for rapid industrialization and hence economic growth. Because of the severe housing shortage, 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.

B. 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 (Wozniak, 1998). The Polish economy rapidly made the transition from 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. 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% of GDP in 1994 compare to 18.8% in 1988 (Strong, Reiner, & Szyrmer, 1996). Economic growth has continued in Poland since 1992.

During the transition, the income inequality in Poland increased. Declines in real income[2] resulted for all centrally planned economies, but the burden of these declines was not spread 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's impact varied with the population segment. 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, farm income, and other. The main impact during the years following the reform was on wages and farm income; the incomes from social transfers and other sources actually rose.

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

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

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

TABLE 2.—ANNUAL PERCENTAGE CHANGES IN REAL INCOMES BY SOURCE IN POLAND 1989–1991 (PERCENT)

	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
Farm income	+13.5	−49.9	−18.7
Other incomes	+5.3	+19.2	+16.5

Source: Euromonitor PLC (1994).

III. Rationing, Virtual Prices, and Consumer Demand

A. Rationing

Research on quantity rationing has been primarily concerned with how the demand functions for nonrationed market goods were affected by the rationing. Tobin and Houthakker (1951) described how rationing of consumer goods could create a short-run disequilibrium for a related Hicksian composite good. Neary and Roberts (1980) extended the work of Tobin and Houthakker (1951) by deriving the properties of the demand systems under rationing and then comparing them with the same properties without rationing. The implication is that parameters of unrestricted demand functions can be used to explain behavior under rationing. The fundamental contribution of Neary and Roberts (1980) was to popularize the concept of *virtual prices* in demand theory under rationing. That concept is a crucial tool for showing 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

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

That is, the virtual price is an implicit function of the rationed quantity, prices of the nonrationed goods, and utility U_0. Given the virtual price p_1^V, the Hicksian demand functions with rationing (x_2^{Rc}) are equal to the Hicksian demand functions without rationing (x_2^c):

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

Led by Deaton and Muellbauer (1980a), empirical studies of rationing have followed for both developed and planned economies. Deaton (1981) presents techniques for generating rationed demands from nonrationed demands and applies them to an extended version of the linear expenditure system (LES) and the almost ideal demand system (AIDS). Bettendorf and Barten (1995) refine the virtual price approach and apply Neary and Roberts's (1980) model to the analysis of rent controls. Recent work of Hausman (1997a) examines the impact of new goods on consumer welfare. Given the demand function, Hausman solves implicitly for the virtual price that causes the demand for the new good to be equal to 0 in the preintroduction period. Based on an example of a new cereal brand, Hausman finds that the CPI may be overstated for cereal by approximately 25% if the new cereal brands are neglected. To date, however, no application has focused on transition economies and the power of the virtual price concept for estimating consumption and welfare changes.

B. Virtual Prices and Consumer Demand

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

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

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 (1980b), a translog flexible functional form is chosen for $a(p_1^V, p_2)$ which depends on both market and virtual prices. That is,

$$\begin{aligned}\log a(p_1^V, p_2) &= \alpha_0 + \sum_{j=1}^{k} \alpha_{Vj} \log p_{1j}^V + \sum_{j=k+1}^{n} \alpha_j \log p_{2j} \\ &\quad + \frac{1}{2}\Bigg(\sum_{i=1}^{k}\sum_{j=1}^{k} \gamma_{ViVj}^{*} \log p_{1i}^V \log p_{1j}^V \\ &\quad + \sum_{i=k+1}^{n}\sum_{j=k+1}^{n} \gamma_{ij}^{*} \log p_{2i} \log p_{2j} \\ &\quad + \sum_{i=1}^{k}\sum_{j=k+1}^{n} \gamma_{Vij}^{*} \log p_{1i}^V \log p_{2j} \\ &\quad + \sum_{i=k+1}^{n}\sum_{j=1}^{k} \gamma_{iVj}^{*} \log p_{2i} \log p_{1j}^V \Bigg).\end{aligned} \tag{4}$$

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

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

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 & Muellbauer, 1980a). 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

$$\begin{aligned}w_i\big|_{p_1^V} &= \alpha_i + \sum_{j=1}^{k} \gamma_{iVj} \log p_{1j}^V + \sum_{j=k+1}^{n} \gamma_{ij} \log p_{2j} \\ &\quad + \beta_i \log[I^V / a(p_1^V, p_2)] \qquad \text{for} \quad i = 1, \ldots, n,\end{aligned} \tag{6}$$

where $\gamma_{ij} = \frac{1}{2}(\gamma^*_{ij} + \gamma^*_{ji})$ and $\gamma_{iVj} = \frac{1}{2}(\gamma^*_{ViVj} + \gamma^*_{VjVi})$. 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, that is,

$$w_i|_{p_1^V} = \alpha_i + \sum_{j=1}^{k} \gamma_{iVj} \log p_{1j}^V + \sum_{j=k+1}^{n} \gamma_{ij} \log p_{2j} + \beta_i \log \frac{I^V}{P(p_1^V, p_2)} \quad \text{for} \quad i = 1, \ldots, n. \tag{7}$$

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

$$w_i|_{p_1^V} = \alpha_i^{**} + \sum_{j=1}^{k} \gamma_{iVj} \log p_{1j}^V + \sum_{j=k+1}^{n} \gamma_{ij} \log p_{2j} + \beta_i \log \frac{I^V}{P(p_1^V, p_2)}, \tag{8}$$

where $\alpha_i^{**} = \alpha_{i0} + \sum_{s=1}^{S} \delta_{is} D_s$, and D_s are the translating variables.

The restrictions on the parameters assuming the theoretical properties for utility maximization are: homogeneity, $\sum_{j=1}^{k} \gamma_{iVj} + \sum_{j=k+1}^{n} \gamma_{ij} = 0 \ \forall i$; symmetry, $\gamma_{iVj} = \gamma_{jVi}$ and $\gamma_{ij} = \gamma_{ji}$; and the summations $\sum_{i=1}^{n} \alpha_i^{**} = 1$, $\sum_{i=1}^{n} \delta_{is} = 0$, $\sum_{i=1}^{k} \gamma_{iVj} + \sum_{i=k+1}^{n} \gamma_{ij} = 0 \ \forall j$, and $\sum_{i=1}^{n} \beta_i = 0$.

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

$$w_{it}|_{p_1^V} = \alpha_{i0} + \sum_{s=1}^{S} \delta_{is} D_{st} + \sum_{j=1}^{k} \gamma_{iVj} \log p_{1j}^V + \sum_{j=k+1}^{n} \gamma_{ij} \log p_{2j} + \beta_i \log \frac{I_t^V}{P(p_1^V, p_2)} + u_{it}, \tag{9}$$

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

$$w_{it} = \tilde{\alpha}_{i0} + \sum_{s=1}^{S} \tilde{\delta}_{is} D_{st} + \sum_{j=1}^{n} \tilde{\gamma}_{ij} \log p_j + \tilde{\beta}_i \log \frac{I_t}{P(p_1, p_2)} + \tilde{u}_{it}. \tag{10}$$

If the additive disturbance terms u_{it} 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 can be 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, 1969). 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" is dropped for this application, and its parameters are recovered using the summation restrictions. The share equations are estimated using the statistical software package SAS, release 6.12, and the SUR method.

IV. Calculation of Virtual Prices and Data

A. *Calculation of Virtual Prices*

The correct price to use for the rationed goods in the prereform years is the virtual price, which sets the quantity demanded equal to the rationed quantity. Thus, calculating the 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 take two approaches in calculating the virtual prices.

First, a pragmatic approach uses external (German) 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 (a nonrationed good) of the two countries. This provides some evidence that if the prices move together the markets are not separated (Mundlak & Larson, 1992). Also, for 1993 to 1998, we compare prices of some food items in Germany and Poland and find 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 are goods

[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 high positive correlation between the relative prices of milk in Germany and Poland (correlation coefficient 0.684), between the relative prices of bread (correlation coefficient 0.683), and between the relative prices of sugar (correlation coefficient 0.963). A positive but smaller correlation existed for the relative price of pork (correlation coefficient 0.16).

consumed both in Poland and Germany. The Polish goods are divided into two groups. In group I, we place the rationed goods—food and housing. In group II, we place the nonrationed goods—alcohol, clothing and footwear, electricity and gas, communication, and transportation. First, to derive the relative price effect of rationing on food, we compute, as follows:

$$\ln RP_F = \ln \frac{p_F^G/p_{OG}^G}{p_F^P/p_{OG}^P}, \tag{11}$$

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, and $\ln RP^F$ is the proportional increase in the relative price of food in Germany compared 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 for housing is computed using the same procedure:

$$\ln RP_H = \ln \frac{p_H^G/p_{OG}^G}{p_H^P/p_{OG}^P}, \tag{12}$$

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 is then defined to be $1 + \ln RP^H$ multiplied by the actual Polish housing price index.[4]

Second, we follow Hausman's (1997a) method of calculating virtual prices. For this method, the virtual prices are imputed from an estimate of the complete demand system for the postreform period. Virtual prices are calculated for food and housing. Here the preferences for a complete demand system (AIDS) with actual prices for the period 1990–1992 are first estimated. Next, using these estimated coefficients, we back out the implied virtual prices that support the prereform data, as the prices at which the shares are the rationed quantity shares. These prices are then averaged across households in each of the prereform years.

B. 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 (GUS) 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 & Peczkowski, 1992). The expenditure data are quarterly. Detailed information on the survey data is given by Adam (1993).

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

In the application of AIDS, 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 (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 to be 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.[5]

The main source for the prices of different commodities and services in Poland is the Polish Statistical Yearbook 1993 and 1994, published by the Polish Central Statistical Office (GUS, 1993, 1994). GUS recorded regional price variation for food items before and after the reform. The main source for German prices of goods and services is the German Statistical Yearbook 1991 and 1992 (Statistisches Bundesamt, 1991, 1992). We use 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 A 2.3, p. 154, "Expenditure Categories for Price Index" (percent) for 1993]. Regional price indices are constructed for food using the available price information for the following food items: bread, pork, milk, and sugar.[6] All price indices are 100 at the end of 1990 (fourth quarter). Quarterly price

[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 they were 6.01, 6.87, and 6.52. These ratios were compatible with available anecdotal evidence. According to a World Bank study for Poland, the rationing of meat was associated with free-market prices three to four times higher than the official prices in state shops for 1988 and 1989 (Atkinson & Micklewright, 1992).

[5] There are problems with including housing in the static demand system, because housing expenditures do not satisfy the intertemporal separability requirements for owner-occupiers, and there were also data-quality issues with getting comparable expenditure shares for owners and renters. We estimated a full AIDS model without housing. The parameters were similar to the AIDS with actual prices, and the CLI was approximately the same. This CLI result was as anticipated, because housing, a rationed good, was a major component of the cost of living. The results for the estimated AIDS model without housing and the CLI are available from the authors.

[6] From a World Bank study of Poland (1995) it was evident that bread, pork, milk, and sugar are the most important food items in terms of budget

indices are constructed using the data on quarterly inflation rates in Poland for 1987 to 1992, obtained from the GUS.

V. Cost-of-Living Indices

CLIs are to be calculated using the estimated parameters from the complete demand system. The CLI is the relative cost of reaching a given standard of living for 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—$L(p^1, p^0) = \Sigma p^1x^0/\Sigma p^0x^0 = \Sigma p^1x^0/I^0$, 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 take account of substitution among commodities due to relative price changes (Deaton & Muellbauer, 1980a). In short, the CPI is crude instrument for measuring the effect of inflation on individual welfare.

The true CLI 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

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

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 is defined as the prereform years. The true CLI can be calculated if we know the cost function $C(U, p)$. From the estimated 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 CLIs from equation (13). The CLIs show the impacts of price liberalization on households' welfare during the transition.

With the estimated coefficients from the virtual AIDS and the standard AIDS, we can calculate indirect utility. The compensating variation given by the difference in cost functions, $CV = C(p^1, U^0) - C(p^0, U^0)$, for each household can be evaluated directly.[7] 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 changes during the transition in the Polish economy.

VI. The Incidence of Impacts of Transition for Selected Household Groups

The main goal of the estimation of the Polish household demand system is 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 is first fitted to quarterly data for 1987 to 1992, ignoring rationing effects (using the actual prices for the rationed goods). Some of the results are inconsistent with theory such as giving a positive sign for the compensated own-price elasticity for housing (table 3). Hence, the model ignoring rationing does not conform to predictions from economic theory, suggesting misspecification of the model of household demand.

Next, after the reforms, the AIDS model is fitted,[8] and the coefficients are used to impute the Hausman virtual prices for food and housing for the prereform years. For the prereform years, the Hausman virtual price for food is very similar to the actual price. For housing, the Hausman virtual price is 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.

The AIDS model with virtual prices for the rationed goods is fitted for the quarterly data for 1987 to 1992, using both sets of virtual prices. Tables 4 and 5 present the estimates of the own- and cross-price elasticities of household demand. All the compensated and uncompensated own-price elasticities are negative, and their standard errors are relatively small, except for the compensated own-price elasticity for fuel in the AIDS model, where virtual prices were developed using the external source. The Marshallian own-price elasticities for food, housing, and fuel are less than 1, whereas those for alcohol and clothing are greater than 1, suggesting elastic demand. The estimates derived from the virtual AIDS model give plausible values for price and income elasticities. Comparing the Hicksian elasticities with virtual prices using both approaches, the elasticities in absolute value are found to be higher using the Hausman approach.[9]

Finally, using the coefficients from the AIDS model with actual prices (appendix table A1), with external virtual prices (table A2), and with Hausman virtual prices (table A3), we estimate 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, increases from 1987 to 1992 by 36%, or by an average of 6.15% per year. The CLI constructed using Hausman virtual prices increases by 26% over the period, or by an average of 4.62% per year. Finally, the CLI using external virtual prices increases by 13% over the

shares. Specifically, the expenditure shares in 1993 were bread, 33%; pork, 33%; milk, 17%; and sugar, 17%.

[7] See Banks, Blundell, and Lewbel (1997) for a similar procedure.

[8] The results from the estimated AIDS model with postreform data are available from the authors.

[9] Using the Hausman approach for calculating the virtual prices, 89% of the observations in the data set have negative compensated own-price elasticities; using virtual prices from the external (German) source, 80%.

TABLE 3.—ESTIMATED DEMAND ELASTICITIES: AIDS WITH ACTUAL PRICES[a]

Group[b]	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 (0.009)
Alcohol	0.44 (0.17)	−2.84 (0.27)	1.35 (0.28)	1.55 (0.16)	−0.10 (0.06)	−0.49 (0.07)
Clothing	−0.54 (0.06)	0.36 (0.08)	−0.38 (0.09)	−0.34 (0.06)	−0.34 (0.02)	−0.01 (0.04)
Housing	−1.38 (0.06)	0.45 (0.05)	−0.40 (0.03)	0.03 (0.13)	−0.30 (0.04)	0.07 (0.04)
Fuel	−0.88 (0.03)	−0.03 (0.01)	−0.35 (0.02)	−0.25 (0.03)	−0.32 (0.02)	0.55 (0.03)
Other	−0.32 (0.03)	−0.31 (0.02)	−0.02 (0.02)	0.07 (0.04)	0.40 (0.02)	−1.14 (0.04)
			Hicksian Elasticities			
Food	−0.001 (0.005)	0.06 (0.005)	0.02 (0.01)	−0.12 (0.01)	−0.05 (0.01)	0.10 (0.01)
Alcohol	0.99 (0.08)	−2.81 (0.29)	1.47 (0.28)	1.66 (0.16)	0.02 (0.05)	−0.33 (0.08)
Clothing	0.08 (0.09)	0.40 (0.04)	−0.24 (0.08)	−0.21 (0.07)	−0.21 (0.02)	0.18 (0.04)
Housing	−0.62 (0.06)	0.50 (0.05)	−0.23 (0.04)	0.19 (0.13)	−0.13 (0.04)	0.30 (0.06)
Fuel	−0.25 (0.03)	0.01 (0.01)	−0.21 (0.02)	−0.12 (0.03)	−0.18 (0.02)	0.74 (0.02)
Other	0.34 (0.03)	−0.27 (0.02)	0.13 (0.03)	0.20 (0.04)	0.54 (0.02)	−0.94 (0.05)

Group	Income Elasticity	Mean Share
Food	0.68 (0.003)	0.50
Alcohol	1.10 (0.02)	0.03
Clothing	1.25 (0.01)	0.11
Housing	1.53 (0.01)	0.10
Fuel	1.27 (0.01)	0.11
Other	1.31 (0.01)	0.15

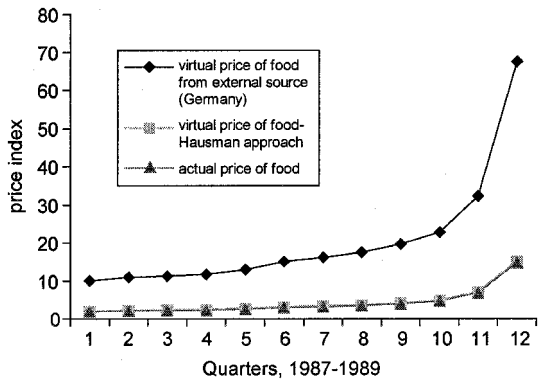
[a] Figures in parentheses are the estimated standard errors of elasticities.
[b] Alcohol includes tobacco. Clothing includes footwear. Fuel includes electricity, transportation, and communication.

whole period, or by an average of 2.44% per year. Thus, the bias in the CLI due to ignoring the rationing effects ranges from 1.53 to 3.71 percentage points per year.

The total welfare loss for different family types has the potential to differ, and measures for seven groups were computed and are reported in table 6. We make three calculations for comparison; two allow for rationing—with external prices and with Hausman approaches—and a third ignores rationing. We report welfare changes measured with compensating variation for seven household types. First, we need to know how much income changed. Table 6 shows this change, measured as the virtual expenditure change and (ignoring rationing) the actual expenditure change. Finally, the ratio of the total welfare loss to the 1987 real total expenditure was computed for all household groups. The group most affected by the economic reform in Poland is families having three children, who have the highest welfare loss over the transition.

Next, we compare the welfare loss over the period 1987 to 1992. Depending on the choice of virtual prices, the loss is two to four times higher when ignoring rationing than when allowing for it. The magnitude of the losses using external-source virtual prices was much smaller. With both virtual-price methods, virtual prices are higher than the actual or reported prices for the rationed good housing during the prereform period. The virtual price for food from the external source is higher than the actual price for food, and the Hausman virtual price for food is slightly higher. Furthermore, the actual prices for the goods experiencing prereform rationing increase much more than the virtual prices with the reform. Therefore, using the CPI overestimates the welfare loss during the transition.

FIGURE 1.—VIRTUAL AND ACTUAL PRICE OF FOOD IN POLAND



The Hausman virtual price of food is slightly higher than the actual price.

FIGURE 2.—VIRTUAL AND ACTUAL PRICE OF HOUSING IN POLAND

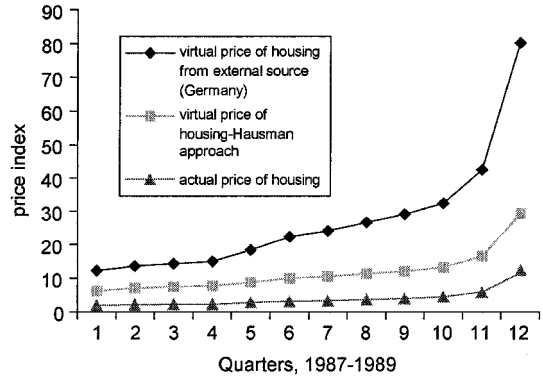


TABLE 4.—ESTIMATED DEMAND ELASTICITIES: AIDS WITH VIRTUAL PRICES FROM EXTERNAL SOURCE[a]

Group[b]	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 (0.005)
Alcohol	−0.26 (0.18)	−1.79 (0.27)	1.67 (0.28)	−0.53 (0.08)	−0.25 (0.07)	0.04 (0.05)
Clothing	−1.08 (0.10)	0.55 (0.09)	−1.40 (0.14)	0.39 (0.05)	−0.82 (0.05)	1.09 (0.04)
Housing	−0.54 (0.05)	−0.09 (0.01)	0.15 (0.02)	−0.66 (0.05)	0.04 (0.02)	−0.49 (0.02)
Fuel	−0.81 (0.04)	−0.07 (0.02)	−0.08 (0.04)	0.13 (0.03)	−0.11 (0.03)	−0.31 (0.03)
Other	−0.47 (0.03)	0.004 (0.013)	0.24 (0.03)	−0.75 (0.03)	0.21 (0.02)	−0.63 (0.06)
			Hicksian Elasticities			
Food	−0.13 (0.01)	0.01 (0.003)	−0.03 (0.01)	0.10 (0.01)	−0.01 (0.01)	0.06 (0.01)
Alcohol	0.42 (0.08)	−1.77 (0.27)	1.74 (0.28)	−0.38 (0.07)	−0.16 (0.07)	0.14 (0.06)
Clothing	−0.31 (0.06)	0.58 (0.09)	−1.33 (0.14)	0.57 (0.05)	−0.72 (0.05)	1.21 (0.04)
Housing	−0.43 (0.05)	−0.05 (0.01)	0.24 (0.02)	−0.44 (0.05)	0.16 (0.02)	−0.34 (0.02)
Fuel	−0.05 (0.04)	−0.04 (0.02)	0.001 (0.04)	0.31 (0.03)	−0.01 (0.03)	−0.20 (0.02)
Other	0.38 (0.03)	0.03 (0.01)	0.33 (0.03)	−0.55 (0.03)	0.32 (0.02)	−0.51 (0.06)

Group	Income Elasticity	Mean Share
Food	0.75 (0.003)	0.61
Alcohol	1.11 (0.01)	0.02
Clothing	1.27 (0.01)	0.06
Housing	1.58 (0.01)	0.14
Fuel	1.24 (0.01)	0.08
Other	1.39 (0.01)	0.09

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

VII. 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 eliminating 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, leading to changing consumption patterns and total expenditures. As subsidies were withdrawn, prices rose rapidly and the Polish living standard declined.

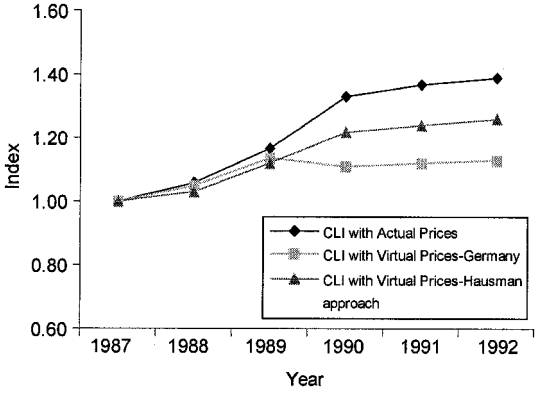
TABLE 5.—ESTIMATED DEMAND ELASTICITIES: AIDS WITH VIRTUAL PRICES—HAUSMAN APPROACH[a]

Group[b]	Food	Alcohol	Clothing	Housing	Fuel	Other
			Marshallian Elasticities			
Food	−0.76 (0.01)	−0.002 (0.001)	−0.04 (0.003)	−0.01 (0.002)	−0.05 (0.003)	−0.01 (0.002)
Alcohol	−0.06 (0.02)	−2.23 (0.28)	0.92 (0.34)	0.37 (0.13)	0.17 (0.08)	−0.11 (0.08)
Clothing	−0.26 (0.01)	0.25 (0.09)	−1.09 (0.20)	0.19 (0.08)	−0.51 (0.05)	0.35 (0.05)
Housing	−0.22 (0.01)	0.08 (0.03)	0.15 (0.07)	−0.74 (0.03)	−0.12 (0.02)	−0.35 (0.02)
Fuel	−0.33 (0.01)	0.05 (0.02)	−0.56 (0.08)	−0.14 (0.02)	−0.39 (0.02)	0.28 (0.06)
Other	−0.17 (0.01)	−0.03 (0.02)	0.27 (0.04)	−0.32 (0.02)	0.20 (0.04)	−1.08 (0.22)
			Hicksian Elasticities			
Food	−0.34 (0.01)	0.02 (0.001)	0.06 (0.003)	0.10 (0.002)	0.04 (0.002)	0.11 (0.003)
Alcohol	0.40 (0.02)	−2.20 (0.28)	1.02 (0.33)	0.49 (0.13)	0.26 (0.08)	0.02 (0.09)
Clothing	0.26 (0.01)	0.28 (0.09)	−0.97 (0.20)	0.33 (0.08)	−0.40 (0.05)	0.50 (0.05)
Housing	0.38 (0.01)	0.11 (0.03)	0.28 (0.07)	−0.58 (0.01)	−0.002 (0.07)	−0.18 (0.02)
Fuel	0.20 (0.01)	0.08 (0.02)	−0.44 (0.08)	−0.001 (0.03)	−0.28 (0.03)	0.44 (0.06)
Other	0.39 (0.01)	0.01 (0.02)	0.39 (0.04)	−0.17 (0.02)	0.31 (0.04)	−0.92 (0.22)

Group	Income Elasticity	Mean Share
Food	0.87 (0.003)	0.49
Alcohol	0.93 (0.01)	0.03
Clothing	1.07 (0.01)	0.11
Housing	1.21 (0.01)	0.13
Fuel	1.09 (0.01)	0.10
Other	1.14 (0.01)	0.14

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

FIGURE 3.—COST OF LIVING INDEX WITH ACTUAL AND VIRTUAL PRICES: POLAND, 1987–1992



The problem of rationing is similar to the problem caused by the introduction of new goods in a market economy: a good that is unavailable because it has not been developed and marketed is effectively rationed at a zero quantity to consumers. Hence, the U.S. CPI and the true CLI are overestimated by the standard treatment of new goods. Accurately assessing the effects of Poland's transition to a market economy required careful analysis of consumption patterns, total expenditure, rationing, and prices. The virtual prices were higher than the actual or reported prices for the rationed goods during the prereform period. Most evaluations of the welfare impacts of the 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 estimates of welfare loss that neglected the rationing effects during the prereform period, the estimated welfare losses that reflected the rationing were reduced by 50% using Hausman's virtual prices and by 75% using external proxy virtual prices.

GDP in real terms divided by the population greatly overestimated the welfare loss for Poland and likely would have done the same for the other transition economies. Specifically, the GDP-based 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 fairly peacefully. The populations were actually much better off than suggested by those who used crude welfare change measures to chronicle the effects of reforms. Incorporating the effects of consumer rationing not only improves our understanding of transition processes, but also may lead to better-targeted compensation packages. The latter point was illustrated by making welfare loss calculations for selected socioeconomic groups in Poland.

TABLE 6.—WELFARE LOSSES AND HOUSEHOLD GROUP (IN MILLION ZLOTYS)

Variable	Families with: No Child	1 Child	2 Children	3 Children	≥4 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 from Hausman Approach							
Compensating variation	4.11	5.43	5.73	6.11	6.13	3.71	4.61
Virtual real total expenditure in 1987	13.81	18.27	19.31	20.58	20.66	12.45	13.67
Virtual expenditure change[a]	−2.53	−3.55	−3.21	−5.36	−2.44	−2.44	−1.72
Total loss[b]	6.64	8.98	8.94	11.47	8.57	6.15	6.33
Relative loss[c] (%)	48.06	49.13	46.3	55.73	41.48	49.39	46.31
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	472	307	441	170	71	125	979

[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.

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APPENDIX

TABLE A1.—DEMAND SYSTEM PARAMETER ESTIMATES AND *t*-RATIOS: AIDS WITH ACTUAL PRICES

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

All prices are in logarithms.

TABLE A2.—DEMAND SYSTEM PARAMETER ESTIMATES AND *t*-RATIOS: AIDS WITH VIRTUAL PRICES FROM EXTERNAL SOURCE

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

All prices are in logarithms.

TABLE A3.—DEMAND SYSTEM PARAMETER ESTIMATES AND *t*-RATIOS: AIDS WITH VIRTUAL PRICES—HAUSMAN APPROACH

Variable	Food	Alcohol	Clothing	Housing	Fuel
Constant	0.976	0.045	0.002	−0.102	0.045
	(52.74)	(10.46)	(0.19)	(−10.40)	(4.24)
Food price	0.085	−0.003	−0.025	−0.015	−0.029
	(38.97)	(−4.65)	(−19.44)	(−14.48)	(−24.09)
Alcohol price	−0.003	−0.037	0.027	0.011	0.005
	(−4.65)	(−4.40)	(2.72)	(2.75)	(1.96)
Clothing price	−0.025	0.027	−0.009	0.022	−0.055
	(−19.44)	(2.72)	(−0.39)	(2.51)	(−10.42)
Housing price	−0.015	0.011	0.022	0.037	−0.013
	(−14.48)	(2.75)	(2.51)	(8.74)	(−5.06)
Fuel price	−0.029	0.005	−0.055	−0.013	0.071
	(−24.09)	(1.96)	(−10.42)	(−5.06)	(28.39)
ln expenditure	−0.062	−0.002	0.008	0.027	0.009
	(−38.99)	(−5.45)	(9.41)	(32.34)	(10.46)
Adult equivalents	0.028	2.6E-04	0.006	−0.016	−0.005
	(25.12)	(0.54)	(9.67)	(−27.71)	(−8.28)
Age	0.001	3E-04	4E-04	−0.001	−3E-04
	(1.95)	(4.06)	(2.56)	(−8.49)	(−1.82)
Age squared	5.74E-06	−7.4E-06	−1E-05	1.3E-05	7.5E-06
	(1.74)	(−9.96)	(−5.91)	(7.21)	(4.01)
Education	0.018	0.002	−1E-04	−0.006	−0.003
	(38.84)	(16.89)	(−0.49)	(−22.66)	(−11.49)

All prices are in logarithms.