Estimating General Equilibrium Trade Policy Effects: Caribbean Community (CARICOM)

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Abstract

paper uses a structural gravity model as a basis for a general equilibrium framework to investigate the importance of international borders, regional trade agreements(RTA) and the potential impact of deeper integration in the form of a currency union within CARICOM. Using panel data for the period 1986-2001, with 3 year intervals, the gravity model is estimated using Poisson Pseudo Maximum Likelihood(PPML) and subsequently used to derive general equilibrium effects. We find that CARICOM is trade-creating within The Region and there is evidence suggesting that currency depreciation of CARICOM members increases The Region's exports to the rest of the world. Most importantly, CARICOM is essential for member states with the smallest economies, and deeper integration in the form of a common currency could be welfare improving for all CARICOM members.

Keywords: Gravity Model, CARICOM, Regional Trade Agreement, Exchange Rate, Poisson Pseudo Maximum Likelihood(PPML) General Equilibrium

1 Introduction

The gravity model used in international trade, to estimate and identify the effects of trade policy, trade cost, geographic and other economic indicators, is one of the most widely used and successful empirical models in economics. It is a tractable representation of economic interaction between any country and the rest of the world. When linked to theories of international trade, the gravity model is attractive as a general equilibrium framework of international trade from which counterfactuals can be derived and the welfare effects of changes in trade policies and cost can be assessed.

This paper uses a structural gravity model to create a general equilibrium framework to investigate the importance of international borders, regional trade agreement and the potential impact of

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deeper integration in the form of a currency union within CARICOM. (1) It quantifies the welfare implications of the regional trade agreement, hereafter referred to as CARICOM, on economies of the The Region. (2) It considers the pass-through effects of exchange rate to trade cost within The Region and the implications that removing such pass-through effects could have on regional trade and the welfare of the The Region. Quantifying the overall and country-specific welfare effects of CARICOM is important to foster a greater understanding of the outcome of policies geared towards deeper economic integration within The Region. Furthermore, it is important that the next phase of the Caribbean Single Market and Economy (CSME), which includes adopting a common currency, is informed by economic analysis. This paper intends to identify, quantify and project the welfare impact of trade policies geared towards greater regional integration.

Adopting the Anderson et al.(2015) General Equilibrium Poisson Pseudo Maximum Likelihood (GE-PPML) approach, the 'conditional' and 'full-endowment' welfare impacts of CARICOM and exchange rate are identified. This general equilibrium framework allows for the estimation of the 'conditional' effects, which are calculated as the percentage difference between baseline estimates and estimates conditional on some constraint, holding exporter's output/income and importer's expenditure constant; whereas, the 'full endowment' effects are identified by assuming that the balance of trade ratio remains constant in the counter-factual and income and expenditure are endogenously determined.

Trade, both intra- and extra-regional, is an integral part of the drive towards regional integration in the Caribbean. Given globalisation and trade liberalisation and the importance of trade to its economies, The Region recognized the need to increase its competitiveness and integrate into the global economy. From a regional perspective, deeper integration has the potential to improve The Region's negotiating capacity both in relation to trade and foreign affairs issues as well as taking advantage of economies of scale, reallocating capital and labour, and establishing businesses to foster growth. Regional markets are small; therefore, external markets are critical to these economies achieving greater growth and hence improved welfare of its people. Generally, deeper regional integration of CARICOM members is aimed at creating internal economic advantage as well as striking better trade deals and improved foreign relations with other third parties, both bilateral and multilateral.

The policy response to foster deeper integration within The Region, thus far, has taken the form of a Common External Tariff (CET) and a Caribbean Single Market and Economy (CSME). The CET framework is aligned with market liberalisation and export promotion, that is, reducing trade costs among members and applying a common tariff on the rest of the world whilst promoting greater trade among members. Following a phased implementation of CET after 1993, the implementation of CSME, which signals the need for firms to increase their regional and international competitiveness, is lagging. The CSME provides a framework for strengthening integration predicted on broader comparative advantage-based production and trade integration and development cooperation. Additionally, embedded into this policy are efforts to foster enterprise, investment, innovation and a flexible integrated labour force; however several aspects, such as the free movement of labour and capital, have not been fully implemented. Most notably is the implementation of a common currency, which should have been implemented in 2015 but has been delayed.

A common currency could have several benefits to The Region especially related to trade and the free movement of capital and labour income; however, the implementation of such a currency needs to be informed by studies that are empirically sound and considers critical stakeholders. A key step associated with achieving this objective is the establishment of a monetary authority that has the ability to back the currency through monetary policy instruments and actions. This aspect is beyond the scope of this research. Here, we consider the implications of a common currency in fostering trade and hence the welfare effects for CARICOM members. From the perspective of trade, the implementation of the common currency will foster a better business environment with less uncertainty, which is critical to expanding the manufacturing sectors of CARICOM members. The adoption of a common currency could facilitate increased flow of capital among members as well as reduce uncertainty, which will improve the business and economic environment. However, the differences in exchange rate regimes across CARICOM members could prove a hindrance given the differences in political philosophy and policies used in the management of the exchange rate (pegged or flexible). Furthermore, in the context of regional trade, if all CARICOM members adopt a common currency, those who currently benefit from exchange rate differential within The Region will be negatively impacted. Additionally, countries that also benefited from currency depreciation, making their exports cheaper to the rest of the world, could see reduction in the gains from trade if the common currency is pegged to a currency or currencies that on average increase in value, hence making its exports more expensive to the rest of the world. However, with greater business confidence (less uncertainty) and greater credibility this could foster greater investment, which includes greater movement of capital within The Region, and technological transfer hence increased trade and growth for the economies of The Region and with the rest of the world. Notwithstanding, there are potential drawbacks, which include: greater constraint on credit in an effort to maintain a currency peg (assuming a pegged currency is adopted); the limiting ability of the monetary authority to adjust the par value of the currency; the susceptibility of the economies of the CARICOM to external shocks; and, the monetary authority's ability to adequately respond to these shocks. These latter aspects are beyond the scope of this paper.

By exploring the differences in exchange rate regime and the depreciation/devaluation of the currencies of the the economies of The Region, it is possible to identify their effects on trade. Usually, the depreciation in a country's exchange rate is theoretically treated as equivalent to a tax on imports and a subsidy on exports (Anderson et al., 2016). In this paper, Anderson et. al. (2016) theoretical gravity model framework, which is set out in detail below, is adopted to explore the pass-through effects of exchange rate on trade.

Recent developments in the derivation and estimation of the gravity model have allowed for more robust estimates of the impact of regional trade agreements (RTAs) or more broadly economic integration agreements EIAs on trade. These developments include: (1) exploring the process of integration over time by taking advantage of the information available in a panel; and, (2) considering issues related to variable endogeneity and residual heteroskedasticity. This involves using the Poisson Pseudo Maximum Likelihood(PPML) to estimate the gravity specifications with fixed effects to capture the multilateral resistance terms and bilateral time-invariant effects. This approach is hinged on the findings of Fally (2015), who examined the pros and cons of a suite of estimators given different distributional assumptions.

The debate on how to estimate the gravity model has been guided by seminal pieces including: Anderson and van Wincoop (2003), who shed light on the omitted variable bias associated with not taking into consideration the inward and outward multilateral resistance terms; Santos Silva and Tenreyro (2006), who highlighted the issue of heteroskedasticity and the implications for estimates by Ordinary Least Squares (OLS) and further championing the use of the PPML estimator; Haveman and Hummels (2004) and Helpman et all (2008), who documented the frequency of zero trade flows and identified possible issues associated with selection into trade; Baier and Bergstrand (2007), Anderson et al. (2010), Yotov (2012) and Bergstrand et al. (2014), who researched the role of distance in trade, dubbed the distance puzzle; and, Head and Mayer (2014), Bosquet and Boulhol (2014), Egger and Staub (2015) and Fally (2015), among others, who examined the properties of several estimators, including the OLS, NLS Gamma PML, PPML and Negative Binomial, when estimating the gravity model. To a large extent, the PPML estimator is found to be least biased and most robust under various distributional assumptions of the error structure and has the added bonus of accommodating zero trade flows.

The baseline for this framework is established using parameter estimates from the literature and a baseline gravity model estimated using the PPML estimator for selected years. We find that CARICOM is trade-creating within The Region. Additionally, there is evidence that currency depreciation of CARICOM members increases trade both within The Region and exports to the rest of the world. In terms of the general equilibrium effects we impose constraints on CARICOM and exchange rate variation within CARICOM and find that CARICOM is essential for member states with the smallest economies, such as Saint Lucia, Grenada, Belize and Barbados. Dismantling CARICOM will cause a decline in these small economies and an overall effect on The Region of -0.28 percent change in real GDP. On the other hand, further integration in The Region in the form of a common currency could be welfare-improving for all CARICOM members. Adopting a common currency could increase real GDP of The Region by 0.5 percent with the greatest beneficiaries being Saint Lucia, Belize, Barbados and Trinidad and Tobago. Further research is required to determine if this common currency should be allowed to float or be pegged to the US$ or a basket of currencies.

The rest of the paper is divided into four sections. section 4.2 covers the general equilibrium gravity model; section 4.3 develops and illustrates the model estimated; section 4.4 describes the data and simulation procedure used; section 4.5 presents the findings; and, the paper concludes with section 4.6.

2 Structural Gravity

Recent research efforts have shown that a gravity representation can be derived from several theoretical models of international trade. These include: Anderson (1979), who assumed Armington (1969) Constant Elasticity of Substitution (CES) preference for national varieties across countries; Krugman's (1979) model of monopolistic competition and international trade; Eaton and Kortum (2001) using a Ricardian trade model based on differences in technology; and, Melitz (2003) trade model of intra-industry reallocation and aggregate industry productivity. Most of these gravity models, grounded in theories of international trade, are quite parsimonious. They are also tractable representation of economic interaction in a many country world when compared to the usual two/three countries/sectors theoretical models (Anderson, 2011). In other words, whether grounded in theories of international trade or not, gravity models make it easy to derive economic insight from, and make inference about, a complex network of trade among all or a subset of countries; however, when backed by theories of international trade it is useful general equilibrium tool.

The structural gravity model is an appealing tool for deriving counter-factual and hence welfare measures associated with changes in trade policies and cost. This is usually achieved by building a general equilibrium model of trade which incorporate both intra-national (trade with self)and international trade. Anderson and van Wincoop (2004) explain that trade separability/modularity, which is the observation that goods are typically supplied from multiple locations, permits research and inference about the distributional costs that cause this distributional pattern in both goods and factor markets. This is one reason why the gravity model is an attractive tool for modelling trade flows. Additionally, the task of drawing inference about distributional cost associated with trade, as opposed to determining the total supplies of goods from all destinations or total demand for all goods or factors from all origins, is straightforward. Furthermore, inference about the distribution of goods or factors is consistent with many plausible general equilibrium models of national/regional production and consumption (Anderson, 2011).

Within the gravity framework with iceberg trade cost (Samuels, 1952), trade cost is proportional to goods shipped from county n to country j and plays a critical role in understanding the distributional pattern of trade. Trade cost can be broadly defined as including "all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself: transportation costs (both freight costs and time costs), policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution costs (wholesale and retail)"(Anderson and van Wincoop (2003) in Snorrason, 2012, p. 26). Trade costs are large and are closely linked to economic policies; therefore, they have far-reaching welfare implications. The current practice in the gravity literature is to estimate trade costs using bilateral characteristics such a distance, RTA, common currency, common language, colonial link and common border; however, to correctly estimate trade cost using these factors, consideration must be given to inward and outward multilateral resistances; i.e. country (exporter and importer) specific characteristics/price indexes/incidence of trade (Anderson and van Wincoop, 2003). This is critical because it allows for unbiased and more robust estimates of trade costs. The most widely used method to control for the multilateral resistance terms is fixed effects, primarily, exporter-time, importer-time and/or bilateral pair fixed effects.

The general equilibrium framework adopted for this paper assumes that changes in trade costs alter the multilateral resistance terms. This inter-dependence between the the multilateral resistance terms and trade costs was first pointed out by Anderson and van Wincoop (2003). They found that by exploiting changes in the multilateral resistance terms caused by a change in trade costs one could derive some measure of welfare implications of such a change. Holding GDP and expenditure (income and output) constant, changes in the multilateral resistance terms as a result of a change in the trade costs is what Head and Mayer (2014) call Partial Trade Impact (PTI) and Anderson et al. (2015) call the 'Conditional' General Equilibrium Indexes. Since output and expenditure are not endogenously determined the resulting effects are partial and limited to a first order conditional change in trade costs. On the other hand, in a 'full' general equilibrium framework GDP is dependent on factor prices and as such any changes in the multilateral terms/prices indexes should also impact output and expenditure. In other words, A 'full' general equilibrium framework is one in which factor prices, output (GDP) and expenditure are endogenously determined. Head and Mayer (2014) call this General Equilibrium Trade Impact (GETI) whilst in Anderson et al. (2015) this is called the 'Full Endowment' General Equilibrium effects.

This paper adopts Anderson et al. (2015) General Equilibrium PPML estimation technique. This methodology hinges on two main assumptions: 1. this framework assumes balanced trade which is imposed by the market clearing condition; and, 2. estimation of the multilateral resistance terms, approximated by fixed effects using the PPML estimator, is sufficient to validate the structural gravity and in subsequent stages conduct counter-factual analysis. These assumptions are described below.

Equations (1) to (4) below are represented from the theoretical gravity model constructed using CES preference.

$$X_{nj}(c) = \frac{Y_n Y_j}{Y_k}\left[\frac{\tau_{nj}}{P_j \Pi_n}\right]^{1-\sigma} \tag{1}$$

$$\Pi_n = \sum_{j=1}^{J}\left[\frac{\tau_{nj}}{P_j}\right]^{1-\sigma}\frac{Y_j}{Y_k} \tag{2}$$

$$P_j = \sum_{n=1}^{J}\left[\frac{\tau_{nj}}{\Pi_n}\right]^{1-\sigma}\frac{Y_n}{Y_k} \tag{3}$$

$$p_j = \frac{Y_j^{\frac{1}{1-\sigma}}}{\gamma_j \Pi_j} \tag{4}$$

Equation (1) characterizes trade flows and equations (2), and (3) are the multilateral resistance terms as described by Anderson and van Wincoop (2003). Anderson (2011) describes the inward and outward multilateral resistance terms as measures of buyers and sellers incidence of trade cost, respectively. Equation (4) is the market clearing condition. These four equations form the basis of the general equilibrium framework.

Equation (4), the market clearing condition is implied by the assumption that total consumption expenditure by country n must equal to the total income of country n ($Y_n = \sum_{j=1}^{J} x_{nj}$). It follows that,

$$[p_n(c)]^{1-\sigma} = \frac{Y_n}{\sum_{j=1}^{J}\left[\frac{\tau_{nj}}{P_n}\right]^{1-\sigma} Y_j} \tag{5}$$

therefore,

$$Y_n = [p_n(c)]^{1-\sigma}\sum_{j=1}^{J}\left[\frac{\tau_{nj}}{P_n}\right]^{1-\sigma} Y_j \tag{6}$$

for all n, where $p_n(c)$ is the exporter's supply price of country j. Dividing both sides by world output, Y_k, and using equation (3) yields equation (4). The γ_j included in equation (4) is a positive distribution parameter of the CES utility function[1], that is, the utility function for the theoretical construct would change from:

$$U_n = \left[\int_{c\in C_n}(x_n(c))^{(\sigma-1)/\sigma}dc\right]^{\sigma/(\sigma-1)} \tag{7}$$

[1] γ_j is included for consistence with Anderson et al. (2015)

to

$$U_n = \left[\int_{c \in C_n} \gamma_n (x_n(c))^{(\sigma-1)/\sigma} dc \right]^{\sigma/(\sigma-1)} \tag{8}$$

but equations (1)-(3) are the same irrespective of the inclusion of γ_n.

The constant elasticity of substitution, σ, can be estimated using the gravity model or, as is common in the literature, it can be parameterised using secondary sources. See Table 1 for a summary of the elasticity from the literature by Head and Mayer (2014)

Table 1: Price Elasticities Estimates

	Median	Mean	s.d.	# of estimates*
Total sample of estimates	-3.19	-4.51	8.93	744
Native Gravity estimates	-1.31	-1.35	5.17	122
Structural Gravity estimates	-3.78	-5.13	9.37	622
Estimation method includes country fixed effects	-3.5	-4.12	8.2	447
Estimation method uses ratios	-4.82	-7.7	11.49	175
Identifying variables include tariffs or freight rates	-5.03	-6.74	9.3	435
Identifying variables include price, wage or exchange rate	-1.12	-1.38	8.46	187

*Data contained in this table is the summary statistics of estimates garnered from 32 papers.

Source: Head and Mayer (2014)

The second binding assumption of this framework is the fixed effects approximations of the multilateral resistance terms, first proposed by Feenstra (2004); however, as pointed out by Head and Mayer (2014), size effects and explanatory power cannot be interpreted as support for the theory. That is, the theoretically constructed multilateral resistance terms may not be statistically equivalent to importer and exporter fixed effects when controlling for size effects.

According to the existing theory, the multilateral resistance terms should have the same unit elasticities as the size effects controls; however, in most findings this is not the case (Head and Mayer, 2014). In more recent work, Fally (2015) demonstrates that the fixed effects estimated using the PPML estimator are consistent with the structural gravity terms. He suggests and shows that if the gravity model is estimated using PPML with exporter and importer fixed effects, the multilateral-resistance terms are the unique solutions of equations (4.2.2) and (4.2.3); however, comparing unconstrained fixed effects and theory-consistent multilateral resistance terms as a test of structural gravity is not really a test because the PPML, once implemented successfully, is consistent with the properties of a structural gravity. Furthermore, Fally (2015)explains that the PPML estimator is the only estimator, of those considered, for which the sum of the fitted values of GDPs and expenditures are equal to the sum of observed values of GDPs and expenditures, which is a desired property to guarantee that the fixed effects from the estimated gravity model are consistent with the structural gravity terms[2]. Such consistency is not guaranteed with OLS, NLLS or Gamma PML.

Estimation using OLS with exporter and importer fixed effects does not imply that $\Sigma_j \log \hat{X}_{nj} = \Sigma_j \log X_{nj}$ and $\Sigma_n \log \hat{X}_{nj} = \Sigma_n \log X_{nj}$ nor does estimation using Non-Linear Least Squares (NLLS) with exporter and importer fixed effects imply that $\Sigma_j \hat{X}_{nj} X_{nj} = \Sigma_j \log X_{nj}^2$ and $\Sigma_n \hat{X}_{nj} X_{nj} = \Sigma_n \log X_{nj}^2$.

[2]A similar argument is made by Arvis and Shepherd (2013)

Similarly, estimation via the Gamma PML with exporter and importer fixed effects does not imply $\Sigma_j \hat{X}_{nj} = \Sigma_j X_{nj}$ and $\Sigma_n \hat{X}_{nj} = \Sigma_n X_{nj}$ nor does using trade shares (X_{nj}/Y_j) as the dependent variable when estimating using the Poisson PML with exporter and importer fixed effects (Fally, 2015). Admittedly, the OLS, NLLS and Gamma PML estimators could be used to establish the baseline model, however, given Fally's findings and consideration for other issues such as zero trade flow and heteroskedasticity[3], the PPML estimator is preferred here.

Another limitation to consider, which is amplified because this paper focuses mainly on CARICOM, is the need to identify intra-national trade (internal trade/trade with self), x_{ii}. Data on internal trade is very limited, especially in the case of CARICOM members; however, it can be inferred from GDP and production data as the difference between GDP or production of country n and total exports from country n i.e $X_{nn} = Y_n - \sum_{n \neq j} X_{nj}$. Head and Mayer (2014) suggest that the use of GDP could be more problematic than production, since GDP includes services that are rarely traded and, as a value-added measure, excludes purchases of intermediates that should be included in intra-national trade. The treatment of intra-national trade in this paper is dealt with in the section describing the data.

2.1 Exchange Rate Effects on Trade: A Theoretical Framework

There are several avenues from which to approach the literature of exchange rate on trade. Mostly, the literature looks at the impact of exchange rate volatility and misalignment on trade; however, few consider exchange regime on trade. Generally, exchange rate volatility and uncertainty is found to have a negative effect on international trade (see Karemera et al. (2015), Chit et al. (2010), Schanbl (2008), Clark et al. (2004), among others). Similarly, misaligned currencies, which could either be over- or under- valued, distort the competitive equilibrium of trade. It affects the competitiveness of all producers of tradable goods and services in a country relative to producers in trading partners by changing the foreign currency price of home exports and domestic currency price of foreign imports (UNCTDA, 2012). The negative effects of exchange rate volatility on trade is closely related to uncertainty about pricing; whereas, the negative effect of misalignment is related to one country pricing its goods more or less expensive. Here, our concern is more along the lines of changes in the exchange over time; that is, changes in the exchange rate year on year. Additionally, since CARICOM is of interest and the next steps in the integration process is adopting a common currency, against the background that many of the members of CARICOM have fixed exchange rate regime, it is important to understand how fixed exchange rate regimes and the formation of currency union could impact trade.

Schanbl (2008) argues that, relative to a flexible exchange rate regime, fixed exchange rate provides a more stable framework for the adjustment of assets and labour market, especially for countries in the economic catch-up process. Similarly, Klein and Shambaugh (2006) find that fixed exchange rate regimes have large significant effects on bilateral trade between a base country and a country that pegs to it. They further suggest that the web of fixed exchange rates created when countries link to a common base also promotes trade, but only when these countries are part of a wider system. On the contrary, Bacchetta and Van Wincoop, (2000) argue, using a theoretical model, that in general both trade and welfare can be higher under either exchange-rate system, depending on the preferences and on the monetary-policy rules followed under each system. Furthermore,

[3]The MaMu Test suggest that heteroskedasticity is present and the GNR regression (test) failed to the reject null that the variance is proportional to the conditional mean

they suggest that there is no one-to-one relationship between the levels of trade and welfare across exchange-rate system. It is against this background, that we hypothesis that changes in exchange rate over time is not the only avenue through which exchange rate impacts trade, but also through the level (scale) difference in exchange rate across members of CARICOM. Adopting a common currency could benefit The Region since it mitigates some trade frictions between members.

To model exchange rate on trade, this paper follows the framework developed by Anderson et al. (2016b), which involves specifying trade cost explicitly as a function of exchange rate.

Consider the following specification of the iceberg trade cost, τ_{nj}, such that the pass-through effects of exchange rate on trade can be represented as:

$$\tau_{nj} = \tau'_{nj}\left(\frac{e_n}{e_j}\right)^{\rho_j} V_{nj}^{\phi_{nj}} \tag{9}$$

where e_n and e_j are the respective appreciation factor of the currency relative to the US$ for country n and country j. Relative to each other, these capture the bilateral appreciation factor that increases the cost of n's shipments to j. τ'_{nj} represents that part of the iceberg trade cost that is determined by the standard variables used in the literature, which include distance, common currency, common language, colonial link and common border. V_{nj} is the volume of goods shipped from n to j. Assuming $V_{nj} = X_{nj}/\tau_{nj}$, which implies that volume depends on trade cost or vice-versa, trade cost depends on volume. Additionally, assume $\phi_{nj} = \phi_j B_{nj}$, where B_{nj} is an indicator variable which takes a value of 1 when a bilateral pair trade internationally and 0 when trade is intra-national. ρ_j is the pass-through elasticity of exchange rate. The subscript j is essential to the model as it assumes that the exchange rate pass-through is non-uniform, such that the pass-through to prices paid in the importing country is different for all j. In cases where the pass-through effects are constant for all j it is impossible to identify these effects, because they cannot be disentangled from the multilateral resistances terms and when estimated with dummy variable fixed effects will be absorbed by the dummies.

Rewriting equation (1), such that exporter- and importer- specific characteristics are captured by the terms O_n and D_j, yields equation (10).

$$X_{nj} = O_n D_j \tau_{nj}^{1-\sigma} \tag{10}$$

The equation above is the standard identity used to estimate gravity models when exporter and importer fixed effects are used in the model. If equation (10) was subscript by time then exporter-time and importer-time fixed effects are used. Defining trade volume as X_{nj}/τ_{nj} and using equations (9) and (10), trade volume can be written as:[4]

$$V_{nj} = \left[O_n D_j \tau'_{nj}\left(\frac{e_n}{e_j}\right)^{-1-\rho_j\sigma}\right]^{1/(1+\sigma\phi_{nj})} \tag{11}$$

Substituting this into equation (9) yields:

[4]Anderson et al. (2016b) suggested that by defining export volume as X_{nj}/τ_{nj}, τ_{nj} removes both the exchange rate effects and the volume used up in trade cost (ice-berg trade cost).

$$\tau_{nj} = \tau'_{nj}\left(\frac{e_n}{e_j}\right)^{\rho j}\left[O_n D_j \tau'^{-\sigma}_{nj}\left(\frac{e_n}{e_j}\right)^{-1-\rho_j\sigma}\right]^{\phi_{nj}/(1+\sigma\phi_{nj})} \tag{12}$$

which simplifies to a trade cost function of:

$$\tau_{nj} = \left[\tau'_{nj}(O_n D_j)^{\phi_{nj}}\left(\frac{e_n}{e_j}\right)^{\rho_j-\phi_{nj}}\right]^{\phi_{nj}/(1+\sigma\phi_{nj})} \tag{13}$$

This trade cost function differs from other specifications in the literature since it explicitly express trade cost as a function of exchange rate pass-through. Furthermore, trade cost is raised to the power $1 + \phi_{nj}\sigma$ whereas in the simplest form of the gravity model, it is raised to the power $1 - \sigma$. Substituting equation (13) into equation (10) yields a gravity equation, which when sub-scripted with time *t* can be written as:

$$X_{njt} = (O_{nt}D_{jt})^{(1+\phi_{nj})/(1+\phi_{nj}\sigma)}\tau'^{(1+\sigma)/(1+\phi_{nj}\sigma)}_{nj}\left(\frac{e_{nt}}{e_{jt}}\right)^{(\rho_j-\phi_{nj})(1-\sigma)/(1+\phi_{nj}\sigma)} \tag{14}$$

where τ'_{nj} includes all other time invariant trade cost determinants such as distance, colonial link, common language and contiguity. Recall that O_n and D_j are exporter- and importer- specific characteristics that vary with time.

2.1.1 Econometric Specification

Following from equation (14) in the previous section and assume $\phi_{nj} = \phi_{nJ} = \phi_J B_{nj}$ for all j in J, where B_{nj} is an indicator variable which takes a value of one for international trade and zero otherwise. When $B_{nj} = 0$, which corresponds to trade with self, $\phi_{nj} = 0$ and when $B_{nj} = 1$, which corresponds to international trade, the estimable gravity equation can be specified as follow[5]:

$$X_{njt} = exp\left[\frac{1+\phi_J}{1+\phi_J\sigma}lnO_{nt} + \frac{1+\phi_J}{1+\phi_J\sigma}lnD_{jt} + \frac{1+\sigma}{1+\phi_J\sigma)}\tau'_{nj} + \frac{(\rho_j-\phi_J)(1-\sigma)}{1+\phi_J\sigma}ln\left(\frac{e_{nt}}{e_{jt}}\right)\right] + \epsilon_{nj} \tag{15}$$

where lnO_{nt} and lnD_{jt} are time-varying country-specific characteristics that are controlled for using exporter-time and importer-time fixed effects; τ'_{nj} includes time-invariant bilateral pair-specific characteristics such as distance, colony, common language and contiguity; and, $\frac{e_{nt}}{e_{jt}}$ is exporter's currency per unit of US$ relative to importer's currency per unit of US$, which is equivalent to the exchange rate between the bilateral pair. If e_{nt} is rising relatively to e_{jt} then the exporter currency is depreciating, which according to the J-curve theory, Davies (1962), should result in exports increasing and imports decreasing. Therefore $\frac{(\rho_j-\phi_J)(1-\sigma)}{1+\phi_J\sigma}$ captures the net effect of exchange rate on both exports on imports[6]. Consider a bilateral pair say Jamaica-Belize, then if $\frac{(\rho_{BLZ}-\phi_{BLZ})(1-\sigma)}{1+\phi_{BLZ}\sigma} > 0$, and the Jamaican dollar has depreciated against the Belizean dollar, Jamaican exports to Belize should increase. On the other hand, if $\frac{(\rho_{JAM}-\phi_{JAM})(1-\sigma)}{1+\phi_{JAM}\sigma} > 0$, and the Jamaican dollar has depreciated against the Belizean dollar, then Jamaican imports from Belize should fall.

In this paper, we model the impact of implementing a common currency among CARICOM members on trade within CARICOM and with the rest of the world by disentangling the exchange rate effects to capture the within region and extra-regional effects. This is done by interacting $\frac{e_{nt}}{e_{jt}}$ with

[5]The following specification is only concerned with $B_{nj} = 1$, which corresponds to international trade.
[6]This is demonstrated in Anderson et al.(2016).

regional and extra-regional dummy variables. We interact $\frac{e_{nt}}{e_{jt}}$ with $CARI_{njt}$, which takes a value of one if both exporter and importer are members of CARICOM and zero otherwise; and, $\frac{e_{nt}}{e_{jt}}$ with $CARI\_EXP_{njt}$, which takes as value of one if the exporter is a CARICOM member exporting to a Non-CARICOM country. The latter interaction only captures the impact of exchange rate on CARICOM's exports to the rest of world. To capture the net effect on trade, $\frac{e_{nt}}{e_{jt}}$ is interacted with $CARI\_Trade_{njt}$, which takes a value of one if extra-regional trade between a bilateral pair involves a CARICOM member. This paper is primarily concerned with the former two interactions as such the estimable equation can be specified as:

$$X_{njt} = exp\Big[\tau'_{nj} + \alpha_1 BDER_{njt} + \alpha_2 * CARI_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right) + \alpha_3 * CARI\_EXP_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right) + P_{jt} + \Pi_{nt}\Big] + \epsilon_{njt} \tag{16}$$

where $\tau'_{nj} = \sum_{m=1}^{M} \beta_m z_{nj}^m$, which include distance, colonial link, common language and contiguity. $BDER_{njt}$ is a dummy, which takes the value one if the trade flow is across national borders and zero for intra-national trade. The identification of the exchange rate effects is dependent on estimation with: (1) internal trade (trade with self), which includes a country's home bias; and, (2) exchange rate, which by specification is equal to zero when a bilateral pair is the same country. However, this approach to estimating the exchange rate effects is limiting since identification should ideally consider intra-national trade across provinces, firms or industries. One way to circumvent this limitation is to consider the 9 CARICOM members[7] with fixed exchange rate regimes as one country and assume the pass-through effect for these countries is the same; however, data limitation prevents such an endeavour. Furthermore, the aim of this exercise is to identify the exchange rate effect among CARICOM members and its impact on exports to third party countries.

Consideration is also given to the impact of RTAs. The model is therefore re-specified as:

$$X_{njt} = exp\Big[\tau'_{nj} + \alpha_1 BDER_{njt} + \alpha_2 * CARI * \left(\frac{e_{nt}}{e_{jt}}\right) + \alpha_3 * CARI\_EXP_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right) + \alpha_4 RTA_{njt} + \alpha_5 CCOM_{njt} + P_{jt} + \Pi_{nt}\Big] + \epsilon_{njt} \tag{17}$$

where RTA_{njt} is a dummy variable, which takes a value of one if the bilateral pair are in a regional trade agreement, and $CCOM_{njt}$ is dummy which takes value of one if the bilateral pair are members of CARICOM. RTA_{njt} is a generic measure of the impact regional trade agreement on trade, capturing the average global effect of RTAs on trade whereas $CCOM_{njt}$ identifies the region-specific impact of CARICOM on trade among CARICOM members. P_{jt} and Π_{nt} are the multilateral resistance terms, which are controlled for using fixed effects. ϵ_{njt} is the error term. In the next section, the estimation techniques are further detailed.

3 Baseline, Estimation and Counter-factual

In this section, the baseline model is described along with the estimation procedure used and justification for the use of this procedure. Additionally, the counter-factual design used is documented.

[7] Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, St. Kitts and Nevis, Saint Lucia and St. Vincent and Grenadines

3.1 Baseline

Following Anderson et al. (2015), the baseline estimates for the general equilibrium model could be established in two ways, namely: (1) parameterization using the existing literature, or (2) estimating a baseline model. The baseline model is estimated and its estimates are compared with those found in the literature.

Disdier and Head (2008) surveyed numerous papers that estimated the gravity model of international trade, and found that the average distance elasticity is approximately -.93, contiguity is on average 0.53, common language 0.54, colonial link 0.91, RTA 0.59, common currency 0.87 and intra-national trade 1.96 (see Table 2 for more details). However, these meta results do not distinguish between estimators nor is there any indication of differences in the samples used to estimate each coefficient. Using random effect (RE) and OLS on survey data of 1,467 distance elasticities from 103 papers, Disdier and Head (2008) estimate using regression analysis that only 2% of the variation in the estimated distance elasticity is explained by the sampling error defined as chance errors in estimating a population parameter arising from the finite sample drawn from that population. The remaining variation in the estimated distance elasticity is attributed to the 'structural' heterogeneity, which is defined as differences in parameters across sub-populations of the data; and, 'method' heterogeneity, which is defined as differences in statistical technique. They find that the PPML is likely to return a distance coefficient that is on average between 20-30% smaller than the average of all other estimators. Additionally, they find that there are correlations between distance and sampling, level of data aggregation and other right hand side (RHS) variables usually used in the estimation of the gravity model. Variation in the estimated distance coefficient is found to be explained by papers that used no developed economies, total or disaggregated bilateral trade data, adjacency control, common language control, country fixed effects and whether or not zero trade flows were included.

Table 2: Estimates of Typical Gravity Model

	All Gravity				Structural Gravity			
Variables	Median	Mean	s.d	# of papers	Median	Mean	s.d	# of papers
Distance	-0.89	-0.93	0.4	1835	-1.14	-1.1	0.41	328
Contiguity	0.49	0.53	0.57	1066	0.52	0.66	0.65	266
Common Language	0.49	0.54	0.44	680	0.33	0.39	0.29	205
Colonial Link	0.91	0.92	0.61	147	0.84	0.75	0.49	60
RTA/FTA	0.47	0.59	0.5	257	0.28	0.36	0.42	108
Common Currency	0.87	0.79	0.48	104	0.98	0.86	0.39	37
Intra-national Trade	1.93	1.96	1.28	279	1.55	1.9	1.68	71

Source: Head and Mayer (2014)

Although this paper is not about further investigating the distance puzzle, these findings are important to estimate and hence establishing the baseline for this paper. Against this background several specifications of the gravity model are considered when establishing the estimated baseline. First, consideration is given to equation (17), which includes only time-varying exporter and importer characteristics. Second, equation (17) is re-specified to resemble Bergstrand et al. (2007)[8]:

[8]This specification proved difficult to implement; however, it is critical to highlight that it was considered.

$$X_{njt} = exp\Big[\sum_{t=1}^{T}\beta_t DBDER_{nj,t} + \alpha_2 * CARI_{njt} * \left(\frac{e_n}{e_j}\right) + \alpha_3 * CARI\_EXP_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right) + \alpha_4 RTA_{njt} + \alpha_5 CCOM_{njt} + P_{jt} + \Pi_{nt} + \Lambda_{nj}\Big] + \epsilon_{njt} \quad (18)$$

where Λ_{nj} are bilateral-pair fixed effects, which controls for unobserved bilateral time invariant heterogeneity. $DBDER_{nj,t}$ is the international border effects ($BDER_{njt}$) interacted with time dummies, $Year^*$. In this specification Bergstrand et al. (2007) do away with the assumption that all country-pairs have the same international border-effects by estimating equation (17) in a panel specification and including country-pair fixed effects; suggesting that since both the fixed and variable costs of exporting varies with time it is possible to separate the international border effects from the Economic Integration Agreement/Regional Trade Agreement (EIA/RTA) effects. By including the country-pair fixed effect any change in $DBDER_{nj,t}$ over time is associated with the change in the cost of international trade relative to intra-national trade, given a reference year. On the other hand, the effects of changes in bilateral trade policies, such as entry into or exit from EIAs/RTAs, will be captured by the EIA/RTA dummy. Note that the ETA/RTA dummy will explain variation in trade flows in the 'bilateral-pair-time' dimension; whereas, $DBDER_{nj,t}$ is explaining trade flows in the 'bilateral-pair' dimension year on year. In equation (18) all the other variables are allowed to change with time, i.e 'bilateral-pair-time' dimension. It is important to note that identification of the variables in τ'_{nj} is not possible with the inclusion of bilateral pair fixed effects; however, interacting distance with time will allow for the identification of the effects of distance over time Bergstrand et al. (2014). Bergstrand et al. (2014) do this to great effect and find that the elasticity on distance has declined over time. Anderson et al. (2016a) also use equation (18) as a robustness check for the estimates of equation (17). This specification has the advantage of mitigating possible endogeneity, associated with selection into RTA, in equation (17).

However, the above approach, while useful for dealing with the issue of endogeneity, is difficult to implement when there are large number of exporters and importers and several years to consider. Additionally, the variables of interest, $CARI * \left(\frac{e_{nt}}{e_{jt}}\right)$ and $CCOM_{njt}$, in equation (17) have limited variation over time. That is, besides Haiti and Suriname, all CARICOM members were and remained a part of the RTA for the entire sample period as well as 5 of the 9 CARICOM members sampled have fixed exchange rate regimes and another 2 have limited variation over time because their exchange rates are managed. Therefore, if the gravity model is estimated using equation (18), the bilateral pair fixed effects will absorb, and is correlated in part with, these effects since they control for all possible (observable and unobservable) time-invariant trade costs at the bilateral level. To mitigate this problem we adopt Anderson and Yotov (2016) approach by estimating the gravity equation using a two-stage procedure. The first stage involves estimating equation (19) and capturing the bilateral pair fixed effects. These bilateral pair fixed effects are used as the dependent variable in the second stage regression.

$$X_{njt} = exp\Big[\alpha_1 * CARI_{njt} * \left(\frac{e_n}{e_j}\right) + \alpha_2 * CARI\_EXP_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right) + \alpha_3 RTA_{njt} + \Lambda_{nj}\Big] + \epsilon_{njt} \quad (19)$$

The second stage regression involves regressing the standard variables used to estimate trade costs as well as $CARI * \left(\frac{e_{nt}}{e_{jt}}\right)$, $CARI\_EXP_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right)$ and $CCOM_{njt}$ on the bilateral pair fixed effects obtained from equation (19) controlling for exporters and importers specific characteristics. That is, estimating the following:

$$\Lambda_{nj} = exp\Big[\tau'_{nj} + \beta_1 BDER_{njt} + \beta_2 * CARI * \left(\frac{e_{nt}}{e_{jt}}\right) + \beta_3 * CARI\_EXP_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right) + \beta_4 CCOM_{njt} + P_{jt} + \Pi_{nt}\Big] + \epsilon_{njt} \quad (20)$$

This two-stage approach is easier to implemented than estimating equation (18) and is useful when examining to what extent selection into RTA is problem and how it may distort the estimates of the gravity equation.

3.2 Baseline Estimation

Aligned with the findings and recommendations of Santos Silva and Tenreyro (2006), Anderson et al. (2015) and Fally (2015), among others, the baseline model is estimated using the PPML estimator with importer and exporter fixed effects for selected years. The PPML estimator is from the family of Generalize Linear Model (GLM) and is found to be a consistent estimator of the coefficients of the gravity model even in the presence of heteroskedasticity, when the test statistic of a MaMu/Park-type test is significantly different from 2 (Head and Mayer, 2014). Additionally, as mentioned before Fally (2015) demonstrates that the gravity model estimated using PPML with exporter and importer fixed effects is consistent with the structural gravity estimation approach. Unique to the PPML estimator is its ability to perfectly match predicted output and expenditures with observed output and expenditures respectively (Fally, 2015). He considers other estimators, OLS and Gamma PML, and finds that in practice the multilateral resistance terms are biased as well as the output and expenditure prediction of these estimators are significantly different from observed.

As an added bonus, the PPML estimator also accommodates zero trade flows, hence allowing information related to observed zero trade flow to be taken into consideration when estimating the model. Other approaches that could be used to accommodate zero trade flow include EK tobit, Heckman Selection and Xiong and Chen (2014). To estimate the EK tobit a marginal number is added to trade flows (usually one) before the log of the dependent variable is taken. By doing so, zero trade flows remain in the data set since the log of one is zero. Heckman selection is a two-stage estimator where in the first stage the gravity model is estimated using Probit with a binary dependent variable taking the value one when bilateral trade flow is observed to be greater than zero, and zero otherwise. From the first stage estimation the inverse Mills ratio is derived and included in the second stage regression which only considers, trade flows greater than one. Xiong and Chen (2014) propose a similar two stage approach, however, in the second stage the gravity model is estimated using a Method of Moment estimator rather than OLS as is the case with Heckman selection. Their concern was aligned with Santos Silva and Tenreyro (2006), that OLS is an inconsistent estimator of the gravity model in the presence of heteroskedasticity. However, this estimator is not found to outperform the PPML, although it has the advantage of disentangling the effects on trade flows at the intensive and extensive margin.

Against this background the PPML estimator is the only estimator considered here in the estimation of the baseline gravity model. The estimates of the baseline model are compared with those established in the literature and analysis carried using some of these established parameter estimates.

3.3 Counter-factual Design

There are three major steps involved in deriving counter-factuals. These include:

- Step 1: Establish Baseline Gravity Model
  - Step 1a: Estimate the baseline gravity model or use existing literature to derive parameter estimates
  - Step 1b: Construct 'Baseline' General Equilibrium Indexes
- Step 2: Estimate Conditional Gravity Model and General Equilibrium Effects
  - Step 2a: Estimate Conditional Gravity Model
  - Step 2b: Construct Conditional General Equilibrium Indexes
- Step 3: Estimate Full Endowment General Equilibrium Effects
  - Step 3a: Estimate 'Full Endowment' Gravity Model
  - Step 3b: Construct 'Full Endowment' General Equilibrium Indexes

Step 1a is mostly described in the previous subsection. It should be noted that the baseline regression is estimated without a constant. This is to avoid the dummy variable trap or perfect collinearity; furthermore, it is necessary to normalize the regression on a selected country's multilateral resistance. Besides being a econometric requirement, this normalization is also a necessary condition to solve the structural gravity system. Subsequent to correctly specifying and estimating the baseline gravity model, the estimated multilateral resistance terms (exporter and importer fixed effects) are used to construct the baseline indexes or the sellers and buyers incidence of trade respectively (Step 1b).

In step 2 the conditional general equilibrium gravity estimates are derived by allowing changes in the outward and inward multilateral resistance, holding changes in output and expenditure constant. These indexes are called Conditional General Equilibrium Indexes. For this paper, the interest is to estimate the impact that CARICOM has on it members as well as to identify the welfare implications of implementing a common currency among CARICOM members. Given these objectives, in Step 2a, the coefficient associated with CARICOM is set to zero. In an alternative scenario the coefficients associated with currency deviation between CARICOM members is restricted to ascertain the potential impact of adopting a common currency. In this step of the analysis the baseline data remain unchanged and inferences are made only through the observed changes in the outward and inward multilateral terms. The gravity equation is re-estimated with the aforementioned constraints imposed. Similar to step 1b, the conditional counter-factual outward and inward multilateral terms are generated. These are compared with the baseline outward and inward multilateral terms from step 1b. Differences in these indexes can be considered measures of welfare since the fixed effects are capturing all country-specific attributes, which in this model are limited to real GDP; however, all changes in real GDP are relative to a reference country.

Unlike in Step 2 where changes in output and expenditure are considered exogenous and hence the general equilibrium effects are conditional, Step 3 considers the full endowment effects associated with the same constraints imposed in Step 2. In Step 3a it is assumed that the trade (im)balance ratio stays the same in the counter-factual for each country and that output and expenditure are endogenous. That is, output and expenditure are allowed to change given the constraints imposed on the model. These endogenous changes in output and expenditure will also cause changes in the multilateral resistance terms and changes in the multilateral resistance terms will result in changes in the trade flows which in turn result in changes in output and expenditure and so forth. Using equation (1) and taking advantage of the fact that the PPML estimator is consistent and guarantees that the sum of the fitted values of output and expenditure is equal to the sum of the observed values of output and expenditure respectively the system of equations (1)-(4)) can be solved.

The mechanism by which the general equilibrium effects are derived can be described as follow. Using the Conditional General Equilibrium effects obtained in Step 2a and the market clearing conditions, $p_j = \left(\frac{Y_j}{Y}\right)^{\frac{1}{1-\sigma}} \frac{1}{\gamma_j \Pi_j}$, changes in the factory-gate prices are derived. Changes in the factory-gate prices result in changes in output and expenditure. By endogenizing (country-specific and world output) output and expenditure, changes in both will trigger changes in trade flows via equation (1). With these new trade flows and new outputs and expenditures, 'second-order' multilateral responses are derived. These will trigger another round of changes in factory-gate prices, which cause changes in output and expenditure and so forth. This process continues until convergence is achieved. Once convergence is achieved the Full Endowment General Equilibrium Indexes can be retrieved.

Similar to Step 2b, the percentage differences between the baseline indexes and the indexes generated from Step 3a are considered the Full Endowment General Equilibrium effects and are measures of changes in welfare.

4 Data

The data used in this paper is drawn from several sources. Trade flow data is taken from De Sousa et al. (2012), which is available via CEPII's 'TradeProd' database[9]. This dataset also includes production, tariff, manufactured value-added, wages and labour data for 26 industrial sectors in the International Standard Industrial Classification (ISIC) for 151 exporting and importing countries over the period 1980-2006. Their original sources of the data were: The Trade, Production and Protection 1976-2004 database made available by the World Bank (Nicita and Olarreaga, 2007); The BACI international trade database at the product level (Gaulier and Zignago (2010)); The United Nations Industrial Development Organization (UNIDO) database, which is the main source of manufacturing production data in Nicita and Olarreaga, 2007; and, Penn World Tables v.6.3 for GDP and relative price data.

Other macroeconomic and socio-economic indicators such as GDP per capita, population, value-

[9]CEPII's TradeProd database is publicly available via *http://www.cepii.fr/anglaisgraph/bdd/TradeProd.htm*

Table 3: Available Production Data for CARICOM

Country	ISO code	Data Available
Bahamas	BHS	1986-1987, 1989-1992 & 1995-1998
Belize	BLZ	1989-1992
Barbados	BRB	1980-1997
Grenada	GRD	1989-1993
Haiti	HTI	1988-1997
Jamaica	JAM	1980-1992
St. Lucia	LCA	1993-1997
Suriname	SUR	1980-1993 & 1996-2004
Trinidad and Tobago	TTO	1981-1987, 1989-1995 & 2000-2002

Source: CEPII's 'TradeProd' database, De Sousa et al. (2012).

added to GDP by agriculture, manufacture, industry and services, and exchange rates were sourced from the World Bank World Development Indicators. De Sousa et al. (2012) was merged with CEPII's geographical bilateral and cultural data set, which includes variables such as distance, common language, colony and contiguity[10]. Currency unions and region-specific RTAs are derived from De Sousa (2012).

To achieve the objectives of this paper the dataset is updated to include intra-national trade (trade with self). Intra-national trade (trade with self) is an essential part of this general equilibrium framework. It is a necessary components to estimating the total production/income/expenditure of each country; however, data coverage is limited. This is a major limitation to our analysis especially since the interest is in CARICOM trade and there are several data limitations in this respect. Recall that intra-national trade is approximated using the difference between production of country n and total exports from country n; however, production data is missing for several CARICOM members at different points in time. See Table 3 for a summary of data available for CARICOM members. The period 1989-1992 has the greatest amount of data available; however, this time interval would be restrictive.

The main concern with using the data available for the period 1989-1992 is that using such a short time period would limit our analysis in identifying CARICOM and exchange rate effects within a period that does not consider the common external tariff implemented post 1992 (deeper economic integration) as well as it coincide with exchange rate and trade liberalisation in some CARICOM members. Against this background, the time dimension of the panel is extended to cover the period 1986-2001. If production data is missing for a CARICOM member during this period, estimated production data is used to fill the gap. The estimation of missing data involves identifying the ratio of GDP to production or manufacturing GDP to production for the years available then estimating a model with a linear trend and a constant or other functional form and subsequently predicting the ratio. The predicted ratio is then combined with observed GDP figures to back out an estimate of production for the years there are missing data[11]. With this, the baseline model is estimated using an unbalanced panel data for 90 countries with three years interval over the period 1986-

[10]CEPII's geographical bilateral and cultural dataset is publicly available via $http : //www.cepii.fr/CEPII/fr/bdd_modele/download.asp?id = 6$

[11]see Annex B for specification about the procedure used to estimated missing for each country

2001. When estimating equation (18) the '*PPML_PANEL_SQ*' coded by Zylkin, T. (2016) in Stata was used as there are a large number of bilateral pair fixed effects; however, this routine is not adaptable to Anderson and Yotov (2016) two-stage procedure (equations (19) and (20)) since it does not allow for the specification of the equation with only bilateral pair fixed effects. It requires that either exporter and importer fixed effects or export-time and importer-time fixed effects are included. Equations (17), (19) and (20) are estimated using the PPML estimator proposed by Santos Silva and Tenreyro (2006).

5 Findings and Discussion

In this section we present the results for equation (17) and subsequently the results for equations (18), (19) and (20). For comparison, equation (17) is estimated in the first instance with exporter and importer fixed effects (regressions 1-4 in Table 4) and then with exporter time and importer-time fixed effects (regressions 5-8 in Table 4). Generally, the results for equation (17) are suspect as the equation seems to suffer from the well-documented issue of endogeneity in this specification of the gravity equation, hence, several variants of equation (17) is estimated both with and without RTA. The results for equation (17) are presented in Table 4 and Table 8 in the Appendix. Concerned about endogeneity, equation (18) is estimated and its estimates compared to those of equation (17). The results for equation (18) are presented in Table 5; whereas, the results for the two-stage procedure are presented in Table 6. Subsequently, regression (7) of Table 4, because of its parsimony, tractability and the size of the elasticities relative to those estimated by all other regressions, is used to estimate the general equilibrium effects.

As is expected log distance is estimated as having a negative effect on exports; however, the elasticities estimated by equation (17) are small, in absolute terms, relative to those established in the literature. According to the literature the median distance elasticity is -0.89 (see Table 2) but here we find distance elasticities ranging from -0.495 to -0.757. Additionally, this range of the distance elasticity is dependent on whether or not RTA is included in the specification. Researchers have argued that the inclusion of RTA biases the results because distance and RTA are correlated. Markedly, the inclusion of RTA introduces endogeneity. One argument is that countries are more likely to sign a regional trade agreements if they are closer to each other, hence the introduction of RTA would distort the distance effect and vice-versa. This can be seen by comparing the results for regressions (2) with (3) and regression (6) with (7) in Table 4. For regressions (6) and (7) of Table 4, which includes exporter-time and importer-time fixed effects, the distance effects moves from -0.495 when RTA is included to -0.726 when RTA is excluded. Similarly, the RTA effects differ from the median effect identified in the literature surveyed by Disdier and Head (2008). The estimated RTA effects using equation (17) are very large when compared to those established in the literature. From Table 2, the median RTA effect is 0.47; however here it is in on average 0.8, suggesting that countries in a regional trade agreement trade 123 percent more with each other than those that are not party to RTAs. Although this estimate is large and at first seems suspect, it is important to contextualize that our estimates consider intra-national trade as such this could account for some of the differences between these estimates and the literature; nonetheless, these differences cannot be solely due to the introduction of intra-national trade because the distance effect increases when the RTA dummy is removed pointing to issues of endogeneity.

In terms of the other traditional variables contained in τ'_{nj}, we observe that the coefficient associated with common language are comparable with estimates found in the literature; however, it decreases when RTA is excludes. Similarly, the coefficient associated with contiguity is in line with the literature but changes when RTA is excluded from the equation. Unlike the coefficient associated with common language, the coefficient associated with contiguity increases when RTA is excluded in the regression. The estimated coefficient for colonial link is smaller than those observed in the literature and is insignificant once RTA is excluded from the regression. $BDER_{njt}$, which is a dummy variable that takes a value of one when there is international trade and zero otherwise, is found to statistically significant and with coefficients ranging from -2.364 to -2.515 suggesting that on average if all trade costs associated with national borders went to zero, trade would increase by approximately 90 percent. This is in line with some estimates in the literature but above the median of 75-85 percent identified in the literature by Head and Mayer (2014). We also observe that when RTA is excluded the coefficient associated with $BDER_{njt}$ increase increases, albeit margin. In terms of statistical significance, common language, contiguity and $BDER_{njt}$ are significant at the 0.1 percent level of confidence; whereas, colonial link is found to be significant at the 5 and 10 percent level of confidence except when RTA is included in the regression and insignificant when RTA is omitted from the regression. The seeming dependence of the statistical significance of colonial link on the inclusion or exclusion of RTA as well as the sized effects of distance, common language, contiguity and $BDER_{njt}$ points to concerns associated with endogeneity in the specification and estimation of equation (17).

In assessing the estimates related to CARICOM, we find that the estimates on the main variables of interest are not sensitive to inclusion of RTA in the regression. We find a positive effect for the implementation of CARICOM. These effects are statistically significant and large, increasing in size as we move from exporter and importer fixed effects to exporter-time and importer-time fixed effects. From regression (6) of Table 4, we find that CARICOM members trade 15 (exp(2.772)) times more among themselves than with others. The same signed and sized effect is found in regression (7), i.e., the exclusion of RTA has no effect on this coefficient. We also find that border effects in among CARICOM members is significantly, albeit at the 10 percent level of significance, from the border effects estimated for all exporter and importers), including CARICOM members. Regression (7) suggests that on average if all trade costs associated with national borders went to zero, trade would increase among CARICOM members by approximately 83 percent. This is 7 percent smaller than the estimated global average as stated above (90 percent).

The other variables of interest are those related to exchange rates. First, for exchange rate within CARICOM, $CARI_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right)$, which is the change in the exchange rate between a bilateral pair that is a member of CARICOM, we find consistently across all regressions in Table 4 that the net effect of exchange rate depreciation and or exchange differential within The Region positively impact trade. As can be seen from regression (6) in Table 4, the elasticity associated with exchange rates within CARICOM is 0.263 suggesting that a 10 percent depreciation leads to an increase of 2.6 percent in exports within The Region. When RTA is exclude from the regression (regression (7)) this increases slightly to 0.286. For the second exchange rates variable, $CARI\_EXP_{njt} * \left(\frac{e_{nt}}{e_{jt}}\right)$, which considers changes in exchange rate between *CARICOM exporters* and the rest of world, we find an unambiguous statistically significant positive relationship between the depreciation of currencies in CARICOM and exports from CARICOM members to the rest of the world. From regression (6) in Table 4, the associated elasticity, α_3, is 0.574 suggesting that 10 percent depreciation leads to an increase of 5.74 percent in exports to the rest of the world. When RTA is exclude from the regression (regression (7)) this increases slightly to 0.591. Although the coefficients on CARICOM and the exchange variables are not sensitive to RTA, there seems to be some relationship with CARICOM and the exchange rate variables. Whenever, CARICOM is excluded from the regression, the coefficients associated with the exchange rate variables decreases. This is somewhat not surprising since 5 of the 9 CARICOM members sampled have fixed exchange rate regimes and as such there will be some correlation; however, the exchange rate variables is picking up scale effects of exchange rate differential across countries. This becomes more apparent in the following set of results.

Table 4: PPML Panel Gravity Estimates using Equation (17) for the period 1986-2001

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exporter & Importer fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Exporter- & Importer- time fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
DV: Exports								
Log Distance	-0.510***	-0.504***	-0.757***	-0.510***	-0.502***	-0.495***	-0.726***	-0.502***
	(-7.65)	(-7.53)	(-11.59)	(-7.65)	(-7.63)	(-7.51)	(-11.36)	(-7.63)
BDER	-2.364***	-2.368***	-2.469***	-2.364***	-2.430***	-2.434***	-2.515***	-2.430***
	(-20.10)	(-20.06)	(-17.47)	(-20.10)	(-20.85)	(-20.79)	(-18.04)	(-20.85)
BDER(CARICOM)	-0.727	-2.099***	-1.425*	-0.727	0.854+	0.0391	0.715+	0.854+
	(-1.44)	(-3.51)	(-2.42)	(-1.44)	(1.69)	(0.10)	(1.88)	(1.69)
RTA	0.864***	0.865***		0.864***	0.788***	0.788***		0.788***
	(8.21)	(8.21)		(8.21)	(7.40)	(7.40)		(7.40)
Contiguity	0.433***	0.436***	0.560***	0.433***	0.471***	0.474***	0.596***	0.471***
	(4.81)	(4.82)	(4.94)	(4.81)	(5.25)	(5.26)	(5.36)	(5.25)
Common Language	0.432***	0.437***	0.357***	0.432***	0.397***	0.403***	0.338***	0.397***
	(4.42)	(4.48)	(3.76)	(4.42)	(4.17)	(4.25)	(3.63)	(4.17)
Colonial Link	0.219+	0.217+	0.0371	0.219+	0.195+	0.192+	0.0211	0.195+
	(1.93)	(1.90)	(0.36)	(1.93)	(1.74)	(1.71)	(0.21)	(1.74)
Exchange Rate (within CARICOM)	0.168+	0.311*	0.270*	0.168+	0.229***	0.263***	0.286***	0.229***
	(1.91)	(2.21)	(2.17)	(1.91)	(3.33)	(3.47)	(4.07)	(3.33)
Exchange Rate (CARICOM Exporter)	0.406***	0.472***	0.481***	0.406***	0.465***	0.574***	0.591***	0.465***
	(10.26)	(14.56)	(14.19)	(10.26)	(5.77)	(8.20)	(7.70)	(5.77)
CARICOM		2.259***	2.204***			2.772***	2.773***	
		(5.71)	(5.69)			(5.92)	(5.91)	
N	25812	25812	25812	25812	25812	25812	25812	25812
R^2	.962	.962	.962	.963	.997	.997	.997	.997

Notes:

t statistics in parentheses and standard errors are clustered at the country-pair level.

***denotes significance at the 0.1 percent, **denotes 1 percent, *denotes 0.5 percent and $^{+}$denotes 10 percent.

Constant, exporter, importer, exporter-time and importer-time fixed effects are not reported. Estimation results are based on equation (17).

Given our concerns about endogeneity, RTA is omitted from the estimation of equation (17) and region-specific RTA are included in the regressions. These regressions((3) and (7)), among others (all excluding RTA), are presented in Table 10 in the Appendix. Generally, estimating with exporter and importer fixed effects or exporter-time and importer-time fixed effects results in significant differences in the coefficients on most region specific RTAs. We find that there is little to no impact on the distance elasticity when region specific RTAs are used instead of an overarching RTA variable. When the results in Table 4 is compared to the results in Table 10 in the Appendices, the removal of RTA or estimation with region-specific RTAs results in an increase in the distance elasticity although still below the median observed in the literature. The coefficients associated with $BDER_{njt}$, contiguity and common language are similar to those in Table 2. The coefficient associated with common language become more aligned with the literature. The elasticities associated with exchange rates *(within CARICOM)* and exchange rate *(CARICOM Exporter)* seems robust to the removal of RTA and estimation with region-specific RTAs; although CARICOM seemingly modify their magnitude.

In order to better identify the overarching effect of RTA, we estimate equation (18). These results are presented in Table 5. Without control for national border effects, the regression is estimated with RTA, CARICOM and the exchange rate variables, along with exporter-time, importer-time and bilateral pair fixed effects. We find that a RTA coefficient of 0.658, which is small that those derived from equation (17). Furthermore, CARICOM and exchange rate (within CARICOM) are not statistically significant. As was noted before, there is limited variation over time in CARICOM and exchange rate (within CARICOM); therefore, it is not surprising that they in not significant in this specification. We find, however, that if the currency of a CARICOM member depreciation, it increases CARICOM's exports to the rest of the world. This estimate is small than that identified in Table 4. This is because this regression picks up pure changes in the exchange rate over time; whereas, the estimate in Table 4 is capturing both the changes over time and the scale effects of differences in exchange rate across nations. A similar argument can be made about exchange rate within CARICOM. Changes in the exchange rate over time within CARICOM does not significantly affect trade; however, it is the scale effects of differences in exchange rate across CARICOM members relative to the US$ that matters.

If we control for border effects relative to 1986, the RTA effects is 0.313, which is half that when the border effects are not controlled for. This estimate is in line with the median estimate identified in the literature. On the other hand, with this specification the exchange rate variables are both insignificant. This is because the BDER interacted with year dummies absorbs year on year changes in the bilateral dimension (changes in exchange rate over time) and bilateral pair fixed effect absorbs all time invariant observable and unobservable effects (scale effects of exchange rate). From regression (2) of Table 5, we observe that relative to 1986 levels the border effects on international trade has been declining at decreasing rate.

Table 5: PPML Panel Gravity Estimates using Equation (18) for the period 1986-2001

	(1)	(2)
Bilateral Pair fixed effects	Yes	Yes
DV: Exports		
RTA	0.658***	0.313***
	(8.66)	(3.82)
CARICOM	0.0856	0.405
	(0.27)	(1.35)
Exchange Rate (within CARICOM)	0.0295	0.0325
	(0.26)	(0.32)
Exchange Rate (CARICOM Exporter)	0.109*	-0.0150
	(2.05)	(-0.32)
BDER(2001)		-0.0572***
		(-4.40)
BDER(1998)		-0.240***
		(-13.15)
BDER(1995)		-0.490***
		(-11.74)
BDER(1992)		-0.606***
		(-11.82)
BDER(1989)		-0.643***
		(-18.32)
N	25074	25074
R^2	0.999	1.000

Notes:
t statistics in parentheses and standard errors are clustered at the country-pair level.
***denotes significance at the 0.1 percent, **denotes 1 percent, *denotes 0.5 percent and +denotes 10 percent.
Constant, exporter-time, importer-time and pairwise fixed effects are not reported. Estimation results are based on equation (18).

Given that equation 18 is very restrictive and eliminates the effects we are trying to analyse, we follow Anderson and Yotov (2016) by estimating equation (19) and (20). Equation (19), which is estimated with all time varying variables and bilateral pair fixed effects, estimates an RTA effects of

1.014, which is larger than those estimated by equation (17) in Table 4 and equation (18) in Table 5. On the other hand, the exchange effects are similar for equations (18) and (19). It suggests that depreciation of the currency of a CARICOM member increases exports to the rest of the world; however, there is no statistical evidence that depreciation increases trade within The Region. On the other hand, the second stage regression (equation (20)- regression (3) of Table 4) returns a positive and significant effect of exchange rate on trade, suggesting that exchange rate differential within The Region has significant effect on trade within the Region. Put differently, variation in the exchange rate over time have had no effects on trade within The Region; however, differences in exchange rate across bilateral pairs have significant impact on trade within The Region. These estimations are not without fault since from regression (2) and (3) it is observed that if the exchange rate variables are excluding from equation (20), the estimated CARICOM effect is approximately half that when the exchange rate variables are included. This possibly points to the collinearity issue mentioned before; however, from Table 4, the exclusion of CARICOM has marginal effects on the coefficients estimated for the exchange rate variables.

Table 6: Two-Stage PPML Panel Gravity Estimates using Equations (19) and (20) for the period 1986-2001

	(1) First Stage Regression Exports	(2) Second Stage Regression Bilateral Pair FE	(3) Second Stage Regression Bilateral Pair FE
Bilateral Pair fixed effects	Yes	No	No
Exporter- & Importer- time fixed effects	No	Yes	Yes
RTA	1.014***		
	(12.18)		
Exchange Rate (within CARICOM)	-0.0932		0.342***
	(-0.54)		(5.14)
Exchange Rate (CARICOM Exporter)	0.104**		0.554***
	(3.11)		(8.24)
Log Distance		-0.429***	-0.411***
		(-7.26)	(-7.02)
BDER		-3.448***	-3.478***
		(-24.89)	(-25.16)
BDER(CARICOM)		-0.239	-0.274
		(-0.71)	(-0.78)
CARICOM		1.638***	2.900***
		(4.74)	(5.80)
Contiguity		0.431***	0.439***
		(3.75)	(3.83)
Common Language		0.417***	0.404***
		(3.68)	(3.60)
Colonial Link		0.245*	0.242*
		(1.98)	(1.98)
N	25812	25812	25812
R^2	0.964	0.962	0.962

Notes:

t statistics in parentheses and standard errors are clustered at the country-pair level.

***denotes significance at the 0.1 percent, **denotes 1 percent, *denotes 0.5 percent and +denotes 10 percent.

Constant, exporter-time, importer-time and pairwise fixed effects are not reported. Estimation results are based on equations (19) and (20).

Despite the challenges associated with accurately identifying the effects of CARICOM and exchange rate differential among members, we conduct counter-facual analysis using Regression (7) of Table 4 to quantify: (1) the effects removing the regional trade agreement (CARICOM) could have on the welfare of CARICOM members; or, (2) implementing a common currency with the regional trade agreement (CARICOM) in place could have on the welfare of CARICOM members. Regression (7) of Table 4 is used as the baseline model because of its parsimony and tractability when estimated. Furthermore, it excludes the overarching RTA variable and includes only the

CARICOM specific trade agreement as well as the coefficients on the variables of interest, CARICOM and exchange rate (within CARICOM), are closest to those estimated by equation (20). Equation (19) and (20) could have been used as an alternative baseline model; however, it's not as tractable and its a estimates are not far from those estimated by equation (17) (regression (7) in Table 4). The large number of bilateral pair fixed effects involved in estimating equation (18) and the computational resources needed to nest equation (18) in our general equilibrium framework makes it unattractive as the baseline model; however, with advancements in statistical packages and more efficient coding, the implementation of equation (18) as a baseline model will become more attractive.

Given the highlighted limitations and concerns about the issue of endogeniety and the fact that it has not been fully addressed[12], these result can be interpreted, maybe not in terms of magnitude but in term of the heterogeneous distribution of welfare, as the expected effects of CARICOM or a common currency on CARICOM members. It is not likely that CARICOM or a common currency on CARICOM members has or will have a uniform impact on all members; therefore, identifying those that benefit more/less remains a useful input for is policy development and implementation. Rather than informing policy using the estimated average regional effects, the properties of the PPML estimator and the structural gravity, through an iterative process, enables the identification and quantification of the welfare effects for each member of CARICOM and hence a broader approach to policy implementation.

First we consider the effects of removing the existing regional trade agreement, CARICOM, which has a baseline estimate of 2.773. This effect is set equal zero holding all other effects constant in the counter-factual analysis. These results are presented in Table 7 Without endogenously determined output and expenditure and relative to Jamaica IMR (importer-year fixed effect), the conditional real GDP of Bahamas, Barbados, Belize, Grenada and Saint Lucia would decrease relative to Jamaica. Barbados, Grenada and Saint Lucia are the largest loser with decreases in GDP of 0.57, 0.99 and 0.78 percent relative to Jamaica. The conditional welfare implications for Haiti and Suriname relative to Jamaica is negotiable; whereas, conditional welfare implications for Trinidad and Tobago is a 0.28 percent increase in real GDP relative to Jamaica. The story is slight different when we endogenise output and expenditure.

With endogenous output and expenditure, which means the effects are no longer relative to Jamaica, removing CARICOM's regional trade agreement will result in decline in all but two member states, Haiti and Suriname. Suriname is not affected as there will be no change in its Real GDP; whereas, Haiti will see an estimated 0.031 percent increase in its GDP. Grenada, St. Lucia and Belize are expected to suffer the greater reduction in real GDP, with changes of -1.87, -1.43 and -0.82 percent respectively. Barbados' real GDP rate will change by -0.561 percent and Bahamas by -0.238 percent. Trinidad and Tobago and Jamaica will be least impacted by the dismantling of CARICOM's regional trade agreement with estimated changes in real GDP of -0.26 and -0.21 percent respectively. The overall effect on The Region is 0.28 percent reduction in real GDP.

[12] Addressing the issue of endogeneity in gravity models, especially as it relates to the one highlighted above, requires substantially more research and guidelines.

Table 7: Estimated general equilibrium effects of removing CARICOM's Regional Trade Agreementt

Country	Conditional			Full Endowment		
	%Δ in IMR	%Δ in OMR	%Δ in Real GDP	%Δ in IMR	%Δ in OMR	%Δ in Real GDP
Bahamas	-2.542	-0.317	-0.244	1.494	-18.192	-0.238
Belize	-0.699	-4.146	-0.128	-5.891	2.789	-0.820
Barbados	-3.377	-0.519	-0.571	-5.082	-9.901	-0.561
Grenada	-7.495	-7.668	-0.995	-5.322	-19.908	-1.869
Haiti	0.081	-0.118	0.016	-11.704	14.428	0.031
Jamaica	0.000	-1.201	0.000	0.000	-4.917	-0.208
Saint Lucia	-4.389	-4.227	-0.783	-4.959	-2.669	-1.431
Suriname	-0.055	-3.536	0.033	289.682	-4.480	0.000
Trinidad and Tobago	1.704	-2.686	0.283	-4.722	-6.736	-0.258

Author's estimates. General Equilibrium estimates based on Regression (7) of Table 4.

These findings are striking. As was suspected by the architects of the The Region's regional trade agreement, CARICOM is critical for the smaller islands member states. We find that states such as Jamaica and Trinidad and Tobago would be least impacted by the removal of the trade agreement, which could be a result of their firms' ability to compete globally when compared to the smaller island such Grenada, Saint Lucia and Barbados. Another finding worth highlighting is the limiting impact on Suriname and Haiti. These are countries that joined the trading bloc later than the others and have been slow to implement components of the regional trade agreement. This could be the reason why there is limited impact on these countries. In case of Suriname, this analysis excludes Guyana, one of Suriname major trading partner and neighbour as such the welfare effects for Suriname may be under estimated. The same could be said for CARICOM members that have substantial trade with Guyana. Given the scale of CARICOM's trade in the global network of trade, the estimated general equilibrium effects of CARICOM on the rest of the world is minimal (See Table 11 in the Appendices).

Another important stage in the process of regional integration is the adoption of a common currency. We explore the implications of exchange rate differential on intra-regional trade by restricting the effects of the exchange rate (within CARICOM) whilst holding all other variables constant, including the effects of CARICOM and the coefficient associated with exchange rate *CARICOM exporter*. With this, we are assuming that the exchange rate applied to the rest of the world is a weight average of previous exchange rates between CARICOM members and third parties. We acknowledge that this assumption is not necessarily the approach that the regional entity might take if it decides to implement a common currency. In fact, given the number of fixed exchange rate regimes and their importance to these countries, it is likely that if a regional currency is to be implemented it will be pegged to the US$ or basket of other currencies. Further research is needed to ascertain if this will be welfare improving for The Region.

Table 8 identifies the welfare effects removing currency differences within CARICOM, without changing the current exchange rate arrangements with the rest of the world, could have on the welfare of member states. Setting the coefficient on exchange rate (within CARICOM) equal zero, ceteris paribus, we find generally that relative to Jamaica the conditional effects are negative for most CARICOM members if a common currency is implemented; whereas, the full endowments welfare effects are positive.

Relative to Jamaica, the conditional change in real GDP for all CARICOM members, except Trinidad and Tobago, is negative. Suriname has the largest conditional change in real GDP of

-2.251 percent relative to Jamaica; whereas, Saint Lucia has the smallest conditional change of -0.07 percent. Trinidad and Tobago conditional welfare increase by 0.14 percent relative to Jamaica. This suggest that if we ignore the secondary and higher welfare benefits, i.e. the effects of changes in factory gate prices, output and expenditure, adopting a common current will benefit Jamaica and Trinidad and Tobago more than other members of CARICOM. These conditional results does convey the direction of effects on real GDP as changes in real GDP are relative to Jamaica's.

Although the conditional welfare effects are mostly negative, when consideration is given to the feedback effects of factory gate prices, output and expenditure, the impact on regional trade from the removal of exchange rate differential within CARICOM is positive for The Region and all CARICOM members. Removing the scaled effects of exchange rate (since there is no estimated/identified time varying effects) within CARICOM results in a 0.5 percent increase in real GDP of The Region. Saint Lucia is expected to benefit the most with an increase in its real GDP of 1.5 percent. Belize, Barbados, Trinidad and Tobago and Grenada with see increases between 0.5-1 percent; whereas, Jamaica and Bahamas real GDP is expected to increase by 0.4 and 0.1 percent respectively. There is virtually no effect on Haiti and Suriname. Similar to the effects of CARICOM, the smaller economies in Eastern Caribbean would benefit more from the implementation of a common currency, at least as it relates to trade. Generally, adopting a common currency will improve the welfare of CARICOM members; however, further research is needed to understand fully the channels through which these benefits are derived.

Table 8: Estimated General Equilibrium effects of implementing a Common Currency among CARICOM members

Country	Conditional			Full Endowment		
	%Δ in IMR	%Δ in OMR	%Δ in Real GDP	%Δ in IMR	%Δ in OMR	%Δ in Real GDP
Bahamas	-5.487	11.950	-1.139	-3.545	-8.717	0.105
Belize	-3.823	5.935	-0.595	-8.662	15.585	0.711
Barbados	0.522	6.737	-0.366	0.038	-3.634	0.694
Grenada	-1.146	7.556	-0.227	3.641	-3.570	0.538
Haiti	-2.910	3.155	-0.457	-14.955	18.322	0.007
Jamaica	0.000	3.996	0.000	0.000	-0.347	0.353
Saint Lucia	3.558	0.982	-0.071	7.862	7.587	1.487
Suriname	-12.004	11.035	-2.251	239.893	16.382	0.005
Trinidad and Tobago	2.001	1.221	0.139	-2.663	-2.149	0.617

Author's estimates. General Equilibrium estimates based on Regression (7) of Table 4.

6 Conclusion and Trade Policy Recommendations

This paper uses a structural gravity model as a basis for a general equilibrium framework to investigate the importance of international borders, regional trade agreements(RTA) and the potential impact of deeper integration in the form of a currency union among CARICOM members. Using panel data for the period 1986-2001, with 3 year intervals, the gravity model is estimated using Poisson Pseudo Maximum Likelihood(PPML) and subsequently used to derive general equilibrium effects. By exploring the differences in exchange rate regime and the depreciation/devaluation of the currencies of the the economies of The Region, it is possible to identify their effects on trade. Usually, the depreciation in a country's exchange rate is theoretically treated as equivalent to a tax on imports and a subsidy on exports (Anderson et al., 2016). In this paper, Anderson et. al. (2016) theoretical gravity model framework is adopted to explore the pass-through effects of exchange rate on trade.

We grapple with the effects of endogeneity in gravity model caused by selection into RTA due to the proximity of trading partners; however, several methodologies are employed to mitigate this issue. Additionally, production data needed to estimate intra-national trade, which are essential for this general equilibrium framework, are limited, especially for CARICOM members. Approximation and estimation procedures were used to circumvent this limitation; however, six CARICOM members were still excluded from the analysis. Despite these limitations, for the most part, the objectives of this paper were met; however, as better data become available then these estimates should be revised.

We find positive and significant effect of CARICOM on trade among members. Furthermore, changes in the exchange rate over time within CARICOM does not significantly affect trade among members; however, it is the scale effects of differences in exchange rate across CARICOM members relative to the US$ that matters for intra-regional trade. On the other hand, changes in both the exchange rate over time and cross country differences in exchange rate matter for exports to the rest of the world. We also find that the effect of international borders on intra-regional trade is no different from the global average effects of international border on trade.

This framework does not explicitly model the free movement of labour and capital, which is paramount to economic growth and development; however, it benchmark the welfare implications of CARICOM and removal of exchange rate differences, at least as it relates to trade. We find that both these are welfare improving. A world without CARICOM would reduce the GDP of almost all CARICOM member. The overall effect on The Region is estimated at -0.28 percent. The largest loser been the small island states of the Eastern Caribbean, namely: Grenada and Saint Lucia. These islands' real GDP would decline by 1.8 and 1.4 percent respectively. The larger economies of Jamaica and Trinidad and Tobago will be least impacted with declines of 0.21 and 0.26 percent in real GDP respectively. The estimated effects for Haiti and Suriname are negligible. The said virtually zero welfare effects are estimated for Haiti and Suriname when the removal of exchange rate differences among CARICOM members is considered. The removal of exchange rate differences among CARICOM members will benefit The Region and all CARICOM members. With this, increases in real GDP above 0.5 percent is expected for all countries with fixed exchange regime, except for Bahamas. Trinidad and Tobago's real GDP is expected to increased by 0.6 percent and Jamaica's real GDP is expected to increased by 0.4 percent. Overall, adopting a common currency could increase The Region GDP by 0.5 percent.

As mentioned above, more detailed analysis is required to better understand the channels through which these welfare benefits are derived. Furthermore, research is need to determine if this common currency should be pegged to the US$ or a basket of currencies or allowed to float. It would also be useful to evaluate, using firm level data, how exchange rate pass-through or adopting a common currency could affect the bottom line of firms' in each member state. Similarly, assessing the impact of the current tariff structure on exporting and non-exporting firms could provide a much richer analysis of the usefulness of the CET. In fact, any analysis using firm level data for CARICOM would advance the literature on firms and trade in CARICOM, since such research is limited. This is primarily because of limited data availability and where it does exist it is not easily accessible. Each member state has their own statistical institute, which usually limits access to its dis-aggregated data on firms and households. Collecting and centralising dis-aggregated data on firms and households for members of CARICOM is a challenge; however, dis-aggregated data is required to better model the progress and shape the benefits of the CSME.

6.1 Trade Policy Recommendations

The growing discontent with RTAs is nested in economic phenomena, such as increasing unemployment, stagnant wages, growing inequality and a general mistrust for leaders and politicians (political economy), around the world. Recent events such as: the United Kingdom (UK) voting to leave the European Union (EU); President Donald Trump's decision to immediately withdraw from Trans-Pacific Partnership, which is one of the largest Free Trade Agreement of this decade; and, Prime Minister of Jamaica, Andrew Holness, launching a Review Commission into Jamaica's participation in CARICOM, are all signs that leaders are being given the mandate to critically scrutinise RTAs and exit those that contribute little to the masses. Using a gravity model and methodology quite similar to those used in this paper, the United Kingdom (UK) treasurer published a report suggesting that the gains for the UK from being a member of the European Union (EU) were significant and an exit could cost the economic 7.8 percent(Dhaingra et al., 2016); however, in the end there was a vote to leave.

Despite what models, like the gravity model covered in this paper, say about the welfare effects of trade, the onus is on our leaders and politicians to pursue and develop the best trade deals and implement policies that will foster greater distribution of the welfare gains from trade. These models are mere tools that help to identify and quantify the effects of various trade policies. Like the results presented in this paper, most of these estimates are at a macro-level but it seems the trickle-down economics that underpins the distribution of benefits to the masses is void in most instances.

Considering the above findings, the following general recommends to enhance trade and the equitable distribution of welfare gains from trade among CARICOM members. CARICOM has increased trade among members and has been welfare improving; however, there are still barriers to trade among members. These include: import licenses and bans, complex/discriminatory rules of origin, unreasonable/unjustified packaging, labeling, product standards, complex and heterogeneous regulatory and legislative environment, occupational safety and health laws and regulations, multiplicity and controls of foreign exchange market, inadequate infrastructure such as road, airports and ports, "buy local" policy, corruption, crime and time consuming customs procedures. CARICOM members must work to reduce these non-tariff barriers to trade and harmonise as much as possible cross country issues that could impede trade and economic development.

It is also recommended that The Region adapts a data driven approach to estimate and monitor trade costs among members as well as how significant these trade costs are when compared to the ROW. Besides aiming to reduce trade cost among CARICOM members, CARICOM should aim to reduce the trade costs associated with third parties. When negotiating with third party countries, we encourage continued negotiation as a collective unit serving the interest of all members both at micro- and macro- levels.

Although CARICOM has been trade-creating among members, the policies of CET and CSME, thus far, are ineffective and insufficient responses to globalization and increased international competitiveness. We therefore recommend that CARICOM members place greater efforts towards improving their business and economic environments. These include:

- making it easier to invest and establish businesses;
- improvement in ease of doing business;

- encouraging businesses, especially small and medium size businesses, to take advantage of the existing regional free trade agreement;
- highlighting, periodically, firms that are already using the RTA to its advantage as well as the challenges been faced;
- developing an open source database from which CARICOM firms could assess information about potential markets. The database should aim to link supplies with potential buyer both regional and international;
- developing a supply chain strategy, which recognises the importance of freight and transport infrastructure (ports, airports, road and intermodal facilities) in linking exporters with markets; and,
- completing the implementation of the CSME, which includes adopting a common currency.

The cost of travel between CARICOM members is expensive. Furthermore, we find that distance between members does have implications for how much trade could be achieved within The Region. Therefore, it is recommended that greater efforts are placed into reducing the cost of travel and shipping. One way to achieve this is to bolster regional travel and regional tourism. Critical to achieving this is changing the mind-set of persons in The Region from one of a 'nationalist' to a 'regionalist'. Changing the mind-set requires using several mediums such as social media, mainstream media houses, schools and other institutions to educate and promote a regional and inclusive approach to economic development. This approach should not be restricted to urban areas but play a key role in shaping rural communities as well as cut across several pertinent industries and sectors. Secondly, encourage healthy competition among shipping and airline carriers in The Region so as to drive down the cost of travel between member countries. Increased traffic between member states will encourage greater trade.

It is important also to build greater climate resilience into the Regional Trade Strategy. Climate change and extreme climate events have the potential to gravely limit the development of CARICOM members. We find that regional trade are more vulnerable to natural climatic disasters, and as such, we recommend building greater resilience in industries that are most vulnerable to these events. One such industry is Agriculture, which is critical to food security of The Region. There are several initiatives already on the way but more needs to be done.

7 Appendices

7.1 Annex A: Sample of Countries

Table 9: Countries included in the Panel

ISO Code	Country	ISO Code	Country	ISO Code	Country
CARICOM Members					
BHS	Bahamas	BLZ	Belize	BRB	Barbados
GRD	Grenada	HTI	Haiti	JAM	Jamaica
LCA	Saint Lucia	SUR	Suriname	TTO	Trinidad and Tobago
Rest of the World					
ALB	Albania	FIN	Finland	NLD	Netherlands
ARG	Argentina	FRA	France	NOR	Norway
AUS	Australia	GAB	Gabon	NZL	New Zealand
AUT	Austria	GBR	United Kingdom	PAK	Pakistan
BGD	Bangladesh	GHA	Ghana	PAN	Panama
BHR	Bahrain	GRC	Greece	PER	Peru
BOL	Bolivia	GTM	Guatemala	PHL	Philippines
BRA	Brazil	HND	Honduras	POL	Poland
CAF	Central African Republic	HRV	Croatia	PRT	Portugal
CAN	Canada	HUN	Hungary	RUS	Russian Federation
CHE	Switzerland	IDN	Indonesia	SAU	Saudi Arabia
CHL	Chile	IND	India	SDN	Sudan
CHN	China	IRL	Ireland	SGP	Singapore
CMR	Cameroon	IRN	Iran, Islamic Republic of	SLV	El Salvador
COL	Colombia	ISL	Iceland	SVK	Slovakia
CRI	Costa Rica	ISR	Israel	SWE	Sweden
CUB	Cuba	ITA	Italy	THA	Thailand
CYP	Cyprus	JPN	Japan	TUN	Tunisia
CZE	Czech Republic	KEN	Kenya	TUR	Turkey
DEU	Germany	KOR	Korea, Republic of	TZA	Tanzania *, United Republic of
DNK	Denmark	LBN	Lebanon	UGA	Uganda
DZA	Algeria	LKA	Sri Lanka	URY	Uruguay
ECU	Ecuador	MAR	Morocco	USA	United States of America
EGY	Egypt	MDG	Madagascar	VEN	Venezuela (Bolivarian Republic of)
ESP	Spain	MEX	Mexico	VNM	Viet Nam
EST	Estonia	MYS	Malaysia	YEM	Yemen
ETH	Ethiopia	NGA	Nigeria	ZWE	Zimbabwe

7.2 Annex B: Estimated Production Data for CARICOM

- Jamaica: Recognizing that the share of manufacturing in GDP has decline over time, the ratio of GDP to production is estimated for the period 1980 to 1992. This is period for which production data is available for Jamaica. A model with a linear trend and a constant is estimated and subsequently the ratio is project. This ratio is then combined with observed GDP figures to backout an estimated of production for the year 1996 and 2001.

- Trinidad and Tobago: Data is missing for a couple years in middle of the sample, 1988, 1996 and 1997 for Trinidad and Tobago. The only year of concern is 1996. A model with a linear trend and a constant is estimated and subsequently the ratio is project. This ratio is then combined with observed GDP figures to backout an estimated of production for the year 1996.

- Barbados: There is data available for Barbados from 1980 to 1997. Although this is a short times series, the data for Barbados rejects the assumption of a linear trend as such a AR(1) model is estimated and used to predict observation for later years. The AR(1) has the lowest mean squared error. Note that only 2001 estimated data was needed for.

- Bahamas: Unlike all the aforementioned countries, manufacturing valued added, instead of GDP, is used for Bahamas since the ratio to GDP exhibit significant volatility and a steep slope; whereas, the ratio to manufacture value add seems to be a lot more stable and the model estimated and the in sample projections better.
- Others: Because of the limited number of years of data for Belize, Grenada Haiti and St. Lucia, no regression methodology was used to estimated and project the missing data. In these cases, the average ratio of GDP to production for the years available are held constant to compute the missing data.

7.3 Annex C: Robustness Check and General Equilibrium Results

Table 10: PPML Panel Gravity Estimates without RTA for the period 1986-2001

DV: Exports	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exporter & Importer fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Exporter- & Importer- time fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Log Distance	-0.762***	-0.757***	-0.683***	-0.762***	-0.732***	-0.726***	-0.721***	-0.732***
	(-11.69)	(-11.59)	(-10.73)	(-11.69)	(-11.46)	(-11.36)	(-12.18)	(-11.46)
BDER	-2.467***	-2.469***	-2.436***	-2.467***	-2.513***	-2.515***	-2.531***	-2.513***
	(-17.52)	(-17.47)	(-18.71)	(-17.52)	(-18.10)	(-18.04)	(-18.34)	(-18.10)
BDER (CARICOM)	-0.387	-1.425*	-1.738**	-0.387	1.015+	0.715+	0.724+	1.015+
	(-0.75)	(-2.42)	(-2.86)	(-0.75)	(1.80)	(1.88)	(1.90)	(1.80)
Contiguity	0.558***	0.560***	0.549***	0.558***	0.594***	0.596***	0.652***	0.594***
	(4.93)	(4.94)	(5.29)	(4.93)	(5.36)	(5.36)	(6.05)	(5.36)
Common Language	0.351***	0.357***	0.385***	0.351***	0.332***	0.338***	0.302***	0.332***
	(3.70)	(3.76)	(4.29)	(3.70)	(3.55)	(3.63)	(3.47)	(3.55)
Colonial Link	0.0404	0.0371	0.101	0.0404	0.0259	0.0211	0.00438	0.0259
	(0.39)	(0.36)	(1.02)	(0.39)	(0.25)	(0.21)	(0.05)	(0.25)
Exchange Rate (within CARICOM)	0.145+	0.270*	0.288*	0.145+	0.231**	0.286***	0.304***	0.231**
	(1.80)	(2.17)	(2.22)	(1.80)	(3.17)	(4.07)	(4.36)	(3.17)
Exchange Rate (CARICOM Exporter)	0.414***	0.481***	0.495***	0.414***	0.477***	0.591***	0.616***	0.477***
	(10.20)	(14.19)	(14.59)	(10.20)	(5.49)	(7.70)	(7.53)	(5.49)
CARICOM		2.204***	2.469***			2.773***	2.888***	
		(5.69)	(6.18)			(5.91)	(6.07)	
NAFTA			0.306***				-0.550**	
			(7.62)				(-2.95)	
EU			0.503***				0.298*	
			(3.88)				(1.97)	
MERCOSUR			1.406***				1.848***	
			(3.60)				(8.72)	
COMESA			1.733*				3.626***	
			(2.37)				(11.33)	
SADC			-0.297				-1.088*	
			(-0.36)				(-1.99)	
ASEAN			-0.138				-1.598***	
			(-0.66)				(-4.33)	
PAFTA			0.950*				1.890***	
			(2.12)				(6.50)	
N	25812	25812	25812	25812	25812	25812	25812	25812
R^2	.962	.962	.974	.962	.997	.997	.997	.997

Notes:
t statistics in parentheses and standard errors are clustered at the country-pair level.
***denotes significance at the 0.1 percent, **denotes 1 percent, *denotes 0.5 percent and +denotes 10 percent.
Constant, exporter, importer, exporter-time and importer-time fixed effects are not reported. Estimation results are based on equation (17).

Table 11: Estimated general equilibrium effects of removing CARICOM's Regional Trade Agreement

Country	Conditional			Full Endowment		
	%Δ in IMR	%Δ in OMR	%Δ in Real GDP	%Δ in IMR	%Δ in OMR	%Δ in Real GDP
Rest of the World						
ALB	0.060	-0.059	0.010	-22.219	28.707	0.025
ARG	0.103	-0.114	0.016	-3.194	-0.155	0.010
AUS	0.231	-0.203	0.036	33.537	-26.985	0.001
AUT	0.128	-0.141	0.021	4.417	-8.010	0.003
BGD	0.007	-0.106	0.003	7.496	-11.924	0.005
BHR	0.262	-0.262	0.044	36.199	-30.263	0.000
BOL	0.111	-0.110	0.012	-0.798	4.475	0.040
BRA	0.118	-0.119	0.018	-8.029	13.131	0.015
CAF	0.201	-0.177	0.034	46.723	-34.575	0.000
CAN	0.126	-0.140	0.021	4.140	-8.039	0.008
CHE	0.242	-0.206	0.038	35.194	-26.853	0.000
CHL	0.024	-0.093	0.002	10.698	-10.040	0.008
CHN	0.114	-0.139	0.020	-8.390	-5.683	0.004
CMR	0.088	-0.099	0.015	-9.429	8.706	0.025
COL	0.040	-0.104	0.009	12.986	-12.318	0.012
CRI	0.110	-0.118	0.016	-0.746	-0.558	0.020
CUB	0.000	0.000	0.000	62.272	-39.731	0.000
CYP	0.121	-0.122	0.019	0.156	-1.958	0.007
CZE	0.076	-0.085	0.013	-18.537	26.294	0.008
DEU	0.138	-0.147	0.024	6.816	-9.226	0.002
DNK	0.129	-0.139	0.021	4.231	-7.505	0.004
DZA	0.242	-0.209	0.038	34.416	-24.301	0.001
ECU	0.103	-0.119	0.012	-0.311	-1.046	0.027
EGY	0.034	-0.099	0.008	13.837	-12.811	0.003
ESP	0.124	-0.135	0.020	3.269	-6.175	0.003
EST	0.078	-0.078	0.013	-21.188	26.520	0.018
ETH	0.076	-0.082	0.012	-20.968	25.559	0.028
FIN	0.122	-0.135	0.019	1.396	-8.191	0.005
FRA	0.128	-0.141	0.021	4.954	-8.180	0.002
GAB	0.264	-0.264	0.044	15.673	-12.494	0.007
GBR	0.125	-0.135	0.020	4.963	-7.842	0.002
GHA	0.296	-0.288	0.049	27.140	-17.269	0.008
GRC	0.057	-0.106	0.014	16.607	-13.074	0.002
GTM	0.019	-0.103	0.000	6.793	-3.836	0.012
HND	0.241	-0.217	0.038	31.401	-24.248	0.005
HRV	0.233	-0.261	0.040	39.185	-30.296	0.000
HUN	0.125	-0.138	0.022	-0.722	-4.784	0.006
IDN	0.132	-0.167	0.028	-2.887	-10.482	0.007
IND	0.119	-0.143	0.021	-1.024	-9.288	0.005
IRL	0.130	-0.134	0.020	-2.078	-6.241	0.008
IRN	0.111	-0.118	0.023	-12.740	6.473	0.008
ISL	0.241	-0.206	0.038	32.691	-25.967	0.002
ISR	0.114	-0.131	0.019	-4.999	-0.992	0.004
ITA	0.117	-0.135	0.018	2.531	-6.332	0.003
JPN	0.132	-0.145	0.024	7.927	-8.221	0.001
KEN	0.110	-0.128	0.017	-1.818	-0.730	0.014
KOR	0.117	-0.160	0.026	-2.826	-7.711	0.003
LBN	-0.388	0.391	-0.065	-29.981	51.685	0.012
LKA	0.118	-0.135	0.018	-3.797	-4.359	0.010
MAR	0.118	-0.129	0.018	-0.124	-3.745	0.012
MDG	0.051	-0.011	0.019	-15.572	32.577	0.038
MEX	0.019	-0.100	-0.001	10.528	-12.682	0.005
MYS	0.296	-0.228	0.047	2.091	-14.975	0.005
NGA	0.264	-0.264	0.044	17.548	-15.418	0.004
NLD	0.133	-0.141	0.022	5.402	-6.746	0.003
NOR	0.124	-0.138	0.020	3.479	-8.284	0.005
NZL	0.122	-0.145	0.022	2.133	-9.153	0.009

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Table 11 continued from previous page

Country	Conditional			Full Endowment		
	%Δ in IMR	%Δ in OMR	%Δ in Real GDP	%Δ in IMR	%Δ in OMR	%Δ in Real GDP
PAK	0.191	-0.147	0.027	61.478	-36.421	0.000
PAN	0.083	-0.086	0.012	1.430	1.097	0.019
PER	0.253	-0.209	0.037	32.661	-26.005	0.003
PHL	0.103	-0.132	0.015	-5.004	-6.777	0.008
POL	0.100	-0.095	0.015	-9.700	4.014	0.005
PRT	0.121	-0.134	0.019	2.746	-4.961	0.006
RUS	0.080	-0.082	0.019	-19.747	26.457	0.010
SAU	0.011	-0.011	0.002	28.883	-25.623	0.000
SDN	0.370	-0.362	0.062	-33.558	61.641	0.046
SGP	0.098	-0.167	0.019	1.224	-2.484	0.001
SLV	-0.108	0.023	-0.025	-14.415	18.595	0.020
SVK	0.077	-0.078	0.013	-20.793	26.533	0.011
SWE	0.121	-0.137	0.019	3.725	-8.658	0.004
THA	-0.206	-0.019	-0.025	-1.324	-17.873	0.004
TUN	0.216	-0.181	0.036	20.755	-19.268	0.002
TUR	0.125	-0.130	0.019	0.924	-5.180	0.005
TZA	-0.044	-0.038	-0.007	-1.503	6.352	0.021
UGA	0.011	-0.011	0.002	28.882	-25.623	0.000
URY	0.113	-0.123	0.018	0.036	-1.926	0.015
USA	0.119	-0.144	0.020	4.599	-7.522	0.003
VEN	0.060	-0.111	0.009	14.712	-11.803	0.022
VNM	0.053	0.035	0.024	-32.120	56.321	0.015
YEM	0.103	-0.103	0.024	-14.604	19.448	0.017
ZWE	0.270	-0.225	0.039	33.682	-25.377	0.004

Author's estimates. General Equilibrium estimates based on Regression (7) of Table 4.

Table 12: Estimated General Equilibrium effects of implementing a Common Currency among CARICOM members

Country	Conditional			Full Endowment		
	%Δ in IMR	%Δ in OMR	%Δ in Real GDP	%Δ in IMR	%Δ in OMR	%Δ in Real GDP
Rest of the World						
ALB	-1.902	1.556	-0.324	-23.871	31.795	0.024
ARG	-3.346	4.881	-0.664	-8.087	3.816	0.009
AUS	-6.854	7.431	-1.147	22.629	-21.768	0.000
AUT	-4.939	6.397	-0.882	-2.701	-2.755	0.003
BGD	-4.485	5.951	-0.629	0.985	-7.334	0.005
BHR	-13.094	15.066	-2.312	18.293	-17.799	0.000
BOL	-4.334	4.804	-0.616	-6.789	9.102	0.039
BRA	-4.310	4.569	-0.709	-13.186	18.191	0.013
CAF	-9.629	9.850	-1.719	31.397	-27.902	0.000
CAN	-4.857	6.500	-0.845	-2.845	-2.765	0.007
CHE	-7.167	7.608	-1.114	23.539	-21.455	0.000
CHL	-4.884	6.160	-0.750	3.459	-5.204	0.008
CHN	-3.815	5.896	-0.671	-13.252	-0.718	0.003
CMR	-2.919	2.833	-0.529	-12.665	12.203	0.024
COL	-5.260	6.466	-0.828	5.064	-7.430	0.012
CRI	-4.312	5.787	-0.722	-6.711	4.517	0.019
CUB	0.000	0.000	0.000	44.012	-33.481	0.000
CYP	-4.428	5.473	-0.726	-5.987	2.938	0.007
CZE	-1.803	1.500	-0.301	-20.674	29.264	0.007
DEU	-5.194	6.529	-0.921	-0.828	-3.919	0.001
DNK	-4.937	6.414	-0.855	-2.860	-2.257	0.004
DZA	-6.870	6.555	-1.280	23.185	-19.581	0.001
ECU	-4.366	5.588	-0.683	-6.409	3.883	0.026
EGY	-5.086	6.163	-0.852	6.028	-8.161	0.003
ESP	-4.866	6.135	-0.809	-3.654	-0.980	0.003
EST	-1.857	1.501	-0.320	-22.765	29.494	0.018
ETH	-1.845	1.473	-0.297	-22.547	28.472	0.028
FIN	-4.594	6.138	-0.766	-5.092	-3.173	0.005
FRA	-5.048	6.438	-0.877	-2.355	-2.893	0.002
GAB	-4.425	3.957	-0.814	9.563	-8.897	0.006
GBR	-5.032	6.310	-0.867	-2.283	-2.655	0.002
GHA	-4.335	4.762	-0.663	18.865	-14.181	0.008
GRC	-5.615	6.463	-0.985	7.933	-8.109	0.002
GTM	-5.106	7.225	-0.749	-0.730	1.930	0.011
HND	-6.272	6.839	-0.952	21.284	-19.308	0.002
HRV	-11.598	15.009	-2.130	21.236	-17.858	0.000
HUN	-4.667	6.316	-0.883	-7.172	0.536	0.006
IDN	-4.258	6.348	-0.743	-8.648	-5.300	0.007
IND	-4.392	6.423	-0.805	-7.081	-4.133	0.005
IRL	-4.445	6.255	-0.677	-8.161	-1.031	0.008
IRN	-3.497	5.456	-0.530	-16.989	11.772	0.008
ISL	-6.514	7.298	-1.142	22.105	-20.723	0.002
ISR	-3.978	5.475	-0.671	-10.334	3.841	0.004
ITA	-4.787	6.215	-0.790	-4.272	-1.115	0.002
JPN	-5.384	5.953	-0.888	-0.048	-3.255	0.001
KEN	-4.610	6.113	-0.801	-8.176	4.602	0.013
KOR	-4.251	5.710	-0.706	-8.538	-2.812	0.003
LBN	-1.871	1.907	-0.314	-31.254	54.965	0.012
LKA	-4.381	6.198	-0.740	-9.803	0.916	0.009
MAR	-4.492	5.755	-0.729	-6.320	1.236	0.012
MDG	-4.175	6.010	-1.064	-21.328	38.639	0.037
MEX	-4.910	6.748	-0.755	3.279	-7.528	0.005
MYS	-4.711	6.408	-0.717	-4.468	-9.771	0.005
NGA	-5.222	5.781	-0.588	10.354	-10.365	0.004
NLD	-5.089	6.326	-0.870	-1.996	-1.495	0.003
NOR	-4.842	6.551	-0.880	-3.446	-2.985	0.005
NZL	-4.632	6.261	-0.845	-4.450	-4.127	0.008

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Table 12 continued from previous page

Country	Conditional			Full Endowment		
	%Δ in IMR	%Δ in OMR	%Δ in Real GDP	%Δ in IMR	%Δ in OMR	%Δ in Real GDP
PAK	-8.635	8.006	-1.309	44.859	-31.874	0.000
PAN	-5.674	7.718	-1.046	-6.611	7.667	0.018
PER	-6.818	7.144	-1.057	21.662	-20.965	0.002
PHL	-4.277	5.978	-0.703	-10.721	-1.758	0.008
POL	-3.242	3.819	-0.497	-13.361	8.178	0.004
PRT	-4.808	6.148	-0.818	-4.099	0.312	0.006
RUS	-1.826	1.503	-0.272	-21.958	29.429	0.010
SAU	-0.674	0.677	-0.113	28.031	-25.046	0.000
SDN	-2.781	2.861	-0.469	-35.896	68.524	0.045
SGP	-4.785	4.903	-0.679	-5.707	2.077	0.001
SLV	-1.323	1.163	-0.237	-15.526	20.545	0.020
SVK	-1.842	1.502	-0.294	-22.471	29.501	0.011
SWE	-4.861	6.438	-0.873	-3.232	-3.404	0.004
THA	-3.668	5.325	-0.506	-6.807	-14.402	0.004
TUN	-4.805	4.468	-0.785	14.157	-15.394	0.001
TUR	-4.580	5.974	-0.809	-5.442	-0.085	0.005
TZA	-3.018	4.620	-0.744	-6.125	9.998	0.021
UGA	-0.681	0.687	-0.114	28.025	-25.039	0.000
URY	-4.368	5.518	-0.790	-6.065	2.897	0.014
USA	-4.933	6.644	-0.858	-2.509	-2.141	0.002
VEN	-5.531	6.928	-0.970	6.136	-6.544	0.019
VNM	-2.404	2.357	-0.424	-34.013	61.296	0.015
YEM	-3.421	3.661	-0.626	-18.396	24.018	0.016
ZWE	-7.186	7.321	-1.124	22.043	-20.199	0.001

Author's estimates. General Equilibrium estimates based on Regression (7) of Table 4.

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