

Liberalization and United States' Intra-Industry Trade

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ABSTRACT: The recent trend of globalization has given rise to a new paradigm in international economics, i.e. the simultaneous exports and imports of a product within country or a particular industry called intra-industry trade (IIT) or two-way trade. This study examines country-levels determinants of intra-industry trade, in U.S. trade. The manuscript applies a static and dynamic panel data approach. In contrast to previous studies, this paper used a dynamic panel data to solve the problems of serial correlation and endogeneity. The results indicate that IIT occurs more frequently among countries that are similar in terms of factor endowments. We also introduce economic dimension; this proxy confirms the positive effect of IIT. Our results also confirm the hypothesis that trade increases if the transportation costs decrease.

Keywords: Globalization; Intra-industry trade; Panel data; United States.

JEL Classifications: C20; F12

1. Introduction

The regional trade agreements (RTA) have contributed to an increasing globalization of world economy. To add to this, sum the process of internationalization and relocation of multinational enterprises into new markets.

The World Bank (2002) refers three waves of globalization. The first came between 1870 -1915. The second wave occurred between 1945 -1980. The current wave began in the 1980s. International trade is having a crucial role in the global economy.

Throughout the 1980s and 1990s much has been written about globalization (Ohmae, 1995, Oman, 1994, Dunning, 1993). Globalization involves a link between companies, nations, governments and peoples. It is consensus in the literature considered that globalization promotes integration of markets for goods and services, technology, finance and labour. These new changes in the global economy helped to reduce transaction costs and transportation. The liberalization of trade policies and the removal of some barriers led to the growth of international trade.

Oman (1994) refers that globalization emerges after the 1970s. Petrella (1996) and Higgot (2000) consider that in this period formed several regional clusters in the world economy. It should be noted that Oman (1994) also considers that the phenomenon of globalization involves a more flexible production systems. This idea is shared by Dunning (1993). Another important reference is to Bhalla and Bhalla (1997) where the authors make the distinction between regionalization and globalization. This book presents an illustrative analysis of trade and international investment in the various regional blocs. One indicator that has been used with some frequency to analyze the globalization is the intra-industry trade. Makhija et al. (1997), Komijani and Kyoumars (1999), Kimura et al. (2007), Leitão and Faustino (2008) are some examples. The practice of outsourcing or fragmentation (Jones and Kierzkowski 1990) demonstrates the importance of flexibility of production.

This paper analyses country determinants of intra-industry trade (IIT), in bilateral U.S trade for the period 1995-2008. The countries selected are Austria, Belgium-Luxembourg, Brazil, Canada, China, Denmark, France, Germany, Korea, Italy, Ireland, Japan, Netherlands, Portugal, Russia, Spain, Thailand, and United Kingdom.

The manuscript uses a panel data approach. In panel data, pooled OLS, fixed effects (FE) and random-effects (RE) estimators are used in this type of study. We also introduced a dynamic panel data. The estimator used (GMM-SYS) estimator permits the researchers to solve the problems of serial correlation, heteroskedasticity and endogeneity of some explanatory variables. These econometric problems were resolved by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998, 2000), who developed the first- differenced GMM (GMM-DIF) estimator and the GMM system (GMM-SYS) estimator. The GMM-SYS estimator is a system containing both first-differenced and levels equations. The GMM- SYS estimator is an alternative to the standard first-differenced GMM estimator. To estimate the dynamic model, we applied the methodology of Blundell and Bond (1998, 2000), and Windmeijer (2005) to small sample correction to have corrected standard errors of Blundell and Bond (1998,2000) but correcting the estimated standard errors using the Windmeijer correction.

2. Literature Review and Empirical Studies

In this section we present a theoretical survey on globalization and intra-industry trade. We intend to demonstrate that there is a relationship between globalization and international trade, specifically the intra-industry trade.

The elimination of barriers to international trade caused structural changes in the international economics. The intra-industry trade has been an indicator widely used by scholars to assess the similarities and differences between trading partners.

The intra-industry trade (IIT) literature began in 1960s when Balassa (1966) analyzed the trade within the industries of customs union in Europe.

Grubel and Lloyd (1975) introduced a comprehensive index to measure IIT. The pioneering works on IIT (Krugman, 1979, 1980, 1981; Lancaster, 1980; Helpman, 1981) exclude the idea that traditional theories could explain IIT. The basic structure of horizontal IIT models is that products are not differentiated by the quality, but the attributes (Krugman, 1979; Lancaster, 1980; Helpman, 1981; Brander and Krugman, 1983; Eaton and Kierzkowski, 1984). Krugman (1979) consider that consumers have similar preference (Neo-Chamberlinian models).

The model of Krugman (1979) demonstrates that IIT occurs between identical economies (geographical proximity). The model of Lancaster (1980), called "Neo-Hotelling model" shows that consumers have a preference map, i.e. "ideal variety". Brander and Krugman (1983) demonstrated that it is possible to explain IIT with Cournot style. The authors incorporate transport costs and the reciprocal dumping. Following Lancaster model, Eaton and Kierzkowski (1984) explain that IIT is determined by the prices and the distance between the product spectrums. In vertical IIT models, the quality is assumed to be directly related to the capital-labour ratio. A capital-rich country is likely to produce higher-quality products; while a labour-rich country is likely to produce lower-quality products.

The Neo Heckscher - Ohlin model of vertical IIT (Falvey and Kierzkowski, 1987), the capital endowment is assumed to be industry-specific with at least one sector producing differentiated products in terms of quality (vertical differentiated product). According to Falvey and Kierzkowski (1987) the unequal income is assuming a source of the demand for variety of vertically differentiated products, a larger difference in income will increase the share of vertical IIT. Shaked and Sutton (1984) explained the VIIT with the "natural oligopoly". The quality is associated on fixed costs. Demand for each quality of the product depends on the distribution of income. Firms face three-part decision process – entry, quality and price.

Only a few empirical studies analyze one industry-specific of intra-industry trade (see for example Clark, 2006, Wakasugi, 2007, and Leitão and Faustino, 2009). The studies show the importance of fragmentation.

The study of Clark (2006) demonstrated that globalization will continue to reinforce the idea that there are more efficient places (i.e with low production costs) and that is linked with vertical specialization. Clark (2006) used a Tobit and Probit specifications at a country and industry level.

The study of Leitão and Faustino (2009) examines the determinants of intra-industry trade in the automobile component sector in Portugal. The manuscript considers Portuguese trade in automobile sector between European Union (EU-27), the BRIC (Brazil, India and China), and United States between 1995 and 2006. The authors using a panel data (static and dynamic panel data: GMM-

System). This study concludes that IIT occurs more frequently among countries that are similar endowments.

3. Measurement of Intra-Industry Trade

The level of intra-industry trade (IIT) is generally measured by the so-called Grubel and Lloyd (1975) index. They defined IIT as the difference between the trade balance of industry i and the total trade of this same industry. In order to make the comparison easier between industries or countries, the index is presented as a ratio in which the denominator is total trade.

$$IIT_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \Leftrightarrow IIT_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \quad (1)$$

Where X_i is an export, M_i import of a specific industry. The index is equal to 1 if all trade is of the intra-industry trade type. If IIT is equal to 0, all trade is inter-industry trade.

4. Modelling Intra-Industry Trade

The pioneering models of intra-industry equations were estimated by ordinary least squares (OLS). Faustino and Leitão (2007), and Leitão and Faustino (2009), use a static and dynamic panel data to evaluate IIT.

Our study uses the GMM-system estimator (GMM-SYS) was proposed by Arellano and Bover (1995) and Blundell and Bond (1998, 2000). The GMM-SYS estimator permits efficient estimates to be obtained. We applied the methodology of Blundell and Bond (1998,2000), and Windmeijer (2005) to small sample correction to have corrected standard errors of Blundell and Bond (1998, 2000) but correcting the estimated standard errors using the Windmeijer correction.

In general, the literature considers that gravity model focuses on the determinants, as in transport cost, income, trade imbalance, and foreign direct investment.

We can consider that intra-industry trade is equal to:

$$IIT_i = f(DGDP, DIST, TIMB, FDI) \quad (2)$$

Where:

$$DGDP < 0; DIST < 0; TIMB < 0; FDI > 0$$

and:

- IIT is the intra-industry trade share ;
- DGDP is the difference in GDP per capita;
- TIMB is the trade imbalance;
- FDI is foreign direct investment inflows.

5. Econometrical Model

Following the literature our study applies a gravity equation with panel data. The dependent variable used is intra-industry trade (IIT). The data for the explanatory variables is sourced from the OECD statistics, and the source has used for the dependent variable is STAN bilateral trade database.

Explanatory Variables

In accordance with the theory, we have chosen the following explanatory variables:

-Economic differences between countries (DGDP): this is difference in GDP (PPP, incurrent international dollars) between U.S. and the partner country. Loertscher and Wolter (1980) suggest a negative sign for the IIT model. Linder (1961) considers that countries with similar demands will trade similar products. Hummels and Levinshon (1995) and Greenaway et al. (1994) found a negative sign. Recent study Ferto and Soós (2008), and Leitão and Faustino (2009), Zhang and Clark (2009) found a positive sign.

-MinGDP: this is the lowest value of GDP per capita (PPP, in current international dollars) between U.S. and the partner country. This variable is included to control for relative size effects. According to Helpman (1987) and Hummels and Levinshon (1995), a positive sign is expected, which is consistent with the hypothesis of a negative correlation between the share of IIT and dissimilarity in per-capita GDP.

- MaxGDP: this is the higher/highest value of GDP per capita (PPP, in current international dollars) between U.S. and the partner country. This variable is also included to control for relative size effects. A negative sign is expected, as in Helpman (1987), Hummels and Levinshon (1995) and Greenaway et al. (1994). A negative sign is consistent with the hypothesis that the more similar countries are in economic dimension, the greater the IIT between them.

- DIM: is the average of GDP per capita between U.S and the partner country. Usually the studies utilized this proxy to evaluate the potential economies of scales and the variety of differentiated product. Umemoto (2005) found a positive sign. The study of Leitão and Faustino (2009) also found a positive sign to Portuguese case.

-DIST: this is the geographical distance between the U.S. and the partner country. Balassa and Bauwens (1987) argue that IIT will be greater when trading partners are geographically close. A longer distance will increase the transaction and transportation costs. Thus, there is a negative relationship between the share of IIT in the industry and geographical distance. Hummels and Levinshon (1995) found a negative sign.

- FDI (Foreign Direct Investment inflows): the relationship between IIT and the level of FDI in a particular industry is somewhat ambiguous since FDI may be a substitute for the trade. Gray (1988) considers an ambiguous relationship between FDI and IIT. Greenaway et al. (1994) estimated a positive sign for the coefficient of this variable;

-TIMB (Trade Imbalance): Following Lee and Lee (1993) our paper considers the trade imbalance as control variable, where TIMB is defined as:

$$TIMB_j = \frac{|X_j - M_j|}{(X_j + M_j)} \quad (3)$$

This variable represents the net trade as a share of trade and takes a value of zero at the lower extreme if there is no trade imbalance and a value of one if there are neither exports nor imports. According to the theory, a negative correlation between this control variable and IIT is expected.

Model Specification

$$IIT_{it} = \beta_0 + \beta_1 X_{it} + \delta t + \eta_i + \varepsilon_{it} \quad (4)$$

Where IIT_{it} is the United States' intra-industry trade, X is a set of explanatory variables. All variables are in the logarithm form; η_i is the unobserved time-invariant specific effects; δt captures a common deterministic trend; ε_{it} is a random disturbance assumed to be normal, and identical distributed (IID) with $E(\varepsilon_{it})=0$; $Var(\varepsilon_{it})=\sigma^2 > 0$.

The model can be rewritten in the following dynamic representation:

$$IIT_{it} = \rho IIT_{it-1} + \beta_1 X_{it} - \rho \beta_1 X_{it-1} + \delta t + \eta_i + \varepsilon_{it} \quad (5)$$

6. Estimation Results

Pooled OLS and Random effects are reported in table 1. The economic differences between countries (LogDGDP) are statistically significant, with an expected negative sign. These results are according to previous studies (Helpman and Krugman, 1985).

As expected, the variable trade imbalance (LogTIMB) has significant and negative effect on IIT (Lee and Lee 1993).

Foreign direct investments (LogFDI), the dominant paradigm predicts a positive sign. The result confirms a positive effect on the IIT when we used a Random effects estimator.

The geographical distance has been used as a typical gravity model variable. The coefficient of LogDIST (Distance) is negative as expected. This result confirms the gravitational model and the importance of the neighborhood. Hummels and Levinshon (1995) also found a negative sign.

In table 2 we see the results with the fixed effects estimator. The explanatory power is very high (Adjusted $R^2=0.80$). All explanatory variables are significant (LogDGDP at 5%, LogMinGDP, at 10%, LogDIM and LogFDI at 1% level), with the exception of Log MaxGDP.

Table 1. The determinants of intra-industry trade (IIT)

	Pooled OLS	Random Effects	
Variables	Coefficient	Coefficient	Expected Sign
LogDGDP	-0.631 (-14.665)***	-1.182 (-18.573)***	(-)
LogTIMB	-0.175 (-2.227)**	-0.142 (-7.935)***	(-)
LogFDI	0.162 (1.294)	0.066 (3.161)***	(+)
LogDIST	-0.403 (-6.731)***	-0.846 (-3.634)***	(-)
C	6.467 (9.566)***	4.782 (5.074)***	
Adj. R ²	0.190	0.180	
Observations	252	252	

T-statistics (heteroskedasticity corrected) are in round brackets.
 ***/** - Statistically significant, respectively at the 1%, 5% levels

Table 2. The determinants of intra-industry trade (IIT)

	Fixed Effects	
Variables	Coefficient	Expected Sign
LogDGDP	-9.356 (-2.394)**	(-)
LogMinGDP	-0.597 (-1.788)*	(+)
LogMaxGDP	-0.208 (-1.154)	(-)
LogDIM	11.140 (2.624)***	(+)
LogFDI	0.076 (3.225)***	(+)
Adj. R ²	0.80	
Observations	252	

T-statistics (heteroskedasticity corrected) are in round brackets.
 ***/** /* - Statistically significant, respectively at the 1%, 5%, and 10% levels.

The difference between per-capita incomes, in logs, (LogDGDP) presents a negative sign. However, the negative estimated sign was expected.

Following Helpman and Krugman (1985) and Hummels and Levinsohn (1995), the study also includes two variables to control for relative size effects. Only lowest value of GDP per capita in logs (LogMinGDP) is statistically significant, but with the wrong sign.

The coefficient of foreign direct investment inflows (LogFDI) is positive as expected, which is confirmed by the fixed effects estimator.

As shows in table 3, the two equations present consistent estimates, with no serial correlation (m1, m2 statistics). The specification Sargan test shows that there are no problems with the validity of instruments used. The GMM system estimator is consistent if there is no second-order serial correlation in the residuals (m2 statistics). The dynamic panel data are valid. We used the criterion of Windmeijer (2005) to small sample correction. The first equation presents four significant variables (LogIIT_{t-1}, LogDGDP, LogFDI, and LogTIMB).

The second model presents five significant variables (LogIIT_{t-1}, LogDGDP, LogMinGDP, LogDIM, and LogFDI). The instruments in levels used are LogIIT_{t-1} (3,3), LogDGDP (3,3), LogFDI(3,3) for first differences. For levels equations, the instruments are used first differences all variables t-2. As expected, the lagged dependent variable is positive.

The difference between per-capita incomes (LogDGDP) presents a negative sign. This result is in accordance with the literature. Zhan and Clark (2009) also found a negative sign. This manuscript also includes two variables to control for relative size effects. Only the lowest value of GDP per capita (LogMinGDP) has the expected positive sign.

The variable, LogDIM (average of GDP), used also by Greenaway et al. (1994), has a significant and predicted positive effect on IIT. Foreign direct investment inflows (LogFDI) also reflect the importance of multinationals on IIT. The trade imbalance (LogTIMB) presents a negative relationship between this proxy and IIT, this result is according to the literature (Lee and Lee, 1993).

Table 3. The determinants of intra-industry trade (IIT)

	GMM- SYS	GMM- SYS	
Variables	Coefficient	Coefficient	Expected Sign
LogIIT _{t-1}	0.384 (2.19)**	0.590 (2.96)***	(+)
LogDGDP	-1.078 (-1.80)*	-1.172 (-1.72)*	(-)
LogMinGDP		0.027 (2.54)**	(+)
LogMaxGDP		-0.260 (-0.300)	(-)
LogDIM		13.320 (1.88)*	(+)
LogFDI	0.015 (3.30)***	0.151 (2.91)***	(+)
LogDIST	0.008 (1.64)		(-)
LogTIMB	-0.099 (-3.32)***		(-)
C	-0.005 (-0.296)	0.023 (0.578)	
M1	0.1868 [0.406]	1.258 [0.208]	
M2	0.8316 [0.852]	0.9192 [0.358]	
Sargan	0.5749 [1.000]	0.3492 [1.000]	
Observations	216	216	

T-statistics (heteroskedasticity corrected) are in round brackets. The null hypothesis that each coefficient is equal to zero is tested using second -step robust standard error. T-statistics (heteroskedasticity corrected) are in round brackets. **, and * indicates statistically significance, respectively at the 5%, and 10% level. P-values are in square brackets. Year dummies are included in all specifications (this is equivalent to transforming the variables into deviations from time means, i.e. the mean across the fourteen countries for each period). M1 and M2 are tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0, 1)$ under the null hypothesis of no serial correlation (based on the efficient two-step GMM estimator). Sargan is a test of the over-identifying restrictions, asymptotically distributed as χ^2 , under the null of instruments' validity (with two-step estimator).

***/**- statistically significant, respectively at the 1% 5% levels.

7. Conclusions

In recent years, there has been significance growth of globalization and intra-industry trade literature. The objective of this manuscript was to analyze some of the determinants of intra-industry trade for that we use a country characteristics explanatory variables. Econometrics estimations support the theoretical models. Our results are robust with static and dynamic panel data.

The variable (LogDGDP) used to evaluate the similarities between trade partners presents a negative impact on IIT, when we used static panel (Pooled OLS, Random Effects, and Fixed Effects), and GMM-System.

This result is according to the literature (Loertscher and Wolter, 1980). The study of Zhang and Clark (2009) also found a negative sign to U.S. experience.

The proxy used to economic dimension (DIM) is according to the literature, i.e the market size benefit and influence the IIT. Leitão (2012) and Leitão and Faustino (2009) show that market size is necessary to differentiated products. The study of Chemsripong and Agbola (2005) also demonstrates that economic dimension is positively related to IIT.

According to the literature we expected a negative sign to geographical distance, we find this sign. It is usual that the literature attributes a negative sign to geographical distance, i.e. trade increases if the partners are geographically close. The trade imbalance (TIMB) represents the net trade as a share of trade. Following Stone and Lee (1995), we include this proxy to control the trade imbalance. According to the literature, a negative sign between this control variable and IIT is expected, and the result shows this. (FDI) has a positive on IIT (Leitão, 2011).

Furthermore, an expansion of the research would be to disentangle IIT into vertical IIT and horizontal IIT, because these different types of IIT may have different determinants. The methodology by which to separate HIIT from VIIT is available, having been pioneered by Abel-el-Rahman (1991), and Greenaway et al. (1994), or more recently the criterion advanced by Kandogan (2003).

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