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FOOD DEMAND IN OTHER COUNTRIES

Market Assessment Models for U.S. Agricultural Exports

by

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Abstract

The growth rate of the United States' agricultural exports to its trading partners was predicted using some measures of each country's past macroeconomic conditions. The model which applies a five-year lag basis predicted better than that which utilizes a ten-year lag. Results show that the significant determinants of the growth rate of U.S. agricultural exports include the importing countries' GDP growth rate, agricultural self-sufficiency, population density, and distance from the United States.

Market Assessment Models
For U.S. Agricultural Exports

Market assessment is a necessary first step in international marketing management. An exporter's decision to either enter a foreign market or expand coverage of existing markets should not be made unless a systematic evaluation of all alternative target markets has been conducted to identify countries which present the greatest opportunities in terms of market size and growth.

An assessment of export marketing opportunities is basically a screening process which involves gathering relevant information about each country and eliminating the less promising markets. This seemingly simple procedure becomes much more complicated as one expands the assessment to include the more than 150 countries in existence today.

Although a number of market assessment models have been proposed since the early 1960s, most of these models have been more suitable for evaluating foreign direct investment opportunities (See Ayal and Zif, 1978, and Stobaugh, 1969, for

examples of these models). In addition, they have generally been qualitative in nature and lack the high degree of predictive accuracy that most agricultural economists and marketing managers desire in a model. Figure 1 gives an example of a qualitative market assessment model.

This paper presents two econometric models which predict the growth rate of U.S. agricultural exports to a specific country given some predetermined variables concerning the country. One model is a forecast of the growth rate of the country's agricultural imports from the United States five years ahead, and the other is growth rate in agricultural imports from the United States ten years ahead. A relatively high growth rate forecast obviously indicates a brighter export potential for U.S. agricultural products.

Theoretical Considerations

Most agricultural economists believe that a strong linkage exists between exchange rates and agricultural trade flows. That is, a depreciation of a country's currency generally results in an increase in its exports and/or a reduction in its imports (Schuh, 1974; Chambers and Just, 1982). This would infer, therefore, that an increasing depreciation rate of a country's currency against the U.S. dollar tends to decrease the country's growth rate of agricultural imports from the United States.

National income is another macroeconomic variable which is believed to affect a country's trade flow. Several studies have shown that a relatively high national income level is associated with a higher import level. Thus, an increasing rate of growth of a country's gross domestic product (GDP) should logically be associated with an increasing rate of growth of that country's agricultural imports from the United States.

One can expect to observe a lower import growth rate for a country whose debt level is increasing (Chacholiades, 1990). Such relationship can be attributed to liquidity problems that a high-debt country faces in the process of meeting huge amortization and debt service payments.
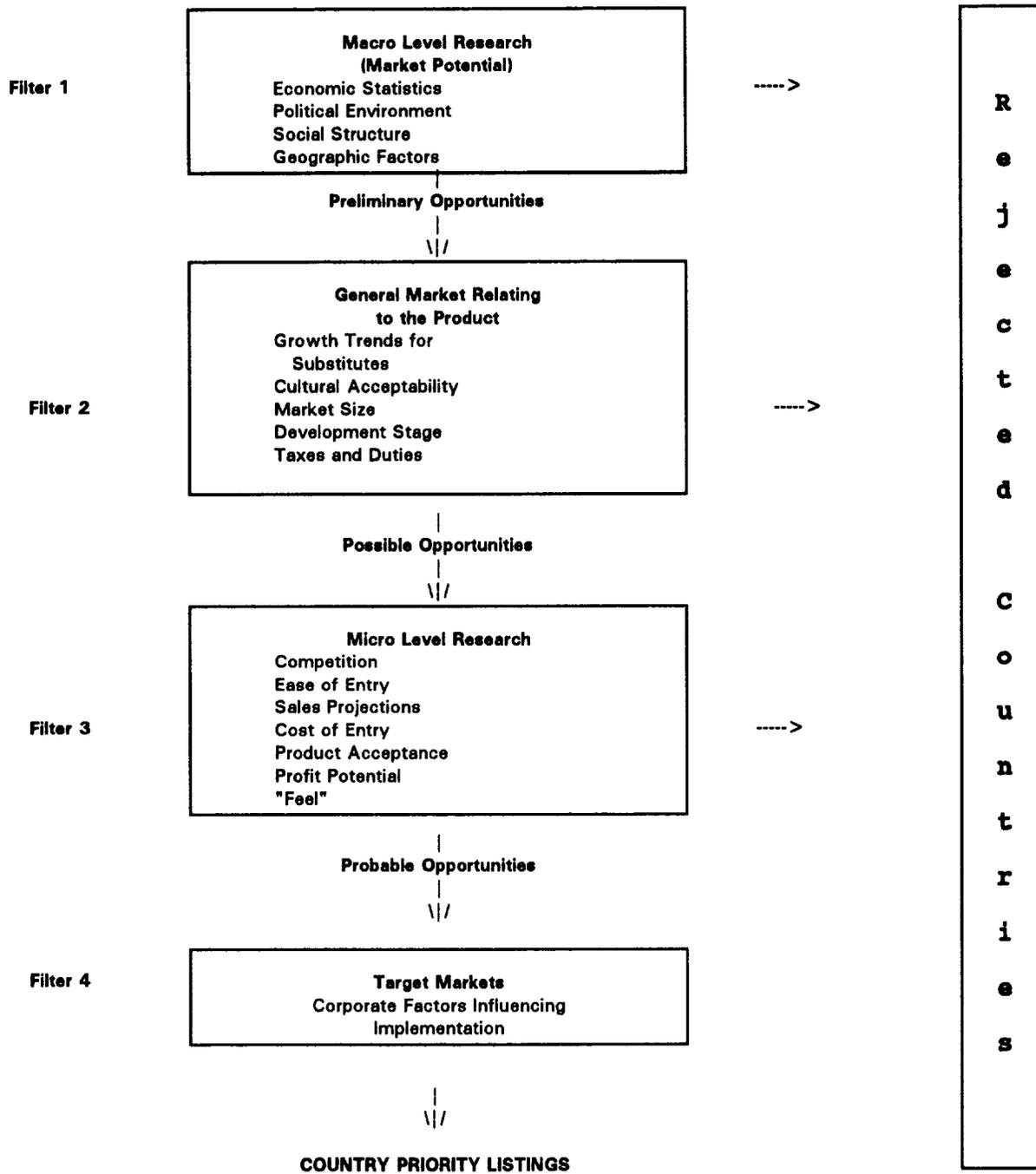
The concept of agricultural self-sufficiency as a determinant of a country's import growth rate is a cloudy issue. Some economists argue that a self-sufficient country would logically preclude trade, thereby reducing both its export and import activities (Grennes, 1984). On the other hand, others argue that as agricultural self-sufficiency sets in, a country would tend to pursue some degree of import liberalization. Thus, a high degree of self-sufficiency can be associated with a high import growth rate.

The relationship between a country's population density and its agricultural import growth rate is obvious. The need for external sources of food and fiber generally increases as a country becomes more densely populated since population increases tend to limit the productive capacity of a country's limited land resources.

The distance between two trading partners is another major determinant of trade since this factor is significantly related with transportation cost. Considering that the net benefit of additional imports can be viewed as the value of these imports less the costs of producing them in the exporting country and transporting them to the importing country, then a higher transportation cost (i.e., longer distance between two trading partners) is expected to reduce the importer's rate of growth of imports.

Model Specification

The primary objective of this study is to construct a model that will enable one to predict the growth rate of U.S. agricultural exports to a country i given some measures of the macroeconomic variables described in the preceding section as observed in that country sometime in the past. In order to achieve this goal, the growth rate of U.S. agricultural exports to country i from the 1976 to 1980 average, to the 1986 to 1990 average, was regressed against the aforementioned variables characterizing country i during the year 1980. This is viewed as a projection of growing markets ten years ahead. Data are averaged over a five-year period to minimize the effects of unusual circumstances possibly associated with one year. Similarly, an alternative five-year growth model was constructed by specifying a

Filter 1

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┌─────────────────────────────────────┐
│        Macro Level Research          │
│         (Market Potential)           │          ----->
│  Economic Statistics                 │
│  Political Environment               │
│  Social Structure                    │
│  Geographic Factors                  │
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Preliminary Opportunities
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Filter 2

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┌─────────────────────────────────────┐
│      General Market Relating         │
│          to the Product              │
│  Growth Trends for                   │
│     Substitutes                      │
│  Cultural Acceptability              │          ----->
│  Market Size                         │
│  Development Stage                   │
│  Taxes and Duties                    │
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Possible Opportunities
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Filter 3

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│        Micro Level Research          │
│  Competition                         │
│  Ease of Entry                       │
│  Sales Projections                   │          ----->
│  Cost of Entry                       │
│  Product Acceptance                  │
│  Profit Potential                    │
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Probable Opportunities
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Filter 4

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┌─────────────────────────────────────┐
│         Target Markets               │
│  Corporate Factors Influencing       │
│      Implementation                  │
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COUNTRY PRIORITY LISTINGS

Rejected countries

SOURCE: R. Wayne Walvoord, "Export Market Research," *Global Trade Magazine*, May 1980, p. 83.

Figure 1. A Model for Selecting Foreign Markets

multiple regression relationship between the growth rate of U.S. agricultural exports from the 1981 to 1985 average to the 1986 to 1990 average, and the same macroeconomic variables measured in 1985.

One can think of the ten-year growth model as having a base of 1980. At that point a decision-maker is assessing the macroeconomic variables available at that time to predict the growth in U.S. agricultural exports to each country of the world. Using export data for 1980 alone may not be accurate in some cases because of unusual circumstances associated with that year. Therefore, it is more useful to look at the 1976-1980 period for U.S. agricultural exports.

The specification for the ten-year growth model is:

$$EXGR_i = a_0 + a_1 \, XRDEPN_i + a_2 \, DT/GDP_i$$
$$+ \, a_3 \, GDPGR_i + a_4 \, AGSSR_i + a_5 \, POPDEN_i$$
$$+ \, a_6 \, AGEX_i + a_7 \, DIST_i + e_i$$

where $EXGR_i$ is the growth rate of U.S. agricultural exports to country i from the 1981-85 average to the 1986-90 average, i.e.,

$$\frac{\sum\limits_{t=86}^{90} \dfrac{AGEX_{it}}{5} - \sum\limits_{t=76}^{80} \dfrac{AGEX_{it}}{5}}{\sum\limits_{t=76}^{80} \dfrac{AGEX_{it}}{5}}$$

$AGEX_i$ being the total value of U.S. agricultural exports to country i during the specified years.

$XRDEPN_i$ is the depreciation rate of country i's currency against the U.S. dollar from 1975 to 1980, computed as follows:

$$\frac{XR_{i,1980} - XR_{i,1975}}{XR_{i,1975}}$$

XR_i being country i's exchange rate against the U.S. dollar, expressed as country i's currency per U.S. dollar.

DT/GDP_i is the ratio of country i's foreign debt to its GDP in 1980;

$GDPGR_i$ is country i's GDP growth rate from 1975 to 1980;

$AGSSR_i$ is country i's self sufficiency ratio for agriculture in 1980;

$POPDEN_i$ is country i's population density as of 1980, measured in number of persons per square kilometer;

$DIST_i$ is the distance between country i and the United States in kilometers.

The five-year growth model has exactly the same variables except for one additional regressor, $BASE_i$, and that all were measured with 1985 as the base. Thus, all time-related variables are five years ahead of the ten-year growth model.

$BASE_i$ is a base variable that measures country i's growth rate of its agricultural imports from the United States averaged during the 1976-1980 period, to its U.S. import average during the 1981-1985 period. One may consider it as a one (five-year) period lag component of the dependent variable $EXGR_i$, and is computed as:

$$\frac{\sum\limits_{t=81}^{85} \dfrac{AGEX_{it}}{5} - \sum\limits_{t=76}^{80} \dfrac{AGEX_{it}}{5}}{\sum\limits_{t=76}^{80} \dfrac{AGEX_{it}}{5}}$$

Data Source and Analysis

Cross-sectional data on agricultural import volumes of each country from the United States and the relevant macroeconomic variables discussed in the model specification were gathered from various trade and financial publications of the International Monetary Fund, United Nations, U.S. Department of Agriculture, and the World Bank. The distance measurements between the United States and its prospective trading partners were taken from Direct Line Distance (International Edition) by Fitzpatrick and Modlin.

The number of observations used were only limited by missing information for a number of countries which forced the exclusion of these countries from the study. In the final analysis 64

countries were used for the ten-year growth model and 57 were used for the five-year growth model.

The basic econometric tool used in testing the preceding specifications was regression analysis, with t- and F-tests conducted at the 10 percent level. Considering that the models were specified primarily for predictive purposes, heavy emphasis was placed on results of the F-test or goodness of fit, and R^2 measurement in evaluating the models. Nevertheless, the statistical significance and signs of resulting coefficient estimates were evaluated to verify their consistency with economic theory.

Results and Discussion

Table 1 presents a general summary of the regression of the two models. Results of econometric tests for the two specifications suggest that the five-year growth model performed much better as a predictive model than the ten-year growth model. This is to be expected, especially given the shocks that occurred between the late 1970s and the late 1980s.

The Ten-Year Growth Model

With an F-value of 0.968 and an R^2 of 0.1079, the ten-year growth model does not appear to be an adequate predictive model. In addition to this weakness, only one coefficient was found to be significant at the 10 percent level (XRDEPN).

The predictive weakness of this model may be explained by the relatively long lag between the time that the macroeconomic variables were observed and the time that the import growth rate is predicted. Considering today's dynamic world, where a great number of economic and political developments are shaping up every minute, such a result should not be totally surprising.

The Five-Year Growth Model

An F-value of 3.638 and an R^2 of 0.3775 make the five-year growth model much better as a predictive model than the ten-year model. Of particular interest is the fact that five out of the eight coefficients were found to be statistically significant at the 10 percent level. In addition, all

but one, **XRDEPN**, had signs consistent with a priori expectations. The positive sign of the **XRDEPN** coefficient, however, can be explained by the commonly held notion that currency devaluation usually adds to inflationary pressure. This drives up the domestic price of imports in the country and, assuming that the import demand curve is relatively more inelastic than the import supply curve, then the resulting import value should be greater than the initial volume.

The country's GDP growth rate, agricultural self-sufficiency, population density, and distance from the United States were the other significant factors in explaining U.S. agricultural export growth. Specifically, the five-year growth model predicts that a 1 percent five-year growth of a country's GDP will be associated with a 0.0000006 percent growth in the country's agricultural imports from the United States five years hence, holding all other factors constant. Similarly, the model also predicts that a one unit increase in the country's agricultural self-sufficiency ratio will drive the country's growth rate of agricultural imports from the United States to increase by 0.15 percent in the next five years, assuming that all other factors are held constant.

The **POPDEN** coefficient of 0.0001 implies that for every one person increase per square kilometer of land area in the country, holding all other factors constant, there will be an associated 0.01 percent increase in the country's growth in agricultural imports from the United States within the next five years.

Finally, the model predicts that a country's U.S. agricultural import growth rate will decline by 0.002 percent for every kilometer that it is located farther away from the United States, assuming all other variables are held constant.

Summary and Conclusion

The basic premise of this paper has been that the growth rate of U.S. agricultural exports to a particular country can be predicted by looking at macroeconomic variables about that country. Two general multiple regression models were estimated to reflect such relationships--one which reflects a ten-year-ahead forecast and another which reflects

Table 1

Regression Results of the Market Assessment Models

Variables	Ten-Year Growth Model Parameter Estimate	T-value	Five-Year Growth Model Parameter Estimate	T-value
Intercept	-0.0014 (1.4476)	-0.001	-0.1486 (0.1037)	-1.43
XRDEPN	0.6003 (0.2599)	2.310*	0.0002 (0.0001)	2.36*
DT/GDP	-0.00000039 (0.000005)	0.071	-0.0008 (0.0007)	-1.07
GDPGR	-0.0115 (0.1027)	-0.112	0.0000006 (0.0000002)	-3.04*
AGSSR	0.0058 (0.0104)	0.554	0.0015 (0.0007)	2.27*
POPDEN	0.0001 (0.0007)	0.185	0.0001 (0.0001)	1.76*
AGEX	-0.00000056 (0.000005)	-0.931	0.00000009 (0.00000009)	1.09
DIST	-0.00001 (0.0001)	-0.169	-0.00002 (0.000008)	-2.80*
BASE	-	-	0.0083 (0.0131)	0.63

$$n = 64 \qquad\qquad n = 57$$
$$F = 0.968 \qquad\quad F = 3.638$$
$$R^2 = 0.107 \qquad\quad R^2 = 0.377$$

*denotes significance at the 10% level.
Standard errors are reported in parenthesis.

a five-year-ahead forecast. The analysis thus allows U.S. policy-makers and/or agricultural export managers to rank countries based on their potentials as high growth export markets for U.S. agricultural produce.

Results suggest that the five-year growth model performs better as a predictive model than the ten-year growth model. Specifically, the significant determinants of U.S. agricultural export growth rate to a particular country include the country's rate of currency depreciation, GDP growth rate, agricultural self-sufficiency, population density, and distance from the United States.

Although the five-year growth model yielded a relatively high R^2 of 0.3775, there is reason to believe that an improvement of the model can be attained by breaking down the dependent variable into more specific categories of U.S. agricultural exports (i.e., estimating separate five-year growth models for each product-specific category). This will not only reduce the aggregation bias that the current model presents but will also make the resulting models more useful in terms of specific applications.

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