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DETERMINANTS OF WORLD WHEAT TRADE FLOWS AND POLICY ANALYSIS: AN APPLICATION OF GRAVITY MODEL

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1. Introduction

One of the primary purposes of many trade models is to explain trade flows between exporting and importing countries. Most research works in this area used spatial equilibrium models on the basis of mathematical programming algorithm (Takayama and Judge, Bawden, Koo, and Mackinnon). In these studies, trade flows are explained by the prices of commodities in importing and exporting countries and transportation costs between countries. Thompson (1981), however, indicated that spatial equilibrium models performed poorly in explaining trade flows of agricultural commodities which generally are distorted by exporting countries' export promotion programs and importing countries' protectionism.

The world wheat trade is a classical example of the trade intervention. Less than a dozen wheat exporting countries compete with one another to increase their market shares in the world market. Major export promotion programs commonly used by these wheat exporting countries are (1) Long-Term Agreement (LTA) mainly used by Canada and Australia, (2) Credit Sales (CS) used by the United States, Canada, France, and Australia, and (3) Export Enhance Program (EEP) used by the United States beginning in 1985.[1] On the import side, most importing countries have been using various types of trade barriers to protect their domestic agricultural sector. The traditional spatial equilibrium model has a limited capability of including all these variables.

The gravity model has been used to evaluate bilateral trade flows of aggregate commodity across pairs of countries. Formal theoretical foundations for the gravity model have been provided in Anderson (1979) and Bergstrand (1985, 1989). In the gravity model, trade flows of aggregate commodity are explained by macroeconomic variables in addition to prices in importing and exporting countries and transportation costs between countries.

In this study, the gravity model is respecified for a specific commodity and applied to the world wheat trade to analyze factors affecting trade flows of wheat. The objectives are to identify determinants of specific commodity trade flows and to analyze comprehensive trade policies exporting countries commonly have used. This study focused on wheat trade, where special attention is given to evaluate impacts of promotion programs and of import-restricting policies on the world wheat trade. Combining time series and cross section series improved the efficiency of parameter estimates.

We demonstrate how specification test and non-nested hypothesis test procedures are used to discriminate among competing variables and models. Further, the use of panel data allowed construction and testing of alleged trade effects, normally impossible for purely cross section or time series models. Specification tests indicate that policy variables affecting a specific commodity trade should be included to identify correct specification. We find strong evidence that trade policies influenced world wheat trade and direction of trade.

The development of the commodity specific gravity model for the world wheat trade and formulations of the time series and cross section model are presented in Section 2. Econometric issues, including specification tests are discussed in section 3. Estimated models using econometric techniques and the analysis of our findings are presented in Section 4.

2. A Commodity Specific Gravity Model

The derivation of the single commodity gravity model follows the procedure indicated in trade literature. According to Linneman and more recently Bergstrand, a gravity model is a reduced form equation from a partial equilibrium of demand and supply systems. The model is specified generally as follows:

$$X_{ij} = \gamma_0 Y_i^{\gamma_1} Y_j^{\gamma_2} C_{ij}^{\gamma_3} T_{ij}^{\gamma_4} P_i^{\gamma_5} P_j^{\gamma_6} E_{ij}^{\gamma_7} I_i^{\gamma_8} I_j^{\gamma_9} e_{ij} \qquad \begin{matrix} i = 1,2,\ldots N_1 \\ j = 1,2,\ldots N_2 \end{matrix} \qquad [1]$$

where X_{ij} is the quantity of commodity traded from Country i to Country j, $Y_i[Y_j]$ represents income of Country i(j), C_{ij} is transport cost rate (c.i.f./f.o.b.) between i and j, T_{ij} is j's tariff on the commodity imports, $P_i(P_j)$ is the price of commodity at Country i's export port (Country j's import port), E_{ij} is the spot exchange rate (Country j's currency in terms of Country i's currency), $I_i(I_j)$ represents inflation in respective countries. The γs are parameters of the model. Mathematical derivations of Equation 1 are explained in Bergstrand and need not be repeated here.

Unlike traditional gravity models of aggregate goods trade, such as those described in Bergstrand (1985,1989), Anderson (1979), and Linneman (1962), the commodity specific gravity model can incorporate the unique characteristics associated with trade flows of a specific commodity used by exporting and importing countries. In wheat trade, exporting countries use various types of export promotion programs such as the Long-Term Agreement (LTA), Credit Sales (CS), and Export Enhancement Program (EEP). Wheat importing countries have their own trade barriers to protect their domestic agricultural sector.

Support price programs have been used by most importing countries. Three variables representing the export promotion programs and one variable representing import restricting programs are included in the model. It is hypothesized that the export promotion programs enhance wheat trade while the support price program impairs wheat trade.

A dummy variable representing trade flows of wheat among European Community (EC) member countries is included in the model. It is hypothesized that economic integration such as the EC enhances wheat trade among the member countries. The empirical model includes another dummy variable representing the foreign currency restriction exercised by importing countries under an assumption that the currency outflow restriction may affect flows of the world wheat trade. The empirical commodity specific gravity model is as follows:

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta_2} OFR^{\beta_3} P_i^{\beta_4} P_j^{\beta_5} E_{ij}^{\beta_6} I_i^{\beta_7} I_j^{\beta_8} e^{\beta_9 ED_{ij}} e^{\beta_{10} FD_j} e^{\beta_{11} LD_{ij}} e^{\beta_{12} CD_{ij}} e^{\beta_{13} SD_j} e^{\beta_{14} EEP_{ij}} V_{ij} \quad [2]$$

where OFR is ocean freight rates between Countries i and j, ED_{ij} is a dummy variable identifying trade flows among EC member countries (= 1 if both counties i and j belong to EC, and = 0 elsewhere), FD_j is a dummy variable representing foreign currency restrictions in importing countries (=1 if any restriction on capital outflow was enforced during the period of study, and = 0 elsewhere), LD_{ij}, and CD_{ij} are dummy variables representing LTA and CS, respectively, in exporting countries, SD_j is a dummy variable representing support price in importing countries, and EEP is a dummy variable representing the export enhancement program. The policy variables replace T_{ij} in Equation 1 as factors enhancing or resisting trade flows. Past research used distance as a proxy for transport cost C_{ij}. Given that geographical distances do not vary over time, we used ocean freight rates to reflect changes in transport cost over time.

Countries included in this analysis are nine exporting countries and 34 importing countries (Table 1). Time period considered is from 1981 to 1987. Exporting and importing countries which are engaged in sporadic trade are not included in this analysis to obtain data consistent over time period and cross section series. Few exporting (importing) countries are considered as importing (exporting) countries because they simultaneously exported and imported wheat.

Finally, some remarks regarding the use of qualitative variables are in order. Trade policies were not necessarily in force for every year and country

TABLE 1. LIST OF COUNTRIES INCLUDED IN THE INTERNATIONAL WHEAT TRADE ANALYSIS

Exporting Countries and Export Ports	Importing Countries and Import Ports
Argentina: Buenos Aires	Algeria: Algiers
Australia: Bunbury, Cape Lewin	Bangladesh: Chittagong
Canada: West Coast (Vancouver); East Coast (Montreal) St. Lawrence	Belgium: Oostende
France: Marseille, Le Havre Bordeau	Brazil: Rio de Janeiro
United Kingdom: Tilbery or London	Canada: See export ports
West Germany: Hambury	Chile: Santiago & Valpariso
Netherlands: Rotterdam	China: Shanghai
Belgium: Oostende	Colombia: Cartagena
United States: Great Lakes (Duluth); Atlantic Coast; U.S. Gulf Ports; NW Pacific (Portland)	Denmark: Skagens Odd
	France: (see export ports)
	West Germany: Hamburg
	Greece: Thessalonika
	India: Bombay, Calcutta
	Indonesia: Djakarta
	Israel: Haifa
	Italy: see export ports
	Japan: Yokohoma & Tokyo
	South Korea: Inchun
	Libya: Banghazi, Tabalous
	Mexico: Progresso
	Morocco: Casablanca
	Netherlands: Rotterdam
	Nigeria: Lagos, Port Harcourt
	Pakistan: Karashi
	Philippines: Manilla
	Saudi Arabia: Juddah
	Sri Lanka: Colombo
	Switzerland: no sea port
	United Kingdom: see export ports
	United States: see export ports
	Venezuela: La Guiera
	Yemen Arab Republic: Aden
	Yugoslavia: Raguck
	Egypt: Port Said

during the period of the study. Some program values were zeros at times. Thus, policy variables were coded into qualitative variables to limit those variations. We recognize that qualitative variables identify average effects, but they provided more coherent results. It is expected that b_0 β_1, β_2, β_4, β_6, β_8, β_9, β_{11}, β_{12}, and β_{14} are positive and that β_3, β_5, β_7, β_{10} and β_{13} are negative.

3. Econometric Issues and Procedures

Traditional gravity models typically use gross domestic product (GDP) to represent income variable (Linemann 1966; Bergstrand 1985 and 1989; Summary 1989). Total farm income rather than total GDP is the variable most closely related to wheat production. Thus, farm income should be tested against GDP to identify correct specification. The non-nested JA test developed by McAleer (1985) is used for that purpose. The JA test results indicate with 1% significance level that farm income rather than total GDP should be used in the analysis (computed t = 7.314).

This result supports the hypothesis that GDP for the farm sector is related most closely to agricultural product trade flow and represents a farm production constraint. Alternatively, considering that Equation 1 is nested in Equation 2, the likelihood ratio test for specification (Kmenta, p. 593) has given a likelihood ratio $\lambda = 26.815$ which exceeds $\chi^2_4 = 13.277$ and rejects the null hypothesis of no trade policy variable augmentation at the 1 percent level. This means that in modelling specific commodity flows, trade policies should be included and should be subject to specification tests.

Previous studies use cross section data to estimate relationships in a given time unit. However, data may be available with information in cross section form observed over several years. Hence, we propose to further parameterize the econometric model in Equation 2 over time and cross section units. This is especially needed for the agricultural commodity for which trade flows are highly volatile due to weather conditions in importing and/or exporting countries. The estimated parameters of the model with cross section data for a particular year may not provide accurate information to evaluate trade flows of a commodity. A pooling technique which combines the cross section and time series data, therefore, may be most appropriate.

In the context of general econometric models, the problems associated with pooling techniques has been discussed by Hausman (1979), Judge et al. (1985), and Hsiao (1986). For clarity and notational simplification we use Hausman's (p. 1261) notation. Equation 2 in time series and cross section framework is written as

$$X_{ijt} = Z_{ijt}\,\beta + U_{ij} + e_{ijt} \qquad [3]$$

where X_{ijt} is trade observation from i to j at time t (t=1, ..., T), Z_{ijt} is a corresponding trade determinant vector, U_{ij} is the trade effect associated with that country pair, and e_{ijt} is the error term.

Equation 3 has the main advantage of allowing for different effects for each country pair. We recognize a wider data variability between pairs of countries observed each year (the cross section relative to the time series).

To test the null hypothesis that $U_{ij} = 0$, the Breusch and Pagan test statistic[2] was computed to be 369.4167, exceeding $\chi^2_4 = 6.635$ at the 1 percent level thus rejecting the null hypothesis. Since U_{ij} differ statistically from zero, it should be determined if they are fixed or random. The Hausman test[3] statistic of m = 31.785 exceeds $\chi^2_4 = 29.14$ at 1 percent level, thus rejecting the assumptions of orthogonality between U_{ij} and RHS variables in favor of fixed effects specification. We, however, recognize that the error component model consistently has the lowest mean square error. Following Judge et al. (1985,

p. 338) and Hsiao (1986, p. 45), we present both model estimates but focus on the covariance model estimates in the empirical discussion. The small differences between estimates of both models carry no implication in the analysis. The covariance model estimates have the advantage of being unbiased and valid under the null hypothesis of no misspecification and the alternative hypothesis. Estimates from the covariance model may be inefficient. The error component model has a desirable property of being asymptotically efficient although estimates may be biased.

The covariance model was estimated by OLS on variables expressed in the deviation form. As explained in Hsiao (1986, p. 131), dummy variables for individual country pairs and/or time effects are not needed. A Lagrange Multiplier test for heteroskedasticity developed by Breusch and Pagan (1979) suggest that error terms are not homoskedastic. Parks' procedure (1967) corrects simultaneously for heteroskedasticity within cross section series and autocorrelation within time series. In our case, however, the results yielded some wrong signs, probably because of insufficient time series observations. Instead, we used the Fuller and Battese (1973) procedure, also described in Judge et al. (1985, p. 334). The method provides estimates of variance components for cross section ($\hat{\sigma}_u^2$ = 0.4998), variance component for time series ($\hat{\sigma}_t^2$ = 0.0), and variance components for error term ($\hat{\sigma}_t^2$ = 4.1195). Although the procedure provides no test for time effects, a zero variance estimate of time effect and a nonnegative $\hat{\sigma}_u^2$ indicates that time effect is not ommitted incorrectly in Equation 3 (Judge et al., p. 335).

4. Results

Table 2 presents the estimated parameters of three different models: covariance model, error component model, and generalized gravity model. Both of these covariance and error component models are estimated with (Model 2) and without (Model 1) the dummy variable representing the EEP which was introduced in September 1985 by the United States. The data used for this study are summarized in the appendix. All the parameters have the sign as hypothesized in the previous section except ocean freight rates from exporting countries to importing countries and income deflators.

According to the theory of spatial equilibrium, the quantities of a commodity traded should be inversely related to ocean freight rates. In this study, the estimated coefficient of the ocean freight rate variable does not differ significantly from zero and has a positive sign. This simply indicates the world wheat trade patterns among the trading partners are not determined on the basis of distances. Since the types and quality of wheat produced in exporting countries are not homogeneous and demand is type and quality specific in most importing countries, the world wheat trade pattern has not been established on the basis of distances among trading countries. For instance, Japan imports more wheat from the United States than from Australia though distance between Japan and Australia is shorter than those between the United States and Japan. This is because some of the wheat imported by Japan from the United States are hard red spring and hard red winter wheat which are not produced in Australia.

The estimated coefficients for farm GDP deflators in exporting countries and for GDP deflators in importing countries have signs contrary to our expectations. This problem was noticed by Bergstrand. Normally, inflationary

TABLE 2. GRAVITY EQUATION COEFFICIENT ESTIMATES FOR WHEAT TRADE FLOWS (DEPENDENT VARIABLE: QUANTITIES OF WHEAT TRADE)

	Covariance Model		Error Component Model		Generalized Gravity Model
	Model 1	Model 2	Model 1	Model 2	
i's farm income (Y_i)	0.4264**	0.4134**	0.5595**	0.5593**	0.3645**
	(4.110)	(3.933)	(5.057)	(5.031)	(3.152)
j's income (Y_j)	0.1533*	0.1637*	0.1515*	0.1514	0.1438
	(1.963)	(2.076)	(1.9809)	(1.800)	(1.915)
Ocean freight rate (C_{ij})	0.3479	0.3675	0.5828	0.5831	0.8857*
	(0.826)	(0.752)	(1.478)	(1.4770)	(2.256)
EC dummy (ED_{ij})	1.4006**	1.3796**	1.1718**	1.1710**	1.0722**
	(4.424)	(4.320)	(4.4259)	(4.236)	(3.44)
Foreign currency restriction dummy(FD_j)	-0.2546	-0.2531	-0.4176*	-0.4187*	-
	(-1.166)	(-1.139)	(-2.107)	(-2.082)	
i's export unit price (P_i)	5.2992**	4.5411**	7.6385**	7.6422**	6.8440**
	(5.460)	(3.917)	(9.750)	(9.646)	(9.222)
j's import unit price (P_j)	-7.3922**	-7.2479**	-7.7177**	-7.7154**	-7.9015**
	(-14.499)	(-13.685)	(-13.994)	(-13.862)	(-14.913)
Exchange rate (E_{ij})	0.2847	0.275	0.3414	0.3405	0.2694
	(0.789)	(0.752)	(0.883)	(0.877)	(0.719)
i's income deflator (I_i)	-1.398	-1.073	-1.7159*	-1.7114	-1.9630*
	(-1.630)	(-1.217)	(-1.968)	(-1.935)	(-2.325)
j's income deflator (I_j)	-0.5014*	-0.5298*	-0.7534**	-0.7538**	-0.2724
	(-2.107)	(-2.210)	(-3.007)	(-3.001)	(-1.170)
Long-term agreement (LD_{ij})	2.1732**	2.1699**	2.0708**	2.0717**	—
	(5.548)	(5.515)	(5.924)	(5.903)	—
Credit sale (CD_{ij})	0.7455*	0.7553*	0.7837**	0.7822**	—
	(2.645)	(2.630)	(3.084)	(3.029)	
Domestic support price (SD_j)	-0.6954**	-0.7132**	-0.7119**	-0.7121**	
	(-2.831)	(-2.890)	(-3.204)	(-3.20)	
Export enhancement program (EED_{ij})	—	0.0031	—	0.0036	—
		(0.025)		(0.032)	
Intercept	—	—	14.4937*	14.4524*	14.7275**
			(2.220)	(2.170)	(3.152)
R2	0.437	0.439	0.436	0.436	
DF	497	498	497	498	508
MSE	4.3845	4.3980	3.5694	3.5766	4.9064

**Significant in two-tail t-tests at 1 percent level.
*Significant in two-tail t-tests at 5 percent level.

trend in an exporting country will make that country's wheat less competitive in the world market and will result in a decrease in the quantities of wheat traded. Similarly, inflationary trend in an importing country will increase its imports of wheat. The negative signs on deflators may have been affected by import substitution elasticities.

Effects of Income, Price, and Exchange Rates

The results of the JA test indicate that including farm income provides a correct specification of wheat trade model. Indeed, GDP for the farm sector represents agricultural production capacity in exporting countries, and disposable income represents consumer's purchasing power in importing countries. The estimated coefficients on the variables are positive as hypothesized and differ significantly from zero at the 1 percent level. This implies that a rise in exporting and/or importing countries' income leads to increased trade flows. The magnitude of the coefficients are smaller than 1.0, indicating that the quantities of wheat traded are neither sensitive to the production capacity in exporting countries nor to disposable income in importing countries. The insensitivity in exporting countries can be attributed to excess production capacity and domestic farm support programs in the countries. The insensitivity in importing countries is mainly because wheat is a necessity. The extent of the sensitivity, however, is greater in exporting countries than in importing countries.

The estimated coefficients on import prices and export prices are negative and positive, respectively, as hypothesized. The corresponding t-values indicate that the coefficient on the export and import prices differ significantly from zero at the 1 percent level. The magnitude of the coefficients are greater than 1.0 in the absolute value, implying that quantities of wheat traded are sensitive to prices of wheat in exporting and importing countries. The magnitude of the coefficient in importing countries is larger than that in exporting countries in the absolute value, indicating that the quantities of wheat traded are more sensitive to the import prices than the export prices because of the strong competition among exporting countries in most importing countries.

Exchange rates used in this analysis are defined as changes in the prices of importing countries' currencies in terms of exporting countries' currencies. The coefficient for the exchange rate variable is positive as hypothesized. An appreciation of an importing country's currency (a depreciation of an exporting country's currency) makes the exporting country's wheat cheaper in the importing country's market, leading to increased trade flows. However, The t-test indicates that the estimated coefficient does not differ significantly from zero at the 1 percent level.

Effects of Trade Promotion Programs and Policies

Specification tests indicate that export promotion programs should be included in the wheat trade model. Export promotion programs (LTA, CS, and EEP) have a positive sign as expected. The corresponding t-statistics indicate that the variables representing the LTA and CS are significantly correlated to the quantities of wheat traded. The magnitude of the coefficient on LTA is larger than that on CS, implying that LTA has promoted wheat sales more effectively than CS. The t-value for the EEP variable indicates that the variable does not differ significantly from zero at the 5 percent level and the magnitude of the coefficient is smaller than those of the other programs. This indicates that the patterns of wheat trade flows are not largely influenced by the EEP[4]. The EEP substantially increased the U.S. exports of wheat in the targeted markets where the United States competes with other exporting countries including EC, while the United States barely maintained or lost its market shares in the other markets where the EEP was not used. The EEP also reduced the effectiveness of the credit sale program in the world wheat markets. This study suggests that overall effects of the EEP on the U.S. exports are minimal during the sample period (1981-1987), although the program has been effective in a few targeted markets.

Some importing countries have used the price support program to protect their domestic agricultural production. The variable has a negative sign and its coefficient differs significantly from zero at the 1 percent level. This implies that the support price program used by some importing countries reduces trade volume of wheat. The support price program was used to raise the price of wheat in importing counties to protect the agricultural sector in the countries and, accordingly, led to decreased wheat imports.

In discussing factors aiding trade, we introduced a dummy variable representing EC member countries. The question is, "Did the European integration into a common market enhance wheat trade among the member countries?" The theory of welfare economics proves that economic integration increases welfare of the member countries through increases in trade volume among the countries. The estimated model shows that the EC enhances the world wheat trade. The coefficient for the EC dummy variable is positive as expected and is highly correlated to the quantities of wheat traded according to the t-statistics.

A dummy variable representing the countries which allocate or restrict uses of foreign currencies for wheat imports is introduced in the model. The variable has a negative sign as expected and is not significant at the 10 percent level. This implies that lack or limitation of uses of foreign currencies has, to some extent, impaired the world wheat trade.

5. Concluding Remarks

A reduced form gravity model on the basis of a general equilibrium of world trade is modified and applied to the world wheat market to evaluate factors affecting trade flows of wheat. A parameterization of Bergstrand's generalized gravity model into a time series and cross section framework is found to be efficient in evaluating commodity specific trade flows. This study demonstrates an application of gravity model for comprehensive policy analysis. In the empirical analysis, special attention was given to evaluating impacts of price and non-price export promotion programs and price support programs on the world wheat trade.

This study shows that the modified gravity model is applicable for single commodity to describe trade flows. In the case of wheat trade, the model describes wheat trade flows and still retains the classical features of the conventional gravity model. Income variables are important wheat trade determinants, indicating that sound growth in the world economy would stimulate world trade. As expected, the prices of wheat in importing and exporting countries play an important role in determining the world wheat trade flows. A strong competition among exporting countries makes import demand more sensitive to the import prices than export supply.

The Long-term Agreements are a policy that achieved the highest performance by significantly enhancing international wheat trade. Credit sales contributed to increased wheat trade. The export enhancement program which is mainly used by the United States is found to be ineffective in stimulating the world wheat trade. On the import side, protectionist policies of supporting domestic prices in importing countries greatly impaired wheat trade. The formation of economic union such an EC stimulates wheat trade among member countries.

Appendix: Source of Data

Financial data such as gross domestic product for farm sector exchange rates, international monetary reserves, and gross domestic product deflator were taken from the International Financial Statistics (International Monetary Fund) and world tables (World Bank). Data on wheat (all wheat) exports were published in *International Trade Statistic Yearbook* (United Nations) and *Grain Market News* (U.S. Department of Agriculture) in various issues. Export price data were obtained from the USDA Foreign Agricultural Services. Import prices were computed by dividing the total value of import by the quantity imported in each importing country. Export promotion and trade restriction programs were obtained from Wheat Support Policies and Export Practices in Five Major Exporting Countries (International Wheat Council). Bonus payments under the EEP were obtained from the USDA.

Data on distance between trading countries are not available. The distances were actually calculated by using the oceanographic maps published by the U.S. Navy. Ocean freight rates were obtained from International Wheat Statistics (International Wheat Council) USDA in various issues.

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Endnotes

1. There are a few other government programs which are designed to promote wheat exports, e.g., cooperator programs, the targeted export assistance (TEA) program and food aids (Smith). These programs are not included in his study because the quantities of wheat trade under these programs are relatively small compared to the quantities of wheat traded under LTA, CS, and EEP.

2. Breusch and Pagan (1979) show that

$$G = \frac{NT}{2(T-1)} \left[\sum_{i=1}^{N_1} \sum_{j=1}^{N_2} \left(\sum_{t=1}^{T} e_{ijt} \right)^2 -1 \right]^2$$

which has a χ^2 distribution with appropriate degrees of freedom: where $N = N_1 x N_2$, and e_{ij} = OLS residuals.

3. Specification test of a model based on the behavior of U_{ij} is provided by Hausman (p. 1263) as follows:

$m = \hat{q}' \hat{M}(\hat{q}) \hat{q}$ has a χ^2 distribution with k d.f.

where $\hat{q} = \hat{\beta}_{FE} - \hat{\beta}_{RE}$ is a k x 1 column vector of difference between fixed effects $(\hat{\beta}_{FE})$ and random effects $(\hat{\beta}_{RE})$ parameter estimates (k), respectively, and $\hat{M}(\hat{q}) = V(\hat{\beta}_{FE}) - V(\hat{\beta}_{RE})$ is a k x k covariance matrix of difference between variances of $\hat{\beta}_{FE}$ and $\hat{\beta}_{RE}$.

4. Since EEP was introduced in late 1985, the model might not capture fully the effects of EEP on trade flows of wheat with the given data (1981-1987).

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