Price and Exchange Rate Transmission
in Russian Food Markets

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Introduction

This paper examines the relationship between changes in world agricultural prices, as well as the changes in Russian exchange rates, and changes in Russian domestic consumer prices for various foodstuffs. The empirical heart of the paper is estimation of price and exchange rate transmission elasticities (TEs) for Russia during 1994-1999 for the country's major agricultural imports, in particular the meats.

The estimated TEs are useful for two reasons. The first is for forecasting purposes. Predicting changes in Russian agricultural production, consumption, and trade requires knowledge of price and exchange rate transmission. Commodity forecasting models for Russian agriculture, such as that at the Economic Research Service of USDA, explicitly call for values for such parameters.

The second reason TE estimates are important is as performance indicators. One of the main objectives of Russian economic reform has been integration into the world economy. TEs can serve as measures of such integration. The higher the estimated TEs, the greater is Russia's integration into world agricultural markets.

In this paper, TEs are computed for the 30 largest cities in Russia. With the exception of the two largest cities of Moscow and St. Petersburg, which stand alone, the other 28 cities are grouped into 4 regions depending on accessibility: ports, those on the Volga River, those on the Trans-Siberian Railroad, and those that are truly "landlocked." The results show that TEs involving both world prices and the exchange rate are low. However, TE is strongest for Moscow and St. Petersburg, which suggests that these cities have the best physical and commercial-institutional infrastructure for bringing in imports. The results indicate that Russia could significantly increase its integration into world agricultural markets, thereby expanding its volumes of trade.

Context

In the Soviet Union, foreign trade was a state monopoly, with state planners determining the mix and volume of imports and exports. The state also set domestic producer and consumer prices (with just a few exceptions), including for goods to be exported and imported. Although world prices might have influenced the state price setters, no formal relationship existed between world market and domestic prices. The state also set the official exchange rates between the ruble and foreign currencies.[1] Ruble exchange rates changed in response to changes in foreign rates only to keep cross exchange rates involving the ruble equal. (In other words, if the U.S. dollar rose by 10 percent vis-à-vis the Japanese yen, the Russian official exchange rates involving the dollar and yen would be adjusted such that one dollar now bought 10 percent more rubles than did one yen.) Given the strong state control over domestic prices and exchange rates, transmission between changes in (a) world market prices and exchange rates and (b) domestic prices, was extremely low.

The economic reform that began in Russia in 1992 after the dissolution of the USSR ended the state monopoly on foreign trade, generally freed domestic prices (though this did not happen overnight and some price controls still remain), and created floating exchange rates (though the float can be rather "dirty"). During the period of estimation in this paper (1994-99), formal controls on agricultural trade at the national level were not (as they still are not) overly restrictive. Most tariffs on agricultural imports ranged from 5 to 20 percent, though some were as high as 30 percent. Quotas and other quantitative restrictions have been virtually nonexistent. State trading does not formally exist, though some of the agencies that administered the country's foreign trade during the Soviet period and have now become privatized retain close links to the state.[2] Thus, for certain products behavior akin to state trading might exist to some degree. Nonetheless, at the national level agricultural trade has not been overly controlled. For

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[1] For more information as to how foreign trade was planned and managed in the Soviet Union, see Gregory and Stuart.

[2] For more information concerning agricultural trade restrictions during the transition period, see OECD.

this reason, one could hypothesize that price transmission between the world and domestic markets is fairly high.

As mentioned in the introduction, one of the main reasons TE estimates are useful is for forecasting purposes. The importance of accurate values for TEs in forecasting depends on the degree to which forecasters will assume that world agricultural trade prices and the Russian exchange rate will fluctuate over the projection period. This in turn will in large part depend on the volatility of these variables in the recent past. During the transition period both world agricultural prices and Russian exchange rates have fluctuated considerably. Generally speaking, world agricultural prices rose substantially from 1993 to 1997, but then plunged. For example, U.S. export prices for a ton of wheat in 1994, 1996, and 1999 equaled $4.09, $5.63, and $3.04 per bushel, respectively (ERS, *Agricultural Outlook*, various issues).

In the early reform years of 1992-93, the Russian ruble depreciated severely vis-à-vis Western currencies in both nominal and real terms. From 1994 to 1998, the ruble then appreciated in real terms by about 75 percent (PlanEcon). However, following the economic crisis of 1998, the ruble quickly depreciated in both nominal and real terms, though recently it has begun again to appreciate in real terms. The instability of both world agricultural prices and Russian exchange rate justifies forecasting assumptions that the values will not be stable in the future. This increases the importance of the "accuracy" of the values for TEs used in the forecasting models.

The importance of TEs in forecasting Russia's agricultural trade depends also on how important such trade is in volume terms to both the Russian and world economies. The Soviet Union was a large importer of grain and soybeans and soybean meal, often taking 20-25 percent of total world imports of these products. Because of the severe downsizing of the livestock sector during transition, grain and oilseed imports by Russia and the other countries of the former USSR have fallen substantially. However, Russia has become a major importer of meat—beef, pork, and

poultry (see table 1 at the end of the paper). During the last five years imports have supplied about one third of the country's total consumption of meat. Russia has accounted for 15-20 percent of the world's total meat imports. Other agricultural products on which Russia is heavily import dependent are sugar and vegetable oil. However, unlike meat and vegetable oil, sugar is supplied mainly by another country of the former USSR (Ukraine), with volume levels and prices largely negotiated by the two countries.

Methodology and Data

In this paper the TE for a good is defined as the percent change in the Russian consumer price for the product divided by the percent change in the world price (or exchange rate). A value of 1 gives complete transmission, a value of 0 no transmission.

In real terms, price transmission for a good is measured by estimating the following equation with ordinary least squares:

$$\ln(\frac{\hat{P}_d}{CPI_d}) = \beta_1 \ln(\frac{\hat{P}_f}{CPI_f}) + \beta_2 \ln(e^*) + \varepsilon$$

β_1 is the estimated price TE, while β_2 is the estimated exchange rate TE. P_d and P_f are the domestic and foreign price of the good, respectively, and CPI_d and CPI_f are the domestic and foreign consumer price index, respectively. The real exchange rate e^* equals the product of the nominal exchange rate and the ratio of foreign to domestic CPI.

In calculating the TEs for prices, we use real as opposed to nominal prices. Likewise in calculating the TEs for the exchange rate, we use the real as opposed to nominal rate.
 When the real exchange rate is stable, as some of the simpler theories of purchasing power parity maintain, measures of price transmission that use either real or nominal prices will generally yield the same results (Mundlak and Larson). However, the financial crisis in August 1998 (the worst of many financial crises that hit over the reform period from 1992 through 1999) caused a significant depreciation of the ruble in real terms. This depreciation affected the

relationship between world and domestic prices for goods because of developments that were not specific to, and did not originate within, the markets for these goods. Accounting for changes in the real exchange rate is one way of separating out economy-wide disruptions from market-specific events when calculating the transmission of prices from world to domestic markets.

Estimates are made for three products: beef, pork, and vegetable oil. These products are chosen for two reasons. The first is that imports constitute a large share of domestic consumption, and the second that the bulk of imports come from OECD countries. For example, in 1997 about 30 percent of all meat and 40 of vegetable oil consumed in Russia was imported, with OECD countries providing over 90 percent of the imports. However, of the meats, poultry is the most heavily imported. During the last 5 years imports have provided over half of domestic consumption, with the bulk of the imports coming from the United States. Sales to Russia have in fact accounted for about half of all U.S. poultry exports. We regrettably do not include poultry in our study, for the simple reason that the Russians began reporting prices by region for poultry only in October 1998, too late for our work.

TEs are computed separately for 30 of the largest cities in Russia, which are divided into four categories based on their geographic accessibility with respect to the "world market." The categories are: (1) cities that are sea ports; (2) cities on the Volga River; (3) cities on the Trans-Siberian Railroad; and (4) "landlocked" cities. Aggregate estimates for each of the four city categories are determined by averaging the estimates for all the cities within the category, using the cities' populations as weights.

Moscow and St. Petersburg are not included in any of the 4 city categories, but rather stand alone. Because of their size and privileged status during the Soviet period, these two cities have the best internal infrastructure—both physical and commercial-institutional—vis-à-vis the world market. This means that the cost of shipping imported foodstuffs from importation ports to these

cities is low compared to costs for other cities. St. Petersburg is in fact a major port, with facilities that can handle large import volumes at relatively low cost. Since superior infrastructure would appear to allow for greater integration into world markets and thus higher TE, separating these cities out from the others seems appropriate.

The methodology requires data on domestic consumer prices, world prices, the CPI, and exchange rates. The Russian Ministry of Agriculture has collected domestic prices for beef, pork and vegetable oil for markets in 80 Russian cities (mainly capitals of the various 88 oblasts, republics, and autonomous districts) monthly from January 1994 to December 1999. All 30 cities for which we make calculations are included in the data set.

The "world prices" for goods are unit prices at the border for imports into Russia, computed from the import value and volume data in *Tamozhennaia Statistika*, the quarterly foreign trade publication of the Russian State Customs Committee. The publication reports all import (as well as export) values in U.S. dollars. Russia's State Statistical Committee Goskomstat provides the Russian CPI and the ruble exchange rates, while the U.S. Bureau of Labor Statistics provides the U.S. CPI.

We index the nominal domestic prices by the Russian CPI and then average them into quarterly prices so that they can be compared with the quarterly border prices. We calculate the real exchange rate by multiplying the ruble/dollar exchange rate by the ratio of the U.S. to Russian CPI.

Because all the data used in this study are non-stationary, the standard deviation calculations of the OLS regression have non-standard distributions. In the context of cointegration analysis Wald tests can be developed that yield standard deviations with standard normal distributions.

The authors are currently carrying out these tests on the above data; preliminary results seem to be consistent with the results reported below.

Results

The results (table 2) indicate that TEs involving both world prices and the exchange rate are low. The vast bulk of estimates for product-city pairings are less than 50 percent, and for most estimates below even 25 percent. The results indicate that Russia could significantly increase its integration into world agricultural markets, thereby expanding its volumes of trade. As discussed earlier, Russia in the aggregate is a net agricultural importer vis-à-vis the developed Western countries. From a forecasting point of view, therefore, one could predict that Russian imports from Western countries could rise substantially, assuming it made the reform changes (discussed later) that raise price transmission. The commodity forecasting model for Russia of the Economic Research Service currently uses a price transmission elasticity for all agricultural products of 0.5. The results in this paper suggest that this value might be on the high side, or at least should be no higher.

The results do not show much difference between TE for world prices and the exchange rate. The main difference involving the results is that the estimates for vegetable oil are relatively high throughout the country (between 0.25 and 0.5 for most product-city pairings), while the estimates for beef and pork are relatively high for only Moscow and St. Petersburg. (The one exception to the higher estimates for these two cities for meat is the extremely low estimate of 0.02 for price TE for pork for Moscow.) One reason we should expect TE to be higher for vegetable oil than for meat throughout the country is that unlike meat, vegetable oil is non-perishable. It thereby can penetrate to more isolated internal markets with much less risk of spoilage.

However, there are two other likely reasons why TE is higher for Moscow and St. Petersburg, reasons which are revealing about the success of economic reform in Russia to date in creating

well-functioning markets for agricultural goods. The first reason is that many regional governments throughout the country adopt policies that have the effect of segmenting internal agricultural markets. Such policies include restrictions on prices and profit margins for local producers. The most common restrictive policy is controls on outflows of regional agricultural output. There are probably a number of reasons for this policy, the most benign being that the regions wish to protect their own consumers by ensuring that local food supplies are adequate. The most malign-possible reason is corruption, as officials might be exploiting the regional price differences created by these restrictions to earn easy arbitrage profits. We discussed earlier that agricultural trade restrictions in Russia at the national level are not extreme. However, regional controls on agriculture—on prices, profits margins, and most importantly outflows--segment regional markets from each other, as well as reduce integration into world agricultural markets, as revealed by low price transmission.

The second reason TE is lower for interior markets compared to Moscow and St. Petersburg is undeveloped internal infrastructure for moving agricultural goods internally (which also contributes to domestic market segmentation). Although storage is also inadequate, the main weakness is transportation, particularly the poor road system. The cost of shipping agricultural products between regions can exceed producer prices. Deficient transportation and storage increase the risk of spoilage for perishables such as meat.

An equally serious problem is deficient commercial and institutional infrastructure. Producers and traders in particular need a financial system that allows fast and affordable access to capital, a system for quick and inexpensive dissemination of market information (where can one buy and sell, and at what price?), and a strong system of commercial law that protects property and enforces contracts. The absence of this market infrastructure increases the costs and risks of

producing and, in particular, selling output—that is, it raises the transaction costs of doing business.[3]

A number of empirical studies provide evidence of segmentation of regional agriculture and food markets in Russia. The strongest evidence has been poor price cointegration between regions— that is, substantial variation in food prices between regions that cannot be explained by transport costs (see Gardner and Brooks and Berkowitz 1998 and 1999).[4] Internal price cointegration and price transmission between world and domestic markets both serve as indicators of the degree to which Russia has created a well-functioning and open domestic agricultural economy. The relatively low results that research has found for both domestic price cointegration and price transmission show that much more progress is necessary to meet this reform objective.

There are understandable reasons why TE is higher for Moscow and St. Petersburg than for the "hinterland." If surplus producing regions within Russia restrict agricultural outflows and the internal infrastructure for moving agricultural goods from surplus to deficit regions is poor, then cities and regions within the country that must rely on food inflows—with Moscow and St. Petersburg being at the top of the list--have strong incentive both to minimize any possible policy impediments to food imports and to improve the physical and institutional infrastructure for bringing in food imports. The Soviet Union was also a food importer, with much of the imports going to Moscow, Leningrad (the Soviet name for St. Petersburg), and other large cities. These cities therefore inherited from the Soviet period a relatively well-developed infrastructural system for delivering imported foodstuffs. In the case of St. Petersburg, which is a major port with relatively close access to European food markets, the physical infrastructure for handling imports is the quality of its own port facilities.

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[3] Further discussion of the problems that weak institutional infrastructure creates for agricultural development in the transition countries can be found in a forthcoming ERS study, *Changes in Agricultural Markets in Transition Countries* (Liefert and Swinnen).

[4] The Europe, Africa, and Middle East Branch of ERS is also currently researching price cointegration within Russia.

Higher TEs computed for Moscow and St. Petersburg are consistent with the higher reliance of these cities on food imports. As just argued, the greater the degree to which a city or region depends on food imports, the more incentive it has to reduce the policy and physical and institutional impediments to trade that will hinder its access to world agricultural markets, as measured by price transmission. The Economic Research Service has calculated that in Russia in 1997, imports accounted for only about 20 percent of all food consumed (*Agricultural Outlook*, ERS, June-July 1999, p. 17). However, the general evidence shows that imports provide over half of all food consumed in Moscow and St. Petersburg.[5]

Conclusion

This paper finds that the transmission of changes in both world agricultural prices and the Russian exchange rate to domestic consumer prices for foodstuffs is low. This indicates that Russia could significantly increase its integration into world agricultural markets, thereby expanding its volumes of trade. However, transmission is stronger for Moscow and St. Petersburg than for cities in the "hinterland." This suggests that these cities have adopted fewer policies that impede integration into world agricultural markets, as well as have better physical and commercial-institutional infrastructure for bringing in imported foodstuffs.

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[5] A misconception has developed during the transition period that imports account for over half of *all food* consumed within Russia. The likely reason for this misconception is that observers are extrapolating the experience of Moscow and St. Petersburg, which do import over half of their food, to the entire country. Our low TE calculations are consistent with the ERS finding that imports do not provide the bulk of Russia's food supplies. A high overall national dependence on food imports would indicate that Russia relies on, and is therefore heavily integrated into, world agricultural markets. Our TE calculations suggest the opposite.

Table 1: Russian Agricultural Imports
values in millions of U.S. dollars
volumes in thousands of tons

	1998		1999		2000	
	volume	*value*	*volume*	*value*	*volume*	*value*
Meat						
beef	411	606	522	549	271	338
pork	282	448	444	407	213	212
poultry	814	563	236	154	688	367
Grain	1,448	249	6,290	632	4,317	551
Oilseeds	116	41	299	89	120	47
Sugar	4,248	1,334	6,204	1,256	5,050	765
Vegetables	1,202	343	1,725	361	1,353	312
Fruit	1,290	720	854	439	1,239	657
Other		5,969		3,774		3,727
Total Ag and Food imports		10,273		7,661		6,976

Source: World Trade Atlas

Table 2: Price and Real Exchange Rate Transmission Elasticities

	Beef		Pork		Vegetable oil	
	PTE*	ERTE*	PTE	ERTE	PTE	ERTE
Moscow	0.34	0.46	0.02	0.28	0.26	0.34
St. Petersburg	0.51	0.57	0.48	0.34	0.40	0.46
Ports	-0.03	-0.03	-0.05	-0.19	0.30	0.19
On the Volga	0.17	0.03	0.03	-0.12	0.27	0.14
On Trans-Siberian railroad	-0.16	0.00	0.03	-0.02	0.47	0.24
Landlocked	-0.04	0.06	0.06	0.03	0.32	0.33

*PTE is the price transmission elasticity

ERTE is the real exchange rate transmission elasticity

The data used in this study are non-stationary, so standard deviations have a non-standard distribution. Consequently, we do not report standard deviations in table 2.

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