An Inquiry Concerning the Growth of Cotton Farming in Nicaragua

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PREFACE

I would like to take advantage of this opportunity to acknowledge my indebtedness to all those people who kindly provided me with data that made this dissertation possible and also to those whose suggestions and criticisms improved upon my attempts to answer the questions raised in it. Both lists are very long and I can mention only a few by name.

My greatest personal debt is to Prof. Thomas J. Rothenberg who directed my efforts and provided so many ideas that any merits that this dissertation may have should be credited to him.

Professors Daniel L. McFadden and James N. Boles greatly contributed to my understanding of the problems involved and of the statistical techniques necessary to tackle them. Professor McFadden's generosity, moreover, made it possible to carry through at a crucial time. Professor Bo S5dersten's friendship and confidence were a constant source of encouragement. Needless to say, whatever errors I was either too stubborn or too obtuse to remove are entirely my responsibility.

Among those who made this dissertation possible, I must mention Mr. Carlos Morales Carazo first. I am also indebted to Messrs. *Ren{* Bequillard, Pedro Bland6n, Gabriel and Fernando Horvilleur, Benvenuto Martinez, Alfredo Roque, and Donald Spencer. Without their cooperation it would have been impossible to gather even the most rudimentary information.

Mr. Jose Mejia should be credited for the fine work that he did in translating my doodlings into legible graphs.

Finally I would like to acknowledge the financial support that I received from the Institute of International Studies and from the Center for Latin American Studies, both of the University of California, Berkeley.

Pedro Belli

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INTRODUCTION

Among the many theories purporting to provide recipes for economic development one of the most controversial, and a favorite of some South American economists, recommends embracing industrial activities and de-emphasizing investment in sectors that produce primary commodities. It is adduced that in the long run the terms of trade tend to turn against the primary products in favor of industrial goods. The road to development therefore is paved with manufactures, not with raw materials.

Vague as it is, and wanting as it may be, the recipe has its advocates. In Central America, where these South American theories are not specially popular, the magic formula never received a fair hearing. In fact, Nicaragua disobeyed its dictum with astonishing results.

Around 1950 Nicaraguans decided that the road to wealth was paved with cotton. At first only a few intrepid souls ventured into the cultivation of what later came to be known as the "white gold." But later, as vast numbers joined, cotton became one of the leading crops and eventually displaced coffee as the chief export. Production expanded so fast that in the 1966/67 crop year Nicaragua had become the tenth largest exporter of cotton in the world--a remarkable achievement, especially considering the size of the country and the initial levels of production. Since 1950 the small nation has enjoyed very high rates of growth and it is tempting to conclude that cotton has been the cause.

Indeed, at first sight, the causal connection between growth and cotton seems obvious. Moreover, the many activities--cotton gins, fertilizers, insecticides, cotton-seed oil and textile industries--that

sprang to life as a direct, or indirect, result of increased cotton production make the temptation harder to resist.

The impression that a casual observer derives from conversations with a Nicaraguan farmer is that, if the land is appropriate, growing cotton is a highly profitable proposition--one in which "it is impossible to lose." If this were true, the phenomenal growth in cotton production would be understandable. But, why did it not occur before? Did something special that indiced large scale production happen during the 1950's?

The growth in production from 1949 to 1953 coincided with a rise in the price of cotton. Since 1953, however, cotton prices have declined slowly and production has increased more than tenfold. Whatever it was that stimulated production, it was not simply the price of cotton.

Why, then, did the industry grow so rapidly? It is the intention of this dissertation to answer this and other questions concerning the recent economic development of Nicaragua. Cotton is very important in the Nicaraguan economy. It constitutes over 40 percent of all exports and represents more than 7 percent (value added) of GNP. Is it wise to continue relying on it as a main export good and as a principal source of foreign exchange, or are the South American prophets of doom correct?

The chief aim of this study is to explain the long-run phenomenon and to explore the implications of the results with reference to the future economic development of the nation. To that purpose it presents several hypotheses, econometric models to test them, the results obtained, and attempts to forecast trends in cotton prices.

The dissertation is divided into four chapters. Chapter I is a brief economic history of Nicaragua from 1904 to the present. Its purpose is to provide a historical background against which to assess the

role of cotton in the development of the country. The second chapter contrasts the progress of cotton production in the world since 1945 with that of Nicaragua. The third chapter presents the theoretical explanations, the econometric models and the empirical results. The fourth chapter consists mainly of a summary of the findings of other researchers with regard to future trends in the demand for cotton. It also contains an attempt to forecast cotton prices and to pursue the implications of the trends with respect to the economic development of the country.

CHAPTER ONE

THE COUNTRY: NICARAGUA SINCE 1904

1904-1917: Internal Revolts, World War I and American Intervention

Three characteristics have governed the economic and political life of Nicaragua: its geographical position, the size of its population and the thirst of its citizens for political power. Like strong winds they have blown the small country back and forth from prosperity to adversity, from independence to subjection. The following pages present Nicaragua's economic history as shaped by these three characteristics.

As a consequence of its geographical position, Nicaragua has attracted the attention of foreign powers interested in building canals uniting oceans. In varying degrees, these powers have determined the course of political events within the country and steered the economy along ways that not always led to growth, or to social welfare.

The size of its population--1.7 million at present and only 638,000 in 1920[1]--has permitted foreign intervention to take its course without serious opposition. But more importantly, it has forced Nicaragua into heavy dependence on foreign trade. Its small and indigent population has never provided large native markets to support flourishing industrial or agricultural activities. Import duties notwithstanding, Nicaraguans have always found it cheaper to buy most of their daily necessities abroad than

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[1]Latin American Center, University of California, Los Angeles, *Statistical Abstract of Latin America 1966* (Los Angeles: Regents of the University of California, 1967), pp. 48-49.

to manufacture them at home. In exchange, they have offered a narrow range of agricultural and forestry products whose desirability--as reflected in price levels--have determined the income of the country.

Political ambition and desire for power have often induced Nicaraguans to sacrifice the country's political independence and economic welfare for the sake of personal gain.

It was personal ambition that in 1907 led the Nicaraguan president--Zelaya--to attempt a unification of the five Central American republics. First he installed a puppet government in Honduras and then he tried to influence militarily the internal politics of El Salvador. In the process, he incurred the ire of the United States, Mexico and the other Central American republics. Zelaya's modest imperialistic designs finally brought his downfall. In 1909 a revolution, financed in part by foreign interests, broke out against his regime and Zelaya fled the country.[2]

Zelaya's meddling with the internal affairs of other Central American republics may have been the immediate cause of his demise, but his relations with the United States had already been strained by his signal disinterest in the protection of American property at home.[3] Madriz, his successor, proposed no change towards foreign interests; like Zelaya he strongly opposed American economic penetration. The United States withdrew recognition of his government and actively backed a revolt that finally overthrew him in August, 1910.[4]

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[2]U.S. Department of State, *The United States and Nicaragua: A Survey of the Relations From 1909 to 1932* ("Latin American Series," No. 6, Washington: U.S. Government Printing Office, 1932), p. 6.

[3]*Ibid.*, p. 7.

[4]Raymond Lee Hazlet, "United States Foreign Policy in Nicaragua, 1909-1928" (unpublished M.A. dissertation, University of California, 1934) pp. 3-6.

The economic consequences of Zelaya's adventures and Madriz' attempt to suppress the revolt against his regime soon became apparent. In 1909 Zelaya had negotiated a loan of 2.5 million pounds sterling with a London syndicate in order to refund the external debt, but his political activities were costly and beyond the capacity of the government's budget; to pay for them he had to inflate the currency. The revolution that deposed Madriz cost the government over 2 million dollars. Estrada and Diaz, his successors, deemed it necessary to issue 33.6 million pesos ostensibly in order to meet the government's obligations. The weight of these policies was more than the country's meager reserves could bear. The exchange rate with respect to the dollar fell from 2.08 in 1900 to 11.50 in 1910 and finally to 28.00 in 1911.[5]

It was partially in order to aid the government in meeting its internal and external obligations that, in 1911, the State Department negotiated a treaty with the Nicaraguan government. Among other things, the treaty arranged for a 15 million dollar loan to refund the national debt and to provide for the establishment of a National Bank to stabilize the currency and act as fiscal and disbursing agent for all government funds.[6] The treaty failed in the U.S. Senate, but its ideas were

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[5]U.S. Congress, Senate, Committee on Foreign Relations, *Foreign Loans, Hearings* before a subcommittee of the Committee on Foreign Relations, 69th Cong., 2d sess., 1927, p. 4. It is not clear what system regulated the currency in circulation before 1911. It seems that the country was under a gold standard with respect to foreign currencies, but that there were no restrictions on the amount of national currency that the Government could issue, or that if there were such restrictions, they were not observed. After the establishment of the National Bank of Nicaragua, this institution was empowered to issue any amount of currency without guaranty (gold backing) or other limitation. Nevertheless, a gold exchange fund to maintain parity with the dollar was created as part of the deal. Thus it seems that some sort of modified gold standard was in effect (U.S. Congress, *Foreign Loans, Hearings*, pp. 3-4.)

[6]Hazlet, *U.S. Foreign Policy*, pp. 12-15; Charles E. Chapman, "An

nevertheless executed. The State Department persuaded two New York banking houses--Brown Brothers and Co., and J. and W. Seligman and Co.--to lend the Nicaraguan government 1.5 million dollars in exchange for Nicaraguan Treasury bills guaranteed by customs revenues. In accordance with the treaty, as added,security, the bankers appointed Colonel Clifford D. Ham Collector General of Customs (Recaudador General de Aduanas) and established the National Bank--incorporated in Connecticut and under the bankers' control--to watch over the stability of the currency and act as fiscal and disbursing agent for all government funds. Finally, the two governments created a body--the Mixed Claims Commission--in order to pass upon claims arising out of the activities of the Zelaya regime and out of the revolt that caused its downfall. This body worked from 1911 to 1914 and passed on more than 7,000 claims, reducing them from US $13,800,000 to US $1,800,000.[7]

The stabilization of the currency was among the immediate purposes of the National Bank. As carried out, it involved a complete replacement of the old peso with a new unit of currency, the *córdoba*, whose value was to be on a par with the dollar. Even though the market rate at the time was 28 pesos to one dollar, conversion began at 18.00 to one and gradually went up to 12.5 to one.[8] It seems that one of the primary motives behind the inflated conversion rate was to benefit high government officials and their friends, who held vast amounts of the old currency.[9]

American Experiment in Nicaragua," *The American Review of Reviews*, LXVI (October, 1922), pp. 406-407.

[7]Hazlet, *U.S. Foreign Policy*, pp. 12-13; Chapman, "An American Experiment," p. 407; U.S. Department of State, *Survey of Relations*, p. 15.

[8]U.S. Dept. of State, *Survey of Relations*, p. 24.

[9]It seems that President Diaz also held over 33 million pesos. See Hazlet, *U.S. Foreign Policy*, p. 17, and U.S. Congress, Senate, *Foreign Loans, Hearings*, p. 6.

In 1912 the Nicaraguan political forces emerged once again. With American intenvention as a basic issue of contention, General Mena, the Minister of War, led a revolt that provoked the intervention of the United States Marines and added to the financial embarrassment of the government. The revolt failed, the Marines stayed and the government proceeded with its fiscal reforms.[10]

But the small nation, committed to foreign trade, was not to prosper yet. Two successive crop failures and a sharp drop in coffee prices in 1911, from 1.58 to 0.76 dollars per kilo (Table I.27, p. 51; deflated values), so lowered exports, hence income, imports, and Government receipts from taxes on international trade, that they nearly ruined the country's shaky finances and seriously impaired the program for fiscal rehabilitation. On October 8, 1913, new loan contracts, providing for an additional U.S. $2,000,000 were negotiated with the New York bankers. As security the bankers received Treasury bills from the Nicaraguan government, fifty-one percent of the stock and control of the government's railroad and steamship lines and fifty-one percent of the stock and control of the National Bank.[11] But World War I practically nullified the financial effects of these loans. The European markets stopped buying Nicaraguan coffee and bananas and government receipts fell. (See Tables I.1 and I.2 below.)

The country's financial troubles stemmed from internal revolts, inefficient governments, and from its reliance on one or two crops as sources of foreign exchange and fiscal revenues. The First World War dramatically exposed the dangers inherent in such arrangements. Before the War, coffee was Nicaragua's chief crop and export product, and France

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[10] Chapman, "An American Experiment," p. 407.

[11] *Ibid.*, p. 408; Hazlet, *U.S. Foreign Policy*, pp. 50-51.

TABLE I.1

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS BY COMMODITY, 1911-1918

	1911	1912	1913	1914	1915	1916	1917	1918
Coffee	64	46	65	46	43	41	29	29
Wood	--	3	4	9	6	7	22	18
Gold	14	23	14	17	24	18	15	16
Sugar	--	--	--	1	--	5	4	9
Bananas	5	11	5	10	8	9	8	7
Hides	3	6	4	8	11	9	9	4
Rubber	9	4	3	2	4	5	4	1
Others	5	7	5	7	4	6	9	17

Source: Nicaragua, Administracion de Aduanas, *Memoria del Recaudador General de Aduanas*, 1918 (Managua: Administración de Aduanas, 1919), p. 16.

TABLE I.2

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS BY COUNTRY OF DESTINATION, 1911-1918

	1911	1912	1913	1914	1915	1916	1917	1918
United States	31	46	35	49	67	70	85	83
Mexico	--	--	--	--	--	--	--	12
Panama	--	--	--	--	--	--	--	1
Canada	--	--	--	--	--	1	1	1
France	40	16	23	23	13	18	8	--
Germany	16	18	24	11	--	--	--	--
England	8	13	13	7	9	1	--	--
Others	4	7	5	10	11	10	6	3

Source: Same as for Table I.1.

its second best customer (Tables I.1 and I.2). Customs revenues, obtained mainly from import taxes, provided over forty percent of total government revenues (Table I.3). By 1918 the war had ended trade with France. The deflated price of coffee had fallen from an average of U.S. $0.67 per kilo (1904-1913), to an average of U.S. $0.44 (1914-1918), as Table I.27 shows.[12] Nicaraguans began to ship their coffee and other exports to the United States, but they could do nothing about the low coffee prices; fiscal revenues fell. The American and English creditors agreed to a suspension of all interest and sinking-fund payments on their bonds and the government muddled through.[13]

TABLE I.3

NICARAGUA: SOURCES OF GOVERNMENT REVENUES, FISCAL YEARS 1917/18 to 1926/27 (U.S. Dollars)

	Customs Receipts	Internal Revenues	Revenues for public Instruction	Miscellaneous Receipts	Total
1917-18	1,039,308	1,303,866	83,782	844,039	2,658,550
1918-19	1,230,179	1,624,085	161,293	114,581	3,130,138
1919-20	2,032,200	1,789,320	246,351	186,015	4,253,886
1920-21	1,706,093	1,576,067	223,760	178,524	3,684,444
1921-22	903,898	1,207,954	182,430	147,956	2,442,238
1922-23	1,327,110	1,265,747	184,734	397,694	3,175,285
1923-24	1,877,868	1,342,981	293,319	250,739	3,764,907
1924-25	2,175,327	1,336,365	239,080	108,931	3,859,703
1925-26	2,604,130	1,416,763	256,326	102,910	4,380,129
1926-27	2,382,387	1,073,259	207,697	125,095	3,788,438
Total	17,278,500	13,936,407	2,078,772	1,844,039	35,137,718
Average	1,727,850	1,393,641	207,877	184,404	3,513,772
Percent	49.2	39.7	5.9	5.2	100

Source: W. W. Cumberland, *Nicaragua: An economic and Financial Survey* (Washington: U.S. Government Printing Office, 1928), p. 83.

[12] I used the U.S. BLS index of Wholesale Prices of all commodities as deflator because I wanted to have a rough measure of the purchasing power of Nicaraguan export revenues and this seemed to be an adequate approximation.

[13] Three million dollars, which the government received in 1917 in

The war, however, clearly exposed the country's economic malady. To prosper Nicaragua had to sell a lot of coffee at good prices. Disturbances in either price or quantity could spell trouble for the government as well as for the people. Since coffee prices fluctuated widely from one year to the next, and since the crop was subject to the vagaries of the weather, national income and government revenues were highly uncertain and unstable. For example, from 1945 to 1960 the best coffee crop represented 10 percent of GNP, the poorest only 4.5 percent. Assuming that during 1911-1918 coffee exports as a proportion of GNP were not higher than during 1945-1960, tha rise in coffee prices from 1910 to 1911 would have caused GNP to increase anywhere from 16.3 to 7.6 percent. The fall in prices from 1911 to 1912 would have caused a drop in GNP of similar proportions. And it should be emphasized that these estimates are probably on the low side, for coffee's importance in the economy diminished in more recent years in spite of an absolute increase in production, as we shall see later on.

When the war ended the financial situation was desperate and the government's maneuvers had practically delivered the country into the hands of New York bankers. The latter were in charge of collecting customs duties, running the "National" railroad and directing the activities of the "National" bank. But worst of all, Nicaragua had mortgaged part of its future income in order to pay for past mistakes, political uprisings, and the corruption of its rulers.[14] Very little of benefit in the way of

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exchange for granting tha United States the perpetual, exclusive and tax-free rights necessary to the construction of a canal across Nicaraguan territory, were among the many stop-gap measures that enabled the government to muddle through. See Hazlet, *op. cit.*, p. 33.

[14] U.S., Congress, Senate, Committee on Foreign Relations, *Foreign Loans, Hearings* before a subcommittee of the Committee on Foreign Relations, 69th Cong., 2d Sess., 1927, p. 6.

increasing future income could come to the Nicaraguan people out of all these transactions. It is doubtful that the government could have found more unproductive uses for foreign capital earned at such high cost.

1917-1918: The Financial Plan of 1917. The Depression Curtails Incipient Recovery. World War II: Its Effects on Export Prices and on the Balance of Payments.

Towards the end of the war, however, muddling through ceased to satisfy the government and it decided to tackle the financial problems head on. With the help of General Emiliano Chamorro (President) and of Martin Benard (Minister of Finance), Colonel Ham devised a scheme to reorganize and readjust the national debt. In 1917, Chamorro, the U.S. government, and the bankers accepted the proposal, and soon after they began to implement the idea.

The Plan of 1917 involved a complete revision of the national debt and created a body to exercise some control over the country's finances. With respect to the national debt, the Plan left the foreign bonded debt intact, but provided for the payment of all floating foreign and internal debts and claims in a reduced amount of cash and domestic bonds.[15] Concerning the financial administration, the Plan fixed the government's monthly budget and created the High Commission, a body whose principal function it was to supervise the payment of the guaranteed customs bonds (issued in 1917 in lieu of sundry claims against the government, and secured by a 12-1/2 percent surcharge on the customs import duties). Secondary powers of the High Commission included complete control over alterations in customs duties and the exclusive authority to permit the government to exceed its monthly budget. In addition, the Plan specified priorities to govern the use of customs revenues.[16]

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[15]Chapman, "An American Experiment," p. 408.

[16]U.S. Department of State, Survey of Relations, p. 36.

The National Bank was to receive all of the money collected by the Collector General and to allocate it as follows:

1. Expenses incurred in collecting and managing customs houses.
2. Banker's expenses incurred in conducting financial business of the Republic.
3. Moneys due on 1909 bonds.
4. Exchange fund (to maintain parity with the dollar).
5. Interest payments due on 1913 Treasury bills.
6. Interest payments due on 1917 Differed Treasury bills.
7. The remainder, if any, to pay for the general expenses of the government.

Finally, there was a 12-1/2 percent surcharge on imports to pay for the national debt consolidated by means of Guaranteed Customs Bonds.[17]

The purpose of these restrictions was to assure foreign debtors that their loans would be repaid. There are no indications whatsoever that the Nicaraguan government's preoccupations transcended the repayment of the debt. And of course, neither the New York, nor the London bankers, were too concerned over Nicaragua's welfare--and it was they, after all, who by now controlled most of the country's public revenues and policies regarding bank loans. It would have been very surprising indeed to find much government investment in public works before Nicaragua had cancelled its foreign debt. And yet there were pressing problems that required the government's immediate attention. The country was a nation in name only, but in reality it was two dissimilar regions united by a common government and little more. The western section around the two lakes contained about 70 percent of the population and very likely an equal percentage of the national wealth. It was rich agricultural country and

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[17]Nicaragua, Administracion de Aduanas, *Memoria, 1919*, p. 4.

the backbone of the economy: coffee was its most important product. The eastern littoral, populated by a combination of native Indians and Negroes, was separated from the western part by language, culture, and a dense tropical jungle. Bananas and mahogany were this region's chief products.[18] Before the invention of the airplane, the San Juan river was the only connection between them.

Although the gulf between the eastern and western sections was the most extraordinary instance of the country's dearth of communications, it was not unique. The country lacked all sorts of transportation facilities, but the government had done little about it. After President Zelaya finished the railroad that connected the most important cities of the eastern region, internal revolts and official inertia curtailed further construction. As late as 1928 not a mile of railroad had been added, and only 415 miles of highway had been constructed in the entire country, as Table I.4 shows.

In defense of the government's inactivity, it may have been adduced that, its good intentions notwithstanding, its hands were tied. Even though at the time this may have been true, in years to come this excuse would lose force. The Financial Plan of 1917, leaning heavily on foreign trade, could not have come at a better time and it succeeded in delivering the country from the bankers' hold.

With the end of World War I the market for coffee returned to normal. The Europeans began to buy once again and the price doubled from 1918 to 1919, exceeding the 1904-1913 average. From 1917 until 1930 the trend in the performance of the Nicaraguan economy was decidely upwards, as Figure I.2 shows. During these relatively peaceful years the export

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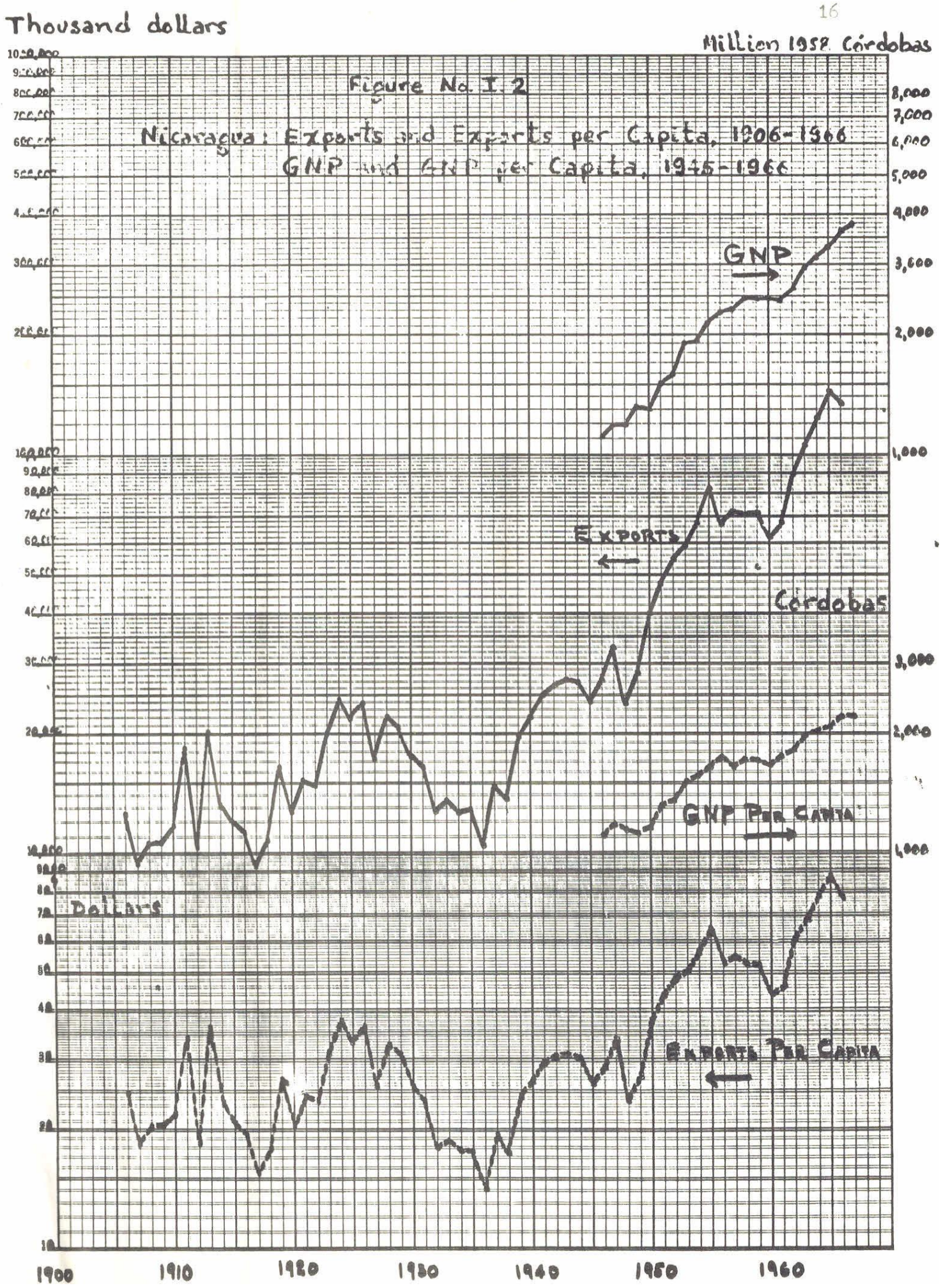
[18] U.S. Department of State, *Survey of Relations*, pp. 1-2.

TABLE I.4

NICARAGUA: HIGHWAY MILEAGE, JANUARY 31, 1928

Department	Principal Points	Length in Miles
Chontales	Puerto Diaz-Juigalpa-La Libertad	42.22
	Tipitapa-Las Banderas-Bosco	19.25
Chinandega	Chinandega-El Viejo	.71
Granada	Granada-Nandaime-Ochomogo	24.84
	Granada-Diriomo-Diria	3.10
	Granada-Panaloya-Malacatoya	21.68
	Granada-Sitio	6.21
	Granada-Asese	3.74
	Granada-Mombacho	3.10
	Granada-La Laguna	6.21
	Granada-El Capulin	3.74
Leon	Leon-Poneloya	18.63
	Leon-Telica	3.10
Managua	Managua-Jinotepe	27.36
	Managua-Matagalpa	78.24
Rivas	Rivas to various points	61.21
	Rivas-La Chocolata	.93
Nueve Segovia	Ocotal-La Cruz-San Albino	55.89
	Ocotal-Santa Clara-Puntalitos	12.42
	Ocotal-Susucayan-El Jicaro	4.97
	Ocotal-Somoto-Yalaguina	6.21
	Ocotal-Telpaneca-Palacaguina	3.10
Carazo	Jinotepe-Santa Teresa	4.65
	Jinotepe-Diriamba	3.10
Total		414.61

Source: See Table I.3; p. 70.


Thousand dollars
Million 1958 Córdobas
Figure No. I.2
Nicaragua: Exports and Exports per Capita, 1906-1966
GNP and GNP per Capita, 1945-1966
GNP
EXPORTS
Córdobas
GNP PER CAPITA
Dollars
EXPORTS PER CAPITA
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
1900
1910
1920
1930
1940
1950
1960

trade reached previously unattained levels and even underwent a slight diversification. Banana exports went up as the plantations of recently established firms began to produce; business was so brisk that in 1923 direct transport from the Atlantic coast to New York began to operate regularly.[19] The sugar trade also gained some prominence during these years, but it suffered from widely fluctuating, though on the average declining, prices.

Inflation and the moderate upsurge in trade aided Nicaragua in repaying a sizable part of its national debt and in regaining a bit of independence within a very short time. At the end of each year from 1917 to 1920 Nicaragua had a large surplus in its Treasury. On June 30, 1920, the surplus Treasury balance exceeded a million dollars. In 1920, the Government repurchased the Pacific Railway from the bankers (at a substantial loss) and, counting on future Treasury surpluses, announced its intention to build a railroad to the Atlantic. But the frailty of Nicaragua's economic stability shattered the Government's dream. A recession gripped the world and coffee prices went down. By 1922, the Treasury was empty.[20] But prices recovered quickly and from 1923 until the Great Depression Nicaragua enjoyed some prosperity. In 1924 the Government repurchased the National Bank,[21] and in 1926 the country attained what at that point was the highest level of trade in its history (as Table I.27, pp. 51-54 shows). In 1927 another revolt disrupted economic activities; exports fell and the extraordinary expenses incurred in combatting the continued revolutionary activities were so heavy that in March, 1927, the

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[19] Nicaragua, *Memoria*, 1922, p. 7.

[20] U.S. Department of State, *Survey of Relations*, pp. 37-46.

[21] *Ibid.*, p. 46.

government was without funds and had to secure a short-term loan of U.S. $1,000,000 from the Guaranty Trust Co., and J. and W. Seligman & Company.[22] To pay for it all there was a general 12-1/2 percent increase in import taxes, an additional 50 percent increase on imports of tobacco and liquor, and a levy of various taxes on exports of coffee.[23]

Allegedly concerned with the welfare of its citizens and with their commercial interests, the American Government sent some 3,000 soldiers to protect them from the ravages of the revolt. The Marines brought dollars, and commerce at least gained thereby. Their monthly consumption was estimated at from $100,000 to $150,000 during 1927, and at $250,000 during 1928.[24] Even though exports declined, capital transfers and imports increased. The import side of trade was so brisk and hence Government receipts so high, that by the end of 1928 the 1927 short-term loan had been repaid in full.[25]

Even though the evidence is scanty, it is difficult to conclude that the 1927 revolution did more than temporary damage to the economy. In his annual report, the Collector General of Customs claimed that there was extensive destruction. He estimated that the total damage exceeded U.S. $20,000,000 (more than 22 percent of the total estimated capital in the country, and about one-half of the total taxable capital) and maintained that the sugar and banana plantations, the lumber companies and the gold and silver mines suffered severely.[26] But to judge from export

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[22]U.S. Department of State, *Survey*, pp. 69-60; Nicaragua, *Memoria*, 1927, p. 19.

[23]*Ibid*, Nicaragua, [24]*Ibid*, p. 16; 1928, p. 50.

[25]Nicaragua, *Memoria*, 1928, p. 2.

[26]Nicaragua, *Memoria*, 1927, pp. 4-10.

statistics, these statements were a gross exaggeration. With the exception of wood and sugar exports, trade in the other commodities either did not decline appreciably, or recovered within a year. Even granting that the revolutionaries chased the lumber companies out of the Atlantic coast, it is not at all clear that in the long-run it was political strife, and not the preferential treatment accorded to Cuban sugar by the United States, that caused Nicaraguan sugar exports to fall . If it is true, as the Collector claimed,[27] that more than one-half of the 1926 sugar crop remained in the field because the members of the labor force that should have been picking it were busy shooting one another, then the revolution was responsible for the sudden drop in the 1925/26 exports. But before blaming the revolutionaries for the slackening of the sugar export trade, it should be remembered that sugar prices went down shortly thereafter, from 17 to 11 cents per kilo, and continued to fall until 1939 when they rested at 6 cents per kilo (Table I.27; deflated values).

By 1928, total exports were at 90 percent of the 1936 level and fourth highest in the history of the country. To be sure, some exports had declined, but others had increased. Had the revolution damaged the plantations substantially, recovery within a year would have been impossible. The subsequent decline in exports, from 1930 to 1940, may be attributed more correctly to the depression that afflicted the Nicaraguan export markets than to the damages of the short-lived revolt.

The revolution, then, did not seriously impair the country's means of production, but it did increase its fiscal burden: the revolt more than trebled the public debt, from 6.96 (March 31, 1926) to 23.53 million dollars (March 31, 1928).[28] Concomitantly, the country saw its foreign

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[27] *Ibid.*, p. 4. [28] Nicaragua, *Memoria*, 1926, p. 4, and 1928, p. 51.

earnings go down as a result of the depression and its obligatory capital exports go up as a result of the revolt.

In spite of the fighting and its detrimental fiscal consequences, 1928 was not an entirely bleak year. First, it signalled the end of major political upheavals in the country and second, it marked the beginning of serious governmental attempts to assess the country's economic possibilities, diagnose its illnesses and propose remedies.

In 1928 at the request of the Nicaraguan government, the State Department sent one W. W. Cumberland to survey the economic and financial situation of the country. His findings were anything but flattering to the Nicaraguan rulers. If indeed ever poverty and external restrictions could have been adduced in defense of the official economic policies, Cumberland's report did away with this argument. He blamed the government's languor for the virtual absence of social overhead capital and hinted that the spectre of corruption cast its shadow in more than one official decision concerning the use of funds. For example, he showed that the main obstacle in the way of implementing public works was the government's attitude, not its financial situation nor political restrictions. The appropriations in the budget for public works were ridiculously small to begin with the yet they included the salaries of the public administrators: (See Table I.5 below.)

> In fact, only $10,000 of the 1927/28 budget can be considered as the annual amount appropriated in the budget for general public works and even part of this infinitesimal sum is also expended for other purposes than the construction and maintenance of public works.[29]

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[29]W. W. Cumberland, *Nicaragua: An Economic and Financial Survey* (Washington: United States Government Printing Office, 1928), p. 104.

As a result of these practices, there were few usable roads in the country and those that existed were poorly maintained:

> Most roads are impassable in the rainy season and at other times are far from satisfactory. None is supplied with entirely satisfactory roadbed, drainage, or culverts, and maintenance is somewnat a result of accident.[30]

Table I.6 gives Cumberland's estimates of the costs of constructing a network of roads connecting the main cities in the country. From these estimates and from Table I.5 it is obvious that, if only the money spent from 1917 to 1927 on war, navy, and police had been used in building roads, by 1927 Nicaragua would have had half of the recommended roads already built. Cumberland further asserted that poverty was not the main obstacle in the upkeep and construction of roads, but rather the absence of a maintenance organization and the budgetary practices which made no provisions for the appropriations of the requisite funds.[31]

TABLE I.6

NICARAGUA: ESTIMATED LENGTH AND COST OF HIGHWAYS

	Estimated length (miles)	Estimated Cost at $10,000 per mile
Managua to Rama via La Libertad	197	$1,970,000
Managua to Bluefields via La Libertad and Rama	248	2,480,000
Managua to Rama via Boaco	224	2,240,000
Baoco to Matagalpa	48	480,000
Managua to Puerto Cabezas via Matagalpa	349	3,490,000
Matagalpa to San Pedro del Norte	133	1,330,000
Matagalpa to Ocotal	83	830,000
CChinandega to Ocotal	113	1,130,000
Leon to Ocotal	117	1,170,000
Leon to Matagalpa	101	1,010,000
Total	1822	18,220,000

Source: Cumberland, *op. cit.*, p. 73

[30] *Ibid.*, p. 70.

[31] *Ibid.*, pp. 73-74.

TABLE I.5

NICARAGUA: EXPENDITURES, BY OBJECTS OF EXPENDITURES, FISCAL YEARS 1917-18 to 1926-27

	1917-18	1918-19	1919-20	1920-21	1921-22	1922-23	1923-24	1924-25	1925-26	1926-27	Average	Percent
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	
Legislature	28,813	46,633	28,633	88,837	55,884	46,930	56,704	106,083	173,080	117,996	74,959	2.0
Judiciary	84,973	86,652	86,652	102,657	157,869	108,897	109,833	109,833	109,833	132,808	109,001	2.9
Executive office	13,728	29,392	25,392	31,081	49,469	34,344	46,951	36,387	37,309	35,796	34,045	0.9
Foreign relations	60,495	75,139	54,463	146,584	109,943	113,278	95,662	82,892	95,736	121,831	95,602	2.5
Finance	249,671	177,385	223,575	261,589	238,174	188,878	211,812	153,383	222,703	239,967	216,714	5.7
Public Debt:												
1909 bonds	903,925	238,089	426,195	442,433	259,176	287,575	590,638	585,725	593,707	601,103	492,856	12.9
Customs guaranteed bonds of 1918	—	210,238	292,309	223,600	269,382	230,782	265,035	311,653	365,195	355,850	252,404	6.6
Treasury bills of 1913	1,005,127	148,083	311,128	—	—	—	—	—	—	—	146,434	3.9
Treasury bills of 1917	492,920	15,839	127,159	—	—	—	—	—	—	—	77,582	2.0
Treasury bills of 1920	—	—	—	300,000	460,758	199,834	656,198	603,339	—	—	222,013	5.9
Emergency currency of 1914	330,350	94,559	61,776	63,540	24,124	—	—	—	—	—	57,435	1.5
Bank loan of 1914	111,906	—	—	—	—	—	—	—	—	—	11,191	0.3
Agricultural loans of 1921	—	—	—	244,019	—	—	—	—	—	—	24,402	0.6
Bank loan of 1927	—	—	—	—	—	—	—	—	—	383,766	38,377	1.0
Charges on financial operations	14,319	6,532	19,470	66,074	25,170	17,913	13,980	17,222	6,393	5,500	19,256	0.5
Cost of customs collection	51,000	53,856	65,612	86,494	59,572	73,113	85,754	103,884	101,943	121,754	86,298	2.2
Government	83,211	74,568	113,873	90,517	57,574	87,561	113,600	121,703	77,952	128,776	94,933	2.5
War, navy and police	436,174	387,498	398,498	446,481	450,192	394,644	357,448	514,886	620,750	3,121,639	712,821	18.6
Public health	—	—	2,172	19,044	17,200	15,256	16,567	17,900	40,850	84,346	21,333	0.6
Justice and charity	46,896	87,848	49,061	88,054	80,058	71,441	71,768	70,335	62,527	80,799	73,879	1.9
Public Instruction	196,843	297,350	295,350	489,412	339,960	309,306	382,523	337,042	347,042	424,982	341,981	9.0
Public works administration	27,178	113,161	110,950	37,370	24,199	88,788	23,806	11,860	10,218	35,651	48,318	1.2
Post office, telegraph and telephone	167,920	135,837	139,837	167,541	139,826	166,171	195,310	153,800	164,760	250,475	168,148	4.4
Public works	10,000	24,950	275,911	330,426	268,097	86,275	149,753	136,550	259,979	325,716	186,766	4.8
Pensions	60,000	31,238	11,483	34,630	32,484	22,000	24,000	24,000	24,000	32,500	29,633	0.8
Miscellaneous	500,000	225,331	—	129,143	17,793	42,952	69,837	446,948	315,124	108,389	185,552	4.8
Total	4,875,449	2,560,178	3,150,245	4,029,285	3,136,904	2,585,938	3,537,179	3,945,425	3,629,101	6,709,644	3,815,935	100.0

Source: Cumberland, *op. cit.*, *Economic and Financial Survey*, p. 28.

The government's disregard for public education was equally deplorable. 1920 estimates showed that only 19 percent of the total school population from 6 to 19 years, inclusive, were receiving regular instruction.[32] The government spent so little effort in providing its citizens with the rudiments of culture that in 1950 the literacy rate was less than 40 percent.[33]

Public health, moreover, suffered from equally acute neglect: "... competent authorities are of the opinion that of five children who are born only three reach the age of two years and no more than two arrive at maturity."[34] And of those who survived, approximately 90 percent served as hosts to a welter of parasites. Upon reaching adulthood, syphillis and malaria added to their afflictions.[35] Yet, in 1927 the government considered US $84,346 (approximately 12 cents per capita per year) adequate to improve the health of its population (Table I.5).

Finally, there were no government efforts to change, improve, or modify the techniques or the composition of production:

> "Agriculture will long continue to be the chief source of wealth of the Republic. Its encouragement is therefore an important feature of any sound economic policy. Thus far nothing has been accomplished in that direction, and no plans have been formulated."[36]

Cumberland's survey was the culmination of a series of studies, initiated at the government's request, designed to analyze the economic

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[32] Cumberland, op. cit., p. 25.

[33] United Nations, Economic Commission for Latin America, Análysis y Proyecciones del Desarrollo Económico, Vol. IX El Desarrollo Económico de Nicaragua (Mexico: United Nations, 1966), Cuadro 184, p. 190.

[34] Cumberland, op. cit., p. 22.

[35] Ibid.

[36] Cumberland, op. cit., pp. 3-4.

situation and propose strategies for development.[37] In spite of it alleged concern, a mortgage bank to provide long-term loans to farmers was the entire upshot of the government's preoccupation with development. While this was a step in the right direction, it could hardly begin to move the country towards self-sustained growth, let alone give it a "big push" to awaken it from its economic lethargy. The government did not become a positive force in the development of the country until around 1950. Before that its role can be described only as passive, or negative.

When the depression of the 1930's began, the economy had barely begun to recover from the ravages of the first World War. Exports, deflated by the U.S. BLS Index of Wholesale Prices of all Commodities, had increased by 88 percent from 1917 to 1930, but they had not yet reached the pre-war levels. Imports, also, were lagging behind. Only the composition of trade seemed to have improved. But this was an illusion. Coffee was cheaper and hence it appeared less important in the over-all picture. There was more trade in bananas, but less in gold. The apparent diversification was partly the result of prosperity in banana and wood exports, but mostly of diminished gold production and depressed coffee prices, as Table I.27 (pp. 51-54) shows.

Finally, the lesson of World War I notwithstanding, Nicaraguans were increasingly tying their economic future to one country—the United States. Thus, whereas in 1911 the export trade had been divided between France (40%), the United States (31%) and Germany (16%), by 1930 the United

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[37]Other studies included: Nicaragua, Presidente 1924-1926 (Bartolomé Martínez) *Encuesta Económica, Propuesta a la Consideración Nacional por el Señor Presidente de la República, don Bartolomé Martínez* (Managua: Tipografía y Encuadernación Nacional [1924?]) and Jeremiah W. Jenks, *Report Regarding Important Financial and Economic Problems* (Managua: mimeographed, 1925).

States not only provided over 60% of Nicaragua's imports but was beginning to absorb more than 50% of the country's exports, as Tables I.7-I.9 show. The small republic, therefore, not only continued to rely upon a few agricultural products for its livelihood, but was depending more and more on one country as well.

TABLE I.7

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS BY PRODUCTS, 1919-1930

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Coffee	50	27	29	30	35	56	45	62	45	58	54	45
Bananas	4	7	17	25	19	13	14	9	16	16	18	27
Wood	13	18	11	9	16	10	15	10	19	11	12	6
Gold	12	12	12	13	7	6	5	5	7	3	4	5
Sugar	5	22	16	8	12	8	12	7	5	4	2	4
Corn	1	--	--	1	--	--	--	--	1	1	2	1
Hides	3	3	1	2	1	2	2	1	1	2	1	1
Timber	--	--	--	--	--	--	--	--	1	--	--	--
Silver	2	3	3	3	2	1	1	--	--	--	--	--
Cocoa	--	--	--	1	--	--	--	--	--	--	--	--
Rubber	1	--	--	--	--	--	1	1	--	--	--	--
Cotton	--	--	1	--	--	1	--	--	--	--	--	1
Lard	--	--	1	2	--	--	--	--	--	--	--	--

Source: Nicaragua, *op. cit.*, *Memoria*, various issues.

TABLE I.8

NICARAGUA: PERCENTAGE COMPOSITION OF IMPORTS BY COUNTRY OF ORIGIN, 1919-1930

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
U.S.	84	81	73	80	76	73	70	70	66	63	63	61
Gr. Britain	8	12	12	9	12	12	11	10	11	11	11	10
Germany	--	1	2	1	3	4	6	7	7	9	9	9
France	2	2	4	2	1	2	3	2	3	3	3	3
Honduras	--	--	--	--	--	--	--	1	2	2	1	1
Peru	--	--	4	3	2	2	2	2	2	2	3	4
Italy	--	--	--	--	1	1	2	2	1	2	2	2
Panama	2	1	--	--	1	1	1	1	1	1	2	2
Japan	--	--	--	--	--	--	--	--	1	1	1	1
Spain	--	1	1	--	--	--	--	1	--	1	--	1

Source: *Ibid.*

TABLE I.9

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS BY COUNTRY OF ORIGIN, 1919-1930

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
U.S.	62	86	77	71	72	57	65	53	55	52	53	50
Germany	--	--	1	--	--	3	4	5	9	8	12	12
France	28	5	10	16	14	16	14	23	13	16	8	14
Holland	--	--	1	4	--	6	3	4	6	7	8	3
Gr. Britain	4	3	1	3	2	3	4	2	7	3	4	3
Italy	--	--	--	--	1	2	1	2	1	3	2	2
Spain	--	--	1	--	4	5	3	5	2	2	1	1
Honduras	--	--	1	1	--	--	1	--	1	2	2	3
Antilles	--	--	--	--	3	2	2	1	1	1	2	2
Panama	--	2	1	--	--	--	--	--	1	1	1	1
Norway	--	--	--	--	--	1	--	--	1	1	--	--
Finland	--	--	--	--	--	1	--	--	1	1	2	1
Guatemala	--	--	--	--	--	--	--	1	1	1	2	1
Sweden	--	--	--	--	--	1	--	--	--	1	1	--
Costa Rica	--	1	2	2	--	--	1	--	1	--	--	--
Canada	--	--	1	--	--	1	1	1	--	--	--	--
Denmark	--	--	--	1	--	1	--	--	--	--	--	--
El Salvador	1	1	--	1	--	--	--	--	--	--	2	--
Mexico	1	2	--	--	--	--	--	--	--	--	--	--

Source: *Ibid.*

As Figure I.3 shows, the Depression completely arrested the recovery that followed World War I and deeply affected the economic life of the small republic. The price of its major crop fell precipitously from 86 cents per kilo in 1929 to 52 in 1930, and kept falling, settling finally at 32 in 1940. With the exception of gold, the prices of the other leading exports followed similar trends, as Table I.27 (pp. 51-54) shows. As a result, the level of trade became almost as low as it had been during the First World War.

The ensuing reduction in foreign earnings soon created a balance-of-payments problem. In 1931 the government established exchange controls and later on it imposed differential exchange rates to impede the outflow

of foreign currencies.[38] But it was all to no avail; the outflow of dollars could not be stemmed and the government had to devalue the *córdoba* in 1934, 1937, and 1938, finally bringing the exchange rate down from parity to five per dollar. Even though these measures were taken in order to alleviate the foreign exchange crisis of the 'thirties, they were to be important elements in the post-World War II growth of the export sector, as I shall discuss later.

After the re-valuation of gold in 1934, production of this metal went up. From 1939 to 1947 gold became the leading export, both because its own volume rose and because other exports went down. The prosperity of the mines was in great measure responsible for the recovery of the export sector after 1938. There are no indications, however, that this wealth trickled down to the rest of the economy. After 1940 gold production stabilized at around 7 million dollars per year, and life went on as usual (Table 1.27).

In 1940, for the second time in the century, political strife closed the European markets and Nicaragua had to trade chiefly with the United States. In previous years this country had become increasingly important as customer and supplier, but the Second World War made it Nicaragua's sole trading partner, as Tables I.10-I.12 show. Unlike the Great War, however, the Second World War did not depress the Nicaraguan foreign sector. The demand for some strategic products--rubber, for example--rose fast, and the traditional exports attained pre-Depression levels, as Table I.27 shows. Prices of exports did not recover fully, but there was a clear improvement. It would be foolish to say that Nicaragua benefitted from the war because no one knows what would have happened had the war not occurred.

[38] United Nations, Economic Commission for Latin America, *op.cit.*, p. 12.

TABLE I.10

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS BY PRODUCTS, 1931-1945

Year	Coffee	Bananas	Gold	Cotton	Wood	Hides	Sugar
1931	50	30	6	—	2	1	1
1932	36	49	8	--	1	--	1
1933	46	38	9	--	1	1	1
1934	45	30	13	--	2	1	4
1935	55	21	10	1	2	1	2
1936	45	17	17	3	2	2	2
1937	44	14	12	8	6	3	2
1938	35	13	26	4	6	2	2
1939	32	8	42	3	4	1	1
1940	22	5	61	2	3	1	--
1941	22	2	61	1	3	1	—
1942	25	--	59	2	2	1	--
1943	22	--	50	2	3	--	1
1944	24	--	49	—	4	1	2
1945	26	--	51	--	4	1	--

Source: Nicaragua, *op. cit.*, *Memoria*, various issues.

TABLE I.11

NICARAGUA: PERCENTAGE COMPOSITION OF IMPORTS BY COUNTRY OF ORIGIN, 1931-1945

Year	U.S.	Gt.Brit.	Germany	France	Italy	Mexico	Honduras	Peru
1931	61	9	9	3	2	--	2	5
1932	63	10	9	3	2	--	1	5
1933	63	13	7	3	1	--	—	5
1934	59	12	8	3	1	--	—	3
1935	50	12	17	3	1	--	1	3
1936	46	12	24	3	1	--	--	3
1937	54	8	15	2	1	--	--	3
1938	60	8	10	2	6	--	--	3
1939	68	5	12	3	—	—	—	3
1940	84	3	--	1	--	--	--	3
1941	88	1	--	--	--	--	--	3
1942	77	2	--	--	--	9	1	4
1943	61	2	--	--	--	21	1	4
1944	75	2	--	--	—	7	1	3
1945	71	1	--	--	—	9	1	1

Source: *Ibid.*

TABLE I.12

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS BY COUNTRY OF ORIGIN, 1931-1945

Year	U.S.	Germany	France	Holland	Gt.Brt.	Italy	Spain	Honduras	Japan	Others
1931	52	13	12	7	7	1	1	2	--	5
1932	65	9	9	6	6	1	1	2	--	1
1933	50	14	13	7	7	1	3	3	---	2
1934	50	12	14	7	7	1	2	4	--	3
1935	56	16	17	2	2	1	1	4	--	1
1936	54	21	13	2	2	1	—	3	3	1
1937	55	15	8	3	1	1	--	--	5	12
1938	67	11	3	3	2	—	—	—	2	12
1939	77	--	2	3	1	--	—	--	--	17
1940	94	—	--	--	--	--	—	—	2	4
1941	96	--	—	--	--	--	—	--	--	4
1942	95	—	--	--	--	--	—	1	--	4
1943	88	--	--	--	—	--	—	2	--	10
1944	91	—	—	—	—	--	--	--	--	9
1945	90	—	—	--	1	--	—	—	--	9

Source: *Ibid.*

not occurred. But it is obvious that the war did not aggravate the economic plight thrust by the Depression upon the small nation. The prices of all major exports improved after 1940, and never had Nicaraguans to destroy surplus crops on account of overfulfilled quotas.

As a result of the devaluations of the *córdoba* preceding the Second World War, the inaccessibility of the European markets, and the tight controls imposed on U.S. exports during the war, Nicaragua had a favorable balance of trade for many years. By 1945 it had accumulated a substantial volume of international reserves. For a short time the government abolished the import restrictions that it had imposed in 1931. But inflation[39]

[39]The price of basic food commodities increased approximately 400% from 1939 to 1946. The general price level seems to have increased twofold during the same period (U.N, Economic Commission, *op. cit., Análisis*, pp. 9-18, and Nicaragua, *op. cit., Memoria*, 1952, p. 67).

and the pent-up demand for imports exhausted the stock of foreign currency as soon as the war ended, and the controls returned. By 1948 the banking system's reserve fund was dry. By 1950 a new devaluation, from 5 to 7 cordobas per dollar, became necessary.[40]

1950-1966: The Growth of Cotton Farming and its Effects on the Economic Development of Nicaragua.

At this point the economic future of Nicaragua seemed very bleak indeed. Internal revolts, a world war, two depressions and the government's indifference contributed to keeping Nicaragua at the bottom of the pyramid of wealth. More than 60 percent of its population was illiterate, its per capita income was less than U.S. $200, and the basic structure of the economy remained discouragingly unchanged. The country continued to depend on coffee as a source of foreign exchange almost as much as it had in 1911, gold was once more the second most important export, and no new products capable of giving the economy the "big push" appeared in sight.

Moreover, the communications network remained almost as primitive and inadequate as it had been twenty years earlier. Practically no new roads had been constructed, and the government's inertia had permitted the slow deterioration of the railroad.[41]

Only the country's endowment of natural resources and low population-to-land ratio provided some hope. Unlike other underdeveloped countries, Nicaragua had vast areas of uncultivated, ferile land. As large as England and Wales -- or Wisconsin (U.S.A.) -- its population was scarcely over a million: there were only 18 inhabitants per square mile, compared to 31 in Costa Rica, 26 in Honduras, 80 in Guatemala, 98 in El Salvador and 43 in the United States. It was conservatively estimated that no more than one-fourth of the arable land was under cultivation or used for grazing.[42]

[40] U.N. ECLA, Analisis, pp. 9-18.

[41] Ibid.

[42] International Bank for Reconstruction and Development, The

The richness of the soil was so impressive and the under-employment of the land so extensive that in 1953 a mission from the International Bank of Reconstruction and Development remarked: "From its nearly year-long travel in the country, the mission concluded that few underdeveloped countries have so great a physical potential for growth and economic development as does Nicaragua."[43] And more than twenty years earlier W. W. Cumberland had noticed the eminent suitability of the country's western region for cotton culture:

> Cotton is only produced in small quantities. Substantial areas of the western section are admirably suited to the growth of the cotton plant, but pests are numerous, including the boll weavil and the pink bollworm. Provided control measures over those pests could be developed, cotton would seem to be one of the most attractive industries to which the country could devote its attention. . . . The crop is well-adapted to small-scale farming . . . and climate conditions in the western section . . . are admirably adapted to cotton culture.[44]

The development of synthetic insecticides (DDT, BHC, Dieldrin, Toxaphene, etc.) during and after World War II provided the control measures that permitted the full utilization of the land's fertility. Almost simultaneously, the price of cotton doubled (from 1950 to 1951), and Nicaraguan entrepreneurs seized the opportunity with a vengeance. Cotton became the second leading export by 1954, and grabbed the lead by 1955: in five years the production had increased by more than 12-fold. Cotton provided the "big push" and the long period of stagnation was over. In the following years the Nicaraguan economy achieved rates of growth unprecedented in its history and second only to those of Venezuela in all of Latin America.

Economic Development of Nicaragua (Baltimore: Johns Hopkins Press for International Bank for Reconstruction and Development, 1953), p. xxiii.

[43] *Ibid.*

[44] Cumberland, *op. cit.*, p. 38.

Later chapters explore in detail the causes underlying the growth of cotton production. For the rest of this chapter the discussion will focus on the impact that the development had on the economy as a whole.

It was very fortunate for Nicaraguans that coffee and cotton did not have to compete for land. Coffee grows in the shaded, cool mountainous regions of Managua, Carazo, and Matagalpa; cotton in the sunny plains of Managua, León, and Chinandega. Cotton, therefore, did not displace the traditional export crop, but rather came to its aid in the arduous task of pushing the economy forward.

But other crops did not fare as well. Their substantial displacement from the lands of Managua, León, and Chinandega stands out among the important consequences of the cotton boom. Thus, while the total cultivated land in these three departments increased by only 16.8% from 1952 to 1964, the area cultivated with cotton in these regions went up 433%. On the other hand, the area planted with cotton in the rest of the country increased at approximately the same rate as the total area cultivated in these latter regions (Tables I.13 and I.14 below).

Two other developments deserve to be mentioned. First, the total cultivated area in the country increased by 55% from 1952 to 1964, and second, the main areas of expansion were the non-cotton farmlands. This confirms the IBRD's conjecture that at the beginning of the cotton boom there was substantial unemployment of land, and it implies that cotton farmers switched crops, but did not clear large, previously uncultivated areas.

From previous discussions it is obvious that Nicaragua is not a rich country and that in 1950 it was at the very botton of the pyramid of wealth. It is also obvious that fertile land is one of its most important

TABLE I.13

NICARAGUA: HECTARS PLANTED WITH COTTON AND WITH ALL OTHER CROPS, EXCLUDING COFFEE, 1952-1965

Year	Cotton Departments			Other Departments		
	Cotton	Total	% with cotton	Cotton	Total	% with cotton
1952	21,888	161,252	13.6	8,371	133,263	6.3
1953	32,822	169,707	19.3	9,648	165,518	5.8
1954	69,413	179,704	38.6	17,118	168,811	10.1
1955	71,217	191,199	37.2	14,980	188,312	7.2
1956	63,355	184,323	34.4	10,194	247,447	4.1
1957	71,933	182,211	39.5	16,437	188,259	8.7
1958	67,976	169,740	40.0	6,158	179,321	3.4
1959	64,090	136,799	46.9	2,239	202,915	1.1
1960	59,189	136,828	43.4	1,770	200,321	0.9
1961	72,763	153,255	47.5	4,543	231,645	2.0
1962	88,199	157,439	56.0	6,061	227,620	2.7
1963	106,353	178,599	59.5	11,888	233,555	5.1
1964	116,575	188,385	61.9	18,003	270,261	6.7
1965	122,555	N.A.	N.A.	19,412	N.A.	N.A.

Source: calculated from Banco Nacional de Nicaragua, Asesoria de la Junta Directiva, *Estudio de la Economia del Algodon en Nicaragua* (mimeographed, n.d.), *Cuadros 7-9*, and from Nicaragua, Banco Central de Nicaragua, *Informe Anual* (Managua: Editorial y Litografia San Jose, 1966), p. 140.

TABLE I.14

NICARAGUA: HECTARS PLANTED WITH VARIOUS CROPS IN COTTON AND NON-COTTON DEPARTMENTS, 1952-1964

Yearr	Sesame		Rice		Sugar		Corn		Beans		Sorgum	
	Cotton	Other	Cotton	Other	Cotton	Other	Cotton	Other	Cotton	Other	Cotton	Other
1952	22,322	4,387	9,797	14,517	12,232	6,672	63,339	58,757	9,259	24,823	22,366	15,735
1953	15,815	5,187	14,591	19,377	11,036	4,941	59,184	79,897	13,579	25,246	22,680	21,223
1954	13,667	3,289	6,944	11,185	11,398	5,801	47,739	71,068	11,261	31,605	19,282	28,746
1955	11,960	4,295	5,654	13,590	8,234	6,444	59,537	98,698	15,483	36,661	19,114	32,544
1956	6,084	1,971	6,633	18,597	9,533	8,504	66,215	113,161	11,306	60,275	21,200	32,645
1957	9,533	3,241	6,740	17,291	10,931	8,420	62,215	85,402	6,910	19,399	13,950	38,069
1958	13,282	4,345	4,995	17,799	12,361	9,198	52,630	81,537	7,155	30,914	12,743	29,370
1959	12,999	3,088	5,192	15,657	11,237	8,462	29,893	99,037	4,845	34,605	8,543	39,826
1960	9,359	4,635	4,922	16,428	12,349	9,225	35,910	95,147	2,787	35,055	12,312	38,064
1961	5,396	5,323	5,716	18,033	14,125	13,417	36,591	108,581	5,755	40,114	12,909	41,635
1962	3,736	2,768	2,927	19,657	12,571	10,168	32,943	107,532	3,331	39,351	13,733	42,084
1963	4,456	2,502	4,188	17,273	12,979	8,279	35,231	125,251	2,965	39,654	12,429	28,708
1964	5,137	3,472	4,182	18,292	13,132	8,170	32,031	142,468	3,811	45,513	13,520	34.386
Percentage change in area												
a. cotton depts.	-77		-57		+6		-49		-58		-40	
b. all depts.	-68		-8		+11		+42		+45		+26	
Percentage change in all depts.	≈ 0		+23		+28		-17		≈ 0		-40	

Source: *Ibid.*

assets. Why then did its inhabitants fail to use it? Was it because, contrary to the remarks of Cumberland and of the IBRD mission, the unused land was marginal and not well suited to agriculture?

Apparently not. Aggregate yield of all crops other than cotton, coffee, and tobacco increased from 330 kilos per hectar in 1950 to 512 in 1962. This suggests that the new lands were at least as fertile as the old ones. Moreover, yields of individual crops show no discernible pattern: some go up and other go down, implying that the new lands may have been more suitable for some crops than for others, but not that they were less fertile (Tables I.14 and I.15).

More likely, the land lay idle because there were no tractors to clear it and it was either too expensive or too difficult to do it by hand. There is no readily available data on costs of clearing land by hand, but there are several estimates of the number of tractors in the country and it is clear that they were not enough to open up vast areas.

An FAO mission that surveyed the agricultural potential of Nicaragua estimated that in 1949 there were about 400 tractors.[45] The IBRD report mentions 600 in 1952,[46] and I prepared Table I.16 from import statistics, assuming various tractor life-spans.

Among other benefits, the cotton boom brought an extensive mechanization of agriculture. Unlike the traditional crops, cotton suffers intensely from pests. To combat them using human or animal power is impractical at best, but more often it is impossible: farmers were forced

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[45]Food and Agriculture Organization of the United Nations, *Report of the FAO Mission for Nicaragua* (Washington-Rome: United Nations, 1950), p. 152.

[46]International Bank for Reconstruction and Development, *The Economic Development of Nicaragua*, p. 314.

TABLE I.15

NICARAGUA: YIELD (in kilos per Hectar) AND HECTARS PLANTED WITH COFFEE AND OTHER CHIEF CROPS

Year	Coffee	Sesame		Sugar Cane		Sorgum		Potatoes		Tobacco	Rice		Red Beans		Corn	
	A	A	Y	A	Y	A	Y	A	Y	A	A	Y	A	Y	A	Y
1950	71,548	14,884	611	14,196	36,209	34,517	1,565	101	12,842	449	15,906	1,298	27,144	680	115,215	1,000
1	72,621	18,226	549	14,578	30,231	37,536	1,208	298	12,781	500	16,529	1,421	27,740	683	115,425	901
2	73,067	23,647	867	19,620	44,101	41,430	1,328	578	12,798	554	41,255	1,474	35,736	874	133,328	1,019
3	79,911	27,437	664	19,471	42,543	39,141	1,369	168	12,816	508	24,978	1,430	35,012	856	125,427	978
4	76,304	21,575	630	16,412	42,243	45,101	1,345	638	12,790	608	34,895	1,603	39,884	787	142,875	971
5	80,098	17,419	588	17,668	41,977	49,273	985	262	12,782	549	18,624	1,413	44,035	714	122,048	835
6	82,345	16,698	581	15,079	45,326	53,068	959	856	12,790	695	19,769	1,158	53,567	668	162,553	889
7	84,501	8,275	603	18,529	47,196	57,470	862	1,284	12,790	974	25,919	1,168	73,534	645	184,270	755
8	88,637	13,123	602	19,880	46,392	53,438	801	824	12,795	841	24,686	1,344	27,027	439	151,645	695
9	92,954	18,108	602	22,148	46,786	43,262	880	849	12,787	923	23,437	1,427	39,108	516	136,390	793
1960	97,264	16,526	595	20,236	47,174	49,688	790	885	12,800	823	21,418	1,517	40,524	544	132,448	797
1	102,023	14,318	669	22,163	47,222	51,751	753	914	12,790	918	21,933	1,549	38,875	572	134,633	884
2	106,858	11,012	664	28,293	46,205	56,032	892	943	12,793	906	24,397	1,584	47,120	680	149,133	826

Source: calculated from Nicaragua, Consejo Nacional de Economia. Oficina de Planificacion, *Analisis del Desarrollo Económico y Social de Nicaragua, 1950-1962* (Managua: mimeographed, May, 1965), pp. 125-140. For some crops yield does not appear because it was not available.

TABLE I.16

NICARAGUA: TRACTORS IMPORTED FROM THE UNITED STATES, 1930-1946, 1948, 1949, AND TOTAL NUMBER OF TRACTORS IMPORTED 1947, 1950-1962

Year	Imported from the U.S.	Grand Total	Cumulative Total	
			10 Years Preceding	15 years Preceding
1930	6			
1	0			
2	0			
3	0			
4	1			
5	1			
6	0			
7	2			
8	11			
9	13			
1940	63		97	
1	23		114	
2	0		114	
3	3		117	
4	5		121	
5	60		180	188
6	2		182	184
7		15	195	199
8	78		262	277
9	106		355	382
1950		125	417	506
1		345	739	851
2		283	1022	1132
3		306	1325	1427
4		713	2033	2127
5		604	2577	2668
6		83	2658	2728
7		43	2686	2771
8		82	2690	2850
9		66	2650	2911
1960		32	2557	2883
1		91	2303	2872
2		280	2300	3237

Source: calculated from Nicaragua, Oficina del Recaudador General de Aduanas, *Memoria, op. cit.*, various issues, and from United States, Dept. of Commerce, Bureau of the Census, *Foreign Commerce and Navigation of the U.S.*, various issues. The *Memoria* does not list the number of tractors imported by Nicaragua in some years, so I used U.S. statistics for these years, considering that more than 80 percent of all imports came from this country.

to use tractors in order to spray insecticides, if not to till and plow the land. As Table I.17 suggests, the switch to mechanical power was fast.[47]

In addition to the mechanization of agriculture, other events also contributed to the agricultural expansion. As I shall discuss later on, the National Bank adopted new agricultural credit policies that facilitated the amplification of crop (as opposed to plantation) agriculture. And the government at last began to build roads on a large scale, bringing previously inaccessible areas into the mainstream of economic life (Table I.18).

The cotton boom differed from other periods of prosperity in that it carried with it permanent changes in the economy. The traditional exports had very few backward linkages and fewer forward linkages than cotton.[48] The production of coffee, compared to that of cotton, is a very simple process. The coffee tree requires but minimal care and its cultivation needs little capital equipment. As long as the weather is fairly good, profitable crops are possible without intensive care, use of fertilizers or insecticides. Moreover, the processes which transform the coffee fruit into a commodity are simple and few: they involve drying the fruit, peeling, decorticating, and roasting it. Because the final product must satisfy widely different tastes all over the world, coffee is usually exported before roasting it to ensure freshness and enable local processors to mix their own blends. A plant to process instant coffee, therefore, is about the only ancillary industrial activity that the crop provides, excluding the decorticating plants.

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[47]To estimate the total number of tractors in the country I assumed that the average life of a tractor is between 10 and 15 years and calculated lower and upper bounds accordingly. Since few, if any, farmers use tractors to cultivate coffee, I estimated two tractors-to-land ratios, one including all the cultivated land, and another excluding the coffee land.

[48]Nicaragua, Banco Nacional de Nicaragua, Asesoría de la Junta Directiva, *Manual de Informaciones Estadísticas* (mimeographed, n.d.), p. 115.

TABLE I.17

NICARAGUA: ESTIMATED NUMBER OF TRACTORS PER 1000 HECTARS OF CULTIVATED LAND, 1945-1962, ASSUMING THAT THE AVERAGE LIFE OF TRACTOR IS 10 OR 15 YEARS

Year	Tractors per 1000 Hectars of Total Cultivated Land		Tractors per 1000 Hectars of Cultivated Land, Excluding Coffee Land	
	Life =10	Life = 15	Life = 10	Life = 15
1945	.88	.92	1.14	1.19
6	1.00	1.01	1.29	1.31
7	1.31	1.33	1.72	1.75
8	1.21	1.28	1.57	1.66
9	1.79	1.92	2.04	2.20
1950	1.38	1.68	1.81	2.12
1	2.19	2.52	2.79	3.22
2	2.52	2.79	3.08	3.41
3	3.62	3.89	4.51	4.86
4	4.95	5.176	6.08	6.36
5	6.02	6.23	7.41	7.67
6	5.54	5.68	6.68	6.86
7	5.21	5.41	6.28	6.47
8	5.87	6.22	7.29	7.73
9	6.00	6.60	7.61	8.35
1960	5.87	6.62	7.56	8.53
1	5.26	6.78	6.84	8.83
2	4.68	6.59	5.99	8.43

Source: Calculated from Table I.16, and United Nations, Economic Commission for Latin America, *Análisis, op, cit., Cuadro* 16, p. 28

TABLE I.18

NICARAGUA: KILOMETERS OF ROADS, 1946, 1951, 1953, 1955, 1958, 1960 AND 1962

	1946	1951	1953	1955	1958	1960	1962
Paved	182	170	210	280	515	669	787
Not Paved	212	180	200	320	584	468	700
All Weather Roads		190	270	387	580	1400	1480
Dry Season Roads	570	1900	2400	2700	3400	3600	3600
Total	964	2440	3080	3687	5079	6137	6267

Source: U.N., *Análisis, op. cit., Cuadro* 165, p. 172.

In contrast, the cotton plant benefits from intensive use of insecticide, capital, and fertilizers. Moreover, its products--seed and fiber--have many uses that stimulate the growth of native industries. Thus, in 1952 around 25 percent of the total consumption of insecticide was mixed in Nicaragua; by 1955 the proportion had jumped to 40 percent and by 1959 it was a full 98 percent.[49] At the moment, there are plans to install new fertilizer plants that should begin to operate in the near future.

From the output side, the cotton gins were the first to begin operations because seed cotton is never exported. From 1950 to 1955 the gross value of the production of cotton gins jumped from 14.6 to 203.7 million *córdobas* (constant prices); value added increased at an average annual rate of 70 percent (Table I.19).

Finally, the large amounts of cotton fiber and cotton seed that the new levels of production brought provided ample supplies of raw materials to the textile and vegetable oils industries, and in time their output augmented also (Table I.19).

Cotton did not transform the Nicaraguan economy radically. The country still exports only a few products (cotton and coffee make up over 60 percent of all exports); customs duties remain the most important sources of fiscal revenues; imports as percentage of GNP remain high, and industrial output is still a very small proportion of GNP. Nevertheless, as a result of the prosperity of the cotton industry, there were many changes in the economy that not only improved the standard of living, but that also put Nicaragua in a better position to develop in the future.

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[49] Albert O. Hirschman, *La Estrategia del Desarrollo Económico* [*The Strategy of Economic Development*] (Mexico: Fondo de Cultura Económico, 1961), pp. 104-124.

TABLE I.19

NICARAGUA: PRODUCTION OF TEXTILES, VEGETABLE OILS AND COTTON GIN INDUSTRIES, 1945-1963.

Year	Textiles (Million *córdobas*)	Cotton Gins (Million *córdobas*)	Vegetable Oils (Thousand lbs.)
1945	9.5	1.1	
6	9.5	1.4	
7	10.0	1.9	
8	11.1	0.2	
9	11.7	1.7	
1950	10.3	14.6	
1	10.0-	20.0	
2	9.8	42.9	
3	10.5	57.0	2,052
4	16.6	103.0	NA
5	18.3	203.7	NA
6	17.9	161.9	NA
7	19.6	191.9	NA
8	21.7	243.6	15,776
9	26.5	201.8	14,037
1960	27.9	128.8	15,327
1	27.2	102.6	12,101
2	38.4	175.6	17,467
3	39.6	226.5	19,240
4	63.6	379.7	14,989
5	70.9*	504.8	17,363
Average Annual Rates of Growth of Value Added			
1945-1950	1.6	70.0	
1950-1955	12.2	70.0	
1955-1960	8.8	-8.8	
1960-1963	8.3	35.0	

All money values are in 1958 *córdobas*

*Estimated values.

Sources: Column 3, 1953: Great Britain, Board of Trade, *Overseas Economic Surveys, Nicaragua, Economic and Commercial Conditions in Nicaragua* (London: H. M. Stationery Office for the Board of Trade, 1954), p. 7. 1958-1965: Nicaragua, Banco Central, *Informe Anual* (Managua: Editorial y Litografía San Jose, various issues). Columns 2 and 3, 1945-1963: same as for Table I.18, p. 140; 1964-1965: Nicaragua, Banco Central, *op cit.*, *Informe*, various issues.

First, the upsurge in exports caused imports and government receipts to rise. This happened at the same time that the government began to awaken to and do something about the problems that were hampering the economic development of the country. As a result, public investment became an important part of total investment and the government an influential element in the growth of the country (Table I.20).

The construction of roads and the installation of electric power generators were among the most tangible outcomes of the government's new role, as Tables I.20 and I.21 show. But there were other, and perhaps more important, consequences: the creation of institutions to disseminate information, to promote economic development, to supervise the ports, and to provide low-cost housing. From 1950 to 1966 the government strengthened the Department of Roads (Departamento de Carreteras), created the Institute for the Promotion of Economic Development (Instituto de Fomento Nacional), the Housing Institute (Instituto de la Vivienda), and the National Enterprise for Light and Power (Empresa Nacional de Luz y Fuerza).[50]

This is not to say that the growth of cotton production was the effective cause of the government's change in attitude. On the contrary, the construction of roads and the installation of electric power generators undoubtedly aided the development of the cotton industry. But the cotton boom, coming when it did, coincided with the government's new orientation and provided the means to construct the required social overhead capital.

The second major change was in the composition and direction of trade. During the last sixteen years, of the traditional exports, only gold declined in both quantity and value. All the rest increased in value at least. Cotton exports merely augmented faster in the midst of a

[50] U.N., ECLA, *Análisis*, p. 56.

TABLE I.20

NICARAGUA: INSTALLED ELECTRIC POWER GENERATING CAPACITY, 1950-1963. (Megawatts)

Year	Public and Private			Public					Private		
						Thermoelectric					
	Total	Hydro electric	Thermo electric	Total	Hydro electric	Sub total	Steam	Diesel	Total	Hydro Electric	Thermo electric
1950	20.6	8.7	17.3	8.3	0.8	7.5	0.2	7.3	17.7	7.9	9.8
1	26.3	8.7	17.6	8.3	0.8	7.5	0.2	7.3	18.0	7.9	10.1
2	26.4	8.7	17.7	8.3	0.8	7.5	0.2	7.3	18.1	7.9	10.2
3	33.2	8.9	24.3	12.8	1.0	11.8	0.2	11.6	20.4	7.9	12.5
4	37.8	8.9	28.9	16.2	1.0	15.2	0.2	15.0	21.6	7.9	13.7
5	40.2	9.2	31.0	16.8	1.0	15.8	0.2	15.6	23.4	8.2	15.2
6	42.4	9.2	33.2	16.9	1.0	15.9	0.2	15.7	25.5	8.2	17.3
7	43.0	9.2	33.8	17.2	1.0	16.2	0.2	16.0	25.8	8.2	17.6
8	75.6	9.2	66.4	47.8	1.0	46.8	30.0	16.8	27.8	8.2	19.6
9	76.6	9.2	67.4	48.1	1.0	47.1	30.0	17.1	28.5	8.2	20.3
1960	77.4	9.2	68.2	48.4	1.0	47.4	30.0	17.4	29.0	8.2	20.8
1	77.5	9.3	68.2	48.5	1.1	47.4	30.0	17.4	29.0	8.2	20.8
2	77.5	9.3	68.2	48.5	1.1	47.4	30.0	17.4	29.0	8.2	20.8
3	79.5	9.3	70.2	50.5	1.1	49.4	30.0	19.4	29.0	8.2	20.8

Source: See Table I.18; p. 156.

TABLE I.21

NICARAGUA: PERCENTAGE PARTICIPATION OF ELECTRIC ENERGY IN THE TOTAL GROSS CONSUMPTION OF ENERGY, 1945-1964 (PETROLEUM EQUIVALENT, IN TONS)

Year	Total Energy (1)	Commercial energy (2)	Fuels of Vegetable origin (3)	Electric Energy Total (4)	Thermo-Electric (5)	Hydro Electric (6)	Percentages (4)÷(1) (7)	(4)÷(2) (8)
1945	228	56	172	23	11	12	10.1	41.1
6	227	51	176	24	12	12	10.6	47.1
7	232	51	181	26	14	12	11.2	51.0
8	239	55	184	26	14	12	10.9	47.3
9	266	75	191	27	14	13	10.2	36.0
1950	271	80	191	28	15	13	10.3	35.0
1	308	82	226	29	15	14	9.4	35.4
2	330	102	228	30	17	13	9.1	29.4
3	333	108	225	32	19	13	9.6	29.6
4	352	118	234	36	22	14	10.2	30.5
5	382	146	236	38	24	14	9.9	26.0
6	395	139	256	40	26	14	10.1	28.8
7	417	151	266	43	29	14	10.3	28.5
8	493	213	280	48	34	14	9.7	22.5
9	459	178	281	56	41	15	12.2	31.5
1960	489	193	296	59	45	14	12.1	30.6
1	516	193	323	61	48	18	11.8	31.6
2	546	231	315	71	56	15	13.0	30.7
3	598	287	311	81	68	13	13.5	28.2

Source: see Table I.18; p. 56.

TABLE I.22

NICARAGUA: PUBLIC EXPENDITURE FOR INVESTMENT IN ECONOMIC SERVICES, 1950-1963
(millions *cordobas* at 1958 prices)

Year	Total		Total in Economic Service		Roads and Bridges		Agriculture		Energy		Transport and Warehouses		Communications		Other services	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
1950	27.2	100.0	19.0	70.0	16.1	59.4	—	—	.0.4	1.6	1.4	5.0	—	—	1.1	4.0
1	32.3	100.0	23.4	72.4	19.9	61.7	0.9	2.7	0.6	2.0	1.4	4.2	0.4	1.4	0.2	0.7
2	53.1	100.0	42.5	80.0	30.4	57.2	2.2	4.2	4.2	8.0	2.1	3.9	3.4	6.4	0.2	0.4
3	68.1	100.0	53.5	78.6	35.1	51.6	1.5	2.2	7.7	11.3	4.2	6.1	4.2	6.2	0.7	1.1
4	74.9	100.0	55.8	74.5	35.7	47.7	0.7	1.0	4.1	5.4	12.4	16.5	1.1	1.4	1.8	2.4
5	88.4	100.0	58.5	66.2	47.9	54.2	1.9	2.2	5.9	6.7	1.7	1.9	—	—	1.0	1.2
6	102.8	100.0	73.3	71.3	49.8	48.5	0.9	0.9	17.9	17.4	2.1	2.0	1.2	1.2	1.4	1.4
7	122.5	100.0	97.1	79.3	58.7	47.9	1.4	1.1	32.9	26.9	1.6	1.3	1.2	1.0	1.3	1.1
8	114.1	100.0	92.9	82.3	68.6	60.1	0.5	0.5	22.7	19.9	1.3	1.1	0.6	0.5	0.3	0.2
9	103.6	100.0	84.1	81.2	55.3	53.4	—	—	4.7	4.6	22.6	21.8	1.0	1.0	0.5	0.5
1960	74.9	100.0	55.8	74.5	40.2	53.7	0.2	0.3	5.9	7.9	6.8	9.1	2.3	3.1	0.4	0.4
1	102.4	100.0	64.9	63.4	41.7	40.7	0.1	0.1	17.9	17.4	1.1	1.1	4.0	3.9	—	—
2	121.2	100.0	92.9	76.7	53.7	44.3	0.8	0.6	31.0	25.6	4.1	3.4	3.0	2.5	0.4	0.3
3	154.7	100.0	115.5	74.7	61.0	39.5	0.2	0.1	47.9	30.9	2.1	1.4	3.8	2.5	0.5	0.3

Source: same as for Table I.18; p. 57.

growing sector. From the import side, the reliance on the United States diminished and Japan became Nicaragua's best customer, as Table I.25 shows. At present the country is less susceptible to external shocks than before 1950 and more resistant to changes in the economic conditions of particular geographical areas (e.g. Europe, Asia, America) if only because the composition of its export trade is more evenly spread among these regions (see Tables I.23, I.24 and 25).

The establishment of native industries centered around the cotton crop was the third event that placed Nicaragua in a better position vis-a-vis future development. Whereas before the country could only suffer from lower coffee, gold, or banana prices, now the textile and vegetable oils industries, at least, stand to gain from lower cotton and cottonseed prices.

Finally, the very process of cultivating cotton seems to have modified the attitude of farmers toward agriculture and of Nicaraguans toward business in general. As Cumberland remarked, pests are cotton's worst enemy, and successful methods of controlling them have a high rate of return; ample rewards await ingenuity and daring. And, because approximately six months elapse between sowing and harvesting, it is easy to see rapidly the results of experiments concerning fertilizers, or of any idea that modifies existing techniques of production. Of course, the outcomes of innovations regarding insecticides become evident even more quickly. In short, the learning process is fast, the rewards for talent immediate, and the risk for complacency enormous. Coffee, on the other hand, is more resistant to attacks; the weather is its worst enemy. Furthermore, the coffee tree matures in four or more years and the results of innovations that modify the arrangement of trees, that introduce new

TABLE I.23

NICARAGUA: PERCENTAGE COMPOSITION OF IMPORTS BY COUNTRY OF ORIGIN, 1946-1966

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
United States	76	85	84	79	81	72	71	65	65	65	63	58	55	52	53	49	50	48	47	47	46
West Germany	--	--	--	--	2	5	4	7	9	6	7	11	8	7	8	8	7	7	8	6	7
Costa Rica	2	1	--	1	--	1	1	--	--	--	1	1	1	1	1	1	--	1	3	4	6
El Salvador	1	1	1	1	1	1	2	2	3	2	1	2	2	3	2	2	3	2	3	4	5
Guatemala	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	2	3	4	4	5
Japan	--	--	--	--	1	--	1	3	2	2	2	3	4	5	7	6	6	6	6	7	5
Belgium	--	--	--	1	1	1	3	2	2	2	3	3	4	3	3	4	4	3	3	3	4
Great Britain	1	2	2	2	3	4	4	4	3	3	4	4	4	4	4	4	4	5	4	4	3
Panama	3	1	1	1	1	1	2	3	3	3	2	2	3	3	3	3	3	3	3	3	3
Venezuela	--	--	--	--	--	--	--	--	--	--	--	--	1	1	1	1	1	3	4	3	3
Others	17	10	12	15	10	15	12	14	13	17	17	16	18	21	17	21	20	19	15	15	13

Source: see Table I.7

TABLE I.24

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS, 1946-1966

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Cotton	1	1	--	1	5	12	13	15	27	39	36	31	35	41	23	27	35	37	41	45	40
Coffee	24	25	32	18	50	40	42	39	40	35	36	40	34	19	31	25	17	16	17	18	15
Meat	--	--	--	--	--	--	--	--	--	--	--	--	--	3	5	6	7	8	6	4	7
Copper	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	4	4	4	6
Cotton-seed	--	--	--	--	--	1	1	2	2	4	5	5	5	6	4	4	5	5	6	6	6
Gold	39	36	29	32	23	19	17	16	13	10	11	10	10	10	11	11	9	7	6	4	3
Shrimp	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	1	1	1	3
Wood	5	8	5	6	5	4	5	7	5	4	5	5	4	5	6	4	3	2	2	1	2
Sesame seed	5	10	14	17	4	5	8	5	4	2	2	2	3	3	4	3	2	2	2	1	1
Others	26	20	20	26	13	19	14	16	9	6	5	7	9	13	16	20	16	18	15	16	17

Source: *ibid*; also table below.

TABLE I.25

NICARAGUA: PERCENTAGE COMPOSITION OF EXPORTS BY COUNTRY OF DESTINATION, 1945-1966

	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Japan	--	--	--	1	--	1	5	2	6	11	13	9	5	11	22	14	19	20	22	23	32	30
United St.	90	78	77	75r	64	70	54	52	44	45	37	38	39	37	27	43	45	38	37	26	24	22
W. Germany	--	--	--	--	3	--	1	5	10	14	16	23	17	17	14	14	12	14	11	19	14	15
Portugal	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	2	1	3	3	5
Costa Rica	3	2	4	2	1	1	--	--	--	--	--	--	--	1	4	2	1	1	1	2	3	4
El Salvador	--	--	--	3	2	2	5	2	2	3	1	1	1	1	2	2	1	2	2	2	3	4
Others	7	10	19	19	30	27	35	39	38	27	33	28	38	33	31	25	22	23	26	25	21	20

varieties, or that change the conditions under which the trees grow, become evident only after a long wait. The entrepreneur's learning process is slow. Consequently, the coffee grower leans more towards waiting and watching than towards watching and doing. To sum up and exaggerate a little, it may be said that whereas coffee breeds gentlemen of leisure, cotton forges old-fashioned entrepreneurs. It seems that the attitude of the latter, in time permeated other sectors of the economy and instilled in the Nicaraguan businessman the willingness to take risks and the drive to seek new opportunities.[51]

Practically every economic series reflects the dynamism and progress that have characterized the Nicaraguan economy since 1950. It is unfortunate that GNP series (or even estimates) do not exist for years before 1945; direct comparisons are impossible. Nevertheless, the foreign trade statistics--important as they are in the economy--reflect the economic gains that the development of cotton farming brought to the country. Table I.26 shows per capita exports since 1904, GNP and per capita GNP since 1945. The difference between pre- and post-1950 are patent.

The cotton boom, then, brought wealth to the Nicaraguan farmers, more dynamic mentality to other sectors of the economy, unprecedented rates of growth, new industries and a more diversified export basket. In 15 years the "white gold" ended the secular stagnation that foreign interventions, internal revolts and reliance on coffee and gold had fostered.

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[51] I have no "hard" evidence for these remarks. They are merely the impressions gathered from conversations with farmers, sundry businessmen connected with the cotton crop, and with Government officials. Some works have passing references about the differences in mentality between coffee growers and cotton farmers, but they do not elaborate at length. See, for example, Nicaragua, *op. cit.*, *Analisis*, p. 130.

TABLE I.26

NICARAGUA: PER CAPITA EXPORTS 1904-1966, PER CAPITA GROSS NATIONAL PRODUCT, AND GROSS NATIONAL PRODUCT, 1945-1966

Year	Per Capita			GNP (in millions 1958 cordobas)
	Exports* (Dollars)	Imports* (Dollars)	GNP (Cordobas)	
	(1)	(2)	(3)	(4)
1906	24.72	19.91		
7	18.35	15.35		
8	20.36	16.51		
9	20.42	13.22		
1910	21.97	13.80		
1	34.01	29.59		
2	18.08	23.76		
3	35.99	26.93		
4	23.35	19.48		
5	20.80	14.38		
6	19.24	17.39		
7	15.60	16.68		
8	17.88	13.67		
9	26.66	17.00		
1920	20.59	26.46		
1	24.11	15.86		
2	23.60	15.30		
3	31.27	20,61		
4	37.46	25.40		
5	33.45	28.08		
6	35.97	28.31		
7	25.84	29.22		
8	32.69	37.32		
9	30.60	33.20		
1930	25.53	25.00		
1	23.61	21.60		
2	18.07	13.85		
3	18.89	14.82		
4	17.69	15.60		
5	17.74	15.91		
6	14.10	16.92		
7	19.49	15.57		
8	17.45	15.19		
9	24.47	18.76		
1940	26.76	19.88		
1	29.61	25.90		
2	30.78	14.55		
3	30.98	27.15		
4	30.06	19.80		

TABLE I.26 continued

Year	Per Capita			GNP (in millions 1958 cordobas)
	Exports* (Dollars)	Imports* (Dollars)	GNP (Cordobas)	
	(1)	(2)	(3)	(4)
1945	26.13	22.38	1116	1107.2
6	28.83	23.89	1180	1195.0
7	33.70	30.48	1152	1194.1
8	23.82	23.94	1119	1324.7
9	27.52	24.80	1164	1308.8
1950	37.65	26.85	1318	1504.7
1	43.66	28.33	1350	1591.2
2	48.33	27.39	1526	1907.9
3	50.43	40.29	1568	1955.3
4	56.31	52.30	1649	2144.9
5[1]	65.00	57.00	1751	2285.0
6	52.97	56.02	1642	2320.9
7	54.87	62.34	1729	2475.0
8	52.64	57.72	1718	2450.0
9	52.00	48.15	1662	2449.8
1960	44.15	50.36	1749	2454.2
1	46.84	50.95	1810	2607.9
2	61.31	66.79	1991	2927.6
3	69.08	71.68	2028	3093.5
4	78.00	85.38	2081	3323.9
5	87.80	94.49	2208	3654.5
6	78.37	100.26	2208	3786.2

*Deflated by BLS Index of Wholesale Prices of all Commodities (1906-1950); Nicaraguan index from 1950 to 1966.

[1]Pre-1955 imports are FOB, but CIF thereafter.

Sources: Columns (1) and (2): Nicaragua, *op. cit.*, *Memoria*, various issues.

Columns (3) and (4): 1945-1963: calculated from U.N. ECLA, *op. cit.*, *Analisis*, p. 125. 1963-1966: Nicaragua, Benco Central de Nicaragua, *op. cit.*, *Informe Anual*, various issues.

TABLE I.27

NICARAGUA: DEFLATED VALUES, QUANTITIES AND AVERAGE EXPORT PRICES OF CHIEF EXPORT PRODUCTS, TOTAL EXPORTS AND TOTAL IMPORTS, 1904-1966

Year	Exports (1000's Dollars)	Imports (1000's Dollars)	COFFEE			Deflator
			Value (1000 US$)	Quantity (Metric Tons)	Price (Dollars/kilo)	
1904	12003	9792	3193	9825	0.32	32.7
5	10766	10477	4684	9143	0.51	32.9
6	12481	10053	4032	8808	0.46	33.9
7	9412	7874	3692	8490	0.43	35.7
8	10605	8602	4436	9364	0.47	34.4
9	10781	6981	4216	8441	0.49	37.0
1910	11775	7399	7241	12029	0.60	38.6
1	18532	16127	12087	7648	1.58	35.5
2	10217	13140	4690	6163	0.76	37.8
3	20188	15105	13099	11993	1.10	38.2
4	13284	11083	6153	10351	0.59	37.3
5	12018	8313	5216	9133	0.57	38.0
6	11293	10209	4639	10453	0.44	46.8
7	9292	9942	2740	8429	0.33	64.3
8	10816	8271	3137	11594	0.27	71.7
9	16371	10439	8269	15281	0.54	75.8
1920	12766	16407	3401	6961	0.49	84.5
1	15114	9944	4405	13580	0.32	53.4
2	14940	9686	4348	8874	0.49	52.9
3	20015	13191	7145	13713	0.52	55.1
4	24235	16431	13660	17997	0.76	53.6
5	21876	18365	9959	10822	0.92	56.6
6	23776	18714	14781	17672	0.84	54.8
7	17258	19518	7805	10255	0.76	52.3
8	22062	25189	12815	17804	0.72	53.0
9	20869	22643	11330	13248	0.86	52.1
1930	17641	17277	8016	15303	0.52	47.3
1	16479	15078	8318	15846	0.52	39.9
2	12758	9775	4154	8127	0.51	35.6
3	13468	10565	6133	13704	0.45	36.1
4	12756	11244	5790	14677	0.39	41.0
5	12918	11582	7119	18525	0.38	43.8
6	10516	12624	4785	13107	0.37	44.2
7	14911	11909	6521	15789	0.41	47.2
8	13684	11907	4723	14261	0.33	43.0
9	19671	15083	6256	17416	0.34	42.2
1940	22079	16400	4870	15299	0.32	43.0
1	24960	21837	5387	12668	0.43	47.8
2	26531	12541	6644	12726	0.52	54.0
3	27327	23947	6083	11967	0.51	
4	27086	17840	6562	13071	0.50	56.9
5	24116	20658	6355	12252	0.52	57.9
6	27356	22672	6530	11776	0.55	66.1
7	32861	29722	6568	10047	0.65	81.2
8	23868	23989	9621	14491	0.66	87.9
9	28340	25545	5224	6839	0.76	83.5
1950	39910	28459	19967	20984	0.95	86.0
1	47761	30991	19079	16098	1.19	96.7
2	54610	42245	23044	18912	1.22	94.0
3	58798	46981	23012	18774	1.23	92.7
4	67792	62965	27103	17073	1.59	92.6
5	83000	73000	29884	22765	1.31	93.2
6	67648	71532	24084	16943	1.42	96.2
7	71928	81731	28790	22035	1.31	99.0
8	70803	77634	24134	22912	1.05	100.4
9	71761	66442	13775	16309	0.84	100.6
1960	62434	71214	19087	21770	0.87	100.7
1	68153	47129	17316	20965	0.83	100.3
2	89633	97641	15337	20551	0.75	100.6
3	106448	110456	17485	24072	0.73	100.3
4	124562	136349	29990	23279	0.90	101.5
5	145313	15637	27711	28195	0.91	102.5
6	13441	171949	20568	23215	0.89	105.8

TABLE I.27—continued

Year	GOLD			WOOD		
	Value (× $1000)	Quantity (Kilos)	Price ($ per Gram)	Value (× $1,000)	Quantity (× 1000 Board feet)	Price ($ per B-F)
1904	2101					
5	1951			131		
6	2569			1003		
7	2095			599		
8	2256			413		
9	2632			722		
1910	2321			46		
1	2625			118		
2	2399			320		
3	2783			843		
4	2389			1223	11896	0.102
5	2461			716	7542	0.095
6	2049			799	9685	0.083
7	1440			2030	19587	0.102
8	1736			1997	18420	0.109
9	1974			2185	18803	0.116
1920	1490			2312	23759	0.094
1	1854			1687	11549	0.146
2	2015			1338	10460	0.128
3	1495			3279	20386	0.160
4	1438			2340	18847	0.124
5	1037			3280	28579	0.115
6	1197			2449	18369	0.134
7	1174			3300	24224	0.136
8	685			2334	21988	0.106
9	833			2466	22611	0.108
1930	899			1131	11205	0.100
1	1033			398	5234	0.077
2	1073			110	1856	0.058
3	1150			130	2564	0.051
4	1659			222	5471	0.407
5	1295			320	7622	0.042
6	1828			222	4808	0.046
7	1799			915	14154	0.064
8	3607			877	14985	0.059
9	8301	3166	2.62	794	13835	0.058
1940	13391	5112	2.62	637	10028	0.064
1	15320	6514	2.35	818	8496	0.093
2	15622	7502	2.08	452	5544	0.081
3	13692	6879	1.99	938	11942	0.079
4	13376	6768	1.98	1163	13680	0.079
5	12292	6329	1.94	1164	13878	0.087
6	10788	6341	1.70	1493	19612	0.083
7	9410	6790	1.39	2124	28504	0.077
8	8851	6916	1.28	1514	20816	0.074
9	9172	6816	1.35	1666	22198	0.073
1950	9309	7161	1.30	2007	29594	0.076
1	9037	7820	1.16	2056	33837	0.068
2	9471	7920	1.20	2965	38119	0.061
3	9519	7923	1.20	4252	43778	0.078
4	8800	7241	1.22	3206	31562	0.097
5	8692	7201	1.21	3785	37347	0.102
6	7603	6504	1.17	3437	35592	0.101
7	7013	6181	1.13	3385	38027	0.097
8	7292	6536	1.16	3026	33584	0.089
9	7140	6401	1.16	3647	39475	0.090
1960	6868	6156	1.16	3567	37339	0.092
1	7710	6555	1.18	2903	27809	0.095
2	7660	6884	1.13	2641	26990	0.104
3	7073	6326	1.19	2214	22263	0.098
4	6843	6244	1.10	2086	20906	0.099
5	5274	4853	1.09	1899	18407	0.103
6	4895	4598	1.06	2373	22657	0.105

TABLE I.27--continued

Year	BANANAS			RUBBER		
	Value (× $1000)	Quantity (1000 stems)	Price ($ per stem)	Value (× $1000)	Quantity (Metric Tons)	Price ($ per KG)
1904	875	1733	0.50	911	300	3.03
5	900	1744	0.52	1435	358	4.01
6	2065	1402	1.47	1136	296	3.84
7	232	378	0.62	882	287	3.07
8	779	1216	0.64	549	204	2.69
9	443	764	0.58	621	188	3.31
1910	277	490	0.57	896	285	3.15
1	955	1465	0.65	1625	349	4.66
2	1119	1477	0.76	437	154	2.83
3	1110	1393	0.80	730	221	3.30
4	1351	1526	0.89	332	143	2.32
5	979	1106	0.89	455	223	2.04
6	1056	1111	0.95	547	296	1.85
7	747	960	0.78	403	295	1.37
8	746	862	0.87	60	74	0.81
9	737	799	0.92	113	136	0.83
1920	967	1167	0.83	41	50	0.83
1	2631	1874	1.40	6	10	0.56
2	3724	2618	1.42	--	4	--
3	3724	3429	1.09	15	19	0.76
4	3185	2845	1.12	7	13	0.57
5	3073	3027	1.02	163	140	1.16
6	2237	2163	1.03	190	144	1.32
7	2759	2386	1.16	48	40	1.20
8	3628	3144	1.15	17	19	0.89
9	3810	4092	0.93	2	2	0.96
1930	4734	3861	1.23	--	--	--
1	4965	2973	1.67	--	--	--
2	6286	3378	1.86	--	--	--
3	5122	3698	1.30	--	--	--
4	3771	2686	1.40	--	2	--
5	2742	3002	0.91	--	1	--
6	1742	1932	0.90	29	54	0.54
7	2087	2472	0.84	142	186	0.76
8	1807	1950	0.93	79	151	0.52
9	1550	1653	0.94	66	105	0.63
1940	1037	1556	0.67	35	74	0.47
1	586	731	0.80	25	55	0.46
2	52	83	0.62	678	523	1.30
3	--	--	--	1566	1267	1.24
4	7	11	0.64	1895	1643	1.15
5	140	121	1.16	1463	1217	1.20
6	292	314	0.93	576	584	0.99
7	414	468	0.88	257	303	0.85
8	750	679	1.10	--	--	--
9	992	769	1.29	--	--	--
1950	706	662	1.07	3	7	0.49
1	514	587	0.87	134	170	0.79
2	377	493	0.76	138	120	1.14
3	354	459	0.77	15	24	0.63
4	448	577	0.78	13	11	1.18
5	376	470	0.80	6	55	0.12
6	165	214	0.77	31	38	0.82
7	92	112	0.82	20	30	0.67
8	70	92	0.76	17	16	1.06
9	83	103	0.80	9	17	0.53
1960	137	181	0.76	9	27	0.33
1	54	63	0.85	16	12	1.33
2	761	325	2.25	7	--	--
3	1384	353	2.58	--	--	--
4	2138	774	2.76	--	--	--
5	767	311	2.47	--	--	--
6	841	675	1.25	--	--	--

TABLE I.27--continued

Year	SUGAR			COTTON		
	Value (× $1000)	Quantity (Metric Tons)	Price ($ per kilo)	Value (× $1000)	Quantity (Metric Tons)	Price ($ per kilo)
1904	37	169	0.22	46	110	0.42
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	492	1823	0.27	99	116	0.85
1910	39	230	0.17	26	63	0.41
1	31	253	0.12	15	24	0.63
2	69	357	0.19	69	116	0.60
3	84	497	0.17	--	1	--
4	125	709	0.18	--	6	--
5	42	212	0.20	82	94	0.86
6	530	3035	0.17	15	17	0.88
7	361	2911	0.12	29	56	0.52
8	1035	6240	0.17	48	78	0.62
9	803	3847	0.21	16	24	0.67
1920	2776	8408	0.33	27	77	0.35
1	2451	12107	0.20	134	287	0.46
2	1278	9948	0.13	--	2	--
3	2368	10757	0.22	20	74	0.27
4	1894	8342	0.23	227	274	0.83
5	2759	10981	0.25	123	131	0.94
6	1599	10155	0.16	14	20	0.70
7	847	5401	0.17	29	37	0.78
8	975	8648	0.11	--	--	--
9	457	3502	0.13	--	--	--
1930	774	6887	0.11	102	147	0.98
1	175	1653	0.11	41	108	0.38
2	185	1597	0.12	--	--	--
3	161	1269	0.13	--	--	--
4	451	5257	0.09	44	96	0.46
5	201	2012	0.10	125	214	0.59
6	190	2634	0.07	303	531	0.57
7	282	2435	0.11	1171	1352	0.88
8	300	4776	0.06	610	1357	0.45
9	199	3248	0.06	601	1246	0.48
1940	--	10	0.09	472	1088	0.44
1	--	--	--	260	787	0.33
2	--	1	--	578	1530	0.38
3	405	3333	0.12	535	1211	0.45
4	541	3327	0.16	57	74	0.77
5	--	--	--	--	--	--
6	855	2833	0.30	119	322	0.37
7	--	--	--	--	441	--
8	182	1840	0.10	--	--	--
9	479	4582	0.10	254	380	0.67
1950	823	5929	0.14	2141	3307	0.64
1	1459	8346	0.17	5643	4358	1.30
2	988	7657	0.13	7274	9530	0.76
3	1038	9167	0.11	9065	12783	0.71
4	1202	10721	0.11	18104	23196	0.78
5	1008	8785	0.11	32270	43972	0.74
6	448	3917	0.11	24497	36338	0.67
7	1023	8967	0.11	22013	36016	0.61
8	1632	15375	0.11	24795	42701	0.58
9	2101	24350	0.09	29172	61687	0.47
1960	3411	34857	0.10	14581	27390	0.53
1	2826	25346	0.11	18286	32515	0.56
2	4444	37468	0.12	31110	55660	0.56
3	6008	41134	0.15	39662	73125	0.54
4	5657	47932	0.12	40728	93484	0.54
5	5383	45477	0.12	64390	121631	0.53
6	2023	17219	0.12	54083	116000	0.47

Sources: Nicaragua, *op. cit.*, *Memoria*, various issues;
U.N. ECLA, *op. cit.*, *Analisis*, p. 24;
Economic Statistics Bureau of Washington, D.C., *The Handbook of Basic Economic Statistics*, XXI (January, 1967), p. 122;
International Labor Office, *Yearbook of Labor Statistics, 1966* (Geneva: ILO, 1966), p. 628.

From 1904 to 1950 all values are deflated by the U.S. Bureau of Labor Statistics index of Wholesale prices of all commodities. From 1950 to 1966, the deflator is a Nicaraguan price index.

In 15 years cotton farming provided Nicaragua with a strong basis to build future growth through the utilization of the backward and forward linkages that it entails and which remain to be fully exploited in the country.

OIAPTER TWO

THE COMMODITY AND THE PROBLEM: CO'ITON IN THE WORLD ECONOMY SINCE 1945; COTTON IN NICARAGUA SINCE 1950.

The development of cotton farming in Nicaragua, then, contributed in great measure to the econor-d.c growth of the country. The industry began to rise around 1950, became a major export crop five years later and has been growing almost continuously ever since. The phenomenon is unique in the sense that in no other country did cotton production increase as fast. Only Spain comes close to the Nicaraguan rates of growth, and then that country produces only one-half of Nicaragua's output, as Table II.1 shows. World cotton production has little more than doubled since the crop year 1945/46. The improvement in Nicaraguan yields has also been outstanding: 35% above world yield in 1951/52, 200% in 1967/68. Such peculiar progress begs for an explanation and it is the purpose of this chapter, first, to review the most notable events in the cotton world since 1945, and then to ascertain whether some simple, previously successful models explain the production responses of Nicaraguan cotton farmers.

The gradual erosion of the United States' leadership position in the cotton world is perhaps the most significant event in the area during dle last twenty years. Even though this country still is thea ajor e;iq;orter of cotton, its share has been declining since 1945; exports have remained stationary, but world exports have almost doubled (Table II.2), with the largest increases coming during the 1945-1955 decade. The Soviet Union, China, India and Pakistan account for more than half of the increase, and a host of smaller countries for the rest. Whereas in 1945 the U.S.

TABLE II.1

LEADING COUNTRIES IN GROWTH OF COTTON PRODUCTION SINCE THE CROP YEAR 1945/46

Country	Production Index (1945/46 = 100)	1967/68 Output (1,000 Metric Tons)
Nicaragua	2,975	119
Spain	2,000	60
Venezuela	1,500	15
Colombia	1,147	103
Syria	854	111

Source: Intl. Cotton Advisory Committee; see Table II.2.

produced 42% of the world's total, in 1945 its share was only 16%. This drop was absolute as well as relative: the U.S. output went down and other countries reaped larger crops. At present the Soviet Union is the world's largest producer of cotton (Tables II.2 and II.3).

Since 1951/52 there has been a gentle but perceptible rise in yield around the world, from 224 kg per hectar in 1951/52 to 335 in 1967/68 (Table II.2). It is impossible to ascertain how far back the trend goes because there are no reliable statistics on the amount of cultivated land for years before 1951/52. If, however, yields increased because modern insecticides achieved more effective pest control, then it is doubtful that there were noticeable changes from 1945/46 to 1951/52. In the United States--the world's largest producer at the time--the modern insecticides gained widespread use around 1950.[1]

From all this we can see that the growth of cotton output in Nicaragua has surpassed the rate of growth in cotton production in the world as a whole and in any other country individually, helping to displace some of the traditional producers. So fast has production increased

[1] U.S., President's Science Advisory Committee, *Cotton Insects*, A Report of a Panel of the President's Science Advisory Committee (Washington, D.C.: U.S. Government Printing Office, 1965), p. 4.

TABLE II.2

COTTON PRODUCTION: WORLD, USA AND NICARAGUA: STATISTICS CONCERNING YIELD, AREA, PRICES AND PRODUCTION, 1945-1967

Year*	WORLD Consumption	WORLD Production (×1000 MT)	WORLD Yield (KG/H)	U.S.A. Production (×1000 MT)	U.S.A. Yield (KG/h)	U.S.A. As Percent of World Production	NICARAGUA Production (×1000 MT)	NICARAGUA Yield (KG/H)	NICARAGUA Average Export Price of Cotton (US $ per CWT)
45/46	5,317	4,587		1,919	286	41.8	.8		—
46/47	6,136	4,684		1,859	265	39.7	.2		20.4
47/48	6,213	5,475		2,528	299	50.6	--		20.4
48/49	6,112	6,275		3,176	351	49.8	1.1		--
49/50	6,454	6,753		3,463	315	51.3	4.3		25.3
50/51	7,603	6,020		2,141	302	35.6	4 .		25.3
51/52	7,625	7,554	224	3,286	303	43.5	8.7	304	25.3
52/53	8,003	8,700	245	3,288	314	37.8	12.7	421	56.9
53/54	8,413	9,019	264	3,556	363	39.2	22.8	511	32.6
54/55	8,634	8,896	266	2,955	382	33.2	44.4	639	29.9
55/56	8,918	9,480	278	3,183	467	33.6	34.7	400	32.9
56/57	9,309	9,120	276	2,825	458	30.9	41.8	602	32.0
57/58	9,234	9,034	282	2,376	435	26.3	47.7	778	29.9
58/59	9,924	9.710	304	2,493	522	25.6	46.7	630	27.8
59/60	10,499	10,267	314	3,170	518	20.9	28.0	423	26.8
60/61	10,206	10,113	312	3,107	500	30.8	34.0	534	21.9
61/62	9,972	9,819	307	3,117	491	31.3	55.0	714	24.7
62/63	9,799	10,454	326	3,237	512	30.5	73.0	750	25.9
63/64	10,343	10.943	330	3,339	578	30.6	93.0	810	25.9
64/65	10,881	11,301	341	3,306	579	29.2	124.0	920	25.0
65/66	11,033	11,536	350	3,260	591	26.8	111.0	749	25.3
66/67	11,262	10,383	337	2,085	538	20.2	115.0	296	24.6
7/8 prelim.	N.A.	10,261	335	1,659	507	16.2	119.0	778	N.A.

Sources: International Cotton Advisory Committee, *Cotton-World Statistics. Quarterly Statistical Bulletin* (Washington: International Cotton Advisory Committee), various issues; U.S. yield, 1945-1951: U.S. Department of Commerce, *op. cit.*, various issues.

*Year beginning August 1.

TABLE II.3

COTTON EXPORTS: WORLD TOTAL AND EXPORTS OF SELECTED COUNTRIES
1945/46-1966/67

(Thousands of Metric Tons)

Year*	World	USA	USSR	UAR	Mexico	Nicaragua
1945/46	2,000	783		186	57	
46/47	2,082	768		323	44	
47/48	1,880	427		342	77	0.2
48/49	2,321	1,030		368	50	0.2
49/50	2,702	1,252		357	142	2.2
50/51	2,578	891		333	161	4.3
51/52	2,706	1,244	249	198	213	3.5
52/53	2,613	693	271	376	214	15.0
53/54	2,940	852	347	323	206	23.0
54/55	2,708	781	336	236	271	21.7
55/56	2,843	505	310	312	438	51.8
56/57	3,501	1,724	319	201	283	32.3
57/58	3,099	1,297	310	274	306	31.7
58/59	2,953	630	347	301	390	71.8
59/60	3,806	1,609	390	400	281	24.9
60/61	3,704	1,493	379	345	347	30.1
61/62	3,386	1,101	347	244	323	52.5
62/63	3,458	747	325	296	409	62.4
63/64	3,920	1,257	390	299	308	87.2
64/65	3,682	913	455	339	349	123.8
65/66	3,678	661	510	343	459	116.0
6/7 prelim.	3,946	1,052	542	311	301	95.4

*Year beginning August 1st.

Source: See Table II.2.

TABLE II.4

TEN LARGEST COTTON PRODUCERS IN THE WORLD, 1945/46 AND 1967/68

1945/46			1967/68		
Country	Production	Percentage of World Production	Country	Production	Percentage of World Production
U,S.A.	1,919	42	U.S.S.R.	2,016	19.6
India & Pakistan	783	17	U.S.A.	1,659	16.2
China	395	9	China	1,409	13.7
U.S.S.R.	369	8	India	1,117	10.8
Brazil	293	6	Brazil	542	5.2
Egypt	235	5	Pakistan	510	5.0
Mexico	94	2	U.A.R.	437	4.3
Peru	71	1.5	Mexico	434	4.2
Argentina	64	1.4	Turkey	385	3.8
Uganda	41	0.9	Sudan	184	1.8

Source: see Table II.2

TABLE II.5

LEADING COUNTRIES IN YIELD, 1965/66

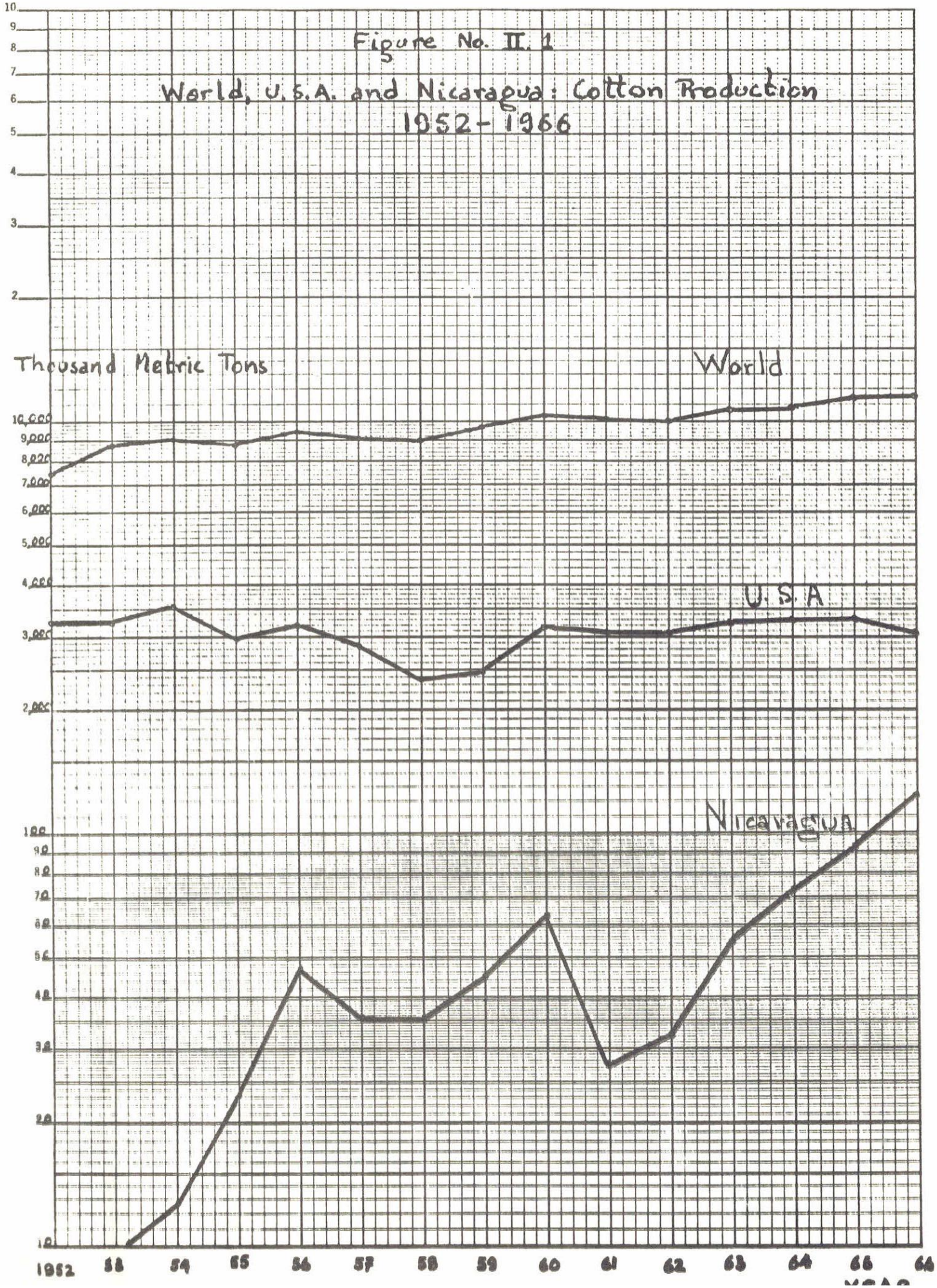
(kilos per hectar)

Country	Yield	Country's Production as Percent of World Production	Area (× 1,000 Hectars)
Israel	1,096	0.27	26
Australia	1,967	0.27	29
Guatemala	841	0.73	89
U.S.S.R.	817	19.65	2,469
Nicaragua	778	1.15	153

Source: see Table II.2.

Figure No. II. 1

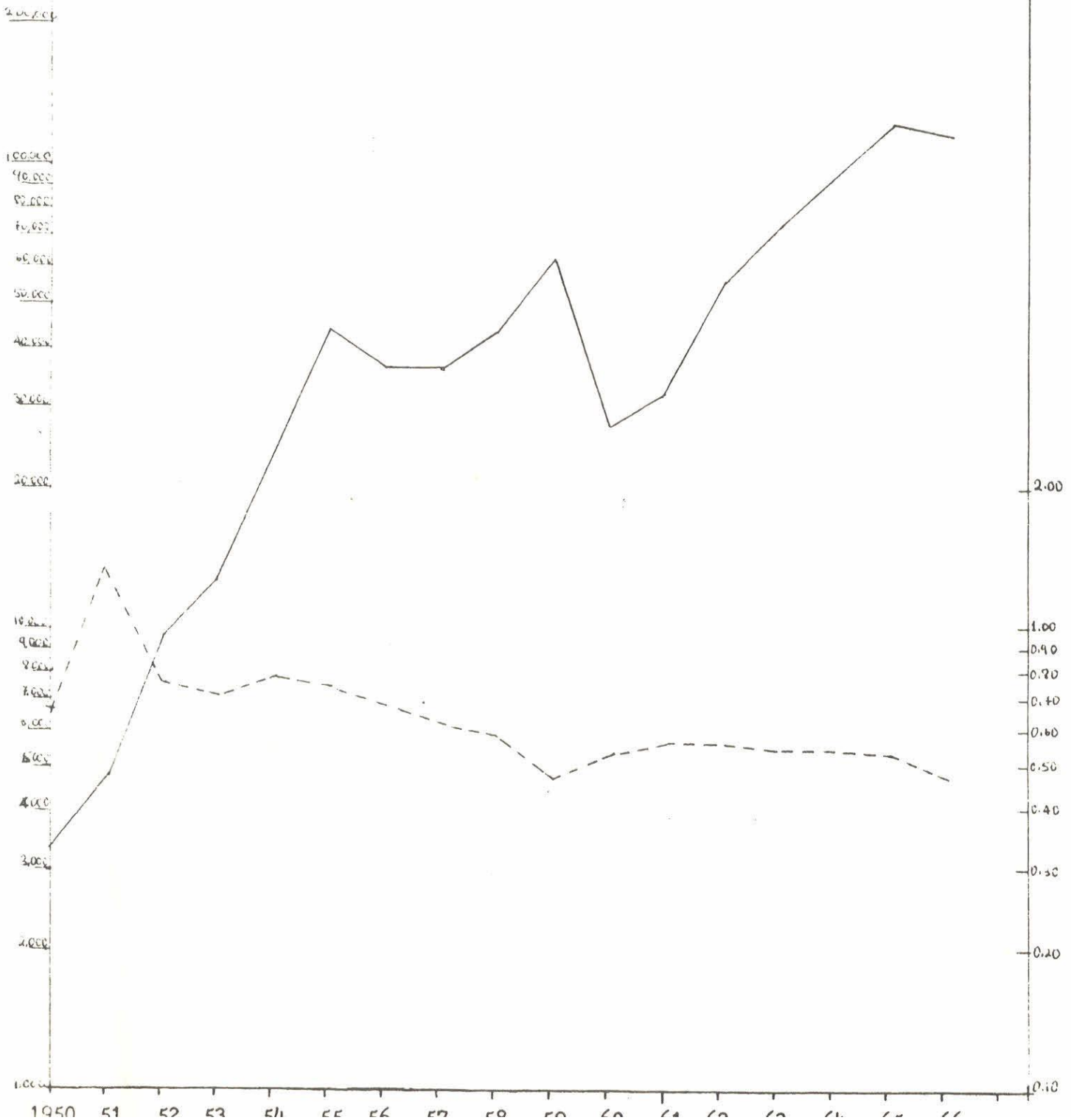
World, U.S.A. and Nicaragua: Cotton Production
1952 - 1966



Exports (Metric Tons) Price (dollars per Kilo)

Figure No. II.2

Nicaragua: Cotton Exports and Cotton Price
1950-1966



that even though in 1945 Nicaragua produced less than 1,000 metric tons of cotton, in 1967 it had become the world's eleventh largest producer, exceeding the levels attained by Peru, Argentina and Uganda--countries that in 1945 were among the ten largest producers and whose output has increased since then. Simultaneously, the Nicaraguan yield became one of the world's highest, exceeded only by that of the Soviet Union among the large producers (Tables II.2 and II.5).

From the theoretical point of view, the Nicaraguan phenomenon is most puzzling because it came in spite of falling cotton prices, as Table II.2 shows. To find an industry growing in spite of falling prices is surprising, but to find one growing at such rapid pace is disconcerting! A simple regression between price and quantity:

$$Y_t = a + bP_t + e_t \qquad \text{II.1}$$

where Y stands for output of Nicaraguan cotton, P for world cotton price, e for a random error, shows that for the 1950-1965 period, the least-squares estimate of b is -73,591 with a standard error of 23,755. Allowing for lagged responses to price and changing (II.1) to:

$$Y_t = a + bP_{t-i} + e_t \quad (i = 1,2) \qquad \text{II.2}$$

changes the estimate of b to -22,363 for price lagged one year, and to -25,296 for price lagged two years, as Table II.6 shows.

Introducing a time trend in equations (II.1) and (II.2) renders the estimate of b positive in every case, but the standard errors remain large. Moreover, the estimated elasticities are very low. Yet, it would probably be incorrect to conclude that the price-elasticity of supply is near zero, or negative. Rather, it is probably the case that these estimates are inaccurate.

TABLE II.6

SIMPLE REGRESSION ESTIMATES OF PRICE-ELASTICITY OF SUPPLY FOR NICARAGUAN COTTON, 1950-1965

Case 1: $Y_t = a + bP_t + e_t$

Variable	Constant	P_t	Elasticity
Coefficient	a	b	
Estimated Value	3,237,940	-73,591	-2.02
Standard Error	N.A.	(23,755)	

Case 2: $Y_t = a + bP_{t-1} + e_t$

Variable	Constant	P_{t-1}	Elasticity
Coefficient	a	b	
Estimated Value	1,819,250	-22,362	-0.698
Standard Error	N.A.	(11,945)	

Case 3: $Y_t = a + bP_{t-2} + e_t$

Variable	Constant	P_{t-2}	Elasticity
Coefficient	a	b	
Estimated Value	1,947,920	-25,296	-0.818
Standard Error	N.A.	(11,500)	

Case 4: $Y_t = a + bP_t + c_t + e_t$

Variable	Constant	$P_t P_t$	t	Elas.
Estimated Value	- 575,561	9,461	144,162	0.260
Standard Error	N.A.	(35,020)	(51,164)	

Case 5: $Y_t = a + bP_{t-1} + c_t + e_t$

Variable	Constant	P_{t-1}	t	Elas.
Estimated Value	- 777,914	10,448	158,036	0.326
Standard Error	N.A.	(11,071)	(37,964)	

Case 6: $Y_t = a + bP_{t-2} + c_t + e_t$

Variable	Constant	P_{t-2}	t	Elas.
Estimated Value	-419,416	4,049	142,283	0.131
Standard Error	N.A.	(11,369)	(38,856)	

Of course, many economists maintain that farmers, especially peasant farmers, do not respond to price, and perhaps for them the Nicaraguan phenomenon would not come as e surprise.[2] But even if this postulate about peasant behavior were applicable to the highly commercialized Nicaraguan cotton agriculture, econometric studies have increasingly been showing that output elasticities are positive and high, even in peasant economies. The underlying theme of these studies is that when on the surface it appears that there is no relationship between output and price, it is because "shift variables" veil the relationship to any but the keen eye of the econometrician. Thus, R. Krishna[3] estimated the price-elasticity of supply for cotton in the Punjab region at values ranging from 0.59 (short-run) to 1.62 (long-run). He assumed that yield, rainfall and the area used in ell crops were "shift variables," and also that actual acreage was an approximation to desired, long-run acreage. By simply deflating the price of cotton by the average of alternative crops, Falcon[4] found a high correlation between percentage changes in cotton acreage and price lagged one year. Falcon's short-run elasticity estimate was 0.41.[5]

Marc Nerlove's *The Dynamics of Supply: Farmers' Response to Price*[6] was of course the seminal work introducing lagged responses to price and

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[2]See for example, Joseph Grunwald, "The 'Structuralist' School on Price Stability and Development: The Chilean Case," *Latin American Issues: Essays and Comments*, ed. Albert O. Hirschman (New York: Twentieth Century Rund, 1961), pp. 95-123; Walter Neale, "Economic Accounting and Family Farming in India," *Economic Development and Cultural Change*, VII (1959), 289-301.

[3]R. Krishna, "Farm Supply Response in India-Pakistan: A Case Study of the Punjab Region," *Economic Journal*, LXXIII (Sept., 1963), 477-484.

[4]Walter Falcon, "Farmer Response to Price in a Subsistence Economy: The Case of Pakistan," *American Economic Review*, LIV (May, 1964), 580-591.

[5]*Ibid.*, p. 585.

[6]Marc Nerlove, *The Dynamics of Supply: Farmers' Response to Price* (Baltimore: Johns Hopkins Press, 1958).

allowing for delayed acreage adjustments. In it he showed that even in highly commercialized agricultures it is possible to underestimate price elasticities when farmers' responses to price changes are not immediate. Following Nerlove, I applied his model to the Nicaraguan case, but the results were disappointing: the estimated coefficients either came out negative, or had very large standard errors. In one case the estimated long-run elasticity was negative and in the other it was low, as Table II.7 shows.

Since Nerlove's model is somewhat complex, before presenting the results, it would be helpful to give a brief summary of its underlying theory.

To begin, he postulates a supply function:

$$Y_t^* = C + aP_t^* + bt \qquad \text{II.3}$$

where Y^* is the "desired" (presumably, profit maximizing) level of output, P^* is "expected" price, a is the long-run price coefficient, t denotes time, c is a constant and b a trend coefficient.

Nerlove also assumes that present output may differ from desired output. He argues that, from year to year, it is difficult to adjust the fixed factors to the "desired" level. Hence actual, present output may differ from the "desired" level because it depends partly upon past production decisions. In particular, Nerlove assumes a partial adjustment model:

$$Y_t - Y_{t-1} = \gamma(Y_t^* - Y_{t-1}) \qquad \text{II.4}$$

where Y_t is actual output, and γ is the coefficient of adjustment. If farmers were able to adjust the fixed factors instantaneously, there would be no difference between actual and desired output; γ would be equal to one.

TABLE II.7

ESTIMATES OF THE PARAMETERS OF THE NERLOVIAN SUPPLY FUNCTION FOR NICARAGUAN COTTON, 1950-1965

Case 1: Area is the Non Price Variable.

Coef. Name	π_{01}	π_{11}	π_{21}	π_{31}	π_{41}
Variable Name	Constant	P_{t-1}	A_{t-1}	A_{t-2}	t
Value	50,957	-330.34	0.6092	-0.3763	4.640
Standard Error		(764.31)	(0.3234)	(0.3874)	(3.064)

Long-Run Elasticity Estimate: -0.11

Case 2: Output is the Non Price Variable.

Coef. Name	π_{02}	π_{12}	π_{22}	π_{32}	π_{42}
Variable Name	Constant	P_{t-1}	Y_{t-1}	Y_{t-2}	t
Value	476,181	5.664	0.9426	-0.2956	77.186
Standard Error		(8.460)	(-.3600)	(0.4639)	(48.716)

Long-Run Elasticity Estimate: 0.53

Farmers make their production decisions before they know the selling price of their produce; they respond not to the post-production, observed market price, but to the price that they expect to prevail. This price, in turn, probably depends upon past prices. Nerlove postulates that it depends on past, expected prices, as well as in past actual prices:

$$P^*_t = \beta(P_{t-1} - P^*_{t-1}) + P^*_{t-1} \qquad \text{II.5}$$

where P^* stands for expected price, P for the actual market price, and β for an unknown coefficient of adjustment. When β is equal to one, expected price becomes the last market price.

If past prices are to influence present expectations less and less the farther that they are removed in time, β must lie between zero and one.

In order to estimate the long-run coefficient, a, it is necessary to solve the system and express output as a function of observable variables. The solution takes the form:

$$Y_t = \pi_0 + \pi_1 P_{t-1} + \pi_2 Y_{t-1} + \pi_3 Y_{t-2} + \pi_4 t \qquad \text{II.6}$$

where the π's are functions of a, b, c, γ and β. According to the standard theory of production, the long-run price coefficient, a, should be positive. Moreover, since

$$a = \frac{\pi_2}{1 - \pi_2 - \pi_3}$$

if π_1 is equal to zero, a will also be equal to zero.

Using the data in Table II.8, I estimated a for the period 1950-1965. I ran two versions of equation (II.6). In the first version, the non-price variable was area, in the second it was output.[7]

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[7]Nerlove used area instead of output because, he argues, forces outside the farmers' control (weather, for example) influence output, and area planted reflects the desired output better than actual output. It is evident that his reasoning is correct only if farmers expect the same yield

TABLE II.8

DATA FOR LEAST-SQUARES REGRESSION, NAIVE MODELS AND DISTRIBUTED LAGS (NERLOVE'S) MODELS

Year	Area (*Manzanas*) (1)	Output (cwt's) (2)	Price (US $ per cwt) (3)
1950 =1949/50	21,316	73,500	25.3
1	23,945	113,500	56.9
2	66,802	380,000	32.6
3	43,226	267,871	29.9
4	60,672	421,192	32.9
5	123,616	1,031,344	32.0
6	123,139	813,514	29.9
7	105,067	966,860	27.8
8	126,213	1,149,830	26.8
9	105,905	1,059,661	21.9
1960	94,756	602,235	24.7
1	87,081	721,843	25.9
2	110,437	1,239,280	25.9
3	134,657	1,609,733	25.0
4	168,916	2,038,138	25.3
5	192,254	2,712,031	24.6

Sources: Columns 1, 2, 1963-1965: Nicaragua, Banco Nacional de Nicaragua, *Manual de Informaciones Estadísticas* (mimeographed, n.d.), p. 63; 1950-1962: Nicaragua, Oficina de Planificación, *op. cit.*, *Análisis*, *Cuadro* No. 14, p. 20; Column 3: See Table I.27.

The regressions equations that I used were:

$$A_t = \pi_{01} + \pi_{11}P_{t-1} + \pi_{21}A_{t-1} + \pi_{31}A_{t-2} + \pi_{41}t + E_{1t} \qquad \text{II.7}$$

$$Y_t = \pi_{02} + \pi_{12}P_{t-1} + \pi_{22}Y_{t-1} + \pi_{32}Y_{t-2} + \pi_{42}t + E_{2t} \qquad \text{II.8}$$

where the A's denote area, the Y's denote output and the E's stand for a random error.

Table II.7 gives a summary of the results. The long-run price coefficient, a, is negative in one instance and imprecisely measured in both cases. This implies that either Nicaraguan farmers behave contrary to the tenets of economic theory, or that there were so many factors involved in the growth of the industry that they cannot be explained simply in terms of Nerlovian lagged responses. The next chapter explores several hypotheses that may elucidate the causes underlying the expansion of production.

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year after year and if, whatever variations occur, can be attributed to the outside forces. See Marc Nerlove, *op. cit.*, p. 62.

CHAPTER THREE

THEORETICAL EXPLANATIONS, ECONOMETRIC MODELS AND EMPIRICAL RESULTS

From the preceding discussion it may be inferred that the price of cotton was not the cause of the industry's growth. In fact, after 1953 it was probably more of a deterrent than a stimulus. The purpose of this chapter is to investigate what other developments provided the incentives that made cotton farming such a popular and successful venture. The chapter begins with a description of the institutional setting. It then continues with a presentation of three alternative but possibly complementary hypotheses that could explain the growth of the industry. Econometric tests of each hypothesis follow. Finally, the consequences of agricultural credit policies on the growth of the industry signal the end of the section.

Cotton farming in Nicaragua may be appropriately classified as a competitive industry, both within the country and in the international market. During the 1964/65 crop year there were approximately 4,000 farmers participating in the industry. The nine largest cultivated 6.73% of the land, the forty-two largest 19.05% and the two hundred and six largest 46.75% (Table III.1). In 1966/67 the country produced approximately 1% of the world's total and its exports represented about 1.5% of the world's exports. It is reasonable to conclude, therefore, that in the international market the country faces rigid prices, and that within Nicaragua individual farmers are price takers. This is not to say that as a group cotton farmers' decisions leave input prices unchanged. Even though the prices of imported inputs (fertilizers, tractors and other

TABLE III.1

NICARAGUA: DISTRIBUTION OF COTTON FARMERS, BY AMOUNT OF AREA PLANTED, 1964/65

Hectars Planted	Farmers		Hectars Planted	
	Number	Percentage	Number	Percentage
0- 3.5	976	25.06	2,200	1.66
3.5- 7	858	22.01	4,373	3.30
7- 14	652	16.73	7,778	5.87
14- 35	637	16.34	15,272	11.48
35- 70	335	8.60	17,530	13.23
70-140	234	5,97	23,467	17.71
140-350	164	4.21	36,704	27.70
350-700	33	0.85	16,325	12.32
700-1750	9	0.23	8,918	6.73

Source: calculated from Nicaragua, Banco Nacional de Nicaragua, Asesoria de la Junta Directivo, *Estudio de la Economia del Algodon en Nicaragua* (mimeographed, n.d.) *Cuadros* Nos. 7 and 10, and p. 11

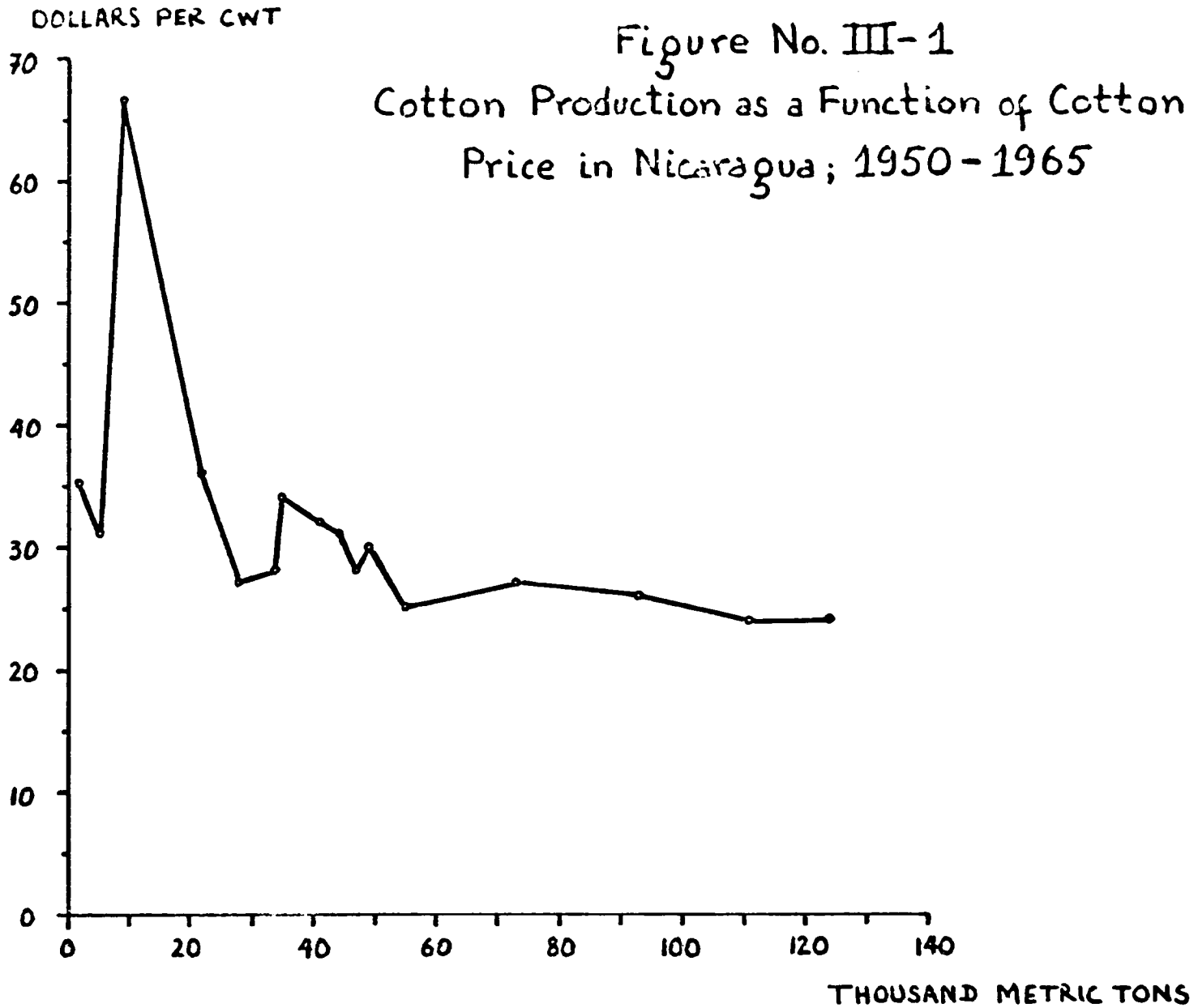
mechanical devices, and insecticides) probably do not change, the level of cotton production affects the wage rate and the rental price of land, as we shall see later on. Nevertheless, it is probably accurate to postulate that the individual farmer perceives a world governed in inflexible prices.

As Figure No. III.1 shows, a plot of price vs. quantity suggests a downward-sloping supply curve. From the theoretical point of view, of course, the firm's supply curve must slope upwards. The industry's supply curve may slope downwards if the firm's cost curves fall as a function of time. The latter may occur for a variety of reasons which may be divided into two categories. One, external economies that result from the industry's expansion. Two, developments within the individual firms that lower costs regardless of the industry's size. In both cases a close look at developments at the firm level is enlightening, first because it may provide a clue as to why the industry began to expand in the first place, and second for obvious reasons.

In Nicaragua it seems that it was developments at the firm level which lowered costs, for the expansion of the industry raised input prices, as Table III.16 (p. 114) indicates. The growth of production, therefore, came in spite of rising input prices. In order to investigate what led to the displacement of the short-run supply curves (at the farm level), I formulated three hypotheses that seemed helpful. The next three sections show how returns to scale, technical change, and learning by doing affect the movements of the short-run supply curves. In addition, they present tests designed to ascertain which of these three best explains the displacement in the present case.

Figure No. III-1

Cotton Production as a Function of Cotton Price in Nicaragua; 1950-1965



Returns to Scale

The first hypothesis considered here is that the production of cotton is subject to increasing returns to scale. According to this postulate the short-run supply curves moved outwards because individual farmers' unit costs declined as they increased acreage.

In the long run farmers may increase the area under cultivation; it is very difficult, however, to change it during any given year. To be sure, it is possible to increase acreage even after sowing, but it is not easy. In cotton farming, correct timing is essential for success. The crop must be harvested before it rains, for wet seed cotton is of little value. In Nicaragua this requires that sowing take place approximately four months before the rainy season. Moreover, over 80 percent of the farmers work on short-term credit and they receive no other income until they sell their crops; the maximum amount that they may borrow is a fixed proportion of the land that they plan to cultivate.[1] In addition to physical constraints, then, there are *financial obstacles that impede* quick and easy changes in acreage after a certain time. In the short run, therefore, the farmer's problem may be properly described as an optimization process subject to a land constraint.

As Table II.2 showed, yield went up concomitantly with production. Any hypothesis that attempts to explain the displacement of the short-run supply curve must be consistent with increases in yield. It is easy to show that under increasing returns to scale yield will generally go up as the fixed factor of production is augmented.[2] From the theoretical point

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[1]Nicaragua, Banco Nacional de Nicaragua, *op. cit.*, *Estudio*, pp. 20-22.

[2]It is sufficient to show that increasing returns and increasing yield are not mutually contradictory. To establish the proposition it is

of view, then, returns to scale offers an explanation for the expansion of production and the concomitant rise in yield. The next few paragraphs describe the available data and discuss the statistical problems involved in testing the hypothesis.

The sample at hand consisted of observations on 311 farms engaged in production during the crop year 1964/65 and it included the following items:

1. Output in hundredweights.
2. Area.
3. Land rented.
4. Expenditures on insecticides, fertilizers, defoliants, herbicides, fuel and lubricants, spare parts and seed.
5. Wage bill for labor used in
   a. tilling,
   b. Fumigating,
   c. harvesting.
6. Value of following capital items:
   a. tractors,
   b. picking machines,
   c. ox carts and oxen

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enough to show that it is true for a certain class of functions. Consider homogeneous production functions: if as the fixed factor, land, goes up by some percentage, p, the other factors of production go up by the same percentage as a result, then yield will always increase. By assumption, each input goes up by p percent. Homogeneity and increasing returns imply that output goes up more than p percent. Hence yield has gone up.

It is reasonable to assume that as land goes up by, say, 10%, farmers will use 10% more labor, 10% more capital, 10% more insecticide, etc. In fact, it is easy to show that if the production function is Cobb-Douglas, the percentage change in the variable factors resulting from a change in the fixed factor is always greater than the percentage change in the fixed factor. As long as the production function is Cobb-Douglas and exhibits increasing returns to scale, yield will go up as more land is used.

d. buildings,

e. land.

7. Price received by farmers for the cotton.

8. Prices paid by farmers for:

a. seed,

b. labor used in picking,

c. land rented.

In view of the data, I chose to measure the degree of returns to scale by estimating a production function. For that purpose I postulated a Cobb-Douglas form solely for heuristic reasons. It is to be viewed not as an accurate representation of reality, but merely as a useful approximation.

The easiest way to measure returns to scale within the Cobb-Douglas framework is to use least-squares on a log-linear version of the production function:

$$Y = X\beta + E \qquad \text{III.1}$$

where Y stands for the vector of observations on output (in logarithms), X for the matrix of observations on inputs (also in logarithms), and E for a vector of random errors.

This simple and appealing technique, however, is statistically unsatisfactory if X is a matrix of random variables correlated with the vector of errors, E. Whether this correlation exists or not is an empirical problem. From the theoretical point of view it is difficult to decide whether it does or does not. If the entrepreneur maximizes profits and chooses the level of inputs according to the marginal conditions, then it is very likely that the correlation will exist.[2] If, on the other hand,

[2] Jacob Marschak and William H. Andrews, Jr., "Random Simultaneous

the entrepreneur does not maximize profits, but only the expected value of profits, then as Zellner, Kmenta and Dreze[3] have suggested, it is reasonable to assume that X is independent of E. The key assumption that Zellner and the others make is that the source of disturbances in the production function is different from the source of disturbances in the marginal conditions. The former may be attributed to influences outside the entrepreneur's control, the latter to mistakes that he makes. *A priori*, there is no reason to suppose that the two are dependent upon one another. Under these circumstances the least-squares estimator of β in (III.1) is consistent and unbiased.[4]

In cotton farming there is another simultaneous equations bias concerning insecticides and fertilizers, for the economically optimum level of these inputs depends not only on price ratios, but also on the presence of insects and on the fertility of the land. Because most cotton production in Nicaragua is confined to an area roughly sixty miles in radius, it may be presumed that the land is fairly homogeneous and that the input of fertilizers depends solely on price ratios. The problem concerning insecticides, however, is a bit more complex.

The presence of insects tends to bias the estimate of the coefficient of insecticides towards zero. Output of cotton depends partly on insects; the input of insecticide solely on them. If all farmers choose the amount of insecticides that they use on the same basis, there will be

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Equations and the Theory of Production," *Econometrica*, XII (July, 1944), 143-205; Marc Nerlove, *Estimation and Identification of Cobb-Douglas Production Functions* (Chicago: Rand McNally and Co., 1965).

[3] A. Zellner, J. Kmenta and J. Dreze, "Specification and Estimation of Cobb-Douglas Production Function Models," *Econometrica*, XXXIV (October, 1966), 784-795.

[4] *Ibid.*

a perfect correlation between insects and insecticide. The correlation between output and insects, however, is negative. Hence, if the level of insects does not appear in the regression, the coefficient of the input "insecticides" will be biased towards zero.

Assuming that X and E are correlated, it is still possible to obtain consistent, if biased, estimators of the production function coefficients. Two solutions to the problem are given below.

First, let us consider the solution proposed by Klein.[5] Let the production function be:

$$Y = AK^{\alpha}N^{\beta}$$

From the profit maximizing conditions we get:

$$\alpha = cK/pY$$

$$\beta = wN/pY$$

where c, w, and p are the prices of K, N and pY, respectively. Taking logarithms, we obtain:

$$\ln \alpha = \ln (cK/pY)$$

$$\ln \beta = \ln (wN/pY).$$

As an estimator of $\ln \alpha$ and of $\ln \beta$ Klein suggests a and b, the geometric means of the ratio of factor proportions:

$$a = \frac{1}{n} \Sigma \ln (cK/pY)$$

and similarly for $\ln \beta$. Klein obtains estimates of the production function parameters by taking antilogs of a and b. As estimators of $\ln \alpha$ and $\ln \beta$, a and b are unbiased and consistent, but as estimators of α and β,

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[5] Lawrence Klein, *A Textbook of Econometrics* (Evanston: Row, Peterson and Co., 1953), pp. 226-236; "The Use of Cross-Section Data in Econometrics with Application to a Study of Production of Railroad Services in the United States," N.B.E.R. (mimeographed, n.d.) as quoted in Nerlove, *Estimation and Identification*, pp. 29-83.

antilog α and antilog β are only consistent.[6] This approach was appealing because the estimators are easy to compute and the data that they required was readily available.

The second solution involves estimating reduced-form equations and from them obtaining estimates of the production function coefficients. Using the same production function and marginal conditions as before, and solving for Y, K and N in terms of prices, the system yields three reduced-form equations, one for the supply function and one derived-demand equation for each factor of production. The general form of the system is:

$$Y = X\Pi + U$$

where Y is the vector of observations (in logarithms) on inputs and outputs, X the matrix of observations (in logarithms) on input- and output-prices, and U a vector of random errors. Π is the matrix of unknown parameters to be estimated and whose components are functions of the original production-function coefficients. To estimate Π it is necessary to have data on the physical quantities of inputs and output, and on all prices.

For the problem at hand I assumed that the production of cotton depends upon labor, land, capital, seed, fertilizer and insecticide. For reasons already discussed, I assumed that land is exogenous.

Before dwelling at length in the precedural details of estimation, a brief description of the cultivation of cotton will aid the reader in judging the appropriateness of the variables selected as inputs for the production function.

The process may be divided into three parts: (1) preparing the land for sowing, (2) protecting the crop after the seed germinates, and (3) harvesting the crop. The first part is straightforward. Farmers

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[6] Nerlove, *op. cit.*, pp. 29-83.

plow the land, plant the seed and, sometimes, also fertilize the soil at the same time. After the seed germinates, sundry types of insects attack the tree and farmers usually spend great efforts in combatting the noxious pests, chiefly with insecticides. But protection also involves killing weeds and ridding the tree of superfluous foliage. Depending on the size of the farm, farmers fumigate either by hand, tractor or airplane. The other operations are usually done by hand, although some farmers have begun to experiment with chemical weed-killers and with defoliants. The third and final stage begins after the tree blossoms. During this period fumigation is still necessary, but harvesting becomes more important. The best cotton has a white, long and strong fiber. To a large extent length depends on the variety planted, but exposure to sunlight, dust and mist has a notable influence on color and strength. It is best to pick the cotton as soon and as gently as possible. In Nicaragua, for many years cotton was solely hand picked, but recently, as labor becomes scarce, some farmers—very few—have begun to use machines.

The sample included reports of many farmers who did not know the expenditures that they had incurred in one or more of the six input variables above, and I eliminated them from further analysis. In addition, preliminary examinations of the 254-observations subsample showed that farmers cultivating less than 14 hectars reported substantially lower costs. Suspecting that the discrepancy reflected under-reporting of labor costs, I calculated total costs minus labor costs for all strata, expecting the procedure to equalize costs among strata. But, as Table III.2 shows, the differences persisted, indicating either that smaller farmers did incur lower costs, or that if they did not, they under-reported consistently. Because many of these smaller farmers do not keep books, I

TABLE III.2

AVERAGE COSTS PER STRATUM

Hectars Planted	Total Expenses per Hundredweight		Total Expenses Minus Labor Costs per Hundredweight		Number of Farms
	Mean	Standard Deviation	Mean	Standard Deviation	
0- 3.5	26.15	7.14	12.13	3.96	27
3.5- 7	27.69	7.30	12.73	3.12	25
7- 14	31.66	7.83	12.93	3.42	24
14- 35	39.11	17.17	18.21	10.40	30
35- 70	36.61	6.68	16.44	3.92	23
70-140	35.24	8.53	15.71	5.13	37
140-350	35.03	8.70	15.21	3.52	65
350-700	33.64	7.49	15.02	3.93	19
700- ∞	35.20	2.09			5

decided to eliminate their data under the assumption that they were under-reporting. The resulting subsample contained 165 farms.

Because *a priori* it is impossible to decide whether there is a simultaneous equations bias, I decided to use three methods of estimation (least-squares on the production function, Klein's method and reduced-form estimation) and to compare the results.

Least-Squares on the Production Function.—The estimating equation was of the form,

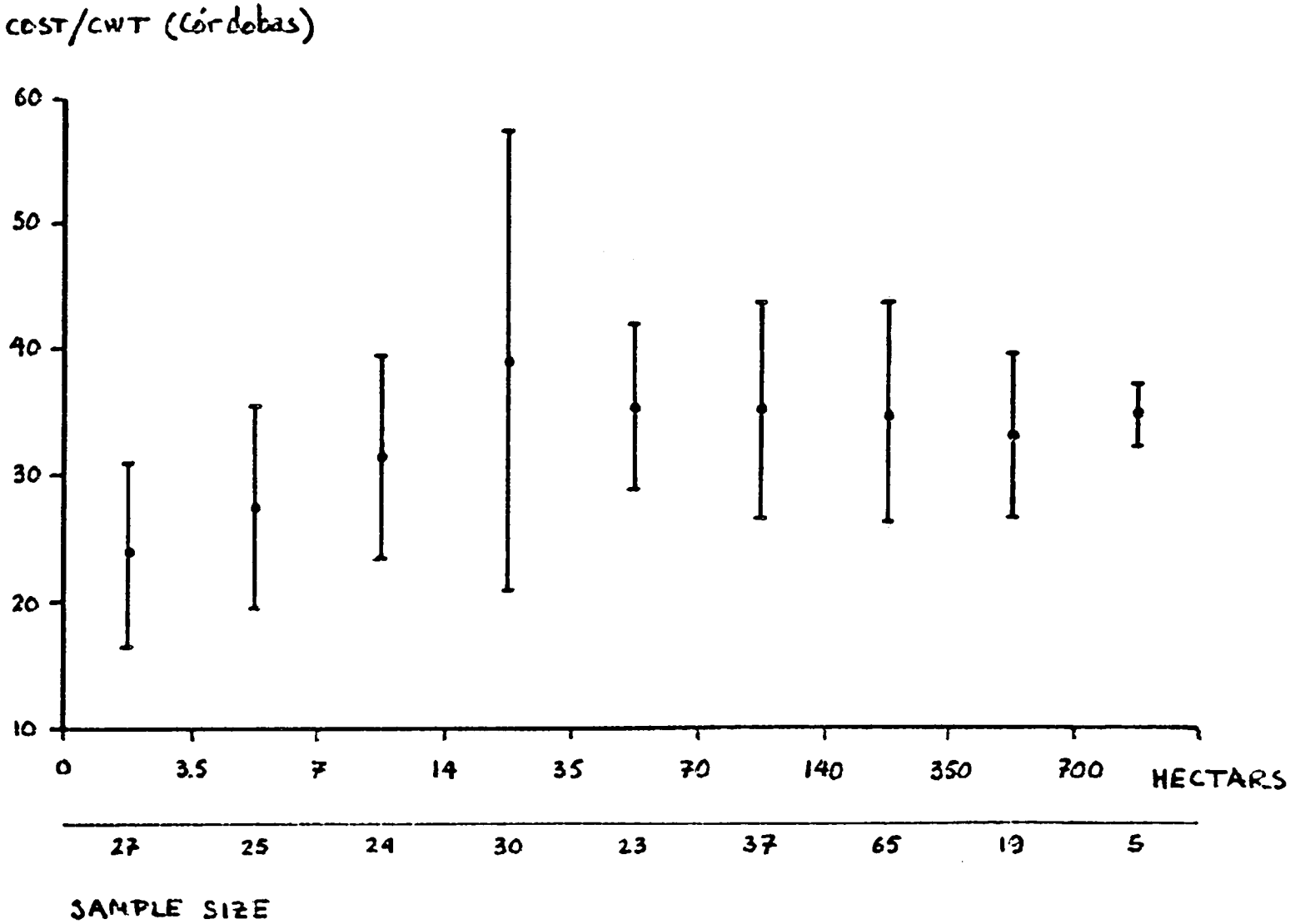
$$\ln Y_j = A + \Sigma \ln \alpha_i X_{ij} + \gamma \ln L_j + \varepsilon_j \quad (j=1, \ldots, 165) \quad \text{III.2}$$

where Y represents output of cotton (in hundredweights), and X_i the ith input. The Units of each input varied for reasons explained below.

Ideally, in order to estimate the coefficients of all the inputs, the latter should be in physical units and perfectly homogeneous. To allow for quality differences, appropriate weights should be used whenever possible. The sample at hand contained expenditure data; land was the

Figure No. III.2

Average Cost as a Function of Area



only input available in physical units. However, each farmer reported the price of seed, the wage rate and the price of cotton, and there were small variations in these prices. Hence it was possible to obtain physical quantities of the labor and seed inputs. Before doing that, I scrutinized the sources of price variance in order to decide upon the appropriate procedure.

Theoretically, prices should have been constant over the sample. The input and output markets are competitive, the product and the factors of production fairly homogeneous. Nevertheless, the quality of seed, and the quality and composition of insecticides and fertilizers vary. It would seem, then, that in order to allow for variations in quality, it would be appropriate to weight the physical quantities--and what more appropriate weights than prices? For these inputs expenditure is a good measure. Given the size of the country and the skills necessary for tilling the land and picking the cotton, labor may be classified as a homogeneous input; physical quantities should be the units of the variable entering the regression.

Finally, a word about the capital input. Perhaps the ideal measure here is tractor-hours and square feet of floor space used in housing tractors and other mechanical implements. No such data was available and I had to devise a proxy. Assuming that tractors last half as long as buildings and that the number of tractor-hours is directly proportional to the number of tractors owned, then the capital input would be proportional to the value of tractors and the value of buildings. As a proxy, I chose

$$C = 0.20T + 0.10B$$

where T represents the reported value of tractors and other mobile equipment, and B represents the reported value of buildings and other structures.

In sum, the inputs and their respective units for the least-squares regression on the production function were:

land	*manzanas* (physical)
seed	*córdobas* (money value)
insecticide	*córdobas* (money value)
fertilizer	*córdobas* (money value)
labor	men-days
capital	*córdobas* (money value).

Estimators that Presuppose Simultaneous Equations Bias

a. Klein's Approach.--The data in this case were, in all instances, the same used for the least-squares regression above. Because Klein's method requires expenditure data, instead of physical quantities, the variables entering the analysis were in money values. The capital input was exactly the same as in the previous case. The estimator took the form:

$$\hat{b}_i = \text{antilog } b_i$$

where

$$b_i = \frac{1}{n} \sum_j (\ln P_i X_{ij} - \ln P_0 Y_j)$$

for each b_i, excluding the coefficient of the exogenous variable, land. For the latter, I first obtained estimators of the coefficients of the other variables and then defined a new dependent variable, $\hat{Y}$, as follows:

$$\hat{Y}_j = \ln Y_j - \sum \hat{b}_i \ln X_{ij},$$

and estimated the coefficient of land using least-squares on the equation below:

$$\hat{Y}_j = B + \gamma L_j + V_j,$$

where V_j represents a random error. Table III.3 gives a summary of the results obtained using the two methods outlined above.

TABLE III.3

LEAST-SQUARES AND KLEIN'S METHOD ESTIMATES OF THE PRODUCTION FUNCTION COEFFICIENTS

Variables	Estimates	
	Klein	Least-Squares
Seed	0.00942	0.06759 (0.07628)
Insecticide	0.16016	0.01758 (0.05161)
Fertilizer	0.05930	0.08765 (0.04346)
Labor	0.30493	0.22652 (0.05035)
Capital	0.04686	0.00124 (0.02024)
Land	0.48100 (0.04360)	0.66016 (0.06260)
Scale Parameter μ	1.062	1.058 (0.00145)
R^2		0.9721

Both estimation methods indicate that there are slightly increasing returns to scale. Some of the least-squares estimates differ appreciably from the Klein method estimates, but the scale parameter, $\mu = \Sigma\alpha_i + \gamma$, is practically the same. This suggests that, as far as the latter is concerned, the simultaneity problem may be a red herring. Unfortunately, comparisons of individual parameters cannot be enlightening because, in many instances, the least-squares estimate was imprecise. It is curious, and perhaps significant, that in general the more precise the least-squares estimate, the lesser the difference between the two methods.

A word about the coefficient of insecticide. Whereas the bias mentioned above may be solely responsible for the imprecision surrounding this estimate, there are indications that, at present, insects have

developed resistant strains and insecticides may no longer be effective. This possibility is discussed later on.

b. Reduced-Form Estimation.--For reasons discussed above, of the three prices available in the sample, that of seed may be considered as a weight for quality differences. The wage rate may be properly classified as a true price, not a weight, because variations arise out of geographical differences. The price of cotton varies mostly because of quality differences which presumably are out of the entrepreneurs' control. To the extent that they are, the entrepreneur's production decisions are independent of these variations. But transport costs from the farm to the cotton gin undoubtedly influence farmers' decisions concerning output. Since these costs are predictable, it is reasonable to assume that the farmer makes his production decisions with them in mind. It is fitting, then, to use the actual price received by farmers, subtract transport costs, and use the resulting value as the cotton-price variable entering the regression.

Assuming that farmers maximize profits, that the wage rate, the price of cotton and land are exogenous variables, and that the production function is Cobb-Douglas, a model that utilizes this information takes the form:

$$\ln Y - \Sigma\alpha_i \ln X_i = A + \gamma \ln L$$

$$\ln \alpha_i + \ln Y - \ln X_i = \ln P_o - \ln P_i \qquad (i=1, \ldots, n)$$

where Y stands for output, X_i for the ith input, P_o for the price of cotton, P_i for the price of the ith input, A for a constant term, α_i for the coefficient of the ith input, and L for land.

For the problem at hand, the reduced-form of this system is the following:

$$\ln Y = C_0 - \frac{\alpha_1}{\Delta} \ln P_1 + \frac{\Sigma\alpha_i}{\Delta} \ln P_0 + \frac{\gamma}{\Delta} \ln L \qquad \text{III.3.a}$$

$$\ln X_1 = C_1 - \frac{\Sigma\alpha_i - \alpha_1 - 1}{\Delta} \ln P_1 + \frac{1}{\Delta} \ln P_0 + \frac{\gamma}{\Delta} \ln L \qquad \text{III.3.b}$$

$$\ln X_j = C_j + \frac{\Sigma\alpha_i - \alpha_j}{\Delta} \ln P_1 + \frac{1}{\Delta} \ln P_0 + \frac{\gamma}{\Delta} \ln L \qquad \text{III.3.c}$$

where $\Delta = 1 - \Sigma\alpha_i$, C_0, C_1, and C_j are constant terms, X_1 stands for the labor input, P_1 for the wage rate, Y for output of cotton, P_o for the price of cotton (adjusted for transport costs) and X_j for inputs other than land and labor.

It is easy to show that the scale parameter, μ, is equal to $\Sigma\alpha_i + \gamma$ and is identified even in the system of equations (III.3.a-III.3.c). As a matter of fact, from the supply function alone we may obtain:

$$\gamma = \Pi_4/(\Pi_3 + 1)$$

$$_i = \Pi_3/(\Pi_3 + 1)$$

and from these equations, we can get,

$$\mu = (\Pi_3 + \Pi_4)/(\Pi_3 + 1)$$

where Π_3 and Π_4 are the coefficients of P_0 and L, respectively. The other equations merely impose restrictions which, when utilized, presumably increase the efficiency of the estimator of μ. Considering the computational difficulties, I did not take advantage of the more efficient estimators, but instead estimated μ from the supply function alone. Table III.4 presents a summary of the results.

As before, the estimate of the scale parameter suggests that there are slightly increasing returns to scale. Because it is a ratio of random variables it is difficult to calculate its standard error. Nevertheless, the estimate of the scale parameter obtained with the least-squares regression on the production function is very precise. It is reasonable to suppose that this one is also precise, especially since they are very close.

TABLE III.4

NICARAGUA: ESTIMATES OF THE SUPPLY FUNCTION FOR COTTON, CROP YEAR 1964/65

Variable	Coefficient	Estimate	Standard Error
Wage Rate	Π_2	0.02142	0.08354
Price of Cotton	Π_3	0.42771	0.41305
Land	Π_4	1.06184	0.01652
Scale Parameter	μ	1.043	

Moreover, a simple manipulation will show that $(\mu >> 1) \leftrightarrow (\Pi_4 > 1)$. Π_4 was measured accurately and it is greater than one.

The supply function estimates also suggest that the short-run supply-price elasticity is considerably greater than zero. Although the estimate has a large standard error, its value is well within the range of previous estimates, as Table III.5 shows.

TABLE III.5

ESTIMATES OF SHORT-RUN AND LONG-RUN PRICE ELASTICITIES FOR COTTON

Author	Region	Period	Value SR	Value LR
Falcon	Punjab	1933/34-1958/59	0.41	
Krishna (a)*	Punjab	1922/23-1941/42	0.72	1.62
Krishna (b)	Punjab	1922/23-1943/44	0.59	1.08
Nerlove	U.S.A.	1909-1932	0.34	0.67
Present	Nicaragua	1964/1965	0.42	

*Krishna (a) is for American varieties. Krishna (b) is for Indian-Pakistani varieties.

Sources: Wlater P. Falcon, "Farmer Response," *op. cit.*, 580-591; R. Krishna, "Farm Supply Response," *op. cit.*, 477-487; Marc Nerlove, "Estimates of Selected Agricultural Commodities," *Journal of Farm Economics*, XXXVIII (May, 1956), 496-509.

In summary, the cross-section data suggest that there are very slight economies of scale in the production of cotton. Also, there are indications that the short-run price elasticity is somewhere between 0.34 and 0.73. In the long run, of course, constant returns imply infinite elasticity, but the pecuniary and technical diseconomies that arise from the industry's expansion undoubtedly deter growth and make the industy's supply curve appreciably less than infinitely elastic. The studies by Nerlove and Krishna suggest that the long-run price elasticity may be somewhere in between 0.67 and 1.62.

If firms within an industry enjoy constant, or increasing, returns to scale, the industry as a whole will show a tendency to expand and firms a tendency to grow in size. Normally, factor prices will go up a result, the industry's growth will slow down, but firms may merge and become larger. The effects of the industry's expansion on factor prices in Nicaragua is discussed later on. As far as the other aspect is concerned, in Nicaragua, detailed distributions of farms by size exists only after 1960. Based on an agricultural census conducted during the crop year 1951/52, I constructed upper and lower limits of the possible distribution for that year. Table III.6 shows the distribution since 1960, and three possible distributions for 1951-52. Tables III.7 and III.8 are complementary to III.6.

The most striking features of these tables are the change in the number of farms, the stability of the distribution of farms within the industry,and the stability of the percentage of hectars cultivated by farms falling within each stratum. As Tables III.6 and III.7 show, the number of farmers in all strata has gone up, and almost in equal proportions. The strata which have expanded faster are those at the upper ends, indicating either that new farmers have begun operating large farms, or that the old

TABLE III.6

NICARAGUA: DISTRIBUTION OF FARMS BY SIZE, CROPS YEARS 1951/52, 1960/61-1966/67

Farm Size (Hectars)	Number of Farms									
	51/52*			60/61	61/62	62/63	63/64	64/65	65/66	66/67
	1	2	3							
.7-3.5	49	239	27	433	658	746	954	810	878	551
3.5-7	86	169	82	401	612	756	981	916	1,061	849
7-14	181	216	309	368	575	722	920	898	1,018	932
14-35	289	287	334	338	444	531	690	805	923	843
35-70	223	170	383	220	252	306	400	482	511	492
70-140	172	177	140	161	224	250	291	326	404	410
140-350	142	47	21	85	112	146	167	200	240	257
350-700	80	0	9	7	11	16	21	30	42	46
700-1000	83	0	0	2	1	2	2	2	3	4
Total		1,305		2,015	2,889	3,475	4,426	4,469	5,080	4,384

*Column one gives the number of cotton farmers owning farms within the range given. The classification disregards the number of hectars actually tilled. Thus, a farmer with a 500-hectar farm may have planted only 10 hectars of cotton, but his farm will fall under the 350-700 category. Columns two and three are a re-classification of the data designed to reflect the number of farms which actually had planted on them the number of hectars indicated by the stratum under which they fall.

Sources: 1951: Nicaragua, Dirección General de Estadística y Censos, *Boletín de Estadística*, III Epoca, No. 4, pp. 49-54; 1960-1963: Nicaragua, Ministerio de Agricultura y Ganadería, División de Estudios Económicos y Agropecuarios; 1964-1967: Nicaragua, Comisión Nacional del Algondón.

TABLE III.7

NICARAGUA: PERCENTAGE DISTRIBUTION OF COTTON FARMS BY SIZE, CROP YEARS 1951/52, 1960/61-66/67

Farm Size (hectars)	51/52*	60/61	61/62	62/63	63/64	64/65	65/66	66/67
0-3.5	18.31	21.49	22.78	21.47	21.55	18.13	17.29	12.57
3.5-7	12.95	19.90	21.19	21.76	22.16	20.50	20.89	19.37
7-14	16.55	18.26	19.91	20.78	20.78	20.10	20.04	21.26
14-35	21.99	16.77	15.37	15.28	16.59	18.02	18.17	19.23
35-70	13.03	10.92	8.72	8.81	9.04	10.79	10.06	11.22
70-140	13.56	7.99	7.75	7.20	6.57	7.30	7.95	9.35
140-350	3.6	4.22	3.88	4.20	3.77	4.48	4.73	5.86
350-700	0	0.35	0.38	0.46	0.47	0.67	0.83	1.05
700- ∞	0	0.10	0.03	0.06	0.05	0.04	0.06	0.09

*Calculated from column 2, Table III.6.

TABLE III.8

PERCENTAGE OF HECTARS CULTIVATED BY COTTON FARMS IN EACH STRATUM 1960/61-1964/65

Farm Size (hectars)	1960/61	1961/62	1962/63	1963/64	1964/65
0-3.5	1.50	1.96	1.62	1.70	1.66
3.5-7	3.20	3.61	3.64	3.82	3.30
7-14	5.67	6.83	6.71	7.04	5.87
14-35	11.73	12.01	11.44	11.91	11.48
35-70	17.31	15.23	14.30	15.71	13.23
70-140	25.41	26.41	23.66	22.21	17.71
140-350	27.17	27.23	30.10	28.19	27.70
350-700	4.90	5.79	6.98	7.96	12.32
700- ∞	3.91	1.35	1.55	1.34	6.73

*This column gives the percentage of hectars cultivated by *farmers*, not by farms. It is not strictly comparable to the other ones.

Source: See Table III.6.

ones have acquired more land. These movements suggest that the industry may enjoy some increasing returns, but it is difficult to conclude that such returns are spectacularly steep.

Table III.8 suggests similar conclusions. The percentage of area cultivated by farms at the upper end has gone up, especially for the two strata containing the largest farms, but the stability of the distribution is more impressive than the changes. This table also indicates that maybe the very large farms enjoy lower costs. In view of the estimates of the scale parameter, however, the origin of the savings incurred by the larger farms may be more pecuniary than technical.

The cross-section data, therefore, shows that cotton farming is subject to at least constant returns. There are some indications of increasing returns, but if they exist, they are not substantial. Certainly the degree of returns to scale that may be present is not, by itself, sufficient to explain the growth of the industry, even though it may still be one of the important elements in the contributing cluster. This discovery is comforting because of the uniqueness of the Nicaraguan phenomenon. It would be unsettling to ascertain that Nicaraguan conditions are so peculiar that they produce sharply increasing returns that are absent everywhere else. And if larger farms were to produce signally cheaper cotton in every corner of the world, the Nicaraguan rates of growth would not have been unique.

Technical Change

The second hypothesis that I would like to explore concerns technical change. It is quite possible that there may have been changes in the quality of inputs, or in the techniques of production, which lowered farmers' unitary costs. Without investigating the nature of these changes,

I wanted first to ascertain whether they had occurred. The purpose of this section is to present the tests that I designed and the results that I obtained.

Customary tests for technical change involve calculating a residual that cannot be explained by changes in the factors of production, or estimating the coefficient of a time trend when estimating a production function. For these tests, time-series data on inputs and output usually suffices. I was fortunate enough to gather a time-series of cross-sections and hence to formulate a more general test than usual ones. I had observations on six farms for several years ranging from 1953 to 1965, a total of 38 observations. The sample contained farmers' expenditures on fertilizers, insecticides, labor and repairs. It also included the area used, the output of cotton and the legal depreciation allowed--10% of the purchase value of the capital equipment. The observations were distributed as follows:

Farm No.	Crop years available
1	1954/55-1965/66
2	1959/60-1964/65
3	1958/59-1956/66
4	1961/62-1965/66
5	1962/63-1965/66
6	1954/55-1957/58

] Once more I assumed, for heuristic reasons, a Cobb-Douglas production function, and also a linear production function of the form:

$$Z = A + \Sigma\alpha_i \frac{X_i}{L} + \gamma L$$

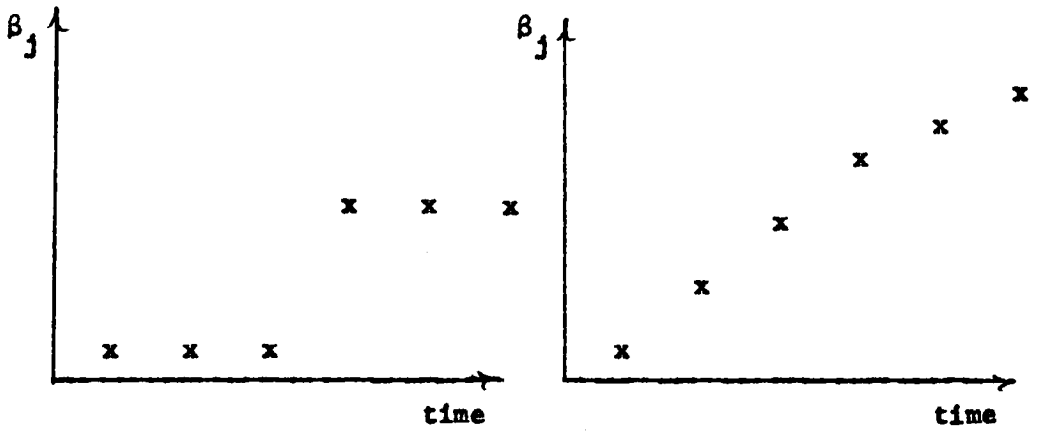
where Z stands for yield per hectar, X_i for the ith input, and L for land. The test for technical change was to use analysis of covariance techniques

and to establish whether there had been a systematic shift in the intercepts of the function as time passed. Specifically, the test was to determine whether in the regression functions,

$$\ln Y_{ij} = \delta_i + \beta_j + D + \Sigma\alpha_k \ln X_{kij} + \varepsilon_{ij} \qquad \text{III.4}$$

$$Z_{ij} = \delta_i + \beta_j + D' + \Sigma\lambda_k (X_{kij}/L_{ij}) + L_{ij} + U_{ij} \qquad \text{III.5}$$

where δ_i and β_j are shift parameters denoting the ith farmer and the jth year, respectively, there were indications of a "year effect." Continuous technical change would show the parameter β_j increasing as a function of time; discrete technical change would show jumps in groups of β_j's, from one technical epoch to the next, as the figures below show.



Discrete Technical Change Continuous Technical Change

As Figure III.3. Possible Kinds of Technical Change

As before, I required that the hypothesis be consistent with increases in yield. And of course, given the appropriate bias, it is clear that technical change will lead to higher yield.

The regression equations were both of the form outlined in (III.4) and (III.5). The inputs (expenditure in all cases but land) were: fertilizer, insecticide, labor and capital. The latter was equal to the

reported depreciation. The results, however, are inconclusive. Although some years' influence output significantly, the hypothesis that $\beta_1 = \beta_2 = \ldots = \beta_n = 0$ could not be rejected at the 5% level. From this point of view, the data does not indicate the presence of technical change. But from Table III.9 and Figures III.4 and III.5, it is difficult to say that the parameter β_j has not increased through time. The standard error of each β_j is, in general, large, but maybe this means simply that the estimates are imprecise, not that the actual values of the shift parameter are really zero.

TABLE III.9

ESTIMATES OF THE SHIFT PARAMETER, β_j

	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Value[1]	0	-2.80	5.82	7.90	1.77	8.24	2.62	9.03	11.62	11.58	13.83	7.23
Std. Error		5.12	5.34	6.79	6.08	6.70	6.65	6.79	6.96	6.42	6.14	6.95
Value[2]			0	0.16	-0.28	0.79	-0.17	0.11	0.33	0.25	0.26	0.16
Std. Error				0.20	0.21	0.23	0.23	0.23	0.26	0.24	0.21	0.25

[1]Estimates obtained from equation III.5.

[2]Estimates obtained from equation III.6. The same number of years do not appear in both equations because one farm, of the two available for those years, did not use fertilizer during 1954 and 1955. Because the Cobb-Douglas version of the production function is not pliable enough to handle problems like this, I chose to eliminate these years from the analysis.

The estimates of the coefficients of the production function suggest that the data is somehow deficient. The standard errors are large in almost every instance and there are three negative coefficients, as Table III.10 shows. It is difficult to believe that the marginal physical productivity of land, capital and insecticide are negative, as these estimates indicate.

Figure No III-4

Estimates of Shift Parameter β_j, Eq. III-4

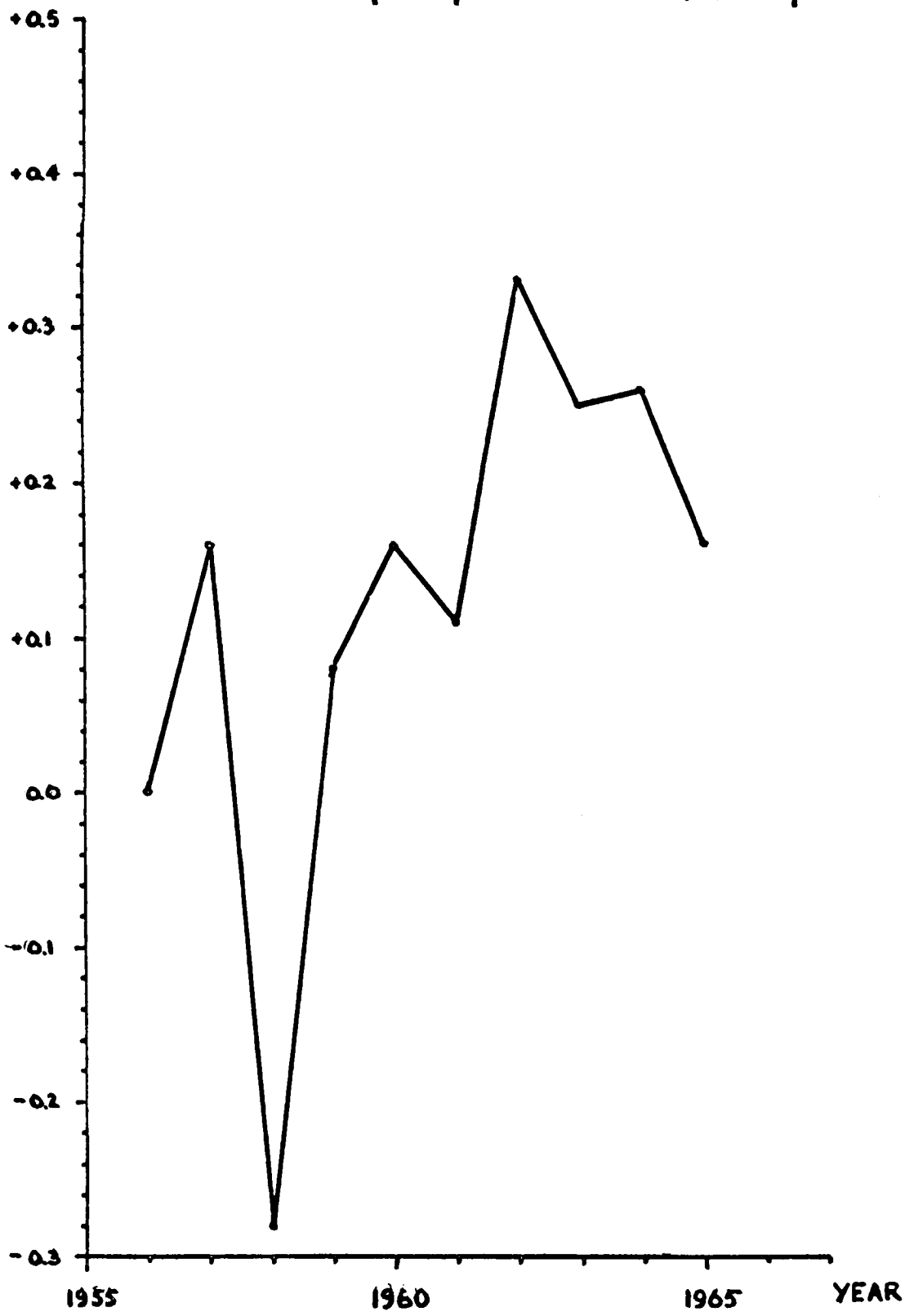


Figure No. III-5

Estimates of Shift Parameter β_j, Eq. III-5

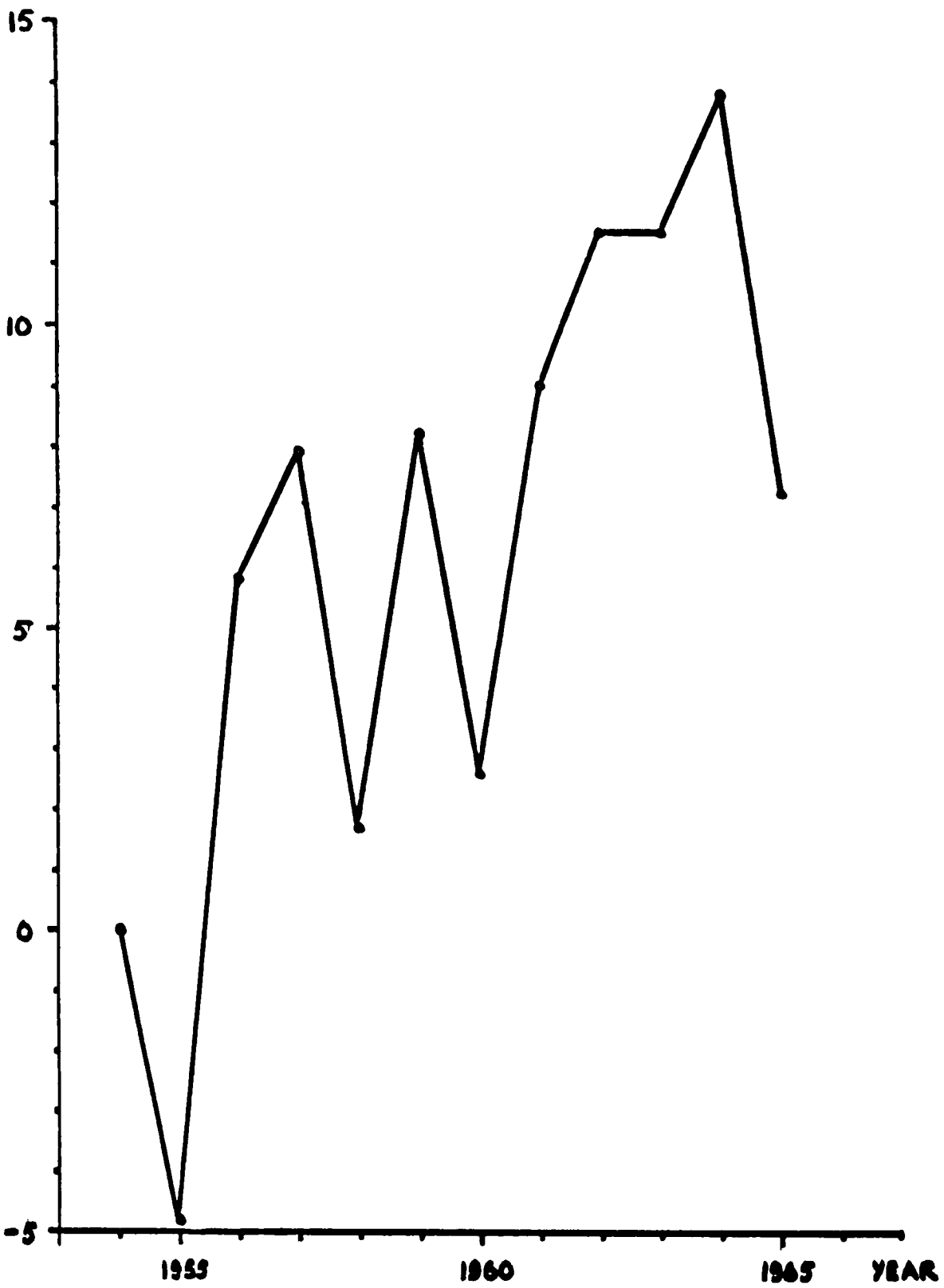


TABLE III.10

ESTIMATES OF THE PRODUCTION FUNCTION COEFFICIENTS, TIME-SERIES DATA 1956-1965

Variable	Estimated Value	
	Equation (III.4)	Equation (III.5)
Insecticide	-0.26412	-0.01066
	(0.12837)	(0.00991)
Fertilizer	0.07481	0.03370
	(0.13552)	(0.02817)
Capital	-0.10993	0.10521
	(0.17401)	(0.06458)
Labor	0.47702	0.02630
	(0.21987)	(0.00964)
Land	-0.05985	-0.00572
	(0.24822)	(0.00597)
R^2	0.9255*	0.8020*

*Adjusted for degrees of freedom.

From this data, then, it would be unwarranted to conclude that technical change was absent. On the one hand the null hypothesis that there is no "year effect" is not rejected by the data. But on the other, graphs of the shift parameter against time show an upward trend which becomes stronger the longer the time period considered. Perhaps there was some technical change, but it was not strong enough to show up in this data. If so, it alone probably would not have caused the industry's expansion. Once more, this should not be surprising. Whatever technical change occurred was probably embodied in fertilizers and insecticides, and hence generally available. Nicaragua would not have been alone.

Learning by Doing

The third and final hypothesis to be tested concerns the possibility that the growth of the industry came as a result of learning.

TABLE III.11

ANALYSIS OF COVARIANCE, TWO WAY CLASSIFICATION, EQUATION III.4

Source of Variation (1)	R^2 (2)	Adjusted Sum of Squares for Dependent Variable (2)	d.F (3)	Mean Square (4)	F Ratio (5)
1. Between Farms		0.841715	5	0.16834	5.97
2. Between Years		0.346793	9	0.03853	1.37
3. Residual when model contains farm effects only	.9292	0.805306	20		
4. Residual when model contains year effects only	.8988	1.152099	16		
5. Residual when model contains both farm and year effects	.9727	0.310384	11	0.0281	

TABLE III.12

ANALYSIS OF COVARIANCE, TWO WAY CLASSIFICATION, EQUATION III.5

S Source of Variation (1)	R^2 (2)	Adjusted Sum of Squares for Dependent Variable (2)	d.F (3)	Mean Square (4)	F Ratio (5)
1. Between Farms		625.65	5	125.13	5.81
2. Between Years		384.29	11	34.94	1.62
3. Residual when model contains farm effects only	.8186	729.24	27		
4. Residual when model contains year effects only	.7587	969.90	21		
5. Residual when model contains both farm and year effects	.9144	344.25	16	21.52	

According to this hypothesis, at the beginning of the expansion Nicaraguan farmers were neophytes as far as cotton farming was concerned. Under the umbrella of high prices that prevailed up to 1957, farmers learned their trade, lowered their costs and, when prices began to decline rapidly, were able to produce at a profit in spite of the price squeeze.

Various sources suggest that mastering production techniques, or discovering optimum input mixes, has remarkable effects on costs. First, some farmers in Nicaragua maintain that improvements in yield occurred chiefly because they learned how to use fertilizers and insecticides.[6] Secondly, estimates of unitary costs show a downward trend, especially during the early years. Consider first the estimates of costs per hundredweight as calculated by the *Banco Nacional*. Each year the Banco estimates costs per *manzana* for all agricultural products. The estimates shown in Table III.13 are equal to the Banco's estimates divided by the actual yield attained that year. The second series is an average of the actual costs incurred by the six farms that I surveyed. Both series show wide fluctuations with a tendency towards stabilization at levels lower than the initial values. This is what we would expect in a new industry where during the initial years many inexperienced entrepreneurs make costly mistakes. As natural selection winows the inefficient farmer and as experience teaches the beginner, the industry's aggregate cost declines and tends to stabilize at around the minimum point. Third, farmers in the United States reduced costs by experimenting with different factor proportions. In California,

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[6]Conversations with Rene Bequillard, Alfredo Roque, Benvenuto Martinez, and Fernando Horvilleur at various dates from November, 1966, to January, 1967; Managua, Nicaragua.

TABLE III.13

NICARAGUA: ESTIMATES OF COSTS OF COTTON PRODUCTION, *CÓRDOBAS* PER HUNDREDWEIGHT, 1950-1965

Year	1952	1953	1954	1955	1956	1957	1958
Bank	64.55	48.01	43.95	55.50	39.85	40.26	N.A.
Actual	N.A.	N.A.	26.14	82.22	42.77	44.79	59.93

Year	1959	1960	1961	1962	1963	1964	1965
Bank	47.19	N.A.	35.35	39.36	43.07	42.08	N.A.
Actual	38.41	49.89	49.37	60.05	49.15	43.57	52.43

for example, farmers found that trees on the outside rows of a field produced more cotton than those on the inside rows, and proceeded to modify their seeding practices so as to obtain the maximum number of "outside" rows per acre. Thus, at the beginning they planted solid fields; then they began to plan four rows and to skip four, then to plant two and skip two, and finally to plant two and skip one. Yields increased from 33 to 54% over the plant-four-skip-four method.[7] The plant-four-skip-four has given as much as 102% increase over the solid planting.[8] Productions costs, then, may decline as learning takes place. There are indications that in Nicaragua unitary costs declined through time and that learning may have been the cause. The next few paragraphs present a more rigorous test of this hypothesis.

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[7] O. D. McCutcheon and Alan G. George, "Skip-Row Cotton Planting in the San Joaquin Valley," University of California Agricultural Extension Service, *One Sheet Answers* #141; O. D. McCutcheon, *A Decision for the Cotton Grower* (Hanford: U.S. Department of Agriculture and University of California Agricultural Extension Service, mimeographed, n.d.) 1-2.

[2] McCutcheon, *A Decision*, p. 1.

In his article on learning by doing, Kenneth Arrow[9] mentioned that two generalizations from psychological learning theories emerge with particular interest for economists. One, learning appears as a result of repetition and two, ". . . learning associated with repetition . . . is subject to sharply diminishing returns . . ."[10] These findings suggest that profit-maximization is a seldom-attained goal. Even at constant factor and output prices, an entrepreneur learning a new business discovers the optimum input mix only after a few trials. When relative prices change, the search for the profit-maximizing input-mix begins anew. In an environment with unstable prices this quest becomes a continuous pursuit of elusive goals. In this section I have attempted to bring these two generalizations into the usual profit-maximizing scheme in an effort to explain the growth of the industry as a case of learning by doing.

First I assume that entrepreneurs undertaking a new venture only by chance attain the profit-maximizing input-mix. The initial level of inputs will usually exceed or fall below the optimum, and only with time and experience do they finally attain it.

Secondly, I assume that the profit-maximizing level depends, as usual, on input and output prices. Let X_t be the input level actually used at time t. Learning by doing implies that

(1) $$\lim_{t \to n} X_{it} = \bar{X}_i \qquad \text{III.6}$$

(2) $$\lim_{t \to n} \frac{\partial X_{it}}{\partial t} = 0 \qquad \text{III.7}$$

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[9]Kenneth Arrow, "The Economic Implications of Learning by Doing," Review of Economic Studies, XXIX (June, 1962), 155-173.

[10]Ibid., p. 155.

where $\bar{X}_i$ is the profit-maximizing level of the ith input, and n is some finite number that stands for the trials necessary for learning what $\bar{X}_i$ is. Equation III.6 reflects the generalization that learning appears as a result of repetition, and III.7 the generalization that learning is subject to diminishing returns.

To incorporate production theory into this scheme, X_{it} should also depend on prices. As an empirical approximation, the following function, which fulfills all of these conditions, is useful:

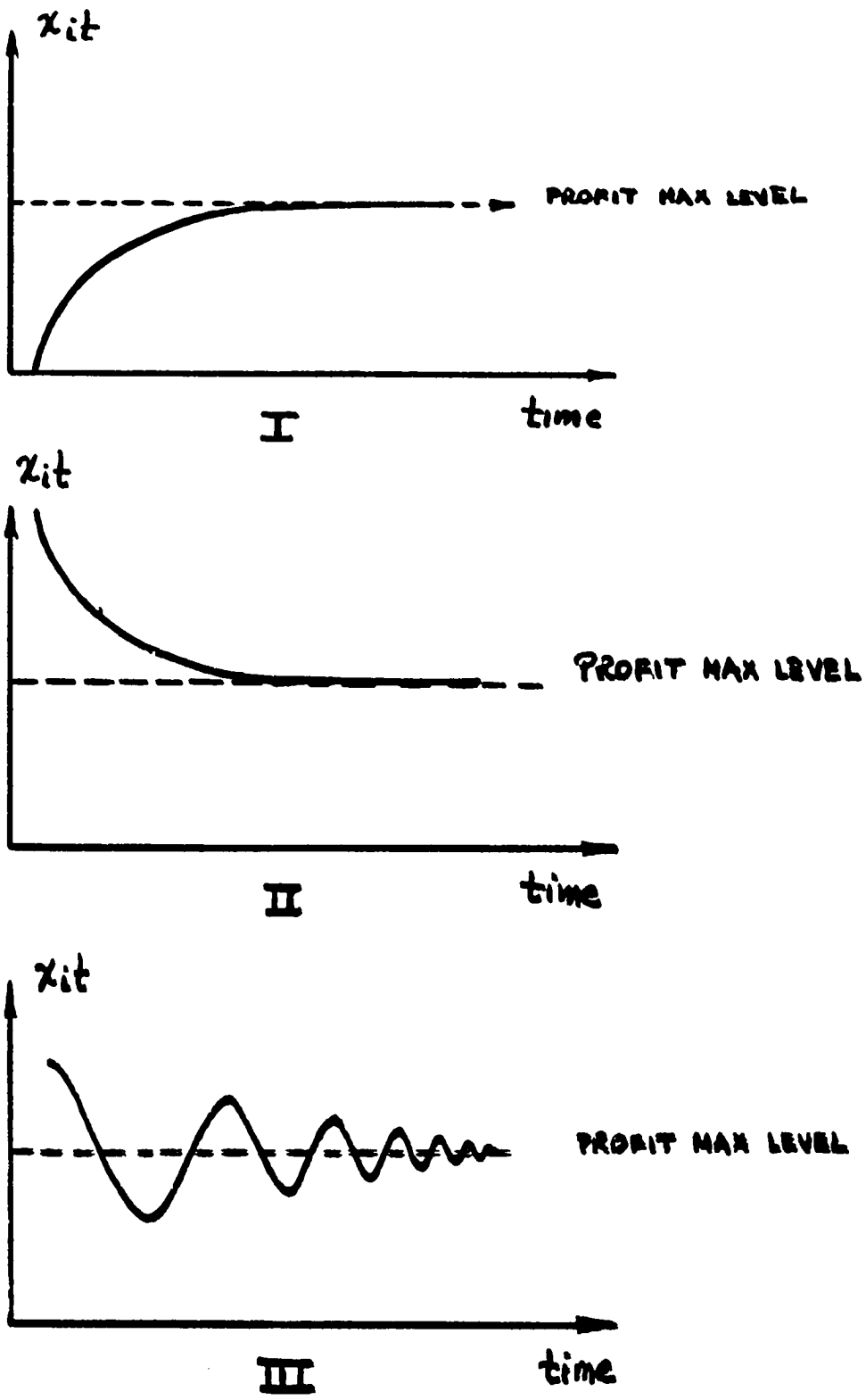
$$\ln X_{it} = c + a \frac{P_i}{P_o} + b \frac{1}{t} \qquad \text{III.8}$$

Here t stands for the number of trials, which for the problem at hand is the number of years. If learning is an influential factor, the estimate of b should be different from zero. Moreover, given the rapid rate of expansion from 1952 to 1957 and from 1960 to 1965, it is reasonable to suppose that most of the essential learning, if any, occurred during the first five years, and that after ten years, at constant factor prices, farmers would have mastered the techniques of production. Hence I required that, in addition to finding that t be an influential factor, the estimated value of b should imply that the amount used of any particular input at t = 10 should be no more than 10% away from the profit maximizing input. In equation (III.8) this would require that the estimate of b be around one; negative when the adjustment path is upwards, positive when the adjustment path is downwards.

Unlike technical change, learning by doing neither requires, nor implies, a change in the curvature of the isoquants or in the scale of the same in order to explain the growth of the industry. It simply maintains that at first farmers did not know how to utilize the inputs optimally, but that they learned with experience.

Figure No. III-6

Possible Adjustment Paths of Derived Demands for Inputs When Entrepreneurs Learn by Doing



To test the hypothesis, I used a regression equation of the form outlined in (III.8):

$$\ln X_{ijt} = c + \delta_j + a\frac{P_i}{P_o} + b_i\frac{1}{t} + \varepsilon_{it} \qquad \text{III.9}$$

where X_{ijt} stands for the amount of the ith input used by the jth farmer in the tth year, δ_j is a shift parameter to allow for farm differences and c is a constant. Table III.14 gives a summary of the results.

TABLE III.14

ESTIMATES OF THE COEFFICIENTS OF THE LEARNING BY DOING DERIVED DEMAND FOR INPUTS

Dependent Variable	Coefficient		
	Constant	a	b
Land	5.305693	6.751101	-0.826932
	(0.399616)	(10.954935)	(0.476186)
Fertilizer per Unit of Area	5.919489	-1.024522	-2.971578
	(0.601217)	(1.252299)	(1.098425)
Insecticide per Unit of Area	6.852612	0.108754	-3.318659
	(0.848334)	(0.387599)	(1.010882)
Labor per Unit of Area	6.661010	1.214550	-1.449347
	(0.421385)	(1.170558)	(0.764960)

The estimates of b are, in all cases, different from zero. The hypothesis that b = -1 can be rejected only in the case for insecticide at the 5% level. The estimates of b for fertilizer and insecticides, however, are large, suggesting that after ten years farmers would have been using only 70 to 75% of the profit maximizing quantity, instead of the required 90%. These tests indicate, then, that learning by doing cannot be ruled out as a contributing factor in reducing costs.

The test for technical change in the preceding section was formulated in the analysis of covariance framework, but it could have been formulated by introducing a proxy for time in the production function.

The corresponding derived demand equations would then have been functions of the time proxy and would have looked similar to (III.9). The only difference would have been that in the case of learning by doing the demand for inputs may decrease or increase as a function of time, whereas technical progress requires that they increase. Nevertheless, the regression equations would have been alike, with time entering in both cases. Thus, it may be objected that the two tests are really one and the same, that it is impossible to distinguish between them. This is a telling argument. We must conclude that either hypothesis--technological change or learning by doing--is consistent with the available evidence. In fact, probably both have played some role.

Developments at the Industry Level

So far the discussion has centered around events which may have lowered costs at the farm, led to the expansion of existing firms and thus to the displacement of the industry's supply curve. In this section the emphasis shifts to developments which affected the entire industry.

Without doubt, the entry of new firms was among the most important influences in the expansion of the industry's supply curve. The agricultural census of 1952 showed that in the crop year 1951/52 there were 1,305 farms engaged in producing cotton. The total cultivated area was 46,042 hectars.[11] In 1966/67 the number of farms was 4,384 and the cultivated area was 132,506 hectars.[12] Thus, whereas yield increased by a factor of approximately 2.25 from 1951 to 1964, it was the sheer number of new firms and the expansion of old ones which accounted for more than 65% of the

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[11]Nicaragua, Dirección General de Estadísticas y Censos, *op. cit.*, *Boletín*, p. 52.

[12]Nicaragua, Banco Nacional, *Estudio*, Cuadro No. 7; Table III.6.

6.42-fold increase in production. Ad discussed before, the expansion of firms within the industry was not nearly as important as the entry of new ones. The increase in production may be attributed in great part to the latter phenomenon.

The reasons for the expansion of the industry are various, but not complex. First, there is strong evidence supporting the hypothesis that the production of cotton is subject to constant, or only slightly decreasing, costs. This implies that the timid, beginning farmer may produce as cheaply as his larger colleague. There are no technical barriers to entry; unit costs do not depend on the size of the farm. This not only facilitates entry, but also encourages experimentation on the part of would-be cotton farmers.

Second, around 1950 the Nicaraguan government began building new roads, which provided easy access to the cotton land. At the same time it took to liberalizing the credit laws under which the *Banco Nacional* was operating. It may be recalled that the Banco was created to serve as a central bank and as treasury all at once. The stabilization of the currency was one of its main functions. In 1940, however, the government undertook the complete reorganization of the Banco and began to pay attention to the role that it could play in the economic development of the country.

The 1940 *Ley Orgánica del Banco Nacional de Nicaragua*[13] empowered the bank to extend loans to small farmers (14 hectars or less) using the future crop as security, but limited the maximum credit available to 100,000 *córdobas* (approximately $20,000 at ths then operative exchange

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[13]Literally: Organic Law of the National Bank of Nicaragua.

rate).[14] This amount sufficed to cover the expenses incurred in cultivating approximately 70 hectars.[15] Because the majority of cotton farmers work primarily on credit, this ceiling put an effective limit on the size of farm that most farmers could cultivate. Another drawback of the law was the absence of a provision authorizing the bank to grant credit to farmers renting the land. In 1941 the definition of "small" farmers was changed to encompass those cultivating up to 28 hectars, and the bank was freed to grant credit to tenant growers as well.[16] In 1949 the 100,000 *córdobas* limit was removed and the bank officers were authorized to use their judgment when granting larger loans, but the higher limit applied to permanent crops only. In 1952, probably as a result of farmers' demands, but ostensibly as a consequence of rising costs and of sound economic planning, the government reformed the agricultural loans laws to read as follows:

> The total [amount loaned to farmers] shall not exceed 70% of the estimated cost of production of the crop, as calculated by the bank's technicians, nor shall it exceed under any circumstances the total actual cost of [raising and harvesting] the crop. The total amount that an individual person, or legal body, may borrow shall not, under any circumstances exceed Two-Hundred and Fifty-thousand *córdobas*.[17]

These laws signalled the transformation of the bank from a central bank into a development bank with special attention to agriculture. The change was not immediate and it does not seem to have been premeditated. But eventually the Banco's agricultural loans gained paramount importance

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[14]Nicaragua, Banco Nacional de Nicaragua, Sección de Estadística e Investigaciones Económicas, *Leyes Bancarias y Monetarias: República de Nicaragua* (Managua: Talleres Tipográficos Heuberger, 1951), p. 128.

[15]Using the Banco's own estimates of costs for 1952.

[16]Nicaragua, Banco Nacional, *op. cit.*, *Leyes Bancarias*, p. 134.

[17]Approximately $35,000. See Nicaragua, Banco Nacional, *Revista Trimestral*, XXII (April-June, 1953), 11.

over its other operations. In 1960 the *Banco Central* grew out of one of the *Banco Nacional's* departments, took over the management of the currency and freed the latter to devote its entire attention to search for and implement agricultural policies to promote economic development.

The liberalization of credit policies could not have come at a better time. When the price of cotton rose from $25.3 per hundredweight in 1950 to $56.9 in 1951, many Nicaraguans turned to agriculture. Fortunately, wealth was not a pre-requisite for cultivating the land, for the Bank stood ready to finance future cotton growers, and it required the crop as the only security. Agricultural credits rose phenomenally and the Bank began to grant larger and more realistic loans to farmers, as Table III.15 shows.

The laws described above remained in operation until 1959. The initial expansion of the industry from 1950-51 to 1955-56 was arrested that year by unfavorable weather, and by low prices the next two years. It seems that at this point the inefficient farmers who had enjoyed the umbrella of high prices were forced out of the industry by gigantic losses that left the Bank with 64% of its portfolio frozen. Out of a total portfolio of 229,667,000 *córdobas*, 27,835,000 *córdobas* were tied up in loans that had been granted extensions but that were paying interest and service charges; 109,704,000 *córdobas* were tied in defaulted loans that were not paying interest or service charges; and 9,797,000 *córdobas* were in the process of being recovered through judicial procedures.[18]

In this situation the Bank and the government realized that only a radical change in policy could extricate the country from the danger of

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[18]Nicaragua, Banco Nacional, *El Banco Nacional de Nicaragua y sus Programas de Desarrollo* (Managua: Litografía San José, 1966), pp. 31-32.

TABLE III.15

AGRICULTURAL LOANS OF THE BANCO NACIONAL DE NICARAGUA, 1940/41 TO 1964/65

Year	Maximum Loan Allowed to Cotton Farmers (cordobas per manzana)	Average Loan Allowed to Cotton Farmers (cordobas per manzana)	Total Amount of Loans to Cotton Farmers		Total Amount of Agricultural Loans	
			1000 cordobas	Manzanas covered	1000 cordobas	Manzanas covered
1940/41		N.A.	N.A.	2,701	1,161	25,073
41/42		N.A.	N.A.	3,013	2,827	26,073
42/43		N.A.	N.A.	3,075	3,045	26,958
43/44		N.A.	N.A.	867	3,775	28,051
44/45		292	762	2,608	5,109	32,836
45/46		284	1,162	4,097	7,038	39,691
46/47		304	170	560	5,861	31,664
47/48		273	60	220	9,705	55,454
48/49		290	1,005	3,462	13,365	63,505
49/50		328	6,532	19,898	14,035	56,165
50/51	450	408	11,386	27,925	21,068	72,483
51/52	650	563	22,800	40,492	59,657	117,829
52/53	850	688	22,560	32,768	63,485	100,008
53/54	1,000	877	42,116	48,011	94,602	121,373
54/55	1,100	982	94,844	96,556	140,865	152,833
55/56	1,100	982	108,197	110,149	152,810	179,055
56/57	1,100	1,015	89,604	88,268	147,428	170,249
57/58*	1,100	1,013	88,106	86,937	154,586	159,795
58/59*	N.A.	998	84,282	84,438	141,680	126,478
59/60*	900	870	52,196	59,961	98,333	105,791
60/61*	1,190	1,116	63,691	57,056	107,936	105,834
61/62*	N.A.	1,098	82,266	74,917	125,542	114,526
62/63*	N.A.	1,173	107,972	91,998	160,785	140,195
63/64*	n.A.	1,223	136,925	111,998	184,752	157,729
64/65*	N.A.	1,268	180,416	142,276	248,236	204,085

*Includes loans by commercial banks as well.

Source: Nicaragua, Banco Nacional de Nicaragua, *Revista Trimestral del Banco Nacional de Nicaragua*, V (October-December, 1965), p. 68, and various other issues.

imminent crisis. The solution adopted was two-fold. First, the Bank granted an 8-year extension to all defaulted debts. Second, it put into effect a new credit system designed to winow the inefficient farmers. Thus, only cotton growers whose average yield over the previous three years exceeded 30 hundredweight per hectar could obtain loans from the Bank. Loans were granted at the rate of $5.00 per hundredweight, the total per hectar being equal to 70% of $5.00 times the yield obtained during the previous year. This policy is still in effect, but with slight modifications: the minimum permissible yield has been raised to 50 hundredweights per hectar.[19]

The rise in yield after 1956/57, therefore, was the result of selection as well as of improvements in the techniques of production. Up to 1959/60 the credit policies of the Bank placed severe barriers to the expansion of firms within the industry beyond a certain point, as no one could obtain more than $35,000 per year. In 1959/60 the policies came to favor high-yield farmers and lifted all restrictions on the expansion of firms.

Thus, it was a combination of institutional changes in the Bank's credit policies and the presence of slightly larger than constant returns to scale that spurred the growth of the industry. From 1952 to 1955 the price of cotton remained stable--under constant returns and in the absence of institutional barriers to entry, we would expect the industry to expand. It did. Output went up from 380,000 hundredweight to 1,031,344. It was during these years that farmers probably learned the most about the techniques of cultivating cotton.

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[19]Nicaragua, Banco Nacional, *op. cit.*, *Programas*, pp. 34-36.

From 1954/55 to 1959/60 cotton prices fluctuated slightly, but the general trend was down. The industry behaved likewise; area went down from 86,000 hectars to 61,000 (Tables I.17 and II.1). After 1960 prices began to go up and the reforms of the *Banco Nacional* to sift the low-yield farmers. It was during these latter years of slightly rising prices that the industry expanded most rapidly. This behavior is consistent with constant returns and with learning by doing, especially if it is granted that by 1960 farmers had learned enough about cotton cultivation to be able to reap the full benefits of constant costs.

Finally, I would like to discuss the repercussions of the industry's expansion on factor prices, and the consequences of the widespread and intensive use of insecticides within and outside the industry. Concerning factor prices, those of land and labor exhibit the sharpest rates of change, as would be expected. These are native inputs and hence the most susceptible to structural changes within the country. Insecticides and fertilizers are both imported inputs. The former is mixed in Nicaragua in order to meet local needs, and the latter is imported almost ready for use.[20] Because the Nicaraguan market is small compared to the sources of supply of these inputs, it is quite natural to expect their prices to remain stable.

Rising input prices have undoubtedly slowed down the growth of the industry. Unfortunately, it is impossible at the moment to elaborate upon these remarks because the data available are scanty and unreliable. Table III.16 cannot be considered anything but an indication of trends and it cannot serve under any circumstances as a basis for quantitative inferences.

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[20]This is no longer true today (1968), but it applies to the years studied here.

TABLE III.16

NICARAGUA: INDICES OF DEFLATED PRICES OF LABOR, INSECTICIDE AND FERTILIZER, CROP YEARS 1951/52-1965/66 (1964/65=100)

Year	Price of			
	Land (Rental)	Labor	Insecticide	Fertilizer
1951/52	N.A.	N.A.	N.A.	204
52/53	N.A.	N.A.	N.A.	107
53/54	N.A.	53	N.A.	100
54/55	N.A.	37	N.A.	176
55/56	N.A.	57	N.A.	104
56/57	N.A.	47	N.A.	104
57/58	52	46	N.A.	85
58/59	53	55	N.A.	83
59/60	110	74	103	97
60/61	100	98	103	92
61/62	67	97	106	114
62/63	72	99	116	106
63/64	102	106	110	104
64/65	100	100	100	100
65/66	113	93	97	105

Source: calculated from own sample.

The industry's growth brought widespread use of insecticides, and with the latter came a new problem that has become so serious that it has threatened not only the cotton industry, but also beef exports. The threat to the cotton industry arises from the development of resistant strains when insects are subjected to pesticides for long periods. The history of cotton pests and organic insecticides in the United States is illustrative of the problem.

Organic insecticides (DDT, BHC, Toxaphene, chlordane, etc.) were introduced during World War II and shortly thereafter (DDT in 1943, BHC in 1945, and so on). Farmers began to use them in large quantities around 1950 and, at that time, were spectacularly effective. From 1950 to 1955 the battle against insects seemed to be won. But then, in 1955, the boll

weevil developed resistance to the recommended chlorinated hydrocarbons. Farmers turned to other types of insecticides (organic phosphorous compounds), but the story fairly repeated itself:

> By the end of the 1963 season, almost every major cotton pest species contained local populations that had developed resistance to one or more of the chlorinated hydrocarbon, organic phosphorous or carbamate insecticides, or mixtures of chlorinated hydrocarbons. Moreover, strains developed in the laboratory that are resistant to all of these.[21]

In Nicaragua the cotton industry began to experience the same results beginning around 1965/66 and worsening in more recent years. Moreover, the widespread use of DDT and organic phosphorous compounds so contaminated cattle that exports of beef to the United States contained residues of insecticides that were approaching unacceptable limits and sometimes even exceeding them.[22] Thus, two of the most successful export trades were being threatened by the boll worm, the boll weevil, the aphids and sundry cotton pests.

Fortunately it appears that rigid control over some operations and an integrated attack on pests, using insecticides and predators, provides an answer to the problem. In Cañete Valley, Perú, pests were brought under control through rigid enforcement of the following rules:

(1) Annual planting of cotton only. Ratooning (the second year cultivation from the same seed) being prohibited.

(2) Fixed dates for sowing, aircraft manuring and picking according to the particular conditions developing in each agricultural year.

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[21] U.S., President's Science Advisory Committee, *Cotton Insects*, A Report of a Panel of the President's Science Advisory Committee (Washington, D.C.: U.S. Government Printing Office, 1965), p. 4.

[22] Richard S. Welton, "Problems Halt Fantastic Growth in Nicaragua's Cotton Industry," *Foreign Agriculture*, VI (Feb. 12, 1968), p. 4.

(3) Designated cotton-free periods.

(4) Prohibition of the use of synthetic, organic insecticides--unless approved by the official entomologists.

(5) Use and liberation of beneficial insects (parasites and predators bred in insectories and sold to farmers).

(6) Use of mineral insecticides, especially arsenate of lead and the use of baits in the soil for the control of cutworms (*Noctuidae*).[23] The problem, therefore, although serious, is not insoluble. Yields may decline, but the savings on insecticides may more than compensate for the reduction in output.[24]

In conclusion, the expansion of the industry may be ascribed to a removal of institutional barriers concerning credit policies, and to lower costs arising from (1) heavy government investment in economic services, especially in the construction of new roads, (2) learning by doing and (3) perhaps some technical change. The removal of credit limits facilitated entry into the industry, and the expansion of old firms already in it; it enabled new as well as old farmers to take advantage of the peculiarities of constant costs. New firms did not suffer severely from higher unit costs if they began on a small scale; old firms could expand without incurring higher unit costs, and may even have benefitted from the larger scale.

The expansion of the industry brought diseconomies of scale from the input side. Nicaraguan cotton output is still too small to affect the

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[23]Gustavo de la Torre, "Integrated Control of Insects in Perú," *Pest Articles and News Summaries*, XIII (February, 1967), p. 72.

[24]The interested reader is referred to reports of experiments conducted in California: L. A. Falcon, and others, "A Comparison of Season Long Cotton Pest Control Programs in California During 1966," publication forthcoming in the *Journal of Economic Entomology*.

international price perceptibly, but the price of land and the wage rate went up concomitantly with the expansion of the industry. The latter was probably the cause of the former two. More seriously, the widespread use of insecticides has created resistant strains in the noxious pests, which, in recent years, has forced farmers into heavier expenditures on insecticides, but with diminished effectiveness. At present the main policy questions concerning the industry center around the control of pests and incentives for further growth. The latter was discussed above; the former depends to a large extent on future trends in cotton prices: this is the subject of the next and final chapter.

CHAPTER FOUR

DEMAND PROJECTIONS, PRICE TRENDS AND CONCLUSIONS

We have seen that for the last eighteen years cotton has played a prominent role in the economic development of Nicaragua. Even though reliance on one crop to provide over 40% of a country's exports entails obvious dangers, Nicaragua has fared very well indeed as a result of its dependence on cotton. At the moment, the only exports that may noticeably diminish cotton's relative importance are meat and shrimp. Both are relatively young industries and the two combined do yet yet exceed 10% of total exports (Table I.24); Nicaragua's future during the next ten years, at least, will depend on cotton exports and it is appropriate to inquire about future trends in cotton prices. It is the purpose of this chapter to attempt such a forecast. For the purpose, I relied chiefly on a study by Mark L. Fowler, and on the projections of Bela Balassa.[1]

Since 1920 world production and world consumption have moved at approximately the same pace. In recent years consumption increased more than production, and last year the world consumed more cotton than it produced (Table I.2). The fastest growth of world consumption and world production occurred since the end of World War II. These events, plus the gradual decline of exports from the United States, summarize the salient features of the world market for raw cotton.

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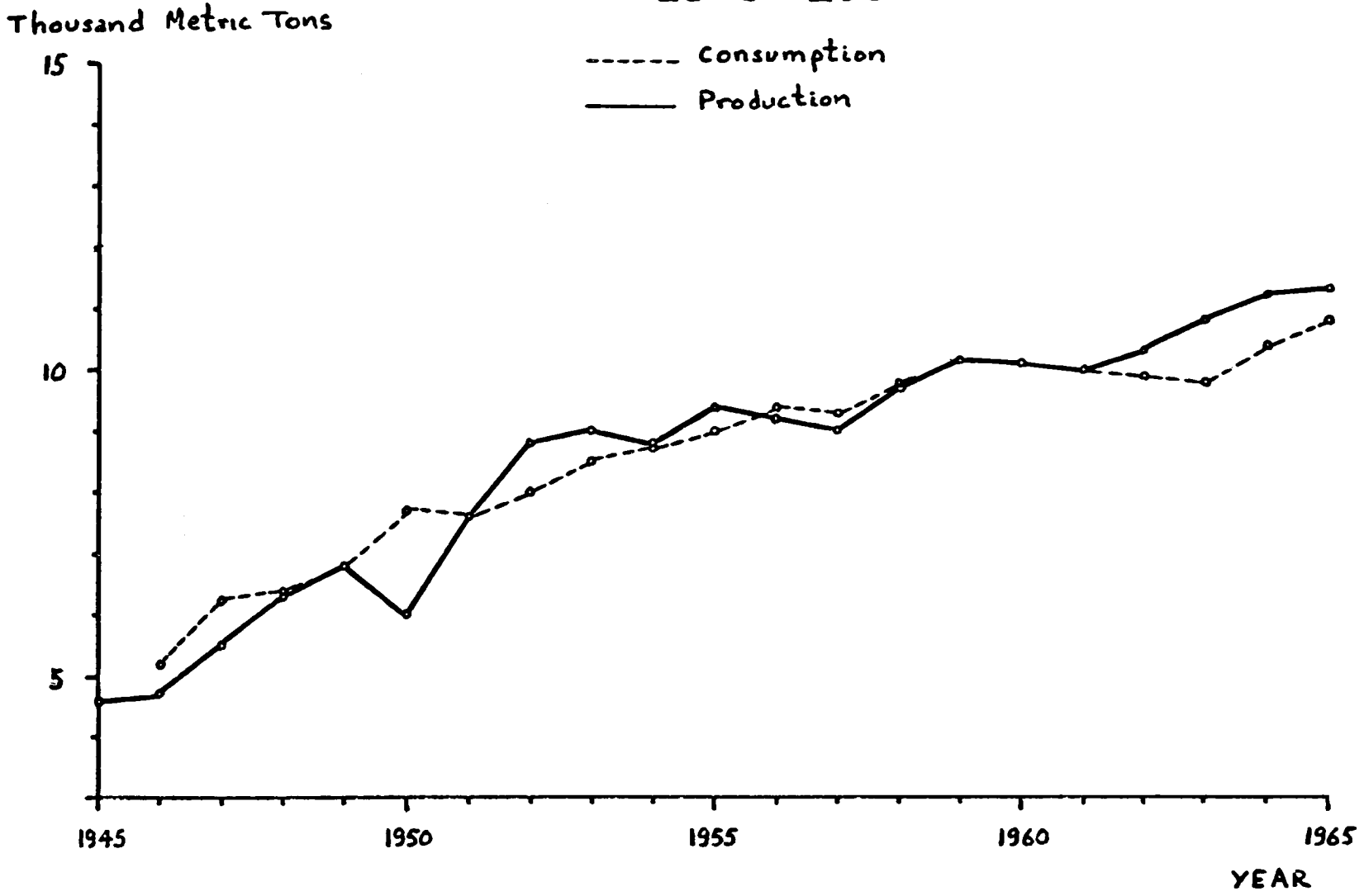
[1] Marquis Lyndon Fowler, "An Economic-Statistical Analysis of the Foreign Demand for American Cotton," (unpublished Ph.D. dissertation, Univ. of California, Berkeley, 1961); *Export Demand for U.S. Cotton: Implications of Structural Changes in the World Economy* (Oklahoma Agricultural Experimental Station, Bulletin B616, Dec., 1963), and Bela Balassa, *Trade Prospects for Developing Countries* (Homewood: Richard D. Irwin, 1964).

Figure No. IV-1

World Consumption and World Production of Cotton

1945 - 1965



From Nicaragua's point of view, it is important to know how fast world demand and world supply are expected to grow, and how price will be affected by these events. Because even at this point Nicaraguan exports are an insignificant part of world exports, it is reasonable to assume that they will not perceptibly affect world cotton prices during the next few years, and that Nicaragua will still be a price taker ten years hence.[2]

With regards to demand, Fowler lists three obvious determinants: total world population, per capita income of consumers, and the "nature of competition between cotton and man-made fibers."[3] More interestingly he estimated the income elasticity of demand at over 0.5 (using averages of per capita consumption and per capita income for several countries over two time periods).[4]

From 1958 to 1963, world per capita income grew at an average rate of approximately 4% per year.[5] At this rate, using Fowler's lowest estimate on income-elasticity, per capita consumption of cotton may be expected to grow at about 1.9% per year.

The growth of production, on the other hand, falls into two periods, 1945-1952 and 1952-1965. The overall growth is approximately 3.9%

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[2]Even assuming that Nicaraguan exports double in ten years, they would still be only 2% of *present* world exports.

[3]Fowler, *Export Demand*, pp. 8-12.

[4]Fowler estimated four equations, two for 1948-50 and two for 1952-54:

1948-50

$$C = 11.96 + \underset{(0.00435)}{0.057}\, I \qquad R^2 = 0.59$$

$$C = -3.292 + \underset{(0.1568)}{2.067}\sqrt{I} \qquad R^2 = 0.77$$

1952-54

$$C = 13.778 + \underset{(0.0036)}{0.43}\, I \qquad R^2 = 0.74$$

$$C = 1.560 + \underset{(0.1754)}{1.770}\sqrt{I} \qquad R^2 = 0,75$$

(*Ibid.*, pp. 11-12)

[5]U.N. *Yearbook of National Income Statistics, 1966.*

per year, but from 1952 on, it is only 1.2% per year.[6] Per capita production estimates reflect this dichotomy, as Table IV.1 shows.

TABLE IV.1

ESTIMATES OF WORLD PER CAPITA PRODUCTION OF COTTON

Year	1950	1958	1960	1965
Population Estimate (in millions)	6,020	9,733	10,257	11,533
Production Estimate (1000s M.T.)	2,517	2,904	3,005	3,297
Per Capita Production (kilos)	2.385	3.352	3.413	3.498
Rates of growth:	1950-1958: 4.2%			
	1958-1960: 0.9%			
	1960-1965: 0.5%			
	1958-1965: 0.6%			
	1950-1965: 2.5%			

Source: Table J-2, U.N. Statistical Office, *Demographic Yearbook*, 1966 (New York: U.N., 1966).

If per capita production continues to grow at the slower, more recent rate, according to these calculations consumption will soon exceed production and, in the short-run at least, prices should rise.

In the long run, however, it is doubtful that prices will rise very much, or very fast. Assuming that the demand for cotton depends upon world population, world per capita income, and the price of cotton, and that the supply of cotton depends upon its own price and a time trend, it is easy to show that prices may be expected to fall at a rate of approximately 0.5% per year.[7] Because this value is based on rough estimates of

[6]The appearance of DDT and other modern insecticides probably accounts for the two distinct periods.

[7]Let the demand for cotton be given by

the relevant elasticities, it is probably subject to a large error and it may be more accurate to say that prices will remain constant over the long run.

Bela Balassa, in his *Trade Prospects for Developing Countries*, came to similar conclusions. He foresaw " . . . some decline in cotton prices. . . ." because man-made fibers have displaced cotton from many traditional uses. He cited clothing, medical applications, home furnishings—especially draperies and carpets—and tire cords as cases that buttressed his conclusions. He projected a fall in per capita consumption of cotton in

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$$q^d = D[P, Y(t), N(t)]$$

where P stands for the price of cotton, Y(t) for per capita world income at time t, N(t) for world population at time t. Let the supply of cotton be given by

$$q^s = S(P,t),$$

then

$$\dot{P} = \frac{E_y^d \cdot \dot{Y} + E_n^d \cdot \dot{N} - \frac{\partial s}{\partial t} \cdot \frac{1}{f}}{E_p^s - E_p^d}$$

where E_y^d = income demand elasticity.

E_p^d = price demand elasticity.

E_p^s = price supply elasticity.

$$E_n^d = \frac{\partial D}{\partial N} : \frac{N}{D}$$

and a dot over a variable denotes percent rate of change of that variable.

Substituting the appropriate values we obtain: $\dot{P} = -0.5$. The values used to calculate the percent rate of change of prices were:

1. Percentage change in population: 1.8 (U.N. *Statistical Yearbook, 1966*, p. 26).
2. Percentage change in consumption: 2.5 (calculated from, International Advisory Committee, *Cotton World Statistics*, various issues).
3. E_y^d: 0.5 (Fowler, *Export Demand*, pp. 11-12).
4. Percentage change in income: 2.0 (assumed). I did not use the U.N.'s estimate because it seemed too large.
5. E_p^d: - 0.31 (Fowler, "Economic-Statistical Analysis," p. 91).
6. E_p^s: 1.6 (Table III.5).
7. $E_n^d \cdot \dot{N} = \dot{D} = E_p^d \cdot \dot{P} - E_y^d \cdot \dot{Y} = 2.1$
8. $\frac{\partial s}{\partial t} \cdot \frac{1}{f} = \dot{S} - E_p^s \cdot \dot{P} = 4.0$

North America, from 10.1 kilograms in 1960 to 9.5 in 1970 and 9.3 in 1975. For Europe and Japan, Nicaragua's chief cotton customers, he projected opposite trends.[8] Tables IV.2 and IV.3 are Balassa's estimates of per capita consumption in several areas of the world.

From these two projections it may be concluded that cotton prices will not rise in the long run and may even fall slightly. It is difficult to foresee events which may effect violent changes in the long run, although in the short run the policies of the government of the United States can cause serious yearly price fluctuations. The drastic reduction in U.S. production and exports since 1965 provides a good example. Under the system in effect from 1960 to 1965, the government's Commodity Credit Corporation granted farmers loans of 30 cents per pound with the crop as collateral (the world market price for American cotton in the crop year 1963/64 was 29.52 CIF Liverpool for SM 1 1/16").[9] As a result, farmers' stocks swelled to an all-time record. The omnibus Farm Act of 1965 slashed the cotton loan guarantee from 30 cents to about 20 cents a pound and U.S. production went down from 3,306,000 metric tons in 1964/65 to 1,659,000 in 1967/68.[10] International prices rose as a result. The price of Nicaraguan cotton (CIF, Liverpool, SM 1 1/16") went up from 28.59 in 1963/64, to 30.50 in March, 1968.[11]

In the long run, then, it is doubtful that cotton prices will rise. Neither the price projections based on elasticities, nor Balassa's

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[8] Bela Balassa, *op. cit., Trade Prospects*, pp. 245-257.

[9] International-Cotton Advisory Committee, *Cotton-World Statistics* XX (October, 1966), 34.

[10] *Wall Street Journal*, April 8, 1968; Table II.2.

[11] ICAC, *Statistics, op. cit.*, XXI (April, 1968), 34.

TABLE IV.2

PER CAPITA FIBER CONSUMPTION LEVELS IN WESTERN EUROPE AND JAPAN (kg.)

	1953	1954	1955	1956	1957	1958	1959	1960	1970I	1970II	1975I	1975II
Common Market												
Cotton	4.3	4.7	4.4	4.7	5.3	4.8	4.8	5.2	5.7	5.8	6.0	6.2
Wool	1.5	1.5	1.4	1.6	1.8	1.4	1.6	1.6	1.7	1.8	1.7	1.8
Man-made	1.9	2.1	2.2	2.5	2.7	2.8	2.9	3.3	4.0	4.1	4.8	5.1
Total	7.7	8.3	8.0	8.8	9.8	9.0	9.3	10.1	11.4	11.7	12.5	13.1
United Kingdom												
Cotton	5.3	6.5	5.9	5.8	6.2	5.2	5.9	5.9	6.2	6.3	6.3	6.4
Wool	2.6	2.5	2.5	2.4	2.5	2.2	2.7	2.3	2.2	2.3	2.2	2.3
Man-made	3.0	3.2	3.2	3.5	3.8	3.1	3.7	4.4	4.7	4.8	4.8	5.0
Total	10.9	12.2	11.6	11.7	12.5	10.5	12.3	12.6	13.1	13.4	13.3	13.7
Northern Europe												
Cotton	4.3	4.7	4.6	4.6	5.1	4.6	4.8	5.1	5.6	5.7	5.9	6.1
Wool	1.9	1.8	1.9	2.0	2.1	1.8	2.0	2.0	1.9	2.0	1.9	2.0
Man-made	1.8	2.0	2.1	2.0	2.4	2.1	2.6	2.7	3.3	3.4	3.7	4.0
Total	8.0	8.5	8.6	8.6	9.6	8.5	9.4	9.8	10.8	11.1	11.5	12.1
Southern Europe												
Cotton	2.7	2.8	3.1	3.1	3.3	3.5	3.5	3.4	3.9	4.0	4.2	4.4
Wool	0.7	0.7	0.7	0.8	0.8	0.7	0.8	1.0	1.0	1.0	1.1	1.1
Man-made	0.6	0.7	0.9	1.0	1.0	1.0	0.9	0.9	1.5	1.8	1.8	2.3
Total	4.0	4.2	4.7	4.9	5.1	5.3	5.1	5.1	6.4	6.8	7.1	7.8
Japan												
Cotton	4.2	3.5	3.2	4.1	4.0	3.4	3.9	4.3	4.5	4.6	4.7	4.8
Wool	0.8	0.6	0.6	0.9	0.9	0.7	1.0	1.1	1.3	1.4	1.3	1.4
Man-made	2.0	2.3	2.3	2.5	3.0	2.0	2.9	3.7	4.8	5.0	5.4	5.9
Total	7.0	6.4	6.1	7.5	7.9	6.1	7.8	9.1	10.6	11.0	11.4	12.1

Source: Bela Balassa, *op. cit.*, *Trade Prospects*, p. 417.

TABLE IV.3

PER CAPITA END-USE CONSUMPTION OF TEXTILE FIBERS IN THE UNITED STATES
(Kg., cotton equivalent)

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1970I	1970II	1975I	1975II
Clothing																
Cotton	4.07	4.36	4.13	4.43	4.65	4.47	4.85	4.92	4.72	4.67	5.09	4.95	5.00	5.05	5.00	5.05
Wool	.59	.62	.51	.56	.56	.52	.55	.56	.53	.49	.53	.52	.52	.53	.52	.53
M-made	1.96	2.22	2.29	2.21	2.12	1.96	1.94	1.92	1.94	1.92	2.06	2.02	2.68	2.72	2.88	3.02
Total	6.62	7.20	6.93	7.20	7.33	6.95	7.34	7.40	7.19	7.08	7.68	7.49	8.20	8.30	8.40	8.60
Other Consumer Type Products																
Cotton	1.22	1.27	1.13	1.18	1.20	1.20	1.23	1.21	1.13	1.08	1.11	1.07	.95	.95	.90	.90
Wool	.07	.07	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.03	.03	.02	.02
M-made	.63	.67	.62	.59	.56	.54	.62	.64	.64	.69	.79	.79	.91	.91	.97	.97
Total	1.92	2.01	1.79	1.81	1.80	1.78	1.89	1.89	1.81	1.81	1.94	1.90	1.89	1.89	1.89	1.89
Home Furniture																
Cotton	2.31	2.74	2.56	2.59	2.76	2.68	2.75	2.73	2.56	2.52	2.69	2.54	2.35	2.40	2.30	2.35
Wool	.33	.39	.21	.24	.28	.22	.25	.26	.23	.21	.29	.27	.25	.26	.24	.25
M-made	.32	.54	..56	.62	.73	.76	1.01	1.10	1.20	1.24	1.39	1.42	2.49	2.64	2.96	3.21
Total	2.96	3.67	3.33	3.45	3.77	3.66	4.01	4.09	3.99	3.97	4.37	4.23	5.09	5.30	5.50	5.81
Industrial Uses																
Cotton	2.71	2.97	3.14	2.42	2.11	1.95	2.05	1.88	1.74	1.57	1.66	1.53	1.20	1.20	1.10	1.10
Wool	.07	.11	.07	.05	.04	.03	.03	.02	.02	.02	.02	.02	.01	.01	.01	.01
M-made	2.39	1.65	1.86	2.24	2.43	1.98	2.48	2.19	2.19	2.06	2.56	2.31	2.38	2.38	2.38	2.38
Total	4.17	4.73	5.07	4.71	4.58	3.96	4.56	4.09	3.95	3.65	4.24	3.86	3.59	3.59	3.49	3.49
All Uses																
Cotton	10.31	11.34	10.96	10.62	10.72	10.30	10.88	10.74	10.15	9.84	10.55	10.09	9.50	9.60	9.30	9.40
Wool	1.06	1.19	.83	.89	.92	.81	.87	.88	.82	.76	.88	.85	.81	.83	.79	.81
M-made	4.30	5.08	5.33	5.66	5.84	5.24	6.05	5.85	5.97	5.91	6.80	6.54	8.46	8.65	9.19	9.58
Total	15.67	17.61	17.12	17.17	17.48	16.35	17.80	17.47	16.94	16.51	18.23	17.48	18.77	19.08	19.28	19.79

Source: *ibid.*

consumption projections based on uses and per capita consumption augur favorably for Nicaragua. This is not to say that the future is bleak, but merely to sound a warning note. Cotton prices will probably not rise in the future; most likely they will remain constant, but a gentle fall should not come as a surprise. Maybe the South American prophets of doom of correct, after all.

And so, where to now? Should the Nicaraguan government continue to encourage the expansion of cotton farming, or should it seek to develop alternative export products? The predicted trends in cotton prices suggest that programs designed to reduce cotton production costs should command the highest priorities. Irrigation and strict enforcement of rules designed to control noxious insects are possible courses of action.

Given the importance of cotton in the export ledger, the consequences of similar reliance on coffee in the past and the pessimistic note on price, the government should seek the diversification of the export basket. It should also encourage the exploitation of the backward and forward linkages of cotton farming in order to minimize the adverse effects of external shocks.

CONCLUSION

For the first part of this century, stagnation and extreme dependence on few, usually one, export product characterized the Nicaraguan economy. The first fifty years found the country at the mercy of foreign powers, internal revolts and governments that, in general, were more preoccupied with their own economic gains than with the well-being of their subjects. As a consequence, Nicaragua did not progress, either socially or economically.

Around 1950, high cotton prices initiated a rush to the countryside. Soon therafter, as a result of institutional changes in agricultural credit policies, constant returns to scale, technical change, and the reduction in costs that followed when Nicaraguans began to master the techniques of farming cotton, the latter became the chief export product. In spite of the widespread switch to cotton, neither the traditional exports, nor the crops that were being raised in what became cotton land, suffered. Both, production and exports, flourished. Higher income led to higher imports and they in turn to higher government receipts. Newly acquired preoccupation with development led the government to invest more than ever before in roads, sources of electric power and other much-needed social overhead capital. These investments in turn facilitated production and lowered costs, further stimulating cotton farming and ancillary activities. Suddenly Nicaragua awakened from its slumber and began to grow at unprecedented rates that finally put it among the five fastest growing countries in the world (behind Taiwan, Israel, Japan and Trinidad-Tobago from 1960 to 1965).[1]

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[1] U.N. *Statistical Yearbook, 1966*, pp. 572-574.

After fifteen years of prosperity nature is conspiring against further expansion of cotton production. The United States and Peru have experienced similar phenomena, but they have successfully controlled the noxious insects. The threat, though serious, is not fatal.

The trend in future cotton prices is not optimistic. Certainly it does not warrant encouraging further expansion. Rather, it suggests that Nicaraguans should seek new export products and devote considerable attention to the reduction of cotton production costs. Even though cotton has given Nicaragua a taste of honey, it is perhaps wiser to begin looking for other sources of pleasure.

BIBLIOGRAPHY

Arrow, Kenneth. "The Economic Implications of Learning by Doing," *Review of Economic Studies*, XXIX (June, 1962), 155-173.

Balassa, Bela. *Trade Prospects for Developing Countries*. Homewood: Richard D. Irwin, 1964.

Carter, H. D. and Dean, J. W. "Cost-Size Relationships for Cash Crop Farms in a Highly Commercialized Agriculture," *Journal of Farm Economics*, XLIII (May, 1961), 264-277.

Chapman, Charles E. "An American Experiment in Nicaragua," *The American Review of Reviews*, LXVI (October, 1922), 405-410.

Cumberland, W. W. *Nicaragua: An Economic and Financial Survey*. Washington: U.S. Government Printing Office, 1928.

Davies, Owen L. (ed.). *Statistical Methods in Research and Production with Special Reference to the Chemical Industry*. London: Oliver and Boyd for Imperial Chemical Industries, 1961.

de La Torre, Gustavo. "Integrated Control of Insects in Perú," *Pest Articles and News Summaries*, XIII (February, 1967), 71-73.

Falcon, L. A. *et al.* "Comparison of Season Long Cotton Pest Control Programs in California During 1966." Publication forthcoming in the *Journal of Economic Entomology*.

Falcon, Walter P. "Farmer Response to Price in a Subsistence Economy: the Case of Pakistan," *American Economic Review*, LIV (May, 1964), 580-591.

Food and Agriculture Organization of the United Nations. *Report of the FAO Mission for Nicaragua*. Washington, D.C.: United Nations, 1950.

Fowler, Marquis Lyndon. "An Economic-Statistical Analysis of the Foreign Demand for American Cotton." Unpublished Ph.D. dissertation, University of California, Berkeley, 1961.

Fowler, Mark L. *Export Demand for U.S. Cotton: Implications of Structured Changes in the World Economy*. Okalhoma Agricultural Experiment Station Bulletin B616, December, 1963.

Great Britain, Board of Trade. *Overseas Economic Surveys: Nicaragua, Economic and Commercial Conditions in Nicaragua*. London: H.M. Stationary Office for the Board of Trade, 1954.

Griliches, Zvi. "The Demand for Fertilizers: An Economic Interpretation of a Technical Change," *Journal of Farm Economics*, XL, No. 3 (August, 1958), 591-606.

Hazlet, Raymond Lee. "United States Foreign Policy in Nicaragua, 1909-1928." Unpublished M.A. dissertation, University of California, 1934.

Hirschman, Albert O. *La Estrategia del Desarrollo Económico.* Mexico: Fonds de Cultura Económico, 1961.

_____ ed. *Latin American Issues: Essays and Comments.* New York: Twentieth Century Fund, 1961.

International Bank for Reconstruction and Development. *The Economic Development of Nicaragua.* Baltimore: Johns Hopkins Press, 1953.

International Cotton Advisory Committee. *Cotton-World Statistics. Quarterly Statistical Bulletin.* Washington: ICAC, various issues.

Jenks, Jeremiah, W. *Report Regarding Important Financial and Economic Problems.* Mimeographed, Managua, March, 1925.

Krishna, R. "Farm Supply Response in India-Pakistan: A Case Study of the Punjab Region," *Economic Journal*, Vol. XXIII,(September, 1963), 477-487.

Klein, Lawrence. *A Textbook of Econometrics.* Evanston: Row, Deterson and Company, 1953.

Latin American Center of the University of California. *Statistical Abstract of Latin America.* Los Angeles, 1966.

Marschak, J., and Andrews, W. H., Jr. "Random Simultaneous Equations and the Theory of Production," *Econometrica*, Vol. 12, Nos. 3 & 4 (1944), 143-205.

McCutcheon, O. D. *A Decision for the Cotton Grower.* Hanford: U.S. Dept. of Agriculture and University of California Agricultural Extension Service.

McCutcheon, O. D. and George, A. "Skip-Row Cotton Planting in the San Joaquin Valley," in *One Sheet Answers* (University of California Agricultural Extension Service, No. 141).

Mundlak, Yair. "Empirical Production Functions free of Management Bias," *Journal of Farm Economics*, Vol. XLIII, No. 1 (February, 1961), 44-56.

Neale, Walter. "Economic Accounting and Family Farming in India," *Economic Development and jCultural Change*, Vol. VII, No. 3 (April, 1959), 286-301.

Nerlove, M. "Estimates of the Elasticities of Supply of Selected Agricultural Commodities," *Journal of Farm Economics*, Vol. XXXVIII, No. 2 (May, 1956), 496-509.

Nerlove, M. *Estimation and Identification of Cobb-Douglas Production Functions*. Chicago: Rank McNally and Company, 1965.

_____. *The Dynamics of Supply: Farmers' Response to Price*. Baltimore: Johns Hopkins Press, 1958.

Nicaragua, Banco Central de Nicaragua. *Informe Anual*. Managua: Editorial y Litografía San José, various years.

Nicaragua, Banco Nacional de Nicaragua. *El Banco Nacional de Nicaragua y Sus Programas de Desarrollo*. Managua: Litografía San José, 1966.

_____. *Manual de Informaciones Estadisticas*. Managua, n.d. (Mimeographed.)

_____. *Revista Trimestral del Banco Nacional de Nicaragua*. Managua: Banco Nacional, various issues.

_____, Asesoria de la Junta Directiva. *Estudio de la Economia del Algodon en Nicaragua*. Managua, n.d. (Mimeographed.)

_____, Sección de Estadistica c Investigaciones Económicas. *Leyes Bancarias y Monetarias: Republica de Nicaragua*. Managua: Talleres Tipográficas Heuberger, 1951.

Nicaragua, Consejo Nacional de Economía Oficina de Planificación. *Analisis del Desarrollo Económico y Social de Nicaragua, 1950-1962*. Managua: May, 1965. (Mimeographed.)

Nicaragua, Dirección General de Estadísticas y Censos. *Boletín de Estadística*, III Epoca, No. 4.

Nicaragua, Oficina del Recaudador General de Aduanas. *Memoria del Recaudador General de Aduanas*. Managua: Oficina del Recaudador General de Aduanas, various issues.

Nicaragua, Presidente 1923-1924 (Bartolomé Martinez). *Encuesta Económica; propuesta a la Consideración Nacional por el Señor Presidente de la República, don Bartolomé Martinez*. Managua: Tipografia y Encuadernacion Nacional [1924?].

Powell, A. I. "Intervention by the United States in Nicaragua, 1898-1912." Unpublished M.A. thesis, University of California, 1921.

United Nations, Economic Commission for Latin America. "Analisis y Proyecciones del Desarrollo Economico," Vol. IX, *El Desarrollo Economico de Nicaragua*. Mexico: United Nations, 1966.

United Nations, Statistical Office. *Demographic Yearbook, 1966*. New York: U.N., 1966.

United Nations. *Yearbook of National Income Statistics, 1966*. New York: U.N., 1966.

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the U.S.* Washington: U.S. Government Printing Office, various issues.

U.S. Department of State. *The United States and Nicaragua: A Survey of the Relations from 1909 to 1932.* Latin American Series, No. 6. Washington: U.S. G.P.O., 1932.

U.S. President's Science Advisory Committee. *Cotton Insects.* Report of a Panel of the President's Science Advisory Committee. Washington: U.S.G.P.O., 1965.

U.S. Senate. *Foreign Loans. Hearings Before the Subcommittee of the Committee on Foreign Relations.* 69th Cong., 2d session, January 25, 1927. Washington: U.S.G.P.O., 1927.

Wall Street Journal, Monday, April 8, 1968, p. 20.

Welton, Richard S. "Problems Halt Fantastic Growth in Nicaragua's Cotton Industry," *Foreign Agriculture*, VI (February 12, 1968), 2-5.