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Household Expenditure Patterns for Carbohydrate Sources in Russia

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This study provides a unique view of the demand for carbohydrate sources in Russia at the household level. The data used in this analysis were obtained from a 1996 survey in eight Russian metropolitan areas. An almost ideal demand system (AIDS) model is used to examine the expenditures for potatoes, bread, flour, rice, and pasta. The impacts of household demographic factors on the consumption of carbohydrates are also discussed.

Key words: carbohydrate sources, consumer demand, demographic variables, household survey, Russia, Shonkwiler and Yen consistent two-step estimation procedure

Introduction

The volatile nature of the Russian political and economic system in recent years has brought about severe changes in the availability of food for consumers. Russia experienced a staggering 35% year-to-year drop in forecast grain (primarily wheat) availability over the 1994–1998 five-year period, partially due to adverse weather conditions and in part due to the virtual elimination of grain imports. Imports of processed food have likewise been decimated since the devaluation of the ruble in August 1995. Reduced purchasing power has forced Russian consumers to rely more on basic food items such as bread, but the declining availability of grain has made even these "cheap" energy sources more expensive [U.S. Department of Agriculture/Foreign Agricultural Service (USDA/FAS), 1998].

The economic crisis of 1998 triggered hyperinflation in Russia. From September 1998 to August 1999, the nominal price of wheat (in rubles) in Russia nearly tripled, going from 1,020 R to 3,010 R ($80 to $124) per metric ton. Similarly, the nominal price of top-grade flour more than doubled during this time period, from 3,380 R to 7,005 R. These prices continued to rise even though the production and import projections for 1999 were higher than in previous years (USDA/FAS, 1999a). The consumer price index (CPI) increased by 120% over the period September 1998 through August 1999, while the food and beverage price index rose by 140% during the same time period [Russian-European Centre for Economic Policy (RECEP)]. By contrast, in 1996 and 1997, the CPI rose only 20% and 10%, respectively (State Committee of the Russian Federation on Statistics). Inflation slowed again in 1999. The CPI rose 40% in 1999 and 20% in 2000, and similar changes were observed in the food and beverage index for these years (1.35 and 1.17, respectively) (RECEP).

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Lower-than-average potato harvests in recent years have also spurred Russian imports of potatoes. Prior to 1997–98, annual potato imports had dropped to roughly 70,000 tons due to above-average production. Low production in 1997–98 resulted in a swelling of imports to 180,000 tons. However, 1998–99 imports were forecast to be only 130,000 tons because of the 1998 ruble devaluation (USDA/FAS, 1999b). As with grains, potatoes represent a primary energy source for Russian households which has become more expensive due to reduced purchasing power.

In recent years, Russia has experienced an economic turnaround. New economic reforms, including the law of land ownership, have promoted further growth of the Russian economy as well as the political and economic integration of Russia with Western economies such as the European Union (EU) and the United States. Although harvest volume was good in 2001 (the most recent year for which crop data were available at the time research was conducted for this study), the availability of quality wheat is a continuing concern. Based on USDA/FAS projections for 2002, it was anticipated that the 2001 low grain prices might negatively affect the following year's output by reducing incentives for farmers to plant spring crops (USDA/FAS, 2001). Grain imports were expected to increase in 2002. However, a positive grain trade balance was forecast for 2002, as export shipments were still predicted to be greater than imports. Nevertheless, exports for 2002 were forecast to be lower than in 2001 due to increased world wheat production and stocks, and new wheat import duties in the European Union (USDA/FAS, 2002).

The size of the market, along with a desire to continue favorable political relations with Russia, have made raw commodity and processed food exports to Russia an important issue for both U.S. agribusinesses and government agencies. Because U.S. agriculture depends on foreign markets to sustain profitability, U.S. exporters must assess means for rebuilding and expanding shipments of small grains and potatoes to Russia. This could be achieved through a combination of favorable economic adjustments in Russia and U.S. agricultural policies encouraging exports. Appropriate actions by either country could effectively result in increased Russian household (disposable) income and cheaper U.S. imports. To comprehend the magnitude of market potential requires an understanding of the tastes and preferences and purchasing habits of Russian consumers. However, a paucity of detailed information on household expenditure patterns has been a hindrance to such market research in the past.

This study provides some insight into the demand for carbohydrate sources (i.e., grain-based products and potatoes) by households in eastern Russia. For decades, information on food demand at the household level in Russia was not observable. The allotment system of Communism did not allow for variations in food expenditures and consumption resulting from price and/or income responses. The move toward a free-market system in Russia has made it possible to measure household expenditures on various items and examine the impacts of prices, household income, and demographic differences on consumption patterns.

Data and Procedures

The data used for this analysis come from a 1996 study of household expenditures in eastern Russia metropolitan areas. These data were gathered as part of a larger market study examining opportunities for exporting more U.S. rice to Russia. Accordingly, although the data reflected reliable price and consumption information for a broad array of food products, carbohydrates were of primary interest. In addition, the carbohydrate sector is the only food category where the general public receives direct subsidies—specifically for bread.

A primary assumption in performing this study with these data is that carbohydrates are separable from other food items purchased by consumers, i.e., a price change in a carbohydrate food item would not directly impact purchase decisions related to meats, dairy products, fruits, or vegetables. Previous studies related to carbohydrate consumption have also assumed two-stage budgeting. Richards, Kagan, and Gao (1997) recognized separability in their evaluation of potato and potato substitute demand using data from numerous USDA and Bureau of Labor Statistics resources. Gao, Wailes, and Cramer (1994), and Richards, Gao, and Patterson (1998) similarly recognized separability in studies utilizing data from the U.S. Nationwide Food Consumption Survey (NFCS) (USDA/Human Nutrition Information Service, 1992)—the survey format after which this study's survey instrument was modeled.

The American Business Center of Vladivostok contracted with Russians trained in interviewing to conduct the on-site interviews, which were carried out in late February and March 1996. Following the accepted survey protocol of focus interviews and testing of the survey instrument, a research design was developed focusing on eight major markets representative of the total market area of Siberia and the Russian Far East. The eight cities chosen for the survey, with their approximate populations shown in parentheses, were: Vladivostok (750,000), Khabarovsk (700,000), Irkutsk (500,000), Ulan Ude (500,000), Krasnoyarsk (800,000), Novosibirsk (1,000,000), Omsk (1,000,000), and Tomsk (1,000,000).

Statistical determination[1] of the necessary sample size in each city revealed that 200 usable surveys would ensure response with 95% repeatability and a 4% margin of error in responses in each city. Interviews were conducted in retail shops in middle-class neighborhoods. The intercept method was used to select respondents—i.e., interviewers "intercepted" respondents as they carried out their shopping activities. This procedure was conducted in five representative neighborhoods in each city until 200 completed surveys were obtained. A screening question was used to ensure only the household's primary shopper was interviewed. All interviews were enumerated in Russian by Russians to avoid misinterpretation and limit interviewer bias.

Average respondent age across the region was 36.34 years, ranging from 31.09 years in Ulan Ude to 41.26 years in Novosibirsk. The number of persons per household ranged from 3.28 in Novosibirsk to 3.99 in Tomsk, averaging 3.64 over the entire sample population. Average monthly income net of housing subsidies for the region was 1.74 million rubles per household. Households in Krasnoyarsk, Vladivostok, Khabarovsk, and Irkutsk had monthly incomes of at least 2 million rubles; households in the remaining four cities reported monthly incomes of less than 1.5 million rubles.

Respondents were asked about average weekly expenditures and quantities of 20 food items: beef, pork, chicken, fish, processed meats, eggs, cheese, milk, butter, fats and oils, sugar/candy, fresh fruits and vegetables, canned fruits and vegetables, potatoes, bread, flour, rice, pasta, other grains, and beverages (nonalcoholic). Weekly food expenditures

[1] Probability sampling assumed a 50% (most conservative) negative response (nonpurchase) rate of the form $N = [\sigma^2 \rho(1 - \rho)]/e^2$.

Table 1. Descriptive Statistics for Carbohydrate Expenditures and Quantities, Weekly Income, and Household Size for Responding Russian Households

Variable		Mean	Standard Deviation	Minimum	Maximum
Potatoes:	Expenditure (rubles)	9,685.0	15,578.0	0	200,000.0
	Quantity (kg)	4.43	6.09	0	50.0
Bread:	Expenditure (rubles)	18,000.0	17,962.0	0	150,000.0
	Quantity (kg)	6.40	6.78	0	75.0
Flour:	Expenditure (rubles)	5,296.2	9,936.3	0	225,000.0
	Quantity (kg)	1.39	2.41	0	50.0
Rice:	Expenditure (rubles)	3,764.3	4,754.0	0	60,000.0
	Quantity (kg)	0.73	0.94	0	12.0
Pasta:	Expenditure (rubles)	5,715.2	6,671.4	0	70,000.0
	Quantity (kg)	0.96	1.19	0	15.2
Weekly Income (rubles)		427,810	781,130	16,154	23,077,000
Household Size (no. of persons)		3.64	1.43	1	9

Note: The number of observations is 1,372 (86% of total number of households) after dropping those households that did not report their income and/or food expenditures, and those households with annual income over 50 million rubles.

averaged 679,172 R per household, ranging from 549,145 R in Novosibirsk to 858,310 R in Krasnoyarsk.

The purpose of this study was to examine the demand for carbohydrate sources by Russian households under the economic and political conditions faced by Russia since the demise of Communism. Five commodity groups were used in this analysis: potatoes, bread, flour, rice, and pasta. Households providing appropriate responses to the survey indicated their average weekly expenditures and quantities for these commodities, reported in table 1.

The Models

To examine the expenditures on various carbohydrate sources by responding households, an almost ideal demand system (AIDS) model[2] was used (Deaton and Muellbauer, 1980). This model is an extension of the Working-Leser model for estimating Engel curves:

$$w_i = \alpha_i + \beta_i \log(EXP), \tag{1}$$

where w_i = budget share, EXP = expenditures, and α_i and β_i are parameters to be estimated.

As argued by Deaton and Muellbauer (1980), α_i and β_i in the Working-Leser model can represent functions of prices, thereby accounting for price effects if one wishes to estimate Engel curves using time-series data. The premise of the AIDS model stems from duality concepts that link expenditures (*EXP*) to a cost function. After derivation, the general AIDS model is denoted as a system of equations with the form:

[2] Weak separability was assumed. This assumption may be tested using the procedures outlined by Nayga and Capps (1994), or Eales and Unnevehr (1988).

(2) $$w_i = \alpha_i + \sum_j \gamma_{ij} \log(p_j) + \beta_i \log\left(\frac{EXP}{P}\right), \quad i = 1, ..., 5,$$

where i represents carbohydrate sources, EXP is a given level of expenditures, and P is a price index defined by the nonlinear equation:

(3) $$\log(P) = \tau_0 + \sum_k \tau_k \log(p_k) + ½ \sum_k \sum_j \delta_{kj} \log(p_k) \log(p_j).$$

The theoretical restriction of additivity is met by:

(4) $$\sum_k \alpha_k = 1, \quad \sum_k \beta_k = 0, \quad \sum_k \gamma_{kj} = 0,$$

and homogeneity in prices is satisfied if and only if:

(5) $$\sum_k \gamma_{jk} = 0.$$

Symmetry is satisfied if:

(6) $$\gamma_{ij} = \gamma_{ji}.$$

The Stone Price Index was utilized as a linear approximation of P:

(7) $$\log(P^*) = \sum_k w_k \log(p_k), \quad P \cong P^*,$$

which makes the price index (P) proportionally the same as some other price index (P^*). The resulting model is now a *linear approximation* of the almost ideal demand system (LA/AIDS).

Deaton and Muellbauer (1980) also suggest a scaling function can be interpreted as a measure of household size that takes into account economies of household size which can be used to deflate total expenditures to reflect a "needs corrected per capita level" (p. 314). Because Russian households spend approximately half of their incomes on food (Shiptsova, Goodwin, and Holcomb, 2000), household food demand is affected substantially by the number of people in the household. In this study, the demographic scaling procedure originally proposed by Barten (1964) is used for the household size variable. In addition, other demographic variables are considered in the model, consistent with many previous demand analyses (e.g., Hyman and Shapiro, 1974; Park et al., 1996).

The original demand equations, in simplest form, can be expressed as:

(8) $$D_i = D_i(\mathbf{P}, \mathbf{S}, EXP), \quad i = 1, ..., n,$$

where D_i is per capita demand for the ith carbohydrate source, $\mathbf{P}$ is a vector of commodity prices, $\mathbf{S}$ is a vector of demographic variables, and n is a number of commodities. The modified (scaled) system is written as:

(9) $$D_i(\mathbf{P}, \mathbf{S}, X) = a_i D_i^*(p_1 a_1, p_2 a_2, ..., p_n a_n, X) = a_i D_i^*(p_1^*, p_2^*, ..., p_n^*, X),$$

where $p_i^* = a_i p_i$ are scaled prices, and a_i are scaling parameters which are functions of demographic variables s_r, $r = 1, ..., d$. When scaling a_i functions are the same for all commodities, they can be interpreted as reflecting the number of "equivalent adults" in the household. The following scaling functions are used in the estimation:

$$a_i = a_i(s_1, ..., s_d) = \prod_r s_r^{\eta_{ir}}. \tag{10}$$

This form of scaling function was previously employed by Green, Hoy, and McManus (1991) within the LA/AIDS model framework when estimating effects of advertising on consumer demand. The homogeneity of degree zero constraint for demographic variables is imposed by:

$$\sum_i \eta_{ir} = 0, \quad r = 1, ..., d. \tag{11}$$

This procedure also allows for accounting for the economies of household size on the demand for carbohydrate sources.

Product prices were not provided by responding households; only quantities and expenditures for commodities were reported. Prices were therefore derived for consuming households by dividing expenditures (rubles) by quantities (kilograms). Not all of the 1,600 responding households reported average weekly purchases of each carbohydrate source. To allow the use of as many observations as possible in the demand estimations, average prices from consuming households for each metropolitan area were assigned as prices for households from that same metropolitan area which did not report average weekly purchases. Elementary statistics for aggregate imputed prices are reported in table 2, and more detailed information for each metropolitan area is available from the authors upon request.

As noted previously, some households responding to the average weekly food consumption/expenditure survey indicated no purchases of certain food items, possibly due to infrequent or sporadic purchasing of that commodity or no preference for that commodity. To circumvent censored response bias in this study, the consistent two-step (CTS) estimation procedure proposed by Shonkwiler and Yen (1999) was incorporated. As with the Heien and Wessells (1990) procedure (see also Heien and Durham, 1991; Park et al., 1996), the CTS procedure augments each equation in a demand system (the second step) using information gained from probit estimates (the first step). Drawing upon the mathematical notation used by Shonkwiler and Yen (1999), a system of equations with limited dependent variables can be denoted by:

$$\begin{gathered} y_{ih}^* = f(\mathbf{x}_{ih}, \beta_i) + \varepsilon_{ih}, \quad d_{ih}^* = \mathbf{z}_{ih}'\alpha_i + \nu_{ih}, \\ d_{ih} = \begin{cases} 1 \text{ if } d_{ih}^* > 0, \\ 0 \text{ if } d_{ih}^* \le 0, \end{cases} \quad y_{ih} = d_{ih} y_{ih}^*, \\ (i = 1, ..., n; \; h = 1, ..., H), \end{gathered} \tag{12}$$

where i and h represent, respectively, equation number and household observation; y_{ih} and d_{ih} are observed dependent variables; y_{ih}^* and d_{ih}^* are corresponding latent variables; $\mathbf{x}_{ih}$ and $\mathbf{z}_{ih}'$ are vectors of exogenous variables; β_i and α_i are parameter vectors; and ε_{ih} and ν_{ih} are random errors.

Continuing in the CTS procedure, maximum-likelihood (ML) probit estimates of α_i were obtained for each of the n equations, where n represents a number of carbohydrate

Table 2. Descriptive Statistics for Imputed Carbohydrate Prices (rubles/kg) Paid by Responding Russian Households

Variable	Mean	Standard Deviation	Minimum	Maximum
Potatoes	2.50	2.49	0.13	60.00
Bread	3.19	2.63	0.15	35.00
Flour	4.13	2.98	0.30	50.00
Rice	5.80	4.46	0.30	50.00
Pasta	6.56	3.56	0.40	80.00

Notes: The number of observations is 1,372 (86% of total number of households) after dropping those households that did not report their income and/or food expenditures, and those households with annual income over 50 million rubles. (Summary statistics for each metropolitan area are available from the authors upon request.)

Table 3. Mean Values of Cumulative Distribution Functions (CDFs) and Standard Normal Probability Density Functions (PDFs) from the First-Step Probit Regressions

	CDF		PDF	
Variable	Mean Value	Std. Deviation	Mean Value	Std. Deviation
Potatoes	0.5746	0.0954	0.4200	0.0262
Bread	0.8778	0.0499	0.9068	1.0696
Flour	0.6672	0.0997	0.6221	5.9486
Rice	0.7323	0.0695	1.0727	2.1863
Pasta [a]	0.7570	0.0798	0.5914	1.7237

Notes: The number of observations is 1,372 (86% of total number of households) after dropping those households that did not report their income and/or food expenditures, and those households with annual income over 50 million rubles.

[a] The CDF and PDF for pasta were not used in the second-step estimation because the equation for pasta was dropped to avoid singularity of the variance-covariance matrix of disturbance terms.

sources. The exogenous variables used in these probit estimations were household characteristics that might influence purchasing decisions, such as household size and income; binary variables representing households that own a garden; dummy variables for geographic location; discrete variables representing number of people in the household working in government, education, manufacturing industry, communications, or skilled trade; and discrete variables representing number of retired people in the household, and number of persons falling in a classification other than the survey's category of "professional" (e.g., doctor, lawyer, engineer, etc.).[3]

Utilizing the cumulative distribution functions (CDFs) and standard normal probability density functions (PDFs) derived from probit estimations (table 3), the second step of the CTS procedure was performed. Shonkwiler and Yen (1999) mathematically denote the augmented system of equations as:

$$(13) \qquad y_{ih} = \Phi(\mathbf{z}_{ih}'\hat{\alpha}_i)f(\mathbf{x}_{ih}, \beta_i) + \delta_i\phi(\mathbf{z}_{ih}'\hat{\alpha}_i) + \xi_{ih},$$

[3] The results for the probit equations estimation in (12) can be obtained from the authors on request.

where Φ is the standard normal CDF for each equation i, ϕ is the standard normal PDF for each equation i, i is a carbohydrate source, $\mathbf{z}_{ih}'$ is a column vector of explanatory variables for household h from probit model equations in (12), and $\hat{\alpha}_i$ is a vector of estimated parameters from probit model equations in (12).

The estimated equations for the AIDS model therefore took on the following form for each household:[4]

$$(14) \qquad w_i = CDF_i \times \left\{ a_i + \sum_j \gamma_{ij}\left[\log(p_j) + \eta_j \log(HSIZE)\right] + \beta_i \log(EXP/P^*) \right\} + \delta_{i18} PDF_i + \varepsilon_i,$$

where w_i is budget share of carbohydrate source i for $i = 1, ..., 5$; p_j is price of carbohydrate source j for $j = 1, ..., 5$; EXP is expenditures on all carbohydrates; P^* is the Stone approximation of the carbohydrate price index; $HSIZE$ is household size; CDF_i is the standard normal CDF for each carbohydrate source i from equation (13); and PDF_i is the standard normal PDF from equation (13).

The system was then estimated using the full-information maximum-likelihood (FIML) procedure in SAS. Tests for homogeneity and symmetry were performed and these assumptions were found to hold. Therefore, theoretical restrictions (5) and (11) for homogeneity (in prices and the demographic variables) and (6) for symmetry (in prices only) were imposed, and the equation for pasta was dropped from the system of equations to avoid singularity of the variance-covariance matrix of disturbance terms.

As pointed out in previous studies (Murphy and Topel, 1985; Shonkwiler and Yen, 1999), the use of maximum-likelihood estimation in each step provides for consistent, albeit to some degree inefficient, parameter estimates. The incorporation of estimated δ's from the first step (in the CDFs and PDFs) introduces heteroskedasticity into the second-step estimation, resulting in consistent but inefficient parameter estimates. Future econometric research is needed to develop an FIML procedure solving both steps simultaneously to address this efficiency issue.

Results

Parameter estimates and their associated *t*-statistics are reported in table 4. It should once again be noted this study assumes these carbohydrate sources are separable from all other goods. Thus, the reported elasticities are conditional. The elasticities were computed according to the method outlined by Green and Alston (1990).

As observed from table 4, own-price coefficients for all the carbohydrate sources are positive and significant, indicating an increase (decrease) in product price increases (decreases) that source's share of total carbohydrate expenditures. Cross-price parameter estimates show that an increase (decrease) in the price of potatoes, flour, and/or rice will result in a smaller (larger) share of carbohydrate expenditures for bread. Although this finding reveals that bread is a complement for potatoes, flour, and rice, the bread expenditure share does not significantly change with the price of pasta. This finding is

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[4] Other demographic variables such as location and profession were initially considered in the estimation. However, because these household characteristics have been incorporated into the estimations of the CDF and PDF per Shonkwiler and Yen (1999), they were not included in the final demand specifications.

Table 4. Unadjusted Parameter Estimates for the LA/AIDS Carbohydrates Model

Explanatory Variable	Carbohydrate Source				
	Potatoes	Bread	Flour	Rice	Pasta
$\text{Log}(P_{Potatoes})$	0.1128*	-0.0403*	-0.0099	-0.0129	-0.0497*
	(9.1132)	(-3.3656)	(-0.9430)	(-1.4481)	(-4.5539)
$\text{Log}(P_{Bread})$	-0.0403*	0.0882*	-0.0232*	-0.0171*	-0.0075
	(-3.3656)	(6.9863)	(-3.0227)	(-2.7235)	(-0.9596)
$\text{Log}(P_{Flour})$	-0.0099	-0.0232*	0.0645*	-0.0216*	-0.0098
	(-0.9430)	(-3.0227)	(6.6150)	(-2.4392)	(-0.9992)
$\text{Log}(P_{Rice})$	-0.0129	-0.0171*	-0.0216*	0.0763*	-0.0248*
	(-1.4481)	(-2.7235)	(-2.4392)	(9.1674)	(-3.0035)
$\text{Log}(P_{Pasta})$	-0.0497*	-0.0075	-0.0098	-0.0248*	0.0918*
	(-4.5539)	(-0.9596)	(-0.9992)	(-3.0035)	(7.8776)
$\text{Log}(EXP/P^{*})$	0.1309*	0.0010	0.0045	-0.0496*	-0.0868*
	(12.7478)	(0.1354)	(0.9409)	(-12.7848)	(-14.2305)
HSIZE	-0.5486*	0.0967	0.0066	0.0358	0.4096*
	(-4.0063)	(0.6708)	(0.0379)	(0.3249)	(2.7274)
PDF	0.3131*	0.5583*	0.0169	0.0444	-0.9328*
	(7.1361)	(8.5346)	(0.5009)	(0.9443)	(-12.0005)
Constant	0.0253	0.3508*	0.1547*	0.2059*	0.2634*
	(0.7412)	(13.5510)	(5.0119)	(6.7311)	(5.8324)

Notes: An asterisk (*) denotes statistical significance at the $\alpha = 0.05$ level. Values in parentheses are t-statistics.

plausible, as bread is a staple of virtually every meal or snack in Russia. Based on the parameter estimates, potatoes are complements for bread and pasta.

The β parameters (EXP, $\mathbf{P}$) disclose some interesting findings for Russian households. As the households divert more rubles to carbohydrate expenditures, the share of budgeted carbohydrate expenditures for potatoes will rise. Conversely, the shares for rice and pasta decline, while the shares for bread and flour do not significantly change. These parameter estimates suggest Russian households may welcome the opportunity to consume more potatoes if more rubles are available (and budgeted) for carbohydrate expenditures.

Price, household size, carbohydrate expenditure, and income elasticity estimates are reported in table 5. Estimated income elasticities for all carbohydrate sources indicate they are all normal goods. As suggested by the statistically significant parameter estimates in table 4, the uncompensated cross-price elasticities show that bread is a net complement for potatoes, flour, and rice when both substitution and income effects are considered. This result is not surprising, since in the Russian Far East, bread is generally consumed at every meal regardless of the other carbohydrate sources offered as part of the meal—partially due to the direct subsidies citizens receive for bread. Rice is a net complement for all carbohydrate sources except potatoes, whereas pasta is a net complement for potatoes and rice only.

Household size elasticity estimates also yielded some interesting insights. Larger households spend more of their carbohydrate budget on pasta and the most commonly consumed and relatively inexpensive carbohydrate source—bread. Much of the pasta in eastern Russia is low quality (mushy) and inexpensive, which makes it a more attractive carbohydrate source for large families with severe budget constraints. Conversely, the

Table 5. Price, Household Size, Expenditure, and Income Elasticities (via Green and Alston, 1990) for Carbohydrate Sources

	Carbohydrate Source				
Elasticity	Potatoes	Bread	Flour	Rice	Pasta
Potatoes[a]	-0.6738*	-0.1166*	-0.0286	-0.0373	-0.1436*
Bread[a]	-0.0814*	-0.8221*	-0.0469*	-0.0345*	-0.0152
Flour[a]	-0.0572	-0.1341*	-0.6275*	-0.1246*	-0.0566
Rice[a]	-0.0945	-0.1251*	-0.1582*	-0.4409*	-0.1814*
Pasta[a]	-0.2524*	-0.0383	-0.0498	-0.1258*	-0.5337*
HSIZE[b]	-0.2506*	0.0541	-0.0068	-0.0156	0.3210*
Expenditure[c]	1.3783*	1.0020	1.0262	0.6364*	0.5591*
Income[d]	0.1790*	0.1301	0.1333	0.0826*	0.0726*

Note: An asterisk (*) denotes statistical significance at the $\alpha = 0.05$ level.

[a] Price elasticities (compensated): $\varepsilon_{ii} = -\delta_{ij} + \gamma_{ij}(CDF_i/w_i)$, where $\delta_{ij} = 1$ if $i = j$, and zero otherwise.

[b] Household size elasticities: $\pi_i = (\Sigma\, \gamma_{ij}\eta_j)*(CDF_i/w_i)$.

[c] Expenditure elasticities: $\mu_i = 1 + \beta_i(CDF_i/w_i)$.

[d] Derived by multiplying μ_i by the income elasticity of carbohydrate expenditures.

shares of carbohydrate expenditures assigned to potatoes, flour, and rice decrease as household size increases. The decrease in budget share of potatoes in larger households is not unexpected, because many households in Russia grow their own potatoes.

Expenditure elasticities ranged from 0.6 for rice to 1.4 for potatoes (table 5). These elasticities indicate that a 1% increase in budgeted carbohydrate expenditures would result in increased potato consumption of almost 1.5%, with expenditures for bread and flour increasing near a proportional 1%. Smaller growth trends are evident in rice and pasta (approximately 0.6% each).

Income elasticities have been derived through the use of an auxiliary regression of carbohydrate expenditures on household income. Multiplying the expenditure elasticities by the income elasticity of carbohydrate expenditures gives the income elasticities for each carbohydrate source (Hyman and Shapiro, 1974; Manser, 1976; Capps, Tedford, and Havlicek, 1985; Park et al., 1996). The income elasticities confirm these carbohydrates are all normal goods. Furthermore, the fact that the income elasticities are near zero for rice and pasta provides evidence for the premise that these food sources are viewed as staple items by the households.

Conclusions and Implications

Basic food items such as potatoes, bread, flour, rice, and pasta products have been, and continue to be, the most often consumed food items in Russian households. An increase in income may result in these households dedicating a larger share of their expenditures to potatoes and a smaller share of their expenditures to pasta products. Buckwheat is another widely consumed carbohydrate source in Russia; however, it was not included in the survey, and therefore could not be incorporated within the analysis.

Bread has a more elastic own-price demand than the other carbohydrate sources and was found in this study to be a net complement for potatoes. Further, the surveyed households were more inclined to allocate rubles for additional carbohydrate purchases to potatoes, followed by flour and bread. It may be that Russian households have become generationally dependent on bread and potatoes, thereby making rice and pasta less suitable substitutes for these food items. The importance of these foods to Russian consumers is evident from the government subsidization of bread and the recent rise in imports of potatoes, when even grain imports are declining (USDA/FAS, 1999a, b).

Depending upon the strength of the Russian ruble, market opportunities may exist for U.S. grains and potatoes. For instance, Russia might choose to further expand livestock production and allocate a large portion of domestically produced grains to feed, triggering an increase in imports of higher quality grains for bread production. Availability of grains and potatoes from the European Union, along with the rice supplied by Pacific Rim countries, will determine the ability of U.S. exporters to capture a larger share of Russian markets for carbohydrates. Likewise, commodity availability from Europe and Asia may impact the ability of the United States to politically bargain through the use of food aid programs.

Further studies of habit formation and behavior transitions related to carbohydrate consumption in eastern Russia are warranted, especially as the market structure and government policies (e.g., bread subsidies and grain import practices) evolve over time. Future surveys may wish to collect more and different demographic information to assess the impacts of personal and household characteristics on carbohydrate consumption. However, what can be done in future studies will depend critically on the development of reliable secondary data sources (similar to the U.S. Nationwide Food Consumption Survey or other sources)—sources that currently do not exist.

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