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**Modeling the Economic Impact of Trade Liberalization
comprised of Tariff and Non-Tariff Measures under
CAFTA-DR in Costa Rica**

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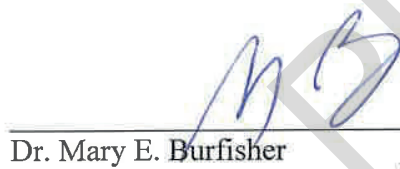
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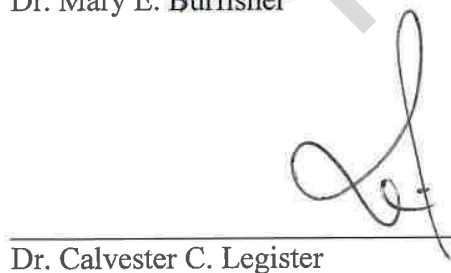
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ABSTRACT

According to theory, free trade and open markets bring about prosperity for both developed and developing member countries under free trade agreements. It has become commonplace among econometric modelers, seeking to determine the impact of trade reform, to construct general equilibrium models. However, in doing so, the existence and impact of Non-Tariff Measures (NTM) have been a consistently overlooked aspect of the domestic economic impact of systemic shocks to trade. This research addresses the impact of tariff and non-tariff measure reductions, agreed to under the Central American Free Trade Agreement (CAFTA-DR), on the household in Costa Rica since its inception. To this end, a modified Static Computable General Equilibrium (CGE) model for the economy of Costa Rica, with a base year of 2007, coupled with a point-in-time linear regression comparison for 2016, has been developed and considered. Following ECORYS 2006, Gruebler (2016) and Francois (2013), the reform measures will be trade tariff reductions simulated at the macro level with the CGE model in conjunction with a point-in-time review of the NTMs. This study concludes that with decreases in the price of traded commodities due to tariff elimination, consumer welfare increases, owing largely to increased consumer surplus and decreased producer rents and government revenues. This also bodes well for overall aggregate welfare as determined by equivalent variation analysis. With respect to non-tariff measure analysis, the results reveal significant additional welfare efficiency gains across factor and sector returns, in much the same direction as the original equivalent variation.

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Chapter I

INTRODUCTION

A. Purpose

The goal of this paper is to understand the change in economic welfare of consumers in Costa Rica given the economic impact of tariff and non-tariff measure elimination. The economy of Costa Rica will be used to ascertain the impact of trade liberalization under the Dominican Republic-Central American Free Trade Agreement (CAFTA-DR) on the national aggregate welfare as the ultimate measure of consumer well-being. Welfare is defined as the allocation of national income between private consumption, government consumption, and savings, where households gain benefits from their own current household consumption expenditure. "Welfare," as used herein, questions how well-off a region becomes as a result of a policy change. The answer depends on what the change does to its (1) national income, (2) prices, and hence the purchasing power of that income, and lastly, (3) how households evaluate the benefits of additional real expenditure. Households also benefit from current net national saving, since this increases their future household consumption. Finally, households benefit from the government's provision of public goods and services as proxy for current government expenditure. According to Hertel (1997), as national income is allocated between aggregate private consumption, aggregate government consumption, and savings, successive increases in real household or government expenditure or savings may generate equiproportional increases in economic well-being.

Ever since Jacob Viner wrote *The Customs Union Issue* in 1950, economists have believed that a free trade area, by removing trade restrictions among member states, increases specialization in production to the benefit of member countries while also having positive spillover effects on the rest of the world (Salvatore, 2007). Such outcomes are largely explained by the underlying theories of Ricardian Comparative Advantage and Heckscher Ohlin–Stoelper Samuelson style (HO–SS) Factor Abundance Theory. Viner, however, showed that these theories do not always hold true (Salvatore, 2007). Free Trade Agreement (FTA) member nations and the rest of the world would benefit only if the FTA created rather than diverted trade (Salvatore, 2007). According to Viner (1953), this phenomenon, called “trade diversion,” occurs when trade is diverted from a more efficient exporter toward a less efficient one by the formation of a free trade agreement or a customs union. Viner showed that the reduction of tariffs and nontariff barriers to trade in a regional trade agreement has both benefits and costs (Sawyer & Sprinkle, 2009). Whether or not a trade agreement between two countries, including the U.S. and Costa Rica, increases consumer welfare depends on whether trade creation is larger than trade diversion (Sawyer & Sprinkle, 2009). Furthermore, determining efficiency gains from free trade requires the preparation of a counterfactual simulation that evaluates intra-FTA trade and growth with the FTA versus without the FTA, among other things (Salvatore, 2007). To accomplish this, a general equilibrium model of trade and growth would have to be constructed; the model would have to be validated by in-sample static or dynamic simulation, and then used for counterfactual simulation (Salvatore, 2007). Ever since the early works by Adelman and Robinson (1978), the Computable General

Equilibrium (CGE) models, such as those developed by the Global Trade Analysis Project at Purdue University, have become a commonly used tool in analyzing income distribution and poverty. CGE models are a class of economic model that use actual economic data to estimate how an economy might react to changes in policy, technology, or other external factors. CGE models or Applied General Equilibrium (AGE) models are descended from the input-output models pioneered by Wassily Leontief, but prices play a more important role. Commodity prices transmit shocks through an economy, and as such are most determinative of variations in collective well-being. CGE models are useful whenever we wish to estimate the effect of changes in one part of the economy upon the rest.

This paper seeks to apply national accounts data by way of a social accounting matrix (SAM) in order to determine whether the theoretical impact of free trade on economic well-being, uncovered across a plurality of studies, still holds in the case of Costa Rica under CAFTA-DR. The goal of this paper is to understand the economic impact on national aggregate welfare due to the elimination of tariffs and non-tariff measures. The main research question with respect to Costa Rica's current economy is what economic impact did CAFTA-DR's tariff reductions have on consumers' household welfare.

B. Limitations

This model only examines the impact of import tariffs and non-tariff measures, and simulates the impact of their removal. It does not examine the removal of all trade taxes and distortions, such as subsidies, nor does it examine the export side of traded

markets and associated taxes. Additionally, for import trade volumes to Costa Rica, the model only takes into consideration the top 100 lines of Harmonized System Codes (HS), as there are as much as 1,300 lines of product codes of imports per trading partner at the four-digit level that are mostly zero values. These zero values introduce distortions into the regression. At least 1,200 lines of these codes account for only about 20% of dollar volumes of trade; this is the case for every trade partner.

Additionally, the trade volume data derived from the World Bank's World Integrated Trading Solution (WITS) data omits the year 2015. Missing this year may cause issues in distilling this data and running the regression, but for most part, the results appear to be unimpeded by the omission. There are some anomalies that may be caused in part by this missing data, but these cannot be definitively explained at this time.

C. Contribution to Practice, Value to Practitioners

The findings that emanate from such a study can be utilized as a foundational consideration and a policymaking apparatus of such future initiatives. One such example can be seen in the context of the Free Trade Agreement of the Americas (FTAA), where studying the agreement's impact on economic welfare across such categories as labor, employment, poverty, etc., can provide a useful tool—albeit by no means dispositive, however, of the entire effects of free trade on an economy. Such a tool nonetheless may provide practitioners an aid in shaping the policies under the proposed FTAA. The FTAA was a proposed agreement to eliminate or reduce the trade barriers among all countries in the Americas except Cuba. The FTAA is an

extension of NAFTA and was opposed by Cuba, Venezuela, Bolivia, Ecuador, the Dominican Republic, Nicaragua, and Honduras, all of which subsequently entered the Bolivarian Alternative for the Americas in response. This opposition was due largely to the fact that there was no consideration of net job loss under prior trade agreements. Studies such as this one can play a role in raising these issues in the public discourse, such that protections can be discussed and incorporated into future free trade negotiations, making them more advantageous for all concerned.

D. Significance of the Topic, Motivation to Pursue It

Addressing the impact of free trade on economic welfare among labor is significant for several reasons. Chief among these is the contribution to the development of public policy protections geared toward labor and the rights of minority groups within these free trade areas. My background leaves me particularly well-suited to conduct a study such as this, given my 20 years' experience working in banking and finance, as well as my extensive graduate level studies in the development of Capital Markets Regulation and the operation of law and government in general. My background, skills, and experience enable me to study the intersection where law and regulatory policy meet economics, in the interest of further promulgating macroeconomic reform policies.

Additionally, I think this is a very important issue that I am particularly passionate about as a person of color who is concerned about the vanishing landscape of manufacturing and agricultural jobs in America. I am very interested in seeing that such arrangements incorporate much needed protections that ensure continued

opportunities for American laborers, Central American farmers, and any disenfranchised workers of the global community. I think that by shedding light on this issue may bring renewed consideration to the incorporation of such provisions within these regional agreements. More particularly, the study of tariff reductions on economic well-being is important, because, as noted by Froning (2000), international trade is the framework upon which national prosperity rests. In fact, free trade policies have created a level of competition in today's open market that engenders continual innovation and leads to better products, better-paying jobs, new markets, and increased savings and investment (Froning, 2000). Additionally, it has been hypothesized that free trade enables more goods and services to reach a nation's consumers at lower prices, thereby substantially increasing their standard of living (Froning, 2000).

Chapter II

LITERATURE REVIEW

This study seeks to further the long line of research into the effects of trade liberalization policies on national aggregate welfare in Costa Rica. For purposes of this paper, “welfare” is measured by the welfare decomposition tool developed by Huff and Hertel (2001), the derivation of which culminates in what is called “equivalent variation.” According to Huff and Hertel (2001), equivalent variation seeks to determine how much more one can buy based on the shock imposed by the model. Huff and Hertel (1996) derive welfare decomposition for the equivalent variation in the Global Trade Analysis Project (GTAP) model which is very specific to the GTAP model (Hanslow, 2000). This decomposition utility breaks down the cause of the change. Wages are not considered as a measure of welfare in this analysis because they don’t say much in the way of well-being, as they don’t provide much information on prices; equivalent variation looks to consumption bundles and prices of goods in its calculation. The welfare decomposition tool subdivides the overall measure of welfare into components that have a reasonably intuitive interpretation (Hanslow, 2000). It is composed of six components: (1) the allocative efficient effect, (2) endowment effect, (3) technology effect, (4) commodity terms of trade effect, (5) investment savings terms of trade effect, and (6) preference change effect (Huff and Hertel, 2000).

The GTAP approach is generalized to derive a welfare decomposition that can be applied to most, if not all, CGE models (Hanslow, 2000). General production and

utility functions are accommodated, as are foreign income flows (Hanslow, 2000).

Among the earliest single country studies to focus on Central America was that by Catteneo, Hinojosa-Ojeda, and Robinson (1999), which used a computable general equilibrium model to assess the gains from unilateral trade liberalization in Costa Rica within a comparative static framework (Catteneo et al., 1999). In order to model the economy-wide repercussions of trade liberalization, they followed the standard neoclassical model specification with 25 sectors, seven types of households, and one aggregate enterprise account (Catteneo et al., 1999). They calibrated it using a 1991 SAM for Costa Rica that represented the initial equilibrium that is perturbed by the postulated exogenous shocks (Catteneo et al., 1999). The study produced results for two different closure rules for the external account: first, they simulated for “trade liberalization scenarios with fixed foreign savings,” and second, they simulated for “trade liberalization with flexible foreign savings” (Catteneo et al., 1999). The significance of this closure item was that the amount saved in an economy will equal the amount invested (Langdana, 2002). More specifically, in an open economy, governmental borrowing plus private investment must equal private savings plus foreign investment (Langdana, 2002). To understand why savings equals investment, the GDP equation must be rearranged to solve for investment as a function of the other variables in the economy. In its new form, investment in the economy will be equal to the total amount produced minus consumption spending and government purchases (FreeEconHelp, 2018). Investment leads to the accumulation of capital, which leads to increased labor productivity, which leads to economic growth; in this way, high amounts of savings develops into economic growth. In the general

equilibrium model, savings must equal investment for the economy to clear (Langdana, 2002). Lastly, Catteneo et al. (1999) found that the impact of trade liberalization on income distribution seems to be quite modest, although different depending on the scenario (Catteneo et al., 1999). The small impact is due largely to the fact that even though different households receive income from different labor factors, all households receive some form of capital income (Catteneo et al., 1999). This dampens the income redistribution effect of labor wage changes, and highlights the importance of capital returns and the taxation thereof. In summary, Catteneo et al. (1999) found that the microeconomic impact of trade liberalization is positive. However, it is also apparent that the macroeconomic impact of tariff removal has a very strong influence on the results of the different scenarios they tested (Catteneo et al., 1999).

Rivera and Rojas-Romagos (2007) assessed the main economic results of CAFTA-DR for Central America using a GTAP CGE application. At the time, Central America enjoyed preferential access to the U.S. market through the Caribbean Basin Initiative (CBI), which has since been consolidated and augmented under CAFTA-DR (Rivera & Rojas-Romagos, 2007). Meanwhile, the agreement required widespread opening of Central American markets to U.S. imports over time (Rivera & Rojas-Romagos, 2007). The implementation of the Agreement on Textiles and Clothing (ATC) protocol in 2005 implied increased Chinese competition for the region (Rivera & Rojas-Romagos, 2007). Thus, CAFTA-DR should have balanced for this new source of competition in the textile and apparel sectors, while creating large opportunities for labor market improvements and FDI inflows to CA (Rivera & Rojas-Romagos,

2007). If these opportunities were exploited, the region would have had much to gain from CAFTA (Rivera & Rojas-Romagos, 2007).

To predict the impact of CAFTA-DR on the Honduran economy, Morley, Nakasone, and Piñeiro (2008) used a recursive dynamic general equilibrium model in order to incorporate the general equilibrium effects of the changes introduced by CAFTA on prices, output, and employment across different sectors of the economy (Morley et al., 2008). These authors have observed that trade liberalization under CAFTA-DR is mainly limited to tariff reductions in various agricultural commodities (Morley et al., 2008). Those changes will obviously affect prices, output, and employment in agriculture (Morley et al., 2008). They will also have indirect effects on urban consumers, government revenue, prices, the balance of payments, and the exchange rate, which in aggregate may be larger than the direct effect of the tariff reductions in agriculture and second-round effects combined (Morley et al., 2008).

Morley and Piñeiro (2011) developed a dynamic regional computable general equilibrium model for Guatemala that incorporates regional disaggregated sectors for agriculture. The model was designed to be useful as a development tool for determining the effects of regional investments, and was intended to explore reducing regional poverty as well as policy options to deal with a number of macro and balance-of-payments issues (Morley & Piñeiro, 2011). What is unique about this study is that Morley and Piñeiro depart from the standard model and develop a recursive dynamic model that incorporates unemployment in the short run (Morley & Piñeiro, 2011). Morley and Piñeiro (2011) specify a fixed minimum wage and an informal sector and use a recursive dynamic framework to solve for the short-run

adjustment process that occurs as the economy responds to shocks (Morley & Piñeiro, 2011). Additionally, the model is regional, permitting them to examine the impact of sectoral development policies, particularly those focused on agriculture (Morley and Piñeiro, 2011).

Their model was based on a Guatemalan SAM for 2008, which extended previous work in three directions: regionalizing the SAM, using information from a recent agricultural census; putting land into the matrix, which permits us to tie production in agriculture to each of the four regions in the SAM; and regionalizing household income, in order to show the regional impact of each of the simulated external shocks or increases in productivity (Morley and Piñeiro, 2011). The SAM was disaggregated into the 61 sectors and four regions. Additionally, the regional CGE model used in this part of the research was based on the standard neoclassical-structuralist model, originally presented by Dervis et al. (1982), with some modifications to capture the multimarket aspect of the agricultural sector (Morley & Piñeiro, 2011). The advantage of the regionalized model is that it links decisions made at the national level with outcomes on poverty, employment, and production across regions (Morley & Piñeiro, 2011). This structure allowed the authors to examine policies intended to improve the regional distribution of activities and income in a consistent, general equilibrium fashion, which incorporates national macro fiscal and monetary constraints (Morley & Piñeiro, 2011). This advance is made possible by the availability of regional information from the recent agricultural census (Morley & Piñeiro, 2011).

There are three factors of production: labor (differentiated by skill and region), land (differentiated by region), and capital (Morley & Piñeiro, 2011). Production is related to factor inputs in a constant elasticity of substitution (CES) production function, which allows producers to substitute these three inputs until they reach the point where the marginal revenue of each factor equals the factor price (wage or rent) (Morley & Piñeiro, 2011). The second choice producers make is the amount of intermediate inputs they will use. This specification is made assuming fixed shares that specify the appropriate amount of intermediate inputs per unit of output and of labor or capital (value-added) (Morley & Piñeiro, 2011). Finally, output prices depend on the value-added (cost of labor, land, and capital), the intermediate inputs, and any relevant taxes and subsidies (Morley & Piñeiro, 2011).

In 2013, Morley and Piñeiro (2013) replicated a similar CGE for Honduras, where they developed a dynamic regional computable general equilibrium (CGE) model that incorporates regional disaggregated sectors for agriculture. In this case, their research sought to address two pressing policy concerns in Honduras: (1) to determine what growth strategy the country should follow, given its severe balance-of-payments constraint and dependence on remittances and the price of oil, and (2) to determine the impact on growth of investments in projects to increase agricultural productivity, given the importance of agriculture to the rural poor and to the Honduran economy.

Supplementing the CGE results is a linear regression gravity model drawn from Gruebler, Ghodsi, and Stehrer (2016) which demonstrates the impact of a relatively new research field. This model compares trade effects of non-tariff

measures (NTMs) with the impact of tariffs by computing ad valorem equivalents of non-tariff measures. The origin of the gravity model of trade lies in the work of van den Bosse et al. (2013), who introduced the gravity model to explain international bilateral trade. The gravity equation predicts that the gravitational force between two countries is proportional to the product of the masses of the two countries and inversely proportional to the distance between them (Burger et al., 2009; van den Bosse et al., 2013). Gruebler et al. (2016) examined the relevance of non-tariff measures (NTMs) at the six-digit level of the Harmonized System over the period 2002–2011 by estimating ad valorem equivalents. Their study draws on information from NTMs reported to the WTO from the Integrated Trade Intelligence Portal (I-TIP), distinguishing various NTM types, such as technical barriers to trade and sanitary and phytosanitary measures. To assess whether NTMs facilitate or impede trade across countries, we apply a gravity approach, which allows calculating implied ad valorem equivalents of NTMs for about 100 WTO member countries (Gruebler et al., 2016). Evidence of these AVEs is differentiated by NTM types, income groups, industries, and product categories (Gruebler et al., 2016).

van den Bosse et al. (2013) studied the effect of tariffs and non-tariff measures on imports by using bilateral trade data. Theory describes that using OLS for the estimation of the gravity equation has three major shortcomings: the bias created by the logarithmic transformation of the dependent variable, the violation of the homoskedasticity assumption, and the zero trade values that are removed from the analysis or are manipulated by adding a small number (van den Bosse, et al., 2013). In the analysis, the authors compare OLS, Poisson Model, Negative Binomial Poisson

Model, and Zero Inflated Negative Binomial Poisson Model and apply them to the gravity equation. As control variables, common border and common language are used (van den Bosse, et al., 2013). The main conclusion was that tariffs have a robust significant negative impact on imports over all econometric specifications, and increasing tariffs raises the probability of a zero trade flow (van den Bosse et al., 2013). This regression includes various explanatory variables coupled with those specific to the classic gravity model. There is evidence that NTMs have a positive impact on imports and the probability of trade. The effect of NTMs on imports is an overall effect (van den Bosse et al., 2013). Individual effects of several types of NTMs are unknown and can still be negative (van den Bosse et al., 2013).

Francois (2013) builds on an important previous study benchmarking the current level of transatlantic NTBs. That report found that the potential gains for the EU and US were substantial (Francois, 2013). Francois (2013) reviewed the importance of the bilateral economic relationship and provides computable general equilibrium (CGE)-based estimates for the economy-wide impact of reducing both tariff and non-tariff barriers (NTBs) (Francois, 2013). Estimates are provided with regard to expected changes in GDP, sector output, aggregate and bilateral trade flows, wages, and labor displacement, among other issues. The analysis uses the GTAP8 database (projected to 2027), in conjunction with NTB estimates reported in the ECORYS (2009) study (Francois, 2013). The study investigates different policy options for the deepening of the bilateral trade and investment relationship between the EU and the United States (Francois, 2013). These range from partial agreements that are limited in the scope of barriers they would address (tariffs only, or services