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US MARGINAL INTRA- INDUSTRY TRADE AND COUNTRY CHARACTERISTICS

Abstract: This study examines the marginal intra-industry trade (MIIT) and its components horizontally and marginal vertical intra-industry trade (MVIIT) applied to the United States. We present an alternative methodology to evaluate marginal intra-industry trade (MIIT) which was presented by Thom and McDowell (1999) and Azhar and Elliot (2008). Using a panel data approach, the results show a negative correlation between endowments and marginal intra-industry trade. These results indicate that marginal intra-industry trade occurs more frequently among countries that are similar demand. Our results also confirm the hypothesis that trade increases if the transportation costs decrease.

Key words: Marginal horizontal and vertical intra-industry trade, United States, Panel Data.

JEL Classification: C20,C30,F12

1. Introduction

The intra-industry trade (IIT) or two-way trade is defined as simultaneous exports and imports of a product within country or a particular industry. The literature of IIT emerged with Verdoorn (1960) and Balassa (1966). This phenomenon occurred in the years following the formation of the European Economic Community (EEC).

In the 1990s (Hamilton and Kniest,1991,Brülhart, 1994) new developments which occurred with a special emphasis on marginal intra-industry trade and adjustment costs.

The main motivation of this paper is to evaluate the marginal intra-industry trade (MIITT) and its components the vertical marginal intra-industry trade (VMIIT) and horizontal marginal intra-industry trade (HMIIT). The study is applied to United States with trade partner of NAFTA, European Union and ASEAN over the period 1995-2008, using a panel data analysis. It is our aim to present an alternative methodology suggested by Thom and McDowell (1999) and Azhar and Elliott (2008).

The research of US intra-industry trade has been realized by Zhang and Clark, (2009), Chang, 2009,Leitão (2011a).

Usually MIIT is analyzed in terms of structural adjustment issues. Where the issue of labour market is the central question (Thorpe and Leitão, 2011; Fertö and Soós, 2010; Brülhart and Elliot, 2002, and Erlat and Erlart, 2006, Leitão 2011b).

The question of adjustment is still a matter under discussion, despite the various contributions as Hamilton and Kneist (1991), Greenaway et al. (1994), Brülhart(1994), Menon and Dixon (1997). Economic theory argues that the measurement adjustment is correct in terms of marginal change, i.e., to analyse the symmetries and asymmetries between trading partners.It is consensus in the literature that the intra-industry trade (IIT) or two-way trade is defined as simultaneous exports and imports of product within country or a particular industry.

The indicator of Grubel and Lloyd (1975) is the index most used in the empirical studies. However this measurement is a static index, i.e does not evaluate the changes in trade. This discussion has been the subject of several proposals in the literature (Hamilton and Kniest, 1991; Menon and Dixon ,1997; Brülhart,1994). The index of Brülhart,1994 is the most used in issues of adjustment costs.

Even in 1990s there were important contributions. Greenaway et al. (1994) and Abd-El-Rahaman (1991) introduced new types of differentiation (horizontal and vertical intra-industry). Horizontal intra-industry trade (HIIT) occurs within similar products. In other words, the products are differentiated by attributes. Vertical intra-industry trade (VIIT) is explained by different quality products (high and low quality).

This paper presents two contributions. First, we use a methodology to evaluate the marginal intra-industry and their components horizontal and vertical MIIT. Second we revisited the classic econometric models.

The structure of the paper is as follows. The next section presents the literature review and empirical studies. Section 3 we present the hypothesis. Section 4 shows the methodology. Section 5 presents the econometric model. The final section provides conclusions.

2. Literature Review and Empirical Studies

The pioneering models of Krugman (1979) and Lancaster (1980) consider a monopolistic competition with increasing returns to scale to explain the IIT.

Helpman and Krugman (1985) synthesized these type models called Chamberlin-Heckscher -Ohlin. These models combine monopolistic competition and the theory of Heckscher – Ohlin (differences in factor endowments and horizontal product differentiation). In vertical intra-industry trade we can refer the contributions of Falvey and Kierzkowski (1987) and Shaked and Sutton (1984).

The VIIT is explained by different varieties of quality products (differences in income distribution: lower income country specializing in lower quality products, higher income specializing of quality products).

There are numerous empirical studies of intra-industry trade. We list the recent research on the topic (Blanes, 2005; Zhang and Clark, 2009; Chang, 2009; Leitão et al., 2010, Leitão, 2011a; Faustino and Leitão, 2011).

Blanes (2005) used a Pooled OLS estimator to evaluate the impact of immigration on MIIT. The author uses the index of MIIT proposed by Brülhart(1994). The results of Blanes showed a negative correlation between geographical distance and MIIT. For the lowest value of GDP (MinGDDP) and highest value of GDP (MaxGDP) the author found a positive impact on MIIT. To the proxy of factor endowments, Blanes (2005) found no statistically significant association between this variable and MIIT.

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Zhang and Clark (2009) investigate HIIT and VIIT for the case of United States. This study uses both industry and country–specific characteristics as explanatory variables. The study of Zhang and Clark (2009) show that HIIT will have relatively low factor adjustment costs when compared with the VIIT. The results support the new trade theories and the traditional theory (Heckscher - Ohlin model).

Chang (2009) examines the main factors of HIIT and VIIT including investment approaches of a firm in the industry of information technology for Asian, European and US markets. The results indicate that vertical intra-industry trade is playing its significant role among Asian and European markets while horizontal intra-industry trade is significant between Asian and US.

The study of Leitão et al. (2010) analyses vertical intra-industry trade (VIIT) within Portugal's automobile parts and components industry. Leitão et al. (2010) adds new empirical evidence for the international fragmentation of the production process. For trade partner countries, the authors choose the EU countries, the BRICS, and the US during the period 1995 to 2005. According to the authors, automobile production in each country promotes higher VIIT of auto parts.

Leitão (2011a) analyses the determinants of United State's intra-industry trade (IIT) applied to the agriculture sector. The results indicate that IIT in this sector is a negative role of the difference in GDP per capita between U S. and its trade partners. This is according to the literature; that is, countries with similar demands will trade similar products. Statistically strong evidence is also found that this trade is influenced by the economic dimension between trading partners. The foreign direct investment inflows have a positive influence on U.S. bilateral IIT.

The study of Faustino and Leitão (2011) examines the determinants of vertical intra-industry trade (VIIT) in the automobile components industry between Portugal and the European Union 27 (EU-27) and the BRIC countries (Brazil, Russia, India and China) during the period 1995-2006. The study uses a dynamic panel data (GMM-System). Faustino and Leitão (2011) concluded that the main determinants of vertical intra-industry trade in the automobile components are the different structures of demand (Linder hypothesis) and the distance variable used to proxy the transaction costs.

Leitão (2011b) demonstrates that international technology diffusions are associated with in the changes in labour market. The author also finds a positive correlation between change of employment and knowledge. The economic dimension and market structure are according to smooth adjustment hypothesis (SAH).

3.   Measurement of Marginal Intra-Industry Trade

It is usual the empirical studies using the relative price of exports and imports to determinate the horizontal intra-industry trade and vertical intra-industry trade. This technique has been criticized, because the vertical intra-industry trade is inflated, when using the criterion of Greenaway et al. (1994)   or Abd-el-Rahman(1991). Thom and McDowell (1999) showed that it's possible disaggregate the marginal intra-industry trade (MIIT) in horizontal MIIT and vertical MIIT. Other proposals have emerged as Azhar and Elliott (2008). The methodology of Azhar and Elliot also inflated the vertical MIIT.

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Our proposal pretends separating marginal intra-industry trade (MIIT) into its components horizontal marginal intra-industry trade (HMIIT) and vertical marginal intra-industry trade (VMIIT). This methodology is based on the indexes, proposed by Kandogan (2003), being an alternative proposal for Thom and McDowell (1999) and Azhar and Elliott (2008).

A large part of global trade (*GT*) in industry is marginal inter-industry trade (*MINT*). The methodology is summarized below:

$$GT_i = \Delta X_i + \Delta M_i \qquad (1)$$

where ΔX_i is marginal of exports and ΔM_i is marginal of imports.

$$MIIT_i = (\Delta X_i + \Delta M_i) - |\Delta X_i - \Delta M_i| \qquad (2)$$

$$MINT_i = GT_i - MIIT_i \qquad (3)$$

$$HMIIT_i = \sum \left(\Delta X_{ik} + \Delta M_{ik} - |\Delta X_{ik} - \Delta M_{ik}| \right) \qquad (4)$$

$$VMIIT_i = MIIT_i - HMIIT_i \qquad (5)$$

In order to make the index is normalized by total industry trade:

$$MIIT_{ij} = 1 - \frac{\left| \sum_{k=1}^{K} \Delta X_{ijk} - \sum_{k=1}^{K} \Delta M_{ijk} \right|}{\sum_{k=1}^{K} \Delta X_{ijk} + \sum_{k}^{K} \Delta M_{ijk}} \qquad (6)$$

and

$$HMIIT_{ijk} = 1 - \frac{|\Delta X_{ijk} - \Delta M_{ijk}|}{\Delta X_{ijk} + \Delta M_{ijk}} \qquad (7)$$

and

$$VMIIT_{ij} = MIIT_{ij} - HMIIT_{ij} \qquad (8)$$

4. Econometric model

Marginal intra- industry trade (MIIT), vertical and horizontal MIIT between United States and NAFTA, European Union and ASEAN for the period between 1995 and 2008 are constructed from the OECD at the five-digit level of the Standard International Trade classification (SITC) in US dollars. Other

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explanatory variables are taken from World Development Indicators, the World Bank.

4.1. Explanatory and testing of hypothesis

Based on the literature of intra-industry trade, we formulate the following hypothesis:

Hypothesis 1: MIIT and HMIIT predominate between countries that are similar in terms of factor endowments.

Hypothesis 1(a): VMIIT predominate among countries that are dissimilar in terms of factor endowments.

Economic differences between countries (DGDP): this is difference in GDP (PPP, incurrent international dollars) between U.S. and the partner country:

$$\left| GDP^{U.S.} - GDP^{partner} \right|$$

According to the literature the expected sign for the variable difference of income per capita is negative in the models of IIT and HIIT (Hummels and Levinshon (1995), and positive in model VIIT (Greenaway et al.1994). The recent study of Leitão et al. (2010) found a positive correlation between the variable   difference of income per capita and VIIT. It should be mentioned that the recent study by Zhang and Clark (2009) found a negative relationship to the model VIIT for the case study of North American.

Hypothesis 2: There is a positive relationship between lowest value of GDP per capita and MIIT (HMIIT, and VMIIT).

-MinGDP: this is the lowest value of GDP per capita (PPP, in current international dollars) between U.S. and the partner country:

$Min(GDP^{U.S.}, GDP^{partner})$

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 positive correlation between the share of IIT(HIIT, VIIT) and dissimilarity in per-capita GDP. The study of Yoshida et al. (2009) confirms this hypothesis. Blanes (2005) found a positive sign between MinGDP and MIIT.

Hypothesis 3: There is a negative relationship between highest value of GDP per capita and MIIT (HMIIT, and VMIIT).

This variable is also introduced to control for relative size effects. A negative sign is expected (Helpman 1987, Hummels and Levinshon 1995, and Greenaway et al. 1994). The negative sign is consistent with the hypothesis of similarity between the countries. However, Blanes (2005) found a positive sign between MaxGDP and MIIT.

MaxGDP: this is the higher/highest value of GDP per capita (PPP, in current international dollars) between U.S. and the partner country.

$$Max(GDP^{U.S.}, GDP^{partner})$$

Hypothesis 4: Trade increases when partners are geographically close.

Based in Balassa and Bauwens (1987), Blanes (2005) we consider a negative correlation between geographical distance and MIIT, horizontal and vertical MIIT. Leitão (2011a) found a negative sign between geographical distance and US trade patterns.

DISTxDGDP: this is geographical distance multiplied by the DGDP between the U.S. and the partner country.

Hypothesis 5: The foreign direct investment influences the volume of 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. The study of Leitão (2011a) found a positive correlation between FDI and US. intra-industry trade.

FDI : this is foreign direct investment inflows.

4.2. Model Specification

$$y_{it} = \beta_0 + \beta_1 X_{it} + \delta t + \eta_i + \varepsilon_{it} \qquad (9)$$

where y_{it} is the marginal intra-industry trade (MIIT$_{it}$) horizontal MIIT (HMIIT$_{it}$) and vertical MIIT (VMIIT$_{it}$), X is a set of explanatory variables. All variables are in the logarithm form; ηi 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 (ε_{it})=0; Var (ε_{it})=$\sigma^2 \succ 0$.

The model can be rewritten in the following dynamic representation:

$$y_{it} = y_{it-1} + \beta_0 + \beta_1 X_{it} - \rho\beta_1 X_{it-1} + \delta t + \eta_i + \varepsilon_{it} \qquad (10)$$

5. Empirical Results

We used a dynamic panel data. The estimator (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.

In Table 1 we can observe the determinants of MIIT and its components HMIIT and VMIIT. The models present consistent estimates, with no serial correlation (the Arellano and Bond test for Ar(2)). The specification Sargan test shows that there are no problems with the validity of instruments used. The Windmeijer (2005) finite sample correction is used.

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Table 1 : GMM-System

Variables	LogMIIT Coefficient	LogHMIIT Coefficient	LogVMIIT Coefficient
Lagged dependent Variable	0.19 (1.99)**	0.13 (3.16)***	0.63(4.65)***
LogDGDP	-12.52 (-6.41)***	-15.16 (7.95)***	4.17 (3.54)***
LogMinGDP	4.45 (12.3)***	3.41 (7.15)***	2.80 (4.54)***
LogMaxGDP	0.65 (0.85)	1.80 (1.83)*	0.46 (0.41)
LogFDI	0.95 (4.61)***	0.73 (4.63)***	0.49 (4.10)***
LogDISTxDGDP	-2.77 (-7.16)***	-2.43 (-6.23)***	-0.76 (-3.79)***
C	0.79 (12.5)***	0.70 (7.32)***	0.69 (3.11)***
Arellano-Bond test for Ar(2) (P-value)	0.89	0.96	0.85
Sargan test (P-value)	1.00	1.00	1.00
N	216	216	216

The null hypothesis that each coefficient is equal to zero is tested using one-step robust standard error. T-statistics (heteroskedasticity corrected) are in round brackets. P-values are in square brackets; ***/**/*- statistically significant at the 1 per cent, 5 per cent, and 10 per cent levels. Ar(2) is tests for 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). The Sargan test addresses the over-identifying restrictions, asymptotically distributed X^2 under the null of the instruments' validity (with the two-step estimator).

The MIIT model presents all significant variables (LogMIIT$_{t-1}$, LogDGDP,LogMinGDP,LogMaxGDP,LogFDI,and ogDISTxDGDP).

The instruments in levels used are LogMIITt-1(3,7),LogDGDP (3,7), LogMinGDP(3,7),LogMaxGDP(3,7) and LogFDI(3,7) for first differences. For levels equations, the instruments are used first differences all variables t-2.

Our results show that United Sates MIIT is negatively correlated with factor endowment (LogDGDP), and geographical distance (LogDIST). We can conclude that trade partners have similar demands and preferences evaluate the relative size effects. The coefficient of foreign direct investment flows (LogFDI) is

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positive with significant. So we can conclude that FDI and MIIT are complementary.

In the model of HMIIT, the instruments in levels used are $LogHMIIT_{t-1}$(3,7),$LogDGDP$(3,7),$LogMinGDP$(3,7),$LogMaxGDP$ (3,7) and $LogFDI$(3,7) for first differences. For levels equations, the instruments are used first differences all variables lagged t-2.

The lagged dependent variable ($LogHMIIT_{t-1}$) is statistically significance with a positive sign.

A negative effect of economic differences between countries ($LogDGDP$) on HMIIT was expected and the results confirm this, showing the importance of similarities within countries.

As expected, the variable $LogMinGDP$ has a significant and a positive effect on $LogHMIIT$. Our results confirm the empirical studies of Blanes (2005). The highest value of income ($LogMaxGDP$) is according to Greenaway et al.1994. The coefficient of foreign direct investment ($LogFDI$) is statistically significant, with an expected positive sign. This result indicates that there is a link between trade and FDI.

The proxy $LogDISTxDGDP$ is according to the hypothesis formulated, i.e trade increases when partners are close.

For the model VMIIT the instruments' in levels are $LogVMIIT_{t-1}$(2,7), $LogDGDP$(2,7) ,$LogMinGDP$ (2,7), $LogMaxGDP$ and $LogFDI$ (2,7) in the equations in first differences. For levels equations, the instruments are first differences, with all variables lagged t-1. As show in table 1, all explanatory variables are significant ($LogVMIIT_{it-1}$,at 1%, $LogDGDP$, at 1%, $LogMinGDP$ at 1%, $LogDISTxDGDP$ at 1%, $LogDISTxDGDP$, and $LogFDI$ at 1% significance level), with the exception the coefficient highest value of income ($LogMaxGDP$).

The variable of economic differences between countries ($LogDGDP$) demonstrates the vertical MIIT predominates among countries that are dissimilar in terms of factor endowments, i.e there is a positive impact between factor endowments and vertical MIIT.

The control variable ($LogMinGDP$) validates the second hypothesis formulated. Our result is according to previous studies (Helpman,1987, Hummels and Levinshon,1995, and Blanes 2005).

6. Conclusions

The main objective of this study was to analyze the MIIT and its components horizontal and marginal vertical intra-industry trade (VMIIT).

The main contribution of this paper is to demonstrate that it is possible to explain the marginal intra-industry trade based on the country characteristics as explanatory variables. Remember that marginal intra-industry trade (MIIT) is typically explained by the issues of structural adjustment and the labour market (Thorpe and Leitão, 2011, Leitão 2011b).

For that this manuscript examined the marginal intra-industry trade (MIIT), horizontal and vertical marginal intra-industry trade of United States with trade partner of NAFTA, European Union and ASEAN over the period 1995-2008, using a panel data analysis.

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The variable (LogDGDP) used to evaluate the relative factor endowments shows that MIIT and MHIIT occurs more frequently among countries that are similar in terms of factor endowment.

Our results also show that the VMIIT is explained by different factor endowments.

The variable foreign direct investment (FDI) is according to the dominant paradigm, i.e, there is a positive relationship between FDI and MIIT. The results show that FDI and trade are complementary.

The control variables (LogMinGDP, and LogMaxGDP) used to analyze the relative size effects (Helpman 1987, Hummels and Levinshon, 1995, and Greenaway et al. 1994) is according to the literature. This result is found by Egger et al. (2002) and Cieslik (2005), demonstrating that it is possible to introduce new goods under the assumption of increasing returns.

The literature attributes a negative sign to geographical distance, i.e. trade increases if the partners are geographically close. Our findings support this hypothesis.

The study has however some limitations. In the future, we need to include other control variables as in border, cultural similarity (langue and historical proxies).

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