PEANUT MARKETS IN THE U.S., CANADA, AND MEXICO: AN ECONOMETRIC ANALYSIS

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Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
May 1997

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ACKNOWLEDGMENTS

First of all I would like to thank Almighty God who made it possible for a man who was born in a remote village of a poor country to achieve a Ph.D. degree. Simply, I would not have accomplished this goal without Dr. David Henneberry, my major professor, who, through all these years, not only encouraged, inspired, and helped me with my academic activities, but also helped me solving my personal and family problems. I also owe special thanks to Dr. Shida R. Henneberry, my examination committee member, for her help and guidance throughout this program. I would like to extend my appreciation to my other examination committee members, Dr. Larry Sanders and Dr. Joseph Jadlow for their assistance, guidance, and moral support. My thanks to Dr. Daryll Ray, Dr. Brian Adam, and Dr. Arthur Stoecker for their guidance and inspiration. Special thanks also go to the department's secretaries, Betty, Joyce, Cathy, and Gloria for being very nice and helpful. I would like to thank Rick Maloney, Haidar Haidary, and the Oklahoma Department of Agriculture for having me intern for two years and assigning me this project. Also, I am grateful to the libraries and computing services of OSU and OU.

I also owe special thanks to Jerry Marquardt, the franchisee of the Kettle restaurant in Norman, who gave me a job and kept my work schedule adjusted to my school schedule during the past four years. She always made me feel like a family member rather than an employee. I am appreciative to my friends at the restaurant, Max Marquardt, Mikie, Naijah, Nizam, and Esayas for their moral support. I extend my sincere appreciation to Jayne Lane and Kim Swearingen, the owners of La Ritz salon, for giving me a job and for their generosity for the last five years. Special thanks also must be given to my cousins and friends, Hamidullah, Tariq, Mabbood, Amin, Salahuddin, Fayaz, Saleem, Tariq, Tahir, Shad, Azmat, Naseer, Asghar, Shahnaz, Arif, Tariq, Naseem, Bari, Suleman, Ehsan, Farman, Greg, Yani, Amir, Mark, Quizi, Rashad, Assim, Massood, Michael, Negash, and Allalyn for their moral and/or financial support.

I owe special thanks to my late father, Shah Baz Khan, who invested all of his life in raising and educating thirteen children (seven of his own and six of his loving brother Sikandar Khan who died while his oldest child was nine and youngest was not yet born). I would like to pay special thanks to my mother, Gul Andama, for her unconditional love and who devoted her entire life to raise her family. My sincere gratitude to my grand mother, aunt, sisters, brothers, and cousins and a special thanks to the late Riaz Ahmad Khan who supported me all of his life and whom I miss very much. I am greatly appreciative to Imtiaz Ahmad Khan and Qaiyum Khan for helping me out of every major crisis of my life. Also, I want to give special thanks to my sister-in-law Karen Willis, and her family, Gary and John for their encouragement and financial support. Most of all I would like to thank my wife, Cynthia O. Perkins, who lived with me through all the hardships during the completion of my degree. I would not have made it through this program without her full time work for the last six months and her unconditional love.

I dedicate this thesis to my late uncle, Sikandar Khan, who paved the road for our family's success.

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CHAPTER I

INTRODUCTION

Peanuts (Arachis hypogaea) also called groundnuts originated in South America around 1800 BC. It is believed that peanuts were grown by the Incas living on the Northern coast of Peru, as some pottery jars shaped like peanuts and other items with peanut designs in Indian tombs have been discovered there. Cultivated peanuts were probably first domesticated in the valleys of Paraguay and Parana rivers in the Chaco region of South America. They were carried to Europe by early Spanish explorers and from there traders took them to Africa and Asia. In Africa, they were traded for spices and elephant tusks and were called Goobers. During the 18th century, the slave traders used peanuts as food for slaves on ships because it was the cheapest available food and the leftover peanuts were the first ones introduced to North American soil Rienow (1986).

Peanuts are annual soil-enriching legumes best adopted to well-drained, sandy, loose, and fertilized soil as well as significantly warm sunshine. They are sowed after the first frost when the temperatures reach about 70 degrees Fahrenheit and planted 2-3 inches deep, 3-6 inches apart in rows with about 2-3 feet distance between the rows (The World Book Encyclopedia 1993). Peanut plants grow yellow flowers and the flowers lose their pedals, the budding peanut ovary called the "peg" slowly curves downward and penetrates the soil about three inches deep where it develops into a mature plant. Peanuts are harvested after 130-155 days either by hand or machinery in two stages: first, the plants are dugout and left in the field for about three days and then picked (Flanagan 1986).

Peanuts are well-known for their high nutritional value of food energy, protein, fat, niacin, thiamin, phosphorus as well as considerable amounts of calcium, iron, copper, and magnesium. Scientific development of peanuts was started by George Washington Carver who discovered that peanuts were rich in protein, fat, and energy and developed three hundred uses for them. Since then leading scientists have done extensive research on peanuts. Peanuts are used to make a number of food products such as peanut butter, milk, flower, margarine, cooking and salad oil, cheese, mayonnaise, and candies as well as non-food products including shaving cream, adhesives, paper, ink, plastic, salve, cosmetic, shampoo, shoe polish, dyes, lubricating oils, metal polish, fertilizer, fodder and meal for livestock, insulation filler, buffing for steel mills, floor sweeping compound, wallboard, and carrier for certain deactivated chemicals . The levels of protein, oil, and carbohydrates contained in peanuts are, respectively, 28, 50, and 18 percent.

An Overview of World's Peanut Production and Utilization

Fletcher, Zhang, and Carley (1992), and Sanford and Evans (1995) present an over view of global peanut industry. Their summary states that Peanuts are one of the worlds major oilseeds ranking fourth in production after soybeans (Glycine max), cotton (Gossypium) seed, and rape (Bassica napus) seed (Canola) seen in table 1.1. Closely behind rapeseed, peanuts have also significant importance in the worlds oilseeds industry. In the 1980s, the world's peanut harvested area was over 18 million hectares and the

Table 1.1. World Supply and Utilization, Major Oilseeds, 1981-92.

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
					1,000	Metric	Tons.					
Production												
Soybean	85998	93306	82800	93140	97030	98111	103530	96058	107369	104137	107380	116980
Cottonseed	28191	27323	26090	33910	30630	27240	31266	32457	30704	33390	36617	31597
Peanut	19905	17630	18400	19680	19990	20383	20976	22990	21976	22121	22244	23034
S.flowerseed	14739	16506	15430	17990	19560	19264	20952	20331	21884	22841	21836	21324
Rapeseed	12371	15063	14270	16930	18570	19473	23338	22634	21983	25112	28267	25136
Exports												
Soybean	29550	28506	26140	25270	26070	28515	30422	23850	28112	24259	28255	29752
Cottonseed	143	114	250	290	280	243	315	310	328	340	445	565
Peanut	1036	1013	950	1100	1370	1281	1295	1111	1297	1335	1374	1335
S.flowerseed	2115	1922	1960	2180	1980	1813	2220	1890	1983	1983	2212	1903
Rapeseed	2142	2394	2580	3150	3630	4599	4529	4256	4252	4000	4799	3999

Sources: Fletcher, Ping, and Carley (1992), Groundnuts-Production, Utilization, and Trade in the 1980's; and Sanford and Evans (1995), Peanuts-Background for 1995 Farm Legislation.

average production was 20 million metric tons with gross returns to producers of around $ 24 billions. They also are fourth after soybeans, rapeseed, and sunflowerseed in the worlds oilseeds export market . Peanuts have passed cottonseed in terms of the world's oilseed exports, however, their exported volume is behind sunflowerseed because India, the worlds largest peanut producer, utilizes more than 90 percent of its peanut production domestically (most of which is crushed and used as cooking oil for human consumption and protein meal for livestock).

World peanut production has been continuously increasing with the highest increase in the 1980's. The early 1990's data do not show significant difference from peanut production in the late 1980's. The production trend has been increasing slowly yet constantly. The world average peanut production for the years 1966-68 was 16,435,000 tons while the average production in the 1970's increased to 16,948,600 tons (an increase of 500,000 tons). The average production in the 1980's was 19,809,800 tons which is an approximate increase of 17 percent over the average production of the 1970's. This major increase in the 1980's was achieved by higher per hectare production whereas the harvested area remained almost the same. The average harvested area was 18.7 million hectares for the years 1966-68, 18.2 million hectares during the 1970's, and 18.3 million hectares during the 1980's and early 1990's. The per hectare peanut yield for the years 1966-68 was .88 tons, which increased to .98 tons per hectare in the late 1970's (an approximate increase of 6 percent in the 1970's over 1966-68). The average yield increased to 1.08 tons per hectare in the 1980's, another increase in yield of almost 17 per cent over the 1970's. Some increase in yield is observed in the developing countries in the early 1990's over the late 1980's because of the use of advanced agricultural technology whereas the increase in yield in the developed countries is almost the same in the early 1990's as it was in the late 1980's.

Peanuts are used directly for food in their primary form by the developed regions of the world such as Europe and North America. In Asia and most parts of Africa, on the other hand, peanut oil is an important source of human consumption. World wide domestic utilization of peanuts for both food use as well as oil and meal has been increasing, however, a continuous shift from crushed to food use has been simultaneously observed over the time. Domestic utilization of peanuts in the food use increased, on average, from 5,245,000 tons in the 1970's to 7,024,000 in the 1980's, an approximate increase of 34 per cent. Crushed peanut utilization, on the other hand, has increased on average from 9,839,000 tons in the 1970's to 10,655,000 tons in the 1980's, an increase of almost 8 percent. Crushed peanut utilization dropped from 58 percent (of total world peanut production) in the 1970's to 53.5 percent in the 1980's whereas the peanut utilization for food purposes increased from 31 percent (of total world peanut production) in the 1970s to around 36 per cent in the 1980s. The same pattern in the trend is followed by the early 1990s.

Global Peanut Trade and the GATT

In terms of world's peanut trade Fletcher, Zang, and Carley discuss that a shift in the form of traded peanuts has been observed in the world trade market since the early 1960s. Peanut oil was the dominant item in the world peanut trade as compared to edible peanuts in the 1960s and early 1970s, however, the opposite has occurred since then (world peanut trade is driven by edible peanuts rather than by peanut oil) . The overall peanut trade increased modestly in the 1980s and early 1990s over the 1970s . Due to the implementation of the General Agreement on Tariff and Trade (GATT) the volume of world peanut trade is expected to be significantly different in the late 1990s and in the next century.

The GATT 1994 is the continuation of the GATT finalized during the second session of the Preparatory Committee of the United Nations conference on Trade and Employment on October 30, 1947. The "GATT 1994" which adopted at the Uruguay Round in December 1993 after seven years of negotiations is the first step toward trade liberalization. The purpose of the GATT is to establish policies that will reduce world wide market access barriers through reduced governmental interventions such as subsidies, trade restrictions or any other internal supports, and to protect environment and human health. The reduced government interventions enhance competitiveness among the economies. The implementation of these policies will eventually result in world wide optimal resource use, maximized consumers' and producers' benefits, and a global social welfare. The GATT has been enforced since January 1, 1995 among the member nations. GATT is an optional agreement and does not require the membership of all the countries of the world and therefore, although a large number of the countries are its members yet some African countries and China (one of the largest Asian economies) have not accepted the membership thus far. There is no time limitation for countries to become members of GATT. Also, GATT is time-wise more flexible for the developing countries (as compared to developed countries) to adopt its provisions so that the developing countries ' domestic markets can become competitive and can adjust to the world market without facing largest shocks. Regarding the GATT they argue that the reduction or elimination of market access barriers for peanuts as a result of implementation of the GATT will influence world peanut production and trade in the future. These examples include the United States government's import restriction on peanuts and India's self- sufficiency policy on vegetable oil. With the adoption of the global agreement, the United States has reduced the peanut import restriction and has opened the domestic market to the rest of the world. Under the new GATT agreement, India also could eliminate or reduce the vegetable oil self-sufficiency policy which will lead to a different world peanut production and trade volume than the existing one because India is the world's largest peanut producer.

In the same research Fletcher, Zang, and Carley classify the geographic distribution of peanuts into six broad regions namely the Americas, Africa, Asia, Near East, Europe, and Oceania as shown in table 1.2. These regions have further been categorized into sub regions. As mentioned earlier, world peanut production has been increasing over time, however, the increase has not been observed across the regions. Asia's production has increased in the 1980s over the 1970s while the production in Africa and in the Americas has decreased during the same time period as shown in table 1.3. The average production in Asia increased by 41 percent in the 1980s over the 1970s. The highest increase, however, was observed in East Asia (113 percent) . This unusual increase was mainly the result of the per acre increase in yield in China, the world's second largest producer . On the other hand, peanut production was decreased in Africa by 17 percent in the 1980s over the 1970s with the Eastern and Southern African countries the major contributors to this loss. In the Americas the decrease in production was 12 percent with the significant contribution made by South American countries

Table 1.2. Groundnut Geographic Classification, by Region and Country.

America		Africa		
South America	North America	Eastern Africa	South Africa	West Africa
Argentina	Canada	Burundi	Madagascar	Benin
Bolivia	Mexico	Sudan	Malawi	Burkina Faso
Brazil	United States	Tanzania	Mozambique	Central African Republic
Colombia		Uganda	South Africa	Cameroon
Dominica			Zambia	Chad
Ecuador			Zimbabwe	Co^te d'Ivorie
Paraguay				Gambia
Trinidad and Tobago				Ghana
Uruguay				Guinea-Bissau
Venezuela				Senegal
				Togo

Asia			
East Asia	Southeast Asia	Southwest Asia	Near East Asia
China	Bangladesh	India	Egypt
Hong Kong	Indonesia	Pakistan	Israel
Japan	Malaysia		Jordan
Korea	Myanmar		Morocco
Taiwan	Philippines		Syria
	Singapore		Turkey
	Thailand		

Europe			
East Europe	EEC	West Europe	Oceania
Czechoslovakia	Belgium	Austria	Australia
Hungary	France	Norway	New Zealand
CIS	Germany	Sweden	
Yugoslavia	Luxembourg	Switzerland	
	Netherlands		
	Portugal		
	Spain		
	U.K.		

Source: Fletcher, Ping, and Carley (1992), Groundnut-A Global Perspective.

Table1.3. World Groundnut Production by Region, 1980-89 ('000 tons).

Regions	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Average 1980's	Average 1970's	Change
Americas													
N. America	1105	1879	1610	1555	2054	1935	1737	1751	1910	1929	1746.5	1735	11.5
S. America	647	676	584		703	750	812	713waz zu	488	616	663.1	995	-331.9
Sub total	1752	2555	2194	2197	2757	2685	2549	2464	2398	2545	.6	2730	-320.4
Africa													
E. Africa	881	928	69564 2	612	585	475	610	685	700	648	681.9	1043	-361.1
S. Africa	763	527	416	276	431	360	507	471	476	498	472.5	780.4	-307.9
W. Africa	2321	2658	2844	2489	2369	2471	2775	2978	2752	2693	2635	2761.9	-126.9
Sub total	3965	4113	3955	3377	3385	3306	3892	4134	3928	3839	3789.4	4585.3	-795.9
Asia													
E. Asia	3762	3994	4053	4116	4981	6824	6052	6370	5847	5470	5146.9	2418.5	2728.4
S.E. Asia	1529	1641	1680	1677	1847	1774	1727	1750	1849	1864	1733.8	1361.3	372.6
S.W. Asia	5062	7295	5366	7174	6505	5183	5950	5352	9078	8080	6504.5	5708.6	795.9
Sub total	10353	12930	11099	12967	13333	13781	13729	13472	16774	15414	13385.2	9488.4	3896.8
Near East1	150	168	158	144	160	167	158	200	231	237	177.3	98.1	79.2
Europe	8	8	6	6	8	10	8	6	7	7.4	7.4	9.1	-1.7
Oceania	43	58	23	47	42	43	45	39	32	37	40.9	38.3	2.6
World	16271	19832	17435	18738	19684	19990	20383	20317	23369	22079	19809.8	16948.6	2861.2

Source: Fletcher, Ping, and Carley (1992), Groundnut-A Global Perspective.

whereas the production in North America increased by 1 percent. The Americas contributed 12 percent to the world peanut production in the 1980s as compared to 16 percent in the 1970s. Africa's contribution to world peanut production dropped as well: from 27 percent in the 1970s to 18 percent in the 1980s. Asia's contribution increased significantly from 56 percent in the 1970s to 67 percent in the 1980s with the East Asian region the major contributor.

The changes in world peanut production are the result of variation in yield and the shifts in harvested area. The largest peanut yield increase was observed in Asia, especially in East Asia where the increase in the 1980s was 26 percent more than the yield in the 1970s. The overall yield in Africa declined over the same period of time. The Americas had also a yield increase with South America the leading contributor. In the 1980s, Asia increased the peanut harvested area by 12 percent while Africa and the Americas had a decrease of 13 and 25 percent, respectively, in the 1980s over the 1970s. Asia's share of world peanut harvested area in the 1980s was 64 percent (6 percent increase over the 1970s), Africa's share was 30 percent (4 percent less than 1970s), and the Americas share was 6 percent (2 percent less than the 1970s).

In terms of global trade, the Asian peanut export increased by 177 percent in the 1980s over the 1970s (the largest among all the regions) mainly contributed by China. The export trade of Africa decreased because of the decline in world peanut oil trade. The increase in the Americas' peanut export trade was not significant mainly due to several years of unfavorable climatic conditions for peanuts in the United States. Asia remained the largest contributor in terms of the world peanut export share in the 1980s:

37 percent as compared to 14 percent in the 1970s. This significant increase (of 23 percent) was the result of China's entry into the global peanut market. Africa's export share in the world peanut trade decreased from 40 percent in the 1970s to 15 percent in the 1980s whereas the Americas' share remained almost unchanged (42 percent over both decades). Peanut imports increased in the Americas and Asia while they decreased in Europe. The decline in European imports was due to decreased peanut oil imports even though the import of edible peanuts increased it was not enough to off set the decrease in peanut oil imports. In terms of the world peanut import trade shares in the 1980s, Europe accounted for 58 percent followed by the Americas and Africa, respectively, 11 percent and 3 percent.

Fletcher, Zang, and Carley also rank the worlds ten largest countries in terms of peanut production, utilization, and trade in the 1970s and 1980s seen in table 1.4. The degree of change in the rankings between the two periods was small in terms of peanut production and utilization, however, the change in rankings of some exporting countries was significant between the two decades. Table 1.5 shows the production and harvested area of the worlds largest peanut producing countries. The most significant increase in production was observed in China. India also increased its production in the 1980s over the 1970s. There is, however, a slight change in production in the rest of the countries. The early 1990s data also show that peanut production in China and India increased relatively more than the increase in peanut production in the remaining major peanut producing countries of the world. Sanford and Evans (1995) state in a report prepared for the 1995 U.S. Farm Legislation that the worlds largest peanut exporting countries (in the 1990s) are the United States and China running almost parallel followed by Argentina.

Table 1.4. Top ten countries in world groundnut production, utilization, and trade.

Production		Harvested Area (ha)		Domestic Utilization		Exports		IMPORTS	
1970's	1980's	1970's	1980's	1970's	1980's	1970's	1980's	1970's	1980's
India	India	India	India	India	India	USA	USA	France	UK
China	China	China	China	China	China	Sudan	China	UK	Netherlands
USA	USA	Senegal	Senegal	USA	USA	India	Argentina	Italy	Japan
Senegal	Indonesia	Nigeria	Sudan	Senegal	Indonesia	S.Africa	Sudan	Japan	Germany
Sudan	Senegal	Sudan	Nigeria	Sudan	Senegal	Gambia	Hong Kong	Canada	Canada
Indonesia	Myanmar	Myanmar	USA	Indonesia	Myanmar	Brazil	India	Netherlands	France
Nigeria	Sudan	USA	Myanmar	Nigeria	Nigeria	Senegal	Gambia	Germany	Singapore
Brazil	Nigeria	Indonesia	Indonesia	Brazil	Sudan	Nigeria	Vietnam	Portugal	formerly USSR
Argentina	Zaire	Zaire	Zaire	Myanmar	Zaire	China	Netherlands	Switzerland	Hong Kong
Myanmar	Argentina	Argentina	Cameroon	Argentina	Brazil	Argentina	South Africa	For. USSR	Indonesia

Source: Fletcher, Ping, and Carley (1992), Groundnut-A Global Perspective.

Table 1.5. Groundnut Production and Harvested Area by the Major Producing Countries, 1980-89.

Regions		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Average 1980's	Average 1970's	Change	Change Percent
Production	('000 t)														
India		5005	7223	5282	7086	6436	5120	5875	5300	9000	8000	6432.7	5652.1	780.6	13.8
China		3600	3826	3916	3951	4185	6664	5882	6170	5693	5300	4918.7	2233.4	2685.3	120
USA		1045	1806	1560	1495	1999	1870	1677	1640	1806	1828	1672.6	1680.5	12.58	63.5
Indonesia		791	728	795	747	755	780	750	786	830	840	780.2	639	141.2	22.1
Senegal		521	878	1109	568	560	587	817	932	690	738	740	882.6	-142.6	188.6
Myanmar		431	564	541	532	667	560	544	519	565	575	549.8	406.5	143.3	35.3
Sudan		707	740	497	413		275	380	435	450	400	468.7	796.5	-327.8	163.6
Nigeria		530	428	396	591	500	400	400	475	350	350	442	511.4	135.4	191.2
Zaire		320	347	357	367	375	375	380	380	380	380	366.1	294.1	71.7	24.4
Argentina		243	270	250	329	270	439	518	450	243	370	338.2	431.3	111.7	183.2
Others		3078	3022	2732	2659	3547	2920	3160	3230	3362	3298	3180.8	4321	-320.2	195.4
Harvested area	('000 ha)														
India		6801	7429	7215	7539	7168	7120	6982	6844	8430	8100	7362.8	7221.1	241.7	3.4
China		2339	2472	2416	2201	2421	3318	3253	3022	2914	2956	2731.2	1839.3	891.9	48.5
USA		566	602	517	556	618	594	621	626	659	663	602.2	608.4	14.28	32767
Indonesia		508	461	480	523	510	515	516	550	605	615	528.3	462.1	66.2	14.3
Senegal		1064	1080	1121	937	874	607	808	846	903	790	903	1130.5	-227.5	184.7
Myanmar		514	598	571	561	647	595	564	537	585	600	577.2	613.6	168.4	14.58
Sudan		894	998	782	770	735	400	540	575	575	550	68.9	834.6	-152.7	186.5
Nigeria		650	479	600	600	550	520	660	800	700	700	625.9	906.3	-280.4	173.9
Zaire		480	496	510	524	524	524	524	530	530	530	517.2	439.9	63.3	14
Argentina		197	166	125	146	143	168	233	192	150	160	168	355.9	-187.9	152
Others		3750	3750	3614	3433	3469	3476	3665	3703	3725	3697	3628.2	3911.7	-283.5	13.28

Source: Fletcher, Ping, and Carley, Groundnut-A Global Perspective (1992).

India has also been gaining more of the market share in world peanut market trade during the 1990s as illustrated in table 1.6. This might be the result of the relatively less restrictive food self sufficiency policy started recently by the Indian Government in 1992. The world's major peanut importing countries include the Netherlands, Indonesia, the United Kingdom, Germany, Japan, Canada, and Singapore. Indonesia has increased peanut import significantly since 1992, however, a slight readjustment is observed among the rest of the worlds leading importing countries in the 1990s over the 1980s. In terms of world peanut import market share, Fletcher, Zang, and Carley state that the largest improper in the 1980s was the European Community (EC) which imported about 50 percent of worlds traded peanuts. The leading importing countries included the UK (12 percent), the Netherlands (11.63 percent), Japan (9.80 percent), Germany (8.36 percent), Canada (7.50 percent), France (7 percent), and Singapore (5.34 percent).

The three-fold objectives of this study are first, to quantitatively analyze the existing peanut industry in the U.S., Canada, and Mexico. Second, to identify various forces that explain the variation in peanut markets in the U.S., Canada, and Mexico, and finally, to investigate the interrelationship of peanut markets among the member countries of the North American Free Trade Agreement (NAFTA), the U.S., Canada, and Mexico. In order to formulate the quantitative structure of the study, it is necessary to explain the existing peanut production and marketing structure in the U.S., Canada, and Mexico and to introduce the concepts of the North American Free Trade Agreement (NAFTA) that are related to peanut trade among the member countries of NAFTA.

Table 1.6. World Groundnut Major Exporting and Importing Countries, 1986-1994, (1,000 Metric Tons).

Exporting Countries	1986	1987	1988	1989	1990	1991	1992	1993	1994
U.S	301	280	312	449	296	452	431	249	340
China	398	359	247	329	448	311	300	450	350
Argentina	170	150	86	122	130	169	110	115	110
Sudan	10	75	50	25	20	25	20	20	20
India	40	10	70	35	45	61	48	70	75
S. Africa	16	37	33	28	27	14	35	30	15
Gambia	40	55	54	60	33	53	50	40	38
Brazil	8	8	2	3	2	3	2	3	3
Paraguay	23	19	10	15	10	15	15	15	15
Vietnam	40	40	40	40	70	70	65	65	65
Malawi	20	22	4	1	2	0	0	0	0
Other	215	240	203	190	252	261	259	278	280
Total	1281	1295	1111	1297	1335	1374	1335	1335	1311
Importing Countries									
EC-12	557	577	582	624	582	648	557	567	586
Netherlands	177	144	149	192	230	242	186	192	205
U.K.	147	154	160	173	115	118	120	127	130
Germany	106	108	125	129	120	110	107	105	115
France	51	74	59	49	43	101	71	65	55
Italy	32	31	34	33	31	29	26	27	28
Spain	29	33	37	33	30	30	30	32	30
Japan	114	124	124	120	121	132	102	95	90
Canada	107	68	70	70	90	72	80	100	90
Singapore	75	110	90	90	90	90	90	90	90
Hong Kong	72	55	55	65	65	65	65	65	65
Indonesia	66	41	21	72	137	79	154	160	165
Switzerland	40	30	28	27	24	22	26	28	27
Other	237	178	170	198	229	218	229	231	209
Total	1268	1233	1204	1322	1393	1381	1313	1346	1337

Source: Sanford and Evans (1995), Peanuts-Background for 1995 Farm Legislation.

U S Peanut Industry

In the United States peanuts became popular and important in the last century. Soldiers of both sides of the American Civil War used peanuts as one of the major food sources because of their high energy content and good taste. After the war was over some of the soldiers took peanuts in their pockets to grow on their farms. Since then the steady increase in the number of people engaged in the production, processing, and distribution of peanuts has affected the United States peanut industry as well as the economy. Although produced by more than 50 countries in the world, no other country utilizes the full potential of peanuts as food as the United States. Harrison (1992) reports that Peanuts rank seventh among crops in the U S, grown on 1.7 million acres with production of 2 million metric tons and a farm value of $1.3 billion Farm. Sanford and Evans further explain that three regions grow 98 percent of the U.S. peanut crop: the southeast region which includes the states of Georgia, Florida, Alabama, and South Carolina; the southwest region consists of Texas, Oklahoma, and New Mexico; and the Virginia-Carolina region includes the states of Virginia and North Carolina. Georgia, the leading peanut producing state, accounted for about 45 per cent of total U S peanut production during the early 1990's. The southeastern region accounted for 63 percent of the total U.S. peanut production, the southwestern region 23 percent, and the Virginia-Carolina region 15 percent. The southeastern region has increased its share of the total U.S. peanut production in the past four decades, however, its share has decreased during 1991-93 due to the 1993's drought. The share of peanut production in the southwest region has slightly increased whereas the share of the Virginia-Carolina region has decreased.

Delineation of Peanut Farms

In 1992, peanuts were grown on 16,194 farms in the U.S. of which 15,914 farms were located in the nine largest peanut producing states as shown in tab 1.7. The number of peanut farms in 1987 was 18,905. The average size of U.S. peanut farm was 98 acres in 1992 and 76 acres in 1987. More than 50 percent of the peanut farms sized less than 50 acres (1-49) in 1992 and their contribution to the total U S peanut production was 9 percent. The farms sized (100-249) acres were 3,333 in number (21 percent of total U.S. peanut farms) and their contribution to the total U.S. peanut production was 33 percent during the same year.

The U.S. peanut production has gradually increased since 1967. Imports have increased, on average, from one million pound to two million pounds during the same years. Imported quantity has increased in 1980 and in 1990 (due to severe droughts in the U.S.) to 401 million pounds and 27 million pounds, respectively. In terms of U.S. peanut exports, the increase in quantity is tremendous: from 198 million pounds in 1967 to 1,025 million pounds in 1992. The difference between the beginning stocks and the ending stocks is consistently narrow with the exception of some random shocks (mainly due to production variation). Peanut quantity used for crush has not significantly increased over the time until restrictions were reduced on extra peanut production and even then the increase in crush is not parallel to the increase in production. This is because of high foreign demand for U.S. peanuts due to their high quality. Additional peanuts produced by U.S. peanut farmers are bought by the United States Department of Agriculture or commercial buyers at the lower of the two prices and these peanuts are mainly crushed or

Table 1.7. Number of U.S. Peanut Farms and production, by harvested acreage size distribution, 1992 (1987 in parentheses).

Peanut acres	Farms				Production			
	Number		Percent		Million pounds		Percent	
1 to 49	8273	(10802)	51.1	(57.1)	384	(464)	9.4	(13.6)
50 to 99	2938	(3567)	18.1	(18.9)	515	(580)	12.7	(17)
100 to 249	3333	(3348)	20.6	(17.7)	1333	(1201)	32.8	(35.3)
250 to 499	1228	(949)	7.6	(5)	1054	(737)	25.9	(21.7)
500 to 999	361	(206)	2.2	(1.1)	573	(304)	14.1	(8.9)
1,000 and over	61	(33)	0.4	(0.2)	225	(118)	5.5	(3.5)
Total	16194	(18905)	100	(100)	4065	(3404)	100	(100)

Source: Sanford and Evans (1995), Peanuts-Background for 1995 Farm Legislation.

exported unless needed for domestic food consumption in emergencies (excess domestic peanut demand). The two-tiered price policy and the conditions regarding crush and exports which were instituted by the 1977 Farm Act will be explained in detail latter in this chapter. Quantity of farmers stock basis (peanut available for food use) has increased over the time from 1,419 million pounds in 1967 to 2,175 million pounds in 1992. U.S. per capita peanut consumption as food use has increased from 5.3 million pounds in 1967 to 6.4 million pounds in 1992. Almost half of this category's quantity is used to produce peanut butter.

China is the United States' closest competitor in the world peanut export market. Over the last nine years the U.S. remained the world's largest peanut exporter for four years while China took the lead for the remaining five years. China's fifth year's lead was only by 10 metric tons. In terms of U.S. peanut exports Sanford and Evans present that the total peanut exports have increased from 226,216 metric tons in 1986/87 to 323,557 metric tons in 1992/93. The largest quantity exported was in 1991/92 (339,158 metric tons). The Netherlands and the U.K. were the largest U.S. peanut importers (table 1.8). The Netherlands was the largest importer over the entire time period except for two years (1989/90 and 1990/91) during which the U.K. took over the lead. The third major importer of peanuts was Canada. Other major importing countries included Germany, Spain, Mexico, New Zealand, and Japan. Mexico was the sixth largest importer of U.S. peanuts in 1992/93. Fletcher, Zang and Carley (1992), and Sanford and Evans (1995) conclude that there are four peanut varieties grown in the United States: Runner (Arachis hypogaea subsp hypogaea var hypogaea), Virginia, Spanish (A. hypogaea subsp fastigiate var vulgaris), and Valencias (Subspfastigiata var fastigiata). The runner variety is

Table 1.18. U.S. Peanut Exports, 1986-92

Country	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
	Metric Tons						
Greece	35	0	0	270	155	308	220
Belgium-Luxembourg	1362	1375	1161	1741	2430	2789	1648
Denmark	6	18	9	957	179	548	1281
France	3590	2871	4154	6922	4127	24825	7106
Germany	11348	18129	10607	14861	9168	34108	26394
Ireland	153	315	310	385	406	545	515
Italy	4105	2882	2219	5776	2152	3916	3043
Netherlands	69757	74090	59591	90312	56397	86366	96241
U.K.	44522	36171	59537	94479	67228	71492	61348
Portugal	2688	1807	6402	5709	3360	5952	4868
Spain	9723	10092	13591	14359	11010	15217	14725
Total EC	147289	147750	157581	235771	156612	246066	217389
Canada	41888	30748	36139	49398	36330	52366	57843
Japan	21487	16835	19952	20645	4149	15081	12470
Mexico	86	2221	4140	7115	5621	11268	13479
Norway	1918	2366	2687	4896	1114	2611	4059
Sweden	3071	3304	2281	3619	1848	1911	2260
Switzerland	4785	579	342	899	130	380	329
New Zealand	1625	2350	2862	2088	1879	1379	1348
Australia	376	595	4022	5691	1385	460	275
Other	3691	4090	4583	6910	13257	7636	14105
Total	226216	210838	234589	337032	222325	339158	323557

Source: Sanford and Evans (1995), Peanuts-Background for 1995 Farm Legislation.

predominantly grown in the Southeastern region, (Georgia, Florida, Alabama, and South Carolina), the largest peanut producing region in the United States. The Virginia-Carolina region (Virginia and North Carolina) mainly grows the Virginia type peanuts (the large-kernel variety). The Southwestern region (Texas and Oklahoma) grew two-thirds Spanish variety and the other third the runner type, however, presently this region grows runners more than Spanish because of the higher yield of the former. The fourth variety, the Valencias, is grown in New Mexico mainly under irrigated conditions. Runner type seed covers 70 percent of the United States peanut crop followed by Virginia Spanish, and Valencias that, respectively, cover 20 percent, around 9 percent, and 1 percent of the total crop.

Peanut Utilization in Domestic Edible Products

Data on different varieties of peanuts used in edible products for the time period 1965-93 are taken from Carley and Fletcher (1991), and Sanford and Evans (1995) and shown in table 1.9. The utilization of runner peanuts in food products increased from 386 million pounds in 1965 to 1568.1 million pounds in 1993 (306 percent increase). The value of the Virginia type decreased from 378 million pounds to 296.6 million pounds during the same time period. The use of Spanish type decreased from 475.7 million pounds to 97.1 million pounds (80 percent decrease). The Spanish type peanut use in food products was 37 percent of the total peanut use in food products in the middle 1960's (the highest among the three varieties). Roasting stock for which the type of peanut was not identified (mostly Virginia type was used for roasting stock) has increased its use in food products by more than double during the 1965 to 1989 period. The runner

Table 1.9. Use of Farmers' Stock Peanuts in Primary Food Products, by Type of Peanut in the U.S. 1965 to 1993.

Year	Runners	Virginias	Spanish	Roasting	Total
		Million Pounds			
1965	386.1	378.8	475.7	94.6	1335.2
1966	364.4	399.7	496.1	82.3	1342.5
1967	418	385	529.8	91.5	1424.3
1968	399.6	376.1	596.5	103.9	1476.1
1969	408.4	396.6	605.6	105.8	1516.4
1970	467.4	398.5	550.9	119.2	1536
1971	522.4	371.3	552.2	116.1	1562
1972	584.5	368.7	557.1	116.6	1626.9
1973	696.1	406.3	545.4	152.1	1799.9
1974	830.9	342.8	397.1	129.4	1700.2
1975	919.3	356.9	354.9	142	1773.1
1976	942.7	268.4	316.9	163.2	1691.2
1977	1063.5	251	255.1	190.6	1760.2
1978	1195.7	260.5	235.8	210.9	1902.9
1979	1299.3	224.7	195.6	201.4	1921
1980	1158.5	131.4	140.8	120.3	1551
1981	1317.3	183.7	128.8	200.7	1830.5
1982	1318.9	286.2	135.6	206.4	1947.1
1983	1372.9	217.1	153.9	154.4	1898.3
1984	1397.7	234.4	152.7	211.9	1996.7
1985	1452.2	274.7	164.1	234.6	2125.6
1986	1400.7	373.4	167.4	215.1	2156.6
1987	1533.3	288.6	152.7	187.9	2162.2
1988	1670.9	320.7	142.7	237.4	2371.7
1989	1738	349.8	115.7	242	2445.9
1990	1395	380.4	139.7	230.1	2145.3
1991	1600	396.3	125	282	2403.3
1992	1533.5	367.1	99.8	271.3	2271.6
1993	1568.1	296.6	97.1	223.4	2183.9

Sources: Sanford and Evans (1995), Peanuts--Background for 1995 Farm Legislation; and Fletcher and Carley (1991), Factoes Affecting Consumption of Edible Peanuts and Impact on Farmers in the U.S.

type was the most important variety used in food products accounting for nearly 70 percent of the total peanut use in food products (averaged for the period 1991-93) followed by the virginia type which contributed 15 percent whereas the spanish variety's use was less than 5 percent. In the U.S., peanuts produced for edible purposes are processed mainly for three peanut products: 1) peanut butter; 2) packaged nuts which consist of salted, unsalted, honey-roasted, and flavared nuts; 3) and peanut candies. These data are also taken from the same work of Carley and Fletcher, and Sanford and Evans. According to their presentation, almost half of all the peanuts produced for food uses are processed to make peanut butter as shown in table 1.10. The use of farmers' stock peanuts in peanut butter increased annually, on average, from 700 million pounds during 1965-67 to more than 1 billion pounds during 1991-93. The use of peanuts in peanut butter in recent years (the late 1980's and early 1990's) has partly increased due to the introduction of the government Domestic Feeding and Child and Nutrition Programs. About 33 percent of the total peanuts (produced for edible uses) were processed to manufacture all packaged nuts out of which 21 percent were used for snack peanuts. Use in snack peanuts, on the average, increased from nearly 300 million pounds (annually) in 1965-67 to almost 464.6 million pounds in 1991-93. Peanut candy accounted for approximately 20 percent of the total edible peanuts. The annual average share for peanut candy increased from 263 million pounds during 1965-67 to 451.3 million pounds during 1991-93. Use in roasting stock (cleaned in shell) increased from nearly 100 million pounds to 258.9 million pounds during the same time period. The runner type is the most important variety for shelled peanut utilization while the roasted in-shell market is dominated by the Virginia type. The Valencia type peanuts which are grown mostly in

Table 1.10. Use of U.S. Farmers' Stock Peanuts, by Primary Food Products, 1965-93, (million pounds).

year	Peanut butter	Salted Peanuts	Candy	Roasting	Others	Total
1965	692.9	283.8	239.5	94.6	24.4	1335.2
1966	669	304.2	263.9	82.3	23.1	1342.5
1967	713	3094	287.5	91.5	22.9	1424.3
1968	727.3	319.2	301.1	103.9	24.6	1476.1
1969	747.7	320.4	314.4	105.8	28.1	1516.4
1970	752.3	317.6	323.5	. 119.2	23.4	1536
1971	774.6	321.4	327.2	116.1	22.6	1561.9
1972	802.9	338.4	345.6	116.6	23.4	1626.9
1973	909.5	378.1	334.5	152.1	25.7	1799.9
1974	892.9	370.1	288.7	129.4	19.1	1700.2
1975	889.8	401.2	318.8	142	21.3	1773.1
1976	854.1	337.6	312.6	163.2	23.7	1691.2
1977	867.2	364.7	312.8	190.6	24.8	1760.1
1978	921.7	387.8	357	210.9	25.4	1902.9
1979	971.4	378.9	343.6	201.4	25.7	1921
1980	814.8	273.3	316.4	120.3	26.2	1550.9
1981	899.6	369.7	340.3	200.7	20.3	1830.6
1982	930.4	409.8	377.9	206.4	22.6	1947.1
1983	925.3	401.6	396.4	154.4	20.6	1898.3
1984	962.1	411	386.1	211.9	25.5	1996.6
1985	965.5	476.9	417.4	234.6	31.3	2125.7
1986	948.6	511.1	427.2	215.1	54.6	2156.6
1987	993.8	497.1	433	187.9	50.3	2162.1
1988	1143.8	506.7	434.9	236.7	47.9	2370
1989	1193	522.7	438.9	242	49.2	2445.9
1990	986.9	472.2	405.7	230	50.5	2145.3
1991	1178.4	460.2	436.2	282	45.2	2403.3
1992	1061.3	469.5	436.2	271.3	33.3	2271.7
1993	966.9	464.2	481.5	223.4	47.9	2183.9

Sources: Sanford and Evans (1995); and Fletcher and Carley (1991).

New Mexico and constitute a very low percentage of total U.S. peanut production have the longest shell among all varieties and are excellent for roasting in the shell. The use of the Spanish type was almost evenly divided among all peanut products. Almost 50-60 percent of all shelled runners were used in peanut butter whereas the remaining near 40 percent were used almost equally in peanut candy and snack peanuts. The unshelled roasted Virginia peanuts are used as ball-park peanuts or cleaned in-shell peanuts also called roasting stock in some literature.

Peanuts can also be crushed and used as peanut oil and meal . Although the use of peanut oil and protein meal is very important in some countries, their production and use in the U.S. are almost insignificant. In the U.S. during the years 1991-93, about 888 million pounds of peanuts were crushed annually for oil and meal as compared to 8 billion pounds crushed in India. Soybeans are the most important oil seed crushed for oil and meal in the United States. During the years 1991-93, 76 billion pounds of soybeans were crushed annually for oil and meal. Peanuts used for oil and meal are usually rejected or diverted from edible uses. Rejected peanuts include peanuts that are picked out from edible nuts as well as the low quality (segregation 3) peanuts. The low quality peanuts include peanuts that contain aflatoxine, damaged by insects, and poorly stored peanuts. Aflatoxine is a carcinogen produced by a common mold that can cause illness in humans. The USDA and the United States Food and Drug Administration have been insuring a low level of aflatoxine in peanuts and peanut products lately. Diverted peanuts are those that are produced in excess supply.

U.S. Peanut Production, Cost, and Returns

The U.S. peanut cash receipts and expenses for the period 1981-92,analysed by Sanford and Evans (1995), are shown in table 1.11. Cash receipts ranged from $721 to $754 per planted acre whereas cash expenses varied from $420 to $455. Total returns were reported from $267 to $333 and per pound returns after cash expenses ranged from 7 cents to 13 cents. The highest cash receipts were received in 1984 and were relatively lower in later years mainly due to lower yields which were caused by unfavorable weather conditions. Per acre cash expenses, on the other hand, decreased from $454 to $387 during the years 1981-86 and increased slightly afterwards. Increasing per acre cost was largely associated with increasing chemical costs. The higher cost for the crop year 1991, however, was due to an abnormal increase in the price of peanut seed because of the 1990's drought. Returns after cash expenses have increased as well.

Regional Costs

According to the annual cost-of-production report of USDA's Economic Research Service, among the three peanut producing regions in the United States, the Virginia-North Carolina region enjoyed the highest returns over the years 1990-92. The producers of this region received an average per acre cash receipts of $925. The peanut farmers of the southeast region received an average receipts of $695 whereas the southwest region received $647. The average cash expenses were $497, $433, and $385, respectively, in North Carolina, the southeast, and the southwest regions during the same crop years. The seed and chemical costs in the southwestern region were $75 lower than the remaining two regions. The Virginia-North Carolina region had the highest per acre returns after cash expenses ($427). The other two regions had $262 each or $165 less than the Virginia-North Carolina region.

The U.S. Peanut Policy

Schauband and Wendland (1990) brief the early history of the U.S. peanut policy that since the early 1930's, the U.S. congress has introduced and established different Farm Programs in order to stabilize farm income and farm product prices, and to equate the demand and supply of certain "basic" agricultural commodities. The peanut crop was designated a basic crop in April 1934 by the Agricultural Adjustment Act 1933. This Act was enforced after the failure of the 1929 Agricultural Marketing Act and other previous programs formulated to accomplish the same goals. According to the 1933 Act those farmers who set aside part of their land (take out of production) could get benefit payments from the government. In January 1936, however, the production control features of the 1933 act were authoritatively stated unconstitutional by the U.S. Supreme Court. Agricultural Adjustment Act 1938 and further amended in April 1941 reestablished peanuts as a basic crop and like other basic crops the price support program was enacted to be mandatory (a mandatory program is defined as a compulsory program for a specific crop for a certain time period if at least two-thirds of the producers of the same crop vote for it in a referendum. The vote on peanut quotas is for five years whereas the vote on other "basic crops" quotas is for one year). Since April 1941, while programs for other basic crops have changed through the years, the peanut program of marketing quota, price support, and acreage allotment has remained the same with the exception of no imposition of the program for the period 1943-48 because of the increased demand for peanut food, feed, and oil during the second world war.

Rucker and Thurman (1990), and Schaub and Wendland (1990) present an over view of the U.S. peanut policy by stating that in 1950 after the Korean war started the price support levels for peanuts were set at 88 percent of parity by the Secretary of Agriculture by using the national security provision of the 1949 act. The support levels ranged between 75 and 90 percent during 1952-77. From 1970 to 1977, the price support rate remained constant at the minimum legal level of 75 percent of parity. Parity is a tool that measures the purchasing power of farm products per unit in any year compared to base period specified as 1910-14. In 1948 the revised definition of the parity price formula allowed for the comparison of the current year farm and non farm product prices based on the average commodity prices of the past 10 years. However, parity is no longer used to set price support levels for most agricultural products excluding wool, mohair, and some minor tobaccos.

Farm Act 1977

The peanut program became an important issue during the 1977 Food and Agricultural Act discussions because the trade off between the mounting treasury cost and the well-being of peanut producers was important yet complicated. Because the guaranteed price support was based on 75-90 percent of parity, the farmers were growing peanuts on almost all of their legally allotted acres which resulted in an excess supply of peanuts. Another factor that contributed towards the excess supply was the 250 percent increase in peanut yield over the two decades (1957-77). On the contrary, the demand for

Table 1.11. U.S. sector costs and returns, 1981-92

			Returns above cash expenses		
Crop year	Cash receipts	Cash expenses	Total	Nominal	Real
	Dollars Per Peanut			Dollars Per Pound[1]	
1981	721.19	453.8	267.39	0.101	0.128
1982	667.41	426.25	241.16	0.091	0.109
1983	580.01	427.96	152.05	0.065	0.075
1984	726.46	424.12	302.34	0.107	0.118
1985	638	395.73	242.27	0.087	0.092
1986	689.78	387.08	302.7	0.129	0.133
1987	655.47	390.97	264.5	0.115	0.115
1988	695.66	391.02	304.64	0.126	0.121
1989	679.53	396.54	282.99	0.116	0.107
1990	695.41	408.92	286.48	0.146	0.129
1991	697.23	465.19	232.04	0.094	0.079
1992	753.66	420.44	333.22	0.129	0.107

[1]Returns deflated to constant 1987 dollars by the GDP implicit deflator.

Source: Sanford and Evans, Peanuts: Background for 1995 Farm Legislation (1995).

peanuts was increasing on a rather slower rate which resulted in a surplus supply and consequently higher government costs because the surplus peanuts were either crushed or exported and the prices in both of these markets were significantly lower than the guaranteed price paid to producers by the government. These concerns led to a substantial change in the peanut program under the 1977 Act. This act implemented a program that in the policy makers' view would minimize government costs, peanut producers economic hardships, and surplus supply. The 1977 Act maintained the status quo of the mandatory peanut program while the programs for wheat, feed grains, rice, and cotton were declared voluntary. The price support program was amended by another program called a two-price poundage quota program under which farmers could produce more than the allotted poundage quota (within their legally acreage allotments) but they would receive a lower price for additional peanuts (rejected or diverted from edible uses) and additional peanuts could only be crushed or exported and could not be sold for the domestic edible uses unless placed for loan with the Commodity Credit Corporation CCC (a corporation within the USDA which is owned by the Federal Government and operated by the Consolidated Farm Service Agency and Foreign Agriculture Service) through regional growers' associations. The Growers' Associations act as agents for the USDA. They maintain records of marketing quota and additionals. They also settle warehouses for peanuts put under loan with CCC and administer the price support program. The poundage quota for individual farmers was computed by using the average farm yield as a major factor. The average farm yield was the average yield of the three best years out of the past five years. The guaranteed price of quota peanuts (the higher of the two prices) was set significantly above the world price whereas the price for additionals was based on world market conditions (lower than the world price unlike soybeans price ,however). Additional peanuts placed for loan could (beside crush and export) be used for domestic edible purposes when there was a shortage of peanut supply. Farmers were paid with the highest support price by the growers' associations in the years when additionals were used for domestic edible purposes. Farmers could place both quota and additional peanuts under loan. The only other option that was available to peanut farmers was to sell their peanuts through contracts with peanut handlers. The contracts for quota peanuts could be signed any time before harvest unlike the additional peanuts which had to be contracted before June 15 (a few weeks before harvest). The acreage allotment (minimum) was fixed at 1.614 million acres and distributed among the states (mainly peanut producing states). Prior to the 1977 Act, the Secretary of Agriculture had to grant permission for inter county allotment transfers whereas under the 1977 Act this restriction was abolished.

The 1981 Farm Bill

The 1981 Farm Bill maintained the status quo of the two-tiered price policy, reduced the poundage quota program, and suspended acreage allotments. The minimum quota support price was set at $455 per ton and was raised to $550 in 1985. Increase in the minimum quota support price was instituted to be in the same ratio as an increase in the cost of production, however, the maximum per year increase in the price level was set at 6 percent. The price for those additionals that were placed under loan had to be announced every year by the CCC and was set at $148 per ton for crush peanuts and $425 per ton for exported peanuts. The minimum poundage quota was reduced at the rate of around 3 percent from 1982 to 1985 (1.2 million tons to 1.1 million tons). Quota reduction was started, first, from the farmers who had less acres available to peanut crops than the allotted acreage quota. Secondly, from those who did not utilize the quota in two out of the past three years. Thirdly, from the producers who had leased away their quota and lastly, from farmers who utilized all their allotted quota. The acreage allotment suspension allowed any farmer to grow peanuts, however, the production of non-license holding farmers was considered additional and like the previous Act was subject to the lower price.

Food and Agricultural Act of 1985

The 1985 peanut legislation maintained the two-tiered price support and reduced the annual national poundage quota program. The quota support price was fixed at $607.47 per ton for the crop years 1986 and 1987 which was raised to 615.27, 615.87, and 631.47 per ton, respectively, for the crop years 1988, 1989, and 1990. The support price for additionals (marketed for export edible uses) was set at $400 for the 1986-90 marketing years while the support price for additionals (crushed for oil and meal) remained constant at $149.75 per ton for the whole 1985 Farm Program. The support prices for both quota and additionals were required to be announced by February, 15 (a few weeks before peanut plantation) so that producers can make decisions on how much to produce, where to sell and also the buyers (contractors) can be assured of the peanut supply level. The annual national poundage quota was fixed at 1.355 million tons for the 1986 and 1987 crops and was increased to 1.402, 1.44, and 1.56 million tons, respectively, for the crop years 1988, 1989, and 1990.

The 1990 Farm Legislation

The 1990 Farm Act implemented the basic guide lines of the 1985 peanut legislation. The 1991 annual national peanut quota was set at 1.55 million tons (based on estimated demand) and the quota support price at $642.79 per ton. The quota support price was raised to $674.93 for the next year's crop because of the higher costs of seed after the 1990 drought. The price remained the same for 1993 and was increased to $678.36 for the 1994 and 1995 crops. The support price for additionals (sold for export edible purposes) remained the same $400 for the entire program years (1991-95). The support price for additionals (crushed for oil and meal) was fixed at $149.75 for the 1991 crop and approximately $132 for the remaining crop years of the 1990 Act. The 1991 Act maintained the provisions regarding the sale and lease of poundage quota implemented by the 1981 and 1985 Farm Legislations.

The U.S. Peanut Marketing System

The price support program and the domestic marketing quota for peanuts influence the marketing and processing system of peanuts in the U.S. as they do the production system. Rucker and Thurman (1990) explain the different marketing options available to U.S. peanut producers which are shown in figure 1.1. As shown in the diagram there are two categories of peanut crop: quota peanuts and non-quota or additional peanuts. Quota peanuts can either be contracted with handlers or put under loan with CCC through regional growers' associations. The minimum quota price is guaranteed for both channels. Borges (1995) categorizes three regional growers' associations namely, the Georgia, Florida, and Alabama Growers' Association (for the southeast region), the peanut growers' cooperative marketing association for the Virginia-North Carolina region, and the Southwest Peanut Growers' Association (for the region of Texas and Oklahoma). Although the growers' associations can sell quota peanuts for domestic edible purposes, domestic crush uses and/or export, they mostly sell quota peanuts for domestic edible uses . They sell quota peanuts in the export market and/or domestic crush market only in case of surplus peanut supply.

The non-quota or additional peanuts can either be sold to contractors or placed on loan with the CCC in additionals' pools. According to Bogers's summary there exists six pools in each regional growers' association: one quota and one additional pool for each of the three peanut varieties (runners, virgenia, and spanish). The minimum guaranteed price for additionals is paid only for the peanuts that are placed under loan. The additionals' support price is significantly below the price paid by handlers for additionals, nevertheless if the demand for the domestic edible peanuts exceeds its supply, the additionals (under loan with CCC) are sold for domestic edible uses for the higher quota support price and the profits are proportionally distributed among the producers of the additional peanuts. The (higher) quota price is always higher than what the handlers pay to producers of additional peanuts. Thus the farmers of additional peanuts either have to contract their peanuts with handlers on a price above the minimum guaranteed price for additionals (paid by the government) or accept the minimum guaranteed price for additionals (below the contract price) and expect that the demand for domestic edible peanuts would exceed its supply and they would enjoy a price higher than the contracted price (higher guaranteed quota price). If the demand and supply equations for the domestic edible market are met then additionals bought by growers' associations are either crushed, exported or both. An important point to be mentioned here is that those producers of additionals who have put their peanuts under loan would receive a higher price than the minimum guaranteed price (for additionals) if their peanuts are sold in the export market (by the growers' associations). The contracted additionals can be sold in any of the three markets: domestic edible, domestic crush, and export.

Peanuts From Farm Gate to Buying Point

After peanuts are harvested they are dumped into 5-ton wagons to take to an inspection and buying point. The USDA's Federal-State inspectors examine random samples from each wagon under a microscope for mold and diseases The wagons that are approved are then attached to a forced-air dryer at around 100 degree fahrenheit in order to further dry the peanuts to a moisture content of 10 percent or less. The peanuts are then graded at the inspection station based on their meat content, the size of their pods and cornels, moisture content, and the amount of foreign material in each wagon. After the inspection and grade peanuts are sold to commercial buyers or the USDA. Peanuts are stored at warehouses and cleaned before and after they are shelled and then electric color sorters and visual inspections are used to insure that only the top quality peanuts reach the market for direct (edible) uses such as peanut butter, candy, and packaged nuts. The disapproved peanuts are crushed for oil and meal Opitz (1993).

The US Peanut Export Programs

The U.S. is one of the world's largest exporters of peanuts and peanut products even though it produces only 10 percent of the total peanuts produced worldwide. A detailed information on U.S. peanut export promotion programs are available in

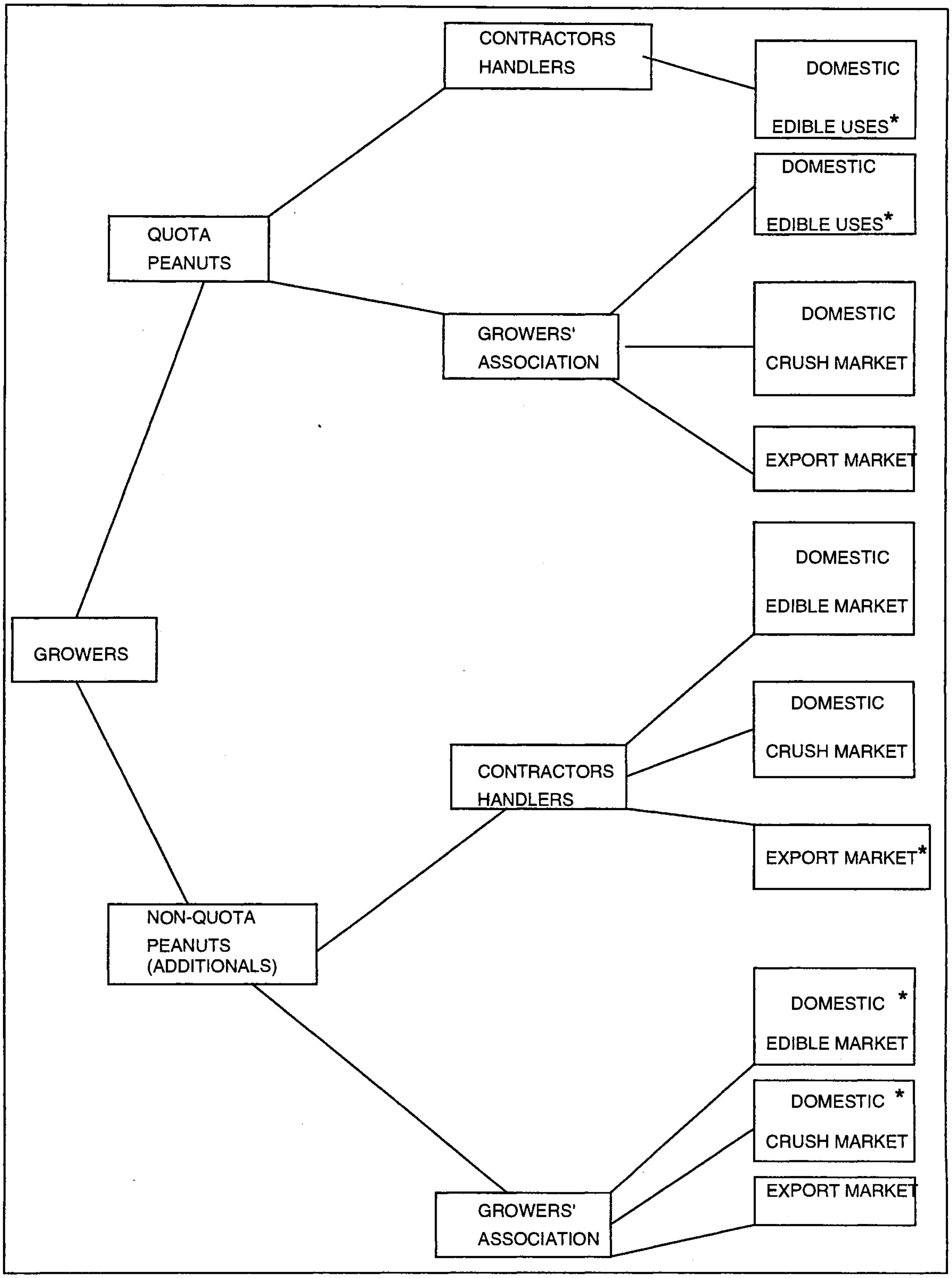

Figure 1.1. Alternative Marketing Options Available to U.S. Peanut Producers. *Frequently Used Market Channels.
Source: Rucker and Thurman (1990), The Economic Effects of Supply Controls-The Simple Analytics of the U.S. Peanut Program.

Hallidurton and Henneberry (1993). According to their research, the U.S. peanut export programs are mainly non-price programs such as Market Promotion Program (MPP) and the Cooperator Market Development Program (CMDP) which are sponsored by the USDA's Foreign Agricultural Service (FAS) and the National Peanut Council of America (NPCA). Although U.S. peanuts are graded the best in the world market, the competitors for U.S. peanuts include China and Argentina. The European Community is the largest importer of U.S. peanut products followed by the Eastern Asian countries including Japan, Taiwan, Korea, and Hong Kong. Saudi Arabia is the largest importer of U.S. peanut butter. Also, the demand for U.S. peanut products has been increasing in some Eastern European Countries and the former Soviet Union such as Poland, Hungary, and Russia. The MPP is replaced by the name "Market Access Program" under the recently approved 1996 Farm Legislation": Federal Agricultural Improvement and Reform Act".

U.S. Peanut Industry under NAFTA

The implementation of the trilateral North American Free Trade Agreement (NAFTA) and the global General Agreement on Trade and Tariff (GATT) will influence peanut producers, buyers/shellers, manufacturers, and consumers of peanuts and peanut products. The previous U.S. annual peanut import quota (775 metric tons) is abolished and replaced by a minimum duty-free quantity of imports that will increase over time and a tariff will be imposed on imports above the minimum duty-free quantity. According to the "Tariff Schedule of the United States Annex 302.2", under NAFTA, Mexico could export 3,377 metric tons of peanuts to the United States (duty-free in the first year, 1994) provided all exported peanuts were produced in Mexico. The duty-free quantities will increase at the rate of three percent annually and at the beginning of the calendar year 2008 quantitative limitations will cease. Consequently there will be no limitations on peanut importation into the United States from Mexico. The projected duty-free quantity under GATT was 33,770 metric tons in the first year which will increase to 56,283 metric tons in the sixth year. The quantitative restrictions, under GATT, will be phased out in ten years

Canada's Peanut Industry and NAFTA

Unlike the United States, Canada does not have any restricted peanut supply policy or price support program because they are not grown on Canada's soil. All peanuts are imported from other countries and as a result the only policy is the boarder policy which regulates peanuts and peanut product imports and exports. Canada is one of the largest importers of U S peanuts and peanut products. As specified in the "Tariff Schedule of Canada Annex 302.2", under NAFTA, Canada has neither any quantitative restrictions nor tariff on peanuts and peanut products imported from the United States or Mexico. Peanut products exported from Canada to the U.S. must be made from peanuts imported from countries other than the U.S. because according to the agreement, Canada and Mexico can not export any peanut product manufactured from peanuts imported from the U S into Canada or Mexico unless exemption is granted by the U S government.

On average, peanut imports into Canada varied from 80,000 metric tons to 100,000 metric tons during the years 1973-94. All peanuts in Canada are used for edible purposes as none of them are crushed for oil and meal. The peanut price increased from \$439.7 per metric ton in 1973 to \$964.58 in 1991. These are unit prices and are taken from various issues of the "Trade Year Book" of the Food and Agriculture Organization (FAO) of the United Nations. Canadian data on the prices of peanuts and peanut products (neither wholesale nor retail) are not available. This was confirmed by a telephonic conversation with the officials of the Department of Statistics, Government of Canada.

Mexico's Peanut Industry and NAFTA

Mexico was a net exporter of peanuts through the 1970s, stayed on the boarder line between net importer and net exporter through the mid 1980s, and became a net importer in 1987 and has been a net importer since then. Currently about 80 percent of the domestic peanut demand is met by peanuts produced within Mexico. These data are taken from various issues of the Food and Agriculture Organization Trade Year Book. The harvested area of peanuts in Mexico increased from 75,000 hectares in 1971 to 90,000 hectares in 1993. The harvested area significantly decreased from 1971 through 1977 and has doubled since then. Peanut production increased from 94,000 metric tons in 1961 to 116,000 metric tons in 1993. The recent increase in peanut production is because of the increased harvested area whereas the per hectare production has not increased significantly over time. Peanut imports, on average, were small in volume through the 1960s and 1970s (under 100,000 metric tons) and increased significantly in 1980 to 1,937,000 metric tons. Peanut imports averaged 25,905 metric tons for the years 1991-93. Peanut exports peaked during the years 1961-66 and started decreasing after 1967 with a dramatic decrease between the years 1982-93. Peanut net exports ranged from 2,259 metric tons in 1972 to 1,350 metric tons in 1979. Net imports skyrocketed during recent years: 13,250 metric tons in 1988 to 30,739 metric tons in 1993. Peanut prices increased from $958 in 1973 to $1,092 per metric ton in 1991 with large fluctuations between most years. Historic data on retail or wholesale peanut prices are not available as explained by the USDA officials John Link and Daniel Plankett at the Mexico Desk in Washington D.C. by telephonic conversations and through electronic mail correspondence.

Edible peanut utilization (edible consumption, seed, and feed uses) in Mexico averaged 292,000 pounds for 1990-93 while domestic production averaged 253,000 pounds. The domestic peanut supply in Mexico and exports to the U.S. is expected to increase in the future Borges (1994). In addition, according to the American Embassy's 1995 report to the USDA, it is expected that Mexico will become self-sufficient in peanut production in 1996 as the price of domestically produced peanuts are significantly lower than the price of imported peanuts: $436 per ton domestically produced runner-type when compared to $890 per ton of the same variety imported. This is the result of the December, 1995 devaluation of Mexico's currency. The embassy's report also suggests that the smaller Virginia and Georgia type peanuts have been replacing by the runner-type and that, in the future, peanuts are expected to be planted on larger farms.

Organization of the Study

The remaining study contains five chapters: chapter two describes the review of literature regarding the peanut production and marketing in the U.S., and the analysis of peanut trade under NAFTA. In chapter three, the relevant theories for the development of the models are presented which includes the analysis of the modern international trade theory and the consequences of the trade distortion policies. Chapter four explains the methodology and the data necessary for the analysis. Chapter five includes the presentation, examination, and interpretation of the empirical results of econometric analysis. Chapter six contains the summary, conclusions, and limitations of the study and recommendations for future research.

CHAPTER II

LITERATURE REVIEW

This chapter describes the review of the previous research that is related to peanut production, marketing, and trade. The review of the literature on the U.S. peanut industry under various government support programs as well as the comparison between the government program verses the free market scenario is presented. The literature review of Mexican and Canadian peanut industry under NAFTA is also included. However, the domestic peanut markets of Mexico and Canada are not discussed in detail due to the unavailability of previous work on these countries domestic peanut markets.

During the early 1970s, producers of most crops were experiencing high production because of the use of high technology and increased returns due to the growing global demand for agricultural commodities. Where fence-row to fence-row plantation was a general practice for other commodities peanut production and marketing were highly regulated by allotment quota and the price support program. Both programs were mandatory and favored peanut producers. The price support program, which aimed high farm income at the cost of the taxpayers, and excess supply of peanuts had necessitated the studies of analyzing the benefits and costs of the peanut program.

Impacts of Peanut Price Support Program

Several agricultural economists started evaluating the peanut crop from the angles of production, processing, consumption, and government costs. Song, Franzman, and Mead (1975) quantified the U.S. peanut producers' benefits and tax payers' costs as a result of the direct peanut price support program. and compared them with the estimated gross farm income and governmental costs under hypothetical free market conditions.

They estimated three separate demand models for peanut prices under the free market scenario: 1) edible uses; 2) crush uses; and 3) the combination of the models of edible and crush uses. Edible uses included peanut butter, salted and roasting peanuts, peanut candy, and peanut butter sandwiches. The peanuts which exceeded edible uses were bought by the commodity credit corporation and later on sold for crushing. All of the three models were estimated by using OLS with the yearly data for the years 1952-72.

The demand model specified for edible utilization is as follows:

$$Y_{et} = B_0 + B_1Z_{1t} + B_2Z_{2t} + B_3Z_{3t} + U_t \quad (1)$$

The variables were defined as:

Y_{et} = Per capita quantity of peanuts (pounds) bought for edible purposes in year t;

Z_{1t} = Per capita income (in dollars) in year t;

Z_{2t} = Average per pound price (in cents) received by peanut farmers in year t;

Z_{3t} = Per pound price (in cents) for tree nuts in year t; and

U_t = Random shock in year t;

B's = The parameters for the respective independent variables.

The empirical results of the above model show a direct relationship of per capita income with the dependent variable (per capita consumption of edible peanuts), an indirect relationship of the dependent variable with its own price, and with the price of tree nuts.

The demand model specified for crushing is as follows:

$$Y_{ct} = A_0 + A_1X_{1t} + A_2X_{2t} + A_3X_{3t} + A_4X_{st} + V_t \qquad (2)$$

Where:

$Y_{ct} =$ The price of peanuts for crush uses in year t;

$X_{1t} =$ Per capita quantity of peanuts (in pounds) utilizing for crushing in year t;

$X_{2t} =$ Per pound price of cottonseed (in cents) in year t;

$X_{3t} =$ Per pound price of soybeans (in cents) in year t;

$X_{st} =$ Per capita quantity (in pounds) of peanuts stocked in CCC's stores in year t;

and

$V_t =$ Random shock in year t.

A's = The coefficients of the independent variables.

The results of this model indicate a negative relationship of the dependent variable (the price of peanuts for crushing) with the quantity of peanuts utilizing for crushing, a positive relationship with the prices of cottonseed and soybeans, and a negative relationship with the quantity of peanuts held in CCC's stock.

The authors make the foundation for the estimation of the third model (the combination of the first and the second models) in the following order:

$$X_{pt} = X_{st} + Y_{et} + X_{1t} \qquad (3)$$

OR $$X_{st} = X_{pt} - Y_{et} - X_{1t} \qquad (4)$$

Where:

X_{pt} = Total peanuts produced in year t; and

X_{st}, Y_{et}, and X_{1t} are defined above.

The total peanuts in any year are the summation of peanuts stocks, quantity used for edible purposes, and quantity used for crushing. Equation No. 3 links equation No. 1 and No. 2. After X_{st} in equation 2 is replaced by X_{st} in equation 4 and Y_{et} in equation 4 is replaced by the right hand side values of equation 1, the new equation is produced:

$$Y_{et} = [A_0 - A_4B_0] + A_4X_{pt} - A_4B_1Z_{1t} - A_4B_2Z_{2t} - A_4B_3Z_{3t} + [A_1 - A_4]X_{1t} + A_3X_3t + [V_t - A_4U_t] \qquad (5)$$

Equation 5 mirrors the dependency of both edible and crush uses of peanuts.

Song, Franzman, and Mead further argue that in the absence of the price support program there would have prevailed a single price for both uses of peanuts and, therefore, a free market price for peanuts is equal to both Y_{ct} (the price of peanuts for crushing) and Z_{2t} (the average price of peanuts received by peanut producers). After rearranging and solving the above equations, the following equation is found as the free market price-quantity relationship model:

$$P_{et} = 1\%\ 1 + A_4B_2\,[A_0 - A_4B_0] + A_4X_{pt} - A_4B_1Z_{1t} - A_4B_3Z_{3t} + [A_1 - A_4]\,X_{1t} + A_3X_{3t} + [V_t - A_1U_t] \qquad (6)$$

The estimated model shows an inverse relationship of the dependent variable (free market price) with total peanut production, a direct relationship with per capita income, an indirect relationship with the prices of tree nuts, a direct relationship with the quantity of peanuts used for crushing, with the price of cottonseed, and with the price of soybeans.

The gross farm income in the free market scenario is equal to the total amount of peanuts sold multiplied by the free market price in any given year. Regarding the direct price support scenario the authors state that the price received by peanut farmers is the specified price set by the government each year and the actual gross farm income is equal to the specified support price level multiplied by the total quantity of peanuts sold in any given year.

Their results indicate that the estimated free market price was lower than the support price (for edible uses) received by farmers in all years and closer (slightly higher or lower) to the price for crushing (the price received by the CCC in the crush market). The average price received by the peanut farmers during the years 1952-72 ranged from 9.6 cents to 14.4 cents per pound. The price received by the CCC for peanuts sold for crushing varied from 4.8 cents per pound to 8.0 cents per pound. The estimated free market price ranged from 4.7 cents to 7.2 cents per pound during the same years. The higher price (higher than the free market price) that peanut growers received due to the price support program ranged from 4 cents to 8 cents per pound.

In terms of the gross farm income, the results indicate that the actual gross farm income was higher than the estimated (under the free market conditions) gross farm income during the entire period of the study. Actual farm income under the support program ranged from $116.9 million to $468 million for the years 1952-72 whereas the estimated total farm income under free market conditions varied from $68.8 million to $234 million. The increase in the gross farm income due to the program (as compared to the free market scenario) ranged from $48 million to $239 million. The U.S. peanut growers enjoyed almost 50 percent higher prices (higher than the free market prices) and higher gross farm income.

Regarding the impact of the direct peanut price program on the taxpayer, these authors argue that the program costs the government $640 million in totality from 1952 to 1972 with the highest cost of $434 million during the years 1965-72. These costs do not include the cost of administering the peanut program and the government cost on the land set a side program (of the peanut crop). Their findings show a price inelastic demand for edible peanuts whereas the demand for crushing is found to be elastic. The price elasticities of the demand for edible and crushing peanuts were found to be .44 and 6.0897, respectively. Since the edible peanuts are price inelastic the increase in the support price does not lead to a proportionate decrease in the demand for edible peanuts. Therefore, the increase in the support price does not lead to a significant increase in the quantity of crushing sold by the CCC and consequently the CCC does not have a downward influence on the price level of crushing peanuts. Therefore, at least the government's cost does not increase through the sale of peanuts in the crush market even if the support price is increased. However, no price support program simultaneously maximizes farm income and minimizes government cost (optimal program). If the support price is set at a very high level the government has to buy all peanuts and sell them in the crushing market because there will exist no demand for edible peanuts. On the other hand, the support price set at the free market level will result in zero government cost. They conclude that the average price received by peanut farmers was significantly higher than the estimated free market price and that the increase in the gross farm income from 1952 to 1972 was 112 percent. Each dollar spent by the taxpayers resulted in a $4.05 increase in gross farm income. Regarding the peanut program they conclude that if the aim of the program is higher farm income, then the government will have to set the support price above the free market price, but if the goal is to save treasury dollars or provide consumers with low food cost, the support price will have to be set closer to the free market price.

After the gross farm income of peanut farmers and treasury costs were quantified as a result of the direct peanut price support program, agricultural economists started analyzing alternative policies that would result in the least tax payer cost as well as non significant adverse impacts on peanut producers' income. Fleming and White (1976) argue that despite the restricted peanut acreage allotment on the national level (1.161 million acres) and the growing peanut demand, edible peanuts were in excess supply as a result of a 100 percent increase in peanut yield in the 1970s over the 1960s. These authors, therefore, suggested a marketing quota program as opposed to the price support program.

Unlike Song et. al (1975) who compared the peanut price support program versus the free market scenario, Fleman and White compared alternative policy tools within the peanut program. They quantified and projected peanut production, consumption, treasury cost, and peanut producers' net farm income under two different peanut policies. First, the marketing quota policy that would restrict peanut production to the average production of 1970-73, and secondly, the direct peanut price support program coupled with the acreage restriction policy. They also have evaluated a marketing quota based on the 1960-73 peanut production for reference.

In addition Fleman and White state that the higher peanut support price (above the free market price level) has motivated peanut producers to grow peanuts on higher yielding farms and to utilize advanced agricultural technology in order to produce a higher quantity of peanuts. Higher yielding peanut varieties have also contributed to increased peanut production. Furthermore, the CCC takes edible peanuts out of the edible market (export and crush) in order to avoid a downward pressure on peanut price in the commercial (edible) market which has encouraged higher peanut production. The self imposing U.S. restriction, that only the highest quality peanuts qualify for exports, has limited U.S. peanut exports and consequently created little or no influence on peanut prices in the world market. Reduced peanut exports have also resulted in more peanut quantity sold in the crush market (on lower prices) by the CCC and the loss from the difference between the export price and the crushing price is the treasury cost. These authors claim that the higher guaranteed price, taking peanuts out of edible market, and less exports result in higher treasury costs.

The authors analyzed peanut production and the general demand model using annual data for the years 1960-73. These production models were estimated for three major peanut producing regions (Virginia-North Carolina, Southeast, and the Southwest) by using the natural logarithm as the functional form. Since the national acreage allotment for peanuts was fixed at the time, the increase in peanut production over the years was because of the yield only. The following production model was estimated regressing yields against time in all three regions. An additional variable for the runner variety of peanuts in the model was estimated for the Southeast region because the percentage of the runner type grown in this region was found to be significant in explaining the high yields. The model is presented as follows:

$Y_i = f(T_i, R_i)$

Where:

Y_i represents yield in pounds in region $_I$; and

T denotes annual time trend.

The authors find that the quantity of peanuts that was sold by the CCC for crushing or used as seed or lost was positively related to peanut production and negatively related to support price.

$LnFL = B_0 + B_1LnPR + B_2LnPS$

Where:

FL denotes the quantity of peanuts used as seed, feed, farm loss, and shrinkage, million pounds;

PR represents total production in million pounds; and

PS indicates support price (cents per pound).

Peanuts that were damaged or of inferior quality in the edible market or anywhere other than the CCC's disposition were found to be only 8 percent of the total edible consumption. Fleming and White state that the demand model for edible peanut consumption is the function of its own price and personal disposable income only because the complimentary and substitute variables were excluded from the model as a result of their statistically insignificant relationship to the model. Furthermore, because of the high correlation between these two independent variables past data (from Song's study) were included in the analysis in order to estimate the relationship between the dependent variable and its price. The following model was estimated using the restricted least squares regression approach:

$$E = B_0 + B_1 PS + B_2 D1$$

Where:

E = Per capita consumption of edible peanuts;

PS = Per pound peanut support price, in cents; and

D1 = Per capita disposable income, in $100.

Regarding the purchases from the CCC this study includes the analysis of the CCC peanuts that were sold either for exports or crushing domestically. The following simultaneous equation model was estimated using the three stage least squares estimation technique.

$CRSHC = B_0 + B_1QAVAIL + B_2PCRSH + B_3PEXP$

$EXP = B_0 + B_1QAVAIL + B_2PCRSH + B_3PEXP$

$PCRSH = B_0 + B_1CRSHT + B_2PSOY + B_3D1 + B_4D14$

$CRSHT = B_1CRSHC + B_2CRSHNC$

Where:

CRSHC = CCC's peanut quantity purchased for crushing in million pounds;

QAVAIL = CCC peanut quantity available for disposition, million pounds;

PCRSH = Price received by CCC for peanuts sold for crushing, cents per pound;

PEXP = price received by CCC for exported peanuts;

EXP = Quantity of peanuts exported (in million pounds);

CRSHT = Peanut quantity that crushed, from all sources;

PSOY = Price of soybeans, per bushel;

D14 = 0 for the years 1960-72 and 1 thereafter; and

CRSHNC = Crushed quantity of peanuts from sources other than CCC, million pounds.

Their results show that the quantity of peanuts bought from CCC for crush uses is negatively related to its own price and positively related to the export price of peanuts. Likewise, the quantity of peanuts for exports is negatively related to its own price and positively related to the price for crushing. The price of peanuts used for crushing is directly related to the price of soybeans. The simulation results for the projected years

1976-80 (using peanut production, edible consumption, crushing, exports, CCC's costs, and average net farm income as dependent variables and peanut support price, personal disposable income, soybean price, peanut export price, and population as independent variables) show that, on average, the peanut production under the price support program will remain 384.6 million pounds higher than the quota policy. The edible consumption of peanuts will stay the same under both programs.

The U.S. peanut producers will annually receive about $13.12 million less under the quota program or the total reduction in the net farm income is projected to be $66 million during the entire projected period. However, it is mentioned that the diverted peanut acres will be used for other crops which will reduce the losses in the net farm income. Peanut exports will decrease under the quota program by 83 million pounds; however, the peanut export trend will increase. The crushing quantity under the quota system will remain 189 million pounds less than the price support program. This gap significantly increased during the last two years because the higher edible peanut consumption relative to the restrictive production under the quota program will lead to reduced peanut overstocks. The authors argue that higher crushing was due to overstocked CCC's inventories which were the result of excess peanut supply. Therefore, with less crushing the CCC will reduce its costs by selling peanuts in the edible market (at higher prices) instead of in the crushing market and will save storage costs as well. The average annual CCC's costs are reported to be $32 million lower under the quota program than under the price support program over the projected period. The authors support the peanut quota program instead of the price support program by concluding that the treasury costs will be reduced by $151 million over the entire projected period by implementing the former policy.

Free Market Recommendations and Farmers' Technical Education

Miller (1981) argues that peanut farmers do not have considerable marketing experience because they sell peanuts at a price that is the same for the entire season. Also, peanut farmers take their crop to buying points right after the harvest because of, beside other factors, peanut farmers do not have farm storage. There also exists lack of future markets and orderly price discovery mechanism in the peanut industry. If the government fails to continue the peanut program and the peanut industry starts operating under free market conditions, will the peanut buyers/handlers/millers and processors have the market power to depress peanut prices? If so, will the benefits of the lower prices pass on from first handlers to processors to consumers? Miller identifies the four-firm concentration ratios in the peanut industry and discusses their policy implications as a result of a continuos prolonged peanut price support program. This study also briefs the exercise of the excessive market power of the U.S. corporate industry and the counterproductive congressional bills that were passed from time to time. As a result of, among other corporations Standard Oil's attempt to exercise monopoly power, the Sherman Act of 1890 was passed that dictated that any conspiracy that would restrain trade should be deemed illegal. Since the monopoly power abuse was not well explained in this act the Congress passed the Clyton Act and the Federal Trade Commission Act in 1894 that forbids the use of monopoly and/or monopsony powers in any market in the United States. Although these previous acts protect U.S. farmers against any market abuses, the general consensus that farmers had weak marketing power led congress to pass the Capper-Volsted Act of 1922 which exempted farmers from the Sherman Clayton and Federal Trade Commission Act and allowed them to organize associations that would protect the farming community from being exploited: to collectively process, prepare, and market agricultural products. Farmers were also allowed to make contracts for their products. Later, the Cooperative Marketing Act of 1926, further allowed farmers to share information through their associations or federations. Peanut cooperative associations would act the same way as other farmer groups under the above mentioned Acts: protect themselves against market concentrations or any other market power(s) that try to exploit peanut farmers. Presently peanut farmers have government sponsored cooperative associations (growers' associations) the role of which need to be defined during the post peanut program period and should not be allowed to use their market power to influence peanut prices in favor of peanut farmers if these associations remain in the industry as peanut cooperative associations during the free market era.

Regarding the marketing channels and structure, this research indicates that during 1970-80 the total number of peanut buying points across the U.S. were 505, with the total of 126 peanut buyers. The four-buyer concentration ratio (the percentage of U.S peanuts bought by the four largest buyers) was 29 percent. The volume of trade of these buyers was more than 190 million pounds each. The largest volume of peanuts was purchased in Georgia (1370 million pounds) followed by Alabama, Texas, North Carolina, Virginia, Oklahoma, Florida, and South Carolina where the volumes of peanuts were purchased, respectively, 577, 417, 372, 238, 201, 149, and 12 million pounds. The largest number of buying points were also observed in Georgia (154) followed by North Carolina (106), Virginia (74), Texas (70), Alabama (56), Oklahoma (30), Florida (11), and South Carolina (4). Florida was the leading state in terms of the average purchase at per buying point. The four-firm concentration ratios for peanut millers were found to be higher in the states with smaller peanut production. The four-firm concentration ratio for the U.S. was 45 percent which, the author argues, could be alarming in terms of price influence by the peanut handling industry.

Regarding the peanut processing industry the author includes that peanut butter sandwiches had the highest 4 plant concentration ratio (only four processing plants in the U.S.). Peanut candy had a 4 plant concentration ratio of 66 percent whereas salted peanuts had 54 percent. Peanut butter's 4 plant concentration ratio was 41 percent (the 4-firm concentration ratio, however, was 53 percent and this is because, except for peanut butter, all other peanut processors had one plant each). Miller states that peanut processors may be the major price making force in the peanut industry as the majority of the industry has a four firm concentration ratio of more than 50 percent. Sheller's could too influence the price. It is concluded that the prevailing price system is inefficient because the price is transmitted from peanut processors to farmers after one year of its original alarm: price increases in the fall after the farmers have sold most of the crop to handlers, retail price of peanut products increases in early spring after peanuts are bought by processors, and finally forward contracts rise (from processors to handlers to farmers) in the late spring and at that time (after one year) farmers realize that the higher price was because of the last year's short supply. If the pricing system was efficient the farmers would have received higher price for the last year's crop. Miller recommends the free market system for peanuts by stating that electronic markets, futures markets, and future contracts can be used as productive tools for peanut price discovery. Miller's recommendations also include providence of loans and technical education to peanut farmers, and peanut farm storage.

Risks Faced by Peanut Handlers

Dubman and Miller (1989) argue that as a result of the peanut program peanut handlers face the most risks in the peanut industry. According to the peanut forward contract legal document there is no penalty for peanut farmers if they do not supply contracted quantity of peanuts to buyers/shellers/handlers due to lower yield or less area planted. On the other hand, peanut buyers are bound to buy all contracted peanuts whether the world prices favor buyers or not. Peanut buyers were not concerned about the risk of short supply before 1980 because there were peanuts available from CCC's storage all year round whereas the CCC does not allow for additional (export) peanut stocks to be passed to the next year. Further, after 1977 if peanut farmers decide to sell peanuts to commercial buyers, they are required to sign preseason contracts for two classes of peanuts (quota and additionals) for two different prices.

The farmers supply quota peanuts first. Consequently, in case of short supply, the buyers/shellers are delivered with less than contracted additional (for exports) peanuts which is a serious risk for buyers because in case of shortage in quota peanuts additionals (buy-back) from CCC could be bought to fill the quota quantity whereas in case of shortage in additional (for exports) peanuts there is no substitute available. Also, according to the CCC's rules the additional (for exports) peanuts must be exported on or before November 31 (about three months after the harvest) which results in another risk factor for peanut buyers, especially when buyers have high inventories. The authors conclude that traditionally farmers supply 80 percent of the contracted quantity to peanut buyers.

Rucker and Thurman (1990) argue that the concerns of policy makers regarding the peanut program peaked when, besides excess peanut supply, the secretary of agriculture Earl Butz announced in 1973 that for the next two crops the CCC will sell peanuts at the same support price regardless of the use of peanuts. The peanut handlers have to pay the CCC the support price whether the purchase is made for the edible, exports, or crush whereas previously the handlers had to bid prices for peanuts bought for exports and crush. Since the support price is significantly higher than the world price it is impossible for the CCC to sell its excess peanuts which led to mountained treasury costs and consequently a tremendous change to the peanut program under the 1977 and succeeding acts.

These authors have estimated the benefits and costs of the peanut program at a time when treasury costs were reduced in comparison to the 1970s and the peanut farmers had become accustomed to a lower net farm income and the peanut program had gained some support. These authors argue that in recent years the quota has been set short of the domestic demand for edible peanuts which has resulted in surplus buy-back every year. Also, if the demand estimates are set exactly equal to the peanut supply there will not be any treasury costs because no peanuts will be sold for crush. At least the costs can be heavily reduced if the gap between supply and demand is narrow because that excess supply can be exported on the world price which is higher than the crush market.

They present the estimated total dollar transfer from consumers to producers, dissipated portion of transfer, and deadweight loss as a result of the peanut program for the years 1982-887. The average annual total transfer is $284 million. The product of the difference between the world price and domestic crush price multiplied by the quantity used for crush purposes is the dissipated amount. The annual total dissipation is $25 million or about 10 percent of the total transfer from consumers to producers. The average annual net transfer from consumers to producers varies from $227 million in the year 1982 to $370.5 million in the year 1987. The average annual dead weight loss is calculated to be $34 million. The average annual per farm net transfer is $11,100 or $272 per planted acre. The annual total consumer cost is $288 million ($1.23 per U.S. citizen). It is concluded that per producer's net benefits are larger than per consumer's costs and that even though the peanut program is costly, the costs have been reduced lately. In addition, foreign demand is met by allowing producers to grow additionals and that no restrictions on peanut exports results in small or no allocative inefficiency. The buy-back provision guarantees the consumers peanut availability and a price not higher than the support price. This study also compares the ratios of deadweight loss to producer benefit for peanuts versus other crops: corn, rice, cotton, sugar, wheat, and peanuts and their respective ratios are .19, .27, .44, .45, .48, and .13. This shows that the cost of the peanut program is still considerably lower than the cost of other commodity programs.

Peanuts Under Regulated VS Free Market System

A study that quantitatively compared the U.S. government intervention levels in peanut markets versus no peanut program, and peanut trade liberalization is done by

Miller and Mabbz-Zeno (1992). They have quantified the outcomes of the current peanut program using the U.S. demand and supply schedules. The demand schedule was derived from the existing price elasticity of demand for peanuts, quantity demanded for peanuts and peanut support prices and the supply schedule was derived from the current peanut production elasticities, quantity of peanuts supplied, and the peanut support prices. Elasticities used in this study are from other studies. Also, the world peanut demand and supply conditions that are shown in this research are conceptual. The major sub-markets for peanuts in the U.S. are specified: domestic edible sub-market, export edible sub-market, and domestic oil sub-market. The previous studies primarily have analyzed the peanut program and its effects on domestic markets (within the frame work of domestic prices, consumers and producers welfare under the program versus the free market conditions). This research includes, besides domestic peanut market conditions under the peanut program versus the non-program, the impacts of the U.S. peanut program versus U.S. peanut trade liberalization on the expected world peanut demand, supply, and prices as well as the feedback of the world peanut demand, supply, and prices on U.S. peanut production, prices, benefits, and costs.

These authors calculated subsidy equivalents (resulted from government intervention) from the price wedge between the U.S. domestic discretionary prices and the world peanut price. A simulation model has been developed for this study the equations of which are as follows:

$$\text{U.S. } Q_{ED} = f(P) \qquad (1)$$

$$\text{U.S. } Q_{EX} = f(P) \qquad (2)$$

U.S. Q_{OL} = f (P) (3)

U.S. Q_D = U.S. Q_{ED} + U.S. Q_{EX} + U.S. Q_{OL} + Others (4)

U.S. Q_S = f (P) (5)

ROW Q_D = f (P) (6)

ROW Q_S = f(P) (7) and

U.S. Q_D + ROW Q_D = U.S. Q_S + ROW Q_S

Where:

U.S. Q_{ED} = Consumption of edible peanuts in the U.S.;

U.S. Q_{EX} = The quantity of peanuts exported from the U.S.;

U.S. Q_{OL} = The quantity of peanuts crushed in the U.S.;

ROW Q_D = Quantity of peanuts consumed in the rest of the world (that was not purchased in the U.S.);

U.S. Q_D = U.S. aggregate demand for peanuts;

U.S. Q_S = U.S. aggregate supply of peanuts;

P = Price of peanuts (all prices at farm level); and

Others = Seed and loss of U.S. peanuts due to shrink or damage.

The results of the model were as expected. The model compares actual prices, quantities, elasticities (based on the 1987 data) and the expected prices, quantities, and elasticities in the absence of the U.S. peanut program as well as under free unilateral trade. The results indicate that the world peanut price under free trade will be influenced as a result of a decrease in the U.S. peanut production and consequently decreased exports. However, U.S. peanut farmers will receive lower than the existing support price but it still will be more than the world price. This will eventually yield to a collapse of the rental volume (the difference between the support price and the new world price) which will result in a loss of farm income of $405 million per year. Under free market conditions the decrease in the U.S. peanut production is shown to be 578 million pounds which will be replaced by an increase of 584 million pounds in imports. The U.S. peanut exports will remain about the same. Due to the expected inelastic world demand of peanuts the increase in the world peanut price, because of the free trade, will result in only a 58 million pound reduction in the world's peanut consumption. The results indicate that U.S. consumers and foreign producers will be the beneficiaries of the suspension of the U.S. peanut program. The U.S. peanut producers losses will be more concentrated than the consumer gains in the absence of the program. U.S. consumers will gain $192 million annually or the per consumer gain will be 84 cents. On the other hand, the total producer loss will be $405 million. The per farm loss will amount to $21,000. The suspension of the program will result in a reduction in total peanut farms in the U.S. and the resources producing peanuts will be employed in the production of other crops which is consistent with the theory of comparative advantage. These authors conclude that the unilateral liberalization of trade agreements such as GATT can result in the increased flow of commodities across countries and can provide opportunities for the application of the theory of comparative advantage.

Borges and Thurman evaluated the variation of peanut production in North Carolina in response to changes in the U.S. peanut support price versus the price of peanuts in the world market. Although the study was limited to one state (North Carolina) rather than on the national level, their results were conclusive. Their findings include that peanut production in North Carolina always exceeds its quota level and that the variation in the peanut production is explained by the world peanut price rather than the U.S. peanut support price. They recommend that in analyzing the North Carolina's peanut supply, it is safe to ignore the effects of the peanut support price on peanut supply.

During the crop year 1991-92, the government's cost on the peanut program was the highest in sixteen years which led Congress to ask the United States General Accounting Office (USAG) to thoroughly investigate the peanut program. The USGA Office submitted a report of detailed evaluation of the U.S. peanut program to the U.S. Congress in February 1993. The report strongly criticizes the continuation of the peanut program and shows that the average U.S. peanut farm size has increased from 12 acres in 1950 to more than 49 acres in 1991 and that the number of peanut farms has decreased. More than 80 percent of the peanut quota is controlled by less than 22 percent of peanut producers. The average minimum net return after costs during the years 1982-92 was 51 percent. The limitation of the intercounty transfer (sell/rent) of quota may prevent efficient peanut producers from producing peanuts. Furthermore, this study indicates that each year consumers pay an additional \$314 to \$513 million for peanuts and peanut products because of the peanut program, most of which is directly transferred to peanut producers as income. Also, the peanut program might affect the world price because of the availability of the higher volume of U.S. peanuts in the world market.

The report recommends a significant readjustment in the peanut program because the present conditions of the peanut industry are different than they were in the 1930s and that the program is no longer fruitful for average peanut producers, consumers, or the government. The producers should be given a transitional period which will allow them to adjust to free market conditions. The support price during this transitional period should be gradually reduced to the range of the world market price. Further, the quota allotment should be reallocated to more efficient peanut producers. Increased peanut imports are also recommended by the authors.

Miller and Mabbs-Zeno had previously quantified the U.S. peanut industry under the U.S. unilateral trade liberalization and had shown a good picture of the industry without the program. After the strong opposition of the program by the United States General Accounting Office report to congress, agricultural economists started analyzing the peanut industry under the program and the phasing out of the program in relation to the preexisting NAFTA and GATT guidelines. Carley and Fletcher (1993) quantified the impacts of NAFTA and GATT on U.S. peanut producers, handlers, manufacturers, and consumers. The current U.S. peanut import quota (775 metric tons) will be abolished with the implementation of NAFTA and GATT.

Under NAFTA, Mexico could export 3,377 metric tons of duty-free peanuts to the U.S. in the first year (1994/95) with a 3 percent annual compound increase in this quantity. All of the exported peanuts from Mexico must be produced in Mexico. The imported peanut quantity will increase to 4,032 metric tons by the year 2000. The imported peanut quantity into the U.S. under GATT in the first year (1994/95) will be

33,770 metric tons which will increase to 56,283 metric tons in the year 2000. Imported peanuts exceeding these quantities will be taxed. Under NAFTA, in the first year, a 123 percent tariff will be imposed on Mexican imported peanuts exceeding the duty-free quantity. This tariff will be reduced at the rate of 3 percent annually for 15 years and thereafter there will be no quantitative restriction or tariff on peanut importation from Mexico.

Under GATT the tariff rate will equal the difference between the world price and the U.S. domestic price which will be decreased by 15 percent in six years. The authors argue that the U.S. government has to reduce the domestic peanut quota after NAFTA and GATT are implemented and to replace this quota by the allowed duty-free imported quantity. Otherwise the U.S. government might face a cost ranging from \$2 million in the fist year of NAFTA to almost \$30 million during the sixth year of GATT. This is due to the U.S. quota peanuts (in the same amount as imported peanuts) will crowd out the edible market because of their higher price and will be sold in the crush market at a lower price by the CCC. If the quota is decreased the peanut farmers will lose from \$2.5 million in the first year under NAFTA to \$42 million in the sixth year under GATT in gross farm income. The loss in the gross farm income will be as high as \$75 million if the support price of edible peanuts is reduced to the level of the imported peanut price. However, there will be less or no income loss if domestic consumption would increase by the same amount as imports. If NAFTA and /or GATT are implemented both quota and support price need to be reduced in order for the U.S. peanut industry to remain competitive. As a result of these adjustments U.S. peanut producers will suffer a loss of \$2.5 million in gross income in the first year to \$60 million in the sixth year under

NAFTA and $70 million in the first year to $164 million in the sixth year under GATT. Also there is a strong possibility of the downsizing of peanut farms. The total estimated loss in economic activity to peanut farmers and small communities where peanuts are a major source of income is shown to be $1.4 billion under GATT.

The effects on the peanut handling industry, under NAFTA and GATT, include a readjustment of the market structure, and the increase in price variability and risk which might lead to vertical integration, forwards contracts, and futures market. These unilateral and trilateral agreements will have economic impacts on peanut manufacturers as well. Increased peanut imports will provide additional peanut purchases to manufacturers. This opportunity will be more advantageous for multinational peanut manufacturers as compared to smaller firms which might lead to a more concentrated peanut market. However, manufacturers will also face price variability and a consequent price risk. Regarding the economic consequences on U.S. peanut consumers, Carley and Fletcher conclude that in a market situation where there are fewer sellers and many buyers the price change would probably not pass on to consumers in its entirety. Their estimations show that a 25 percent decrease in the price of shelled peanuts will lead to an expected decrease of 4-7 percent in the retail prices of peanuts and peanut products.

The first part of this chapter explained the review of the analyses that were carried out in response to the major changes in the government price support program for peanuts during the 1970's. The presentation included the review of the previous work on the benefits and costs of the peanut program versus the potential benefits and costs of various alternative programs. The second part presented the review of the research undertaken regarding the recommendation for the exercise of a free market for peanuts and technical education for peanut growers. Previous research related to peanut trade among the member countries of NAFTA was presented in the last part of this chapter.

CHAPTER III

THEORY

This chapter develops an analytical framework with respect to trade among the countries and regions of the world. A conceptual model as well as an economic trade model are presented in the first part of the chapter. The last part of this chapter provides a graphical analysis of the impacts of government interventions on domestic and world markets in the process of international trade.

International Trade Theory

International trade is based on the existence of excess demand and excess supply of commodities among nations. Excess demand for a certain commodity in a country is the gap between the domestic supply and domestic demand of the commodity in question. To meet the gap, the country imports the commodity from another country where the domestic supply exceeds the domestic demand for that commodity. The price of the commodity should be lower in the exporting country compared to the importing country. The concepts of international trade, the welfare analysis of trade, and the consequences of the trade distortion policies are presented in following sections.

The Theory of Comparative Advantage

A conceptual model of the law of comparative advantage and gains from trade is shown in figure 3.1. The model includes two countries, the U.S. and Brazil, and two

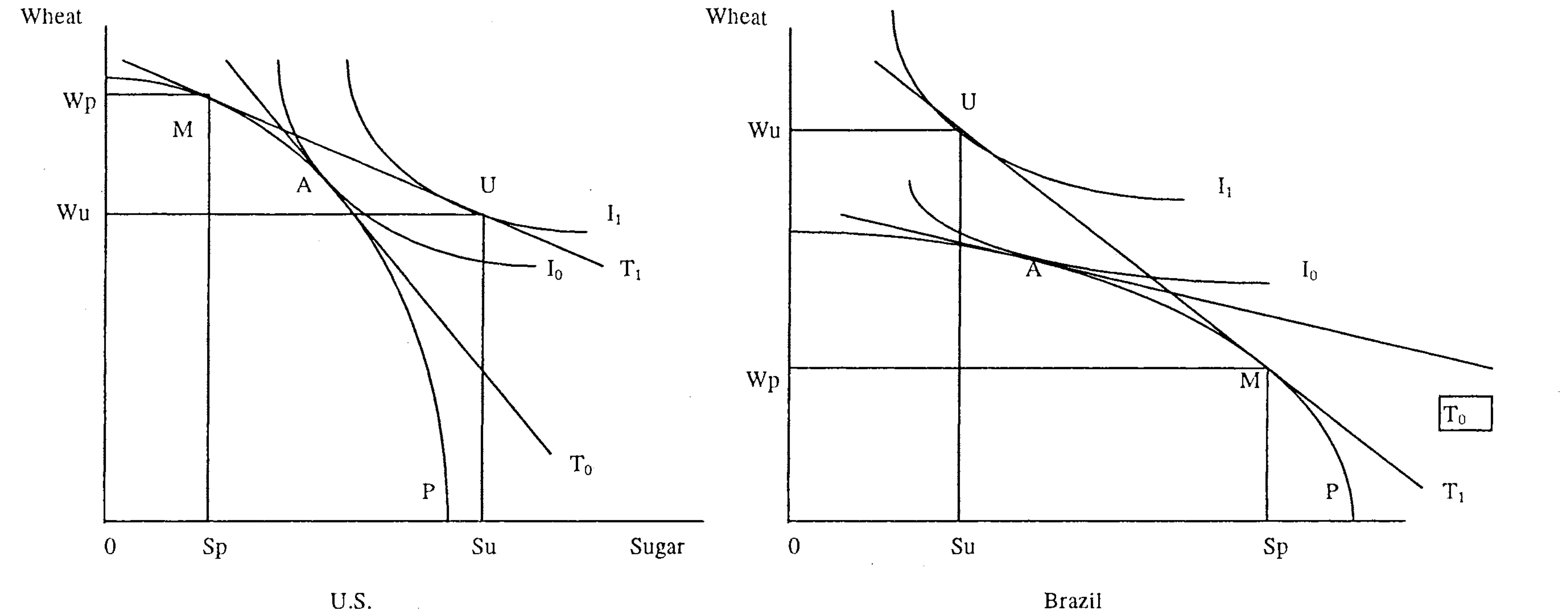

Figure 3.1. Conceptual Model of Comparative Advantage and International Trade.

Sources: Tweeten (1979, P. 417); and Henneberry and Henneberry (1989, P. 324).

agricultural commodities, wheat and sugar. Given the farm resources, the two countries will produce a combination of wheat and sugar along their production possibility frontier curves P. In the diagram, I_0 and I_1 represent the indifference curves of the two countries. In the absence of external trade, given their national endowment, the highest indifference curve that each country can reach is I_0 and the tangency of I_0 to the production possibility frontier curve in each country, point A, represents the production and consumption of the combination of wheat and sugar. In other words, at point A the marginal rate of substitution in consumption is equal to the marginal rate of transformation in production or the slope of I_0 is equal to the slope of P. The slope of the line T_0 indicates the equilibrium price ratio of both commodities in each country. With the assumption of full employment of all available resources in each country, the line T_0 measures the foregone units of sugar in order to produce one additional unit of wheat. The slop of T_0 (in the absence of a trade scenario) is steeper for the U.S. compared to Brazil. This means that in the U.S. the price of sugar is higher than the price of wheat. The opposite is true for Brazil: the flatter slope of the price line in Brazil shows that the price of wheat is higher than the price of sugar as compared to the U.S.

The relatively higher price of sugar in the U.S. and wheat in Brazil are the result of differences in their production capabilities rather than consumer preferences. The United States has a comparative advantage in wheat production and Brazil has a comparative advantage in the production of sugar, although the U.S. can produce both wheat and sugar at a lower cost than Brazil. Also, if the U.S. can produce wheat, sugar or both at a total lower cost compared to all other countries in the world then the U.S. is said to have an absolute advantage in the production of wheat and sugar. Both the U.S. and

Brazil can still benefit from trade even if the U.S. or Brazil have an absolute advantage in the production of these commodities. The absolute advantage theory can be true for any country and any commodity in the world. However, only comparative advantage is necessary for an economy in order to gain benefits from international trade.

As shown in the diagram with international trade, the societal indifference curves of both countries move to higher levels (from I_0 to I_1). Both countries will produce at point M where the new trading price line T_1 is tangent to the production possibility curve. Consumption will take place at point U in both countries where T_1 is tangent to I_1. This situation represents a pareto optimum because the same price line is tangent to the production transformation curve (representing an equal marginal rate of transformation in production) and an indifference curve (equal marginal rate of substitution in consumption). As shown in the diagram, the U.S. produces Wp and consumes Wu of wheat. The difference between the two quantities (Wp-Wu) is the net export from the U.S. and a net import into Brazil. Similarly, the difference between the quantity of sugar produced and consumed in Brazil (Sp-Su) is the net export from Brazil and net import to the United States.

Comparative advantage and trade lead to a greater specialization in the production of wheat in the U.S. and sugar in Brazil and higher indifference curves for both countries which means comparative advantage and trade benefit both countries. Although the prices of both commodities in both countries are assumed to be the same in this analysis, in reality, however, prices vary from country to country because of transportation costs and institutional barriers imposed on trade such as quotas, tariffs, subsidies, and domestic price supports. This variation in prices results in the rejection of the theory of comparative advantage that is based only on relative production costs. Since the variation in prices across nations is generally observed, comparative profits rather than comparative advantage is a more complete concept to be the basis for international trade. In application, where the reality of distortionary government policies exists, this modern theory is particularly important. The theory of comparative profits includes production possibilities, consumer preferences, and trade barriers among nations in a real world situation. Hence, a country will have a comparative advantage in exporting a commodity if it receives the highest return per unit of fixed resources in a real world situation.

Welfare Analysis of trade

The welfare analysis of trade is explained in a partial equilibrium model in figure 3.2. In order to simplify the presentation of the theoretical framework, a one commodity two country trading scenario is assumed. Homogeneity and competitive conditions in both countries are also assumed. The transfer cost and trade barriers are ignored. The three-panel diagram explains the welfare impact of trade on exporting country A and importing country B. The central figure represents the world market W. As seen in the diagram, in the absence of trade, country A produces Q_A of wheat at a price of P_A. The quantity and the price of the same commodity in country B are, respectively, Q_B and P_B.

In the presence of trade, excess supply E_X from exporting country (the quantity that exceeds the exporting country's domestic demand) and the excess demand E_D of the importing country (the quantity demanded in excess of domestic supply in importing country) and the international price are shown in the world market . The international

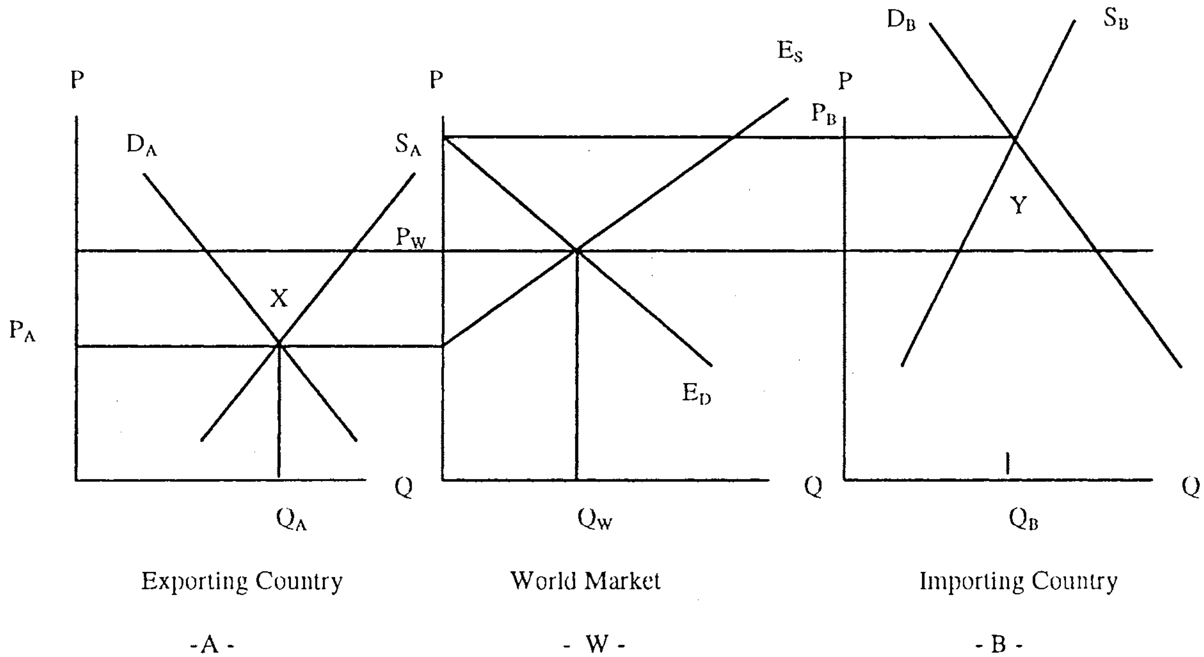

Figure: 3.2. Trade Between Two Countries.
A) Domestic Demand and Supply Curves of Exporting ountry; W) Excess Demand and Excess Demand Curves in World Market; B) Domestic Demand amd Supply of Importing Country

Sources: McCalla and Josling (1985, P. 37); Tweeten (1979, P. 420); and Henneberry and Henneberry (1989, P. 327).

price P_W and the traded volume Q_W are determined at the point where the E_D curve intersects the E_S curve. The international price (which is higher than the exporting country's domestic price before trade and lower than the importing country's domestic price prior to trade) leads to more production and less consumption in the exporting country and more consumption and less domestic production in the importing country. As a result of trade consumers in the exporting country lose and producers gain; however, the gain in the producer surplus more than offsets the loss in consumer surplus by the area X shown in figure A. Further, in the importing country, producers are worse off and consumers are better off but the gain in consumer surplus more than offsets the loss in producer surplus by the area Y shown in figure B. Trade yields a net gain to both exporting and importing countries.

A similar three-panel diagram that includes the analysis of the transportation cost and trade barriers is presented in Tweeten (1979) and Henneberry and Henneberry (1989) which also shows that both trading partners enjoy net gains from trade. The one commodity two country model may be expanded to include more participants by simply adding the excess supply and excess demand schedules of additional exporters and importers. The addition of more countries to the model will reduce the slopes of the world excess supply and excess demand functions, however.

Impacts of Domestic Trade Policies

In the material presented above, no trade barriers among countries were considered. That is, an assumption of no government interventions such as tax, subsidy, and/or quota in the process of international trade was implicit. In reality, however, governments do formulate and implement domestic policies in order to improve producer, consumer, and/or social welfare. For example, the adoption of an import tax, import quota, and export subsidy can lead to an increase in producer welfare. On the other hand, policies such as an export tax, export quota, and import subsidy can result in increased consumer welfare. The graphical analysis of domestic policies are presented by Henneberry and Henneberry (1989) with the distinction of large and small countries. Large and small reflect the relative size or market share (for a commodity analyzed) of a country in the world market rather than the geographic size, population, or national income of that country

Large versus Small Countries

The relative volume of imports and/or exports of a small country compared to a large country is not significant enough to affect through its policies the world price of the commodity for which the country is classified. To the contrary, a large country through its implemented policies do effect the world price of the commodity for which the country is classified. Therefore, it is important to distinguish the impacts of a large and small country on domestic and international markets. A specific country may be classified as a large country with respect to one commodity and small in terms of another commodity because large and small refer to specific commodities. Also, a country that is categorized as a large country in some years may be classified as a small country in others because the level of production of commodities varies over time as well as across geographic regions.

The assumptions of this analysis include a constant marginal utility of money among all producers, consumers, and the government: a one dollar gain to producers exactly offsets a one dollar loss to consumers and/or the government and vice-versa. The world price prevails across all nations until after the adoption of certain policies by one or more countries which yield a difference between the world and domestic prices. It is also assumed that imported goods are perfect substitutes for domestically produced goods. The graphic analyses of import tax, import quota, and import subsidy regarding small and large country cases are presented as follows:

Import Tax: small country

In Figure 3.3, P_W is the world price which is directly translated into domestic price and faced by domestic producers and consumers before the imposition of an import tax (tariff) T on the commodity by a small country. D and S are domestic demand and domestic supply, respectively. After the tariff, the new price faced by producers and consumers increases from P_W to $P_W + T$ and imports decline from Q'_1-Q_1 to Q'_2-Q_2.

The welfare analysis of the small country (after tariff is imposed):

Consumer surplus loss: - a - b - c -d

Producer surplus gain: + a

Government revenue gain: + a

Net social welfare loss: - b - d

Import Tax: large country

In Figure 3.4, P_W is the world price which is faced by domestic producers and consumers of the large country. D and S are domestic demand and domestic supply.

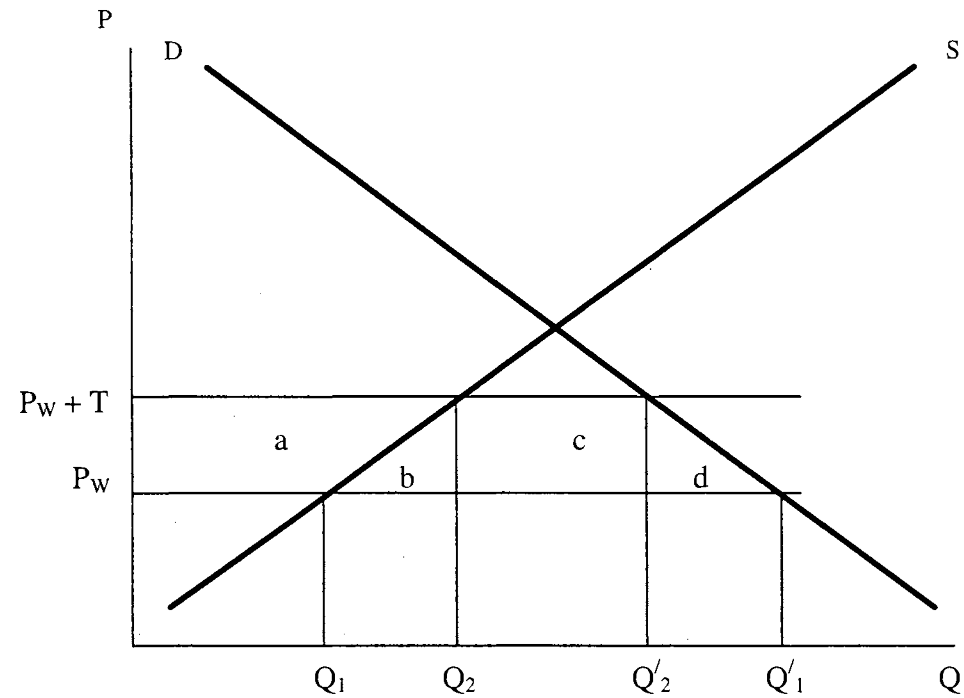

Figure 3.3. Welfare Analysis of an Import Tax: the small Country Case.

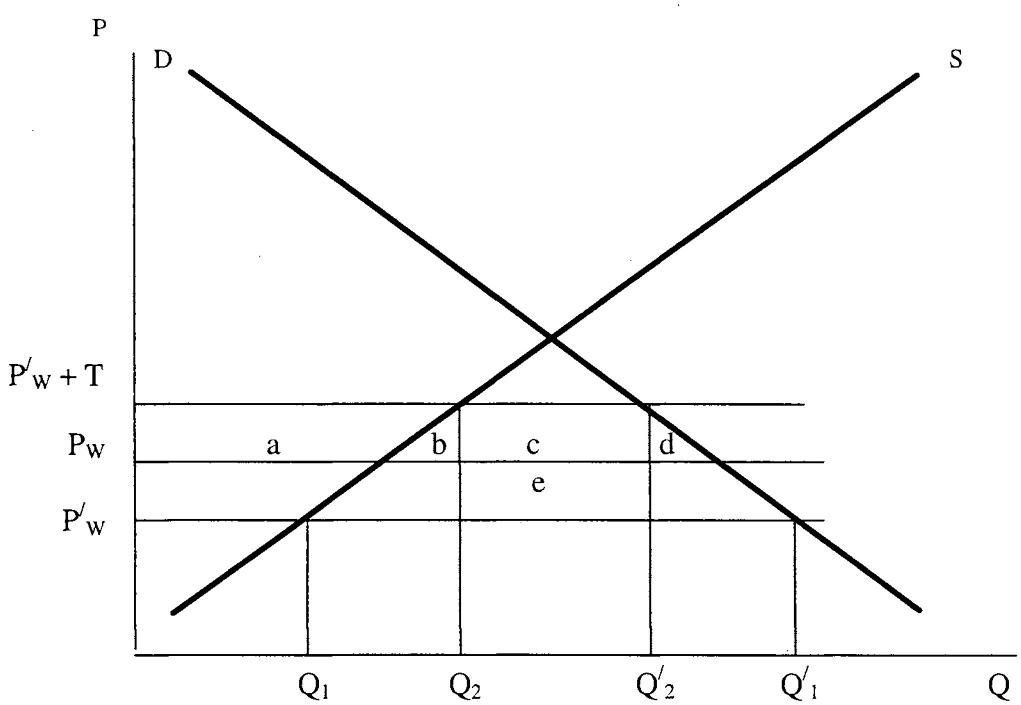

Figure 3.4. Welfare Analysis of an Import Tax: the Large Country Case

When the country imposes tariff T on the commodity, imports to this country decreases from Q'_1-Q_1 to Q'_2-Q_2. Since this is a large country the reduction in the imported quantity yields a decreased world demand which leads to a reduced world price (from P_W to P'_W). The new lower price (after tariff) faced by domestic producers and consumers is (P'_W + T).

The welfare analysis of the large country (after tariff is imposed):

Consumer surplus loss:	- a - b - c - d
Producer surplus gain:	+ a
Government revenue gain:	+ c + e
Net social welfare loss or gain:	+ e - b - d

When e > b + d the country gains from imposing tariff on the commodity and loses when e < b + d. The tariff that maximizes the area e - (b+d) is the optimum tariff.

The summary of an import tax for both the small and large country cases is as follows:

This policy is formulated to improve producer welfare in the country because with the imposition of an import tax, the quantity of imports is decreased which results in a increased domestic production and decreased domestic consumption. The imposition of a tariff in the small country case always leads to a net social welfare loss. The large country, however, may face a net social welfare loss or gain.

Import Subsidy: small country

In Figure 3.5, P_W is the world price faced by domestic producers and consumers before the policy of subsidy is adopted by the small country. After the subsidy, imports increase from Q'_1-Q_1 to Q'_2-Q_2. P'_W - S is the new lower price faced by domestic producers and consumers.

The welfare analysis of the small country (after placing a subsidy on the commodity):

Consumer surplus gain:	+ a + b + c + d + e
Producer surplus loss:	- a - b
Government revenue loss:	- b - c - d - e - f
Net social welfare loss or gain:	- b - f

Import Subsidy: large country

In Figure 3.6, P_W is the world price before the subsidy is granted by the large country. P'_W is the new price as a result of an import subsidy. P'_W is higher than P_W because as the large country grants subsidy, the large country's imports increase from Q'_1-Q_1 to Q'_2-Q_2 which results in increased demand in the world market. The increased world demand drives the price to increase from P_W to P'_W. Finally, the price faced by domestic producers and consumers in the large country is P'_W - S.

The welfare analysis of the large country (after the subsidy is granted):

Consumer surplus gain:	+ a + b + c + d + e
Producer surplus loss:	- b - c
Government revenue loss:	- b -c - d - e - f - h - i - j
Net social welfare loss:	- b - f - h - i - j

The summary of the policy of an Import Subsidy is as follows:

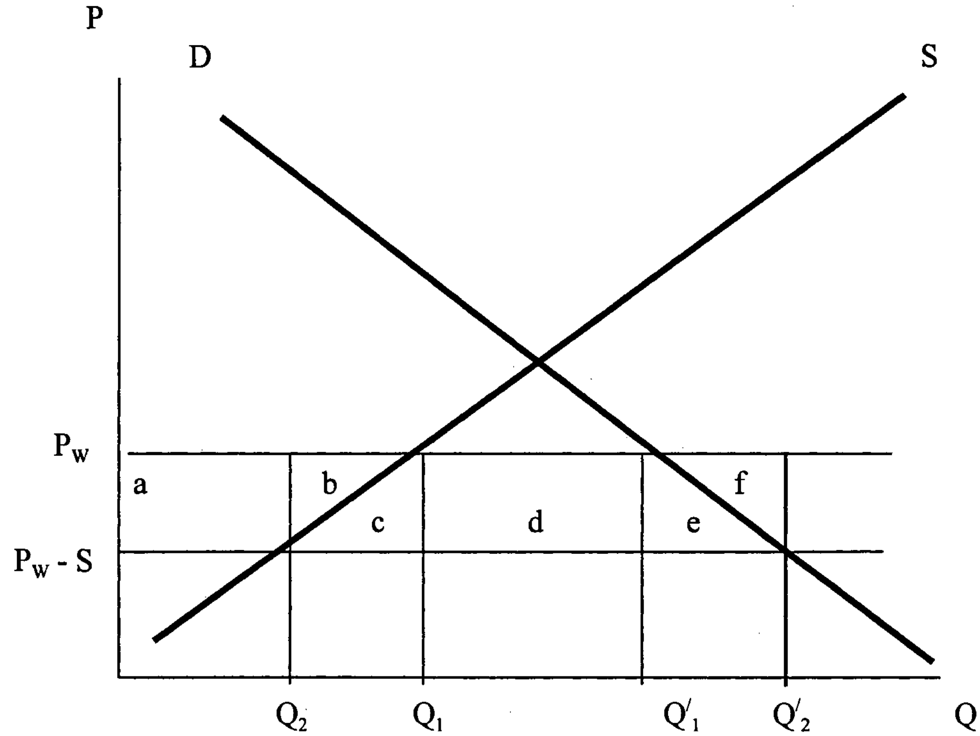

Figure 3.5. Welfare Analysis of an Import Subsidy: the Small Country Case.

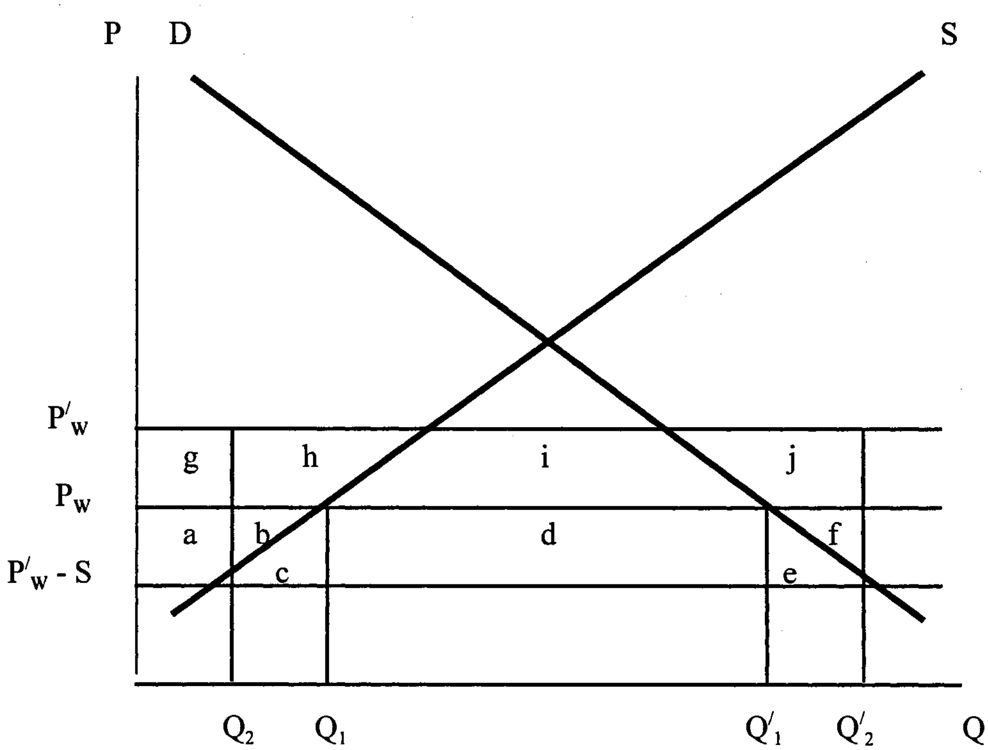

Figure 3.6. Welfare Analysis of an Import Subsidy: the Large Country Case.

Import subsidy leads to decreased prices and increased quantity imported which results in a net social welfare loss in the case of both the small country and the large country.

Import Quote: small country

In Figure 3.7, the world price P_W and domestic price P_d are the same before the quota is imposed by the small country. The supply curve is represented by SS. After the quota, P'_d is the domestic price and SYZS$'$ is the supply curve faced by domestic producers and consumers. The quantity of the imported quota is Q_2-Q_1. After the imposition of a quota, domestic price increases from P_d to P'_d and domestic production increases from Q_1 to $Q_1 + Q_3 - Q_2$. The welfare analysis of the small country (after placing an import quota):

Consumer surplus loss:	- a - b - c - d
Producer surplus gain:	+ a
Government revenue gain:	+ b
Net social welfare loss:	- c - d

Import quota: large country

In Figure 3.8, the world price P_W is the same as domestic price P_d. After an import quota of Q_2-Q_1 is imposed by the large country, the world demand declines which results in a decreased world price from P_W to P'_W. Further, with quota, the supply in the large country declines which causes an increase in the domestic price from P_d to P'_d, the

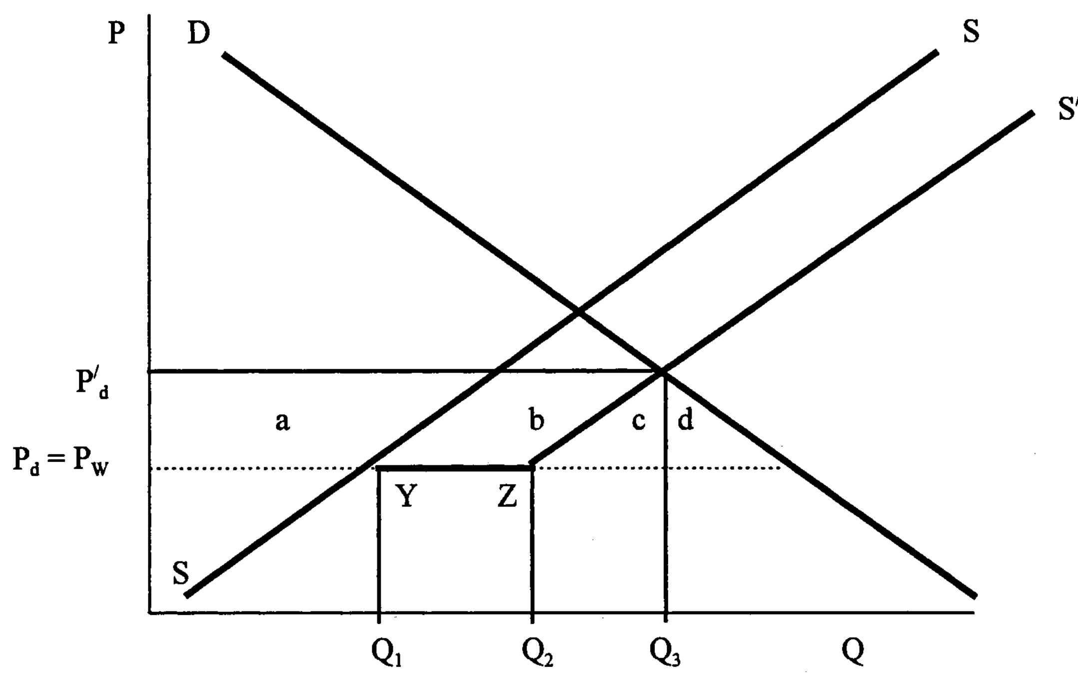

Figure 3.7. Welfare Analysis of an Import Quota: the Small Country Case.

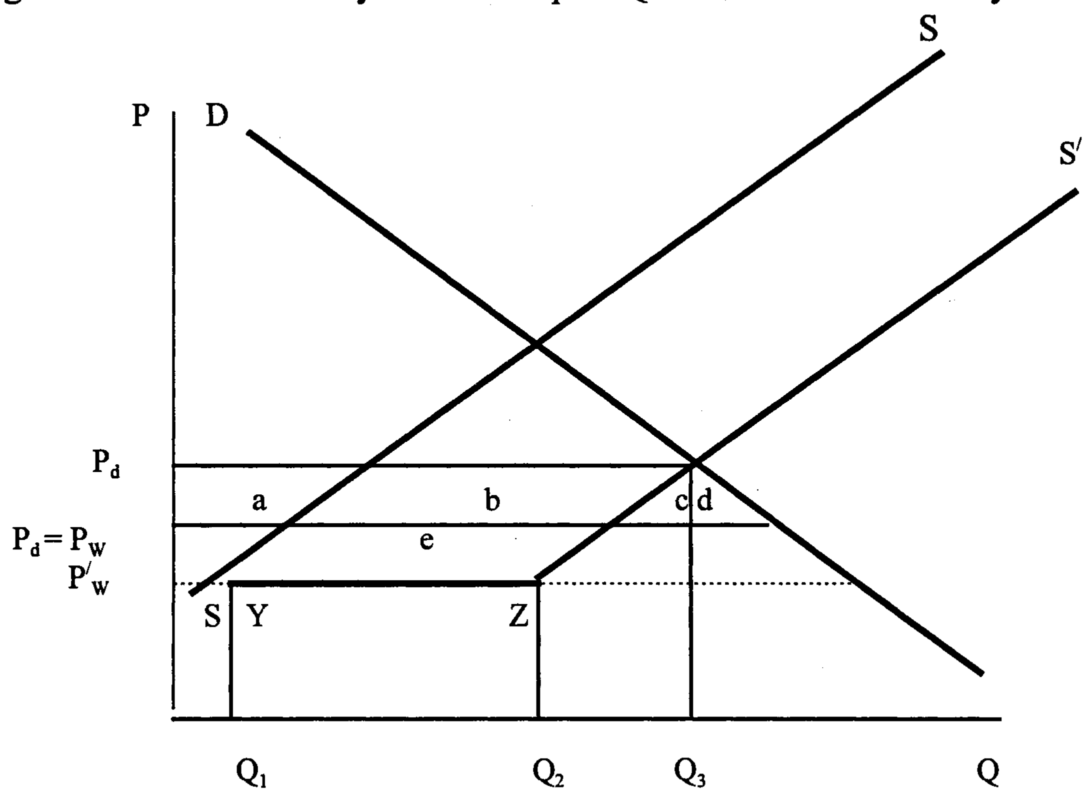

Figure 3.8. Welfare Analysis of an Import Quota: the Large Country Case.

equilibrium point on the demand curve and the new supply curve SYZS′. The welfare analysis of the large country (after placing an import quota):

Consumer surplus loss: - a - b - c - d

Producer surplus gain: + a

Government revenue gain: + b + c

Net social welfare loss or gain: + e - (c + d)

When e > (c + d), the country enjoys a net social welfare gain and suffers a net social welfare loss when e < (c + d). The optimum level of an import quota level would be the level where the area e - (c + d) is maximized.

The summary of the policy: Import quota policy results in an increased welfare to domestic producers. This policy always results in a net social welfare loss when adopted by the small country. In the large country case, however, this policy can lead to a net social welfare gain or loss.

In this chapter the analysis of classical international trade theory and the consequences of deviations from this theory were rigorously explained in separate sections. This explanation dictates the direct quantitative benefits and costs that can be derived after the adoption of free trade and/or government constrained trade polices among nations. Although this study will not estimate the quantitative impacts of the trade distortion policies, the detailed explanation of this theoretical background demonstrates the difference between the free versus restricted trade. Prices, income, and population are important variables in determining the analysis of import or export demand for a commodity. These variables will be used in the estimation process of the models for this research. The theoretical explanation is the most important background for this analysis since this analysis is mainly based on international trade: the trade among the U.S., Canada, and Mexico under the North American Free Trade Agreement.

CHAPTER IV

DATA AND METHODOLOGY

This chapter describes the methodology used in this analysis, the structure, formulation, and specification of the models (for Mexico, the U S, and Canada), the estimation process of the models, and the sources of data.

Three peanut market models will be estimated for the member countries of the North American Free Trade Agreement, the U.S., Canada, and Mexico. The analysis of the U.S. peanut market will contain a single equation model which will be estimated by using the Ordinary Least Squares (OLS) technique. The peanut market analysis for Canada will also be carried out in a single equation model by using OLS. The model for Mexico will be based on the system of equations which will be estimated by using the Three Stage Least Squares (3SLS) estimation method.

The models for the U.S. and Canada will be corrected in case of possible violations of the assumptions of the Ordinary Least Squares estimation method. The Three Stage Least Squares method will be explained in detail in the following section, the modifications to the U.S. and Canadian models in case to accommodate inaccuracies in the underlying assumptions of the Ordinary Least Squares method will be explained later.

The econometric program SHAZAM will be used for the estimation of these models. SHAZAM uses the same procedure as the 3SLS to estimate systems of simultaneous equations. SHAZAM estimates the set of equations by applying a joint generalized least squares procedure using the residuals from the variance-covariance matrix across equations and it allows for linear restrictions to be imposed on the parameters within and across equations.

Three Stage Least Squares Estimation Method

The Three Stage Least Squares estimation technique is preferred to the Two Stage Least Squares (2SLS) because its estimations are consistent and also generally asymptotically more efficient than the 2SLS estimations Judge et. al (1988). The 2SLS estimation method completes the estimation of a structural equation in two steps. In the first step, the endogenous variables are regressed on all the explanatory variables in the system. In the second step, the left hand side variables are replaced in the original (structural) equations by their estimated values from the preceding regressions and then the coefficients of the single equations are estimated by using OLS Gujarati (1988). The 3SLS estimation technique developed by Zelner and Theil (1962) is an improvement over the 2SLS method because the former simultaneously estimates all coefficients of the entire system by using the moment matrix of the structure disturbances estimated by the 2SLS technique. Zelner and Theil state that the 3SLS method has full information characteristics when compared to 2SLS or any other method of estimation that has limited information characteristics because of two reasons: a) if the structural disturbances have nonzero "contemporaneous" covariance (nonzero diagonal moment matrix) then estimations of the coefficients of any identifiable equation in the system are more efficient as soon as there are other equations in the system which are over-identified, b) by using this technique, restrictions can be placed on the parameters of different structural equations in the system. The three assumptions for this presentation are as follows: 1) a complete set of M linear equations with M jointly dependent variables and A exogenous variables, 2) this system can be solved for the jointly dependent variables which means that the reduced form of the equations exists, 3) the error terms (of the structural equations) have zero mean and they are serially independent and their variances and "contemporaneous" covariences are finite and constant through time. Let T be the number of observations then any of the structural equations for all observations, for example, the μth, may be written as:

$$y_\mu = Y_\mu \gamma_\mu + X_\mu \beta_\mu + u_\mu = Z_\mu \delta_\mu + u_\mu \qquad 1$$

Where:

y_μ = Column vector of observations on one of the jointly dependent variables;

Y_μ = T x m_μ matrix of dependent variables with γ_μ as its coefficient vector;

X_μ = T×lμ matrix of exogenous variables with β_μ as its coefficient vector;

u_μ = The column vector of the error terms; and

$$Z_\mu = Y_\mu \quad X_\mu \quad ; \quad \delta\mu = \begin{bmatrix} \gamma_\mu \\ \beta_\mu \end{bmatrix} \qquad 2$$

Let T×A be the matrix of exogenous variables X with the assumption that it has rank A. Given the objective of estimating the parameter vector δ_μ, it is assumed that all equations in the system are identifiable. This assumes that:

$$A \geq \eta_\mu = m\mu + l\mu \qquad (\mu = 1, \ldots\ldots\ldots, M) \qquad 3$$

Where:

η_μ = The total number of coefficients to be estimated in the μth equation.

The 2SLS estimation technique is derived first, followed by the 3SLS method in the following section.

Two Stage Least Squares estimation Method

Equation I multiplied by X' results in:

$$X'y\mu = X'Z_\mu\delta_\mu + X'u_\mu \qquad 4,$$

which is a system of A equations with n_μ parameters (δ_μ) and an error vector, $X'u_\mu$ which has zero mean. In the special case $A = n_\mu$ (just identified system) the coefficient δ_μ may be estimated as:

$$d_\mu = (X'Z_\mu)^{-1} X'y_\mu \qquad 5$$

Where:

$d\mu$ is the estimator that replaced δ_μ, and $X'u_\mu$ is replaced by its expectation. With the assumption that the exogenous variables are all fixed variables the variance covariance matrix of $(X'u_\mu)$, the disturbance vector, may be written as:

$$V(X'u_\mu) = E(X'u_\mu u'_\mu X) = \sigma_{\mu\mu}X'X \qquad 6$$

Where:

$\sigma_{\mu\mu}$ = the variance of each of the T error terms in the μth structural equation. After applying Atkin's generalized least squares method to equation 4, the following equation is obtained:

$$Z'_{\mu}X(\sigma_{\mu\mu}X'X)^{-1}X'y_{\mu} = Z'_{\mu}X(\sigma_{\mu\mu}X'X)^{-1}X'Z_{\mu}d_{\mu} \qquad 7$$

The 2SLS estimator is then derived from the above equation (7):

$$d_{\mu} = [Z'_{\mu}X(X'X)^{-1}X'Z_{\mu}]^{-1}Z'_{\mu}X(X'X)^{-1}X'y_{\mu} \qquad 8$$

After the derivation of the 2SLS technique, the 3SLS method applied to a complete system of equations is explained as:

3SLS Application to a Complete System:

3SLS can be applied to a complete system of equations. The first step in the 3SLS estimation process is to write equation 4 (for all the equations combined) in the following form:

$$\begin{bmatrix} X'y_1 \\ X'y_2 \\ \\ \\ \\ X'y_M \end{bmatrix} = \begin{bmatrix} X'Z_1 & 0 & . \; . \; . & 0 \\ 0 & X'Z_2 & . \; . \; . & 0 \\ . & . & . \; . \; . & . \\ . & . & . \; . \; . & . \\ . & . & . \; . \; . & . \\ 0 & 0 & . \; . \; . & X'Z_M \end{bmatrix} \begin{bmatrix} \delta_1 \\ \delta_2 \\ . \\ . \\ . \\ \delta_M \end{bmatrix} + \begin{bmatrix} X'u_1 \\ X'u_2 \\ . \\ . \\ . \\ X'u_M \end{bmatrix} \qquad 9$$

The above equation (9) is a system of AM equations which contains $n = \sum_{u=1}^{M} nu$ parameters and δ is the column vector of the right hand side parameters. Then all elements of δ can be simultaneously estimated by using generalized least squares (GLS) after the following variance-covariance matrix of the error vector of the above equation (9) is formed:

$$V\begin{bmatrix} X'u_1 \\ X'u_2 \\ \cdot \\ \cdot \\ \cdot \\ X'u_M \end{bmatrix} = \begin{bmatrix} \sigma_{11}X'X & \sigma_{12}X'X & \cdots & \sigma_{1M}X'X \\ \sigma_{21}X'X & \sigma_{22}X'X & \cdots & \sigma_{2M}X'X \\ \cdot & \cdot & \cdots & \cdot \\ \cdot & \cdot & \cdots & \cdot \\ \cdot & \cdot & \cdots & \cdot \\ \sigma_{M1}X'X & \sigma_{M2}X'X & \cdots & \sigma_{MM}X'X \end{bmatrix} \qquad 10$$

The inverse of the contemporaneous covariance matrix is:

$$V^{-1}\begin{bmatrix} X'u_1 \\ X'u_2 \\ \\ \\ X'u_M \end{bmatrix} = \begin{bmatrix} \sigma^{11}(X'X)^{-1} & \sigma^{12}(X'X)^{-1} & \sigma^{1M}(X'X)^{-1} \\ \sigma^{21}(X'X)^{-1} & \sigma^{22}(X'X)^{-1} & \sigma^{2M}(X'X)^{-1} \\ \\ \\ \sigma^{M1}(X'X)^{-1} & \sigma^{M2}(X'X)^{-1} & \sigma^{MM}(X'X)^{-1} \end{bmatrix} \qquad 11$$

Where:

$$[\sigma^{uu'}] = [\sigma uu']^{-1}$$

A straightforward method of GLS is then applied which gives the following results: the two stage column vector $Z'\mu X(\sigma_{\mu\mu}X'X)^{-1}X'y_\mu$ on the left hand side of equation 7 is replaced by the following:

$$\begin{bmatrix} \sigma^{11}Z_1'X(X'X)^{-1}X'y_1 & + & . & . & + & \sigma^{1M}Z_1'X(X'X)^{-1}X'y_M \\ \cdots\cdots & .. & .. & .. & . & \cdots\cdots \\ \sigma^{M1}Z_M'X(X'X)^{-1}X'y_1 & + & . & . & + & \sigma^{MN}Z_m'X(X'X)^{-1}X'y_M \end{bmatrix}; \qquad 12$$

and the right hand side of equation 7 is replaced by the following nxn matrix:

$$\begin{bmatrix} \sigma^{11}Z_1'X(X'X)^{-1}X'Z_1 & \cdots & \sigma^{1M}Z_1'X(X'X)^{-1}X'Z_M \\ \vdots & \ddots & \vdots \\ \sigma^{M1}Z_M'X(X'X)^{-1}X'Z_1 & \cdots & \sigma^{MM}Z'MX(X'X)^{-1}X'Z_M \end{bmatrix} \qquad 13$$

The σ's of these matrices are generally unknown and, therefore, Zellner and Theil (1962) recommend that replacement of these σ's by their 2SLS estimates which are denoted by $s^{\mu\mu'}$. After the replacement, the 3SLS estimator is defined as:

$$\hat{\delta} = \begin{bmatrix} s^{11}Z_1'X(X'X)^{-1}X'Z_1 & \cdots & s^{1M}Z_1'X(X'X)^{-1}X'Z_M \\ \vdots & \ddots & \vdots \\ s^{M1}Z_M'X(X'X)^{-1}X'Z_1 & \cdots & s^{MM}Z_M'X(X'X)^{-1}X'Z_M \end{bmatrix}^{-1} X \begin{bmatrix} \Sigma s^{1u}Z_1'X(X'X)^{-1}X'y_u \\ \vdots \\ \Sigma s^{Mu}Z_M'X(X'X)^{-1}X'y_u \end{bmatrix}$$

Where the Σ's extend over μ = 1,.....,M.

Model Structure and Specification

The North American Free Trade Agreement (NAFTA) will eventually lead to free market trade of goods and services among its member countries: The United States, Canada, and Mexico. Production, marketing, and trade of agricultural commodities are important components of the NAFTA agreement. Since the U.S, Canada, and Mexico have a significant influence on each other regarding the peanut industry, this study will analyze the structure of the existing peanut industry as well as possible changes, if any, in the existing structure in these countries. Three models of the peanut industry have been chosen for this purpose: one model for Mexico, one for the U.S., and one for Canada. The methodology described above is used to estimate these models.

Currently the U.S. is the main exporter of peanuts to both Mexico and Canada. Mexico imports about 80 percent of its total imported peanuts from the U.S. whereas Canada imports nearly 70 percent of its total imported peanuts from the U.S. The structure and specification of Mexico's model will be explained first followed by the U.S. and Canada. The model for Mexico will include three equations. The left hand side variables of these equations will include peanut import demand in Mexico, peanut production in Mexico, and the planted area devoted to peanuts in Mexico. All these equations will be estimated simultaneously using the Three Stage Least Squares estimation method. The model regarding the U.S. will include only one equation with the planted area devoted to peanuts in the U.S. as a dependent variable which will be estimated by using the Ordinary Least Squares estimation technique. The quantitative analysis of the U.S. peanut industry is limited to only one equation because the U.S. is not a net peanut importer, and because the extensive government intervention in the peanut market on different levels may require longer time as well as financial support from some public or private agency in order to quantify the industry as a whole on a national level in a single study. Extensive government intervention is the main reason for the detailed qualitative explanation of the U.S. peanut industry in the early chapters (introduction and literature review) of this study.

In the case of Canada, like the U.S., only one equation model will be estimated using OLS, although for different reasons. Canada does not produce peanuts domestically which means all peanuts consumed in Canada are imported. Therefore, only the peanut import demand in Canada will be estimated in this study.

Economic Models

The simultaneous equation model specified for Mexico contains three equations. The first equation models peanut import behavior in Mexico, the second equation models peanut production in Mexico, and the third equation explains peanut planted acreage behavior in Mexico. The preliminary equations and their relevant variables with definitions are specified as:

IMPORT EQUATION

MNIMP = f (MRGNP , MPOP , MPAREA , MCRPRIC , USRPRIC)

Where:

MNIMP = Annual net imports of peanuts by Mexico, metric tons

MRGNP = Mexico's deflated gross national product, in billion US $

MPOP = Total population of Mexico in thousands

MPAREA = Annual hectares of peanuts produced in Mexico

MCRPRIC = The deflated corn price in Mexico, U S $ / MT

USRPRIC = The deflated peanut price in the U.S.

PRODUCTION EQUATION

MPROD = f (MAGPOP , MYIELD , MCRPRIC , MRGNP , MNIMP)

Where:

MPROD = Annual peanut production in Mexico, metric tons

MAGPOP = Mexico's population involved in agriculture

MYIELD = Per hectare peanut yield in Mexico, Kg

PLANTED AREA EQUATION

MPAREA = f (MPROD , MPOP , MRPRIC)

Where:

MRPRIC = The deflated peanut price in Mexico, US $ / MT

The single equation model specified for the U.S. will explain the variation in annual peanut planted acreage in the U.S. The equation and the definitions of the variables are as follows:

USHAREA = f (USRPRIC , USEXP , CPOP , CRGNP)

Where:

USHAREA = Annual acres of peanuts produced in the U.S.

USEXP = Annual U.S. peanut exports, million pounds

CPOP = Total population in Canada, thousands

CRGNP = Deflated Canadian gross national product, billion US $

The model specified for Canada will explain peanut import demand behavior in Canada. The equation and the definitions of the variables are presented in the following form:

CIMP = f (CPOP , USEXP , USREXP , USRPRIC)

Where:

CIMP = Annual Canadian imports of peanuts, metric tons

USREXP = The deflated U.S. export price of peanuts, US $ /MT

The underlying rationale for the variables that are included in the above models is provided below.

The guidelines offered by economic theory were used in the selection process so that relevant variables with a measurable influence on production, planted area, and imports would be included in the models. Several regressions with different variables were run in the initial stages of this analysis and only those variables that could capture a significant influence on the left hand side variables were included in the final models.

First, the justification for variables included in the three equation model for Mexico (peanut imports, peanut production, and peanut planted acreage) will be explained followed by, respectively, single equation models for the U.S. and Canada.

The Mexican Modeling Framework

IMPORT EQUATION

MNIMP = f (MRGNP , MPOP , MPAREA , MCRPIC , USRPRIC)

Economic theory states that the income of a country, and its imports of normal goods, should have a positive relationship. This means that an increase in the income level in Mexico (MRGNP) should lead to an increase in the demand for imported peanuts in Mexico. Gross national product, in real terms, was used as a proxy for income. The national income rather than the per capita income is used in the analysis. This is because of the possible skewed income distribution. When the income distribution in a society or among farmers is highly skewed, the use of the per capita income as an explanatory variable may not explain the accurate variation in the dependent variable in a regression analysis. The same positive relationship may hold between population and imports, meaning that as the total population in Mexico (MPOP) increases, purchases of imported peanuts in Mexico may also increase.

According to economic theory the relationship between the planted acreage of a commodity and its imports, in general, should be negative, dictating that when the planted acreage of peanuts in Mexico (MPAREA) increases, the import of peanuts should decrease. This is due to the fact that as the planted acreage of peanuts in Mexico increases, peanut production might also increase and as a result more of the peanut demand in Mexico is met by domestic peanut supply.

The price of corn in Mexico is included in the analysis as the farmers income indicator, because corn is the major crop in Mexico grown on a significant percentage of total cultivated land, and an increase in corn prices is positively related to increased farm income. Therefore, this variable is included as an explanatory variable to capture the influence of the Mexican farmers income on peanut imports.

The variable for peanut prices in the U.S. is included in this equation because the U.S. is the main peanut exporter to Mexico. Theoretically, therefore, peanut prices in the U.S. (USRPRIC) should have an inverse relationship with peanut imports by Mexico. Consequently, assuming that peanuts are a non-giffen good, when peanut prices in the

U.S. increase, rational peanut consumers in Mexico will be willing to buy less U.S. peanuts.

PRODUCTION EQUATION

MPROD = f (MPAREA , MAGPOP , MYIELD , MCRPRIC , MRGNP , MNIMP)

The above equation is based on the standard approach that production of an agricultural commodity is a function of land, labor, and capital. The planted acreage of peanuts in Mexico (MPAREA) is the first explanatory variable in the production equation. This variable is expected to have a positive relationship with the peanut production. This is because economic theory suggests that as the planted acreage of a crop increases, the total production of that crop may increase. The variable for Mexico's agricultural population MAGPOP is included in the equation in order to describe the relationship of labor (used in the production of peanuts) with peanut production in Mexico. This variable represents the percentage of the total labor force employed in Mexico's economy. Economic theory predicts that as some percentage of the agricultural labor force leaves small farms, agricultural production will increase. This is because the remaining farmers establish large farms from the combination of several small farms and adopt mechanized and specialized farming which lead to increased agricultural production. It is expected that this variable will have an inverse relationship with peanut production, because as the amount of labor involved in peanut production decreases, peanut production increases. This is because of the adoption of labor saving technology in the agricultural sector. The dislocated laborers, because of the adoption of this labor saving technology, may be employed more efficiently in other sectors of Mexico's economy.

Peanut yield per hectare in Mexico MYIELD is included in this equation as an explanatory variable. In general, the per acre yield of a crop and its production should move in the same direction, because an increase in the yield of a crop means an increase in the total volume of that crop. However, the total production of a commodity may decrease despite a per unit increase in its yield. This may be because of the reduction in the total land used for the commodity in question. In this analysis, per hectare peanut yield in Mexico MYIELD, may have a positive relationship with peanut production, which means that when the per hectare peanut yield in Mexico increases, peanut production increases. This may explain the adoption of new technology, more irrigation, and/or favorable climatic conditions. On the contrary, if the relationship is found to be negative it would mean either a reduction in the total land used for peanuts over time or the continuation of traditional agricultural practices in the production process of peanuts.

The corn price in Mexico is included as an explanatory variable in this equation with the expectation of positive effects on peanut production. This is because, as mentioned earlier, corn is the major crop in Mexico and an increase in its price reflects an increase in farm income, ceteris paribus. It is expected that when Mexican farm income increases, more capital is available to invest in the form of improved seed varieties, fertilizer, pesticides, and machinery in the production process of agricultural commodities including peanuts.

Mexico's real gross national income MRGNP is also included as an explanatory variable. This variable is expected to have a positive relationship with peanut production. That is as the income level in Mexico increases, peanut production also increases. This is because as the income level in Mexico increases, the aggregate demand for goods and services including peanuts shifts upward. This may increase farm income and provide capital for expansion. The variable of peanut imports in Mexico is also included in this equation as an explanatory variable. It is expected that this variable will have a an inverse relationship with peanut production. This is due to the fact that when peanut imports in Mexico increases, peanut production in Mexico decreases.

PLANTED AREA EQUATION

MPAREA = f (MPROD , MPOP , MRPRIC)

In the above equation, peanut production in Mexico MPROD is included as one of the independent variables with the expectation that this variable will have a positive relationship with the dependent variable MPAREA. That is, when peanut production in Mexico increases, the planted acreage of peanuts increase. This is because the increase in peanut production is partly due to the average increase in per hectare peanut yield and this higher yield prompts farmers to increase peanut acreage in the current year. The same type of relationship may exist between the total population in Mexico MPOP and the planted area of peanuts. Accordingly, when the total population in Mexico increases, peanut demand may also increase and to respond to the higher peanut demand, farmers increase the planted acreage of peanuts. Peanut price in Mexico MRPRIC is expected to have a negative relationship with peanut planted acreage. This is because when there is an excess peanut demand, peanuts producers increase peanut planting but at the same time peanut imports increase which pushes the peanut price downward.

The U.S. Modeling Framework

USHAREA = f (USRPRIC , USEXP , CPOP , CRGNP)

In the above equation the peanut price in the U.S. (USRPRIC) is expected to have a positive relationship with the peanut planted area in the U.S. USPAREA. This is because when peanut price increases, U.S. peanut producers increase peanut planted area. The same type of relationship is expected to exist between U.S. peanut exports USEXP and the total peanut acreage produced in the U.S. An increase in U.S. peanut exports reflects an increase in foreign demand for U.S. produced peanuts and to respond to the higher demand farmers in the U.S. will increase peanut planted acreage.

Since Canada is not a peanut producing country and nearly 70 percent of its total peanut imports is imported from the U.S., therefore, it is expected that the total population in Canada CPOP will have a positive relationship with planted acreage of peanuts in the U.S. That is when the total population in Canada increases, farmers in the U.S. will increase their planted acreage of peanuts. Similarly, Canadian national income CRGNP is expected to have a positive relationship with the planted acreage of peanuts in the U.S. That is as the income level in Canada increases, the aggregate demand for goods and services including peanuts increases, and since a significant percentage of the Canadian peanut demand is met by the U.S. peanut supply, producers in the U.S. will increase peanut supply through increased peanut planting.

Canadian Modeling Framework

CIMP = f (CPOP ,USEXP, USREXP, USRPRIC)

In the above equation, the total population in Canada CPOP is expected to have a positive relationship with total peanut imports in Canada CNIMP. That is, as the total population increases, peanut demand and imports may increase because all domestic peanut demand is met by imported peanuts. Total U.S. peanut exports USEXP are included as an explanatory variable in this model because nearly 70 percent of the total imported peanuts in Canada come from the U.S. This variable is expected to have a positive relationship with peanut imports in Canada which means that when the U.S. increases its peanut exports some part of these peanuts may be imported by Canada.

The U.S. peanut export price USREXP is also included in this equation which recognizes the fact that the U.S. is the largest peanut exporter to Canada. This variable is expected to have a negative relationship with the peanut imports in Canada. That is, as the U.S. peanut export price increases, Canada's demand for U.S. peanuts will decrease. The domestic peanut price in the U.S. is different than the U.S. export price, and therefore, the domestic peanut price in the U.S. (USRPRIC) is included as a separate explanatory variable in this equation for the reason explained below. It is important to note that this variable represents the domestic U.S. peanut price. This variable is expected to have a positive relationship with Canadian peanut import demand. That is when peanut price in the U.S. increases, peanut imports by Canada increases. This is because when the U.S. domestic peanut price increases, U.S. consumers switch over to peanut substitutes. Most of the U.S. produced peanuts are consumed in the same year. That is, peanuts that are not consumed in the U.S. are exported in the same year with some carry over stocks of less than 15 percent (of the total production) for the next year. Therefore, when U.S. peanut consumers switch over to peanut substitutes due to the higher price, there exists an excess peanut supply in the U.S. and some of that excess supply may be exported to Canada.

Specific Models for Estimation

The statistical version of the economic models includes three models, one for Mexico, one for the U.S., and one for Canada.

The model that will be estimated for Mexico consists of three equations. The equations and their respective variables are:

Import Equation

$$MNIMP = \alpha_1 + \alpha_2 MRGNP + \alpha_3 MPOP + \alpha_4 MPAREA + \alpha_5 MCRPRIC + \alpha_6 USRPRIC$$

Production Equation

$$MPROD = \alpha_1 + \alpha_2 MAGPOP + \alpha_3 MYIELD + \alpha_4 MCRPRIC + \alpha_5 MRGNP + \alpha_6 MNIMP$$

Planted Area Equation

$$MPAREA = \alpha_1 + \alpha_2 MPROD + \alpha_3 MPOP + \alpha_4 MRPRIC$$

The model for the U.S. is based on one equation. The equation and the variables are :

Planted Area

$$USHAREA = \alpha_1 + \alpha_2 USRPRIC + \alpha_3 USEXP + \alpha_4 CPOP + \alpha_5 CRGNP$$

The model that will be estimated for Canada also has one equation. The equation and the included variables are:

$$CIMP = \alpha_1 + \alpha_2 CPOP + \alpha_3 USEXP + \alpha_4 USREXP + \alpha_5 USRPRIC$$

Data, Their Sources, and Study Period

Annual time series data that covers the time period 1973-94 will be used for this analysis. The data on population, gross national product, and consumer price index for all the three countries under study (Mexico, the U.S., and Canada) are taken from *World Tables 1995*. Figures on peanut imports, peanut price, and the price of corn for Mexico and peanut imports, and peanut price for Canada are derived from the various issues of *FAO Trade and Commerce Yearbook*. The figures on peanut imports (that will be used in this study) in Mexico are the difference between the total imported peanuts in Mexico and the total exported peanuts from Mexico and are defined as "net imports of peanuts in Mexico". In the case of Canada, however, the data on peanut imports represent the total imported peanuts in Canada because Canada does not produce or exports peanuts. The peanut price for Mexico and Canada and the corn price for Mexico are all import (unit) prices.

The figures on the agricultural population, the planted area of peanuts, peanut yield, and peanut production in Mexico are derived from the various issues of the *FAO Production Yearbook*. The figures regarding the agricultural population in Mexico demonstrate the percentage of the total Mexican labor force that is involved in the agricultural sector.

The data on the acreage of peanuts produced in the U.S., U.S. peanut exports, and the domestic peanut price in the U.S. are derived from the USDA's Economic Research Service Report: *Peanuts, Background for 1995 Farm Legislation (1995).* The U.S.

peanut export price is taken from the various issues of the FAO Trade and Commerce Yearbook.

The figures on the gross national product and all the prices for all the countries are deflated by the CPI (1987=100) of their respective countries and expressed in U.S. dollars.

In this chapter, the methodology used for the estimation of the models was presented in the first part. The second part of the chapter described the structure and formulation of the models followed by the specification of the models. The next section dealt with the selection and justification of the of the variables that are included in the models. The last part of the chapter presented the statistical version of the economic models and the sources of the data used in the analysis.

CHAPTER V

EMPIRICAL RESULTS

The test statistics that determine the validity of the statistical models, the estimated statistical equations, the explanation of the relationship among the dependent and independent variables, the levels of significance of the explanatory variables and the magnitudes of their respective responsive parameters are presented in this chapter.

Mexico's Model Diagnostics and Validation

To determine the validity of simultaneous equations models, SHAZAM computes three tests in the estimation process of 3SLS: the Lagrange Multiplier test, the Wald test, and the System R^2 (Shazam User's reference Manual).

The Breusch-Pagan Lagrange Multiplier test performs a test for a diagonal covariance matrix. The null hypothesis regarding this statistic states that a diagonal covariance matrix exists. The Lagrange Multiplier test has an asymptotically χ^2 distribution under the null hypothesis that the diagonal covariance matrix exists. The existence of a non-diagonal covariance matrix results in biased parameter estimates because the estimation procedure fails to minimize the variance. The critical value for the Lagrange Multiplier statistic at the .025 significance level is 9.3484 whereas the computed value for our model is 3.3122, meaning that we fail to reject the null hypothesis. Therefore, it can be concluded that the diagonal matrix exists.

The maintained hypothesis regarding the Wald test states that the slope coefficients of all the explanatory variables that are included in a model are zero. The Wald test is demonstrated by a χ^2, an equivalent statistic, when performing a likelihood ratio test to determine whether or not all the slope coefficients in a multiple regression model are zero. This statistic is compared with a $\chi 2$ distribution table in order to find the critical value. Our simultaneous equations model for the peanut industry in Mexico contains fourteen degrees of freedom (the number of slope coefficients in the system). The critical value for this model at the .025 significance level is 26.1189. The value that is computed by SHAZAM for our model is 104.21 which is highly significant and, therefore, the null hypothesis that the slope coefficients of the explanatory variables in this model are jointly zero is rejected.

A system R^2 is also computed by SHAZAM in the estimation process of simultaneous equation models. This statistic is frequently observed to be very high and, therefore, must be interpreted with caution. The system R^2 for this model is 0.9912. The model is accepted on the basis of the results of the Lagrange Multiplier test and the Wald test. The high R^2 further supports the validity of the model. The explanation of the estimation of Mexico's peanut import equation, peanut production equation, and the equation for the planted area of peanuts in Mexico, respectively, is presented below.

Mexico's Import Equation

Two versions of the import equation for Mexico were estimated. The deflated peanut price in Mexico was included in the first equation as an explanatory variable and this variable has the theoretically expected negative relationship with peanut imports by

Mexico. This is because the peanut import price (unit price) in Mexico was used as the peanut price in Mexico due to the unavailability of data on the domestic market price for peanuts in Mexico, and therefore, as the price of imported peanuts in Mexico increases, peanut imports to Mexico will decrease. However, due to the non-significant relation between the peanut price and peanut imports, this variable was excluded from the second equation. The coefficients, the t-statistics, and the R^2 of equation 1 are included in table 5.1 with the same information for equation 2. The estimated final import equation, its relevant variables, and the relationship among the variables are presented in the following paragraphs.

MNIMP=-6187+2.231(MRGNP)+1.772(MPOP)+.952(MCRPRIC)--.297(MPAREA)-70.194(USRPRIC)

This equation demonstrates that the net imports of peanuts in Mexico are a function of Mexico's deflated gross national product, the total population in Mexico, the deflated corn price in Mexico, the planted area devoted to peanuts in Mexico, and the deflated peanut price in the U.S.

The coefficient of determination R^2 for this equation is 0.896. This indicates that nearly 90 percent of the total variation in net peanut imports by Mexico is explained by this equation. All the explanatory variables that are included in this equation have the theoretically expected signs.

The deflated gross national product of Mexico (MRGNP) has the theoretically expected positive relationship with net peanut imports in Mexico (MNIMP). The coefficient of this variable indicates that as Mexico's gross national income increases by

Table 5.1. Estimated Results of Net Peanut Imports in Mexico, 973-94.

Dependent Variable = MNIMP

Observations = 22

	Equation 1		Equation 2	
Variable	Parameter Estimate	(t-ratio)	Parameter Estimate	(t-ratio)
INTERCEPT	-59118	(-1.269)	-61874	(-1.536)*
MRGNP	2.2239	(3.352)***	2.2310	(3.433)***
MRPRIC	-0.0007	(-0.015)		
MPOP	1.7508	(7.252)***	1.7718	(7.262)***
MCRPRIC	0.98378	(2.588)**	0.95206	(2.917)**
MPAREA	-0.29349	(-1.022)	-0.29734	(-1.443)*
USRPRIC	-72.521	(-2.361)**	-70.194	(-2.533)**

R^2 Equation 1 = 0.8966

R^2 Equation 2 = 0.8962

One Asterisk: (Significance at the p = .1 level)

Two Asterisks: (Significance at the p = .025 level)

Three Asterisks: (Significance at the p = (.005 level)

DEFINITIONS OF VARIABLES

MRGNP = Mexico's deflated gross national product, in billion US $

MNIMP = Annual net imports of peanuts by Mexico, metric tons

MPOP = Total population of Mexico in thousands

MPAREA = Annual hectares of peanuts produced in Mexico

MCRPRIC = The deflated corn price in Mexico, US $ / MT

USRPRIC = The deflated peanut price in the U.S.

Source: Empirical Estimates

one billion U.S. dollars, the net peanut imports in Mexico will increase by 2.23 metric tons. The increase in the import of peanuts appears to be smaller compared to the increase in the gross national product. This may be because Mexico imports less than 25 percent of its total domestic peanut consumption while more than 75 percent of the domestic peanut demand is met by the domestic supply. This variable has a significance level of P=.005.

The total population in Mexico (MPOP) also has the theoretically predicted positive relationship with peanut imports in Mexico. Furthermore, this variable is significant at the p=.005 level. The coefficient of this variable demonstrates that as the total population in Mexico increases by 1000, peanut imports in Mexico will increase by 1.77 metric tons.

The deflated corn price in Mexico is included in this equation as an explanatory variable. This is because corn is the major agricultural crop in Mexico, grown on a relatively large percentage of total cultivated land, and the increase in the corn price represents an increase in farm income. This variable represents the level of rural income in Mexico. This variable also has the theoretically expected positive relationship with peanut imports in Mexico. As the price of corn in Mexico increases by one U.S. dollar per metric ton, peanut imports by Mexico will increase by .95 metric ton. This variable is significant at P=.025.

The annual acreage of peanuts planted in Mexico (MPAREA), although not significant, has the theoretically suggested negative relationship with peanut imports to Mexico. The coefficient of this variable shows that as the planted area of peanuts in

Mexico increases by one hectare, peanut imports in Mexico will decrease by .30 metric tons. Although the per hectare peanut production in Mexico varies from .7 to 1 metric ton per hectare, this parameter can be reasonably accepted.

The deflated peanut price in the U.S. (USRPRIC) is also included in this equation. This is because the U.S. is the major peanut exporter to Mexico and theoretically the peanut price in the U.S. is expected to be inversely related to peanut imports by Mexico. This variable has the theoretically expected sign and is significant at the P=.025 level. The coefficient of this variable demonstrates that as peanut price in the U.S. increases by one U.S. dollar per metric ton, peanut imports in Mexico will decrease by 70.19 metric tons.

Mexico's Production Equation

The production equation has two versions. The first version does not contain the U.S. peanut price as an explanatory variable whereas the second one does include this variable. The estimated coefficients, the t-ratios, and the R^2 of equation I is included in table 5.2 with the estimated coefficients, the t- statistics, and the R^2 of equation 2 (the final version). Equation 2 is specified as:

MPROD=6383-17299(MAGPOP)+112.96(MYIELD)+4.429(MCRPRIC)+

10.325(MRGNP)-2.04(MNIMP)-210.95(USRPRIC)

In the above equation, peanut production in Mexico is a function of Mexico's agricultural labor force, peanut yield per hectare in Mexico, the deflated corn price in Mexico, the deflated gross national income of Mexico, net peanut imports in Mexico, and the deflated peanut price in the U.S.

The coefficient of determination, R^2, for this equation is .7681. This implies that nearly 77 percent of the total variation in Mexican peanut production is explained by this equation. The estimated coefficients of all the explanatory variables in this equation have the theoretically suggested relationship. The agricultural labor force in Mexico (MAGPOP) represents the percentage of the total labor force employed in Mexico's economy. Economic theory predicts that as some percentage of the agricultural labor force leaves small farms, agricultural production will increase because the remaining farmers establish large farms from the combination of several small farms, and adopt specialized and mechanized farming which leads to increased agricultural production. The variable has the theoretically expected negative relationship with Mexican peanut production. The coefficient of this variable demonstrates that as one percent of the agricultural labor force leaves the industry, peanut production increases by 17,299 metric tons. This variable is significant at the P=.005 level.

Peanut yield per hectare in Mexico (MYIELD) is included in this equation. As explained in the theory chapter, in general, the per unit yield and the production of a crop move in the same direction because an increase in the yield of a crop results in an increase in the total volume of that crop. In some cases, however, the total production of a crop may decrease despite a per unit increase in its yield. This may be because of the reduction of the total land used for the crop in question or because of the continuation of traditional agricultural practices in the production process of the crop. On the other hand, a positive relationship between the yield and the total production of a crop may be because of the adoption of new technology, more irrigation use, and/or overall favorable climatic conditions. The results of our analysis indicate a positive relationship between

Table 5.2. Estimated Coefficients for Peanut Production in Mexico, (1973-94).

Dependent Variable = MPROD

Observations = 22

	Equation 1		Equation 2	
Variable	Parameter Estimate	(t-ratio)	Parameter Estimate	(t-ratio)
INTERCEPT	4696	(2.980)***	6383	(4.585)***
MAGPOP	-16737	(-3.118)***	-17299	(-3.791)***
MYIELD	121.64	(4.392)***	112.96	(4.929)***
MCRPRIC	2.3553	(1.402)*	4.4287	(2.910)***
MRGNP	8.3709	(3.099)***	10.325	(4.275)***
MNIMP	-1.0256	(-1.451)*	-2.0396	(-3.141)***
USRPRIC			-210.95	(-3.312)***

R^2 Equation 1 = 0.7061

R^2 Equation 2 = 0.7681

One Asterisk: (Significance at the p = .1 level)

Two Asterisks: (Significance at the p = .025 level)

Three Asterisks: (Significance at the p = .005 level)

DEFINITIONS OF VARIABLES

MPROD = Annual peanut production in Mexico, metric tons

MAGPOP = The percentage of Mexico's population involved in agriculture

MYIELD = Per hectare peanut yield in Mexico, Kg

MCRPRIC = The deflated corn price in Mexico, US $ / MT

MRGNP = Mexico's deflated gross national product, in billion U S $

MNIMP = Annual net imports of peanuts by Mexico, metric tons

USRPRIC = The deflated peanut price in the U.S.

Source: Empirical Estimates.

peanut yield and total production. This may be because of the adoption of new technology by peanut farmers and/or favorable climatic conditions. This positive relationship between the yield and total production of peanuts may not be due to increased irrigation use, because irrigation in Mexico was an explanatory variable in this equation in the preliminary regressions and was found to be insignificant, (thus it was deleted from the model). The coefficient of this variable indicates that as peanut yield in Mexico increases by one kilogram per hectare, total peanut production will increase by 113 metric tons or approximately 110,000 kilograms. The magnitude of this variable is reasonable because the total peanut planted area in Mexico in 1994 was around 90,000 hectares and an increase of one kilogram peanuts per hectare would lead to total increase of around 90,000 kilograms which is close to 110,000 kilograms, the calculated total increase . This variable is also highly significant at the p=.005 level of significance.

Total fertilizer use in Mexico was included in this equation as a proxy for capital investment in the production of peanuts. Economic theory predicts that this sign will be positive, which means that when the investment of capital, in the form of variable inputs such as fertilizer, in the production process of peanuts increases, peanut production will increase. However, the sign of this variable was negative, and, consequently, this variable was dropped from the equation. The reason for this negative relationship may be because of the fact that total fertilizer use in Mexico remained relatively unchanged whereas peanut production is highly varied over the time period of this analysis. This indicates that peanut production is influenced by factors other than fertilizer. These factors, other than favorable weather conditions, may include the utilization of advanced agricultural machinery, improved seed variety, pesticides, and herbicides or overall efficient management. As explained in the theory chapter, corn is the major crop in Mexico grown on a significant percentage of total cultivated land. The increase in the price of corn represents an increase in farm income which indicates an increase in the availability of capital that may be invested in the production process of agricultural commodities including peanuts. Therefore, the deflated corn price in Mexico (MCRPRIC) is included in this equation as proxy for increased use of variable inputs in the production of peanuts. This variable has the theoretically expected positive relationship with peanut production in Mexico. The coefficient of this variable shows that as the price of corn in Mexico increases by one U.S. dollar per metric ton, peanut production will increase by 4.429 metric tons. This variable is significant at P=.005.

The deflated gross national product of Mexico is included in this equation as an explanatory variable. The rational for the inclusion is that as the income level in Mexico increases, aggregate demand for goods and services also increases. In order to respond to the new higher aggregate demand, farmers increase agricultural production including peanut production. This variable has the theoretically expected positive relationship with the peanut production. The coefficient of this variable demonstrates that as Mexico's national income increases by one billion U.S. dollars, peanut production will increase by 10.325 metric tons. It is important to mention that the magnitude of the coefficient of the gross national product in the Mexico's import equation is about twenty three percent of the magnitude of this coefficient which is the same ratio as the peanut imparts ratio to peanut production, around twenty three percent. This variable is also significant at the P=.005 level.

Peanut imports in Mexico (MNIMP) are also included in this equation. This variable also has the theoretically suggested negative relationship with peanut production. The coefficient of this variable indicates that as peanut imports increase by one metric ton, peanut production will decrease by 2.04 metric tons. This parameter can be reasonably accepted with the two to one ratio between imports and domestic production. This variable is also significant at P=.005.

As explained earlier in this chapter, two versions of this equation are presented in table 5.2. The first version does not contain the peanut price in the U.S. (USRPRIC) whereas the second one includes this variable. The coefficient of this variable indicates that as the U.S. peanut price increases by one U.S. dollar per metric ton, peanut production in Mexico decreases by 210.95 metric tons. This may be due to the fact that as the domestic peanut price in the U.S. increases, U.S. peanut consumers switch over to peanut substitutes and, as explained in the introduction and the theory chapters, according to U.S. peanut policy, most of the peanuts that are not consumed domestically are exported during the same crop year. Since the U.S is the major exporter to Mexico some of these peanuts are exported to Mexico. This variable has the same relationship with peanut imports in Canada. As the U.S. domestic peanut price increases peanut imports to Canada increase, which indicates that the U.S. domestic price does influence peanut imports to Canada and Mexico. Although the peanut price in the U.S. does not have the same relationship with peanut imports in Mexico, this may be because of a time lag influence.

Mexico's Planted Area for Peanuts Equation

MPAREA=25722+.229MPROD+.449MPOP-.101MPAREA

In the above equation, the annual peanut acreage produced in Mexico is a function of peanut production in Mexico, the total population of Mexico, and the price of peanuts in Mexico.

The R^2 for this equation is 0.8519 which implies that more than 85 percent of the total variation in the planted area of peanuts in Mexico is explained by this equation.

Peanut production in Mexico (MPROD) has the theoretically expected positive relationship with the planted area of peanuts (MPAREA). The coefficient of this variable indicates that as peanut production in Mexico increases by one metric ton, peanut planted area increases by .23 hectares. This variable is significant at P=.025.

The total population in Mexico (MPOP) also has the theoretically expected positive relationship with the planted area of peanuts. The coefficient of this variable indicates that as the total population in Mexico increases by one thousand, the planted area of peanuts in Mexico will increase by .45 hectares. The magnitude of this variable is in a fairly acceptable region. This is due to the fact that per person peanut consumption in Mexico is around three pounds. An increase in the total population of one thousand indicates an approximate increase of three thousand pounds in the demand for peanuts and the approximate production of .45 hectare sums to around 1400 pounds. These figures show that half of the total increase in the demand for peanuts is met by an increase in the planted area of peanuts.

The deflated peanut price in Mexico is also included in this equation as an explanatory variable. Although the magnitude of this parameter is small, this variable is

Table 5.3. Regression Coefficients for the Planted Area of Peanuts in Mexico, 1973-94.

Dependent Variable = MPAREA

Observations = 22

Variable	Parameter Estimate	(t-statistic)
INTERCEPT	25722	(1.33)*
MPROD	0.22912	(2.345)**
MPOP	0.44828	(1.870)*
MRPRIC	-0.10079	(-2.519)**

$R^2 = 0.8519$

One Asterisk: (Significance at the p = .1 level)

Two Asterisks: (Significance at the p = .025 level)

DEFINITIONS OF VARIABLES

MPAREA = Annual hectares of peanuts produced in Mexico

MPROD = Annual peanut production in Mexico, metric tons

MPOP = Total population of Mexico in thousands

MRPRIC = The deflated peanut price in Mexico, US $ / MT

Source: Empirical Estimates.

included in the equation because of its relatively significant t-value. This variable has an inverse relationship with the planted area. This may be because the price of peanuts increases due to short supply, and peanuts are then imported into the domestic market which places downward pressure on the price, and farmers respond to the new lower price by reducing the planted area of peanuts in the current year. This variable is significant at P=.025.

Elasticity Analysis

The price elasticity and the income elasticity of demand for peanut imports by Mexico were estimated by SHAZAM. The price elasticity is defined as the responsiveness of the quantity demanded for that commodity to changes in its price. The income elasticity of demand is defined as the responsiveness of the quantity demanded for the commodity to changes in the income level of consumers. Economic theory suggests that the price elasticity of demand for a non giffen commodity should be negative meaning, that the quantity demanded for a commodity has an inverse relationship with its price. Theoretically the income elasticity of demand for a normal good should be positive because as the income level of consumers increases, the demand for normal goods also increases.

The direct peanut price elasticity at the mean level (the deflated peanut price in the U.S. with respect to peanut import demand by Mexico) indicates that a one percent increase in the price of U.S. peanuts leads to about a four percent decrease in the imports of peanuts by Mexico (price elastic demand). This is because, as explain earlier, the U.S. is the major peanut exporter to Mexico and as the price of U.S. peanuts increases rational Mexican peanut consumers will purchase less of U.S. imported peanuts. The price elasticity (the peanut price in Mexico with respect to Mexican import demand for peanuts) is very low the explanation of which is given earlier in this chapter. However, this elasticity has the theoretically expected negative sign. The income elasticity has the theoretically positive sign.

The income elasticity is 0.8 which indicates that a one percent increase in the income level of Mexican consumers results in about .8 percent increase in the demand for imported peanuts, ceteris paribus. Since .8 percent is relatively close to unity, it may be argued that peanut imports are responsive to changes in the income level of Mexican consumers. As explained earlier in this chapter, the price of corn was also included in this model as an income indicator in Mexico. The corn price elasticity is .43 which shows that a one percent increase in the price of corn in Mexico leads to .43 percent lead in the demand for imported peanuts by Mexico. This income indicator is less responsive compared to the GNP which may be due to the fact that this variable represents only the income level of Mexican farmers.

Mexico's Additional Model

The original model of Mexico's peanut production contains a per unit yield of peanuts as an explanatory variable and yield is a part of production, therefore, an additional model without yield was estimated as well. However, the original model was not replaced because the residuals of its production equation were found to be normally distributed after performing the Jarque-Bera normality test, goodness of fit test for normality of residuals, skewness tests, and the visual inspection of the residual plot. The results of the additional model are explained below.

The critical value for the Lagrange Multiplier Statistic at the .025 significance level is 9.3484 whereas the computed value for the model is 4.5807 which means that we failed to reject the null hypothesis that the diagonal covariance matrix exists. The null hypothesis regarding the Wald test states that the slope coefficients of all the explanatory variables in the model are zero. The Wald test is demonstrated by a χ^2. The critical value for this model at the .025 significance level is 26.1189 whereas the computed value for the model is 91.852 which results in the rejection of null hypothesis that the slope coefficients of the explanatory variables in the model are jointly zero or the dependent variables in the model are not influenced by the explanatory variables jointly. The system R^2 for the model is 0.9846.

In this model the deflated price of sugar in Mexico is included in the import equation in order to investigate the complementary relationship of sugar with peanuts in Mexico. This is because sugar is used with some of the peanut products such as peanut candy and honey roasted peanuts. The price of sugar in Mexico is not included in the original model because of the unavailability of the import price of the first six observations (these observations are replaced by export price in this model). Also, the cross price elasticity of sugar is low, a one percent increase in the price of sugar in Mexico will lead to a .14 percent decrease in the imported demand for peanuts in Mexico. The income elasticity in this equation indicates that a one percent increase in the income level in Mexico will result in a .92 percent increase in the demand for imported peanuts. The corn price elasticity is .57 and the direct price elasticity (the U.S. price) is -3.38.

The R^2 for the peanut import equation is 0.9155. The explanatory variables, the income level in Mexico, the total population of Mexico, and the deflated price of corn in

Mexico have the theoretically expected positive relationship with peanut imports in Mexico and are significant at the p=.005 level. The U.S. peanut price and the price of sugar in Mexico also have the theoretically correct signs and are significant at the p=.05 and p=.1, respectively. The planted area of peanuts has the theoretically expected inverse relationship with peanut imports but this variable is not significant.

The R^2 for the peanut production equation is 0.5021. All of the explanatory variables in this equation have the theoretically expected signs. The U.S. peanut price is significant at the p=.05 level whereas the rest of the variables are greater than their respective standard errors but their significance level is about .20.

The results of the planted area of peanuts are not significantly different from the original model. The R^2 is 0.8042. The explanatory variables, peanut production, peanut price, and the total population of Mexico have the theoretically expected signs. Peanut production and peanut price are significant at the p=.005 and .05, respectively. The estimated coefficient of the total population of Mexico is greater than its standard error, however, this variable is not significant.

The U.S. and Canadian Models

The Ordinary Least Squares method was used for the estimation of the single equation models for the annual peanut harvested area in the U.S. and peanut imports by Canada. Linear and logarithmic forms were estimated. The results of the linear form were relatively favorable, and, therefore, they are included in the final analysis of this study. Both of these models were corrected for autocorrelation using SHAZAM. The estimated equations, their relevant variables, the regression coefficients and their t-values, the F statistics, and the coefficient of multiple determination R^2 are presented in the following section:

Model for the U.S. Harvested Area for Peanuts, 1973-94.

USHAREA=19881+202.89(USEXP)+857.92(USRPRIC)+.881(CPOP)+1.25(CRGNP)

t-values (2.526) (2.216) (2.378) (3.537) (2.400)

In the above equation, the harvested area of peanuts in the U.S. (USPAREA) is a function the U.S. peanut exports, the deflated peanut price, the total population of Canada, and deflated gross national income in Canada. The R^2 for this model is .6827. This implies that nearly 69 percent of the variation in U.S. peanut production area is explained by this equation. The F statistic is 9.15. The critical value for the F statistic of this model at the .05 level is 2.96. Since the computed value of the F statistic is higher than the critical value, therefore it is concluded that the slope coefficients of the explanatory variables are not jointly equal to zero. The relationship among the variables and the levels of significance of the individual explanatory variables are as follows.

U.S. peanut exports (USEXP) have the theoretically positive relationship with the annual peanut harvested area (USPAREA). The coefficient of this variable indicates that as peanut exports increase by one million pounds, the peanut production area will increase by 202.89 acres. The magnitude of this parameter indicates that half of the total increase in exports comes from an increase in the peanut production area because the average production from 202.89 acres equals to approximately .5 million pounds. The remaining half of the increase in exports may be because of an increase in excess supply due to efficient production management and/or downward pressure on domestic demand (due to the government controlled peanut price). The latter factor may be contributing more to increased exports because the Canadian import model and the Mexican production model show that U.S. peanut exports increase to these countries as the U.S. domestic peanut price increases. This variable is significant at the P=.05 level.

The deflated peanut price in the U.S. has the theoretically expected positive relationship with the peanut planted area. The coefficient of this variable indicates that as the price of peanuts increases by one U.S. dollar per metric ton, the planted area will increase by 857.92 acres. This variable is also significant at P=.025.

The total population in Canada has the theoretically expected positive relationship with U.S. peanut acreage. This is because Canada imports nearly 70 percent of its total peanut consumption from the U.S., and an increase in the Canadian population may lead to an increase in the harvested area of peanuts in the U.S. The coefficient of this variable indicates that as the total population in Canada increases by one thousand, the peanut acreage in the U.S. will increase by .88 acres. This variable is also significant at P=.001.

Theoretically, the demand for peanuts in Canada may increase with the increase in the level of income in Canada . Since Canada does not produce peanuts domestically, the import demand of peanuts represents the volume of the total peanut demand in Canada. On the basis of the above explanation that 70 percent of the total Canadian import demand is met by the U.S. peanuts imported into Canada, the income level of Canadians was also included in this equation which was found to be significant at P=.05. The price elasticity is .38 and the Canadian income elasticity .33.

Peanut Import Model for Canada, (1973-94)

CIMP = -12537+6.522(CPOP)-2.978(USREXPR)+41.091(USRPRIC)

t-ratios (2.662) (4.316) (0.342) (3.229)

In the above equation, peanut imports in Canada (CIMP) are a function of the total population in Canada, the deflated U.S. peanut export price, and the deflated U.S. domestic peanut price. The R^2 for this equation is .7204, meaning that about 72 percent of the variation in peanut imports in Canada is explained by this equation. The F statistic is 15.46. The critical value of the F statistic for this model at the .05 level is 2.96. Since the computed F value is significant, the null hypothesis that the slope coefficients are jointly zero is rejected. The relationship among the variables and the levels of significance of the individual regressors are explained in the following paragraphs.

The total population in Canada (CPOP) has the theoretically expected positive sign. The coefficient of this variable shows that as the Canadian population increases by one thousand, peanut imports in Canada will increase by 6.706 metric tons. The magnitude of this parameter indicates a 12-14 pound per person peanut consumption in Canada which is slightly higher than the actual peanut consumption, 7-9 ponds per person. This variable is in a fairly acceptable range. The variation in this variable may explain the variation in the per person peanut consumption because all peanuts that are consumed in Canada are imported. This variable is significant at the P=.001 level.

The deflated U.S. export price is also included in this equation. The coefficient of this variable shows that as the U.S. peanut export price increases, rational consumers in Canada will buy less of these peanuts. The coefficient of this variable shows that as the peanut export price increases by one U.S. dollar per metric ton, peanut imports in Canada will decrease by 3.123 metric tons. Total U.S. peanut exports were included as an explanatory variable in the preliminary regressions because the U.S. is the major peanut exporter to Canada and this variable was expected to have a positive relationship with peanut import in Canada, however, this variable was found to be insignificant, (thus it was deleted from the model).

The deflated U.S. domestic peanut price is also included in this equation as a regresser variable. The coefficient of this variable shows that as the U.S. domestic price increases by one U.S. dollar per metric ton, the peanut imports in Canada will increase by 44.36 metric tons. This is because, as explained earlier in this chapter, according to the U.S. peanut policy, peanuts that are not consumed domestically are mainly exported in the current year. This variable is significant at the P=.025 level. The U S export price elasticity is -.04 and the U S domestic price elasticity is .42.

In order to determine the validity of the simultaneous equations model for peanut production, imports, and planted area in Mexico, SHAZAM has computed three tests: the Lagrange Multiplier test, the Wald test, and the system R^2. The Lagrange Multiplier test has an asymptotically χ^2 distribution under the null hypothesis that the diagonal covariance matrix exists. The critical value for this statistic at the .025 significance level is 9.3484 compared to the computed value for our model, 3.3122. This means that we fail to reject the maintained hypothesis that the diagonal matrix exists. The null hypothesis regarding the Wald test states that the slope coefficients of the explanatory variables in a model are jointly zero. The Wald test is demonstrated by a χ^2, an equivalent statistic, when performing a likelihood ratio test to demonstrate whether or not all the slope coefficients in a multiple regression model are zero. The critical value for this statistic at the .025 significance level with fourteen degrees of freedom (the number of slope coefficients in our model) is 26.1189 compared to the computed value, 104.21. The highly significant value of this statistic leads us to reject the null hypothesis that the slope coefficients are jointly zero. The significantly favorable results of the Lagrange Multiplier test and the Wald test for the model as a whole, the theoretically expected signs of the explanatory variables, and the significant relationship among the individual variables in the equations suggest that this model is a reasonable representation of peanut production, and imports in Mexico.

The coefficient of determination, R^2, for the model of the harvested area of peanuts in the U.S. is 0.6827, meaning that nearly 69 percent of the variation in the U.S. harvested area of peanuts is explained by this model. The null hypothesis regarding the F-statistic states that the slope coefficients of the explanatory variables in a model are jointly zero. The computed value of the F-statistic for our model is 9.15 whereas the critical value for this statistic at the .05 level is 2.96. This result causes an acceptance of the null hypothesis that the slope coefficients of the explanatory variables in our model are jointly zero. Despite our efforts the quantitative analysis of the U.S. peanut industry as a whole and the U.S. harvested area of peanuts could not be improved. However, the significance of the individual explanatory variables and the joint significance of the slope coefficients along with a relatively reasonable value of the R^2 demonstrate that this model is a partially reasonable representation of the annual peanut harvested acreage in the U.S.

In the Canadian peanut import model, the R^2 is 0.7226 which implies that more than seventy two percent of the variation in Canadian peanut imports is explained by this equation. The computed F-statistic of this model is 11.07 whereas the critical value for this statistic at the .05 level for our model is 2.96. Since the computed F-value is significant, therefore, the maintained hypothesis regarding our model that the slope coefficients are jointly zero is not accepted. This weak Canadian peanut import model may partially represent actual peanut import behavior in Canada.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The North American Free Trade Agreement will eventually lead to free trade in goods and services among its member countries, the U.S., Canada, and Mexico. Agricultural products including peanuts will be significantly influenced in terms of production, processing, distribution, and consumption within and across the participant countries by this new institution of free trade. Currently, the U.S. is the largest peanut exporter to both Mexico and Canada. Canada has always been a net importer of peanuts and this status is expected to remain unchanged in the future, mainly due to the unfavorable climatic conditions for the peanut crop to be grown domestically in Canada. On the other hand, the U.S. and Mexico produce peanuts domestically and have been simultaneously peanut exporters and importers.

The three-fold objectives of this study were first, to quantitatively analyze the existing peanut industry in the U.S., Canada, and Mexico. Second, to identify various forces that explain peanut markets in the U.S., Canada, and Mexico, and finally, to investigate the interrelationship of peanut markets among the member countries of NAFTA.

Three models were estimated during this study: a simultaneous equations model for peanut imports, production, and planted acreage in Mexico, a single equation model for peanut acreage in the U.S., and a single equation model for peanut imports in Canada. Annual time series data for the time period 1973-1994 was used for the analysis.

Mexico

The first equation in Mexico's simultaneous equation model examines peanut import behavior. In this equation, peanut imports are a function of Mexico's deflated gross national product, the total population of Mexico, the deflated price of corn in Mexico, the planted area of peanuts in Mexico, and the deflated peanut price in the U.S. Mexico's gross national product and the total population of Mexico are the major forces which explain peanut imports in Mexico. Both of these variables are significant at the P=.005 level and the signs of the respective parameters of these variables are in accordance with priori expectations.

It is important to note that the coefficient of the planted area of peanuts in Mexico also shows a strong relationship with peanut imports. The climatic and soil conditions in Mexico have shown in the past that Mexico can produce peanuts in excess of its domestic demand. Therefore, the current trend of increased planted area and production may lead to the conclusion that in the future Mexico will have an excess supply of peanuts available for export. In the future, when the U.S. peanut price support program is abolished, the U.S. peanut planted acreage will be reduced because previous research suggests that when the peanut price in the U.S. is lowered to the world price, U.S. farmers will decrease the planted acreage of peanuts due to a high per acre peanut production cost. Mexico, therefore, may export the excess peanut supply to the U.S. in the future.

The deflated peanut price in the U.S. was also included in this equation because the U.S. is the largest peanut exporter to Mexico and, theoretically, the peanut price in the U.S. is expected to be inversely related to peanut imports in Mexico and it is. This variable was found to be significant at the p=.025 level.

As a result of the significance of the individual variables of this equation, the magnitude of their respective parameters, and the R^2 of 0.8962 it may be concluded that these variables are the factors which explain peanut import behavior in Mexico.

The second equation in Mexico's model is the domestic peanut production equation. In this equation, peanut production is a function of agricultural labor, peanut yield, corn price, the gross national product, and Mexican net imports.

The agricultural labor force (MAGPOP) has a highly significant t-ratio at the p=.005 level of significance. The strong relationship is also represented by the coefficient of the variable which indicates that as one percent of the agricultural labor force leaves the industry, peanut production increases by 17,299 metric tons. The high significance of this variable demonstrates that in the future, there exists potential for larger mechanized and specialized farms to be engaged in peanut production. Furthermore, the price of corn (used as a proxy for capital accumulation in agriculture which could be used in the production process of peanuts) and peanut per hectare yield in Mexico are also highly significant at the p=.005 level of significance, which demonstrates that the utilization of more capital and high technology will enhance peanut production. These facts may also lead to the conclusion that, in the future, Mexico will produce an excess supply of peanuts that will be exported to the U.S.

Per hectare peanut yield in Mexico is also significant at the p=.005 level of significance and has a positive relationship with peanut production. This may be because of the adoption of new technology by peanut farmers and/or favorable climatic conditions. This high yield may also attract farmers to grow more peanuts.

The significance of the individual variables, the reasonable magnitudes of their respective parameters, and the R^2 of 0.7681 show that these variables are the factors which explain peanut production in Mexico.

The planted area of peanuts in Mexico, the last equation of the model, is consistent with the previous equations in the model. In this equation, the peanut planted area is influenced by peanut production in Mexico, the total population of Mexico, and the peanut price in Mexico. The coefficient of the peanut production variable indicates that as peanut production increases by one metric ton per hectare the peanut planted area will increase by nearly .23 hectare. As explained in the peanut production equation, there is potential for peanut production to increase which will result in an increase in the planted area of peanuts and further increase the total volume of peanut production in Mexico.

The significantly favorable results of the Lagrange Multiplier test and the Wald test for the model as a whole, the theoretically expected signs of the explanatory variables, and the significant relationship among the individual variables in the equations suggest that this model is a reasonable representation of peanut production and imports in Mexico.

Two single equation models were run separately using the Ordinary Least Squares method to analyze the U.S. peanut harvested area and the peanut imports of Canada. The U.S. peanut industry is analyzed qualitatively in considerable detail in the first part of this study. This is because a quantitative analysis of the industry is affected by extensive government interventions in different stages in the peanut production and marketing process in the United States. The Canadian import model is also relatively weak due to the unavailability of data.

The United States

As explained earlier, the U.S. peanut industry could not be quantitatively analyzed as a result of several peanut price levels, forms, and categories because of the government intervention in peanut markets at different levels. For instance, there exist several peanut prices for different categories: government quota support price, export price, crush price, and prices offered by peanut handlers for peanuts used for domestic consumption, exports, and crush. Also, quota restrictions on domestically produced peanuts and imported peanuts and import restrictions on peanut products. However, a detailed qualitative explanation of the U.S. peanut industry is included in the introduction and literature review chapters of this study which may help farmers decide their future plans regarding peanut and/or alternative crop production and policy makers formulating future strategies for peanut industry. The topics and subtopics that present this detailed explanation include the delineation of U.S. peanut farms, peanut utilization in domestic edible products, peanut production costs and returns, the U.S. peanut policy (historical background and farm acts), the U.S. peanut marketing system, the U.S. peanut industry under NAFTA, the impacts of the peanut price support program, and peanuts under regulated vs. free market system.

In the quantitative analysis of the U.S. model, the U.S. peanut harvested area is a function of U.S. peanut exports, the deflated U.S. domestic peanut price, the total population of Canada, and the gross national product of Canada. All the explanatory variables in this model are significant at the p=.05 level of significance. Despite our efforts the quantitative analysis of the U.S. peanut industry as a whole and the U.S. harvested area of peanuts could not be improved . However, the significance of the individual explanatory variables and the joint significance of the slope coefficients along with a relatively reasonable value of the R^2 demonstrate that this model is a partially reasonable representation of the annual peanut harvested acreage in the U.S.

Canada

In the Canadian peanut import model, peanut imports of Canada are a function of the total population of Canada, the deflated U.S. peanut export price, and the deflated U.S. domestic peanut price. Two out of three explanatory variables in this equation, the total population in Canada and the U.S domestic peanut price are significant at the p=.025 level of significance. All the explanatory variables have the theoretically suggested relationship with peanut imports in Canada, however. The R^2 for this model is 0.7226 which implies that more than seventy two percent of the variation in Canadian peanut imports is explained by this equation. This weak Canadian peanut import model may partially represent the actual peanut import behavior in Canada.

Limitations and Suggestions for Further Research

This research consists of the initial analysis of the peanut industry among the member countries of NAFTA. With the passage of time, as data on actual domestic market prices, quantities, and other relevant variables in Mexico and Canada and data after the agreement's implementation become available, more precise and conclusive analysis of the peanut industry in and across the member countries of NAFTA may be conducted.

The lack of relevant data remained the major constraint of this study. The domestic market prices (wholesale/retail) of peanuts in both Mexico and Canada were not available at the time of the study. Prices of close substitutes were also not available for these countries. The preliminary plan of this study included the development of separate import demand models for peanuts and peanut products (peanut butter, salted peanuts, roasted peanuts, and peanut candy) for the relevant member countries of NAFTA in order to investigate the forces that influence peanuts and peanut products in and across these countries. The plan was modified because of unavailability of historical data on peanut products in Mexico and Canada. The efforts that were made for the collection of these data include searching through several data sources the United Nations affiliated agencies such as FAO, the World Bank, International Trade Statistics, National Trade Data Bank published by the U.S. Department of Commerce and Statistics Administration Office, the internet service, several telephone conversations with the USDA's agricultural officers at Mexico's and Canada's desks, and telephone conversations with Statistics Canada.

The market analysis of peanut varieties (Runners, Virginias, and Spanish) may also be carried out in continuation of this study. Income levels of consumers responded significantly in different models and therefore, the disaggregation of import demands (for peanuts, peanut varieties, peanut products, and peanut oil) may be analyzed in order to identify the income response to separate models. Population is a significant driving force in the Mexican and Canadian models. Different age groups of this variable may be used in the analysis to explore the influence of these groups in different models. The inclusion of the policy variables such as tariff or quota on peanuts and/or peanut products by the member countries may also be included in the analysis.

Further modification or expansion (explained above) of this study needs the estimation of separate econometric models because the effectiveness of the forces involved may not be captured by using one or two econometric models. OLS or ILS technique will need several equations to estimate which may not be unbiased and efficient due to the presence of non diagonal contemporaneous covariance matrix and the 3SLS methodology may need separate models to estimate because of the different sets of relationships of variables. Nevertheless, the expansion of this study to the extent explained above is time and capital consuming which may require a funded project by a public and/or private agency.

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APPENDIX

TABLE A-1. MEXICO'S POPULATION, AGRICULTURAL LABOR FORCE, GROSS NATIONAL PRODUCT, CONSUMER PRICE INDEX, AND PEANUT PRICE (1973-94).

YEAR	POPULATION (000)	AG LABOR FORCE (%OF TOTAL)	GROSS NATIONAL PRODUCT US $ (BILLIONS)	CONSUMER PRICE INDEX (1987=100)	PEANUT PRICE US $ /M.TON
1973	55348	42.5	60.32932	.6	957.75
1974	57082	41.5	75.91906	.7	1224.07
1975	58871	40.5	93.60489	.8	1223.07
1976	60424	39.6	100.90810	1.0	2166.80
1977	62018	38.7	99.22880	1.2	1000.00
1978	63654	37.8	108.84830	1.4	1223.07
1979	65333	36.9	133.27930	1.7	1223.07
1980	67056	36.0	177.02780	2.2	954.55
1981	68670	35.2	223.17750	2.8	1673.83
1982	70324	34.3	213.78500	4.4	2380.95
1983	72017	33.5	193.00560	8.9	1935.50
1984	73750	32.7	154.87500	14.7	1000.00
1985	75526	32.0	164.64670	32.2	863.43
1986	77243	32.5	152.94110	43.1	2100.00
1987	78999	31.9	154.04800	100.0	516.85
1988	80795	31.2	160.78200	214.2	780.32
1989	82632	30.6	182.61670	257.0	833.27
1990	84511	30.0	217.19330	325.5	1082.90
1991	86269	29.3	257.94430	399.3	1091.90
1992	88063	28.7	302.93670	461.2	784.83
1993	90027	28.1	335.80000	501.3	894.47
1994	91858	27.5	368.35060	536.2	997.84

SOURCES: FAO PRODUCTION YEARBOOK
WORLD TABLES (1995)

TABLE A-2. MEXICO'S PEANUT PLANTED AREA, YIELD, PRODUCTION, IMPORTS, AND CORN PRICE (1973-94)

YEAR	PEANUT PLANTED AREA (HECTARES)	PEANUT YIELD (KGS/HA)	PEANUT PRODUCTION (M. TONS)	PEANUT NET IMPORTS (M. TONS)	CORN PRICE US $ /M.TON
1973	42000	1377	59000	-685	108.70
1974	48000	1303	63000	-1200	154.91
1975	62000	1118	69000	-1511	164.31
1976	43000	1206	56000	1442	113.97
1977	45000	1357	61000	-973	112.63
1978	75000	1452	110000	-2370	127.92
1979	76000	1084	83000	-1350	149.28
1980	62000	1110	69000	1070	155.92
1981	74000	1237	92000	5325	147.77
1982	70000	1227	103000	20	161.58
1983	83000	1459	100000	921	135.25
1984	87000	1333	105000	-299	150.14
1985	83000	1333	114000	5245	92.59
1986	73000	1315	65000	-1129	97.18
1987	90000	1500	110000	1015	88.20
1988	85000	1212	53000	13250	128.88
1989	77000	1252	97000	10864	131.15
1990	80000	1242	99000	6239	134.99
1991	90000	1287	115000	21893	125.88
1992	93000	980	91000	25023	141.00
1993	90000	1286	116000	30739	331.10
1994	90000	1270	114000	42787	134.54

SOURCES: FAO PRODUCTION YEARBOOK
FAO TRADE AND COMMERCE YEARBOOK

TABLE A-3. UNITED STATES GROSS NATIONAL PRODUCT, CONSUMER PRICE INDEX, PEANUT PLANTED AREA, PRICE, AND EXPORTS (1973-94)

YEAR	GROSS NATIONAL PRODUCT (BIL US $)	COSUMER PRICE INDEX (1987)	PEANUT HARVEST.AREA (1000 ACERS)	PEANUT PRICE (US $/M.TON)	PEANUT EXPORTS (MIL POUNDS)
1973	1326.4	39.1	1496	357.22	709
1974	1434.2	43.4	1472	394.71	740
1975	1549.2	47.3	1500	432.19	434
1976	1718.0	50.1	1518	441.01	783
1977	1918.3	53.3	1512	463.06	1025
1978	2163.9	57.4	1509	465.27	1141
1979	2417.8	63.8	1520	454.24	1057
1980	2631.7	72.5	1400	555.68	503
1981	2957.8	79.9	1489	590.96	576
1982	3069.3	84.9	1277	553.47	681
1983	3304.8	87.6	1374	544.65	774
1984	3772.2	91.4	1528	615.21	860
1985	4014.9	94.6	1467	535.83	1043
1986	4435.1	96.4	1535	643.88	663
1987	4701.3	100.0	1547	617.42	618
1988	5062.6	104.0	1628	615.21	688
1989	5452.8	109.0	1645	617.42	989
1990	5764.9	114.9	1810	769.57	652
1991	5932.4	119.8	2016	624.03	997
1992	6255.5	123.4	1672	661.52	951
1993	6560.0	127.1	1637	652.70	555
1994	6922.4	130.4	1630	639.45	750

SOURCES: WORLD TABLES (1995)
USDA'S ECONOMIC RESEARCH SERVICE REPORT

TABLE A-4. CANADA'S POPULATION, GROSS NATIONAL PRODUCT, CONSUMER PRICE INDEX, PEANUT NET IMPORTS, AND PEANUT PRICE (1973-94)

YEAR	POPULATION (000)	GROSS NATIONAL PRODUCT (BIL US $)	CONSUMER PRICE INDEX (1987=100)	PEANUT NET IMPORTS (M. TONS)	PEANUT PRICE (US $/M.TON)
1973	22436	131.251	34.4	59338	439.70
1974	22819	158.136	38.2	59337	622.75
1975	23209	179.174	42.3	60379	659.10
1976	23480	198.406	45.5	61587	653.95
1977	23753	207.839	49.1	54693	721.74
1978	24030	224.921	53.5	66212	723.12
1979	24311	246.514	58.4	62672	750.46
1980	24594	271.518	64.3	54204	796.49
1981	24858	294.567	72.3	60351	777.65
1982	25125	286.425	80.1	60351	832.60
1983	25394	297.110	84.8	65462	764.09
1984	25667	323.661	88.5	68154	795.20
1985	25942	343.991	92.0	68285	654.89
2986	26302	364.809	95.8	76961	687.85
1987	26666	412.523	100.0	72459	728.95
1988	27036	478.537	104.0	58988	709.58
1989	27411	519.987	109.2	66466	779.52
1990	27791	545.537	114.4	81332	893.48
1991	28118	562.079	120.8	73867	964.58
1992	28448	577.210	122.7	84498	797.22
1993	28782	574.489	124.8	88251	817.65
1994	29121	587.516	126.6	89024	903.93

SOURCES: FAO TRADE AND COMMERCE YEARBOOK
WORLD TABLES, (1995)

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