FS 02-01 February 2002

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ABSTRACT

The impact of the ruble devaluation on U.S. poultry meat exports to the Russian market was simulated as the combined effects of an export subsidy and a tariff on imports using the Global Trade Analysis Project model and data. Russian imports fell while domestic prices rose. U.S. poultry exports and dark meat prices declined.

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Paper presented at the Southern Agricultural Economics Association annual meetings,

Orlando, Florida, February 2-6, 2002.

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*This research was partially funded by the Edmund S. Muskie and Freedom Support Act Graduate Fellowship Program.
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Exchange Rate and Trade Policy Effects on US Poultry Export Prices

Abstract

The impact of the ruble devaluation on U.S. poultry meat exports to the Russian market was simulated as the combined effects of an export subsidy and a tariff on imports using the Global Trade Analysis Project model and data. Russian imports fell while domestic prices rose. U.S. poultry exports and dark meat prices declined.

Introduction: US Poultry in the World Market

Poultry exports have become very important to the US poultry industry. In 1989, exports accounted for only 4.7% of total production, but during the 1990s, exports increased from 7.1% of production in 1992 to 15.2% in 1995. By 2000, exports of 5.5 billion pounds accounted for almost one-fifth of US broiler production (Salin 2001, p. 7).

The primary poultry importing countries and regions of the world are the former Soviet Union led by Russia, Japan, Hong Kong, China, and the Middle East. In the export market, the US competes with Brazil, France, and the Netherlands (Michel, 1998).
In 2000, the most important importing countries for US poultry were: Hong Kong, Russia, Mexico, Canada, Japan, China, and Poland (USDA, FAS, March 2001). In the mid-1990s, Russia dominated the export market for US poultry meat but sales declined sharply due to the financial crisis of 1998.

In the last three decades, the composition of agricultural trade between the US and Russia changed from a predominance of grains and oilseed meals during the 1970s and 1980s to meat and other consumer-ready products after 1992. In 2000, poultry meat accounted for 54% of the total value of all agricultural exports to Russia, or $325.6 million (USDA, FATUS, November 2, 2001).

While poultry meat has been the dominant export commodity to Russia, exports have fluctuated widely due to economic conditions in the importing country. In 1996, poultry meat, valued at $912 million, accounted for almost two-thirds of the value of all US agricultural and food exports to Russia (Table 1). The Russian market accounted for 40% of all US poultry exports world wide in that year. However, the dominance of one important market can have a significant impact on export revenue if economic conditions change in the import country.

Objectives

The objectives of this study are: (1) to describe the economic situation in the Russian market with reference to US poultry meat imports in the 1990s; and (2) to analyze the impact of the Russian ruble devaluation on the volume and value of US chicken leg quarter exports to Russia using the Global Trade Analysis Project model, data and software.

Russia's Economic Crisis and Its Effect on Agricultural Trade

Russia's current economic crisis began in August 1998. The main cause of this crisis was the Russian government's decision to default on its short-term international debt, resulting in the devaluation of the ruble on August 17, 1998. After the Russian ruble devaluation of August 1998, US exports to Russia dropped significantly (see Figure 1). Even though poultry exports also declined, they fell at a slower rate than all other exports to Russia.

The primary cause of the ruble devaluation was a drop in world prices of Russia's main exports (energy and metals), which put pressure on the ruble and reduced export tax revenue (USDA, ERS, March 8, 2001). This caused a large rise in the government's

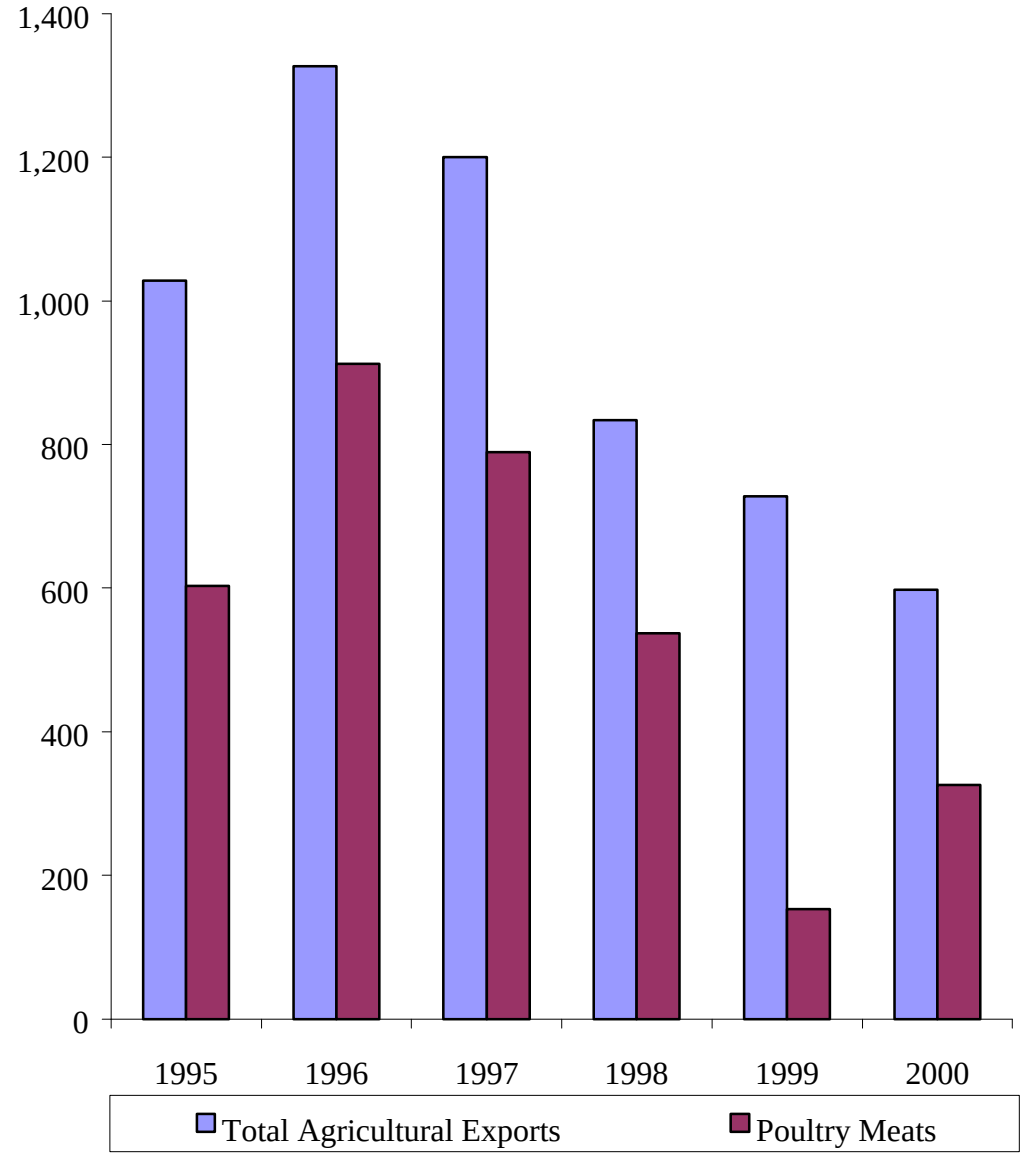
Table 1. Value of US Poultry Meat Exports to Russia and Baltic Region, Calendar Years, 1995–2000

Country	1995	1996	1997	1998	1999	2000
			$ Million			
Russian Federation	603	912	789	537	153	326
Baltic Region	54	98	115	126	216	98
Total Exports to Russia and Baltic Region	657	1,011	904	663	369	424

Source: USDA, FAS, "Status of Meat and Product Exports as of 2000", *Livestock and Poultry: World Markets and Trade, Commodity and Country Analysis*, Table 8. March 2001.

URL: http://www.fas.usda.gov/dlp/circular/2001/01-03lp/toc.htm

Figure 1. Value of Total US Agricultural Exports to Russia, 1995-2000, in $ Millions



Source: USDA, ERS, FATUS, *US Trade Exports - FATUS Commodity Aggregations*. November 02, 2001.

URL: http://www.fas.usda.gov/ustrade/USTExFatus.asp

budget deficit as a result of increased expenditures and lower tax revenues. Another important factor was the spill-over effect from the Asian crisis on investor confidence in Russia (USDA, ERS, March 8, 2001). Andrey Illarionov, the editor of *Izvestia*, a leading Russian newspaper, believes that a shortage of liquid reserves of hard currency to meet loan repayment commitments contributed to the unavoidability of the ruble's devaluation (*Izvestia, Financial* News, July 2, 1998, p. 5).

Stefan Osborne (2001) argues "the ensuing financial crisis caused foreign investors to sell ruble-denominated assets, resulting in a significant depreciation of the ruble. The weak ruble caused the price of imports to rise relative to the price of domestically produced goods" (p. 2). Devaluation of the ruble was not only unavoidable but also beneficial to the Russian economy, according to some Russian economic commentators. The devaluation of the ruble provided a partial solution to a list of macro economic problems in Russia. It changed the level of the internal prices in the country in relationship to imported goods from the rest of the world, making domestic producers more competitive in the internal market in the short term (*Izvestia, Financial News*, July 2, 1998, p. 5).

The ruble crisis also reduced the demand for food and lowered food consumption. Prices for domestic foodstuffs rose in proportion to the depreciation of the ruble. Real consumer income and wealth fell drastically.

The ruble/dollar exchange rate declined from 6.02 rubles to the dollar to 14.13 rubles per dollar between January 1998 and September 1998, a decline of 57.4% in nine months. The further devaluation of the ruble after 1998 continued the crisis. The ruble declined another 37.7% between September 1998 and January 1999. The exchange rate

continued to fall throughout 1999, declining from 22.61 rubles/dollar on January 1999 to 26.71 rubles/dollar on December 1999, a devaluation of another 15%.

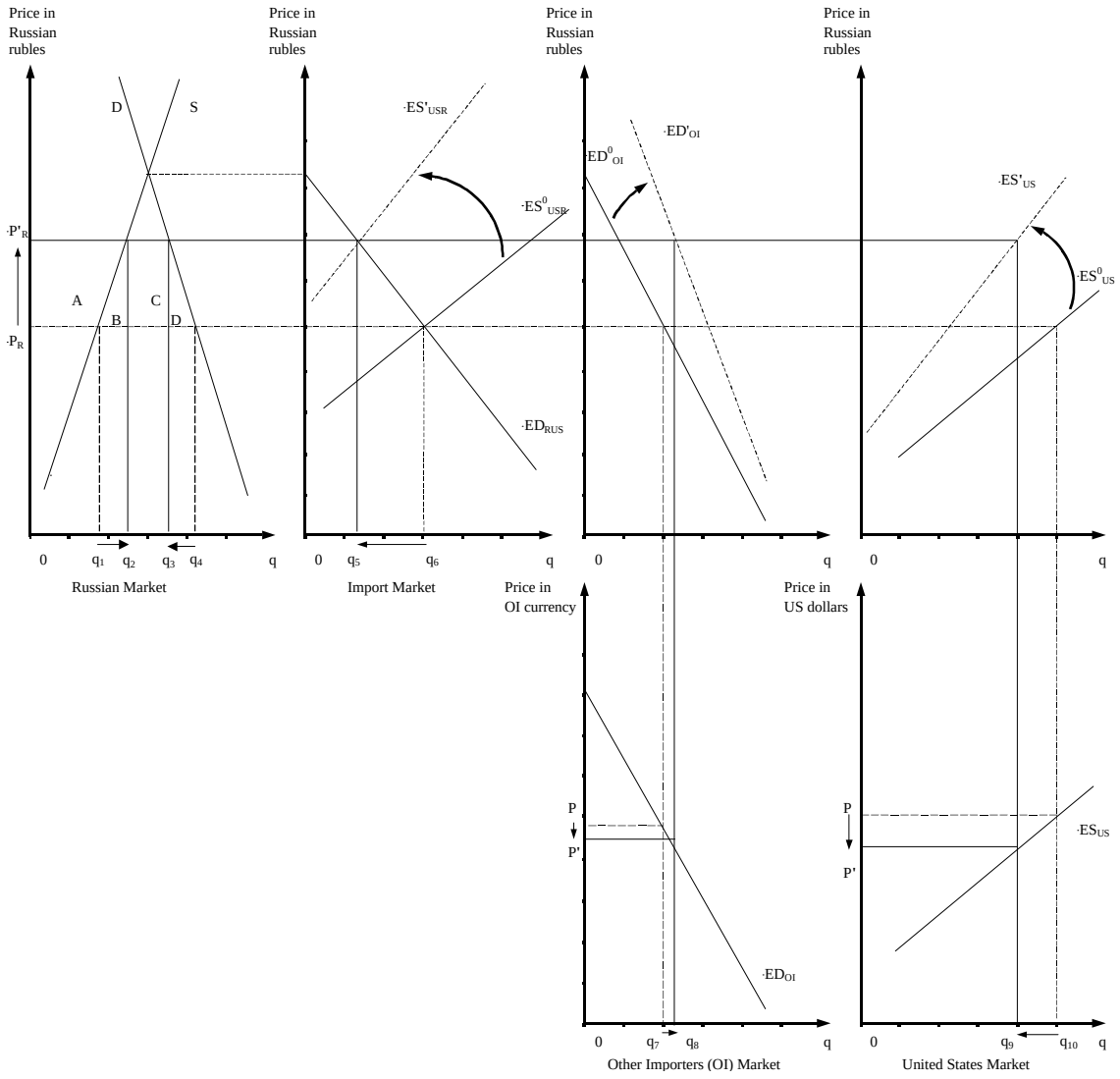
Moscow's food market reacted immediately to the falling ruble exchange rate. Wholesale markets and retail stores experienced a sharp increase in the price of the primary food groups. Prices for imported alcohol rose by 5–10%, tea by 40%, coffee by 30–40%, sunflower oil by 50%, chicken leg quarters by 40%, butter and cheese by 15% and sausage products by 10%. (*Izvestia, Financial News*, September 1, 1998, p. 1).

Welfare Analysis of the Russian Ruble Devaluation

The basic structure of the US-Russian poultry trade and the impact of the ruble devaluation on the Russian poultry meat import can be illustrated using a partial equilibrium framework (Houck, 1986). Russian ruble devaluation can be illustrated using a three-region approach. Russia, being the major importer for US dark meat, is included in the model as a net importing country with a depreciating currency. The US, as the world's leading exporter of poultry products, is included as a net exporter while Other Importers (OI) represents the rest of the world's importing market (such as Hong Kong and China) for US dark meat.

Poultry meat is priced in Russian rubles, US dollars and a composite Other Importer's currency. The upper panel of Figure 2 illustrates the following: supply and demand in the Russian market, the Russian excess demand, the excess demand of other importers, and US excess supply of chicken leg quarters. The initial excess demand and initial excess supply are priced in Russian rubles while the horizontal axis measure supply, demand, imports and exports. The lower panels of Figure 2 represents the ED^0_{OI} and ES^0_{US} expressed in terms of other importers' currencies and US dollars, respectively.

Figure 2. The Effects of the Russian Ruble Devaluation on Poultry Meat Imports



Source: Houck, 1986.

In this analysis, the Russian ruble devalued relative to both US dollar and the currencies of other importers. Devaluation caused the rotation of ED^0_{OI} and ES^0_{USR} to ED'_{OI} and ES'_{USR}, respectively. Devaluation decreases the purchasing power of the Russian consumer. This will drive up domestic prices, expressed in Russian rubles, and, at the same time, will decrease the Russian import demand for dark meat. The original dark meat price is P^0_R before devaluation, while P'_R represents the Russian import price after devaluation.

With more leg quarters being available for other importers due to excess supplies originally intend for the Russian market now being available for other importers, prices for other importers will decline. Other Importers will import more dark meat but at lower prices. Russian domestic prices increase as a result of the devaluation, while prices in the US market and other import markets decrease (Houck, 1986).

The impact of the devaluation on consumers and producers can be analysed using standard welfare measures. Russian consumers lose surplus from the initial trade position by the amount A + B + C + D. Area A is an increase in Russian producers surplus since domestic producers receive higher prices for local chicken products but a loss in consumer surplus for Russian households who must pay higher prices. Area B represents the additional cost of production for poultry producers in Russia. It measures the additional payment to variable inputs that are needed to expand domestic production from q_1 to q_2. Area C is a change in revenue for importers due to the higher Ruble price of imported dark meat. In the presence of a tariff, part of area C would be collected as tariff revenue (Houck 1986, p. 54). Area D is a deadweight consumption loss because Russian

consumers allocate household expenditures away from the more expensive imported dark meat after devaluation to other sources of protein. The empirical estimates of the ruble devaluation are simulated in the Global Policy Trade Analysis framework in the next section of this paper.

Overview of the GTAP Data Base and International Trade Data

The Global Trade Analysis Project (GTAP) was established in 1992, with the objective of lowering the cost of entry for those seeking to conduct policy and quantitative analyses of international economic issues in an economy wide framework (Hertel, p. 3). GTAP is a computable general equilibrium (CGE) model used by researchers to simulate changes in policies and their impacts on specific countries, regions, and the world markets. GTAP database is derived from government and non-government sources. The current version uses a 1997 base year. In this study of US-Russian poultry trade, GTAP is used as a simulation tool for its analyses of the ruble devaluation of August 1998.

Data and Methodology

The Global Trade Analysis Project (GTAP) model (Hertel, 1998) was utilized to simulate the impact of the currency devaluation on US poultry meat exports to Russia. Although currency devaluation cannot be modeled directly in GTAP, we can approximate it by simultaneously simulating the impact of a Russian import tax and an export subsidy. An import tax (export subsidy) on all Russian imports (exports) can be made the equivalent to the actual percentage change in the dollar/ruble exchange rate.

An appropriate regional and commodity aggregation of the GTAP database was conducted for the simulation of the currency devaluation. The aggregation was built in accordance with the theoretical assumptions of this study. The 66 regions of the GTAP

were aggregated into six new regions: Russia as a major importer of poultry meat, US as a major exporter of poultry meat, Hong Kong as a competing importer, China as a competing importer, EU poultry exporting countries as a competing exporter and the rest of the world. The 57 commodities, available in GTAP were aggregated into new commodity groups: poultry meat (not elsewhere classified meat: poultry, pork, eggs), other meat (cattle, sheep, goats, horse), other food (other food and agricultural commodities) and other (all other sectors). GTAP does not include poultry as a separate category. However, poultry represents 93.23% of US-Russian trade in the poultry, pork and eggs group. These region and commodity aggregations are presented in the Table 2.

Stefan Osborne (2001) states that imports become more expensive relative to domestically produced goods due to currency depreciation. Osborne assumes that "a currency depreciation has the same effect as erecting economy-wide trade barriers that protect domestic production from international competition" (p. 2).

The currency devaluation shock was simulated in GTAP as the combined effect of an export subsidy on all Russian exports and an import tax on all imports to Russia. To model export subsidy effects on the devaluing country's market a "txs" shock was introduced. In our simulation "txs" represents a subsidy on good "i" [all goods] from region "r" [Russia] to "s" [all regions] (GTAP software). On the other hand "tms" represents an import tax on good "i" [all goods] from region "r" [all regions] to "s" [Russia] (GTAP software).

Shock Values

The methodology, presented in *Foundations of Multinational Financial Management* (Shapiro 1998, p. 39) was used for calculating the percent of depreciation and

Table 2. Regional and Commodity Aggregation in GTAP Modeling Analysis

Country Code	Region Description
Russia	Former Soviet Union
US	United States of America
Hong Kong	Hong Kong
China	China
EU	Netherlands, France, Germany (major EU poultry meat exporters to Russia)
ROW	Rest Of the World
Commodity Code	**Commodity Description**
Poultry Meat	Meat products not elsewhere classified (nec): poultry, pork, eggs [a)]
Other Meat	Meat: cattle, sheep, goats, horse
Other Food	Other food and agricultural commodities
Other	All other sectors

[a)] In the trade category, poultry accounts for 93.23% of the aggregate value of the three categories [poultry, pork and eggs] in the base year 1997 (USDA, FATUS, November 02, 2001).

appreciation of Russian ruble and US dollar, respectively. July 1998 and July 1999 were used as a base months for calculating appreciation/depreciation of both foreign currencies involved in the analysis. Using the July 1998 exchange rate as the pre-devaluation exchange rate in the formula is justified by the fact that the devaluation of Russian ruble took place in August 1998, so it was logical to include the month prior to the drastic decline in exchange rate calculations. The ruble/dollar exchange rate of July 1999 was chosen to represent the new ruble/dollar exchange rate.

The formula by which we calculated the Russian ruble's depreciation is as follows: amount of ruble depreciation = 100 * (new dollar value of ruble–old dollar value of ruble) / old dollar value of ruble = 100 * (1/e1 - 1/e0)/1/e0 = % change = 100 * (1/24.13 – 1/6.24)/ 1/6.24 = (0.04 – 0.16)/0.16 = -75%. These calculations result in a 75% depreciation of Russian ruble relative to US dollar for exported goods.

The formula used for calculation of US dollar appreciation is as follows: amount of dollar appreciation = 100 * (new ruble value of dollar–old ruble value of dollar) / old ruble value of dollar = (e1 - e0)/e0 = % change = 100 * (24.13-6.24)/6.24 = 287%. On the import side the value of the US dollar relative to Russian ruble increase 287% in one year.

Exports from the devaluing country (Russia) become less expensive, while imports from the appreciating country (US) become more expensive. These relations are equivalent to a 75% export subsidy and 287% import tariff. In GTAP the "power of the tax" shocks are as follows: txs = 75% and tms = 287%. Taking into consideration the fact

that both “tms” and “txs” are exogenous variables in the GTAP model, we may shock the system using these variables.

GTAP Simulation Results

The results of the GTAP simulation include changes in world poultry prices, trade and production. The projected changes in trade statistics between countries included in the model were as expected. These results are reported in the Tables 3 through 6. Bilateral trade data for the poultry meat category before and after the devaluation simulation are discussed in the following section.

As a result of the 75% Ruble depreciation relative to the US dollar, projected levels of Russian poultry imports fell and domestic prices of poultry and other foods rose as expected. Poultry imports from the US fell 46.96% while other meat product imports from the US fell 72.79% (Table 5). Other Russian food imports from the US declined in 75%. In 1997 poultry meat imports from US accounted for 65.8 % of all US food and agricultural imports into Russia (USDA, FATUS, November 2, 2001).
Additional simulation results indicate that the decreased Russian poultry imports, which are projected to result from the devaluation, would be accompanied by an increase Russian poultry production. Poultry production increases by 62.72% while other meat and food outputs rise by lesser amounts (Table 6). These supply responses are influenced by the price elasticities of supply internal to the GTAP program as well as the shares of production resources devoted to poultry and other commodities. This relatively large percentage supply response could partially be explained by the relatively small Russian poultry production prior to devaluation.

Table 3. Simulated Changes in World Market Prices for Poultry Meat and in Market Prices for Poultry Meat in Russia due to Currency Devaluation

Region	Change
	Percent
Russia	101.06
US	-0.99
Hong Kong	-1.11
China	-1.34
EU	-1.30
ROW	-1.19
Commodity	
	Percent
Poultry	101.06
Other Meat	79.84
Food	86.80
Other	71.71
CGDS	82.68

Table 4. Pre- and Post-Quantities of Poultry Meat Exports from All Regions to All Regions

Exporter	Russia	US	Hong Kong	China	EU	ROW
Pre-devaluation						
			1000 Metric Tons			
Russia	175.21	1.28	0.04	0.19	2.03	11.48
US	1073.82	0.03	167.80	502.90	35.26	2372.96
Hong Kong	0.01	0.71	0.00	0.75	0.06	2.79
China	153.75	6.78	211.83	0.00	53.89	781.72
EU	407.35	40.31	15.83	88.38	2059.74	4677.57
ROW	1271.79	1132.32	298.87	182.52	4398.93	8861.35
Post-devaluation						
			1000 Metric Tons			
Russia	55.88	0.70	0.02	0.10	1.13	6.44
US	569.55	0.03	166.37	494.53	34.72	2346.56
Hong Kong	0.00	0.71	0.00	0.75	0.06	2.77
China	83.03	6.84	213.24	0.00	53.68	783.09
EU	219.36	40.60	15.91	87.93	2061.37	4697.76
ROW	682.80	1134.56	298.87	181.10	4376.38	8842.50

Table 5. Simulated Impact of Currency Devaluation on Poultry Meat Exports from All Regions to All Regions and on All Commodity Exports from All Regions to Russia

Exporters	Russia	US	Hong Kong	China	EU	ROW
	- Percent -					
Russia	-68.10	-44.80	-44.88	-44.70	-44.45	-43.90
US	-46.96	-0.38	-0.85	-1.67	-1.51	-1.11
Hong Kong	-46.32	-0.14	-0.02	0.05	-0.61	-0.46
China	-46.00	0.93	0.66	1.42	-0.39	0.17
EU	-46.15	0.72	0.50	-0.51	0.08	0.43
ROW	-46.31	0.20	0.00	-0.78	-0.51	-0.21
Commodity						
	- Percent -					
Poultry	-68.10	-46.96	-46.32	-46.00	-46.15	-46.31
Other Meat	-74.19	-72.79	-72.23	-72.33	-72.34	-72.47
Food	-79.27	-74.78	-74.50	-74.48	-74.47	-74.53
Other Products	-76.25	-86.93	-86.76	-86.65	-86.51	-86.69

Table 6. Simulated Changes in Russian Overall Output Response due to Higher Market Prices after Currency Devaluation

Commodity	Change	Pre	Post	Change
	- - Percent - -	- - - - - - - - - 1000 Metric Tons - - - - - - - - - -		
Poultry	62.72	3973.81	6466.30	2492.49
Other Meat	14.05	6713.72	7657.23	943.51
Food	22.53	75688.98	92742.29	17053.30
Other	-1.27	1026793.00	1013721.00	-13072.20
CGDS	-44.96	123310.20	67869.92	-55440.30

Consumers adjusted their purchases of food items to changes in market prices. In the case of poultry meat exports, quantities fell drastically as noted in the accompanying tables. US poultry meat exports to the Russian market declined pushing more dark meat to the domestic market and other export destinations. Prices fell in the wholesale market as these additional supplies became available. Thus, exchange rate changes in a primary export market have a ripple effect on the commodity in both the importing and exporting country.

Conclusions and Implications

Prior to 1991, most US food and agricultural exports were in the form of bulk commodities. After 1991, Russian domestic production declined due to the removal of subsidies widely available during the period of central planning. Demand for consumer ready products became increasingly important. US poultry exporters found a ready market for dark meat in Russian urban areas. Food imports became a more efficient means of satisfying consumer demand than bulk agricultural imports. US poultry exports rose 51% in just one year 1995–1996. By 1997, US poultry meat had captured 93.9% market share (by value) and 94.3% share (by quantity) of the Russian import market.

Poultry meat products represented 65.8% of total food and agricultural exports from the US to Russia in the late 1990s. Moreover, the Russian market represented 40% of the value of all US poultry meat exports world wide in 1997. Thus, the US poultry export market was heavily dependent on one import destination. This dependency set the stage for the dramatic impact of the Russian currency devaluation of August 1998.

Simulation results indicate that the depreciation of the Russian ruble relative to the US dollar would cause poultry imports into Russia to fall by 46.96% and domestic

prices to rise by 101%. At the same time other meat prices were projected to rise by only 79%. These price changes cause poultry imports from the US to Russia to fall and Russian poultry production to rise by 62.72%. Shrinkage of the Russian import market resulted in an additional excess supply of poultry meat in the US. That in turn caused US domestic prices to fall in the wholesale market. In summary, the exchange rate changes in Russia resulted in a change of poultry positioning, not only in the Russian market itself, but also in poultry markets in the US and in all the other countries importing and exporting that commodity.

As with any modeling exercise the results may be sensitive to the base period of analysis, the characteristics of the focus commodity, and the internal characteristics of supply and demand parameters in the analytical model. The drastic devaluation of August 1998 provided a clear shock for simulation purposes. The intermediate simulation results are consistent with trade theory and expectations. They are not meant to be precise measures of market reactions to currency devaluation but an approximation of the actual changes in trade flows as a result of market forces. These results, however, are very useful for trade policy analysis.

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