Competitiveness of the United States and the ASEAN in the International Agricultural Market

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Three alternative measures were used to determine the competitiveness of the U.S. and the members of the Association of Southeast Asian Nations (ASEAN) in the international agricultural market. Evidence suggests that while the competitiveness of the U.S. has become fairly stable across time, the ASEAN countries have exhibited fluctuating trends, with pronounced increasing trends during the past five years. The impact of technological progress on international agricultural competitiveness was also analyzed. Competitiveness was found to be influenced by interest rates, labor availability, and endogenous technology driven by foreign aid, direct foreign investments, and farm size. These findings provide policymakers and agribusiness managers with relevant inputs which could be useful in formulating appropriate technology generating and/or transfer policies contributing to their country's improved international competitiveness.

The growing notion that a country must become more competitive in the world food market in order to experience sustained economic growth and development has motivated many agricultural economists to explore the true meaning of competitiveness and to investigate the factors influencing such phenomenon. While competitiveness is most commonly defined as the ability of a firm or country to profitably gain and maintain market share, productivity measures are also considered to be important determinants of competitiveness.

Considering that Asia is currently the most economically dynamic region of the world, and that the U.S. share of food exports to the rapidly growing Asia-Pacific market has declined through the years (Behrman and Mikesell, 1981), the possibility of a more intense competition between the US and the less developed ASEAN countries for the share of Asian agricultural imports has increased. Thus, a closer analysis of the competitiveness patterns exhibited by the U.S. and its prospective competitors in the international agricultural market is in order. This paper was therefore conceptualized to determine the level of competitiveness of the U.S. and the members of the Association of Southeast Asian Nations (ASEAN) in the international agricultural market, using three alternative competitiveness measures. In addition, this paper also analyzes the impact of endogenous technological progress on international agricultural competitiveness. An understanding of such relationship should assist policymakers and agribusiness managers in formulating appropriate technology generating and/or transfer policies which may contribute to their country's improved international competitiveness.

Measures and Determinants of Competitiveness

Despite the emergence of many bright export market prospects for U.S. products, Behrman and Mikesell (1981) have noted that the bulk of the world's export markets have been taken over by the Japanese and even by the Asian Newly Industrializing Economies (NIEs). They attributed this reduction in U.S. relative competitiveness to the shift of U.S. technology abroad through foreign direct investments and licensing. While there are many possible explanations for a nation's relative competitive position over another, Porter (1990) argues that these explanations are often conflicting. Some economists consider national competitiveness as a macroeconomic phenomenon which is driven by such variables as exchange rates, interest rates, and government deficits, while others claim that competitiveness is a function of cheap and abundant labor. Porter also argues that competitiveness is strongly influenced by government policy which promotes heightened domestic rivalry

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and technology/skill development. Ultimately, it is argued that the only meaningful concept of competitiveness at the national level is national productivity, but the need to link the productivity concept with the notion of increasing world export shares in order to present a more meaningful concept of national competitiveness should not be overlooked.

Methodology

Data from 1971 to 1990 for the U.S. and a group of less developed country-members of the Association of Southeast Asian Nations (i.e., Indonesia, Malaysia, the Philippines, and Thailand, herein referred to as ASEAN) were analyzed to describe their international competitive position in agriculture. In order to account for the well-received Hecksher-Ohlin (HO) theory, the analysis was extended to both the capital-intensive and labor-intensive sectors of agriculture.

Three competitiveness measures were calculated: international market share, international market share gain index, and export orientation ratio. After these competitiveness measures have been calculated, regression analysis was conducted to determine the impact of a country's level of technological progress on each measure of the country's international marketing competitiveness. Working on the assumption that technology is endogenously determined, a specification was also tested to determine the impact of several variables on the endogenization of technology. This allows testing of hypotheses concerning how technology (i.e., brought about by changes in the levels of foreign investments, foreign aid, research and development expenditures (R&D), and farm size in the respective countries) explain shifts in the level of competitiveness (Salvacruz, 1995). The following recursive system of equations was estimated:

$$(1)\quad PTECH_{ct} = \alpha_0 + \alpha_1 FAID_{ct} + \alpha_2 DFI_{ct} + \alpha_3 RD_{ct} + \alpha_4 LFARM_{ct} + \epsilon_1$$

$$(2)\quad COMP_{ct} = \beta_0 + \beta_1 PTECH_{ct} + \beta_2 AGLABF_{ct} + \beta_3 INT_{ct} + \epsilon_2$$

where *PTECH* is an index of technological progress in agriculture; *FAID* is foreign aid inflows (outflows in the US case); *DFI* is inflow of direct foreign investments; *RD* is research and development expenditures; *LFARM* is the percentage of farms larger than 3 hectares (the conventional cut-off level for LDCs), a market power indicator; *COMP* is a measure of international competitiveness; *AGLABF* is agricultural labor force; *INT* is interest rate; and *c* indexes country and *t* indexes time period (year).

This system of equations was fitted in the US and the ASEAN cases. Since this study involves pooling cross-section and time-series observations, dummy variables were used to identify countries and years.

Capital and Labor Intensity of Commodities

Agricultural capital-to-labor spending ratios of selected crops in the US, taken from US Department of Agriculture farm budget and wage data, were used to classify each crop as either capital-intensive or labor-intensive. Assuming that technological differences between countries are Hicks-neutral, then input requirements of goods from the U.S. will be identical to other countries. Five crops were identified as agricultural capital-intensive; wheat, rice, corn, soybeans, and cotton. Two crops were considered labor-intensive; sugar and tobacco.

Technological Progress Index

The index of technological progress (*PTECH*), represented by an industry's two-factor productivity index, was calculated using the Tornqvist index (Ball, 1984). The aggregate output index for each industry is calculated by multiplying the output of each crop within the sector by that crop's revenue share and summing up the resulting products for all crops in the sector. In measuring the aggregate input index, a weighted average of labor services and land/tractor services was calculated, using the ratios of expenditures to revenues on each of the two inputs as weights.

Measures of International Competitiveness

International Market Share. This measure of competitiveness represents a basic but powerful tool in determining market performance. It is

measured using the ratio of a country's total exports to the world's total exports.

Market Share Gain Index: Although very much similar to the international market share measure, this index provides an explanation of the country's relative market performance between two periods. It is measured using the ratio of a country's current market share and its market share during the previous period.

Export Orientation Ratio: This competitiveness measure, defined as the ratio of a country's exports to its total production, establishes a strong linkage between the country's international market performance and its productivity level.

Results and Discussion

International Competitiveness of the US and the ASEAN

Measures of international competitiveness of the US and the ASEAN in agriculture are presented in Figures 1 to 3. International market share and agricultural export orientation measures indicate that the international agricultural competitiveness of the U.S. in both its capital-intensive and labor-intensive sectors has been stable during the last 20 years, with a slightly deteriorating trend during the past five years. On the other hand, the ASEAN countries' competitiveness have been fluctuating in both the capital- and labor-intensive sectors, with the exception of Thailand which has demonstrated a relatively stable trend in its capital-intensive agricultural sector, with a slight upward trend during the past three years. In Thailand's labor-intensive sector, a pronounced variable trend with a noticeably increasing trend during the past five years is evident. This is not surprising for a labor-rich country which is emerging as another high-growth economy (commonly referred to as Newly Industrializing Economy, NIE). One may therefore infer that improvements in international competitiveness may be indicative of dynamic economic growth.

Using market share gain indices as a measure of competitiveness, all countries exhibit a fairly stable trend in both sectors, with the exception of Malaysia which has exhibited a relatively erratic pattern. An interesting trend can be observed in the case of the Philippines and Thailand where their market share gain indices showed significant upswings during the mid-1970s and then exhibited sharp declines during the early-1980s. These upswings during the mid-1970s may be a consequence of the aggressive export promotion programs that were implemented by these two countries, particularly when martial law was imposed in the Philippines, while the sharp decline during the early 1980s can be attributed to the uncertainties brought about by the political turmoils which caused much speculations and panic among investors, producers, and traders during that period.

Endogenous Technology and Competitiveness in Agriculture

Table 1 presents the results of the endogenization of technology. High values of R^2 and F statistics in both the capital- and labor-intensive agricultural sectors of the U.S. indicate that the model fits the data well. This is not the case with the ASEAN, however, as results yielded very low R^2 and F values. However, the significant dummy variables indicate the existence of structural differences between the countries included in the study that have not been accounted for by the independent variables included in the model. Differences in climate, natural resource endowment, and culture, among others, may have accounted for these significant cross-country differences.

The significant positive sign of the *FAID* and the *LFARM* coefficients in the capital-intensive sector of the U.S. indicates that technological progress is influenced by U.S. foreign aid disbursements and increasing farm size. In the labor-intensive sector, increasing flows of direct foreign investments in U.S. agriculture has a positive influence on technological advancement.

The impact of endogenous technology on three measures of international competitiveness is reflected in Tables 2 and 3. Since differences between each country's level of competitiveness were more evident when market share measures were used, our analysis will focus on the impact of technology on international market share as a measure of international agricultural competitiveness. In addition, while the regression model using market share as a measure of competitiveness yielded very high R^2 and F values, the other measures of international competitiveness failed to generate similar significant results.

The negative *PTECH* coefficient implies that as U.S. productivity increases in the capital-intensive sector, its competitiveness in the world food market declines. This runs counter to a priori expectations. However, if one considers the casual observation that large U.S. agribusinesses are getting more involved with overseas investments, in effect, shifting their production abroad, then it is comprehendible that any improvement in production technology may not generate the expected increase in world market share in processed foods export. There is, of course, the possibility of a misspecification problem wherein an otherwise significant variable may have been omitted in the specification process. The negative coefficients of the *AGLABF* in Table 2 confirms that the Heckscher-Ohlin (H-O) theory holds, and suggests that competitiveness in the capital-intensive sector of both the U.S. and the ASEAN is negatively influenced by increasing agricultural manpower. Similarly, the positive *AGLABF* coefficients in the labor-intensive sectors of both countries support the H-O theory.

Table 1. Parameter Estimates Resulting From the Regression of Two-Factor Productivity Indices of Each Sector Against Technology Determinants in Agriculture.

	U.S.		ASEAN	
	K-Intensive Sector	L-Intensive Sector	K-Intensive Sector	L-Intensive Sector
Intercept	-969.94	-1106.06	0.93	3.44
	(484.02)	(734.60)	(0.59)	(1.33)
FAID	0.06*	0.01	(0.03)	0.11*
	(0.02)	(0.02)	(0.03)	(0.06)
DFI	-0.01	0.05*	(-0.01)	0.01
	(0.01)	(0.01)	(0.01)	(0.02)
RD	0.30	-36.81*	-0.01	0.06
	(9.76)	(14.82)	(0.03)	(0.06)
LFARM	9.71*	11.09	0.01	-0.04*
	(4.84)	(7.35)	(0.01)	(0.02)
	$R^2 = 0.56$	$R^2 = 0.69$	$R^2 = 0.05$	$R^2 = 0.24$
	F = 6.36	F = 7.27	F = 0.29	F = 1.72
	n = 19	n = 18	n = 46	n = 46

Figures in parentheses are standard errors.
* denotes that the coefficient is significant at the 10% level.

Figure 1. International Market Shares of the U.S. and ASEAN Countries in the Agricultural Market.

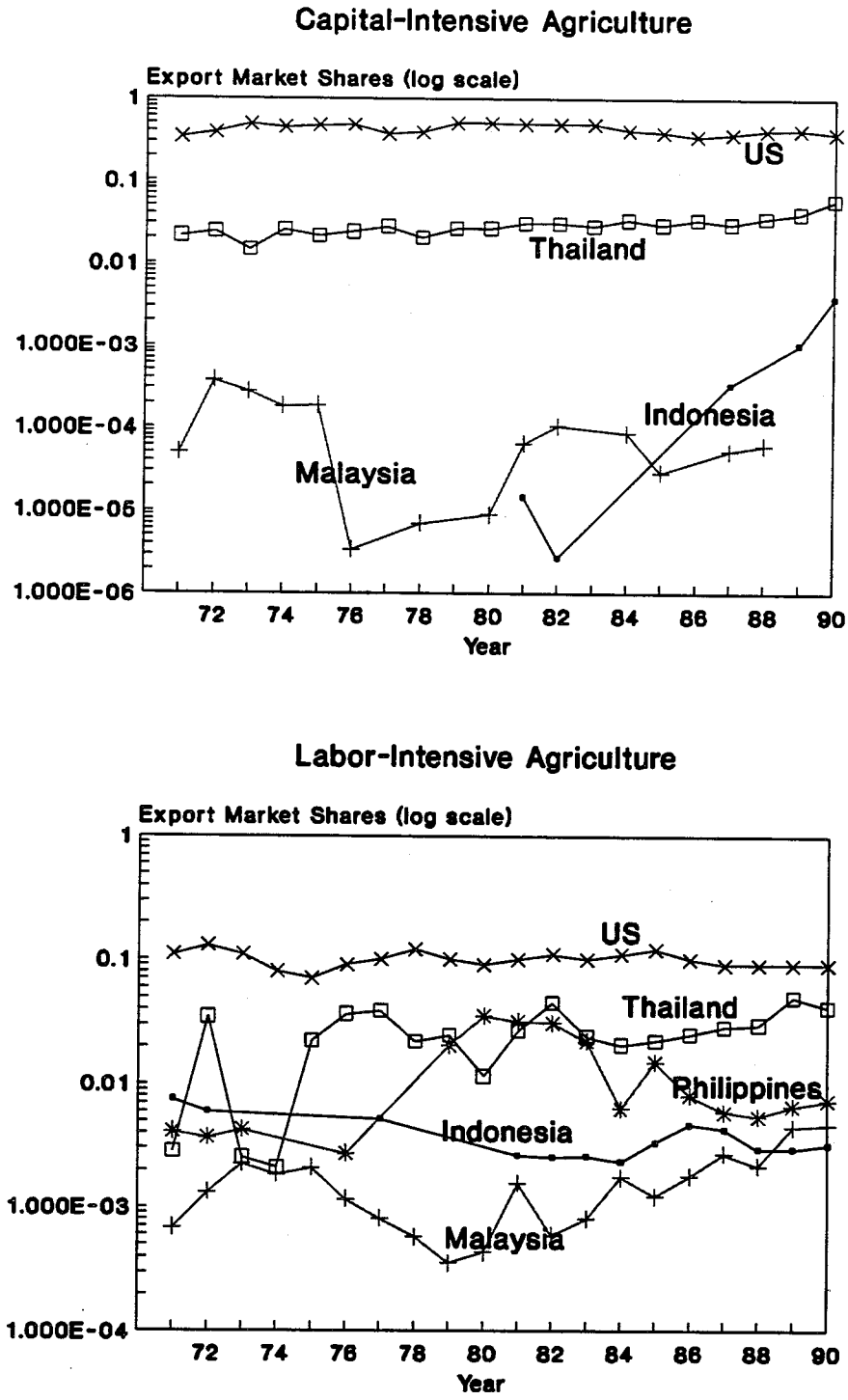
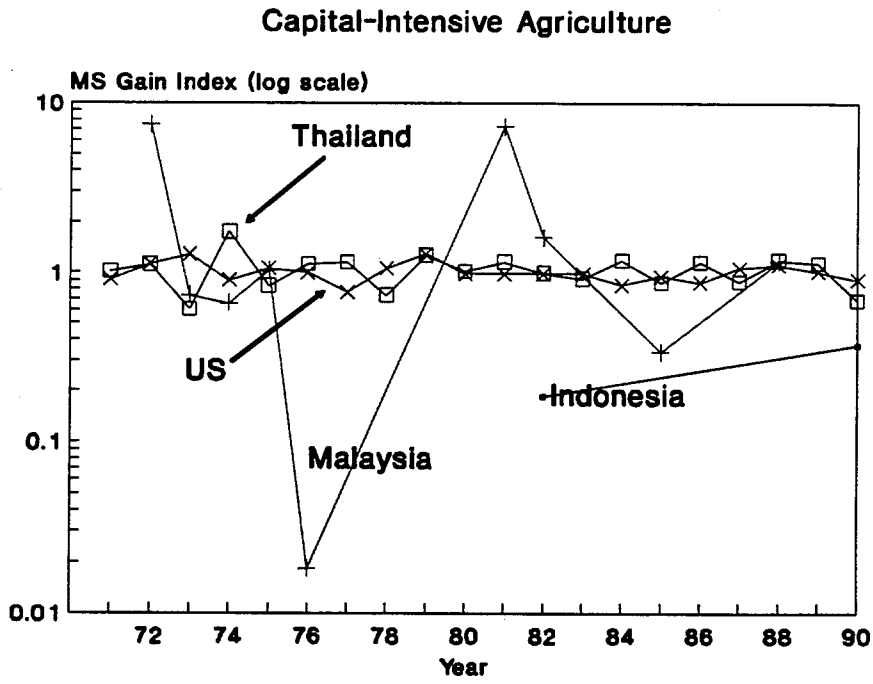


Figure 2. Market Share Gain Indices of the U.S. and ASEAN Countries in the International Agricultural Market.



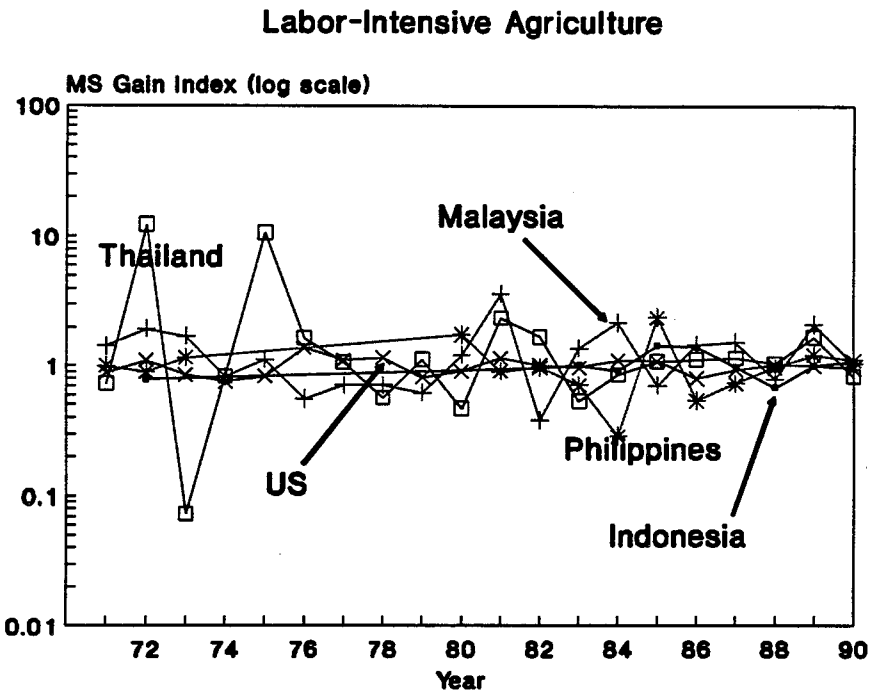


Figure 3. Agricultural Export Orientation of the U.S. and ASEAN Countries.

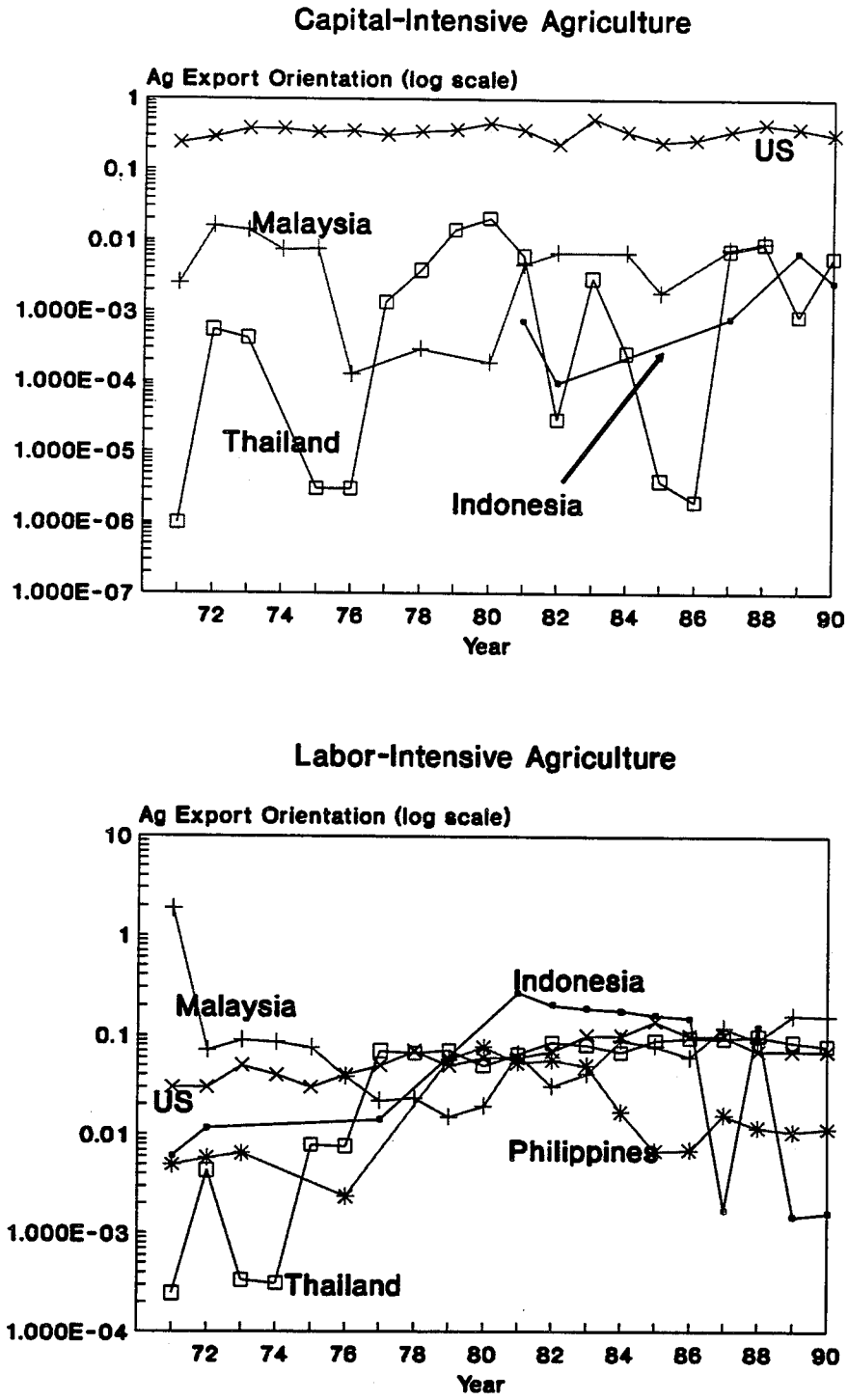


Table 2. Parameter Estimates Resulting From the Regression of Competitiveness Measures in the Capital-Intensive Sector Against Endogenous Technological Progress.

	International Market Share		Market Share Gain Index		Agricultural Export Orientation	
	U.S.	ASEAN	U.S.	ASEAN	U.S.	ASEAN
Intercept	0.53	0.05	0.82	-27.74	0.47	-0.13
	(0.10)	(0.01)	(0.36)	(34.74)	(0.17)	(0.08)
PTECH	-0.05	0.01	-0.07	30.52	-0.14	0.12
	(0.05)	(0.01)	(0.17)	(36.00)	(0.08)	(0.09)
AGLABF	-0.01*	-0.01*	0.01	0.01	-0.01	0.01
	(0.001)	(0.001)	(0.01)	(0.01)	(0.01)	(0.01)
INT	0.01*	-0.01*	0.02	-0.21	0.01*	0.01
	(0.001)	(0.001)	(0.02)	(0.29)	(0.001)	(0.01)
	R^2=0.56	R^2=0.98	R^2= 0.10	R^2= 0.23	R^2= 0.34	R^2= 0.26
	F = 6.36	F= 298.6	F = 0.52	F = 1.08	F = 2.56	F = 1.45
	n = 19	n = 30	n = 18	n = 24	n = 19	n = 32

Figures in parentheses are standard errors.
* denotes that the coefficient is significant at the 10% level

Table 3. Parameter Estimates Resulting From the Regression of Competitiveness Measures in the Labor-Intensive Sector Against Endogenous Technological Progress.

	International Market Share		Market Share Gain Index		Agricultural Export Orientation	
	U.S.	ASEAN	U.S.	ASEAN	U.S.	ASEAN
Intercept	0.10	0.04	1.36	5.98	-0.03	1.87
	(0.03)	(0.02)	(0.36)	(4.72)	(0.06)	(0.46)
PTECH	0.01	-0.01	0.03	1.28	-0.02	-1.22*
	(0.01)	(0.01)	(0.14	(2.55)	(0.02)	(0.26)
AGLABF	0.01	0.01	-0.01	-0.01*	0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.001)	(0.01)	(0.01)
INT	-0.01	-0.01	-0.01	-0.12	0.01	-0.01
	(0.01)	(0.01)	(0.02)	(0.11)	(0.01)	(0.01)
	R^2=0.03	R^2=0.56	R^2= 0.09	R^2= 0.14	R^2= 0.21	R^2= 0.40
	F = 0.18	F= 9.10	F = 0.44	F = 1.01	F = 1.31	F = 4.78
	n = 19	n = 50	n = 18	n = 45	n = 19	n = 50

Figures in parentheses are standard errors.
* denotes that the coefficient is significant at the 10% level

Conclusion

This paper compared the competitiveness of the U.S. against that of a group of developing countries representing the ASEAN in the international agricultural market. The three measures of competitiveness used in this study indicate that the ASEAN countries have generated greater potentials to become more competitive than the U.S. in both capital-intensive and labor-intensive sectors of agriculture. Among the factors discovered to influence competitiveness are the availability of manpower, interest rates, and endogenous technology driven by foreign aid, direct foreign investments, and farm size. Evidently, a negative correlation may exist between productivity improvements and international competitiveness as the U.S. case demonstrates. One needs to understand that this phenomenon may be linked with significant foreign direct investment outflows from the U.S. Thus, new technologies developed by U.S. agribusiness firms may actually be adopted in their foreign production facilities so that these productivity improvements do not directly translate into improved market share performance of the U.S. A more critical evaluation of other economic and business factors such as direct foreign investment flows and their impact on economic activities of the multinationals should therefore be undertaken.

It is interesting to note that market power has been found to have a significant positive impact in improving the technological level of agriculture in general. One can readily observe the proliferation of mergers and acquisitions in the field of agribusiness, particularly among U.S. multinationals. It is not conclusive, however, whether such innovation-generating activities will continue to increase as the market structure approaches a highly concentrated level, in which case, a closer monitoring of consumer and producer welfare may become more important.

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