An analysis of the sources of instability of Mexico's export earnings from cotton

AN ANALYSIS OF THE SOURCES OF INSTABILITY OF MEXICO'S EXPORT EARNINGS FROM COTTON

by

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ABSTRACT

Mexico has been the second largest exporter of cotton in the world; and it has also been the strongest competitor of the United States in most cotton importer countries.

Given these facts this study is concerned with finding the sources of instability of the value of Mexican exports of cotton; it is primarily oriented toward the relations that exist between the U. S. cotton policies and the value of Mexican cotton exports.

The approach considered in this research is that of quantitative analysis in order to achieve the following objectives:

To identify the relationship between the U. S. cotton policies and the variability of the value of Mexican exports, production, and prices of cotton.

To determine the net stabilizing or destabilizing effect of the U. S. cotton policies on the Mexican value of exports, production, and prices.

The statistical concept of variance was used as the basis for the analysis of the data.

The analysis shows that there are some elements of the U. S. cotton policies that cause instability in the export value, the export price, and the production of

Mexican cotton. It also shows that during the last periods analyzed there have been stronger elements contributing to the instability of the value of exports. One of the most important elements contributing to that instability of the value of Mexican cotton exports is production of cotton in Mexico.

CHAPTER I

INTRODUCTION

The export sector is very important for the economic growth of developing countries. It is necessary to export in order for them to be able to acquire the inputs needed for industrialization as well as goods for consumption.

Earnings from exports of primary commodities have had a long history of instability caused by various economic, natural, and political factors. Among the primary sources are the industrial nations. The speculative motives of some traders tend to accentuate this instability through the accumulation and releases of large stocks of primary commodities. Changes in stocks are also a device to keep the quantity of the product in accordance with trade and production.

The United Nations (1952) found for the first half of the twentieth century (1901-1050) that on the whole export price and quantity movements contribute about equally to the instability in export earnings for the most important primary products traded in the world. It is interesting to note that the cyclical fluctuations in export quantity are to a certain degree greater than cyclical fluctuations in price. The percentage fluctuation per annum of the eighteen

commodities studied averaged 18.7. The higher year-to-year percentage changes in export volume of agricultural products were wheat 33, linseed 31, rubber 29, and cotton 21. Surprisingly enough the fluctuations in price for the same commodities and for the same period were lower than those of volume of exports. Rubber with 21 had the highest average percentage annual price change of all the eighteen commodities, followed by cotton and linseed with 18 and finally wheat with 16.

While fluctuations in export proceeds are confined to short run (one year) phenomena which are substantially affected by shifts in demand, the effects of production instability are also evident. Weather, plant diseases, and pests cause variation in yields which affect production which in turn affects exports of primary commodities. Production also varies with area planted and geographic distribution of planting.

The last of the major factors influencing export proceeds listed here is government policies. Trade barriers have been increasing since the 1930's and after World War II "the world has changed greatly and is now a world of planned economics, of state trading, of substantially arbitrary and inflexible national price structure and of management instability in exchange rates" (Viner, 1966, p. 4). The domestic production policies of the large world producers affect directly or indirectly international trade; for

example, the United States as a major producer of cotton affects the world cotton situation, and Brasil influences the coffee market in much the same manner.

All of these institutional variables add uncertainty to the already difficult situation of the primary commodity trade. Thus governmental actions have made traders very sensitive to possible changes in official policies.

Regardless of the source of instability the effects derived from it may be very similar. Instability in export proceeds strongly affects both the income to the producer of primary commodities and the external purchasing power of the exporting countries. Reduction of income from exports to the producers may cause decline in personal consumption expenditures and investment. The countries' position in trade is also damaged as the external purchasing power declines, and with it imports, causing internal investment and consumption to decline.

In countries where stabilization policies are implemented, the adverse effect of instability of exports may be felt on the balance of payments. Since these policies support the level of total consumption and investment, they maintain the demand for imports and in the face of declining export proceeds increase the external debt (Reynolds, 1963, p. 93).

Instability of export earnings also contributes to inflationary pressure during periods of depression and

prosperity. Periods of poor export gains may cause a deficit in the balance of payments thus encouraging devaluation of the country's currency in order to make exports more attractive, which may bring inflationary pressures on domestic prices. During booming export periods the rapid increase in export proceeds may contribute to a rate of inflaction that overwhelms domestic controls. The terms of trade may be unfavorable for developing nations in that the prices of manufactured goods imported by the exporter of primary commodities are higher and more stable than export prices of primary products.

CHAPTER II

PROBLEM SITUATION, OBJECTIVES, AND HYPOTHESES

For many years, Mexico has been the foremost competitor of the United States in most cotton importing countries around the world, and also the world's second largest exporter of upland-type cotton. During the sixties the U.S. supplied an average of 25.44 per cent of the world exports whereas Mexico supplied only 8.88 per cent.

There are several similarities between the cotton industries in Mexico and in the United States. They produce almost the same types, varieties, qualities, and also sell in nearly all foreign markets.

Cotton in Mexico has been the principal factor of the economic life of the areas where it is grown, marketed, and consumed. For several years it has been the principal source of Federal government revenues in the form of taxes on growers, business, and exports.

Cotton supplies raw materials for leading industries like textiles and vegetable oils and usually accounts for between 10 and 20 per cent of the value of Mexican exports. The value of exports of cotton is greater than that of any other single agricultural crop, including sugar, coffee, fruit, and vegetables. Because cotton is a good source of

employment the Mexican government is interested in maintaining and increasing the production and exports of cotton.

Before World War II Mexico was receiving about two million U.S. dollars per year, or less than two per cent of total exchange earnings by way of its export effort in cotton. Between 1958 and 1964, however, cotton exports provided exchange earnings on the order of 200 million per year, or roughly one-eighth of total receipts in the current account of the balance of payments.

The agricultural policies inaugurated during the 1930's in the United States were aimed to guarantee American farmers higher income in return for smaller crops, but the response to the high guaranteed price was higher yields per acre. Until 1956 the U.S. placed itself at a competitive disadvantage via its domestic price support programs. As a result of this the U.S. played the role of residual supplier of cotton and reduced its exportable supply below the free market level, this permitted Mexico and other countries to export their own cotton at prices just below the support prices for comparable U.S. grades of cotton (Freithaler, 1968, p. 74). The accumulation of large inventories while acting as the residual supplier caused the United States to change its export policies to increase its level of exports. The U.S. government policies on cotton affect directly or indirectly the world cotton trade, production, and prices.

There seems to be a correlation between the U.S. and Mexican cotton export policies. Hicks (1965) found that changes in stocks and exports in the two countries show an inverse correlation in several years since World War II. Mexico probably could have adjusted her exports to the level of U.S. exports to avoid reduction in prices and foreign exchange earnings. Findings in a report of the United Nations Economic Commission for Latin America (1957) show that the price elasticity of demand for cotton in importing countries is very small and Mexican exports of cotton depend on world demand and on the level of U.S. exports of cotton.

Hicks also found that there is a relationship between U.S. cotton prices in Liverpool in one year and the number of hectares of cotton harvested in Mexico the following year. This suggests that Mexico may have made downward adjustments in cotton production in response to declines in the Liverpool price the previous year.

In relation to price Swerling (1962) has said "that for cotton probably no single step would have been more disadvantageous to competing exporters (including Mexico) than a downward revision in the U.S. price appropriate to the full employment of postwar cotton technology" (n.p.).

It is extremely difficult to determine the level of U.S. exports at that appropriate price, and therefore we can not say with certainty what has been the real impact of

U.S. price support policies on the Mexican cotton industry. In other words, it is very difficult to estimate what would have been the development of the Mexican cotton industry without the U.S. price support policies.

Because of the tight links between cotton and the rest of the Mexican economy, U.S. cotton policies add uncertainty and instability to the decision making processes of the Mexican cotton producers, exporters, and government planners. Instability and uncertainty have been increased by the implied temporary nature of the U.S. cotton programs. These programs have been reconsidered by the Congress every 2 to 5 years during the last 35 years with changes in the form of control measures aimed at the adjustment of cotton acreage, reduction of surpluses, and maintenance of farm income.

Little research has been done to determine the effects of U.S. programs upon the stability of the Mexican cotton industry. Mexicans and other cotton exporters have for many years talked about the omnipresent danger of a sudden and inconsiderate dumping of U.S. surpluses in the international market which would break the world price. Although many serious implications are drawn from these qualitative discussions very little is known about the quantitative character of the situation. Research on commodity stabilization is often done on qualitative terms, leaving aside the quantitative approach to the problem of

instability of foreign exchange earnings from agricultural exports.

Therefore the approach considered in this research is that of quantitative analysis in order to achieve the following objectives:

1. To identify the relationship between the U.S. cotton policies and the variability of the value of Mexican exports, production, and prices of cotton.
2. To determine the net stabilizing or destabilizing effect of the U.S. cotton policies on the Mexican value of exports, production, and prices.

This research will test the following hypotheses:

1. U.S. cotton policies have destabilized the value of Mexican exports of cotton.
2. Export prices of Mexican cotton at Liverpool, England, have been destabilized by U.S. cotton policies.
3. U.S. cotton policies have destabilized production of Mexican cotton.

CHAPTER III

HISTORICAL REVIEW OF U.S. COTTON PROGRAMS

U.S. government regulations to support agricultural prices and farmer's income have been in effect for almost fifty years (Cable, 1957). Since the early 1920's four major approaches have been used, with minor variations, to solve the problem of instability.

The first proposal, which never became law, was debated in Congress during the years 1927 and 1928, and the idea was "that domestic or U.S. price for a commodity was to be pegged at a fair level," and all that could not be sold at this price was to be purchased by a government export corporation. The corporation was to sell this excess abroad at world market prices. The loss to the government between the supported domestic price and the world price for a commodity was to be shared equally by the producers of that commodity. It is interesting to note that this idea, that of a two-price system, had to wait thirty years in Congress tn order to be accepted under Title II of the Agricultural Act of 1956. Despite this failure to enact legislation some increases in price occurred during the late 1920's. Efforts to improve marketing of agricultural commodities were continued through a new approach to the situation.

On June 15, 1929, Congress passed the Agricultural Marketing Act which changed from the two-price approach to one of orderly production and distribution. The philosophy of this approach was that if surplus crops could be stored until there was a reduction in supply or an increase in demand, and then fed back into the market, farm prices and income would be more stable.

This act had unfortunate results. The Federal Farm Board ran out of funds and was unable to stabilize prices. During the first four-year period, prices were at very low levels and the cotton supply was not reduced. The act was terminated with the abolition of the Board in May, 1933.

In May, 1933, the Agricultural Adjustment Act was passed with the same objective as previous legislation, to establish the same ratio between things the farmer sold and things he bought as existed during the period from August, 1909, to July, 1914. This was referred to as the fair exchange value, later called parity.

The approach of this act was a very different one. Farmers were to get payments from the government if they were willing to reduce acreage and production. The rationale behind this policy was that a reduction in the acreage planted would adjust supply to the demand conditions. On October 17, 1933, the Commodity Credit Corporation was created to make loans to producers of cotton (and certain

other commodities) and to carry out the government storage programs.

The next approach to the problem was that of the Soil Conservation and Domestic Allotment Act of 1936. The intent of this act was to restrict the use of land for basic crops by making payments for adjustments to other uses. Cotton producers were to receive five cents a pound in 1936 for the production that would have been harvested from acreage diverted from cotton to "soil-conserving" crops. Also payments were provided for following soil improving practices.

During World War II there were no major changes in cotton policy with the exception of higher level price supports which were aimed to increase cotton production and to prevent a sharp price decline immediately after the war.

After the war there were minor changes in the approach. During the period from 1946 to July, 1954, there were several price support levels ranging from 92.5 per cent of parity in 1946 to 50 per cent of parity in 1950. But in most of the years included in this period the support price level was at 90 per cent of parity subject to many other regulations such as farmers' approval of marketing quotas, acreage allotments, the level of the normal supply of cotton, and the level of exports.

With the passage of the Agricultural Trade Development and Assistance Act on July 10, 1954, the approach to

the situation was dramatically changed. This act is generally known as Public Law 480 (United States Department of Agriculture, 1967), and it was designed to

> . . . stimulate the exports and consumption of agricultural commodities as a means of reducing surpluses. It provided for exports to friendly nations beyond the usual sales, by accepting payments in their currencies which would be used to buy strategic materials or other specified purposes. Also, surplus commodities could be used to relieve famine conditions abroad (p. 16).

Title I of Public Law 480 authorized the President to carry out a program for the sales of surplus agricultural commodities for foreign currencies under agreements with friendly nations or organizations of friendly nations. In negotiating agreements under Title I of this law, the President is required to take reasonable precautions to safeguard U.S. usual marketing practices and assure that such sales will not unduly disrupt world prices of agricultural commodities or normal patterns of commercial trade with friendly countries. Title II provides that CCC-owned commodities may be used for emergency assistance to needy peoples in foreign countries to meet urgent or extraordinary relief requirements.

Title III authorizes donations of CCC surpluses to needy persons in friendly foreign countries. Under barter programs, a given value of surplus agricultural commodities at established export prices is exchanged for an equal value of strategic or other materials produced abroad, for

materials required in off-shore construction programs of the U.S. government, or for materials required in foreign economic and military aid and assistance programs of the U.S. Title IV provides for long-term supply and credit sales of surplus agricultural commodities.

Other programs used in expanding exports are the CCC export sales and export credit sales programs. The first program offered CCC stocks for exports at prices reduced to the extent necessary to make them competitive in world markets. The second program extended credit for periods up to three years.

Another important program is that of the Export Import Bank of Washington which extends short-term credits to finance exports of surplus of agricultural commodities where such credit is not available from normal commercial sources.

U.S. Role as a Price Maker and Residual Supplier of Cotton

The U.S. government has functioned as the price leader in the world cotton trade. The price at which the U.S. was willing to sell in the export markets was the domestic price minus an authorized export payment. The U.S. export price was a direct function of the price support level to the farmer and the amount of the export payment. These two decisions depend on U.S. government policies.

Due to the large U.S. government stocks and the policy of price supports the world price was not allowed to rise above that of the U.S. If foreign producers raise their prices above the U.S. price, the U.S. supply will enter the export market. In order for foreign producers to be able to export their cotton they must sell below the U.S. export price.

This situation can be visualized by a short-run model which is essentially the same used by Jon Coll (Coll, 1962, p. 6) (Figure 1). Curve X_{df} represents the excess foreign demand for U.S. cotton. The domestic support price for U.S. cotton is represented by line PD_{us}. The export price of U.S. cotton is lower than PD_{us} by the amount of the cotton export payment and is represented by line PE_{us}. This price, PE_{us}, represents the supply curve for the U.S. cotton available for exports. The U.S. subsidized price or supply curve will be perfectly elastic along this level of price until the limit of government stocks is reached. At this limit the supply curve becomes inelastic as only commercial carryover stocks are available for exports and, then, only at sufficient price incentives.

Under the above circumstances the U.S. effectively makes the market price for cotton. This condition holds as long as the excess foreign demand curve (X_{df}) intersects the U.S. supply curve in the horizontal region. On the other hand, if X_{df} were to the right of the horizontal

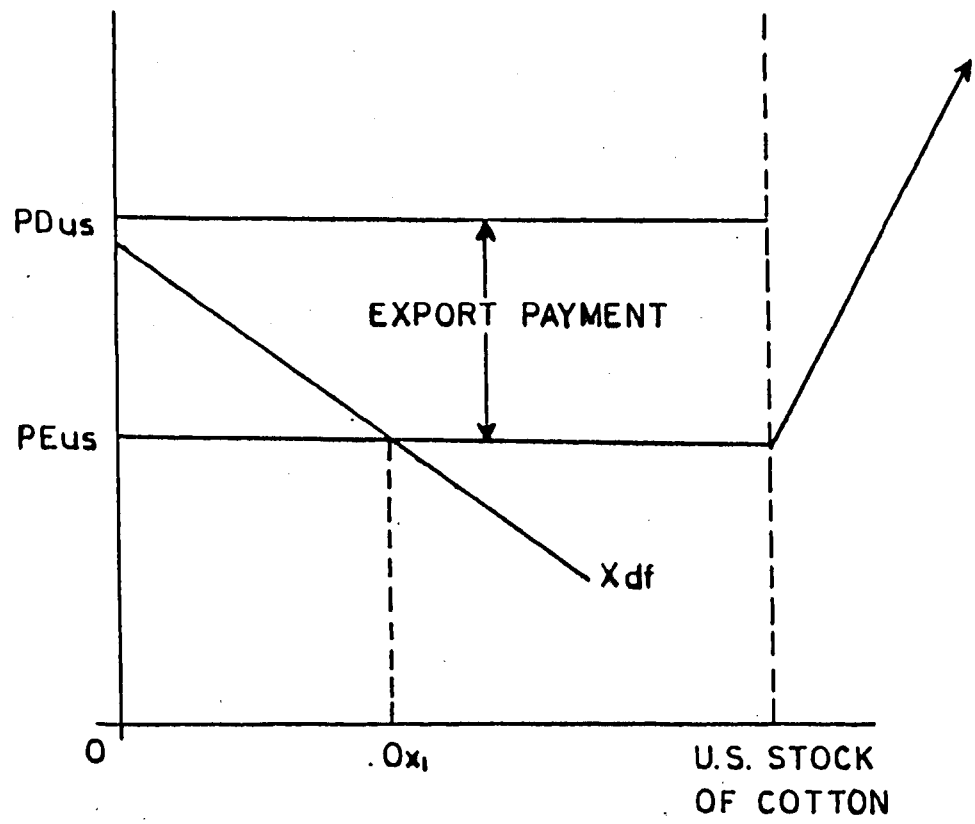

Figure 1. Model of the U. S. role as price maker in the world market for cotton.

region of the U.S. supply curve, this would mean that the U.S. did not have enough stocks to make the world price.

This situation is accentuated by the fact that all the foreign competitors, including Mexico, do not have the financial resources to hold their cotton until prices improve. In these circumstances foreign producers have to sell at prices effectively set by the U.S. "By selling below U.S. price when necessary foreign producers can assure themselves of a market for their production year after year" (Horne, 1960, p. 65). Because of this situation some authors argue that U.S. is the residual supplier of cotton to the world.

CHAPTER IV

MODELS USED IN THIS RESEARCH

Since this study concerns the study of the variability of the value of Mexican exports of cotton, the statistical concept of variance was used as the basis for analysis (Firch, 1964, p. 324). Percentage changes from year to year in the series of data represent the variability to be measured.

Model I: The Variability of the Sum of Two Series

This model is appropriate for the analysis of the variance when this is explained by the addition of the variance of series a plus the variance of series b.

It can be shown that the variance of the combined series (a+b) is a function of the variances of the individual series plus their covariance.

$$\sigma^2_{a+b} = \sigma^2_a + \sigma^2_b + 2\sigma_{ab} \qquad (1)$$

where σ_{ab} is defined as the covariance of (a) and (b) which is equal to

$$\sigma_{ab} = r_{ab}\sigma_a\sigma_b.$$

In this case r is the correlation coefficient between (a)

and (b). If we substitute this last term into Equation (1)

$$\sigma^2_{a+b} = \sigma^2_a + \sigma^2_b + 2r_{ab}\sigma_a\sigma_b \qquad (2)$$

the last two terms of Equation (2) represent the effect of (b) on the variance of series (a+b). The variance is always positive, therefore the first two terms will always be positive whereas the last term will be negative or positive depending on whether the correlation coefficient is negative or positive.

The effect of the variance of (b) on the variance of σ^2_{a+b} may be defined as the following equation.

$$S_{ab} = \frac{\sigma^2_b + 2r_{ab}\sigma_a\sigma_b}{\sigma^2_a} \qquad (3)$$

where S_{ab} is defined as the effect of (b) on the variance σ^2_{a+b} as a proportion of the variance of the series (a).

Series (b) will have a destabilizing effect when S_{ab} takes the following values.

$$S_{ab} < -1, \text{ or } S_{ab} > 0$$

If S_{ab} takes the following values,

$$-1 < S_{ab} < 0$$

series (b) will have a stabilizing effect. If S_{ab} is equal to zero, then series (b) will have no effect.

Model II: Allocation of Total Variance

The second model, a generalization of the first model, is useful in cases where more than two independent variables affect the dependent variable of the model. This model also allows the functional relation to be linear and stochastic rather than a simple sum. The linear function of the model is as follows:

$$X_1 = a + bX_2 + cX_3 + dX_4 + E \qquad (4)$$

where (e) is an error term which represents the effect of variables not included in the model.

The terms a, b, c, and d are the regression coefficients and are constant; X_1 is the dependent variable and X_2, X_3, X_4 the independent variables.

It can be shown that the variance of X_1 is a function of the variances and covariances of the independent variables included in Equation (4).

$$\sigma^2_{X_1} = b^2\sigma^2_{X_2} + c^2\sigma^2_{X_3} + d^2\sigma^2_{X_4} + 2bc\sigma_{X_2X_3} + 2bd\sigma_{X_2X_4} + 2cd\sigma_{X_3X_4} + \sigma^2_e. \qquad (5)$$

The information needed to allocate the variance as in Equation (5) is obtained from the least squares estimation of the regression coefficients b, c, and d of Equation (4).

The value of σ_e^2 may be obtained as the difference between the variance of variable X_1 and the first six terms on the right side of Equation (5).

Another way to compute the value of the variance of the error is to multiply the variance of X_1 by the complement of the coefficient of multiple determination.

We can transform Equation (5) into a new form in order to make it easier to read.

$$E_1 = E_2 + E_3 + E_4 + E_{23} + E_{24} + E_{34} + E_e. \qquad (6)$$

The measure of the effect of any of the independent variables upon the dependent variable can be computed using the followning formula:

$$Z_{14} = \frac{E_4 + E_{24} + E_{34}}{E_1 - (E_4 + E_{24} + E_{34})} \qquad (7)$$

where Z is the criterion of stabilizing or destabilizing effect of one of the independent variables upon the dependent variable, in this case variable number 4.

The critical values are the same as for the S value in Model I.

The Importance of the Trend

In order to compute the variance it is necessary to subtract the mean value from each observation. In this research the variance is measured around a trend which is the average net change in the series.

Regression analysis applied to first difference observations extracts the trend of the dependent variable as the constant term in the equation while the estimates of the regression coefficients are based upon fluctuations around the trend. These features are desirable in this analysis, since the year-to-year fluctuations around the trend should be of primary interest.

Length of Period for Variance Estimate

If we assume that the structure which generates the data remains constant the estimate of variance will improve as we increase the number of observations.

However, this analysis presumes that the relevant structure may have been changing over time, which implies that the estimate of variance will improve as the time period is shortened. The optimum balance between the conflicting goals of statistical reliability of the estimate and homogeneity of the structure must ultimately be resolved by an arbitrary choice of length of period.

A ten-year period, which involves nine year-to-year first differences, was chosen for the variance and regression estimates. The computations are performed in a manner analogous to the computation of a moving average.

CHAPTER V

ANALYSIS OF THE DATA

This chapter will analyze the sources and characteristics of economic variability in the Mexican cotton industry using the models developed in Chapter III.

Stability of Mexican Earnings From Cotton Exports

Because of the complex nature of the relationships, Model II was used to analyze the variance of the value of Mexican cotton exports.

More meaningful statements about the effects of U.S. cotton policies can be made if their effects are quantitatively measured.

This research considers three independent variables which are believed to be the most important variables in the U.S. programs: the commercial exports of the United States; CCC stocks; and exports under special programs, which include the financing of exports by the U.S. government under Public Law 480, the Export Import Bank, and Mutual Security Act.

The production of cotton in Mexico was also considered as an important internal cause of the variability of

the value of cotton exports. In this way the analysis allows for a cause not attributable to U.S. programs.

This study is confined to the period from 1946 to 1970 for two reasons. First, because Mexico only began to export cotton in considerable amounts after 1946. Before 1946, Mexico exported 200,000 bales only twice, and the average exports were around 60,000 bales. After 1946 Mexican exports moved from 204,000 bales up to the highest point in 1965 with 2,2 million bales. The other reason for beginning the period of analysis with 1946 is to avoid the variation due to World War II, often considered an abnormal economic period.

Dollars are used as the unit of measure in order to have a constant monetary unit since the peso was devaluated at the end of 1948, in 1949, and again in 1954. No price deflator was used because this study was not concerned directly with the actual purchasing power of the exchange earnings or terms of trade.

The value of Mexican exports of cotton was subject to violent fluctuations during the first decade (1946-1956) of this study, Figure 2sshows the amount of cash receipts from marketing cotton abroad.

From 1946 to 1951, the value of exports rose about 625 per cent. From 1951 to 1953 export earnings fell by about 15 per cent, but in the next two years the value of exports experienced another sharp increase. Thus, if we are

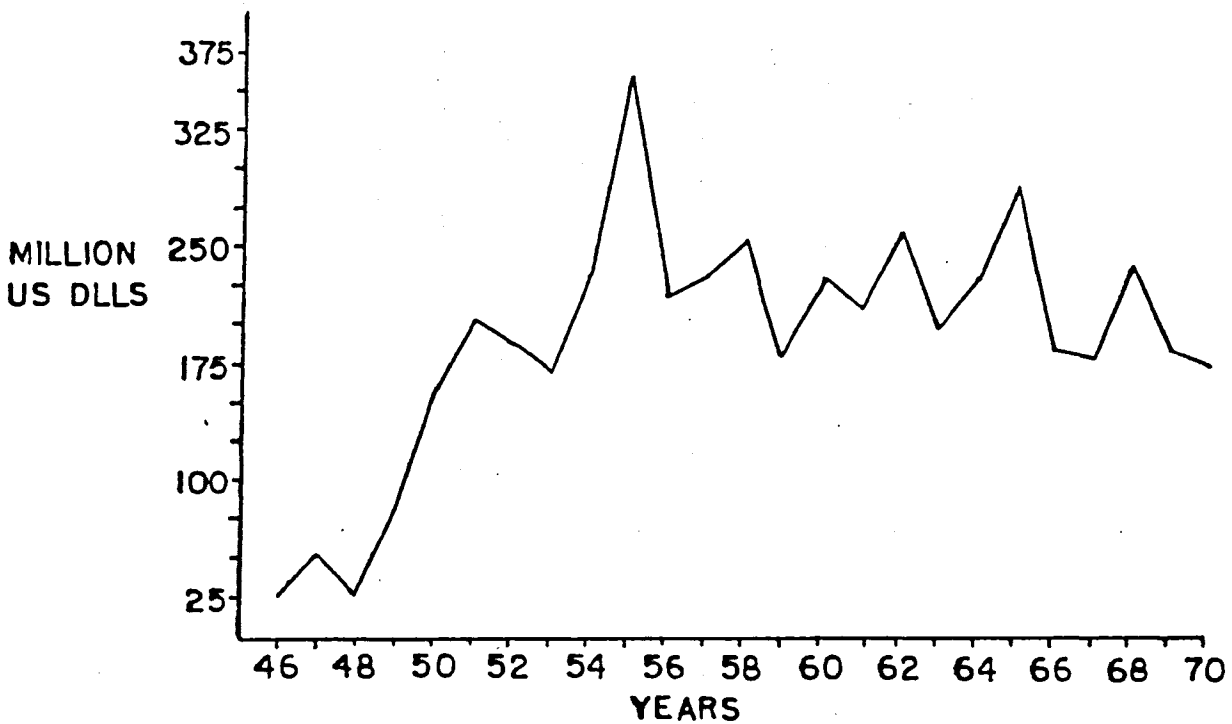

Figure 2. Value of Mexican exports -- Source: Table A.1.

to take 1953 as the base year, the percentage increase of the value of exports was 111 in 1955. The next year it fell lower than the 1954 level. During the period 1946-1955 Mexico experienced a spectacular upward trend in her export earnings, having only three years in which the value of exports decreased. The overall percentage increase in this period was 1,185 per cent; i.e., from 28 to 360 million U.S. dollars worth of cotton sent abroad. Mexico also experienced during this decade the sharpest yearly decline in export earnings in history. Earnings from exports of cotton declined from 1955 to 1956 by almost 40 per cent.

After 1956 the year-to-year fluctuations in export earnings were of lesser magnitude than in the previous decade. The drop in value of exports was never larger than 35 per cent and the upward fluctuations of the value of exports never exceeded 27 per cent.

In summary there seem to be three periods in the fluctuations in the value of Mexican exports of cotton. The period 1946-1955 was characterized by a very dynamic upward trend of the value of cotton exports. From 1956 to 1965 the trend was relatively more stable. From 1966 to 1970, the trend seems to decline, except in the year 1968. The year 1970 was an especially bad year, in which cash receipts from exports of cotton fell almost to the level of 1953.

The Variance of the Value of Mexican Exports of Cotton--1946-1970

Figure 3 shows the variance of the value of Mexican exports of cotton in terms of year-to-year percentage changes. The variance for a specific ten-year period is plotted for the year at the end of the period. Thus, for example, the value plotted for 1957 is the variance for the period 1948-1957, and the value plotted for 1958 is the variance for 1949-1958.

The overall direction of the trend in the variance of export earnings from cotton during the period studied seems to be downward. From 1946 to 1955 the variance around a strong upward trend in the value of Mexican exports of cotton is very high since this is the period which contains large increases in the value of exports. It is interesting to note that while one may suppose that this would be the highest variance experienced, to the contrary, in the period from 1947 to 1956 the variance is even greater, due to the fact that the most drastic decline in export value ever experienced in Mexico is included in this period.

During the next three periods, i.e., 1948-1957, 1949-1958, and 1950-1959, the variance around the trend declines drastically. The variance seems to be more or less stable during the periods 1950-1959 through and 1954-1963. As the drastic increases of the late forties and early fifties pass out of the period covered, the variance seems

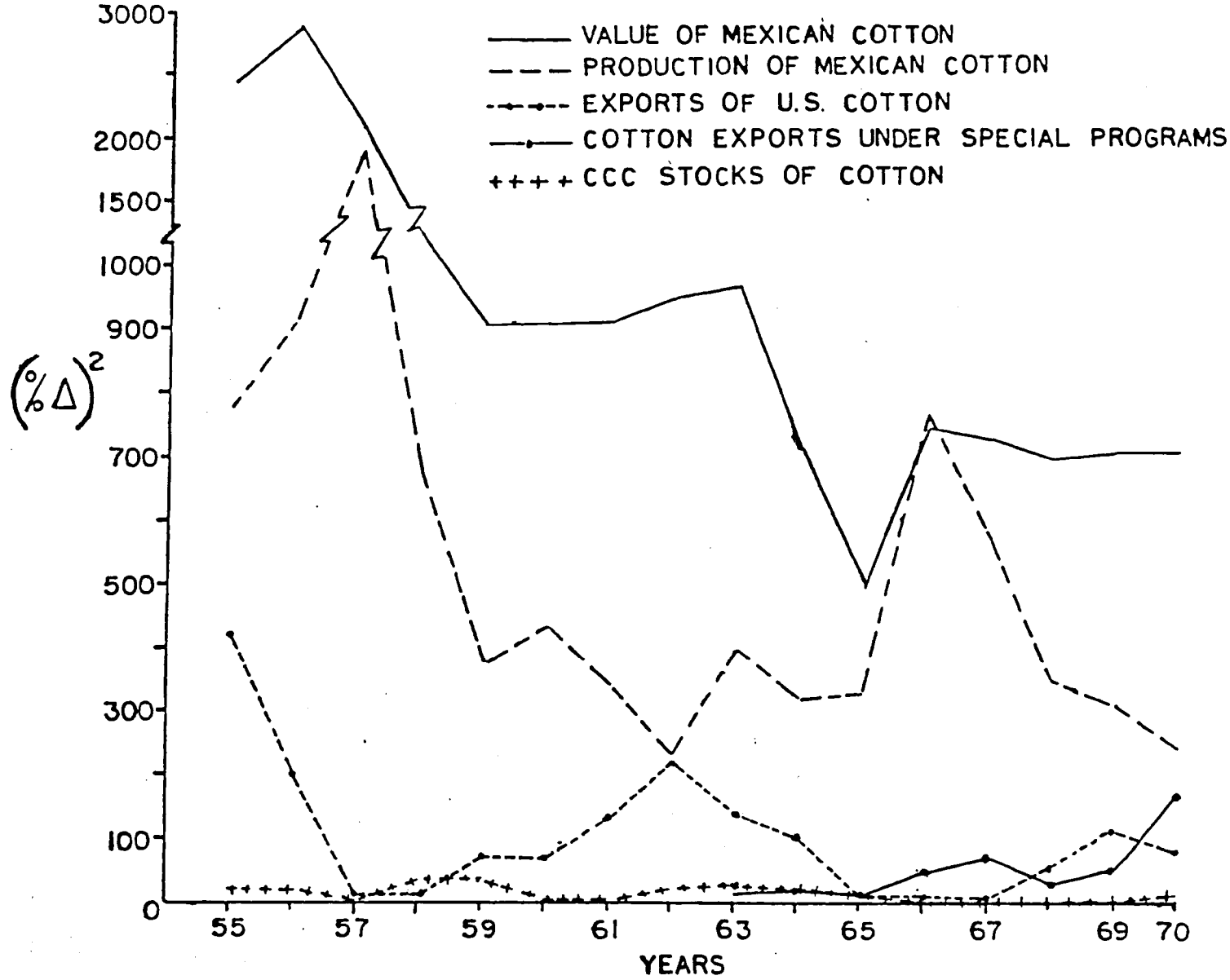

Figure 3. Variance of the value of Mexican exports of cotton and E values -- Source: Table A.2.

to stabilize between the 910 and 968 levels. The effects of the early fifties are felt on these periods; and the variance increases in the last two periods probably due to the highest increase and the highest decrease in the value of exports, which took place in 1955 and 1956, respectively, and the increase in the value of cotton exports experienced in 1962. The period ending in 1963 also includes the decline in the value of exports experienced that same year.

During the period of 1955-1964 the variance declines mainly because in these years the only big fluctuation is that of the decline of 1956. The period 1956-1965 is characterized by the lowest variance since it does not include any of the large fluctuations felt before 1955.

The variance went up again in 1957-1966 to a point higher than that reached in 1955-1964. From 1957-1966 to 1961-1970 the variance stabilizes around the 728 and 697 variance levels.

Explanation of the Variance of the Value of Mexican Exports of Cotton

It is thought that exports of Mexican cotton are very closely related to the production of cotton in the country, since two-thirds of the nation's cotton is exported to foreign markets. During the time period under study import markets have been opened to Mexican cotton under a number of barter trade agreements with Eastern and European countries.

The trend that exports follow for the entire period is similar to that of production; this may suggest that the level of exports is adjusted to production allowing for consumption and storage. In addition production may partly determine the variance of cotton export value because it is too costly both to the Mexican government and to private growers and exporters to store cotton until better prices can be obtained in the market. Therefore it is necessary to sell the quantity produced in any given year. Mexican exporters behave as price-takers in the world market, willing to sell at prevailing prices.

We can then hypothesize that fluctuation in cotton output may be a cause of instability in the value of Mexican cotton exports.

It has previously been suggested that U.S. and Mexican cotton trade are closely related; because both countries sell the same types of cotton to the same markets. Therefore, any change in U.S. cotton policy may cause a variation in the foreign exchange earnings from Mexican cotton.

One source of in tability derived from U.S. cotton policies could be changes in the quantity of cotton held by the Commodity Credit Corporation. The amount of cotton released or held may influence the export price of Mexican cotton.

There are two factors in addition to the CCC stocks that may cause instability in Mexican export earnings from cotton. Mexico and the U.S. are close competitors in the cotton import markets; therefore variations in commercial exports of cotton from U.S. would add instability to the cotton export earnings of Mexico. The inroads that the U.S. makes into the market may affect the quantity of cotton exported by Mexico.

The second determining factor contributing to the variance of export earnings is the special programs which are important because they include several marketing strategies not available to Mexico due to lack of financial resources. One indication of the strength of these strategies is the total disbursements of the Export-Import Bank. Asia was the major area benefitted by these loans, accounting for $803.4 million, 90 per cent of total disbursements.

Nearly all of the disbursements to this area represented credits and guarantees extended for exports of cotton to Japan, the most important market for Mexican cotton (United States Department of Agriculture, 1967, p. 16).

Equation of the Variance of the Value of Mexican Cotton Exports

It is the general consensus in developing economies that stability of export earnings is more desirable in

achieving economic goals than instability, especially if stability is achieved at an economically favorable level.

If stability of export earnings from cotton is considered an important goal of Mexican cotton policy, the effects of the U.S. programs and Mexican cotton production should be evaluated for consistency with that goal.

In light of the foregoing discussion the relationships regarding the explanation of the variance of the value of Mexican cotton exports is as follows:

X_1 = value of Mexican exports of cotton

X_2 = production of Mexican cotton

X_3 = commercial exports of U.S. cotton

X_4 = CCC stocks of cotton

X_{4a} = U.S. exports of cotton under special programs.

The above variables inserted into Equation (5) will read as follows: The total variance of the value of Mexican exports of cotton (VME) associated with the variance of production of Mexican cotton (PMC) is computed in the first term on the right side of the equation. The second term represents the variance of VME associated with the variance of exports of U.S. cotton (EUS). The total variance of VME associated with the variance of CCC stocks of cotton (CCC) is the third term on the right side of the equation.

All of these terms can only be positive since a variance is always positive and any regression coefficient squared will be positive. The fourth term in the equation

represents the total variance of export earnings associated with the covariance of EUS and PMC and is computed as twice the product of the two regression coefficients and the covariance of EUS and PMC.

The total variance of VME associated with the covariance of PMC and CCC is represented in the fifth term of the equation. The following term of the equation has a similar meaning with regard to the other variables under study. Variable X_{4a} which is exports under Special Programs (SP) was included in the model in 1963 and following periods because these programs were first applied in 1954.

Production of Mexican Cotton

A high proportion of the variance in VME seems to be associated with the variance of Mexican production for many of the 10-year periods. In the periods ending in 1955, 1956, 1957, and 1959 the proportion of the variance of VME associated with production is relatively high, especially during 1948-1957. In the decades of 1946-1955 and 1947-1956 the variance of the Mexican production of cotton explains about 31 per cent of the variance in VME. In the next decade the proportion of the variance in the VME explained by variation in Mexican production is even higher, reaching 90 per cent. During the next decades until the period ending in 1962 the proportion declines to only 25

per cent of the variance of the VME, which is the lowest level reached.

After 1962 the variance of the VME attributed to production increases until it explains almost 100 per cent of the variation in the VME, during the period 1957-1966. After the period ending in 1966 the importance of production as a factor of variation in export value declines to 33 per cent in 1970.

Commercial Exports of U.S. Cotton

Variation in U.S. commercial exports of cotton is less important as a factor explaining the variance in the value of Mexican exports of cotton than Mexican production in each of the 10-year periods studied. Only during the 1953-1962 period was the proportion of the variance in VME associated with U.S. exports as high as 25 per cent. It is interesting to note that in the same period (1953-1962) Mexican production of cotton explains approximately the same proportion as U.S. exports.

During this period PMC reached the lowest proportion, whereas U.S. exports reached the highest proportion of the variance of VME.

During the periods ending in 1957-58 and 1965-67 the proportion of the variance in VME explained by EUS is really nonsignificant.

One important thing that Figure 3 shows is that PMC and EUS move in opposite directions. When the proportion of the variance in VME explained by PMC is up, generally, the proportion explained by EUS is down.

CCC Stocks of Cotton

Variations in stocks of cotton held by the Commodity Credit Corporation are a very small source of variation in VME. CCC stocks are more important than EUS only during the period 1949-58. No major importance is attached to CCC stocks in explaining variation in VME outside that period. Furthermore, after the surplus export program was launched (1954), the stocks held by the CCC lost importance as an explanatory factor and show no meaningful association with VME whatsoever.

Special Programs

Public Law 480 and related programs are more important than EUS in explaining variance only during three periods. Since the inauguration of these programs, commercial exports of U.S. lost importance until the period ending in 1967. In that period and in the previous period, special programs are more important than EUS.

During the periods of 1959-68 and 1960-69 the proportion of the variance in VME associated with EUS is again higher than the proportion explained by the special

programs, but in the period 1961-70 special programs affected the variance of VME more strongly than EUS.

Measure of Stabilization

In order to learn whether the United States cotton policies have stabilized or destabilized the value of Mexican exports of cotton, Equation (7) was applied to each of the independent variables. Figure 4 depicts the variance of the VME in the upper portion.

The lower portion depicts the values of Z on a scale with a range from -2 to +6 for each variable during the 25 ten-year periods studied. Figure 4 represents two graphs in one, in order to facilitate interpretation of the results of the computations. The values of the lower graph can be converted into percentages. For example, during the decade of 1948-57 the PMC had a destabilizing effect of 400 per cent of what the variance of VME would have been if PMC had had a zero variance. If a Z value falls within the range of 0 to to -1 that veriable has had a stabilizing effect upon the VME. On the other hand, if the value is less than -1 or greater than zero it has had a destabilizing effect.

CCC Stocks of Cotton

The stocks held by the Commodity Credit Corporation have suffered very wide variations during the time span of this research. CCC stocks have fluctuated from almost nothing in 1947 and 1948 to almost 12.5 million bales in 1966.

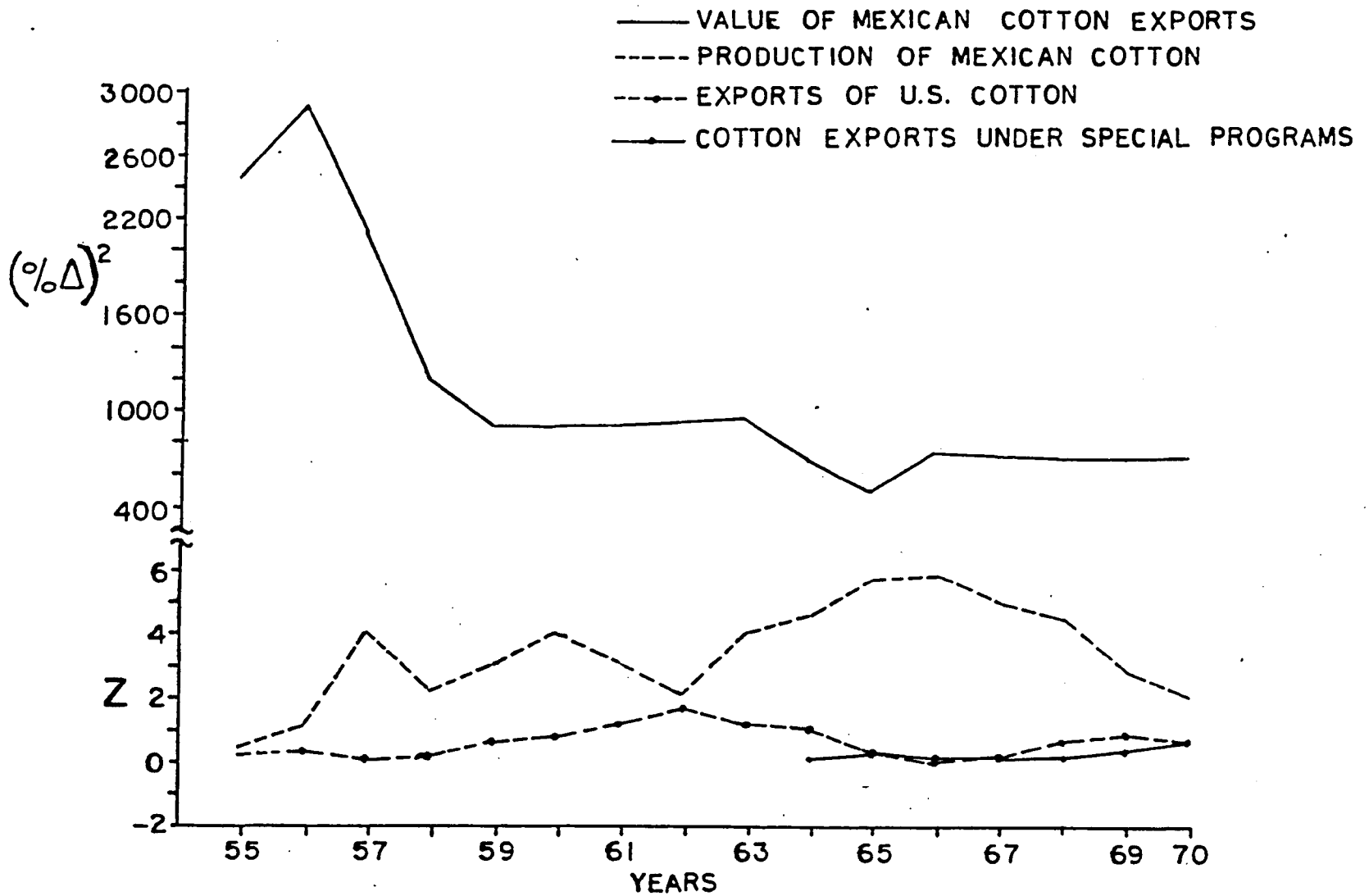

Figure 4. Variance of the value of Mexican exports of cotton and related Z values -- Source: Table A.2.

Even though this situation exists, variation in CCC stocks explains very little of the variance in the VME. The highest point reached by CCC stocks was during the decade of 1950-59, when it explained 4 per cent of the variance in VME. This lack of relationship between the CCC and VME explains the minor importance attached to CCC as a stabilizing or destabilizing factor of the VME. During the entire period CCC acted as a stabilizer during seven 10-year periods. The stabilization effect was so small that it was hardly felt. The highest stabilizing effect was 7 per cent during the decades 1954-63 and 1955-64. In other periods CCC was a destabilizing factor, but the destabilizing effect was never higher than 21 per cent, which is very low when compared with the destabilizing effect of MPC or EUS.

Special Export Programs of the United States

Public Law 480 and related programs are more important than CCC stocks of cotton in explaining the variance of the VME. Since SP contributes more than CCC to the variance of the VME, it is expected that the former will be a greater stabilizing or destabilizing effect than the latter upon the VME. SP had no importance during the first two periods in which they were in effect throughout the periods. This variable did not even reach the 1 per cent level during 1954-63 and 1955-64. The third ten-year period indicates a destabilizing effect of 18 per cent. During the next two

periods, 1957-66 and 1958-67, the SP stabilized the VME relative to what it would have been with zero variance of SP, by 1 and 5.7 per cent respectively.

After these stabilizing periods the SP became a destabilizer, reaching the highest point during the decade 1961-70 with a 61 per cent destabilizing effect.

It is interesting to note that SP gained importance as a destabilizer during this decade since the destabilizing effect of EUS is lower by 2 points. This may be an indication of the importance that SP had in world cotton trade during the last decade. Although the proportion of the variance of the VME associated with SP is greater than EUS during three decades, SP is a stronger destabilizer than commercial exports of cotton of the U.S. in only one period.

United States Commercial Exports of Cotton

The fact that the proportion of the variance in VME explained by PMC goes up as the proportion explained by EUS declines, does not necessarily mean that one acts as a stabilizer and the other as a destabilizer. The plotted index Z on Figure 4 hows that PMC and EUS are both destabilizers, the former with more intensity than the latter.

The commercial cotton exports of the U.S. are the second most important factor contributing to the instability of VME among all the factors considered. It is the most important among the variables representing the U.S. cotton

policies. During the entire period of this research EUS was ranked higher than CCC and SP, with the exception of the decade of 1961-70 in which SP superceded EUS by 2 points. EUS had two stabilizing periods, but again, the stabilizing intensity was very small; during the decade 1948-57, EUS had a stabilizing effect of 8 per cent, and in 1957-66 a stabilizing effect of 13 per cent.

The most interesting period of analysis is that of 1953-62 during which the EUS explained about 25 per cent of the variation in the VME. During this period the EUS had a destabilizing effect of 164 per cent, which is the highest in the entire period of the study. The decades ending in 1961, 1962, and 1963 also showed a very high destabilizing effect on VME, with 108, 113, and 106 per cent destabilizing Z levels, respectively. During these periods, including 1953-62, the U.S. had strong fluctuations in its commercial exports of cotton.

From 1953 to 1954 commercial exports declined almost fifty per cent, and this decline was reflected in the volume of cotton exported under government financed programs. Nevertheless, commercial exports decline sharply again the following season, from almost 2 million bales to 720,000 bales. The next season, 1955-56, EUS jumped to more than 5 million bales. From 1958 to 1959 the U.S. increased its exports from 1.1 million to close to 6 million bales under commercial trade.

During the same decades the variance in VME was increasing at a very low rate. It is very likely that the variance in VME would have been lower if those violent fluctuations in EUS had not taken place. One indication to support this idea is that the variance in VME decreased as the variance in EUS decreased significantly in the next two periods, 1955-64 and 1956-65, while the proportion of the variance in VME associated with PMC during this period remained almost the same. The Z index for EUS went down during these two decades, indicating that the destabilizing effect of U.S. commercial exports was smaller than in earlier decades and the variance of VME tended to decrease during this time while the Z value for PMC was increasing.

During the decade 1957-66 the Z value of EUS moved into the stabilizing range as it affected the variance of VME. After this period the EUS had a destabilizing effect of minor importance while the Z index fluctuated within the 5 to 83 per cent range.

Thus commercial exports of the U.S. have become a less important destabilizing factor relative to PMC during the last 6 ten-year periods.

Production of Mexican Cotton

The Z value for PMC plotted on Figure 4 indicates the destabilizing effect that this factor had upon the variance of VME. PMC is the factor that contributed most to

the instability of the VME among all the factors studied. The Z value for PMC was never lower than that of any of the other factors throughout the periods studied. It never had a value of zero or less than zero. PMC therefore never contributed to the stabilization of the VME; it was always a destabilizing factor.

It is interesting that during the first decade the PMC contributed very little to the instability of VME. The Z value for this period was .40, which means that PMC increased the variance of VME by 40 per cent over what it would have been if the variance of PMC had been zero. This value appears to be relatively low when compared with the rest of the ten-year periods. An explanation to this low percentage of variance attributed to PMC may be that prices and quantity exported were more unstable during this period. However, in later periods, when prices became more stable, the quantity of cotton produced in Mexico gained importance as a destabilizing factor.

Thus during three decades, 1948-57, 1951-60, and 1954-63, the Z value attained by PMC was 400 per cent.

During the decades from 1950-59 to 1954-63, the Z value fluctuated between 300 and 400 with the exception of 1953-62 in which the PMC Z value was reduced to the 210 per cent level. It is during this period that the variance in VME became stable around the 940 level. The total variance in VME probably did not decline in the period of 1953-62

because the destabilizing effect of EUS was strongly felt during that decade. The Z value for EUS was the highest for the entire period, reaching the 164 per cent destabilizing effect. After 1953-62 the Z value for PMC increases constantly from the 400 per cent level in 1954-63 to the 580 per per cent level in 1957-66, which is the highest level attained by this variable.

It is interesting that from 1954-63 to 1956-65, the variance of the VME declines while the destabilizing effect of the PMC factor increases. It is probably due to fluctuations in prices and quantities exported as well as to the decreasing Z value of EUS. After 1957-66 the Z value constantly declines, and the variance of the VME remains stable at around the 748 variance level. The decreasing Z value for PMC may have been counteracted by the increasing Z value of EUS and SP; and these combined factors may have caused the variance to remain fairly stable at the 748 level.

In summary, the analysis shows that production of cotton in Mexico is the most important single factor contributing to the instability of the value of Mexican exports of cotton.

CHAPTER VI

ANALYSIS OF THE VARIABILITY OF THE VALUE OF MEXICAN COTTON EXPORTS AS RELATED TO VARIABILITY OF PRICE AND QUANTITY OF EXPORTS

The variation of the value of Mexican cotton exports (VME) is fully explained by two directly related factors: the Mexican export price of cotton (MEP) and the volume of Mexican cotton exports (MEQ).

$$VME = (MEP)(MEQ)$$

Given this relationship the variance of VME will be explained by the variance in price plus the vari nce in quantity exported (Figure 5).

Model I was used to explain the variability of the value of exports:

$$\sigma^2_{VME} = \sigma^2_{MEP} + \sigma^2_{MEQ} + 2\sigma MEP, MEQ.$$

During the entire period studied the proportion of variation of VME explained by MEQ was much higher than that explained by MEP. It is interesting to note that this result is in accordance with the findings of the United Nations study mentioned earlier. This study found that variations in volume of exports contributed more to the instability of foreign exchange earnings from primary

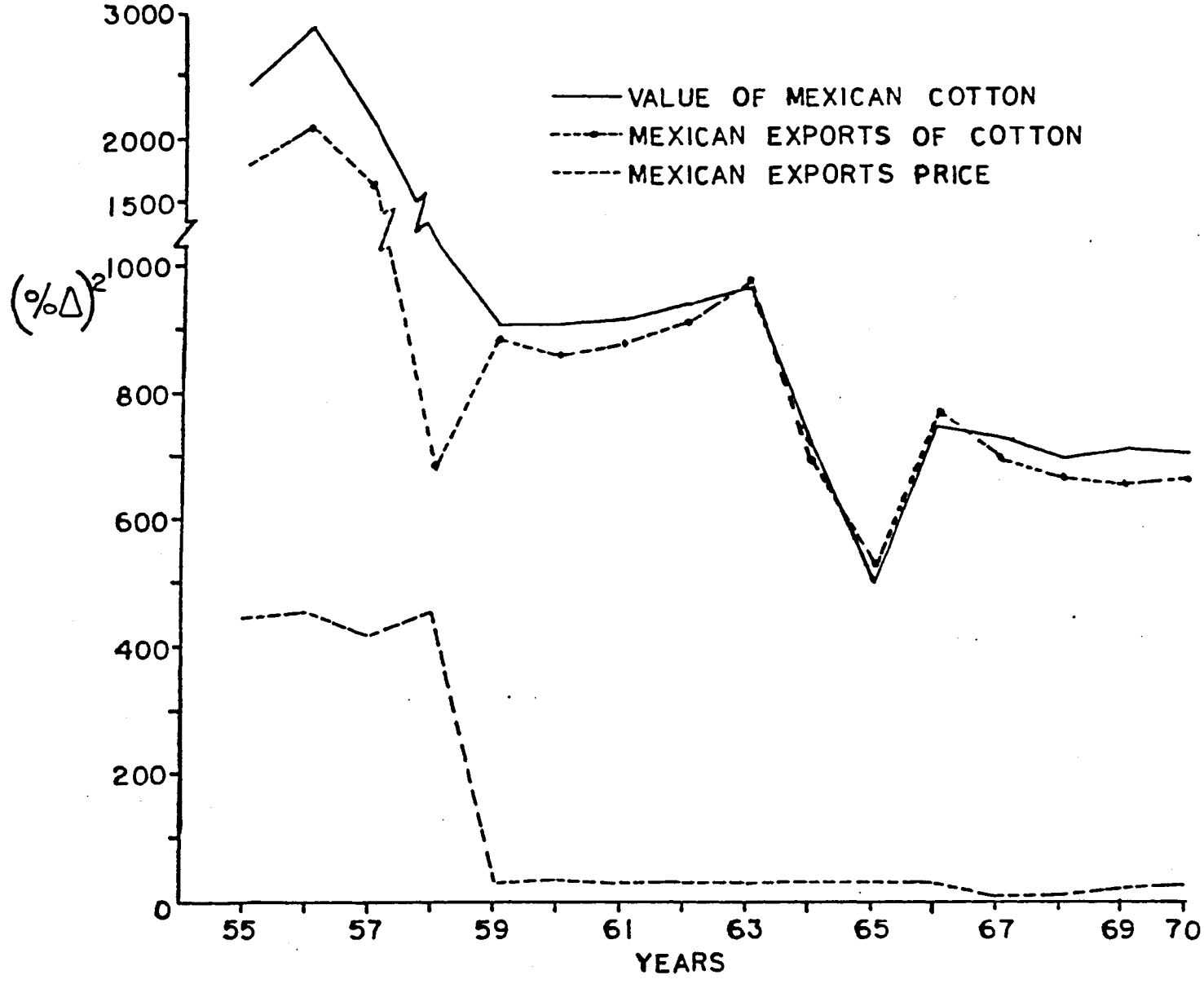

Figure 5. Variance of the value of Mexican exports of cotton and related E values -- Source: Table A.3.

commodities than the variation in price. In our analysis variations in quantity exported had an average contribution of 85 per cent to the variability of foreign exchange earnings from cotton; whereas variations in price contributed on the average only 15 per cent.

During the decades ending in 1955 through 1958, MEP stabilized between the 418 and 461 variance levels, explaining 18 per cent of the variation in VME. After the decade 1949-58 the export price of Mexican cotton contributed very little to the variance of the VME. Since the variance in MEP declined and remained stable through the rest of the period between 12 and 35 variance levels. These variance levels of MEP are very low when compared with the lowest variance level reached by MEQ in 1956-1965.

Since we know the effects of the variability of price and volume of exports on the variability of the value of Mexican earnings from cotton, it remains to analyze the variables which affect these two elements of VME. First, the Mexican export price will be analyzed as a function of the United States export price, the CCC stocks, and world consumption of cotton. The last mentioned variable will indicate the effects of factors not directly related to the U.S. cotton policy upon the Mexican export price.

Secondly, the United States export price, volume of cotton exported, special programs, and the production of cotton in Mexico as determinants of the variation in the

volume of Mexican cotton exports will be analyzed. Lastly, production of Mexican cotton will be analyzed as a function of the U.S. export price, the U.S. production of cotton, and the CCC stocks.

Export Price of Mexican Cotton

Figure 6 shows the trends of the U.S. price (USP) and the Mexican export price (MEP) at Liverpool, England. During the period 1946-70 the realized price for Mexican cotton was below the U.S. price in most years. There are only two exceptions, during 1956 and 1968 Mexico sold on the average at higher prices than the United States.

Prior to 1951 Mexico sold its cotton at higher prices than the United States only once, and from 1946 to 1949 Mexico obtained the lowest prices during the period under study.

As shown in Figure 6 the general trend of prices is downward since 1950. This trend may be due to several causes; the strong competition of man-made fibers, the over-production of cotton in the world during the late 1950's and early 1960's, and the possibility that the United States is losing its strong position as price maker, since its production has dropped from the level of the 1950's and early 1960's.

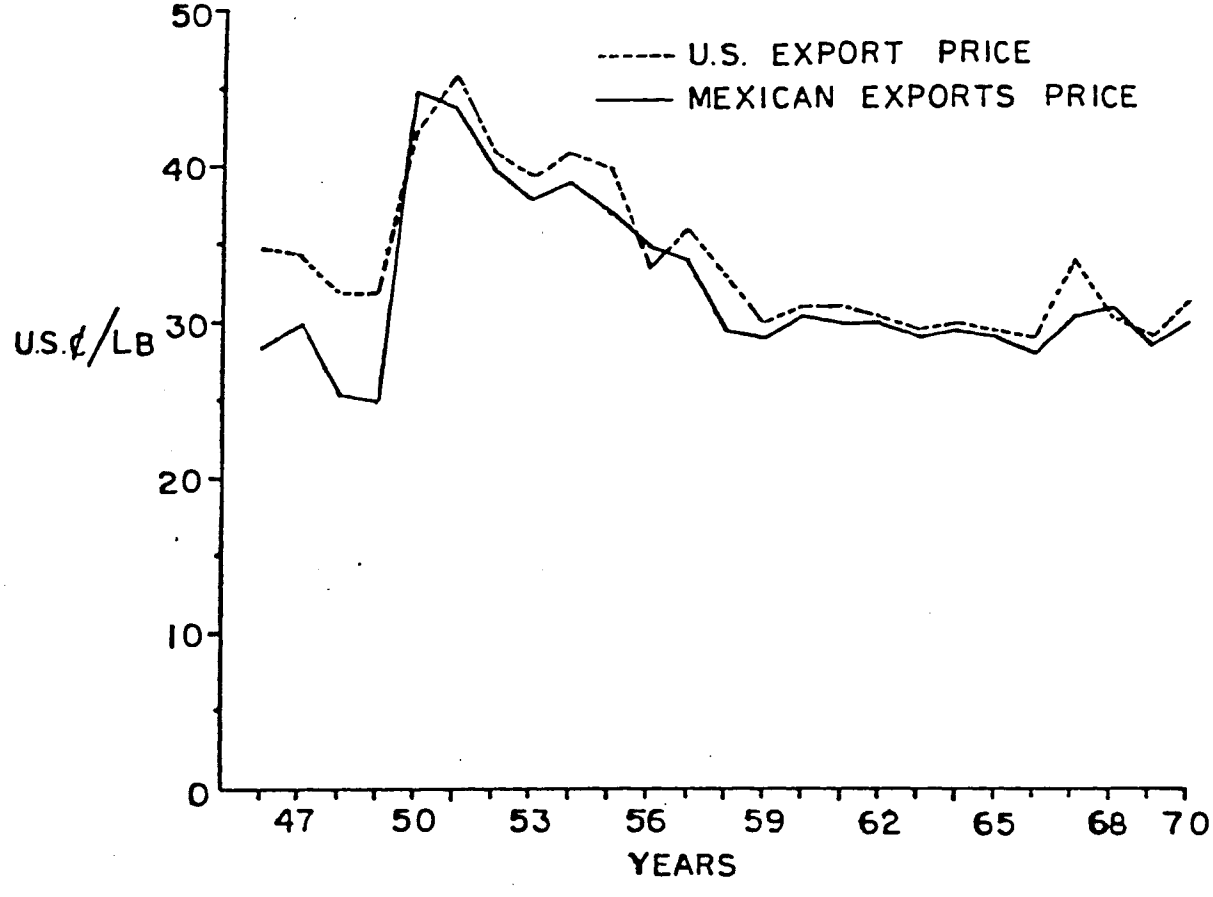

Figure 6. Price of U. S. and Mexican cotton at Liverpool, England -- Source: Table A.1.

Explanation of the Variance of the Mexican Export Price of Cotton

The Mexican price of cotton quoted at Liverpool, England, is subject to fluctuations due to many factors; among them, price of man-made fibers, the U.S. cotton policy, and world consumption of cotton. The focus in this analysis is on the effect of the U.S. cotton policy on the price of Mexican cotton. The explanatory variables used were the export price of U.S. cotton and the level of the cotton stocks at the Commodity Credit Corporation. Both variables are direct consequences of the United States cotton policies.

In this analysis world consumption of cotton also appears as a determinant of the Mexican export price. This will permit the analysis of factors not directly derived from U.S. cotton policy. Since the relationships among these factors were explained earlier this report will now turn to the statistical analysis of the data.

As shown in Figure 7 the variance of the Mexican export price was very high during the first ten-year periods of the total period under study. During these periods Mexico obtained the highest and lowest prices. The lowest average price was obtained in 1949, when the average price per pound of cotton was 25.11 cents. The next year the price of Mexican cotton was 44.83 cents a pound, the highest

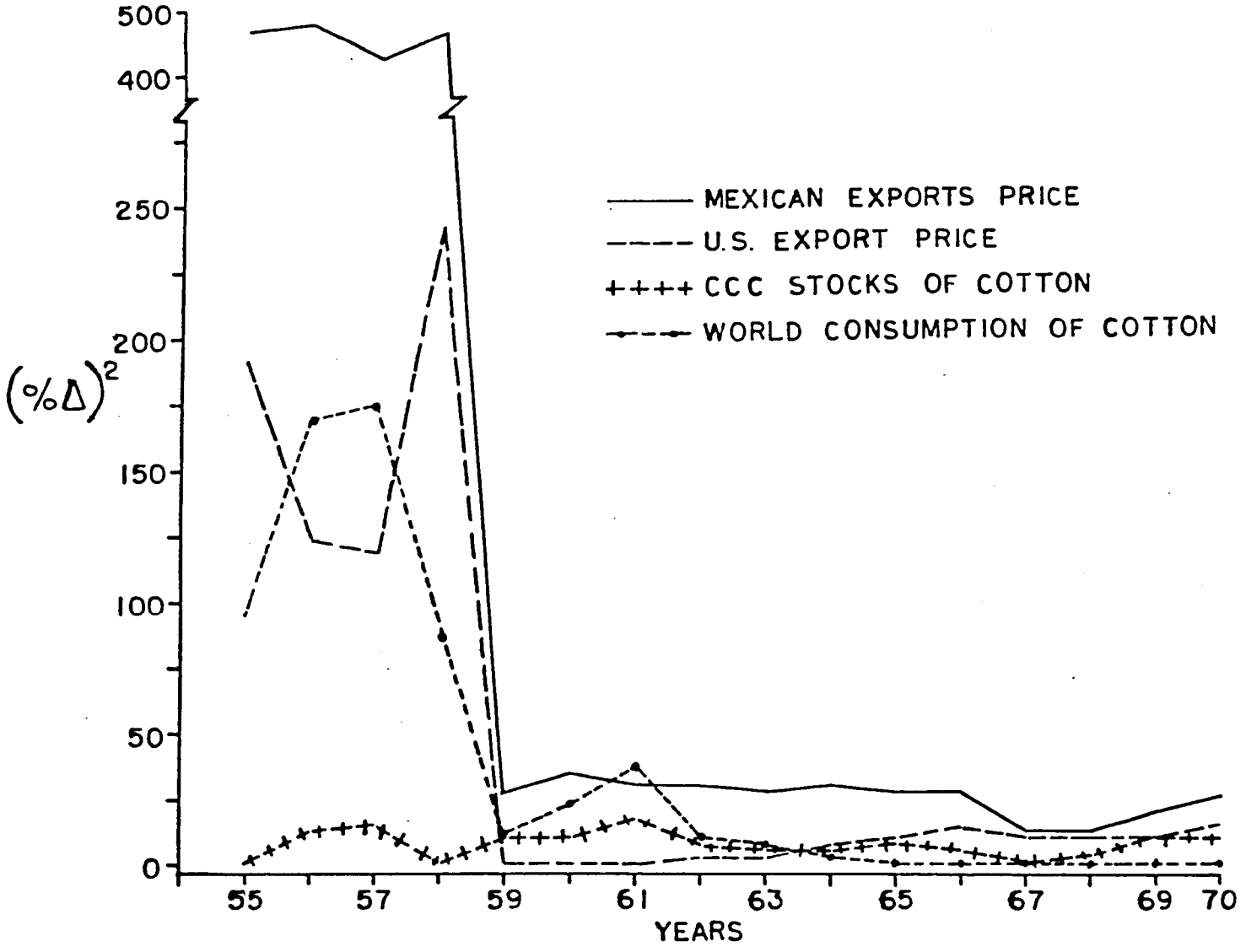

Figure 7. Variance of Mexican price and related E values -- Source: Table A.4.

price ever obtained by Mexico. In that year the U.S. price at Liverpool was 42.58 cents a pound.

The price range for Mexican cotton during these first four periods was 19.72 cents. After those periods of strong variability, the export price of Mexican cotton stabilized between the 36 and 12 variance levels, with an average of 17. This is very low when compared with the variance levels betwee 432 and 477, with an average of 462, experienced during the first four periods.

The range in prices in 1950-59 was 15.62 cents but the variance declined drastically. During 1951-60 the range becomes 14.42 cents and the variance was 36. After these periods the range becomes very small. During 1958-67 it was 2.41 and the variance was 12. The rest of the periods show a range of 2.70 and a variance between 12 and 24.

Since the United States was the price maker in the world trade of cotton the rest of the countries producing cotton receive prices closely related to the U.S.

The Mexican price trend in Figure 6 follows closely that of the U.S. price. Therefore, we may postulate that one of the contributing factors to the variability of the Mexican price is the export price of U.S. cotton fixed by the U.S. Department of Agriculture within constraints established by the U.S. Congress.

Figure 7 shows the variance of the Mexican price and the variation explained by the U.S. price. This factor

contributed a large proportion of the variation of the Mexican price during the decades ending in 1955, and 1958. The proportion of variation in the Mexican price related to the variation in the U.S. price was approximately 41 per cent during the period ending in 1955 and 52 per cent for the decade ending in 1958. It is interesting that during the periods ending in 1956, 1957, and 1959 through 1963 variation in the world consumption of cotton was responsible for a greater percentage of variation of the Mexican price than the variation of the U.S. price or CCC stocks. The average proportion explained by world consumption was 57 per cent and that of the U.S. price was 1.7 per cent. A small part of the remaining variation of the Mexican export price was related to variations in the level of CCC stocks.

During 1955-64 through 1961-70 the U.S. price variation is again the factor which contributes to the variance of the Mexican price. World consumption of cotton became less important after 1955-64. After this decade the contribution of this factor ranged between the 3.4 and 0 variance levels.

It is interesting to note that before a real step was taken by the United States toward solving its domestic farm problem, the variation in the price of the Mexican cotton was explained in greater proportion by variations in the consumption of cotton throughout the world. The two exceptions to this situation are the decades of 1946-55 and

1949-58. This may be attributable to the very wide fluctuations in price during the years of 1949 to 1951, when the United States encouraged production of cotton with high prices.

After 1954, when the Public Law 480 program was launched, the export price of the United States cotton started to gain relative importance in determining the variance of the Mexican price. From 1955-64, when this program had been in effect for ten years, the U.S. price had become the most important factor contributing to the variance of the Mexican price. The second factor which explains the variation of the Mexican price is the level of the variation of the CCC stocks. This factor became more important in explaining the variation than the world consumption of cotton in the 1955-64 period.

The proportion of variation in the Mexican price explained by the U.S. price and the CCC during 1955-64 to 1961-70 were 53 and 30 per cent, respectively. The rest of the variance in the price is explained by the variation of the world consumption of cotton, other variables, and their covariances.

Measure of Stabilization

Figure 8 shows the stabilizing or destabilizing effects of the U.S price, the CCC stocks, and the world consumption of cotton on the Mexican cotton price in Liverpool.

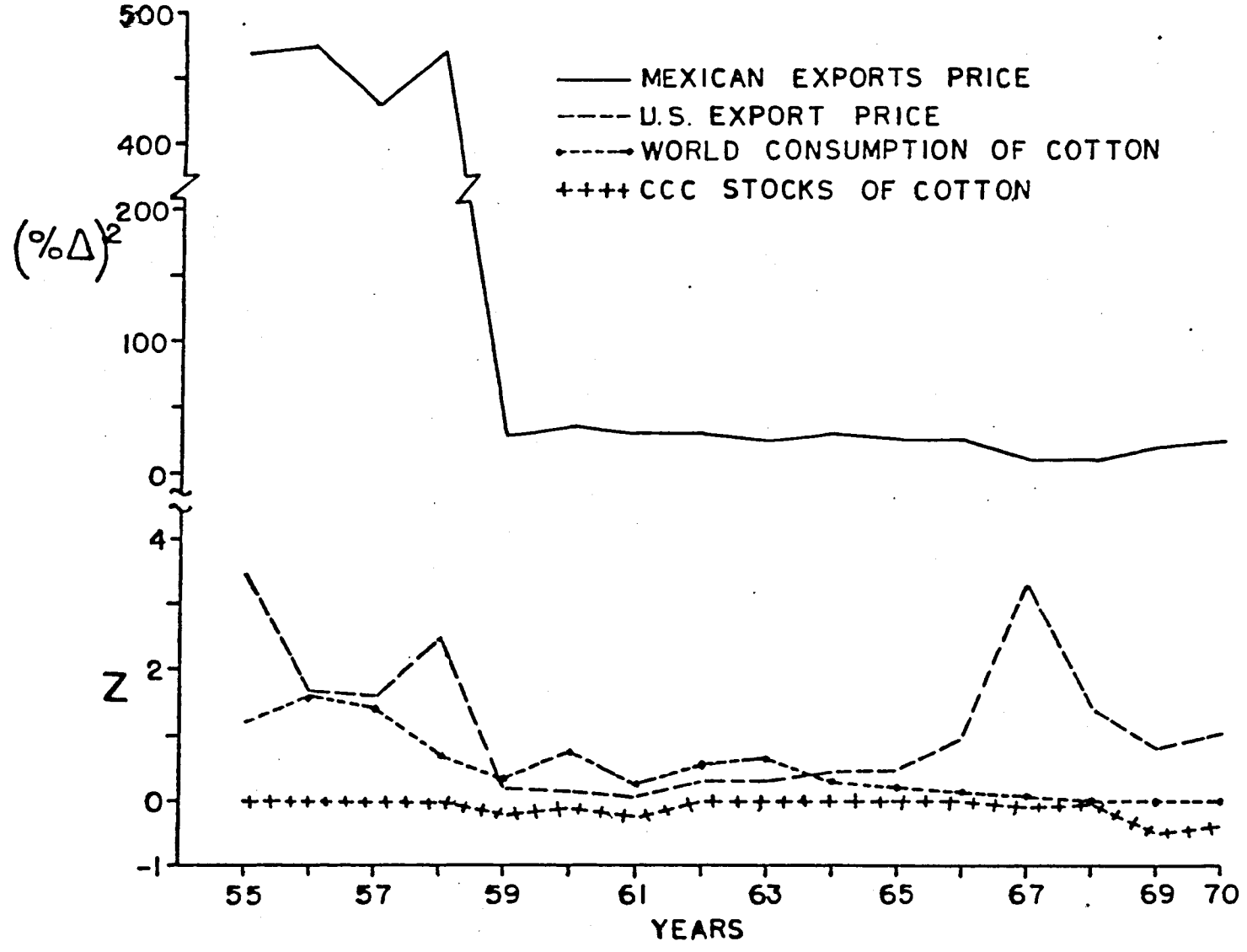

Figure 8. Variance of Mexican price and Z values -- Source: Table A.4.

The United States price of cotton contributes to the instability of the Mexican price during every 10-year period studied. The average contribution of the USP to the instability of the MEP was 116.5 per cent of what the variance would have been if the variance of USP had been zero. During the decade of 1946-55 the variance of USP increased the instability of the Mexican export price by 350 per cent.

After the decade of 1949-58 the USP lost importance as a destabilizing factor of the MEP. During the decades from 1950-59 to 1956-65 the average contribution of the USP to the instability of the MEP was 2.8 per cent. After the Public Law 480 program was launched in 1954 the variance of USP became a substantial contributor to the instability of the MEP. During the periods following the launching of P.L. 480 the destabilizing effect of USP increased to a peak during the 1958-67 period. This effect diminished thereafter but remained at a level well into the range of destabilization factor.

During the early 10-year periods analyzed the variation of world consumption increased the variance of MEP by more than 100 per cent of what it would have been if the variance of world consumption had been zero. The degree of destabilization of world consumption trends downward until it is neither stabilizing nor destabilizing in the last four periods studied.

The effect of variation of CCC stocks has been either neutral or stabilizing in its effects on the Mexican price in various 10-year periods. Without the effect of the CCC stocks the Mexican price would have been more unstable. The releases and holdings of cotton by the CCC is the only factor contributing to the stability of the Mexican price especially during the the 1960-60 and 1961-70 periods.

Variance of Mexican Exports

Among the many factors that influence the variability of Mexican cotton exports the most important is the level of cotton production in Mexico (PMC). Variations in export quantity are directly related to the production of cotton in the country as shown in Figure 9. Among the external variables studied were the exports of cotton from the United States (EUS), the special programs financed by the U.S. government, and the price of U.S. cotton at Liverpool.

In the period 1946-70 the internal factor of production levels explained almost half the variability in exports. Only during two ten-year periods was the proportion of variation in exports explained by production lower than that of U.S. cotton exports (Figure 10).

EUS explained 14 per cent of the variation of Mexican exports during the sixteen ten-year periods. The rest of the variation may be explained, among other factors, but the special programs and the price of U.S. cotton. It

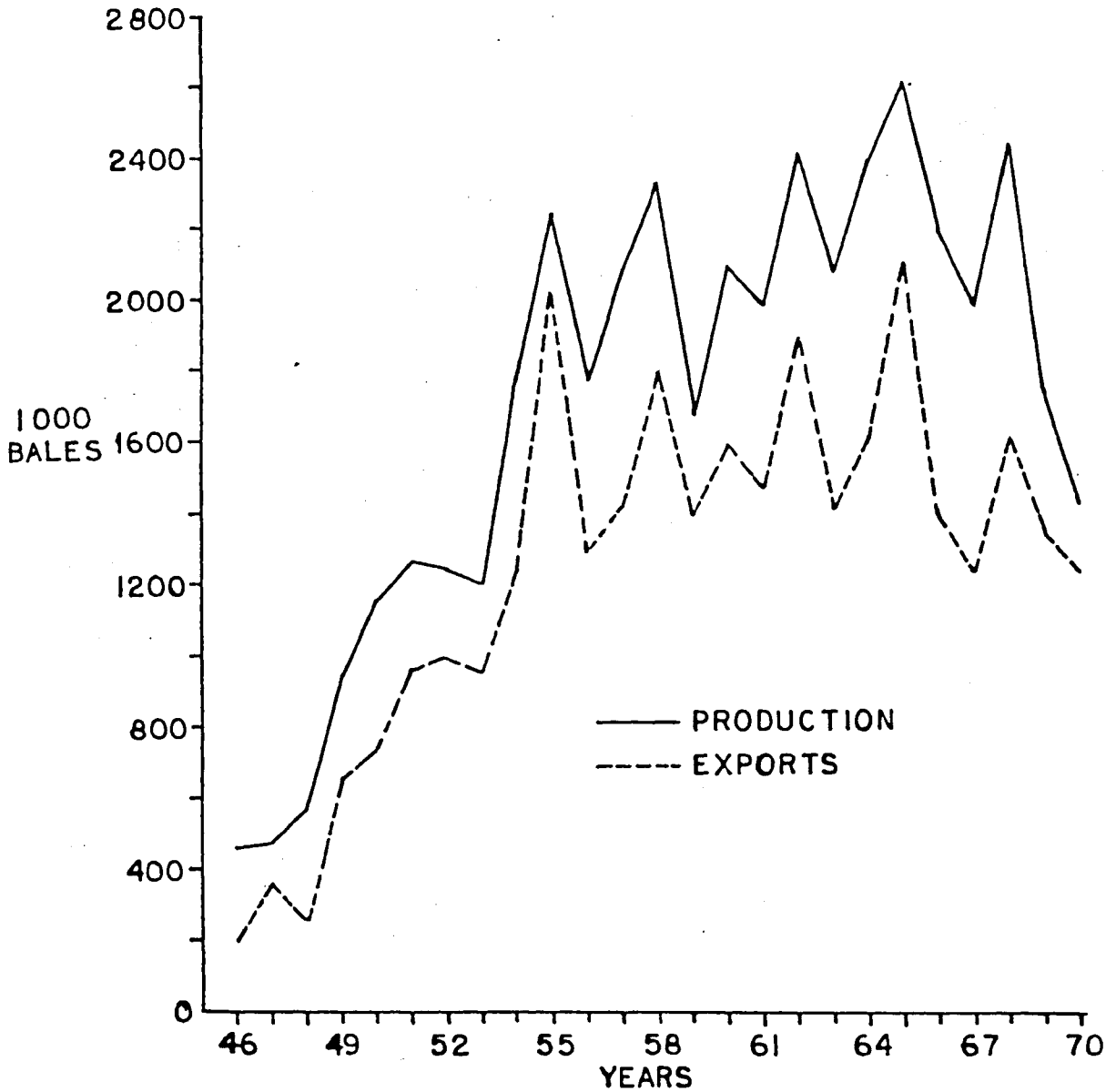

Figure 9. Mexican production and exports of Cotton -- Source: Table A.1.

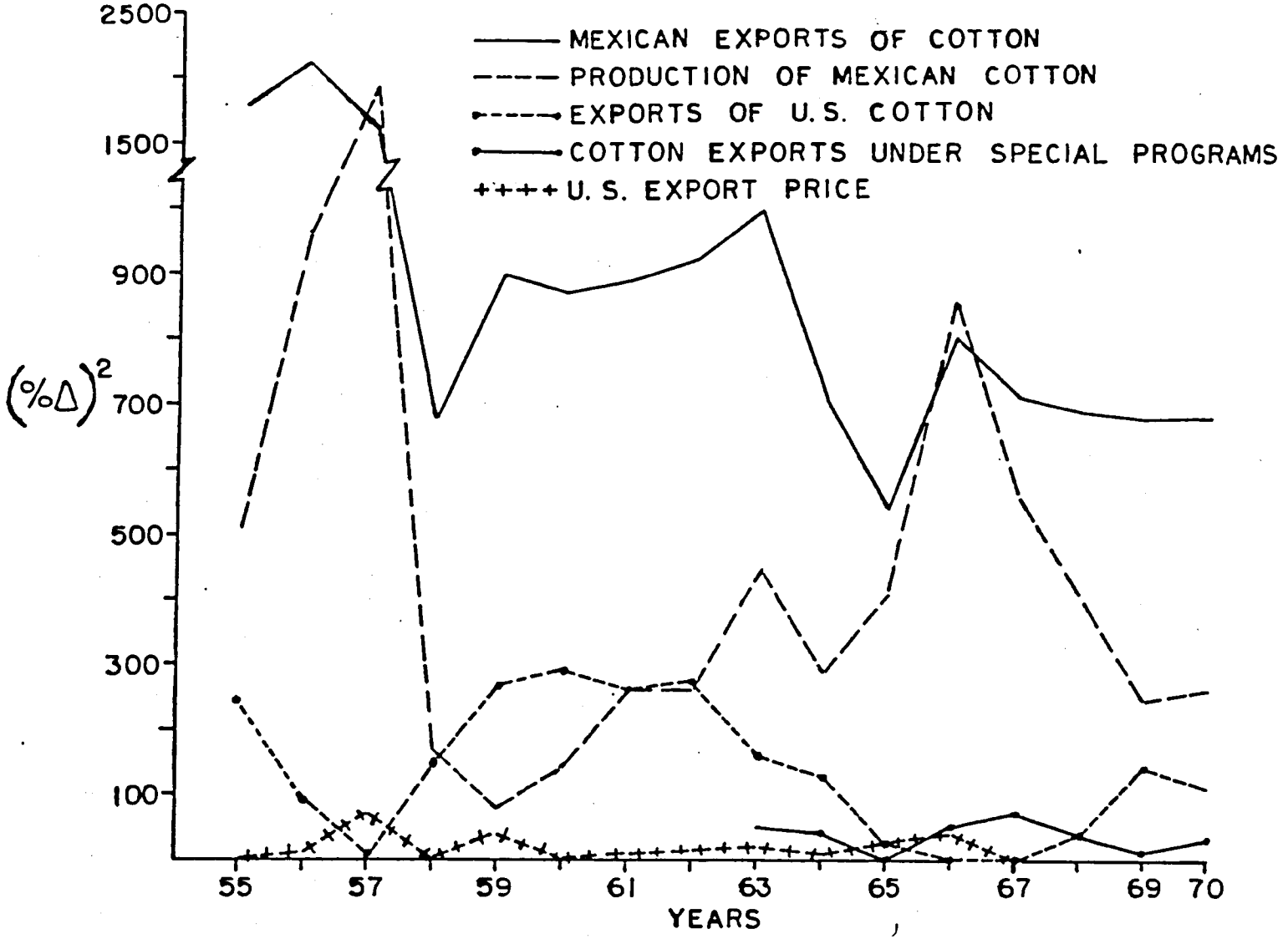

Figure 10. Variance of Mexican exports and related E values -- Source: Table A.5.

is interesting to note that the U.S. price never was an important factor in explaining variations in Mexican export levels.

After the inception of the special programs, they remained more important than the U.S. price except during period 1956-65. During 1957-66 and 1958-67 special programs contributed more to the variation of Mexican cotton exports than U.S. cotton exports, and in 1959-68 these two factors contributed about equally to the variation of Mexican exports of cotton.

There was no attempt to measure the effect of stability or instability of these factors upon the export of Mexican cotton because by looking at Figure 3 one may conclude that these factors affect Mexican exports of cotton in the same way as the value of Mexican cotton.

This results because VME is the product of exports of Mexican cotton multiplied by the price of Mexican cotton at Liverpool, and the price has been far more stable through the years than quantity exported. Therefore the stabilizing or destabilizing factors of VME and Mexican cotton exports must be essentially the same.

One general conclusion is that production of Mexican cotton is the factor that has the greatest affect on Mexican exports of cotton. It was concluded earlier that production is the factor that most affected the value of Mexican cotton. Looking at both exports and value of Mexican cotton, it can

be seen that the price of Mexican cotton is not a strong factor contributing to the variability of the exchange earnings from exports of cotton.

Variance of Production of Mexican Cotton

Production of cotton by Mexican farmers is the factor that contributes most to the variability of exports of cotton from Mexico. Exports of cotton in turn is the factor that contributes most to the variability in exchange earnings from sales of cotton abroad.

It is of interest to know how the United States cotton policy contributes to the variability of the value of Mexican exports of cotton. Since it was found that none of the factors derived from that policy directly contributes to the variability of foreign exchange earnings as much as they do to the production of Mexican cotton, the analysis will now focus on how that policy affects the value of Mexican exports indirectly, through its effect upon the production of cotton in Mexico.

In order to measure the effect of U.S. policy upon Mexican production (PMC) three variables directly related to that policy were analyzed: the Commodity Credit Corporation stocks (CCC), the United States price (USP), and the production of cotton in the United States (USO).

Figure 11 depicts the variance levels of PMC associated with the four variables. The CCC had the highest

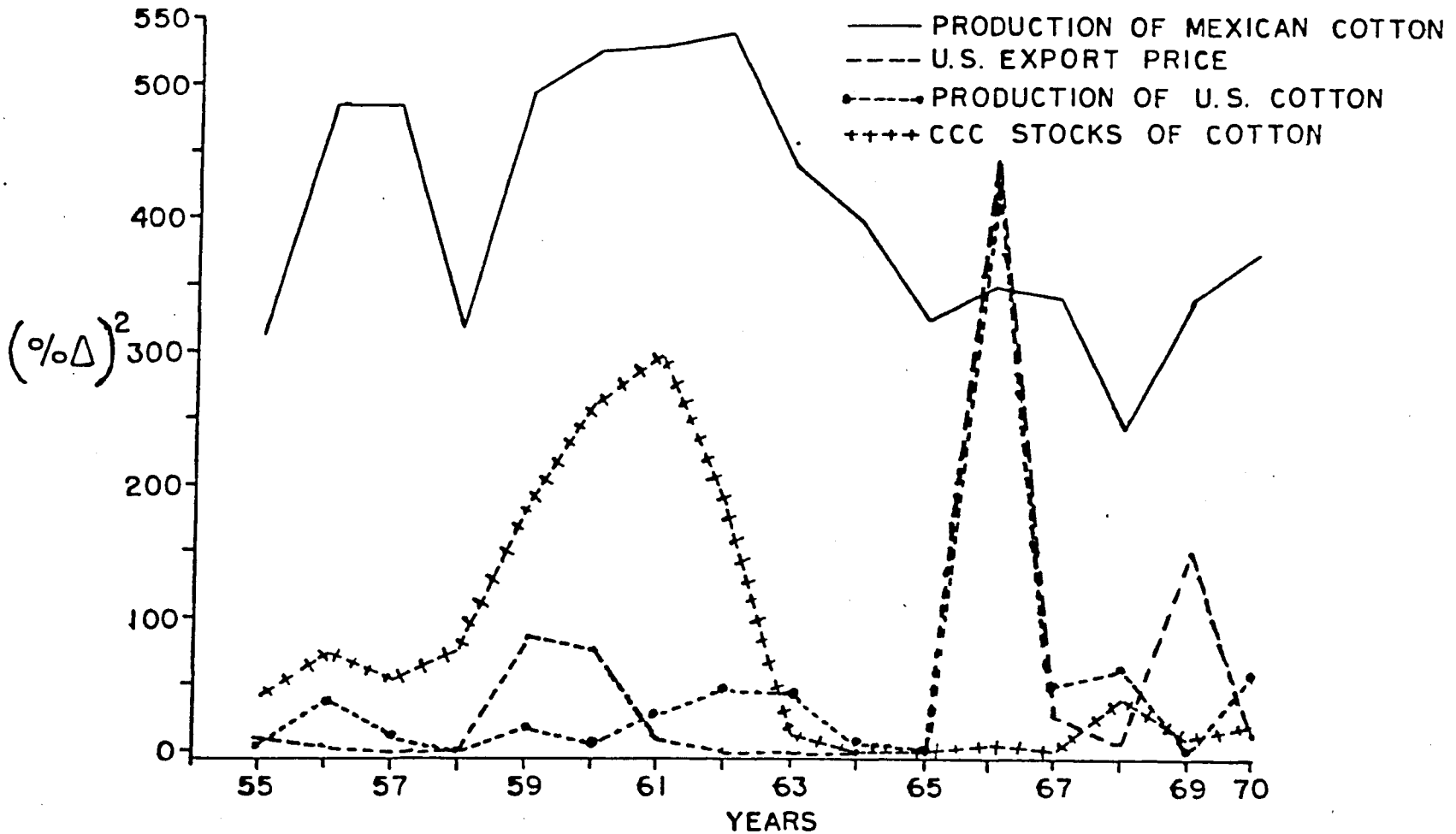

Figure 11. Variance of production and related E values -- Source: Table A.6.

proportion of explained variation in Mexico cotton production with 19 per cent during the entire period. The wild variation in the levels of stocks of cotton held at the CCC from 1946 to 1963 seems to have a very strong effect upon the variability of cotton production in Mexico.

The variations experienced from 1946 to 1952 in the stock level were felt through all the ten-year periods up to 1961. The period in which variation in PMC was most associated to the level of stock of cotton was from 1951-60, when the CCC had the strongest effect upon production of cotton in Mexico and explained 50 per cent of the variation in Mexican output.

After the period of 1953-62 CCC became unimportant as a source of variation, and the price of U.S. cotton and U.S. production gained importance as sources of variation. In the period 1957-1966 these two factors had a very strong effect upon the production of Mexican cotton. These high levels relative to the variance of PMC could be two variables because there were large negative covariances of the three independent variables. Before and after the 1957-66 decade USP and USO were not a very important source of variation with the exception of U.S. price in 1960-69, when it explained 44 per cent of the variation in Mexican cotton production. The United States price explained about 13 per cent of the variation in the variance of PMC during the total period while USO explained only 12 per cent. The

proportion of variation in Mexican cotton production explained by the combined effect of U.S. cotton policy during the 16 ten-year periods was about 44 per cent.

Stabilizing or Destabilizing Effect of U.S. Cotton Policy Upon Mexican Production of Cotton

Among the factors derived from U.S. cotton policy, CCC stocks was an important destabilizer of the Mexican production of cotton during the periods from 1946-1955 to 1953-1962. After these periods its effect was zero or neutral with the exception of the last three decades (Figure 12).

CCC stocks had its strongest destabilizing effect upon Mexican production of cotton during the decade of 1952-61. That decade CCC increased the variance of PMC by 72 per cent; before that decade CCC had only 26 per cent destabilizing effect upon PMC.

Production of U.S. cotton was an important source of instability only during 1957-66 with a 51 per cent increase. Before this decade USO only once had a destabilizing effect upon PMC. It is interesting to note that USO had a small stabilizing effect upon PMC during 1947-56, 1950-59, and 1951-60.

The United States price of cotton was primarily neutral as a source of instability. Only during the decade of 1957-66, with 42 per cent, and during 1960-69, with 65

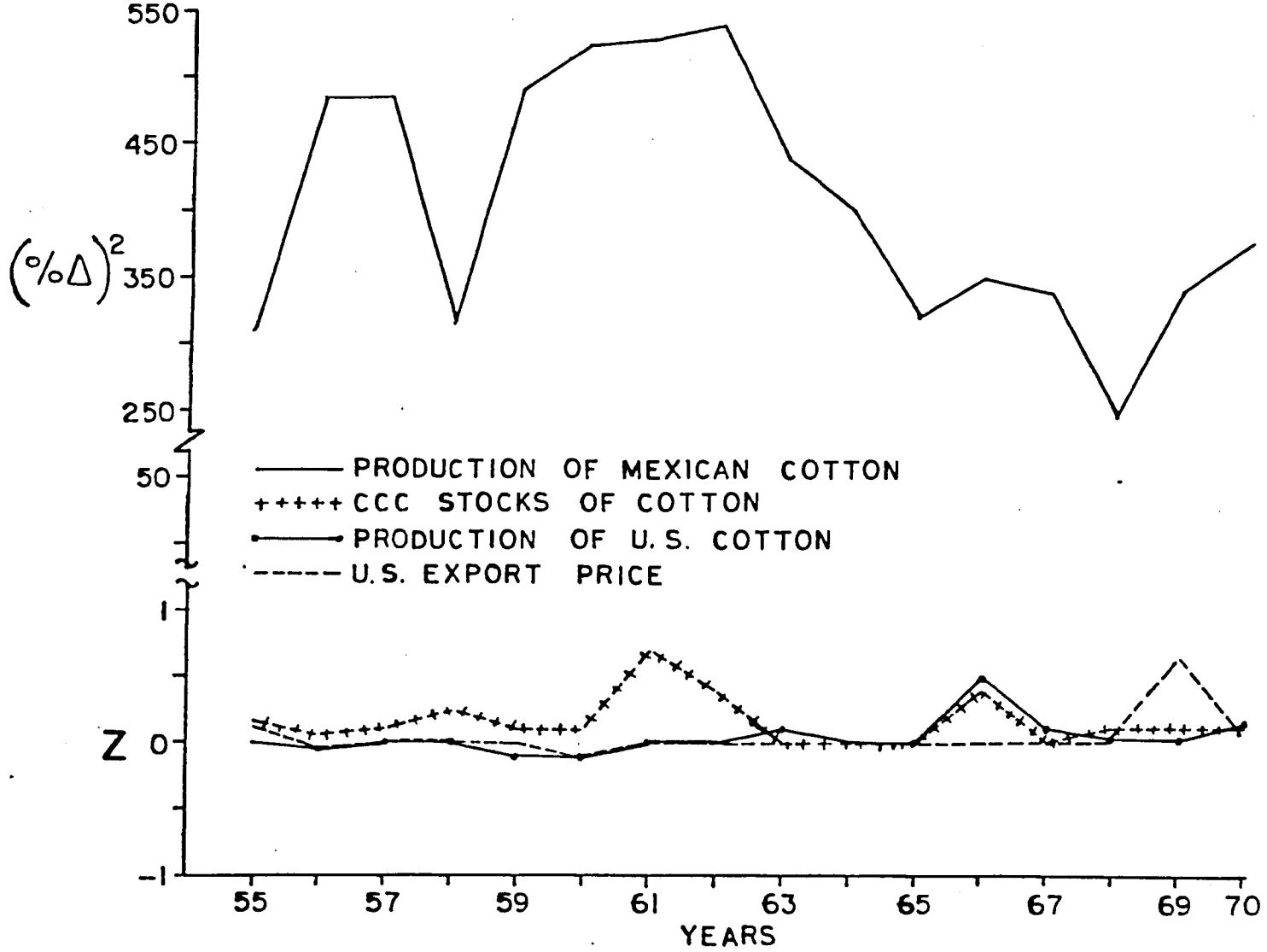

Table 12. Variance of production of Mexican cotton and Z values -- Source: Table A.6.

per cent destabilizing effect, was the USP destabilizing upon the production of cotton in Mexico. USP contributed to stabilize production of cotton in Mexico by small amounts in 1947-56 and 1951-60.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The analysis indicates that there exists a weak relationship between the variability and instability of the value of Mexican exports of cotton and any of the variables related to the U.S. cotton policies.

Commercial exports of U.S. cotton was the variable most related to the variability of the value of Mexican exports of cotton. During the period 1953-62 this factor explained 25 per cent of the variability of VME which is the highest per cent attained through the entire period 1946-1970. During the last six ten-year periods exports of U.S. cotton gave way in importance to the special programs with the exception of two ten-year periods, 1959-68 and 1960-69.

This shows that during the last ten-year periods the relationship between the special programs and the VME has become more important than EUS in explaining the variability of VME. This is a very important factor which very few economists in Mexico take into consideration. Besides, it is difficult to formulate a policy to meet this condition as Mexico does not have the means to sell cotton under any kind of special program.

The relationship between the variance of VME and the variance of cotton stocks held by the CCC is too weak to be considered an important source of variation in the value of Mexican exports of cotton.

Mexican production of cotton is a very important source of variation in the value of Mexican cotton exports. The proportion of variation explained by this factor is higher than any other factor included in the analysis. Variations in quantity of cotton exported explained a greater proportion of the variability of VME than variations in price.

The export price of Mexican cotton remained relatively more stable than quantity exported during the entire period of this study. It was also found that there is a high association between the U.S. export price and the Mexican export price. After the U.S. started real measures to solve its agricultural adjustment problems, the variance of the U.S. export price had a stronger effect on the Mexican export price than either consumption of cotton in the world or CCC stocks of cotton. U.S. export price of cotton remained, after 1955-64, as the key factor in explaining the variance of the Mexican price of cotton.

The proportion of variation in Mexican exports associated with U.S. exports was 14 per cent during the entire period. The export price of U.S. cotton was unimportant in explaining the variance of Mexican exports.

Special programs were more important than U.S. price in explaining this variation. During two ten-year periods this factor contributed more than U.S. exports to the variation of Mexican exports.

Measure of Stabilization

During the entire period covered by this research stocks of cotton held by the Commodity Credit Corporation were a stabilizing factor on the value of Mexican exports of cotton during seven ten-year periods, but this effect was small. The highest stabilizing effect was 7 per cent and the destabilizing effect was never higher than 21 per cent of what the variance of the value of Mexican exports would have been if the variance of CCC stocks had been zero.

Special programs was also a stabilizing factor during two ten-year periods; the stabilizing effect was also very small. During 1961-70 special programs had the highest effect as a destabilizer, contributing 61 per cent to the instability of the value of Mexican exports of cotton.

Commercial exports of cotton from the United States is a factor that contributed to the instability of the value of Mexican exports of cotton with an average of 66.15 per cent. EUS was a stabilizing factor during two decades, 1948-57 with 8 per cent, and again during 1957-66 with 13 per cent. During the period 1953-62 EUS reached the highest destabilizing effect of 164 per cent. There were only four

decades in which commercial exports of U.S. cotton had a destabilizing effect higher than 100 per cent. EUS was the second most important factor contributing to the instability of VME among all the factors considered; and it is the most important destabilizing factor among all the variables representing the U.S. cotton policies.

Production of Mexican cotton is the factor that contributed most to the instability of the value of Mexican exports of cotton among all the variables studied during the entire period of this research. PMC had an average destabilizing effect of 338.7 per cent upon VME. During the decade 1957-66 PMC contributed 580 per cent to the instability of VME which is the highest level attained. The lowest destabilizing effect of 40% was reached during 1946-1955.

The Mexican price of cotton at Liverpool, England, is affected very strongly by the United States export price. The USP is the factor that contributed most to the instability of the MEP during the entire period, with the exception of the 10-year periods ending in 1959 and 1963.

Consumption of cotton in the world was a destabilizing factor of greater proportion than the USP during five consecutive periods from 1950-59 through 1954-63. World consumption of cotton lost importance as a destabilizer after the U.S. launched the Public Law 480 programs.

Stocks of cotton held by the CCC had no destabilizing effect on the MEP, and only a small stabilizing effect on the Mexican price. Although CCC had a very small effect upon Mexican price, CCC had a very strong destabilizing effect upon production of cotton in Mexico. The stocks of cotton held by the CCC is the most important destabilizing factor for PMC of all the factors considered.

Production of cotton in the United States was a stabilizer during two decades, the rest of the time it was a very weak destabilizing factor upon PMC. Only during 1957-66 did production of cotton by the United States have a destabilizing effect upon production of Mexican cotton.

United States price had a very weak effect upon Mexican production of cotton. Only during 1960-69 did the USP have a high destabilizing effect on PMC.

Conclusion

As shown in this research, there are some elements of the United States cotton policies that cause instability in the export value, the export price, and the production of Mexican cotton. Nevertheless, in recent years there have been other stronger elements derived from the Mexican agricultural policy which, in combination, cause instability in production, exports, and the value of cotton exports.

The high price guaranteed by the U.S. policy during 1950 to 1955 provided encouragement for Mexico to expand

cotton production. This high price did not very strongly affect the variability of cotton production nor the variability of the Mexican export price.

If the United States had not implemented the Public Law 480 programs and it had maintained those high prices, the most important factor affecting the variability and instability of the Mexican price would have been world consumption of cotton; as is shown during the decades prior to the launching of those programs (1950-59 to 1955-64) world consumption of cotton accounted for most of the variability and instability in the price of Mexican cotton.

While the forces of demand affected the Mexican price, the high world-wide price maintained by the United States during those years contributed to the economic development of Mexico. During that same period the variability and instability of Mexican production of cotton were not affected very strongly by the United States price. One of the main sources of instability was the CCC stocks.

The period from 1957 to 1966 was very important for both Mexico and the United States. During this period the U.S. had been using the P.L. 480 programs for about three years, the Agricultural Act of 1956 (Soil Bank) allowed the government to lease land from production and this reduced the acreage of cotton harvested. CCC stocks of cotton were very high and had to be depleted somehow, so the United States sold cotton at very low and relatively stable prices.

As a result of this situation Mexico sold at even lower and relatively more stable prices. Exports of cotton from Mexico became more stable after the decade of 1957-66. The consequence of more stable prices and more stable exports was lower value of Mexican exports of cotton and a lower variance level of the value of Mexican exports of cotton.

The only factor that did not become stable during the later years studied was production of cotton in Mexico. Thus production of cotton in Mexico was the only factor contributing to the variability of the value of Mexican cotton exports, which may explain the small variability of the value of Mexican exports of cotton during the last few 10-year periods studied.

This research shows that the volume of Mexican exports of cotton is the main source of variability and instability in the value of Mexican exports. The Mexican export price, which has been determined by the U.S. export price, has been a very weak source of variability and instability. The stable price was a good incentive for production.

The trends of Mexican exports and production move very closely, which may indicate a very close relationship between these two variables; that is, production determines exports of cotton.

Production of Mexican cotton is the main source of instability of Mexican exports of cotton. It appears that

the main sources of instability of production of cotton are not the U.S. cotton policies, but rather internal factors derived from the unstable Mexican agrarian policy such as credit, availability of water, lack of labor force, more profitable cash crops. Also natural factors like plagues and diseases affect yields which may have amplified effects on production and quantity exported.

All these elements account for most of the instability in the production of cotton, which is the key element in determining the quantity of cotton exported. This factor in turn, primarily determines the instability of the value of Mexican exports of cotton.

In the light of the results of this research the hypothesis stating that U.S. cotton policies have destabilized the value of Mexican exports of cotton cannot be totally rejected; commercial exports of cotton from the United States and exports of cotton under special programs have contributed to the instability of the value of Mexican exports of cotton.

This hypothesis is not accepted during the periods 1948-1957 and 1957-1966. During these periods, EUS and CCC stabilized VME with 8 and 13 per cent, respectively. If this hypothesis is tested in the light of the effect of CCC upon VME it cannot be accepted since CCC contributed to the stabilization of VME in seven ten-year periods; during the rest of the periods CCC had a very weak destabilizing effect.

Hypothesis number 2--export price of Mexican cotton at Liverpool, England, has been destabilized by U.S. cotton policies--is accepted during ten ten-year periods of study. United States export price is the main factor affecting the instability of the Mexican export price; the effect of CCC upon MEP was nil during six ten-year periods; the rest of the periods CCC contributed to the stability of MEP but at a very low percentage.

During the periods ending in 1959, 1960, 1961, 1962, and 1963, this hypothesis cannot be accepted since consumption of cotton in the world was the strongest factor contributing to the instability of MEP.

Hypothesis number 3--U.S. cotton policies have destabilized production of Mexican cotton--is accepted during the periods ending in 1961, 1966, and 1969, since the total contribution of U.S. cotton policies to the instability of PMC was 72, 93, and 73 per cent, respectively.

The effect of these factors was never higher than 13 per cent average which is very low when compared with the effect of other variables. The CCC, USO, and USP had a nil or very weak effect upon PMC during the rest of the period; therefore they cannot be considered as the main cause of instability of PMC. This hypothesis then cannot be accepted during the rest of the periods studied.

APPENDIX A

RAW DATA

Table A.1. Basic Data

Year	Value of Mexican Exports	Exports of Cotton from United States	Exports of Cotton Under Special Programs	United States Production of Cotton	Mexican Production of Cotton	Mexican Exports of Cotton	World Consumption of Cotton	CCC Stocks	Mexican Export Price	United States Export Price
	(1000 U.S. Dollars)	(1000 Bales)							(U.S. Cents per Pound)	
1946	27632	3656		8640	460	204	28175	790	28.34	34.82
1947	51617	2625		11860	484	359	29791	50	30.08	34.58
1948	28123	4961		14877	570	232	29124	40	25.36	32.15
1949	78613	6004		16128	937	655	30999	3820	25.11	31.83
1950	159003	4280		10014	1151	742	35082	3540	44.83	42.58
1951	203000	5711		15149	1273	972	35167	80	43.67	46.16
1952	188053	3181		15139	1250	992	36944	280	39.66	41.14
1953	171189	3914		16465	1210	951	38778	2000	37.66	39.62
1954	232870	1985	1600	13696	1780	1253	39858	7035	38.88	40.68
1955	360035	720	1600	14721	2250	2027	41215	8133	37.16	39.75
1956	219346	5217	2700	13310	1790	1310	42960	9857	35.03	33.35
1957	231778	3559	2400	10964	2085	1417	42901	5184	34.22	35.79
1958	254218	1095	1800	11512	2345	1809	45674	2923	29.40	32.70
1959	182560	5959	1435	14558	1690	1304	48343	7042	29.21	29.75
1960	233450	4890	1967	14272	2100	1610	47034	5041	30.34	31.08
1961	213007	3455	1601	14318	1995	1482	45984	1446	30.07	31.22
1962	269374	1764	1665	14867	2425	1897	45137	4688	29.70	30.55
1963	199312	4387	1389	15334	2109	1426	47644	8017	29.24	29.52
1964	227872	2827	1368	15182	2400	1616	50131	10232	29.50	29.88
1965	290271	1874	1161	14973	2625	2127	50935	11397	28.76	29.27
1966	187558	2879	1953	9575	2206	1392	52293	12077	28.19	28.72
1967	181216	2766	1595	7458	2000	1239	52674	5600	30.60	33.76
1968	240817	1677	1148	10918	2450	1631	52085	57	30.89	30.35
1969	183600	1226	1650	10009	1750	1350	53144	2799	28.45	29.17
1970	176495	2430	1313	10270	1440	1221	53900	2937	30.24	31.51

Source: Cotton-World Statistics (1946-1971); Mexican Price was taken from USDA (1946-1950), USDA (n.d.).

Table A.2. Variance of the Value of Mexican Exports of Cotton and Related E and Z Values

YYears	Variance of VME	Production of Mexican Cotton		U.S. Commercial Exports		CCC Stocks		Exports Under Special Programs	
		E	Z	E	Z	E	Z	E	Z
1946-55	2459	780	0.4	424	0.23	20	-0.037		
1947-56	2908	923	1.0	196	0.30	23	0.210		
1948-57	2099	1907	4.0	15	-0.08	1	-0.013		
1949-58	1196	678	2.2	10	0.12	36	0.044		
1950-59	910	382	3.0	67	0.59	36	0.090		
1951-60	912	433	4.0	73	0.68	0	0.001		
1952-61	915	342	3.1	132	1.08	4	-0.010		
1953-62	946	234	2.1	226	1.64	21	0.008		
1954-63	968	404	4.0	138	1.13	26	-0.070	12	0.001
1955-64	724	323	4.6	96	1.06	15	-0.070	17	0.001
1956-65	506	338	5.7	14	0.32	10	-0.056	13	0.180
1957-66	747	770	5.8	6	-0.13	0	-0.007	50	-0.010
1958-67	728	571	5.0	0	0.05	0	0.001	69	-0.057
1959-68	697	349	4.5	54	0.64	1	0.020	31	0.100
1960-69	715	312	2.8	113	0.83	0	0.009	50	0.350
1961-70	710	243	2.0	82	0.59	8	0.091	172	0.610

Table A.3. Variance of Value of Mexican Exports of Cotton and E Values

Years	Value of Mexican Exports	Exports of Mexican Cotton	Mexican Export Price
1946-55	2459	1823	450
1947-56	2908	2100	460
1948-57	2099	1650	420
1949-58	1196	680	460
1950-59	910	890	30
1951-60	912	860	35
1952-61	915	885	30
1953-62	946	910	30
1954-63	968	980	30
1955-64	724	700	30
1956-65	506	530	30
1957-66	747	770	30
1958-67	728	700	10
1959-68	697	670	10
1960-69	715	660	20
1961-70	710	670	30

Table A.4. Variance of Mexican Price and Related E and Z Values

Years	Variance of Mexican Price	U.S. Price		CCC Stocks		World Consumption of Cotton	
		E	Z	E	Z	E	Z
1946-55	469	192.0	3.50	1.50	0.00	94.0	1.18
1947-56	477	125.0	1.70	12.80	0.00	170.0	1.60
1948-57	432	121.0	1.60	16.00	0.00	176.0	1.40
1949-58	469	243.0	2.50	1.40	0.00	86.0	0.72
1950-59	28	1.7	0.24	8.40	0.23	11.8	0.34
1951-60	36	0.5	0.14	8.60	0.11	22.7	0.75
1952-61	32	0.0	0.06	17.00	0.25	37.0	0.25
1953-62	32	3.0	0.34	8.00	0.06	9.0	0.56
1954-63	27	2.7	0.31	5.00	0.05	8.0	0.64
1955-64	29	7.7	0.45	6.60	0.04	3.4	0.30
1956-65	27	10.4	0.45	8.00	0.05	1.5	0.20
1957-66	27	15.4	0.91	5.80	0.00	0.3	0.10
1958-67	12	11.7	3.30	0.13	0.10	0.1	0.05
1959-68	12	9.7	1.40	3.00	0.02	0.0	0.00
1960-69	19	10.2	0.78	9.30	0.49	0.2	0.03
1961-70	24	15.0	1.00	9.00	0.40	0.0	0.00

Table A.5. Variance of Mexican Exports of Cotton and Related E Values

Years	Mexican Exports of Cotton	Mexican Production of Cotton	Exports of Cotton from United States	Exports of Cotton Under Special Programs
1946-55	1789	514	250	
1947-56	2111	961	100	
1948-57	1640	1686	5	
1949-58	679	169	149	
1950-59	897	76	271	
1951-60	871	137	297	
1952-61	892	257	257	
1953-62	924	264	268	
1954-63	995	452	162	49
1955-64	716	285	136	42
1956-65	544	418	20	2
1957-66	796	857	0	46
1958-67	719	578	0	68
1959-68	688	406	42	40
1960-69	678	241	144	12
1961-70	682	256	112	13

Table A.6. Variance of Production of Mexican Cotton and Related E and Z Values

Years	Variance of MEXO	U.S. Export Price		U.S. Production of Cotton		CCC Stocks	
		E	Z	E	Z	E	Z
1946-55	314	12	0.08	5	0.00	37	0.15
1947-56	486	6	-0.04	39	-0.05	75	0.04
1948-57	486	0	0.00	10	0.00	57	0.09
1949-58	318	3	0.00	0	0.00	72	0.26
1950-59	492	89	0.00	18	-0.12	186	0.10
1951-60	524	81	-0.09	13	-0.07	260	0.12
1952-61	532	9	0.00	30	0.00	297	0.72
1953-62	542	4	0.00	48	0.00	187	0.40
1954-63	442	0	0.00	44	0.09	13	0.00
1955-64	397	1	0.00	8	0.00	0	0.00
1956-65	322	0	0.00	1	0.00	1	0.00
1957-66	350	439	0.42	429	0.51	6	0.00
1958-67	342	27	0.00	50	0.09	2	0.00
1959-68	245	6	0.00	63	0.00	41	0.08
1960-69	342	150	0.65	0	0.00	10	0.08
1961-70	376	9	0.04	61	0.15	19	0.07

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