Country-specific Determinants of Intra Industry Trade Types of Agricultural Sector in Selected Developing Countries

Saeed Rasekhi[*]

Shideh Shojaee[**]

Abstract

Regarding few studies of intra industry trade in the agricultural sector, this study have examined country-specific determinants of intra industry trade of agriculture in selected developing countries by using panel technique for trade data at 6-digit level of HS classification over time period 2001-2007. By employing Greenaway, Hine and Milner and Fontagné and Freudenberg approaches we've first divided intra industry trade into its types that is horizontal and vertical ones. Then, based on theoretical and empirical studies, we've estimated determinants of the types of intra industry trade. Overall and based on the results, it seems that the level of development and growth (Human development index) has a significant positive effect on intra industry trade of agriculture in countries under study. Also, the revealed comparative advantage has a significant positive effect on vertical intra industry trade and a significant negative effect on the horizontal intra industry trade in agricultural commodity groups. However, there is no definite result on the effect of exchange rate and trade openness.

Keywords: Intra Industry Trade Types, Revealed Comparative Advantage, Human Development, Exchange Rate, Agricultural Sector, Developing Countries.

1- Introduction

Based on theoretical foundations, international trade is separated in two types Inter Industry Trade (INT) and Intra Industry Trade (IIT). In inter

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∗ Associate Professor of Economics, University of Mazandaran, Babolsar, Iran. (Corresponding Author)

∗∗ M.A. in Economics, the University of Mazandaran, Babolsar, Iran.

industry trade, the country exports and imports products from different industries.

This type of trade is between countries with different factor endowment. In contrast, in intra industry trade, countries simultaneously export and import similar products. In the literature, IIT is divided to Horizontal Intra Industry Trade (HIIT) and Vertical Intra Industry Trade (VIIT). Horizontal intra industry trade occurs when varieties of a product are traded with different characteristics but with the same quality. In contrast, vertical intra industry trade is to simultaneously export and import of products with different quality. This distinction is important because intra industry trade determinants for horizontal differentiated products differ from vertical differentiated goods (Greenaway et al, 1994).

Intra industry trade emergence and growth during the past few decades is one of the most important facts in world trade and has attracted a lot of attention in the international economics literature (Luka and Levkovych, 2004). According to WTO statistics, from 1960, trade between developed countries is calculated more than two-thirds of world trade (Jing, 2009). Also, the major world trade growth after world war II has been due to the intra industry trade (Hirschberg and et.al, 1994). Hence, IIT has played a very important role in world trade.

Intra industry trade was first observed in an empirical work on the evolution of the European Community (EC) by Verdoorn and Balassa (1965), and since then an extensive literature has shown evidence of IIT in the trade of developed (e. g. Grubel and Lloyd, 1975; Aquino, 1987; Greenaway and Milner, 1984), less developed (e.g. Balassa, 1979; Havrylyshyn and Civan, 1983) and centrally planned economies (e. g. Drabek and Greenaway, 1984) (Hartman and et.al, 1993).

Despite the growing importance of product differentiation and intra industry trade in agricultural products, few efforts have been conducted in the study IIT. Most of studies in IIT have focused on manufacturing products. The reason is probably that the agricultural markets are usually based on perfect competition (Fertő, 2005). According to few studies, especially about the types of intra industry trade in agriculture sector and that most studies on this field have been done in developed countries, the present paper has examined the types of agricultural IIT determinants in selected developing countries. For this purpose, we've selected 32

developing countries with the highest share of agricultural sector in their foreign trade.[1] Then, the types of agricultural IIT in these countries have been estimated by using indices including the Greenaway, Hine and Milner (GHM) and Fontagné and Freudenberg (FF) during time period 2001-2007. Finally, we've examined the determining factors of the types of IIT by using panel method. It's mentionable that agricultural sector in this study is based on definition of Uruguay Round Agreement Act (URAA) which includes chapters 1-24 of HS and also list of goods in chapters 29, 33, 35, 38, 43, 50-53. Aquatic products have been considered to complete the agricultural sector in this study.

This paper is organized in four sections. After the Introduction in the first part, the second part is devoted to methodology. Model estimation and data analysis is presented in third Section. In Section four, conclusion is presented. Resources and articles reference come at the end.

2- Methodology

Traditional trade theories are not able to explain intra industry trade. On the other hand, the New Trade Theories (NTT) explains IIT mainly based on product differentiation, imperfect competition and economies of scale. Although Linder (1961) emphasized the role and importance of distinct products in determining the volume of trade between similar countries, but the theoretical studies and experimental researches about IIT actually began with publishing the book by Grubel and Lloyds (1975) (Veeramani, 2001). The majority of previous empirical studies have not recognized the distinction between two types of IIT (horizontal and vertical). However, based on theoretical foundations of Intra Industry Trade, determinants of the two IIT types are different.

One of the most important variables is level of growth and development. This variable on demand side indicates the country's more potential demand for different products (horizontal and vertical) and on supply side indicates

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[1] These countries are Paraguay, Malawi, Côte d'Ivoire, Argentina, Gambia, Uruguay, Seychelles, Saint Vincent and the Grenadines, Ethiopia, Uganda, Kenya, Senegal, Dominica, Mauritius, Belize, Grenada, Guyana, Samoa, Niger, Rwanda, Maldives, Saint Lucia, Guatemala, El Salvador, Rep. of Moldova, Costa Rica, Ecuador, Namibia, Armenia, Sri Lanka, Brazil, Iran

the ability of supplying different products (horizontal and vertical) and also economies of scale degree (Anderson, 2002; Balassa and Bauwens, 1987; Kenen, 1999). So, expected relationship of both IIT with the level of growth and development is evaluated positive. The other variable which has been frequently used in IIT studies is market size. Market size on demand side means demand for different products (Balassa 1986) and on supply side means the wider range of producing different products and as a result lead to more chances to use economies of scale effects (Loertscher and Wolter 1980), more number of different products (Lancaster 1986) and increases the potential for IIT. So relationship between IIT and market size is evaluated positive. Another influential variable on IIT which has been considered in some studies is the exchange rate. There is no agreement in the literature on how exchange rate affects the share of IIT. Based on Ricci model (2006), foreign exchange market liberalization reduces intra industry trade. Specifically in this model, countries tend to act more specialized in flexible exchange rate conditions than fixed exchange rates regime. On the other hand, the effect of exchange rate is also affected by the current account and the M-L condition. If the current account has deficit (surplus) and the Marshall-Lerner condition is established, an increase in exchange rate increases exports and reduce imports. Then, less exports and imports overlaps may decrease intra industry trade. Another important factor that is considered directly or indirectly is product differentiation. Product differentiation occurs when individual firms in an industry produce the same product in different species which are close substitutes in the consumption or production. Despite the similarities between countries and diversity of demand preferences among consumers product differentiation is leading to IIT between countries. Greater country-level product differentiation will create scope for IIT (Zhang and Clark, 2009). Therefore expected relationship in types of IIT and CPD will be positive. Foreign direct investment also has an effect on IIT, although this effect is ambiguous and depends on the nature of the investment. Some studies like Markusen (1984) and then Brainard (1997) have predicted that substitution (succession) of FDI (market-oriented FDI) and trade dominates their complementary relationship. In contrast, authors like Helpman (1984), Helpman and Krugman (1985) has predicted the complementary relationship between FDI (efficiency-seeking FDI) and trade. In general the expected relationship

between FDI and IIT depending on substitution or complementation can be positive or negative. Another determinant is trade openness. The most important characteristic of trade openness and in other words trade liberalization, are to reduce or eliminate price rates and value restrictions on importing which are matching to lower trade barriers and the higher volume of trade as will result in the more IIT levels. Trade liberalization causes the industry to improve its productivity, to offer more vertically differentiated products and lower price, to increase consumer surplus welfare and ultimately to increase IIT (Melitz, 2003).

Another determinant on intra industry trade is comparative advantage.[1] However the country has more comparative advantage than the competitors in producing merchandise, the monopoly power of the producer country and power of determining the price on the international level will increase. This concept was first presented by David Ricardo which is considered as theoretical foundations of international trade. After Ricardo, This theory was examined and evolved by economists such as Balassa (1965), and today is still valid within the framework of free trade among countries. Expecting sign for the coefficient of this explanatory variable differs in relation to types of IIT. Expecting sign is positive for VIIT because VIIT is determined mainly by the determinants of comparative advantage of traditional trade model. In contrast, HIIT is described mainly based on the factors noted in new trade theories (especially economies of scale and horizontal product differentiation) and similarities between countries factor endowments. Thus, it is expected comparative advantage impacts negatively on HIIT. There is no expected sign about the relationship between total IIT and comparative advantage because total IIT includes both horizontal IIT and vertical IIT.

The other determinant is the arable land. It seems that countries with different endowments will produce different quality of agriculture goods. So, we expect this factor is positively related to VIIT. But, HIIT is negatively affected by the land's differences due to this type of trade is determined by the factor similarities. Also, there is again no certain sign about the relationship between IIT and the arable land.

1- VIIT as one of component of IIT is closely related to RCA. So, we expect IIT is affected by RCA.

3- Model Estimation and Data Analysis

Based on the literature of intra industry trade, the general form of IIT relationship (total, vertical and horizontal) in this study is as follows:

$$IIT^k = f\left(DEV, SIZE, EX, CPD, FDI, OPEN, RCA, LAND, IMB\right)$$
$$K = Total(T), Vertical(V), Horizontal(H) \tag{1}$$

The expected signs are:

$$f_{DEV} > 0, f_{SIZE} > 0, f_{EX} \gtrless 0, f_{CPD} > 0, f_{FDI} \gtrless 0, f_{OPEN} > 0, f_{RCA}^V > 0, f_{RCA}^{T,H}$$
$$< 0, f_{LAND}^V > 0, f_{LAND}^{T,H} < 0, f_{IMB} < 0$$

Where IIT^k is the index of intra-industry trade (total, horizontal and vertical), DEV represents the level of development, SIZE denotes market size, EX is the real exchange rate, CPD is the country level of product differentiation, FDI denotes the foreign direct investment, OPEN is the trade openness, RCA indicate the agricultural revealed comparative advantage, LAND represents the arable land and IMB is the trade imbalance.

To divide IIT into its types, we've used two approaches including Greenaway, Hine and Milner (GHM) and Fontagné and Freudenberg (FF). Greenaway-Hine-Milner Index (1994, 1995) for kth type of IIT (vertical and horizontal) (GHM^k) is achieved by the following formula:

$$GHM^k = \frac{\sum_p \left[(X_p^k + M_p^k) - \left| X_p^k - M_p^k \right| \right]}{\sum_p (X_p + M_p)} \qquad k = Vertical(V), Horizontal(H)$$

Where the X_p^k and M_p^k are respectively the values of exports and imports in agricultural products group p for the kth type of IIT.

The second method has been proposed by Fontagné and Freudenberg (1997). The approach groups current trade flow and calculates the share of

total trade for each group. In this approach, first the trade is separated to Two Way (TW) trade or intra industry trade and One Way (OW) trade or inter industry trade and then regarding to similarity condition, two way trade is separated to its types of Two Way Horizontally Differentiated (TWHD) and Two Way Vertically Differentiated (TWVD). Finally, the share of these types of intra industry trade in total trade is calculated based on the following relations:

$$STWHD = \frac{TT^H}{TT}, STWVD = \frac{TT^V}{TT}, STW = \frac{TT^H + TT^V}{TT},$$

$$SOW = 1 - \left(\frac{TT^H + TT^V}{TT} \right) \tag{3}$$

In the present study, level of development and growth are measured by HDI.[1] It is worth saying that this index is used in very few studies that can be pointed out Caetano and Galego (2007).

To measure the market size, two proxies including Gross Domestic Products (GDP) in fixed price and based on Purchasing Power Parity (PPP) and Gross National product (GNP) are used. For exchange rate variables, the real exchange rate is used. For measurement of product differentiation for the j country two indicators have been used: Index of the number of exported products of country in 6-digit level of HS and diversification index in studied country. Diversification index is calculated as follows:

$$DIVER_j = \frac{\left| h_{pj} - h_p \right|}{2} \tag{4}$$

In the above relationship, h_{pj} is the share of p agricultural product group in the export of j country and h_p is the share of agricultural products group in world export. To measure the foreign direct investment, inward foreign direct investment (Stock and Inward) is used. Trade openness is measured with the ratio of total trade (X+M) to Gross Domestic Products (GDP). To

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1- Human Development Index as a composite statistic is calculated by the UNDP through the weighted averaging of three indices including income (GDP per capita), education and life expectancy. This index stands for the level of economic growth development.

calculate the comparative advantage, the RCA index is used. It is necessary to explain that few studies like Bernatonyte and Normantiene (2009) have used these variables to explain IIT. However, these studies also have been conducted for non-agricultural sectors. Based on Balassa method, relative export advantage (RXA) is measured as follows:

$$RXA = \frac{X_j^p \Big/ \sum_p X_j^p}{\sum_j X_j^p \Big/ \sum_j \sum_p X_j^p}$$

(5)

In this relationship, X_j^p is the agricultural export by j country, $\sum_p X_j^p$ total export of j country, $\sum_j X_j^p$ world export in agricultural sector, and $\sum_j \sum_p X_j^p$ is the total world export. The index of comparative advantage based on Volrath index (1991) (RMA) is the same as Balassa method but is based on imports, as follows:

$$RMA = \frac{M_j^p \Big/ \sum_p M_j^p}{\sum_j M_j^p \Big/ \sum_j \sum_p M_j^p}$$

(6)

In this relationship, M_j^p is the agricultural import by j country, $\sum_p M_j^p$ total import of j country, $\sum_j M_j^p$ world import in agricultural sector, and $\sum_j \sum_p M_j^p$ is the total world import. Revealed comparative advantage index is calculated as the difference between relative import advantage (RMA) and relative export advantage (RXA):

$$RCA = RXA - RMA$$

(7)

Another variables that is considered in some empirical studies, is trade imbalance that is used to control any bias in estimating IIT determinant and

of course it is not an IIT determinant. This variable has negative relationship with IIT.

Trade imbalance variable for j country (IMB_j) in the model is measured as follows:

$$IMB_j = \frac{\left| X_j - M_j \right|}{\left(X_j + M_j \right)} \tag{8}$$

On above relationship, X_j (M_j) is exports (imports) of j country. Table (1) presents the method of measuring variables and data sources of present research.

Table (2) provides the results from estimating panel regressions for determinants of intra industry types in selected developing countries during time period 2001-2007. Based on F statistics all regression equations are significant. Heteroscedasticity test (LM) also indicated that there is no heteroscedasticity in selected models. Also, F-Leamer test confirms panel method and based on Hausman test, fixed effects methods are used to estimate the models.

Based on table (2), the coefficient of the level of development variable in all three selected equations is significant and the expected sign is positive. Thus, the importance of country growth and development level in determining and developing their intra industry trade of agricultural products is approved statistically. Variable size Coefficient in the total and vertical IIT models has the expected positive signs and is significant. Thus it seems that market size which may indicate potential of production and demand for differentiated products and an advantage of economies of scale has significant and positive effect on total and vertical IIT in the studied countries. Effect of this variable on HIIT is negative and significant. This unexpected sign is not limited to this study and it is occurred in other empirical studies such as the Turkcan and Ates (2010). The exchange rate variable in the total and vertical IIT models has a positive sign and is significant. Based on these findings, it seems that exchange rate liberalization as a component of economic liberalization could boost their

total and vertical IIT. However, the effect of this variable on HIIT is achieved negative and significant. Perhaps this is confirming the conclusion that increased exchange rate will increase (decrease) exports (imports) and as a result, the amount of overlapping of exports and imports is increased and the intensity of horizontal IIT is declined. However, as was previously expressed, there is no agreement on the effect of exchange rate on the share of IIT in the literature. Variable coefficient of product differentiation in total and vertical IIT model has negative and in the selected equation HIIT has the expected positive and significant sign. Product differentiation variable (export diversification index) represents mainly the horizontal product differentiation and therefore obtained results with VIIT seem reasonable. Also, the negative coefficient of this variable in the total IIT model, at first seems unexpected and inappropriate, but regarding to the significant portion of the IIT in selected countries is dedicated to the vertical IIT, can be an acceptable result. Variable coefficient of foreign direct investment is obtained positive (that also has the role of multinational corporations) in all three selected equations. Thus it appears that multinational companies in the studied country have acted as these countries horizontal IIT supplement. However, certain results have not been achieved with variable degree of openness. But considering the positive and significant effect of trade openness on the total IIT, it seems that in general trade openness increases selected developing countries' IIT. Another variable which its impact on IIT have been reviewed in this study, is revealed comparative advantage. Coefficient of this variable as expected is negative and significant in horizontal and total IIT estimation pattern and positive and significant in VIIT model. Thus, the fundamental factors affecting on HIIT as has also been raised in the IIT models, in contrast to VIIT models, are different from theories based on comparative advantages. However, in relation to arable land variables, certain outcome has not been obtained and contrary sign (positive coefficient for HIIT and the negative coefficient for VIIT) in the estimated equations can be caused by measurement error. Clearly size of arable lands doesn't necessarily mean quality of land (land fertility) and therefore quality of product. Trade imbalance variable coefficients in the IIT and HIIT equations have the expected negative sign and are significant. But

as it is expected the sign is negative for the VIIT equation.[1] Thus, this variable is better to be considered in models to reduce any bias in estimating determinants of IIT in the agricultural sector.

It should be mentioned that the obtained results within the vertical intra industry trade model, are largely similar to results of total intra industry trade. This is due to the fact that in general, a portion of total IIT in selected countries is allocated to vertical IIT. Particularly during the studying period and on average, in 81.70 percent of selected countries, vertical IIT is more than 60 percent of IIT.

4- Conclusion

In this study, intra industry trade of selected developing countries for agricultural products group is estimated based on Greenaway, Hine and Milner (GHM) method and Fontagné and Freudenberg (FF) approach in 6-digit level of HS international classification in the 6-digit level of HS international classification during the period 2001-2007. More determinants of types of non-mutual IIT in selected developing countries were analyzed and identified based on country characteristics. Based on the findings of this research, country characteristics have a decisive effect on the agricultural IIT of investigated countries. Overall and based on the most important results, it seems that the level of development and growth (Human Development Index) has significant positive effect on IIT types of agriculture in studied countries. In other words, economic development by influencing both supply and demand sides of agricultural product group, improves IIT quantitatively and qualitatively. Also, the Revealed Comparative Advantage (RCA) has significant positive effect on vertical IIT and a significant negative effect on the horizontal IIT in agricultural groups. Accordingly, it seems that VIIT mainly is influenced by structural differences and comparative advantage. However, there is no definite result on the types of IIT regarding the effect of exchange rate and trade openness.

1- Regarding to positive and significant coefficient of IMB in the VIIT equation, it seems that the increasing overlapping between exports and imports makes more probable more share of VIIT than HIIT. Since VIIT is similar to inter industry trade, this result is justifiable.

Results for total and vertical IIT are largely similar. This finding is not unexpected because in general, vertical IIT will allocate a significant portion of selected countries total IIT.

Table1: Method of Measuring Variables and Data sources of Present Research

	Proxy Variable	Data Source
DEV	Human Development Index (HDI)	
		HDR
	- GDP (PPP, constant 2005 international $)	WDI
SIZE	-GNP	UNCTAD
EX	Real exchange rate	USDA/ERS
CPD	-Diversification Index -Number of export products index	PC/TAS CD-ROM & UN
FDI		UNCTAD
	Inward foreign direct investment stock (Flows)	
		PWT
OPEN	total trade as a percentage of GDP (in constant prices)	
RCA	Revealed Comparative Advantages Index (in agricultural sector)	PC/TAS CD-ROM & UN
LAND	Arable land (hectares)	WDI
IMB	Trade Imbalance: the ratio of the absolute value of net trade to the total trade in the agricultural sector	PC/TAS CD-ROM & UN

Note: HDR—Human Development Report; WDI— World Development Index; UNCTAD—*United Nations Conference on Trade and Development*; USDA/ERS—United States Department of Agriculture, Economic Research Service; PWT—Penn World Table (Heston, Summers, and Aten 2009); PC/TAS—PC Trade Analysis System; UN—*United Nations Statistics Division*;

Table 2: Results from Estimating Panel Regressions for Determinants of Intra Industry Trade Types in Selected Developing Countries during Time Period 2001-2007

Independent Variable	Dependent Variables		
	IIT	HIIT	VIIT
Constant	-3.35***	-29.53***	105.27***
	-6.93	-4.50	8.21
DEV	1.31***	47.52***	20.30***
	2.47	3.98	2.71
SIZE	4.78E-16***	-1.06E-10***	1.21e-14***
	3.87	-17.15	2.95
EX	0.0002***	-0.003***	0.005***
	5.17	-12.28	3.44
CPD	-0.002***	62.90**	-71.38*
	-3.30	2.06	-1.77
FDI	0.008	0.45***	2.66E-05
	1.49	8.12	1.13
OPEN	0.009***	-0.16***	0.06
	5.89	-2.87	0.94
RCA	-0.013***	-1.98**	2.31*
	-13.09	-2.18	1.89
LAND	-2.72E-08	9.09E-06***	-9.79E-06***
	-0.63	23.91	-7.11
IMB	-0.69**	-7.33***	7.92*
	-2.09	-3.57	1.72
R-squared	0.93	0.86	0.77
Adjusted R-squared	0.91	0.83	0.72
F-statistic	54.04***	27.52***	14.52***
F-Learner test	8.78	3.75	5.61
Hausman test	21.41***	19.47**	18.45**
LM test (Heteroscedasticity)	27.11	40.96	30.45
N (Observations)	204	209	204

Figures in parentheses are *t* -statistics; significance levels are ***=1%, **=5%, *=10%.

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