Trade Liberalization's Impact on Agriculture in Low Income Countries: A Comparison of El Salvador and Costa Rica

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TRADE LIBERALIZATION'S IMPACT ON AGRICULTURE IN LOW INCOME COUNTRIES: A COMPARISON OF EL SALVADOR AND COSTA RICA

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ABSTRACT

Due to both deepening economic crises and pressure from external lenders, Costa Rica and El Salvador implemented trade and market liberalization reforms in the 1980s. This study explores whether these policy changes shifted production toward each country's presumed comparative advantage in agriculture. For Costa Rica, trade and market liberalization strengthened the country's ability to generate agricultural trade surpluses while liberalization caused a decline in El Salvador's agricultural sector. Liberalization also affected how prices and exchange rates influence agriculture in both countries. The findings demonstrate that agriculture's response to liberalization can vary widely among countries. Overall market conditions in the rural sector, including El Salvador's post-conflict challenges, during liberalization's introduction partly explain the different responses. Other potential factors include the pace that governments implement policy reforms and that liberalization will only stimulate agriculture if the country has a clear comparative advantage in that sector.

JEL Classification: O1, Q1
Keywords: Liberalization, Agriculture, Central America
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INTRODUCTION

The debate over trade policy and development remains controversial. One key issue concerns trade liberalization's overall impact on development, with agriculture receiving considerable attention because wealthy countries protect their domestic agricultural markets and many low-income countries (LICs) depend heavily on agriculture (Hoekman et al., 2004; Anderson, 2004). In addition, many LICs have historically protected their economies using import substitution schemes. During the 1980s policymakers in these same LICs began to implement widespread economic reforms, generally described as trade and market liberalization. Yet the precise effects of liberalization reforms on LICs' agricultural sectors remain relatively unexplored, which is surprising given liberalization's widespread reach and agriculture's dominance in LIC economies.

This paper examines the impact of unilateral trade and market liberalization on agriculture in Costa Rica and El Salvador. While these two countries share similar

cultures, language, and geography, their general economic and political experiences are markedly different since the 1970s. The paper will explore whether these factors influence liberalization's impact on agriculture. Section I explores the literature and important background issues. Section II describes the estimation model and methods and Section III provides estimation results. The fourth section discusses relevant policy implications, followed by an overall summary.

BACKGROUND AND LITERATURE REVIEW

Numerous sources describe how most LICs employed trade and market restrictions in the 1960s and 70s (e.g., Schiff and Valdés, 1992; Krueger et al., 1991). Such "import substitution" policies generally supported manufacturing and industrial sectors while providing disincentives to agriculture. Due to poor macroeconomic performance and pressure from foreign lenders, many LIC governments began abandoning import substitution policies in the mid-1980s. As a result, domestic markets became less distortionary and prices more closely reflected scarcity values. In many cases governments also closed marketing boards for agricultural inputs and commodities, hoping that the private sector would fill these roles. In this paper, such policy reforms are all described as trade liberalization, even though they extend beyond restrictions on international trade.

Because of relatively high population densities and the fact that agricultural goods are labor intensive, many LICs presumably have comparative advantages in agriculture. Since the basic premise behind import substitution was to shift resources away from agriculture into manufacturing through price incentives, liberalization reforms were expected to revive agricultural development and stimulate macroeconomic growth through efficient resource allocation. One potential hindrance includes historical neglect of rural infrastructure and marketing channels. In addition, both labor and capital resources might be immobile if their markets are either imperfect or omitted from liberalization reforms. As a result, many years might easily pass before liberalization results in significant agricultural growth and development. Of course, if a country's comparative advantage is not in agriculture, liberalization is expected to shift production and exports into other sectors.

The evidence regarding trade liberalization's effect on agriculture in specific countries shows mixed results. Some studies show that liberalization positively affects agriculture. Amin et al. (2002) find that market reforms in Cameroon improved agricultural sector profitability and subsequently boosted agricultural production. Much of the improvement in agricultural incentives stemmed from currency devaluation, which caused farmers to plant fewer subsidized crops and more traditional export crops where Cameroon enjoys a comparative advantage. Storm (2003) used a general equilibrium model to simulate agricultural trade liberalization in India and finds that agricultural price increases stimulate agricultural investment and increase agricultural yields and rural incomes. As in Cameroon, much of the improvement in agricultural price incentives in India results from domestic currency devaluation. Blake et al. (2002) examine liberalization reforms in Uganda and find improved price incentives for agriculture and welfare gains for rural households.

Other studies find little or no evidence that liberalization positively affects agriculture. Quiroz and Opazo (2000) explain that even though many liberalizing countries in Latin America experienced strong agricultural output growth, agricultural import-competing sectors faced significantly more pressure than expected, primarily because real currency values did not always depreciate as expected. Jaramillo (1998) shows how Colombia's trade liberalization program caused rapid import growth with no corresponding boost in agricultural exports. Deiniger and Olinto (2000) conclude that Zambia's liberalization program in the early 1990s produced agricultural stagnation, mainly due to structural rigidities in the rural economy that prevented farmers from responding to improved incentives and market decentralization. Similarly, Wiggins et al. (2002) describe how the private sector did not provide credit and other agricultural inputs in rural Mexico following liberalization. Weeks (1999) finds that trade liberalization policies caused declining agricultural trade balances throughout Central America. Hossain and Alauddin (2005) conclude that Bangladesh's liberalization program in the 1980s caused strong production and export growth of manufactured goods and reduced growth of agricultural production. Karunaratne (1998) finds similar results for Thailand.

Liberalization reforms in El Salvador and Costa Rica began in the 1980s and covered many sectors. By the late 1970s external and internal economic conditions had drastically deteriorated throughout Central America (Bulmer-Thomas, 1988), with import substitution policies encouraging substantial rent-seeking behavior while providing limited social benefits (Agosin and Ffrench-Davis, 1993). These conditions, coupled with pressure from external lenders, provided the impetus for market liberalization in the 1980s.

The specific liberalization policies in Costa Rica and El Salvador resembled each other in content but policymakers implemented them differently in each country. The Costa Rican government gradually implemented liberalization reforms over a ten year period (Weeks; Evans, 2001; Taylor and Thorpe, 2001; Moreno-Brid and Pérez, 2003). Starting in 1982 with relaxed foreign exchange controls and culminating in a free floating currency, the external financial sector experienced significant liberalization. In addition, average import tariffs declined during this period from over 100 percent to 25 percent and quantity restrictions on trade were converted to tariffs. GATT membership followed in 1990. Liberalization of the banking and financial sectors began in 1984 and included the central bank's new focus on price stability, privatization of state-owned banks, elimination of interest rate controls, and close supervision of financial institutions. By contrast, El Salvador's reforms began in 1989 and were fully complete after just several years. El Salvador became a GATT member in 1991. However, El Salvador's financial reforms did not extend to the foreign exchange market, as the colón was pegged to the dollar in 1994 and the use of US dollars was officially approved in 2001 (IMF, 2006). The two countries also differ in their income per capita, economic growth, and political situation: Costa Rica's gross domestic product per capita exceeded El Salvador's by 50 percent in 1980 and grew to twice that of El Salvador by 2000 (World Bank, 2007). El Salvador also experienced intense civil conflict in the 1980s while Costa Rica was peaceful and democratic during this period.

METHODS AND DATA DESCRIPTION

This study employs Weeks' model of the agricultural sector and trade liberalization. The basic model yields the following estimable equation:[1]

$$AGTRADE_t = a_0 + a_1 \ln(RER_t) + a_2 \ln(RPAM_t) + a_3 \ln(SHGDP_t) + a_4 AGTRADE_{t-1} + a_5 POL_t + a_6 CONF_t + \varepsilon_t \quad (1)$$

where:

$AGTRADE_t$	= net agricultural exports, relative to total agricultural output in year t
RER_t	= the real exchange rate, measured in local currency units per US$, in year t
$RPAM_t$	= the ratio of agricultural to nonagricultural prices in year t
$SHGDP_t$	= the share of agricultural output in total output in year t
POL_t	= binary variable equal to 1 if the country's trade policies are liberalized in year t
$CONF_t$	= binary variable equal to 1 if the country is experiencing conflict in year t
ε_t	= stochastic error term in year t

Table 1 provides descriptions and summary statistics for all variables in equation (1). Choosing years where POL equals one is somewhat arbitrary since liberalization is more correctly described as a continuum ranging from "more restrictive" to "more liberal". However, both Weeks and Edwards (1993) argue that using an index for trade liberalization introduces an artificial ordinality and that a binary variable is satisfactory for estimation purposes. That same logic is embraced here.

Equation (1) employs AGTRADE as the dependent variable, assuming that the agricultural trade balance as a share of total agricultural output measures a country's ability to generate agricultural surpluses for export. As agricultural productivity and output grow, *ceteris paribus*, agricultural surpluses lead to positive change in the agricultural trade balance and AGTRADE.[2] Conversely, during agricultural stagnation agricultural exports decline, agricultural imports increase, and AGTRADE falls. If AGTRADE remains constant, any changes in total agricultural production are presumably offset by changes in population and/or consumption patterns.

The AGTRADE variable also reflects a country's production and trade specialization under liberalized markets. Following Weeks, agricultural goods in LICs are assumed both tradable and labor intensive. Given that most LICs are relatively labor abundant, LICs enjoy a comparative advantage in agricultural goods so that trade liberalization policies increase net agricultural exports.[3] Hence, the coefficient on POL should show a positive sign in countries with comparative advantages in agriculture. Conversely, countries with comparative advantages in other sectors would experience a decline in AGTRADE following liberalization. Exceptions occur when countries with

TABLE 1. VARIABLES USED TO ESTIMATE EQUATION (1)
ANNUAL DATA 1966-2005

Variable Name	Description	Mean (standard deviation) Costa Rica	El Salvador
AGTRADE	Net agricultural trade balance, exports – imports (US$), divided by agricultural output (US$). Source: World Bank (2007) and FAO (2007)	0.820 (0.147)	0.181 (0.237)
ln(RER)	Natural log of the real exchange rate, defined as the official exchange rate (local currency per US$), divided by the GDP deflator. Converted to index, 1991=1 (pre-log). Source: World Bank (2007)	0.280 (0.566)	-0.297 (0.345)
ln(RPAM)	Natural log of the ratio of agricultural price index to industry price index, 1991=1 (pre-log). Each sector's price index derived from the ratio of nominal output to real output, measured in local currency units. Source: World Bank (2007)	0.185 (0.294)	0.379 (0.554)
ln(SHGDP)	Natural log of the share of agricultural output to total output. Source: World Bank (2007)	-1.951 (0.379)	-1.516 (0.567)
POL	Binary variable = 1 if the country has implemented liberalization reforms. Source: Weeks (1999)*	before 1982 = 0, otherwise =1	before 1989 = 0, otherwise =1
CONF	Binary variable = 1 if the country is experiencing civil conflict. Source: Weeks (1999)	not applicable	1981 to 1989 =1, otherwise = 0

Notes: * Assuming that the country did not revert to a more restrictive trade policy since Weeks' publication in 1999. Recent reports from El Salvador (IMF, 2006) and Costa Rica (IMF, 2004) suggests that this assumption is appropriate.

comparative advantages in agriculture face stiff trade restrictions abroad for their exports, so that liberalization increases agricultural imports with no gain in agricultural exports.

When the domestic currency depreciates in real terms (RER rises) agricultural exports become more competitive abroad and agricultural imports more costly, suggesting that the coefficient on RER is positive.[4] To the extent that resources are mobile and domestic output price responsive, an increase in agricultural prices (RPAM) should increase both agricultural output and net agricultural exports. As overall dependence on agriculture (SHGDP) rises, net agricultural exports as a share of total agricultural output should also rise. Assuming that domestic conflict increases risk to farmers and disrupts input and commodity markets, the expected sign on CONF is negative. The partial adjustment model described in the appendix shows that the coefficient on $AGTRADE_{t-1}$ measures the speed of equilibrium adjustment, where $0 < (1- a_4 = \gamma) <1$, with γ being the adjustment coefficient. As γ approaches unity the trade balance adjusts to equilibrium more quickly.

To improve on Weeks' original estimation model, liberalization can potentially affect price and exchange rate elasticities over time:

$$
\begin{aligned}
AGTRADE_t &= a_0 + a_{11}\ln(RER_t) + a_{12}POL_t\ln(RER_t) + a_{13}(TIME_t)POL_t\ln(RER_t) \\
&+ a_{14}(TIME_t^{\,2})POL_t\ln(RER_t) + a_{21}\ln(RPAM_t) + a_{22}POL_t\ln(RPAM_t) \\
&+ a_{23}(TIME_t)POL_t\ln(RPAM_t) + a_{24}(TIME_t^{\,2})POL_t\ln(RPAM_t) \\
&+ a_3\ln(SHGDP_t) + a_4 AGTRADE_{t-1} + a_5 CONF + a_6 POL_t + \varepsilon_t
\end{aligned} \tag{2}
$$

where TIME is an annual linear index starting at 0 the first year trade liberalization begins.

Because equation (1) contains time series variables special estimation procedures are required to prevent spurious results (Mukherjee et al., 1998; Davidson and MacKinnon, 1993). The standard procedure is to first test all variables for stationarity using procedures from Dickey and Fuller (1979) or Phillips and Perron (1988). If the variables are nonstationary they must be transformed by either first differencing or trend removal.

ESTIMATION RESULTS

Statistical tests revealed that the variables in equation (1) are nonstationary. Following the sequential tests described in Holden and Perman (1994) and Davidson and MacKinnon, all variables are difference stationary processes (DSP) with the exception of ln(RER) for Costa Rica which is a trend stationarity processes (TSP).[5] Mukherjee et al. recommend first differencing all variables when a regression equation includes both TSP and DSP variables. Tests confirmed the first difference variables to be stationary. It is standard practice to add an error correction mechanism (ECM) to first difference equations so that the estimation results do not omit potential long relationships between variables (Mukherjee et al., Holden and Perman). One simple ECM procedure first examines whether a long run relationship exists between the variables by estimating the regression in levels (i.e., non-difference) form and checking whether the residuals are stationary, which would imply a long-run cointegrating relationship between all variables. If so, these estimated residuals lagged one period provide a suitable ECM added to the difference estimation equation. Stationary tests using critical values from MacKinnon (1991) confirmed that residuals from equation (1) are stationary for both countries.[6]

Table 2 shows first difference estimates of equation (2) for both Costa Rica and El Salvador, including complete unrestricted estimates and restricted estimates obtained after removing variables with low t statistics. With the exception of the real exchange rate in El Salvador, both RPAM and RER show a highly significant and positive impact on AGTRADE as expected. In El Salvador, RER's impact on AGTRADE is not significantly different from zero. Also note how trade liberalization influences price and exchange rate elasticities. From equation (2):

$$
\frac{\partial AGTRADE_t}{\partial \ln(RER_t)} = a_{11} + a_{12}POL_t + a_{13}(TIME_t)POL_t + a_{14}(TIME_t^{\,2})POL_t \tag{3}
$$

$$
\frac{\partial AGTRADE_t}{\partial \ln(RPAM_t)} = a_{21} + a_{22}POL_t + a_{23}(TIME_t)POL_t + a_{24}(TIME_t^{\,2})POL_t \tag{4}
$$

which allow the exchange rate and price effects on agricultural trade to vary following the introduction of liberalization. This estimation structure is plausible since liberalization generally implies that the economy relies more on price signals to distribute resources between agriculture and other sectors. Table 2's results confirm that some of these changes occurred in both countries. Specifically, liberalization in Costa Rica initially exerts a negative influence on the agricultural price effect, but over time the positive impact of agricultural prices on AGTRADE becomes more pronounced as expected. The impact of the exchange rate on AGTRADE steadily increases following liberalization, though at a decreasing rate. In El Salvador, the impact of the exchange rate evolves from statistically insignificant prior to liberalization to a growing positive influence on AGTRADE after liberalization.

Using equations (3) and (4) and the restricted estimates in Table 2, Figure 1 shows the effects of price and exchange rate changes on agricultural trade. If implemented prior to liberalization, a real currency devaluation has a much larger impact in Costa Rica than El Salvador. But if the devaluation occurs 10 years after liberalization the effects are quite similar. Specifically, a 10 percent currency devaluation yields roughly a 50 percentage point increase in the agricultural trade balance (e.g., from 0.10 to 0.60). Regarding agricultural prices, the positive effect on agricultural trade is constant over time in El Salvador, with a 10 percent increase in agricultural prices yielding a 20 percentage point gain in the agricultural trade balance. The same price increase in Costa Rica prior to liberalization yields a 90 percentage point gain in the agricultural trade balance. If prices increase 10 percent immediately after liberalization, Costa Rica's agricultural trade balance surprisingly falls by 30 percentage points. However, should the price increase occur more than 12 years after liberalization the effect is positive and similar in magnitude to El Salvador. The key finding from Figure 1 is that the overall price and exchange rate effects on agricultural trade are quite similar in each country if they are implemented 10 to 12 years after liberalization.

Regarding the non-policy related variables, the size of the agricultural sector (SHGDP) does not affect the agricultural trade balance in either country. This finding differs from Weeks who finds a significant positive impact for Central America as a whole. It is not clear whether Weeks' result stems from using a different estimation model than equation (2) or from combining data across countries. As expected and similar to Weeks, civil conflict reduces the agricultural trade balance in El Salvador (a 10 percentage point decline in Table 2). The estimated coefficient for the lagged agricultural trade balance falls within the expected range of 0 to 1 in both countries, but is statistically significant only in Costa Rica.

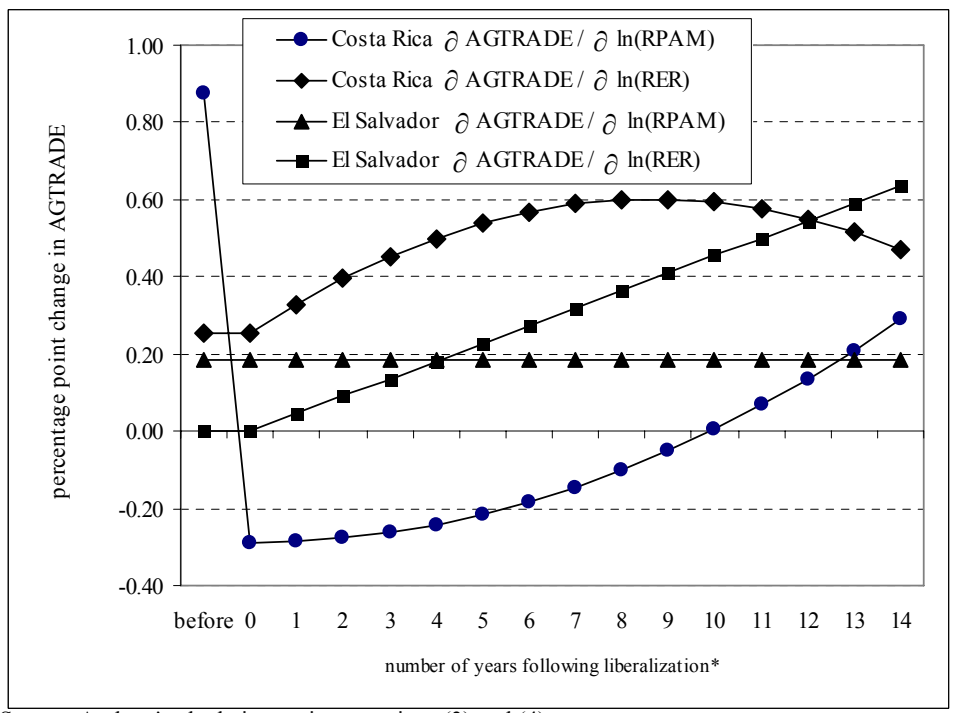
The direct effects of liberalization on agricultural trade differ dramatically between the two countries. Trade liberalization in Costa Rica initially produces a large increase in the agricultural trade balance of roughly 70 percentage points, while liberalization in El Salvador initially causes a decline of nearly 20 percentage points. Equation (2) suggests that interactions with exchange rates and prices potentially alter these effects over time:

TABLE 2. ESTIMATES OF EQUATION (2), IN FIRST DIFFERENCE FORM, FOR COSTA RICA AND EL SALVADOR (T STATISTICS). SAMPLE SIZE = 39 (1967-2005). DEPENDENT VARIABLE = AGTRADE

	Costa Rica		**El Salvador**	
Variable	**Unrestricted**	**Restricted**	**Unrestricted**	**Restricted**
RER	0.177	0.254	-0.013	
	(1.33)	(2.42)**	(-0.17)	
[POL][ln(RER)]	-0.479		-0.183	
	(-0.89)		(-0.58)	
[TIME][POL][ln(RER)]	0.154	0.080	0.137	0.045
	(1.64)	(1.38)+	(1.58)	(1.94)*
[$TIME^2$][POL][ln(RER)]	-0.008	-0.005	-0.006	
	(-1.96)*	(-1.62)+	(-1.24)	
ln(RPAM)	0.680	0.875	0.293	0.183
	(2.18)**	(4.09)**	(1.52)	(3.09)**
[POL][ln(RPAM)]	-0.854	-1.165	0.282	
	(-2.23)**	(-5.17)**	(0.65)	
[TIME][POL][ln(RPAM)]	-0.138		-0.088	
	(-1.20)		(-0.64)	
[$TIME^2$][POL][ln(RPAM)]	0.010	0.003	0.009	
	(1.62)	(3.23)**	(0.98)	
SHGDP	0.255		-0.359	
	(0.79)		(-0.91)	
$AGTRADE_{t-1}$	0.412	0.569	0.074	
	(2.01)*	(3.37)**	(0.34)	
POL	0.789	0.693	-0.308	-0.187
	(3.46)**	(4.00)**	(-2.63)**	(-3.61)**
CONF			-0.152	-0.098
			(-2.87)**	(-2.74)**
Error Correction Mechanism	-0.805	-0.909	-1.049	-0.846
(ECM)	(-3.35)**	(-4.06)**	(-3.20)**	(-5.06)**
INTERCEPT	0.005	0.007	0.006	0.006
	(0.32)	(0.51)	(0.46)	(0.59)
R^2	0.71	0.69	0.72	0.65
Adjusted R^2	0.58	0.59	0.57	0.59

Notes: ** Coefficient significantly different from zero at the 95 percent confidence level.
* Coefficient significantly different from zero at the 90 percent confidence level.
+ Coefficient not significantly different from zero, but included in subsequent calculations given the reasonably high t values (p=0.12 and 0.18, respectively).

FIGURE 1. IMPACT OF A CHANGE IN AGRICULTURAL PRICES OR REAL EXCHANGE RATE ON THE AGRICULTURAL TRADE BALANCE IN EL SALVADOR AND COSTA RICA, BEFORE AND AFTER TRADE LIBERALIZATION

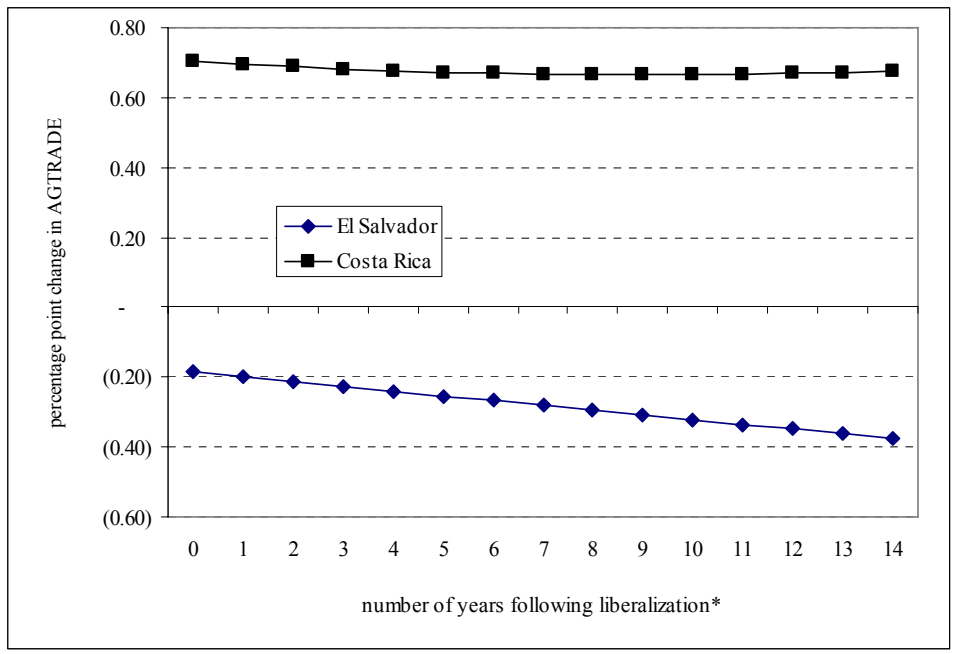


Source: Authors' calculations using equations (3) and (4).
Notes: * Zero denotes the first year that liberalization begins.

$$\frac{\partial AGTRADE_t}{\partial POL_t} = a_{12}\ln(RER_t) + a_{13}(TIME_t)\ln(RER_t) + a_{14}(TIME_t^2)\ln(RER_t) \quad (5)$$
$$+ a_{22}\ln(RPAM_t) + a_{23}(TIME_t)\ln(RPAM_t) + a_{24}(TIME_t^2)\ln(RPAM_t) + a_6$$

In reality, Figure 2 shows that liberalization's impact on agriculture changes little in either country, with almost no change in Costa Rica and a doubling of the initial negative effect in El Salvador only after 13 years.

FIGURE 2. CHANGES IN THE AGRICULTURAL TRADE BALANCE FOLLOWING LIBERALIZATION IN EL SALVADOR AND COSTA RICA



Source: Authors' calculations using equation (5), evaluated at the post-liberalization mean values for ln(RER) and ln(RPAM).
Notes: * Zero denotes the first year liberalization begins.

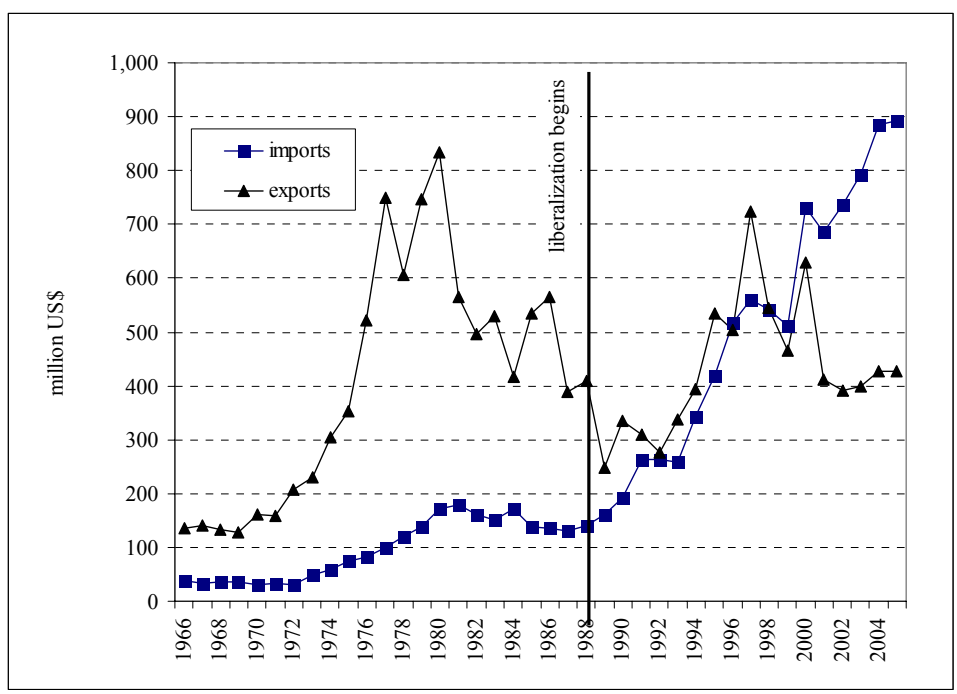
Table 2 and Figures 1 and 2 show two key differences from Weeks' findings for Central America as a whole. First, trade liberalization's influence on agricultural trade is potentially complex since it can also affect price and exchange rate elasticities. Thus, liberalization's impact on agriculture should not be estimated using a single binary variable. Second, it is incorrect to jointly estimate the impact of liberalization on agriculture for multiple countries. This practice artificially imposes identical price and exchange rate elasticities and identical liberalization effects in different countries. The results in Table 2 and Figures 1 and 2 thus represent a substantial improvement over Weeks' study and provide a very different conclusion regarding liberalization's impact on agriculture in Central America.

DISCUSSION AND IMPLICATIONS

Several explanations emerge for the effects of trade liberalization on agriculture shown in Figure 2. Weeks contends that the negative impact of liberalization on agriculture in Central America stems from real currency appreciation and declining agricultural prices. While these phenomena did occur during the past 20 years for both Costa Rica and El Salvador, Weeks' interpretation is incorrect since trade liberalization is a separate factor

from prices and the exchange rate in equations (1) and (2). That is, a change in either real currency values or agricultural prices affect agriculture through coefficients a_{1i} and a_{2i}, which should not be confused with liberalization's impact on agriculture as measured via coefficient a_6. A better explanation for liberalization's negative impact on agriculture, as confirmed here for El Salvador, is that microeconomic conditions prevent farmers from responding to new market opportunities. If structural failures pervade agricultural input or output markets, trade liberalization would cause an immediate increase in agricultural imports with insufficient growth in agricultural output and exports to prevent a decline in the agricultural trade balance. This scenario appears to accurately describe El Salvador immediately following trade liberalization in 1989 (Figure 3). El Salvador's input and commodity markets were likely dysfunctional at this time since the nine-year civil conflict had just ended. Recall that another factor affecting the predicted sign of the POL coefficient is whether the country has a comparative advantage in agriculture. Hence, the estimation results suggest that El Salvador does not have a comparative advantage in its overall agriculture sector, as first presumed. Whether this finding stems from post-conflict problems in agricultural markets or the country's specific resource endowments is unclear.

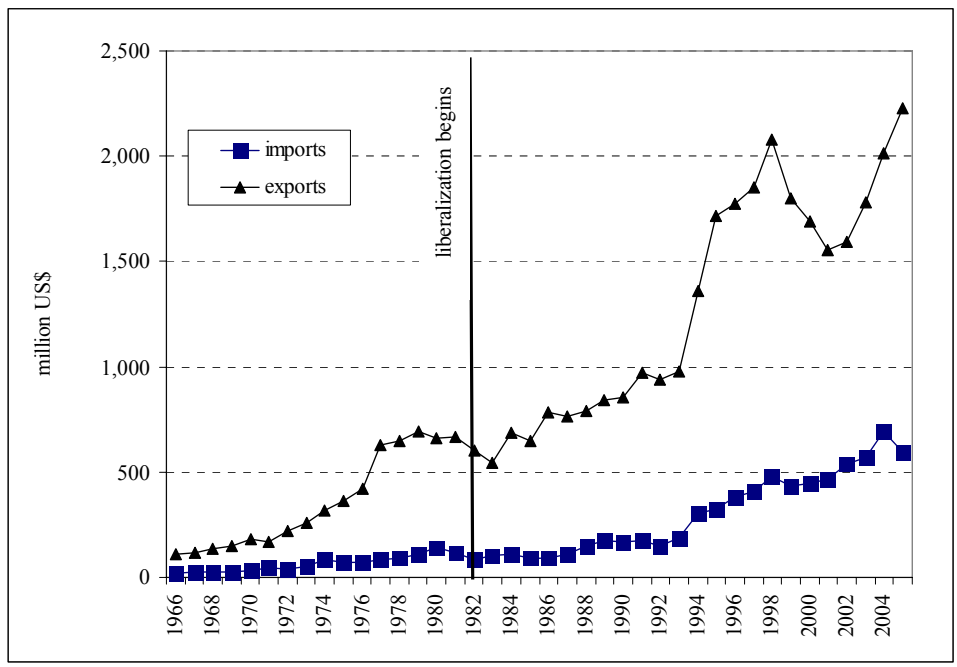
FIGURE 3. TOTAL AGRICULTURAL EXPORTS AND AGRICULTURAL IMPORTS FOR EL SALVADOR, 1966-2005



Source: FAO (2007).

Costa Rica shows a very different pattern from El Salvador since liberalization positively affects the agricultural trade balance. Figure 4 shows that agricultural exports steadily grew following trade liberalization in 1982. One possible explanation is that Costa Rica's relatively advanced state of development and absence of conflict helped support agricultural input and commodity markets during liberalization reforms. These results also suggest that Costa Rica enjoys comparative advantages in agricultural goods.

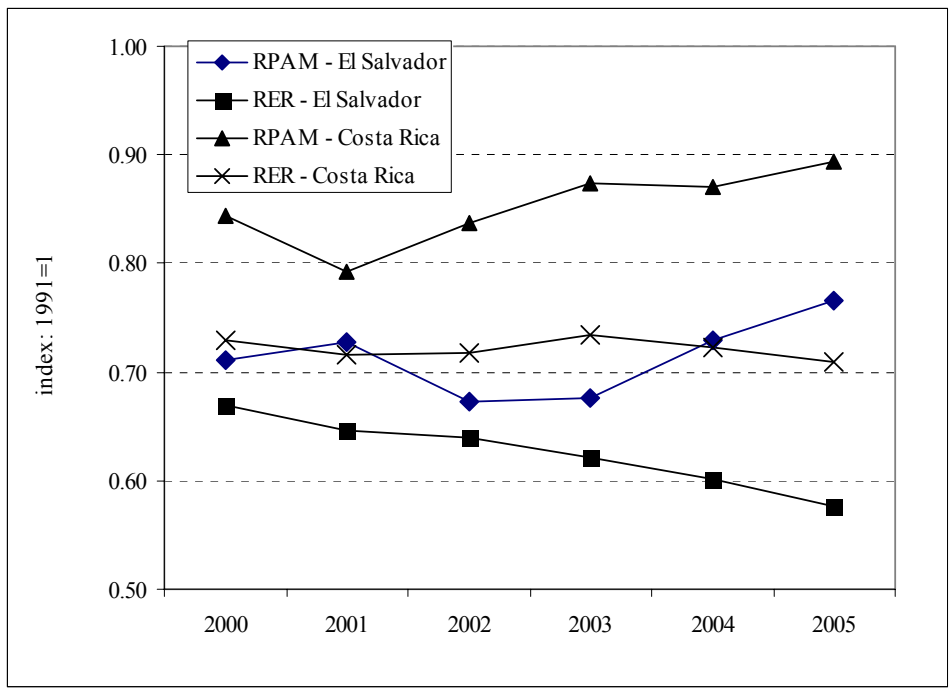
FIGURE 4. TOTAL AGRICULTURAL EXPORTS AND AGRICULTURAL IMPORTS FOR COSTA RICA, 1966-2005



Source: FAO (2007).

The above factors still do not explain the tremendous growth in El Salvador's agricultural trade deficit after 2000 (Figure 3). Agricultural markets should have begun to function 10 years following the conflict and thereby producing an increase in net agricultural exports. However, agricultural exports fell sharply after 2000 while imports continued to soar. El Salvador's fixed exchange rate partly explains this result. Figure 5 confirms that the real value of the Salvadoran colón steadily appreciated after 2000, which created disincentives for agricultural exports and incentives for agricultural imports. Figure 5 also shows that agricultural prices increased slightly in El Salvador after 2000 and *ceteris paribus* this would have induced an agricultural trade surplus. Figure 1 shows that the exchange rate's impact on agricultural trade is much greater than for agricultural prices if both variables move 10 years after liberalization. Hence, the net impact of real currency depreciation on El Salvador's agricultural trade balance after 2000 was negative.

FIGURE 5. THE REAL EXCHANGE RATE AND RELATIVE AGRICULTURAL PRICES IN COSTA RICA AND EL SALVADOR, 2000-2005



Source: World Bank (2007) and authors' calculations (see Table 1).
Notes: A decrease in RER implies a domestic currency appreciation (see Table 1). An increase in RPAM implies an increase in relative agricultural prices.

Previous studies support the notion that microeconomic and structural conditions can hamper agricultural growth and development during liberalization. Deininger and Olinto find that large gaps in input availability hurt Zambian farmers' ability to respond to new opportunities post liberalization. Wiggins et al. express some of the same concerns for rural Mexico. Quiroz and Opazo similarly report how persistent lack of property rights in South America during early liberalization years provided strong disincentives for agricultural investment. Schiff and Montenegro (1997) explain how structural changes, including price policies, can render supply elasticity estimates irrelevant so that liberalization may not produce the expected gains in short run agricultural output.

The above findings also address the optimal sequencing and pace of liberalization. To avoid the kind of damage to agriculture that occurred in El Salvador, policymakers should address rural microeconomic shortcomings before enacting broad liberalization reforms. This point especially pertains to credit and input markets. Evans explains how financial sector reform throughout Central America reduced credit access for small to medium businesses, which would naturally include farmers. Thus, it is plausible that poor credit access by farmers in El Salvador negated some of the potential

gains to agriculture following liberalization. In addition, Costa Rica's use of gradual liberalization reforms and their resulting positive impact on agriculture suggest that policymakers should view rapid "shock-type" liberalization reforms with skepticism.

Another important question is how these two countries' agricultural sectors would respond to global trade liberalization. By one estimate (Beghin and Aksoy, 2003), an agreement at the Doha negotiations of the World Trade Organization would increase global agricultural prices by 10 to 90 percent, depending on the commodity and any related assumptions. Figure 1 suggests that the agricultural sectors in both Costa Rica and El Salvador would benefit from these price increases.

CONCLUSION

This study finds that trade liberalization can either positively or negatively affect agriculture in low income countries depending on the specific economic conditions. Liberalization stimulated agriculture in Costa Rica while El Salvador's agricultural sector negatively reacted to liberalization. These findings emphasize that low income countries' response to liberalization should be modeled as unique processes. The most likely explanation for the different results in Costa Rica and El Salvador is the overall state of economic development in each country, which would have affected the operation of agricultural markets. Costa Rica's economy was stable and relatively advanced when its liberalization reforms began, while an intense civil conflict had just ended in El Salvador prior to liberalization reforms. The results also reflect that Costa Rica likely enjoys comparative advantages in agriculture while liberalization in El Salvador encouraged resource flows away from agriculture. Another factor is that El Salvador rapidly implemented its liberalization reforms, which was not the case in Costa Rica.

ENDNOTES

* The authors wish to thank an anonymous reviewer for helpful insights and comments. However, all content remains the sole responsibility of the authors.

[1] The appendix describes the complete model.

[2] Assuming the country is sufficiently small so that its trade volume does not affect world prices.

[3] Measuring the agricultural trade balance relative to total agricultural output helps eliminate wide variations in the trade balance arising from stochastic production shocks.

[4] Exceptions occur if export supply or import demand elasticities are sufficiently small according to the Marshal-Lerner conditions.

[5] Complete results are available from the authors on request.

[6] Tests for long-run cointegration among all variables use equation (1)'s residuals because critical values in MacKinnon do not match the number of exogenous variables in equation (2). This step is intuitively appealing since the only additional variables added to equation (2) over equation (1) are combinations of existing variables in equation (1). However, the actual ECM used to estimate equation (2) is the lagged residuals from a levels estimate of equation (2).

APPENDIX

Following Weeks' original model, the equilibrium agricultural trade balance (in ratio form) is a log-linear expression:

$$\frac{X_t^*}{M_t^*} = Xn_t^* = \frac{[RER_t]^{\alpha_1}[RPAM_t]^{\beta}[SHGDP_t]^{\alpha_X}}{[RER_t]^{\alpha_2}[SHGDP_t]^{\alpha_M}} \qquad \text{(A.1)}$$

where

X_t^* = equilibrium agricultural exports in year t
M_t^* = equilibrium agricultural imports in year t
RER_t = the real exchange rate, measured in local currency units per US$, in year t
$RPAM_t$ = the ratio of agricultural to nonagricultural prices in year t
$SHGDP_t$ = the share of agricultural output in total output in year t

Each period's change in the trade balance is a partial adjustment process toward equilibrium:

$$\frac{Xn_t}{Xn_{t-1}} = \left(\frac{Xn_t^*}{Xn_{t-1}}\right)^{\gamma} \qquad \text{with } 0 < \gamma < 1 \qquad \text{(A.2)}$$

Substituting equation A.1 into A.2, taking natural logarithms, and adding $\ln(Xn_{t-1})$ to both sides yields:

$$\ln[Xn_t] = \gamma[\alpha_1 - \alpha_2]\ln[RER_t] + \gamma\beta\ln[RPAM_t] + \gamma[\alpha_X - \alpha_M]\ln[SHGDP_t] + (1-\gamma)\ln[Xn_{t-1}] \qquad \text{(A.3)}$$

One important difference in equation A.3 compared to Weeks' model is that Weeks writes $-\gamma[Xn_{t-2}]$ for the last term, which is incorrect even if first differences are employed during estimation. It is not apparent whether this mistake is typographical or otherwise.

As Weeks explains, it is preferable for estimation purposes to use the ratio of the agricultural trade balance to total agricultural output in place of $\ln[Xn_t]$ to avoid large swings in the dependent variable when the trade balance changes from positive to negative. Hence, the estimable equation, before adding policy and conflict variables, becomes:

$$AGTRADE_t = a_0 + a_1\ln(RER_t) + a_2\ln(RPAM_t) + a_3\ln(SHGDP_t) + a_4 AGTRADE_{t-1} + \varepsilon_t \qquad \text{(A.4)}$$

where AGTRADE represents net agricultural exports, relative to total agricultural output, and ε_t is a stochastic error term in year t.

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