American-Eurasian J. Agric. & Environ. Sci., 2 (Supple 1): 12-19, 2008
ISSN 1818-6769

The Study of Intra Industry Trade in Agricultural Products of Iran

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Abstract: The purpose of this paper is to estimate and study intra industry trade (IIT) types of Iran's agricultural products. For this, important indices of Grubel & Lioyd and Fontagn´e & Freudenberg's trade types in 6-digit level of HS international classification are used for estimating agricultural IIT during time period 1997-2003. Results indicate low but increasing IIT types for agricultural products of Iran. Specifically, two way trade of Iran's agricultural products is estimated about 2.73-5.98 percent during the time period. Furthermore, an important part of this IIT is devoted to Vertical Intra Industry Trade (VIIT). Then, it seems that foreign trade in agricultural products of Iran is mainly dependent on traditional comparative advantages, rather than new determinant factors such as product differentiation and economies of scale. With respect to this result, trade liberalization probably has considerable adjustment costs in Iran's agriculture sector which can be reduced by increasing IIT in this sector. Furthermore, regarding the importance of IIT in non oil exports, it is proposed to put an emphasis on agricultural IIT determinants, as well as taking care of existing comparative advantages.

Key words: Intra industry trade (IIT) · Grubel and lioyd index · Trade types index · Adjustment costs · Agricultural products of Iran

INTRODUCTION

Emergence and growth of Intra Industry (IIT) - simultaneous export and import of same product groups - is one of the most important facts in the field of international trade. The phenomena which has been truly considered since the early 1980s, is not consistent with traditional trade theories predictions. Specifically, traditional theories explain international trade between countries according to their structural differences. Furthermore, based on these theories traded product groups should have different factor intensities, i.e. inter industry trade [1]. Intra industry trade has also important policy implications. For instance, Ruffin [2] believes that intra industry trade reduces demand for protection, because this trade involves both trade sides, i.e. export and import. As well, intra industry trade has low trade liberalization adjustment costs compared with inter industry trade. Specifically, trade liberalization moves production factors between sectors, which in turn imposes some costs on economy. Nature of intra industry trade that includes goods with same factor intensities, imposes lower costs on economy. In particular, Krugman [3] demonstrates that countries with sufficiently same endowments, gain from trade liberalization and have less problems compared to standard case [4].

Most studies of IIT focused on manufacturing products and agricultural sector have been neglected in experimental studies [5]. The reason is probably that agricultural good markets are usually in perfect competition [6]. But, IIT in agricultural goods has an increasing role especially between developed countries [7].

Present paper estimates and studies Iranian agricultural IIT during time period 1997-2003, as a very first effort in this field [8]. For this, intra industry trade is evaluated according to its types, i.e. horizontal and vertical intra industry trades [9].

This paper is important regarding some aspects. First, it studies Iran's agricultural intra industry trade share and trend. Second, the study illustrates which factors are important in determining and explaining foreign trade of the Iranian agriculture sector. Noticeably, traditional trade theories explain international trade based on comparative advantage such as relative factor endowment, while New Trade Theories (NTT) emphasis on product differentiation, consumers' taste for variety and economies of scale [10]. Third, dividing IIT to its types is important. As mentioned above, inter industry trade has adjustment costs due to trade liberalization. Vertical intra industry trade such as inter industry trade depends on factor endowment difference (e g. Technology, R&D) and

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thus it has a higher cost compared with other trade types [11]. Fourth, this study may be important because intra industry trade may imply competitive flexibility in world markets and readiness for integration to the world economy [12]. So, it seems that IIT products' group has higher competitive power than those without IIT in world markets and integration can probably bring about more specialization in these products.

MATERIALS AND METHODS

During 1960s, researchers such as Verdoorn [13], Michaely [14] and Balassa [8] have been involved in measuring IIT. Grubel and Lioyd [15] by introducing product differentiation in IIT literature, provided a valuable index for measuring IIT based on Balassa index. Aquino [5] and Greenaway and Milner [16] criticized GL index [17]. Subsequently, IIT measuring literature achieved a considerable growth. On the other hand, another field was opened to measuring IIT, which was dividing IIT to its horizontal and vertical IIT types. This important work was done by Abdel Rahman [1]. This methodology was separately used by Greenaway *et al.* [18, 19] and Fontagn´e *et al.* [20]. What follows are more details of Important IIT indices.

Balassa in his study on European Union (EU) was to answer this question whether forming the union has brought about specialization in inter or intra industry? For this, he used the following index:

$$B_j = \frac{\left|X_j - M_j\right|}{\left(X_j + M_j\right)}$$

Where, B_j is Balassa index in j's industry. The index belongs to closed interval of [0,1] where lowest bound implies perfect intra industry trade, while the highest bound implies perfect inter industry trade. Furthermore, Balassa used simple and un-weighted mean (B) for measuring total industry IIT:

$$B = \frac{1}{n}\sum_{j=1}^{n} B_j$$

Here, n stands for the number of industries.
Grubel and Lioyd [15] using Balassa index, proposed following index:

$$GL_j = \frac{\left(X_j + M_j\right) - \left|X_j - M_j\right|}{\left(X_j + M_j\right)} = 1 - \frac{\left|X_j - M_j\right|}{\left(X_j + M_j\right)} = 1 - B_j$$

This index varies from 0 to 1. If the index is one, total trade is in form of pure intra industry trade and if zero, the total trade will be in the form of inter industry trade [21].

Grubel and Lioyd criticizing un-weighted Balassa index, used a weighted index for measuring IIT of total industry; considering the industry share in total trade as a weigh. The weighted index of Grubel and Lioyed (GL_j) is estimated as:

$$GL_j = \frac{\sum_k \left(2\min\left(X_{jk}, M_{jk}\right)\right)}{\sum_k \left(X_{jk} + M_{jk}\right)} \times 100$$

Where, X_{jk} (M_{jk}) is the export (the import) of j'country to (from) rest of the world.

Considering that determinants of intra industry trade types are different, studies dividing IIT to its types began during 1990s. Specifically, Abdel Rahman [1] and Greenaway *et al.* [18, 19] studied IIT types respectively for France and England.

While GL index did not account for differences in IIT types, Abdel Rahman [1] by introducing this new method, exploited it. In this method, there will be a two way trade, if minority flow of trade is at least greater than γ percent of the majority flow of trade [22]. In other words, there is two way trade, if:

$$\frac{Min\left(X_{p,t}, M_{p,t}\right)}{Max\left(X_{p,t}, M_{p,t}\right)} > \gamma\%$$

Where, p and t imply products' group and time respectively. Trade flows smaller than γ are not important, because they don't represent structural specifications [4].

After determining two way trades, IIT is divided to its types, i.e. HIIT and VIIT. Horizontally (vertically) differentiated products are related to products with the same (different) quality at the same products' group. Different methods have been proposed for measuring the quality of trade products and the relative importance of HIIT and VIIT.

Abdel Rahman [1] used Unit Value (UV) index for measuring quality differences of trade products [23]. Logic of using UV for measuring the quality is based on the valuable study of Dixit and Stiglitz [24], where in an environment with transparent information, price implies quality. Specifically, consumers will pay higher price for higher quality in this condition. In fact, price may be an index of quality where consumers have perfect information on products. Abdel Rahman and other researchers' methodology is based on this assumption that the gap between unit values of export and import only shows the quality differences of exported and imported products of countries.

Abdel Rahman [1] methodology-using Uvs for dividing IIT to its types- has been used by Greenaway *et al.* [18,19] and Fontagn´e *et al.* [19]. Greenaway *et al.* [18, 19] define HIIT as simultaneous export and import of products' group where ratio of export unit value to import unit value belongs to [1-0.15,1+0.15], otherwise intra industry trade is considered as VIIT. In other words, based on the study of Greenaway *et al.* [19], the condition for horizontally differentiated products, is provided as [25]:

$$1-\alpha \le \frac{UV^X}{UV^M} \le 1+\alpha$$

Where, $\frac{UV^X}{UV^M}$, UV^X *and* UV^M are unit value ratio, export and import unit values respectively. Parameter α is dispersion factor [20]. Also, vertically differentiated products are those satisfying the following condition [27]:

$$\frac{UV^X}{UV^M} < 1-\alpha \quad or \quad \frac{UV^X}{UV^M} > 1+\alpha$$

Fontagn´e and Freudenberg (FF) index or trade types index is calculated in two stages. In the first stage, trade flow (export and import) is divided to two way trade and one way trade based on overlapping condition. Based on this criterion, the trade of products' group is two way, if minority flow is at least 10 percent of majority flow. In the second stage, based on Dixit and Stiglitz [24] work and considering similarity condition, two way trade is in turn divided to its types, i.e. HIIT and VIIT. Again it is assumed that value differences between products imply their quality differences.

Imposing these conditions, products are classified in three groups: (1) two way trade in vertically differentiated products, i.e. products' group which satisfy overlapping condition and have high difference in unit value. (2) two way trade in horizontally differentiated products, i.e. products' which satisfy both overlapping and similarity conditions. (3) one way trade which is related to products with low overlap.

In FF method, the share of trade types in total trade is calculated by the following relations:

$$STWHD = \frac{TT^H}{TT}$$

$$STWVD = \frac{TT^V}{TT}$$

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

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

Where, TT^H(TT^V), *STWHD* (*STWVD*), *STW* and *SOW* imply total trade of horizontally (vertically) differentiated products, share of horizontally (vertically) two way trade, share of two way trade and one way trade in total trade (*TT*) respectively.

The present paper uses weighted GL and trade types (FF) indices in order to measure Iran's agricultural IIT during time period 1997-2003. For this, data is collected, refined and processed in 6-digit HS [18] classification. Agricultural products are those mentioned in HS chapters 1-24 [19]. It is notable that, data was obtained from PC-TAS [27] and other sources of UN [28, 29].

RESULTS AND DISCUSSION

In this part, intra industry trade of Iran's agricultural products' group is examined and estimated. Table 1 shows overall situation of intra industry trade of Iranian agricultural products' group, during time period 1997-2003. Considering table 1, there is a relative improvement of situation during the time period. Specifically, share of IIT products' group in total agricultural products' trade has increased from 15.18 percent in 1997 to 20.86 percent in 2003. Furthermore, number of items with the index greater

Table 1: Overall situation of intra industry trade of Iranian agricultural products' group, during time period 1997-2003

	Year					
	1997		2000		2003	
Details	Number	Percent	Number	Percent	Number	Percent
Products' group having IIT	39	15.18	48	16.44	68	20.86
Products' group not having IIT	218	84.82	244	83.56	258	79.14
IIT products group with IIT>50	9	3.5	11	3.77	12	3.68
Total number of products	257	100	292	100	326	100

Reference: Research calculations

Table 2: Intra industry trade of Iranian agricultural products' group, during time period 1997-2003

(Percent)

	Year		
Index	1997	2000	2003
GL	2.73	5.12	5.98

Reference: Research calculations

than 50 percent has increased from 3.5 percent in 1997 to 3.68 percent in 2003. Meanwhile, the number of agricultural products (at 6-digit level of HS) also shows an increasing trend during the same time period.

Table 1 shows an improving trend in Iran's agricultural products' IIT in one hand and low level of this trade in the other hand. To verify this, table 2 presents intra industry trade of Iranian agricultural products' group, during time period 1997-2003. Regarding Tables 1 and 2, intra industry trade of Iran's agricultural products' group has increased during the studied time period. Particularly, the agricultural IIT has increased from 2.73 percent in 1997 to 5.98 percent in 2003. It seems that an important reason for this is the increase of agricultural products number and improved differentiation. In any case, intra industry trade essentially is affected by economic development, thus it is expected that this trade increases during time and as economy develops. Of course, considering new advantage resources such as Research and Development (R&D), Foreign Direct Investment (FDI) and economic integration is important for increasing intra industry trade. Specifically, R&D improves quality competition and motivates technological development [21]. Upgrading quality and quantity of FDI, brings about competitive environment and technological promotion and thus directly and indirectly affects host country's intra industry trade. Economic integration may also increase intra industry trade between members because of decreasing trade barriers and the geographical proximity between them.

Table 3 presents major agricultural products' group of Iran's IIT, during time period 1997-2003. Considering table 3, major three product groups of agricultural IIT include bird eggs (with HS code 040700), sunflower-seed oil and their refined fractions (with HS code 151219) and frozen Fish (with HS code 030379) in 1997. IIT index of these product groups is estimated 90.56, 89.35 and 85.90 percent respectively. Furthermore, major three product groups of agricultural IIT include dried fruits (with HS code 081340), frozen sheep carcasses and half carcasses (with HS code 020441), seeds, fruit and spores for sowing (with HS code 120999) in 2000. IIT index of these product groups is calculated 99.86, 95.95 and 89.33 percent respectively. Thus, major three product groups of agricultural IIT include vanilla beans (with HS code 090500), Seeds, fruit and spores for sowing (with HS code 120999) and miscellaneous animal feed preparations (with HS code 230990) in 2003. IIT index of these product groups is estimated 93.81, 89.48 and 88.95 percent respectively.

Regarding table 3, it seems that intra industry agricultural product groups such as types of oil, fruits, tea, cheese and tobacco, are generally considerably differentiable. This finding is consistent with predictions of IIT models. Specifically, intra industry trade is the product of interaction between the elements of imperfect competition market specially those of product differentiation and economies of scale [15]. Thus, emphasis on products with high differentiability and economies of scale characteristics is considered effective for improving IIT of agriculture

Table 3: Major agricultural products' group of Iran's IIT, during time period 1997-2003

(Percent)

1997			2000			2003		
Cod	Description	Index	Cod	Description	Index	Cod	Description	Index
040700	Bird eggs	90.56	081340	Dried fruits	99.86	090500	vanilla beans	93.81
151219	Sunflower-seed oil and their refined fractions	89.35	020441	Frozen sheep carcasses and half carcasses	95.95	120999	Seeds, fruit and spores for sowing	89.48
030379	Frozen Fish	85.90	120999	Seeds, fruit and spores for sowing	89.33	230990	Miscellaneous animal feed preparations	88.95
090240	Black tea (fermented) & partly fermented tea	65.42	090230	Black tea (fermented)	81.82	080222	Hazelnuts or filberts, fresh or dried, shelled or peeled	88.89
240120	Tobacco	62.60	120921	Seeds, alfalfa for sowing	79.11	200520	Potatoes	88.50
060299	Live plants (including their roots)	58.38	071390	Vegetables	78.81	040620	Cheese, grated or powdered	75.41
110819	Starches	53.54	090411	Dried pepper	68.80	120799	Oil seeds and oleaginous fruits	69.31
150200	Fats of bovine, sheep & goat	51.50	120799	Oil seeds and oleaginous fruits	66.67	130120	Gum Arabic	68.45
210230	Baking powders	50	151620	Veg. fats, oils & fractions hydrogenated	62.39	010511	Fowls, live domestic	58.26
081340	Dried fruits	46.15	091099	Spices	60.03	120600	Sunflower seeds	54.83

Reference: Research calculations

Table 4: IIT types of agricultural product groups of Iran, during time period 1997-2003

(Percent)

	1997		2000		2003	
Year/Trade types	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Index	12.54	87.46	0.85	98.47	21.82	78.18

Reference: Research calculations

sector. In this regard, processing industries are also important. Using economies of scale in these industries as well as considering consumers tastes may be effective in upgrading IIT of agriculture sector and non oil exports subsequently. Furthermore, agricultural clusters [30] like industrial clusters may be defined and built for technological upgrade, exploiting economies of scale and increasing competition among agricultural firms. In this framework, it is expected that strengthening determinants of competitive advantage will result in the increasing of IIT.

Up to now, it is clear that Iran's IIT in agricultural products' group is at a low level. For more discussion, table 4 presents IIT types of agricultural product groups of Iran, during time period 1997-2003. Considering table 4, a major part of IIT for agricultural products is due to vertical intra industry trade. In other words, simultaneous export and import essentially relate to products' group exchange having different qualities. Specifically, the shares of VIIT in total two way trade of agricultural products' group are estimated 87.46 and 78.18 percent in 1997 and 2003 respectively.

Keeping in mind that vertical intra industry trade is essentially affected by relative endowment factor [6], traditional comparative advantages are figured as basic factors in forming Iran's agricultural products' trade. Despite this and regarding table 4, the share of VIIT in agricultural trade of Iran has decreased during the time period. In other words, horizontal intra industry trade of Iran's agricultural products has improved during the studied time period. Considering definition of HIIT-simultaneous export and import of product groups having the same characteristics- this trade is dependent intensively on true recognition of world markets and needs to be taking care of. Anyway, it seems that both IIT types are important for upgrading non oil exports and should be well considered. For this, emphasis should be made on the IIT determinants of agricultural product groups, such as product differentiation, consumers' preferences, economies of scale and market structure as well as taking care of and promoting traditional advantages.

Other important finding based on the estimations of present study, regards the adjustment costs

due to trade liberalization in the agricultural sector. Specifically, these costs are due to reallocating and displacing of resources among economic sectors. Regarding the nature of IIT, this trade has low adjustment costs compared to inter industry trade. Thus, the development of intra industry trade has at least two important effects. The first effect is that developing IIT decreases adjustment costs due to trade liberalization. Second effect is related to the positive effect of IIT on non oil exports.

4-Summary, conclusions and policy implications: The Present paper has estimated IIT of Iran's agricultural products' group during time period 1997-2003 based on latest developments in IIT measuring literature. For this purpose, the weighted index of Grubel and Lioyd and the trade types index of Fontagn´e and Freudenberg at 6-digit of HS classification were employed. Results show that the IIT of agricultural products' group of Iran is at a low level. Specifically, intra industry trade of these products is estimated around 2.73-5.98 percent during time period 1997-2003. Despite this, IIT of Iran's agricultural products has improved during this time period. Furthermore, considerable share of intra industry trade of Iran's agricultural products is due to VIIT, i.e. simultaneous export and import of products' group having different qualities. Also, the share of these products has declined during the time period. Particularly, share of VIIT in total agricultural two way trade has decreased from 87.46 percent in 1997 to 78.18 percent in 2003.

Regarding the low level of agricultural products' IIT, it seems that there is considerable potential for developing IIT and for the exports of agriculture sector in Iran. In contrast, the low level of IIT in agricultural products brings about considerable adjustment costs due to trade liberalization in agriculture sector. Furthermore, regarding the low level of IIT in agriculture sector, competitiveness and globalization in agriculture sector of Iran may be at low level. Also, readiness for integrating to the world economy is higher for products having intra industry trade than other products. Thus, it seems that IIT developing must be emphasized as well as taking care of existing traditional comparative advantages in order to gain more readiness for integrating to the world economy. In this way, present study has following policy implications:

- Considering the fact that economic liberalization policy has been accepted and efforts are being made to gain membership in world trade organization (WTO), it seems that due to these measurements, IIT developing in agriculture sector may decline towards lower costs. However, Trade liberalization may in turn improve IIT in agriculture sector [30-35].
- Developing intra industry trade in agriculture sector may develop exports in this sector and thus overall non oil exports. In this way, it is proposed that determinants of agricultural IIT should be recognized as well as taking care of traditional advantages. Developing processing industries especially in the proximity of plantations (in order to decrease the production costs) and exploiting market structure variables may help to upgrade IIT.
- Protection demand is declined by developing IIT. Thus, it can cut down the number of protection-demand groups' lobbies, after which, a certain rigorous and permanent strategy can be built.
- New resources especially product differentiation and economies of scale are being considered important in order to create stable advantages in the agriculture sector. In this framework, it is necessary to upgrade product differentiation, invest on human capital, strengthen R&D sectors and diversify exports. Thus, building agricultural clusters is worth considering, for collective learning, technological upgrade, exploiting economies of scale and cost reduction.
- Country specific determinants of IIT such as FDI and active contribution to the economic integration may increase IIT. Thus, emphasis on these factors may improve IIT in agriculture sector [35-38].

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