An assessment of CARICOM's extra regional intra industry trade (IIT): A panel data approach

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Conference on the Economy 2013
10-11 October 2013

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Introduction

- The discovery and acceptance of the intra industry trade anomaly has been contentious to say the least. Scholars disagreed on if and how the standard trade theories would have to be modified to incorporate explanations of IIT (Finger 1975 and Gray 1976).
- While theories were developed in this regard, another source of contention has arisen; that being the strand of theory specifically relating to North-South IIT.
- The majority of studies have been concentrated on North-North trade while studies of North- South and South-South trade are few.

Theories of North-South IIT

Substantive theories of North-South IIT		
Helpman and Krugman (1985)	Credited as some of the first researchers to examine North-South IIT and the role of country specific characteristics in determining the source of this trade.	
Falvey (1981)	Investigated determinants of North-South trade at the industry level. IIT is the outcome of vertical based product differentiation rather than as a consequence of scale economies or horizontal based product differentiation. The resulting trade pattern is one in which the North exports high quality products to the South in exchange for lower quality products, with both products falling under the same industry classification.	Quality is an increasing function of capital intensity. IIT arises because (1) of the desire by consumers for different product qualities in line with their income levels and (2) each country produces a range of qualities that differs from the range of qualities desired by the consumer.
Falvey and Kierzkowski (1987)		
Flam and Helpman (1987)		Placed great emphasis on the importance of technological and income differences between countries in explaining IIT flows and the North-South trade structure is determined by these differences.
Other related theories		
Dollar (1983)	Constructed a general equilibrium model to theoretically examine North-South trading patterns when new products are introduced in the North. The South must learn to produce commodities that were formerly produced by the North.	
Markusen and Wigle (1990)	Developed a model to show that there are alternative explanations, consistent with competitive models and factor proportions trade theory, for the observed disparities in trade volumes between North-North partners and between North-South partners. Product differentiation is of less importance as increases in the Armington elasticity revealed stronger results for the cases analyzed.	
Beaulieu et al. (2004)	An explanation is provided of how trade liberalization can potentially create growing wage inequality in an explicitly North-South context rather than the North-North framework	
Liao (2006)	Sectoral IIT is significant in the majority of bilateral trade and industrial factors such as the elasticity of substitution between foreign and domestic products and production-cost effects offer strong explanations for this finding. Sectoral IIT heterogeneity is caused by elasticity of substitution, marginal cost, production-cost effects, and import tariffs	

Source: Compiled by the author.

Background: North-South Trade & CARICOM

Economic Integration Initiatives – From CARIFTA to the CSME

CARIFTA (1968-1973)
CARICOM (1973-1989)
CARICOM REVISED/CSME (1989-2008)
SINGLE DEVELOPMENT VISION (2008-2015)

CARICOM Extra-Regional Trade Agreements

Preferential trade agreements
- CARICOM – Venezuela (1992)
- CARICOM – Colombia (2004)
- Caribbean-Canada Trade Agreement (CARIBCAN) (1986)
- Caribbean Basin Initiative (CBI) (1983)

Free trade agreements
- CARICOM – Cuba (2000)
- CARICOM - Dominican Republic (1998)
- CARICOM - Costa Rica (1994)
- **CARIFORUM - European Union (2008)**

Proposed trade agreements
- **CARICOM – Canada (Negotiating)**
- CARICOM – Mercosur (no definitive stance)
- **CARICOM - United States (no definitive stance)**

Static measures of IIT

- Grubel and Lloyd index (1975)
  - Estimates a commodity or industry's trade pattern for single time periods.

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

  - According to Greenaway and Milner (1986), $B_j = 0$ (perfect inter industry trade) when $X_j = 0$ or $M_j = 0$ and there is no trade overlap in industry j. On the other hand, $B_j = 0$ (perfect IIT) when X_j and M_j match perfectly

Static measures of IIT

Intra industry trade (GL index) for selected CARICOM and extra regional countries % (avg 1999-2010)

	TTO	BRB	GUY	JAM	LCA
AUS	0.19	0.22	0.09	0.01	0.00
AUT	0.14	0.15	0.01	0.03	0.19
BEL	1.11	1.37	0.02	0.03	0.17
CAN	2.87	3.66	0.48	1.50	2.34
CHN	0.64	0.80	0.12	0.14	0.24
COL	13.42	0.33	0.28	0.06	0.39
CRI	0.77	1.42	0.00	0.18	1.98
DNK	0.57	0.32	0.33	0.43	0.06
FIN	0.31	0.44	0.00	0.03	1.62
FRA	1.77	15.36	0.10	0.72	2.43
DEU	1.25	1.52	0.94	0.21	1.08
HND	0.40	0.07	0.01	0.01	0.06
IND	0.57	0.41	0.27	0.76	0.45
ITA	0.45	1.05	0.00	0.67	1.58
JPN	0.06	0.05	0.04	0.01	0.12
MEX	0.42	1.04	0.61	0.14	0.60
NLD	2.12	2.46	0.54	0.25	0.31
NZL	0.19	0.07	0.00	0.47	0.03
PER	0.29	0.00	0.00	0.00	4.13
ESP	0.04	0.30	0.03	0.12	1.69
THA	0.05	0.04	1.29	0.01	0.40
GBR	4.19	7.29	2.18	3.89	2.26
USA	4.07	8.36	3.49	8.00	9.55

Source: Author's computations based on UNCOMTRADE 2013 data

Static measures of IIT

Intra industry trade (GL index) for selected CARICOM and grouped extra regional countries
% (avg 1999-2010)

		TTO	BRB	GUY	JAM	LCA
NAFTA	CAN	2.87	3.66	0.48	1.50	2.34
	MEX	0.42	1.04	0.61	0.14	0.60
	USA	4.07	8.36	3.49	8.00	9.55
LATIN AMERICA	COL	13.42	0.33	0.28	0.06	0.39
	PER	0.29	0.00	0.00	0.00	4.13
CENTRAL AMERICA	CRI	0.77	1.42	0.00	0.18	1.98
	HND	0.40	0.07	0.01	0.01	0.06
EU	AUT	0.14	0.15	0.01	0.03	0.19
	BEL	1.11	1.37	0.02	0.03	0.17
	DEU	1.25	1.52	0.94	0.21	1.08
	DNK	0.57	0.32	0.33	0.43	0.06
	ESP	0.04	0.30	0.03	0.12	1.69
	FIN	0.31	0.44	0.00	0.03	1.62
	FRA	1.77	15.36	0.10	0.72	2.43
	GBR	4.19	7.29	2.18	3.89	2.26
	ITA	0.45	1.05	0.00	0.67	1.58
	NLD	2.12	2.46	0.54	0.25	0.31
ASIAN COUNTRIES	CHN	0.64	0.80	0.12	0.14	0.24
	IND	0.57	0.41	0.27	0.76	0.45
	JPN	0.06	0.05	0.04	0.01	0.12
	THA	0.05	0.04	1.29	0.01	0.40
OTHER COUNTRIES	NZL	0.19	0.07	0.00	0.47	0.03
	AUS	0.19	0.22	0.09	0.01	0.00

Source: Author's computations based on UNCOMTRADE 2013 data

Gravity Model

- **The Extra-Regional IIT Model**

STATIC

1. $$\ln IIT_{ijt} = \beta_0 + \beta_1 \ln DY_{ijt} + \beta_2 AYPC_{ijt} + \beta_3 TIMB_{ijt} + \beta_4 DIST_{ijt} + \beta_5 PTA_{ijt} + \beta_6 CLANG_{ijt} + \beta_7 COLONY_{ijt} + \phi_t + \varepsilon_{it}$$

2. $$\ln IIT_{ijt} = \beta_0 + \beta_1 \ln DY_{ijt} + \beta_2 AYPC_{ijt} + \beta_3 TIMB_{ijt} + \beta_4 DIST_{ijt} + \beta_5 CARIBCAN_{ijt} + \beta_6 CBI_{ijt} + \beta_7 PTAEU_{ijt} + \beta_8 CLANG_{ijt} + \beta_9 COLONY_{ijt} + \phi_t + \varepsilon_{it}$$

Gravity Model

- **The Extra-Regional IIT Model**

DYNAMIC

1. $$\ln IIT_{ijt} = \beta_0 + \beta_1 \ln IIT_{ijt-1} + \beta_2 DY_{ijt} + \beta_3 AYPC_{ijt} + \beta_4 TIMB_{ijt} + \beta_5 DIST_{ijt} + \beta_6 PTA_{ijt} + \beta_7 CLANG_{ijt} + \beta_8 COLONY_{ijt} + \phi_t + \varepsilon_{it}$$

2. $$\ln IIT_{ijt} = \beta_0 + \beta_1 \ln IIT_{ijt-1} + \beta_2 DY_{ijt} + \beta_3 AYPC_{ijt} + \beta_4 TIMB_{ijt} + \beta_5 DIST_{ijt} + \beta_6 CARIBCAN_{ijt} + \beta_7 CBI_{ijt} + \beta_8 PTAEU_{ijt} + \beta_9 CLANG_{ijt} + \beta_{10} COLONY_{ijt} + \phi_t + \varepsilon_{it}$$

Data

Variables in the gravity model		
Symbol	**Variable**	**Expected sign**
DY_{ij}	Difference in GDP	(+/-)
$AYPC_{ij}$	Average GDP per capita	(+/-)
$TIMB_{ij}$	Trade imbalance	(-)
$DIST_{ij}$	Distance	(-)
PTA_{ij}	Preferential trade agreement	(+)
$COLONY_{ij}$	Colony	(+)
$CLANG_{ij}$	Common language	(+)
$LOME_{ij}$	Lome agreement	(+)
EPA_{ij}	Economic Partnership Agreement	(+)
$PTAEU_{ij}$	$LOME_{ij} + EPA_{ij}$	(+)
$CARIBCAN_{ij}$	Caribcan agreement	(+)
CBI_{ij}	CBI agreement	(+)

Sources of Data	
Variable	**Source**
Grubel Lloyd index	UN Comtrade (2013) and own calculations
Gross Domestic Product	World Development Indicators (2013)
Gross Domestic Product per capita	World Development Indicators (2013)
Trade imbalance	UN Comtrade (2013) and own calculations and own calculations
Distance	CEPII
Preferential trade agreement	Constructed from the World Trade Organization
Colony	CEPII
Common language	CEPII

Estimation Procedure

- Panel data econometric techniques: pooled OLS, fixed effects, random effects, and system GMM.
- Several diagnostic tests performed: both the Breusch-Pagan LM test and the F-test indicate that the POLS method is to be rejected against the FEM and the REM.
- Hausman test used to compare the FEM and the REM: reports a high chi-squared statistic which indicates that some of the explanatory variables are correlated with the unobserved effects and the most appropriate method in this case is the FEM.
- The SGMM is used to estimate the dynamic gravity model.

Empirical Findings

Estimated coefficients of CARICOM's extra regional trade (static)			
Dependent variable: IIT (G/L index)	**POLS**	**REM**	**FEM**
Difference in GDP	0.49 (11.71)***	0.53 (5.07)***	1.30 (3.27)***
Average GDP per capita	0.44 (3.99)***	-0.03 (0.18)	-0.53 (1.8)*
Trade imbalance	-20.90 (13.25)***	-16.08 (11.83)***	-15.51 (11.21)***
Geographic distance	-0.98 (9.7)***	-1.01 (3.97)***	omitted
PTA	0.49 (3.11)***	0.91 (2.40)***	omitted
Common language	0.54 (3.59)***	0.69 (1.73)*	omitted
Colony	1.39 (4.37)***	1.35 (1.61)	omitted
Constant	-16.43 11.35***	-12.69 3.63***	omitted
Number of observations	1376	1376	1376
Number of groups	115	115	115
R-Squared	0.3815		0.1802
Breusch-Pagan (POLS vs. REM)		$\chi 2 = 2030.73$ (p=0.00)	
F-Test (POLS vs. FEM)			F= 17.68 (p=0.00)
Hausman test (FEM vs. REM)			F =12.42 (p=0.49)
Wooldridge test for autocorrelation			F =1.41 (p=0.23)
Modified Wald test for groupwise heteroskedasticity			$\chi 2$= 74746.89 (p=0.00)

* denotes significance at 10%, ** denotes significance at 5%, *** denotes significance at 1%
Robust absolute value of t statistics in parentheses.

Estimated coefficients of CARICOM's extra regional trade PTA disaggregated (static)

Dependent variable: IIT (G/L index)	POLS	REM	FEM
Difference in GDP	0.49 (10.04)***	0.52 (4.28)***	1.30 (3.27)***
Average GDP per capita	0.45 (4.06)***	-0.03 (0.15)	-0.53 (1.80)*
Trade imbalance	-21.47 (13.53)***	-16.13 (11.85)***	-15.51 (11.21)***
Geographic distance	-0.87 (6.52)***	-0.89 (2.60)***	omitted
PTAEU	0.34 (2.00)**	0.77 (1.82)*	omitted
CARIBCAN	1.58 (4.07)***	1.94 (1.92)*	omitted
CBI	0.33 (0.72)	0.93 (0.79)	omitted
Common language	0.24 (1.08)	0.37 (0.63)	omitted
Colony	1.73 (4.44)***	1.72 (1.68)*	omitted
Constant	-17.32 (11.84)***	-13.46 (3.80)***	-37.26 (3.36)***
Number of observations	1376	1376	1376
Number of groups	115	115	115
R-Squared	0.3874		0.1802
Breusch-Pagan (POLS vs. REM)		$\chi 2$ = 1984.34 (p=0.00)	
F-Test (POLS vs. FEM)			F= 17.67 (p=0.00)
Hausman test (FEM vs. REM)			F =14.99 (p=0.30)
Wooldridge test for autocorrelation			F =1.418 (p=0.23)
Modified Wald test for groupwise heteroskedasticity			$\chi 2$= 74746.89 (p=0.00)

Estimated coefficients from the SGMM estimation–two-step robust estimates	
Dependent variable: IIT (G/L index)	**CARICOM IIT with extra regional counties**
Difference in GDP	0.49 (1.87)*
Average GDP per capita	-0.18 (0.30)
Trade imbalance	-6.5 (1.52)
Geographic distance	-1.01 (1.99)**
PTA	0.64 (0.68)
Common language	0.73 (1.43)
Colony	1.95 (1.70)*
Lagged IIT (-1)	0.27 (4.08)***
Constant	-8.15 (1.36)
Number of observations	1261
Number of groups (country pairs)	115
Number of instruments	98
Arellano-Bond test for AR(1)	z = -4.94 Pr > z = 0.00
Arellano-Bond test for AR(2)	z = 1.45 Pr > z = 0.14
Hansen J-test	chi2(73) = 81.80 Prob > chi2 = 0.39

* denotes significance at 10%, ** denotes significance at 5%, *** denotes significance at 1%
Robust absolute value of t statistics in parentheses.
Time dummies included in fixed effects but not reported for brevity
Endogenous variables: Lagged IIT (-1), difference in GDP and PTA

Estimated coefficients from the SGMM estimation–two-step robust estimates	
Dependent variable: IIT (G/L index)	**CARICOM IIT with extra regional counties**
Difference in GDP	0.21 (0.75)
Average GDP per capita	-0.33 (0.44)
Trade imbalance	-3.17 (0.80)
Geographic distance	-1.11 (1.41)
PTAEU	-0.14 (0.11)
CARIBCAN	8.00 (2.35)**
CBI	4.67 (2.07)**
Common language	-2.05 (0.13)
Colony	0.21 (0.07)
Lagged IIT (-1)	0.19 (2.87)**
Constant	-17.47 (2.41)
Number of observations	1261
Number of groups (country pairs)	115
Number of instruments	101
Arellano-Bond test for AR(1)	z = -4.88 Pr > z = 0.00
Arellano-Bond test for AR(2)	z = 1.48 Pr > z = 0.256
Hansen J-test	chi2(80) = 133.3 Prob > chi2 = 0.964

* denotes significance at 10%, ** denotes significance at 5%, *** denotes

Interpretation of results

- IIT as used in this model is in its aggregate form. This does not allow for commodity level assessment.
- IIT is low and may be clustered in a few product groups.
- The nature of the NRTA and N-S TA allow for certain categories of commodities to be traded e.g. agriculture and raw materials which historically have reported low IIT scores.

Follow up research

- Modeling of North-South IIT using industry or commodity data
- Competing estimators (see Santos Silva and Tenreyro 2006, Matinez-Zarzoso et al. 2007 and Head and Meyer 2013 for details on alternate techniques)
- Choice of estimator: Poisson Pseudo-Maximum Likelihood (PPML) estimator

Follow up research

- Why PPML?
  - Treats with the “zeros problem” i.e. provides a natural way to deal with zero values of the dependent variable
  - Consistent in the presence of heteroskedasticity
  - Most efficient estimator (see Santos Silva and Tenreyro 2006, Recalde et al. 2008, Bosquet and Boulhol 2009, Gómez Herrera and Milgram Baleix 2009, etc).

Thank you