An Evaluation of East Russian Household Expenditures for Non-Dairy Animal Protein Sources

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For decades, information on food demand at the household level was an unobservable phenomenon in Russia. The allotment system of communism did not allow for variations in food expenditures and consumption resulting from price and/or income changes. During communist rule food stores did not always have readily available quantities of various food items, reinforcing the habit of buying in volume and caching items in pantries, cabinets, and freezers when possible. This practice transcended generation gaps and remains prevalent today.

The purpose of this study was to examine the demand for non-dairy animal protein sources by Russian households under the economic and political conditions faced by Russia since the demise of communism. Specifically, the intent was to estimate price-dependent demand relationships and associated cross-product relationships. From this assessment the impact of changes in income and prices of non-dairy protein products on consumption of the various non-dairy protein products could then be estimated.

As Russia and the rest of the Former Soviet Union (FSU) have worked to reform their political and economic structures, their food marketing and distribution systems have struggled to provide citizens with staple food items. Transferring the government-controlled food-processing entities to private ownership has been difficult; disruptions in food availability have been common.

Changing trade policies and economic conditions in these countries have allowed imported meat products to fill voids left by the adjusting market system. As a result, Russia has become the fifth largest buyer of both U.S. beef and pork exports[1] (U.S. Meat Export Federation 1999a and 1999b) and, until 1999, the largest buyer of U.S. poultry products (Thornton 1999) (Table 1). Russia has set the pace for global poultry-products growth, accounting for nearly 60 percent of the growth in poultry-meat trade (almost exclusively chicken) during the 1990s (USDA-FAS 1999). It appears that the need for importation of meat and poultry products will continue into the future as well. A brief look at the domestic production levels for beef, pork, and poultry in Russia between 1992 and 1995 reveals declines of 24.75, 33.01 and 39.84 percent, respectively. By 1998 Russian production of beef, pork, and poultry had decreased even further (Table 2).

Although imports of U.S. meat and poultry products increased in Russia during the 1990s, there was a decline in trade during 1998 and 1999 due to instability of the Russian economy, temporary import bans resulting from alleged food safety issues, and the desire to protect the domestic Russian poultry industry. Because of U.S. agriculture's dependency on foreign markets to sustain profitability, U.S. exporters must determine how to rebuild and expand shipments of their meat products to Russia. This could be achieved through a combination of favorable economic adjustments in Russia and U.S. agricultural policies that encourage exports. Appropriate actions by either country could effectively result in increased Russian household income and cheaper U.S. imports. This is particularly important in Russia because well over 50 percent of household expenditures are for food products (Goodwin, Holcomb, and Shiptsova 1999).

In recent years Russia has experienced economic turnaround. New economic reforms, including laws providing for land ownership, have promoted further growth of the Russian economy and political and economic integration of Russia with western economies such as the EU and U.S. These changes, in concert with ownership of their economic reform program and improvement in the performance of World Bank-supported projects, provide the strongest economic engagement since

[1] Imports of beef and pork have remained fairly stable in the 1990s and amount to less than $50M combined in any one year (USDA-FAS 1993-2000).

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Table 1. Quantity and Value of Poultry Exports from the United States to Russia (thousand metric tons and million US$).

Exports	1992	1993	1994	1995	1996	1997	1998	1999
Value	10.87	80.50	309.88	606.62	912.57	792.91	534.99	122.01
Quantity	14.63	112.38	382.87	732.02	937.05	990.47	724.95	250.22

Source: USDA-FAS (1993–2000).

Table 2. Production of Beef, Pork, and Poultry in Russia.

Meat type	1992 million metric tons	1995 million metric tons	% change between 1992 and 1995	1998 million metric tons	% change between 1992 and 1998
Beef	3.632	2.733	-24.75	2.247	-38.13
Pork	2.784	1.865	-33.01	1.505	-45.94
Poultry	1.428	0.859	-39.84	0.681	-52.31

Source: Calculations based on FAO data downloaded from http://apps.fao.org, 1999.

the 1998 financial crisis (World Bank Group 2002). In addition, per-capita GDP growth is now positive; it was forecast to be 5.0 percent for 2001 and has averaged 3.7 percent per year as of April, 2001 (*Economist* 2002a).

Russia's livestock sector is beginning a slow turnaround as wealthy enterprises and the government are giving support to the meat production sector. For the first time in more than a decade, swine numbers are expected to grow in 2002, although modestly. Although cattle numbers continue to decline, they are falling at a slower rate than several years ago, and are expected to stabilize in the near future as a result of government support and domestic investment. The meat-processing sector continues to rely on inexpensive raw-material inputs. While Russia's demand for imported higher-priced meat is weakening, the strong overall demand for imported product is expected to continue in the near future as Russia's livestock-production sector still has a long way to go to meet domestic demand. Suppliers of inexpensive items will continue to do well in the Russian market (USDA-FAS 2002b).

Poultry production in Russia is expected to grow by seven percent in 2002, as a consequence of the plentiful availability of inexpensive feed from the 2001 grain harvest and as financially rich Russian oil, energy, and metals enterprises enter the domestic agricultural sector. However, long-term production is not expected to improve rapidly, because of internal structural problems. Meanwhile, poultry imports surpassed 1.3 million metric tons during 2001, as Russian consumer demand for poultry continued to expand, partially precipitated by sharp price increases for competing beef and pork products. The Ukrainian veterinary authorities' decision to ban U.S. poultry imports beginning in January 2002 and the subsequent import restriction on U.S. poultry by Russia will result in increased prices for domestic poultry in the near and intermediate term (USDA-FAS 2002a).

This study represents an original effort to assess consumption patterns by Russian households of protein sources and to examine these consumption patterns in light of real or inferred implications for trade policy between Russia and Western Europe and the United States. 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. The share of U.S. meat and poultry

exports going to Russia likewise makes an analysis of household protein demand across geographic regions imperative for those exporters wishing to concentrate their marketing efforts.

Survey Procedures and Subsequent Primary Data

The data used for this analysis come from a 1996 study of average weekly household expenditures in eight metropolitan areas. These data were gathered as part of a larger market study examining opportunities for exporting more U.S. rice to Russia. The survey was carried out in one-week periods during 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 (RFE). Cities chosen for the survey 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); populations are shown in parentheses and are approximations. The American Business Center of Vladivostok contracted with Russians trained in interviewing to conduct the on-site interviews. Statistical determination[2] of sample size necessary in each city revealed that 200 useable surveys would ensure a response rate with 95-percent repeatability and a 4-percent 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 surveys were completed. All interviews were enumerated in Russian by Russians to avoid misinterpretation and limit bias.

Average respondent age across the region was 36.45 years, ranging from 31.09 years in Ulan Ude to 41.26 years in Novosibirsk. Number of persons per household ranged from 3.28 in Novosibirsk to 3.99 in Omsk, and averaged 3.64. Average monthly income for the region (net of housing subsidies) was 1.74 million rubles per household. Households in Krasnoyarsk, Vladivostok, Khabarovsk, and Irkutsk had average monthly incomes of at least 2 million rubles; households in the remaining cities had average monthly incomes of less than 1.5 million rubles.

Respondents were asked about expenditures and quantities for 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 (non-alcoholic) beverages. Weekly food expenditures averaged 283,711 R per household and ranged from 162,916 R in Tomsk to 398,055 R in Irkutsk. Meats, eggs, and dairy products accounted for well over 50 percent of all food expenditures in all cities. Variations in diet were apparent as expenditures varied across food categories for each city, particularly in percentage of food expenditures by category across the food budget.

Six commodity groups were used in this analysis: beef, pork, poultry, fish, eggs, and processed meat products not elsewhere defined. Included in each commodity group (except for eggs) were all the various cuts and selections associated with that commodity. Households responding to the survey indicated their expenditures on these commodities and the quantities purchased during the one-week survey period (Table 3). Households not providing information on income were removed from this analysis, resulting in 1,279 observations.

Analytical Procedures

The procedures implemented to assess consumption patterns of East Russian households, given the nature and content of the data, were: 1) calculate quality-adjusted imputed prices for each commodity; 2) utilize a two-step estimation procedure to account for protein sources that were not purchased by a household during the survey period; and 3) estimate household minimum subsistence levels of non-dairy animal proteins.

Because only expenditures and quantities were provided, prices were derived by dividing household expenditures on a given commodity by the corresponding quantity consumed of that commod-

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

Table 3. Descriptive Consumption/Expenditure Statistics for Russian Households in Eight Cities (n=1,279).

Variable	Mean	Standard deviation	Data density[a]	Minimum	Maximum
		Expenditures (rubles)			
Beef	28,864	17,815	0.7694	2,000	100,000
Pork	23,550	14,992	0.5880	1,414	80,000
Chicken	18,379	10,100	0.7451	1,000	62,500
Fish	11,645	7,081	0.6466	600	40,000
Processed meats	27,864	17,768	0.6959	1,000	100,000
Eggs	31,575	41,005	0.8397	100	180,000
		Quantities (kg)[b]			
Beef	2.10	1.29	----	0.20	7.00
Pork	1.51	0.97	----	0.10	5.00
Chicken	1.62	0.91	----	0.10	6.00
Fish	1.41	0.86	----	0.10	5.70
Processed meats	1.26	0.82	----	0.04	6.00
Eggs	1.94	1.28	----	0.10	6.00

[a] Data density refers to the proportion of non-zero expenditures from the 1,279 households.
[b] Quantities of eggs were measured in 10s of eggs.
Source: Calculations based on U.S. Trade and Development Agency data, 1996.

ity. To account for quality effects in these imputed prices, the Cox and Wohlgenant (1986) method for quality adjustments was incorporated between[3]. Specifically, imputed prices were regressed on the socioeconomic and demographic characteristics of household size, the presence of children under 18 in the household, household income, geographic location and occupation. The OLS regressions for the Cox and Wohlgenant quality adjustments were

$$(1)\quad p_i = \alpha_0 + \alpha_1 HSIZE + \alpha_2 CHILD + \alpha_3 WEEKINC + \alpha_4 DACHA + \alpha_5 KHABAR + \alpha_6 ULAN + \alpha_7 VLADI + \alpha_8 KRASN + \alpha_9 NOVO + \alpha_{10} OMSK + \alpha_{11} TOMSK + \alpha_{12} PROF + \alpha_{13} GOV + \alpha_{14} ED + \alpha_{15} MANU + \alpha_{16} COMMUN + \alpha_{17} TRADE + \alpha_{18} RETIRED + \alpha_{19} OTHPR + \varepsilon_i$$

where p_i represents the imputed price of commodity i, HSIZE represents household size, CHILD is a discrete variable that indicates number of children under the age of 18 in the household, WEEKINC is the weekly household income, and DACHA is a binary variable representing households that own a garden. Dacha owners may have their own chickens, thereby impacting their willingness to pay for eggs and poultry products.

The remaining variables are dummy variables representing the household's geographic location and discrete variables indicating the number of household members employed in a certain occupation. Locations of respondents included the cities of Khabarovsk (KHABAR), Ulan Ude (ULAN), Vladivostock (VLADI), Krasnoyarsk (KRASN), Novosibirsk (NOVO), Omsk (OMSK), and Tomsk (TOMSK). Occupations included a learned profession such as a lawyer or accountant (PROF), government employee (GOV), education (ED), manufacturing employee (MANU), communications specialist (COMMUN), those who generated their household income through a skilled trade (TRADE), retired individuals (RETIRED), and other professions not elsewhere categorized (OTHPR).

Because binary variables were used, one category from each of the demographic characteristics was excluded to avoid singularity. Therefore

[3] See also Park et al. (1996) and Goodwin, Holcomb, and Shiptsova (1997).

Table 4. Descriptive Statistics for Estimated Quality-Adjusted Prices (in Rubles).[a]

Variable	Mean	Standard deviation	Minimum	Maximum	R^2[b]
Beef	14,886	2,579	1,549	28,786	0.12
Pork	16,089	2,684	-816	31,924	0.24
Chicken	11,639	1,858	447	20,520	0.04
Fish	9,373	2,475	-340	22,506	0.10
Processed meats	7,683	4,366	-16,480	30,034	0.16
Eggs	22,794	20,460	-8,751	81,324	0.13

[a] The number of households that purchased these items during the survey period varied by commodity. Mean values derived from these estimates were assigned as quality-adjusted prices for households not reporting expenditures.
[b] Estimation details available from the authors upon request.

the base households were those located in Irkutsk with no children under the age of 18 and no dacha (small garden/farm) to supplement their household food supply. Following the Cox and Wohlgenant (1986) procedure, quality-adjusted prices were generated by adding the estimated intercept term from each of the regressions ($\hat{\alpha}_0$) to the residual (Table 4). Not all households reported average weekly purchases of each protein source. However, only those reporting expenditures were used in the estimation of quality-adjusted prices. When either expenditure or quantity was not provided by a household, $\hat{\alpha}_0$ (the average quality-adjusted price for each commodity) was used for that commodity group (Park et al. 1996).

As previously mentioned, 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 or lack of preference for that commodity. To circumvent censored-response bias in this study, the consistent two-step (CTS) estimation procedure suggested by Shonkwiler and Yen (1999) was used. The first step of this procedure is a probit regression to determine the probability that a household would purchase a given protein source. The probabilities are mathematically denoted as

$$(2)\qquad \begin{aligned} &p_r[Z_{hi} = 1] = \Phi(W_h\delta_i), \\ &p_r[Z_{hi} = 0] = 1 - \Phi(W_h\delta_i) \\ &i = 1,\ldots, n;\ h = 1,\ldots, H \end{aligned}$$

where Φ is the cumulative distribution function (CDF), W_h is vector of regressors (household descriptive variables) related to the purchase decision, and δ_i is the coefficient vector associated with these regressors for each commodity *i*. The probit analyses provide both the CDF and the standard normal probability density function (PDF) in equation (3) for use in the second step of the estimation procedure.

$$(3)\qquad \begin{aligned} CDF_{ih} &= \Phi(W_h\delta_i) \\ PDF_{ih} &= \phi(W_h\delta_i) \end{aligned}$$

In the second step of the Shonkwiler and Yen estimation procedure, the CDFs are used to weight the respective equations in the demand system. PDFs are used as additional regressors.

The linear expenditure system (LES) was used so that both subsistence quantities and expenditures for each protein source could be estimated[4]. In Western economies the LES model is generally considered relevant only when estimating food consumption by poverty-level households (Holcomb, Park, and Capps 1995). For higher-income households, subsistence levels are easily met; therefore household tastes and preference (e.g., convenience, perceived quality, and health concerns) are primary determinants of food purchases. However, in countries with transition economies where low household incomes impose severe budget constraints, subsistence levels may not even be met by some households. Because Russia is a major importer of U.S. poultry and other meat products, the identification of subsistence levels may be useful to both government officials and food-industry specialists

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

involved in food-trade activities with Russia. As the economic conditions in Russia improve one would expect that subsistence levels for proteins would be met and exceeded as consumers substitute higher-priced and higher-quality proteins for carbohydrates.

Each equation in the demand system incorporated the Shonkwiler and Yen CTS method to address censored-response bias. The resulting demand equations are mathematically depicted as[5]

$$(4) \quad p_{ih}q_{ih} = CDF_{ih}\,[p_{ih}\,\gamma_i + \beta_i(PEXP_h - \textstyle\sum_j p_{jh}\gamma_j)] + \alpha_i(PDF_{ih}) + v_i$$

where $p_{ih}q_{ih}$ is the expenditure for the i^{th} commodity by the h^{th} household; p_{ih} is the quality-adjusted price for the i^{th} protein source in household h; γ_i is the subsistence quantity for the i^{th} commodity; $PEXP_h$ is the weekly expenditures on all protein commodities for household h; $PEXP_h - \sum_j p_{jh}\gamma_j$ is the remaining budgeted expenditures after purchasing subsistence quantities of each commodity for household h; β_i is the marginal share of supernumerary income for the i^{th} commodity group ($\Sigma\beta_i=1$); and α_i[6] is the parameter for the PDF of the i^{th} protein group. The equation for processed meats was dropped from the system of equations to avoid singularity of the variance-covariance matrix of disturbance terms. Homogeneity, adding-up, and symmetry are implicit in the LES (Philips 1983). The system was then estimated using the Full Information Maximum Likelihood (FIML) procedure in SAS.

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 δs from the first step (in the CDFs and PDFs) introduces heteroskedasticity to the second step estimation, resulting in consistent but inefficient parameter estimates. Shonkwiler and Yen, suggested future econometric research to develop an FIML procedure solving both steps simultaneously to address the efficiency issues.

Results

Parameter estimates are reported in Table 5. All γ, β, and α estimates were significant at the 5-percent level. As theory prescribes, all βs were positive and between 0 and 1, and all γs were positive. Mean household consumption for each of the proteins in the survey are provided for ready comparison to the estimated subsistence levels.

Subsistence quantities for beef, pork, chicken, fish, and processed meats ranged from roughly 1 kg (fish) to 1.6 kg (beef and pork) per household per week. Chicken and processed meats have estimated subsistence levels of 1.21 and 1.23 kg per week per household, respectively. A variety of reasons could explain why subsistence levels might be lowest for fish, including the availability and quality of fish that manages to reach the non-port cities in this study. Most fish found in the markets of this region are bone-in, and typically smoked or dried. The subsistence quantity of eggs was 19 eggs per household (3.64 persons per household) per week, compared to an average weekly U.S. consumption of 12 eggs per household (2.59 persons per household and 240 eggs per capita per year, derived from figures available in *Food Review* and U.S. Census data). Unlike the U.S., Russian households do not consider eggs primarily a breakfast food. Eggs represent a quickly prepared and versatile food item that are much more available and can be incorporated in any meal, even separate from their use in "composite" meal entrees, baked items, and desserts.

Note that the estimated subsistence levels for each of these protein sources are close to the observed mean weekly household-consumption levels from the survey. For example, the mean consumption levels and subsistence levels for pork, processed meats and eggs are almost identical to one another. However, mean consumption levels are 34.8 percent, 33.4 percent and 37.9 percent above subsistence levels for beef, chicken and fish, respectively. Results of the analysis also indicate that any additional ruble expenditures would be allocated in the following manner: 36.7 percent for

[5] Demographic translating and scaling procedures were initially considered in the LES estimation. However, these household characteristics have been incorporated in the estimations of quality-adjusted prices per Cox and Wohlgenant and the CDF and PDF per Shonkwiler and Yen. Thus they were not included in the final demand specifications.

[6] The α_i associated with the Shonkwiler-Yen modeling framework is in addition to the traditional LES model and therefore has no restrictions.

Table 5. Parameter Estimates for Russian Household Expenditures for Non-Dairy Animal Proteins.[a]

Non-dairy animal protein commodity groups	Parameter estimates			Mean household consumption per survey (kgs/wk)
	γ_i Subsistence levels of consumption (kgs/wk)	β_i Marginal share of expenditures after meeting subsistence	α_i PDF Coefficient	
Beef	1.5582	0.2098	0.0275	2.10
	(8.08)	(17.62)	(5.03)	
Pork	1.5587	0.1966	0.0148	1.51
	(9.03)	(15.65)	(3.59)	
Chicken	1.2145	0.1093	0.0210	1.62
	(8.60)	(15.56)	(5.98)	
Fish	1.0226	0.0611	0.0122	1.41
	(8.08)	(9.74)	(4.96)	
Processed meat	1.2289	0.0558	----	1.26
	(5.95)	(3.57)		
Eggs[b]	1.9356	0.3674	-0.0285	1.94
	(27.71)	(24.20)	(-3.02)	

[a] Numbers in parentheses are t-statistics.
[b] Subsistence levels are reported in 10s of eggs.

eggs, 21.0 percent for beef, 19.7 percent for pork, 10.9 percent for chicken, 6.1 percent for fish, and 5.6 percent for processed meats. These figures represent a substantial change in non-dairy protein-product consumption patterns if additional expenditures allocations are made possible.

Own-price, expenditure, and income elasticities at the means are presented in Table 6. It should be noted that this study assumes these protein sources are separable from all other goods. Thus the reported elasticities are conditional. Of the six commodities, pork and processed meats were least affected by a change in price. The consumption of beef, however, was most likely to decline with an increase in price. Eggs and pork had slightly higher expenditure elasticities than the other protein categories, both exceeding 1.1. As noted earlier, these commodities also had high household subsistence levels. Processed meats had the lowest expenditure elasticity, at roughly 0.28.

As stated in Park et al. (1996), "Income elasticities, not expenditure elasticities, are at the heart of policy decisions." Therefore, income elasticities were generated through the use of an auxiliary linear regression of protein expenditures on income (Hyman and Shapiro 1974; Manser 1976; Capps, Tedford, and Havlicek 1985; Park et al. 1996). The resulting income elasticities for total meat and egg expenditures could then be multiplied by the expenditure elasticities for each of the protein sources to obtain income elasticities for each protein source. The generated income elasticities suggest that these protein sources are normal goods, ranging from 0.18 for fish to 0.40 for eggs.

Implications

The findings of this study may provide some insight into the household expenditure practices of Russian households for meats exporters. These findings may also be (albeit liberally) compared with those for the United States. Park et al. (1996) used similar one-week household data (1987-88 NFCS data) and methodology to analyze differences in food consumption and expenditure patterns for U.S. households divided by income category (poverty

Table 6. Own-Price, Expenditure, and Income Elasticities for Non-Dairy Animal Protein Commodities for Russian Households.

Commodity	Own-price elasticities[a]	Expenditure elasticities[b]	Income elasticities[c]
Beef	-0.4126	1.0113	0.2502
Pork	-0.1696	1.1614	0.2873
Chicken	-0.3302	0.8277	0.2048
Fish	-0.3181	0.7300	0.1806
Processed meats	-0.0812	0.2784	0.0689
Eggs	-0.3688	1.6186	0.4004

[a] Own-price elasticities were calculated as $[\gamma(1-ß)/q]-1$.
[b] Expenditure elasticities were calculated as $ß*PEXP/(p*q)$.
[c] Income elasticities were calculated by multiplying each commodity's expenditure elasticity by the income elasticity of total non-dairy animal protein expenditures (derived via an auxiliary regression).

status and non-poverty status). A brief comparison of Russian households in this survey to the poverty-status households from the 1987-88 NFCS survey is given in Table 7. Only beef, pork, chicken, and fish were available for comparisons.

As previously noted, the surveyed Russian households spent in excess of 50 percent of household expenditures on food, with more than half of those expenditures being for meat and poultry products. It may be that the households are saturated with these protein sources and would therefore spend a smaller percentage of additional income on meat and poultry than would U.S. households. U.S. households also have access to a greater variety of value-added meat products than do Russian households, which may also explain the higher U.S. income elasticities for primary protein sources. Both pork and chicken have been marketed to Americans more on the basis of value-added convenience aspects in the last 15 years, while most Russian households have purchasing options limited to unprepared primal cuts.

Admittedly, these comparisons do not account for the differences in product-form choices or distribution systems between these two countries. It must also be noted that the estimates from Park et al. are for items consumed within the home (not meals purchased outside of the home). Russian households are much less likely to purchase meals prepared outside of the home; therefore, the estimates are probably closer to "true" weekly household subsistence levels.

Results of this study indicate that an increase in the quantity of protein sources demanded by Russian households is more effectively achieved through reducing price than by increasing income. The possibility of Russian household incomes rising enough to significantly impact meat and poultry demand in the near future is small; therefore, continued growth in U.S.-Russian meat and poul-

Table 7.Comparison of Subsistence Quantities and Income Elasticities of Selected Protein Sources for Russian Households and U.S. Poverty-Status Households[a].

	Russian households		U.S. poverty-status households	
Commodity	Subsistence quantities (kg)	Income elasticities	Subsistence quantities (kg)	Income elasticities
Beef	1.5582	0.2502	0.9718	0.4578
Pork	1.5587	0.2873	0.4808	0.4869
Chicken	1.2145	0.2048	0.7375	0.3603
Fish	1.0226	0.1806	0.1476	0.4659

[a] Numbers for U.S. poverty-status households taken from Park et al. (1996).

try trade will necessarily come from diminishing the costs of trade. These trade costs accordingly impact the cost of the final products purchased by Russian households. For example, a 10-percent reduction in the retail price of poultry would result in an annual consumption increase of 2.78 kg of poultry per household based on mean household-consumption levels and computed own-price elasticities from this study. This translates to approximately 41,700 metric tons per year for RFE and Siberia, assuming there are 15 million households in the region with an average number of persons per household consistent with the sample. Assuming also that the current proportion of chicken imported to Russia from the U.S. remains the same and that Russian domestic production remains proportionately the same, this 41,700 metric ton increase in chicken imports represents a 14.3-percent increase in total U.S. poultry exports from 1999 levels and a 5.4-percent increase from 1998 levels.

Trade costs have been heightened as a result of concerns over the state of the Russian economy and the value of the ruble. Interest rates, driven upward by hyperinflation and risk perception from the fear of non-repayment of debt, significantly raise the price of goods coming into Russia. Loan guarantee programs, such as the USDA's GSM 101 and 102, would be useful in reducing these interest costs and would add a degree of safety for the U.S. exporter. Similarly, U.S. fiscal and trade policy guaranteeing letters of credit would be a step toward regaining the agricultural-export levels that existed prior to 1998. These actions, coupled with the implementation of internationally accepted trade standards and continued improvement in the Russian economy, have set the stage for meat and poultry trade to recover to pre-1998 levels. Continued positive developments in the Russian economy—GDP growth increased 3.0 percent on average from 1997 to 2001 and per-capita personal income increased to US$2,140 at market exchange rates—are indicators of potential future increases in U.S. meat and poultry imports into Russia (*Economist* 2002b). Imports may increase even more if there are positive developments in household incomes in Eastern Russia. In any case, trade between the U.S. and Russia is subject to a number of factors including food safety and animal health, as well as protection of a domestic Russian industry attempting to recover to its former status.

References

Capps, O., Jr., J. R. Tedford, and J. H. Havlicek, Jr. 1985. "Household Demand for Convenience and Non-Convenience Foods." *American Journal of Agricultural Economics* 67:863-69.

Cox, T. L. and M. K. Wohlgenant. 1986. "Prices and Quality Effects in Cross-Sectional Demand Analysis." *American Journal of Agricultural Economics* 68:908-19.

Eales, J. S. and L. J. Unnevehr. 1988. "Demand for Beef and Chicken Products: Separability and Structural Change." *American Journal of Agricultural Economics* 70:521-32.

Economist.com. 2002a. "*Country Briefings: Russia - Forecast.*" http://www.economist.com/countries/Russia/profile.cfm?folder=Profile-Forecast.

Economist.com. 2002b. "Country Briefings: Russia - Factsheet." http://www.economist.com/countries/Russia/profile.cfm?folder=Profile-FactSheet.

Goodwin, H. L., Jr., R. B. Holcomb, and R. Shiptsova. 1999. "Revisiting Engel's Law for Post-Communist Russia: An Examination of Household Food Expenditures During Economic and Political Turmoil." Selected paper presented at the 1999 Food Distribution Research Society meetings, October 17–20, 1999, San Antonio, TX.

Holcomb, R. B., J. L. Park, and O. Capps, Jr. 1995. "Revisiting Engel's Law: Examining Expenditure Patterns for Food At Home and Away From Home." *Journal of Food Distribution Research* 26:1-8.

Hyman, S. and H. Shapiro. 1974. "The Allocation of Household Income to Food Consumption." In *Five Thousand American Families – Patterns of Economic Progress*, vol. 2. J.N. Morgan, ed. The University of Michigan Press, Ann Arbor, MI.

Manser, M. 1976. "Elasticities of Demand for Food: An Analysis Using Non-Additive Utility Functions Allowing for Habit Formation." *Southern Economics Journal* 42:879-91.

Murphy, K. M. and R. H. Topel. 1985. "Estimating and Inference in Two-Step Econometric Models." *Journal of Business and Economic Statistics* 3:371-379.

Nayga, R. M., Jr. and O. Capps, Jr. 1994. "Tests of

Weak Separability in Disaggregated Meat Products." *American Journal of Agricultural Economics* 76:800-08.

Park, J. L., R. B. Holcomb, K. C. Raper, and O. Capps, Jr. 1996. "A Demand Systems Analysis of Food Commodities by U.S. Households Segmented by Income." *American Journal of Agricultural Economics* 78:290-300.

Philips, L. 1983. *Applied Consumption Analysis.* North-Holland Publishing Company, Amsterdam.

Putnamat, J. 2000. "Major Trends in U.S. Food Supply, 1909-99." *Food Review* 23,1:8-15.

Shonkwiler, J. S. and S. T. Yen. 1999. "Two-Step Estimation of a Censored System of Equations." *American Journal of Agricultural Economics* 81:972-982.

Thornton, L. 1999. "Top 30 Export Markets: New Ports of Call." *Broiler Industry* 62,7:38-39.

U.S. Census Bureau. "People Quickfacts." http://quickfacts.census.gov/qfd/states/00000.html.

U.S. Department of Agriculture, Foreign Agricultural Service. 2002a. *Russian Federation Poultry and Products Semi-Annual*, GAIN Report #RS2003.

U.S. Department of Agriculture, Foreign Agricultural Service. 2002b. *Russian Federation Livestock and Products Semi-Annual*, GAIN Report #RS2007.

U.S. Department of Agriculture, Foreign Agriculture Service. 1993-2000. *Foreign Agricultural Trade of the United States.* Washington, D.C.

U.S. Department of Agriculture, Foreign Agriculture Service. 1999. "FAS Online: Poultry and Meat Products." http://www.fas.usda.gov/dlp/circular/1999/99-03LP/pltry1.htm.

U.S. Meat Export Federation. 1999a. "Leading Exports for U.S. Beef, 1988-1997." http://www.usmef.org/expstat/BEEF8897.html.

U.S. Meat Export Federation. 1999b. "Leading Exports for U.S. Pork, 1988-1997." http://www.usmef.org/expstat/PORK8897.html.

U.S. Trade and Development Agency.1996. *Assessing the Feasibility of Establishing a Rice Milling Facility in the Russian Far East.*

World Bank Group. 2002. "Country Brief: Russian Federation." http://lnweb18.worldbank.org/eca/eca.nsf/4980307d4e471bd8852567d10014313b/e2e05bddb7ee295f852567ef00789073?OpenDocument.