U.S.-South America Intra-Industry Trade in Agricultural and Food Products

Shuvo Chakraborty and Evert Van der Sluis

Department of Economics, South Dakota State University

Background

Intra-industry trade (IIT) refers to the international exchange of products between two or more nations within the same industry. IIT concerns two-way trade in similar or largely homogenous products, and tends to occur in industries subject to economies of scale and those trading differentiated products.

Most IIT studies focus on the manufacturing sector where monopolistic competition may occur (Crespo and Fontoura 2004). Relatively few IIT studies involve agricultural products, in part because agricultural markets have traditionally been treated largely as being competitive and much trade in agricultural products involves bulk commodities (Fertő 2005; Rasekhi 2008).

The IIT share out total trade tends to increase as nations develop and as industries move away from perfect competition. IIT generally involves products that have undergone high levels of processing and are associated with high degrees of profitability relative to bulk commodities. Hence, analyzing the degree to which trade in agricultural and food products involves IIT and identifying both industry and country-specific determinants of IIT not only help explain changing trade patterns but also serve to identify factors that influence industry competitiveness.

Objectives

We investigate IIT determinants in agricultural products by focusing on the food and live animal industry product trade between the United States and key South American trading partners between 2010 and 2015. We focus on both industry and country-specific determinants, including gross domestic product (GDP), foreign direct investment (FDI) flows into trading partner nations, the degree of trade imbalance, and economies of scale.

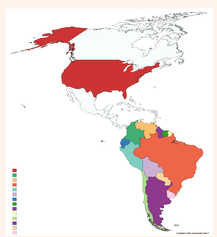

Figure 1. The South American trading partners of the U.S. included in the study

Justification

Since IIT was first identified as a distinct phenomenon in 1966, most IIT studies have been limited to the manufacturing sector and industrialized countries, and have mainly focused on the trade among European countries. Only a small number of studies concerning IIT in agricultural products consider the United States.

Over the past several decades, interest in value-added agriculture activities has increased. The growing importance of value-added agriculture has led to the development of increased amounts of differentiated products, which may also be associated with expanded levels of IIT.

Hypothesis

We hypothesize that a difference in average GDP between the United States and its trading partners, value-added agriculture, and FDI inflows (in current USD) in partner countries are positively associated with IIT. On the other hand, the size of a trade imbalance and differences in per capita income each has a negative relationship with IIT in the food and live animal industry.

Methods

Our analysis is based on Grubel and Lloyd's (1975) IIT index, denoted as:

$$\beta_m = 1 - \frac{|X_m - M_m|}{(X_m + M_m)},$$

where β_m is the Grubel-Lloyd index of IIT for industry m, X_m and M_m denote a country's exports and imports in industry m, respectively. The G-L index reaches its maximum value of one if and only if the total amounts of exports and imports become the same, indicating that all trade consists of an IIT type. The G-L index will reach its minimum value zero if and only if either the value of exports or the value imports is equal to zero, indicating that all trade is in different products and thus fully comprises inter-industry trade (INT).

Our empirical analysis of the IIT determinants is based on a panel regression model. We used STATA 12.0 IC for our analysis. The three options for analyzing are to use pooled OLS / linear regression, a fixed effect model, or a random effect model. We selected the appropriate model based on the results of the Hausman test and Breusch-Pagan Lagrange Multiplier test (B-P test). We constructed a panel data set to analyze the determinants of U.S. IIT in the food and live animals industry with South American trading partners. The empirical form of our model is:

$$B_{uat} = \beta_0 + \beta_1 LNAVGDP_{uat} + \beta_2 LNES_{at} + \beta_3 LNDGDPPC_{uat} + \beta_4 TIMB_{uat} + \beta_5 FDI_{at} + V_{at},$$

where *u* denotes the United States, *a* is the U.S. trading partner, *i* denotes time, B_{uat} is a logistic transformation of the G-L index, $LNAVGDP$ represents the average GDP of the U.S. and its trading partner, and $LNES_{at}$ denotes economies of scale proxied by value-added agriculture activities in the partner country. Further, $LNDGDPPC_{uat}$ refers to the relative difference in GDP between the United States and the partner country, which serves as a proxy for the level of economic development in the partner nation relative to that of the United States, $TIMB_{uat}$ denotes the degree of trade imbalance, FDI_{at} represents the FDI inflow into the partner country, and V_{at} is a random error.

Data

The main source of trade data is the United Nations' Commodity Trade database (UN Comtrade database). For GDP-related data, value-added agriculture and FDI, we used the World Bank database. We analyzed data covering the time period between 2010 and 2015. This study covers the Standard International Trade Classification (SITC) revision 4, classification code 0 (food and live animals) and all of its subcategories at the 2-digit level.

Analysis

To analyze the IIT determinants, we use a logistic transformation of the G-L index as the dependent variable. Explanatory variables include average GDP, value-added agriculture, FDI inflows (in current USD), the trade imbalance, and the difference in per capita incomes. The data show different IIT values across the trading partners for trade in products for the food and live animal industry.

Results

Results of applying the GLS random effect model show that the model is statistically significant. The panel data set is strongly balanced, with no missing values for any of the observations. There are 72 observations in 12 groups, where each group represents a U.S. trading partner. The results show that differences across units are uncorrelated with the regressors. Intra-class correlation, denoted by the Rho value, is 0.71, suggesting that 71 percent of the variance is due to differences across panels.

Table 1. Results of the estimation of the GLS random effect model

Explanatory variables	Coefficient	Std. Error	Z	p>|z|	Significance
LNAVGDP	0.52	0.31	1.66	0.10	*
LNES	0.15	0.06	2.34	0.02	**
LNDGDPPC	2.11	0.63	3.33	0.00	***
LNTIMB	-8.73	0.60	-14.68	0.00	***
LNFDI	0.03	0.04	0.72	0.47	
intercept	-23.34	9.22	-2.53	0.01	

Note: *, **, and *** denote statistically significant at the levels of 10%, 5%, and 1%, respectively.

The results indicate the coefficient of *LNAVGDP* is positive and statistically significant at the ten percent level, suggesting that *LNAVGDP* has a positive relationship with the logistic transformation of the dependent variable. More specifically, a one percent increase in average GDP causes a 0.52 percent increase in IIT intensity relative to INT.

LNES measures value-added agriculture, which is a proxy for the presence of economies of scale in the food and live animal industry in the partner country. An increase in value-added agriculture activities would be expected to enhance a country's capability to produce differentiated products and would lead to additional IIT. The results indicate that the *LNES* parameter estimate is positive and statistically significant at the five percent level.

LNDGDPPC, representing the difference in economic development between the trading partner and the United States, is significant at the one percent level. Contrary to our expectations, we found a positive relationship for this variable.

The variable LNTMB, which denotes the trade imbalance, is also statistically significant at the one percent level, but it is negatively related with the dependent variable. Finally, LNFDI is not statistically significant, but it has a positive relationship with IIT.

Conclusions

Two-way trade or IIT plays an important role in the trade relationship between the United States and its South American trading partners. This is also true for the trade in products of the food and live animal industry. While the IIT index is generally low, it increased for the trade with most South American trading partners between 2010 and 2015.

The analysis of the IIT determinants indicates that average GDP, economies of scale, and difference in level of economic development each has a positive impact on IIT, but the existence of a trade imbalance has a negative impact on IIT. Results of this study are generally consistent with theoretical predictions, except for the variable representing differences in level of economic development between the United States and its trading partners.

Another important finding of this study is the positive relationship between the IIT share and value-added agriculture. Generally, profit margins tend to be higher for high-end differentiated products than for raw commodities. By increasing investments in value-added agriculture, a country may be able to increase product variety. This may also lead to specialization and additional INT and IIT. Thus, one of the policy implications of this study is that it provides confirmation for the intuitive notion that increased value-added agriculture activities are positively associated with IIT levels and therefore increased profitability levels.

References

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For further information

Please contact the authors at shuvo.Chakraborty@jacks.sdstate.edu or evert.vandersluis@sdstate.edu