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The Farmer-Owned Reserve Release Mechanism and State Grain Prices

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ABSTRACT

This report quantifies relationships between reserve activities and State grain prices for corn, sorghum, and wheat and discusses the farmer-owned reserve release mechanisms and some alternatives to the current release mechanism. Release of FOR stocks had little or no measurable effect on lowering State-U.S. monthly grain price differentials for most of the States studied. The 5-day average adjusted prices based on a production-weighted average and a reserve-weighted average were shown to differ from the price series based on a simple average (the current method) only by a few cents. Setting release prices in each State by adjusting the national release price by the normal State-U.S. grain price differentials would narrow the differential for States where an abnormally wide differential has been the case during release status.

Keywords: Farmer-owned reserve, FOR, corn, sorghum, wheat, grain price differentials, 5-day moving average adjusted prices.

PREFACE

This report analyzes the relationship between State grain prices and the farmer-owned reserve program and assesses the release mechanism of the reserve. House Bill (H.R. 5743) introduced by the Committee on Appropriations, U.S. House of Representatives, initially requested this study. The study was subsequently mandated by the committee's report 98-809. A preliminary draft of this report was submitted to the Congress in February 1985 in response to the committee's request.

This report is the revised and completed study. It contains revisions of effects of farmer-owned reserve (FOR) release on U.S. and State grain prices and clarification of some statistics, although the conclusions remain largely unchanged.

The authors are indebted to analysts and statistical assistants in the Program Analysis Division of Agricultural Stabilization and Conservation Service (ASCS) for data assistance and discussion, especially Orville Overboe and Randy Weber. The authors are also grateful to Steve Gill of the Cotton, Grain and Rice Price Support Division of ASCS for providing us with information about the history of FOR release. Jacqueline Z. Chase typed this report.

CONTENTS

SUMMARY

Release of FOR (farmer-owned reserve) stocks had little or no measurable effect on lowering State-U.S. monthly grain price differentials for most of the States studied. Conversely, entry of stocks into the reserve had little or no relative price strengthening effects for most States. Only in Nebraska, Indiana, and Pennsylvania for corn did release of FOR stocks materially lower each State's monthly grain prices relative to the U.S. average. Conversely, these States generally experienced price increases relative to the U.S. price when entry into the reserve was substantial.

The higher total stocks were relative to use in a State, the lower that State's monthly price tended to be relative to U.S. average price. This was generally the case for important grain-producing States included in this study, although the relationship was not statistically significant in some cases.

For a given level of total stocks in a State at the start of a month, the more that were isolated from the market by being CCC-owned or in the FOR, the higher the State's monthly price tended to be relative to the U.S. average. This was the case for many of the important grain producing States studied, although the relationship was not statistically significant for many other States.

In corn-deficit States such as North Carolina and Georgia where use exceeds production, release of FOR stocks was associated with rising State prices relative to the U.S. average, or changes that were statistically insignificant. The statistical models may not have been discriminating enough to separate the supply and demand effects on prices in some of the States.

There are pros and cons to using a 5-day moving average of adjusted daily prices to determine the national average market price. Notable advantages of using the 5-day moving average market price include: 1) that price is timely due to its availability on a daily basis, 2) it is less costly, 3) the calculation is simple due to data being readily available from USDA agencies, or verified by market participants, and 4) the terminal markets included in computing the 5-day moving farm price tend to be highly representative of national price movements.

Despite the above advantages, there are a number of problems with the 5-day moving average market price. First, the 5-day moving average market price may not accurately approximate U.S. farm prices. Second, the assumed similarity in movement between prices in major markets and prices elsewhere may not always hold. Third, the relatively small number of major markets used may not be sufficient for commodities such as wheat that have a large number of classes and grades.

Concerns about the representativeness of the 5-day moving average price raise a question about whether U.S. farm prices could be better approximated by using a weighted rather than a simple average. A case study for corn which compares simple- and weighted-average prices suggests a close relationship between the two price series most of the time. However, it also suggests that when prices deviate sharply from average, the two series could give a different pattern of reserve release and closings.

The analysis was extended to compare three alternative ways of constructing the 5-day moving average adjusted price series: 1) a simple average (the current method), 2) a production-weighted average, and 3) a reserve-weighted average. There was generally a difference of only a few cents between the 5-day average adjusted prices based on the simple, production-weighted, and reserve-weighted daily prices.

Setting release prices in each State by adjusting the single national release price by the normal State-U.S. price difference, among other things, would narrow the State-U.S. grain price differentials for States where an abnormally wide differential has been the case during release status. Conversely, setting release prices this way would widen the State-U.S. grain price differentials for States where an abnormally narrow price difference has been the case.

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INTRODUCTION

Since its inception about 7 years ago, the farmer-owned reserve (FOR) program has been implemented as a longer term grain storage program in an effort to support and stabilize grain prices. During this period, the reserve was in release status intermittently, allowing grain to be withdrawn from the reserve. The corn reserve was in release status intermittently for about 25 months and the sorghum reserve was in that status for 10 months. The wheat reserve was in release status for about 26 months, all prior to January 6, 1981. Farmers in some grain-producing States like Nebraska where both corn and sorghum reserves account for nearly 30 percent of national totals are concerned that release of FOR stocks may depress State grain prices to the extent that the normal (average) State-U.S. price differentials are distorted. A related concern is whether an alternative release mechanism would have a different effect on grain price differentials.

In 1984, the Committee on Appropriations, U.S. House of Representatives, requested a study of the farmer-owned reserve. The study was subsequently mandated by the committee's report 98-809. The report requires " ...that a study be conducted to determine the effects on monthly State cash grain prices as stocks go in and out of release status and taking into account price differences due to volume of grain in the reserve for each State." The report further requires that "...Recommendations should be included as to how the release mechanism, national average price calculation, and differentials between States and between months may be minimized."

This report has been prepared in response to the committee's request. It covers the issues specified in the committee's report and issues raised in discussion with committee staff. The report presents an overview of the operation of the FOR, quantifies relationships between reserve activities and State grain prices, and discusses the FOR release mechanisms and some alternatives to the current release mechanism. In the analysis, it is assumed that monthly State grain prices received by farmers can be used as a proxy for monthly State cash grain prices. This permits a more complete analysis without being restricted by only a few terminal market prices.

THE OPERATION OF THE FARMER-OWNED RESERVE: AN OVERVIEW

The Food and Agriculture Act of 1977 authorized operation of the FOR program to support and stabilize grain prices and to assure a dependable grain

supply. The program attempts to stabilize grain prices by inducing producers to place their grain into the reserve when prices are low and by permitting the release of grain from the reserve when prices are high. Farmers may normally place grain in the reserve after regular 9-month Commodity Credit Corporation (CCC) loans mature. Compliance with acreage reduction programs has been a condition of eligibility. Under the FOR program, farmers agree to hold their grain in storage until maturity of the contract (initially 3 years, but now 3 to 5 years), or until a specified release price is reached in the market. In return for placing grain in the reserve, farmers receive a loan, annual payments for storing their grain (presently 26.5 cents a bushel for wheat, corn, sorghum and barley, and 20 cents a bushel for oats), and a waiver of interest on the loan after the first year of the contract.

At the inception of the FOR, reserve loan rates were the same as regular CCC loan rates. During 1980-82, however, the FOR was implemented as a price enhancement tool by offering farmers reserve loans at rates higher than regular CCC loans. For example, corn producers were offered a $2.90-per-bushel reserve loan rate in 1982, 35 cents higher than the $2.55-per-bushel regular CCC loan rate (table 1). It was even 20 cents above the corn target price. The higher reserve loan rates contributed to the buildup of FOR stocks. Ending stocks of FOR grain (both on- and off-farm) in 1982/83 totaled 1.1 billion bushels of wheat, 1.8 billion bushels of corn, and 171 million hundredweights of sorghum (app. table 1). Since 1983, reserve loan rates have been identical to regular CCC loan rates.

Table 1. Regular CCC loan rates and reserve loan rates: 1978-84 crops

Item	Wheat	Corn	Sorghum	Barley	Oats
		Dollars per bushel			
Regular loan rate:					
1978	2.35	2.00	1.90	1.63	1.03
1979	2.50	2.10	2.00	1.71	1.08
1980	3.00	2.25	2.14	1.83	1.16
1981	3.20	2.40	2.28	1.95	1.24
1982	3.55	2.55	2.42	2.08	1.31
1983	3.65	2.65	2.52	2.16	1.36
1984	3.30	2.55	2.42	2.08	1.31
Reserve loan rate:					
1978	2.35	2.00	1.90	1.63	1.03
1979	2.50	2.10	2.00	1.71	1.08
1980	3.30	2.40	2.28	1.95	1.23
1981	3.50	2.55	2.42	2.07	1.31
1982	4.00	2.90	2.75	2.37	1.49
1983	3.65	2.65	2.52	2.16	1.36
1984	3.30	2.55	2.42	2.08	1.31

"Release" and "call" prices are used to release grain from the reserve when prices are high. In earlier years, FOR stocks were in release and call when the national average market prices reached established percentages of the national average loan rate known as the release and call prices. The percentage required to reach the call price was higher than for the release price. Beginning in 1981, however, release and call prices were expressed as flat rates. When FOR stocks are in release status, farmers may (1) redeem the loan and sell the grain in open markets or hold the grain, or (2) leave the grain in the reserve. Prior to July 1981, interest waivers after the first year of the contract continued, even if the FOR was in release status. This provided a disincentive for farmers to redeem their loans if the interest subsidy exceeded storage costs. Storage payments are presently discontinued and interest is charged if farmers choose not to redeem their loans when FOR stocks are in release status. By contrast, when FOR stocks are in call status, farmers are given 90 days after the call either to redeem the reserve loan or forfeit their grain to the CCC.

Defining Reserve Classes

Release and call prices vary depending upon the time at which the reserve loan contract is signed. Release prices were set initially at 140 percent of the current national average loan rate for wheat and 125 percent for feed grains if these grains entered the reserve before January 7, 1980 (Reserve I). These prices are still in effect unless a conversion agreement to a later reserve has been signed. Reserve I call prices were set at 175 percent of the national average loan rate for wheat and 140 percent for feed grains. Feed grain release and call prices were set proportionately lower than those for wheat in order to limit the effects of grain price variability on the livestock sector.

Farmers with reserve agreements were permitted as of January 7, 1980, to convert to Reserve II by signing a new reserve agreement. Release prices for Reserve II stocks were set at 150 percent of the national average loan rate for wheat and 125 percent for feed grains. Call prices were set at 185 percent of the national average loan rate for wheat and 145 percent for feed grains. Storage payments since January 7, 1980: 26.5 cents a bushel for wheat, corn, sorghum and barley, and 20 cents a bushel for oats. In addition, the first-year interest on corn reserve loans, as well as the second- and third-year interest, was waived for farmers who entered corn in the reserve between October 22, 1979, and August 25, 1980.

Reserve agreements approved on or after August 25, 1980, and before Reserve IV was implemented (July 31, 1981, for wheat and October 6, 1981, for corn, sorghum, and barley) were classified as Reserve III. Farmers with grain then under loan or eligible for loan were permitted to enter the reserve unless the commodity was in call status. Farmers with Reserve I and Reserve II agreements were allowed conversion to Reserve III by signing a new agreement, unless the commodity was in call status. Release prices were set at 140 percent of the national loan rates for wheat and 125 percent for feed grains. Call prices were set at 175 percent for wheat and 145 percent for feed grains.

Reserve agreements approved on or after July 31, 1981, for wheat and October 6, 1981, for corn, sorghum, and barley, and before Reserve V was implemented (May 14, 1982, for all wheat and barley; July 1, 1982, for corn and sorghum; and August 2, 1982, for oats) were classified as Reserve IV. Release and call

prices were expressed as flat rates instead of being based on percentages of the national average loan rates.

Reserve agreements approved on or after May 14, 1982, for all wheat and barley; July 1, 1982, for corn and sorghum; and August 2, 1982, for oats, and before Reserve VI was implemented (January 19, 1984, for all wheat) were classified as Reserve V. Entry of 1983-crop feed grains was permitted into Reserve V after the regular 9-month CCC loan matured.

All reserve agreements approved on or after January 19, 1984, were classified as Reserve VI. Farmers have been permitted to enter 1983-crop wheat into Reserve VI after the regular 9-month loan matured. Entry of eligible grain into Reserve V and Reserve VI is authorized anytime release is not in effect for the respective commodity. Reserve agreements are limited to a total of 5 years in Reserves III, IV, V, and VI.

Release and call prices and volumes of FOR stocks as of November 21, 1984, are shown in table 2. Prior to December 1981, the Government did not sell CCC stocks into the open market at a price less than 105 percent of the call price, or the market price, whichever is higher. Since then, the Government has not sold CCC stocks on the open market at a price of less than 110 percent of the release level for the reserve in effect.

History of FOR Release

U.S. farmers began placing their grain in the FOR in June 1977 for wheat and February 1978 for corn and sorghum. The corn reserve was not in release status until June 19, 1979, when the 5-day moving average farm price reached $2.52 a bushel, which exceeded the $2.50 release price (125 percent of loan rate). (The 5-day average farm price is examined in detail in a later section.) According to operating regulations of the FOR, once the reserve is in release the reserve will remain in that status for the remainder of that month and the entire ensuing month. On August 1, 1979, however, the release was stopped because the 5-day moving average corn price was down to $2.47 a bushel. When the corn reserve hit release status again in the summer of 1980 following an earlier release on October 3, 1979, the release continued for a few months until the reserve was called on October 31, 1980, for Reserve I, and on January 16, 1981, for Reserves II and III.

The volume of corn in the U.S. FOR and changes in these stocks, indicating entry or withdrawal during 1978-84 are given in figure 1 and appendix table 1. The release histories for corn reserves I, II, and III are summarized in table 3.

After the second consecutive announcement of release (at the end of the first full month of release), storage payments ordinarily made for FOR grain were stopped, but no interest was charged prior to 1981 despite the release status. However, exceptions were granted to States, indicated in table 3, where the State's mid-month average price received by farmers was less than the State's average loan rate plus the difference between the national average loan rate and the release level. In these cases, farmers in the exempt States were permitted to continue receiving storage payments and interest waiver.

Following the drought in the summer of 1983 and the payment-in-kind (PIK) program, feed grain prices surged to a new high. As a result, corn

Table 2. Release prices, call prices, and volumes of U.S. FOR stocks by reserve class, November 21, 1984

Item	Wheat	Corn	Sorghum	Barley	Oats
			Dollars per bushel		
Release price:					
Res. I	4.62	--	--	2.04	--
II	4.95	--	--	2.60	--
III	4.62	--	--	2.60	--
IV	4.65	3.15	3.00	2.55	--
V	4.65	3.25	3.10	2.65	1.65
VI	4.45	n.a.	n.a.	n.a.	n.a.
Call price:					
Res. I	5.78	--	--	2.28	--
II	6.11	--	--	3.02	--
III	5.78	--	--	3.02	--
IV	4.65	3.15	3.00	2.55	--
V	n.a.	n.a.	n.a.	n.a.	n.a.
VI	n.a.	n.a.	n.a.	n.a.	n.a.
			Million bushels		
FOR stocks:					
Res. I	1.0	0	0	0.1	0
II	1.2	0	0	0	0
III	7.1	0	0	1.0	0
IV	57.1	114	65.9	7.2	0
V	388.9	304	110.7	89.5	3
VI	216.2	n.a.	n.a.	n.a.	n.a.

n.a. = Not applicable.
-- = No longer in effect.

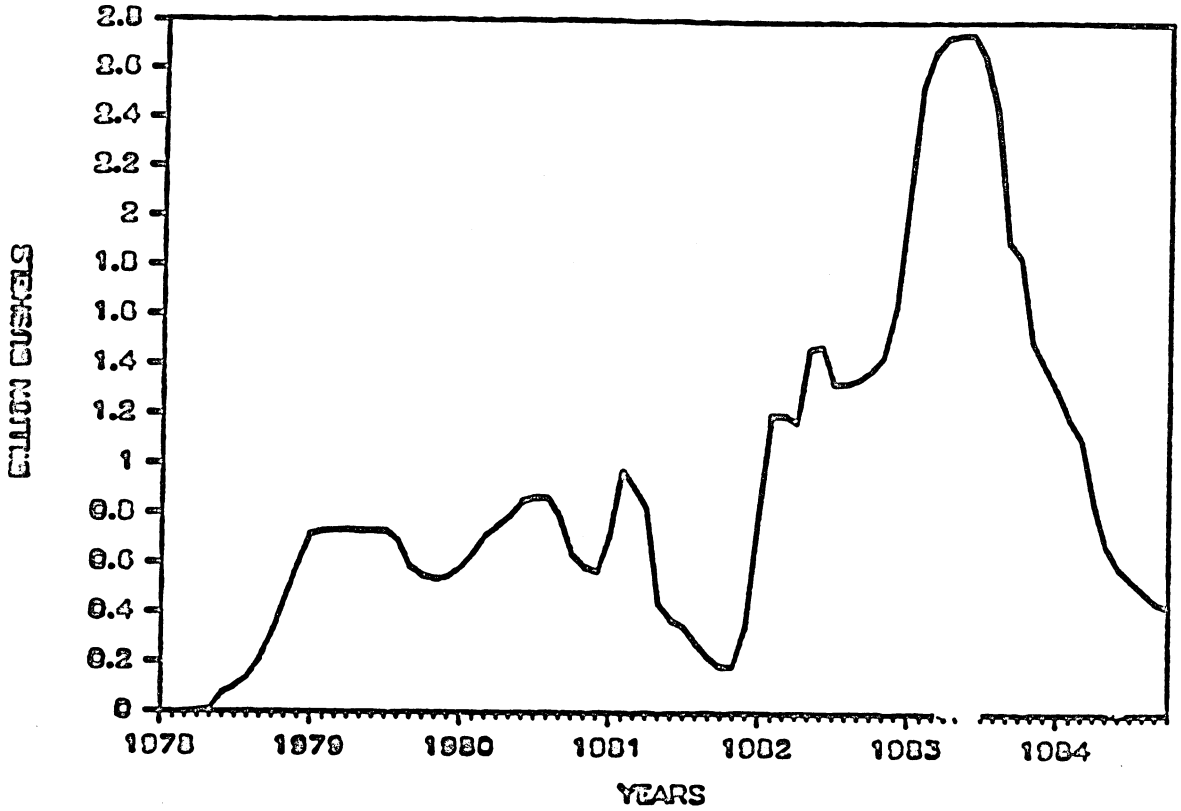
Table 3. Release history for corn reserves I-III

Reserve I		Reserve II		Reserve III	
Release	6/19/79	Release	7/11/80	Release	8/29/80
Stop release	8/1/79	Stop stor. pay.	9/5/80 1/	Stop stor. pay.	10/3/80 2/
Release	10/3/79	Cont. release	10/3/80 2/	Cont. release	11/5/80 3/
Stop release	11/30/79	Cont. release	11/5/80 3/	Cont. release	12/1/80 4/
		Cont. release	12/1/80	Call	1/16/81
Release	7/11/80 1/	Call	1/16/81		
Stop stor. pay.	9/5/80				
Cont. release	10/3/80 2/				
Call	10/31/80				

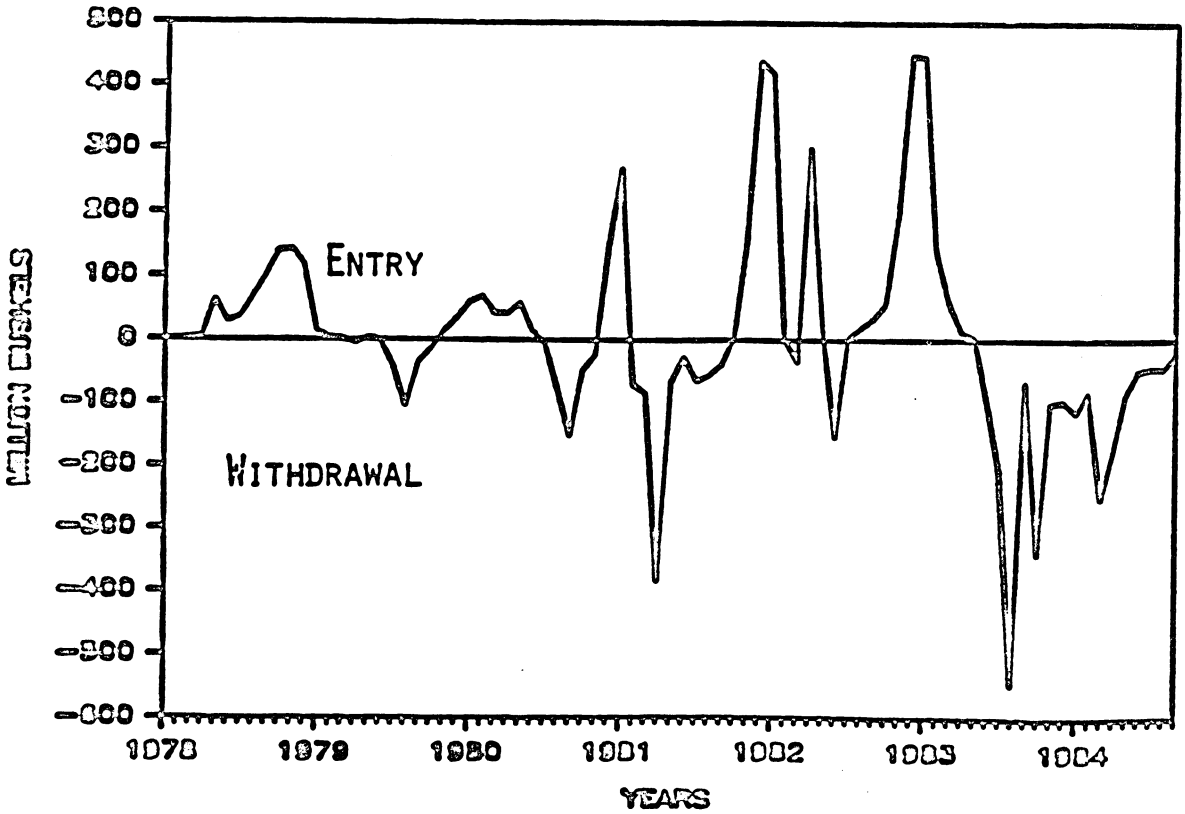
1/ Except for Colorado, Minnesota, Montana, North Dakota, and South Dakota.
2/ Except for Montana, North Dakota, and South Dakota.
3/ Except for Montana and North Dakota.
4/ Except for Montana.

FIGURE 1

CORN IN U.S. FOR



CHANGE IN U.S. CORN FOR



stocks in Reserves IV and V were generally in release status from the mid-July of 1983 until October 1, 1984, for Reserve IV and August 1, 1984, for Reserve V when the releases were stopped. Thus, the release of corn reserve occurred concomitantly with the disbursement of most PIK entitlements during September 1983 through March 1984. Since July 1981, storage payments have been discontinued and interest has been charged when the reserve is in release status. The details are summarized in table 4.

The level and change of sorghum and wheat quantities within the FOR during 1978-84 are given in figures 2 and 3, and appendix table 1. The release history for the two commodities is summarized in tables 5 and 6.

RELATIONSHIP BETWEEN RESERVE ACTIVITIES AND STATE GRAIN PRICES

This section presents theoretical reasoning and empirical evidence of the effects of releasing FOR stocks on State grain prices received by farmers. Previous related studies are first reviewed to determine the relationships between reserve activities and grain prices which have been identified by earlier studies. The historical differences between State and U.S. grain prices are then examined. Average State and U.S. price differentials are compared for all months and release and nonrelease months during 1978-84. Effects of releasing FOR stocks on State and U.S. grain prices and on the State-U.S. price differentials are then discussed for selected States. These States were selected for analysis to reflect various combinations of grain production and FOR stocks. For example, Iowa and Nebraska were selected because of their high corn FOR stocks and corn production. By contrast, Illinois was selected to reflect its high corn production but low FOR stocks. North Carolina, Pennsylvania, and Georgia were selected for their low corn production and low FOR stocks. Grain production, price, and stock data for the selected States are shown in appendix tables 2, 3, and 4.

Previous Related Studies

Past research has focused primarily on the effects of the FOR program on U.S. prices for the reserve crops and on levels of carryover stocks. The conclusions of these studies have been somewhat mixed. Much of the debate has centered on the effectiveness of the FOR to add to total stocks and hence price stability. Increased inventory levels tend to reduce price variability as stocks are able to buffer the effects of supply and demand changes over time. A central question thus becomes: do increases in the FOR necessarily result in an increase in total stocks, or do they merely represent stocks that would have otherwise been held by private inventory holders? This latter effect--known as the substitution effect--has been the subject of the majority of research on the FOR. Table 7 summarizes the major findings of this body of research.

The table presents the estimated effect of a one-bushel increase in FOR stocks on the level of total inventories. Numbers close to one suggest that the FOR is effective in adding to total stocks, while numbers close to zero suggest that inventories placed in the FOR are stocks which would have been otherwise held in private hands. In the latter case, while the FOR may have acted as a price support mechanism, the minimal additions to total stocks suggest that price variability was unaffected. For corn, estimates vary from a low of 0.25 bushels reported by Salathe and others to between 0.6 and 0.8 bushel estimated by Meyers and Ryan. The estimated effects on total wheat stocks ranged from

Table 4. Release history for corn reserves IV and V

Reserve IV		Reserve V	
Release	7/15/83	Release	7/26/83
Cont. rel.	9/2/83	Cont. rel.	9/2/83
Cont. rel.	10/3/83	Cont. rel.	10/3/83
Cont. rel.	11/1/83	Stop rel.	11/1/83
Cont. rel.	12/1/83	Release	11/2/83
Cont. rel.	1/3/84	Cont.	1/3/84
Stop rel.	2/2/84	Stop rel.	2/2/84
Release	3/1/84	Release	3/7/84
Cont. rel.	5/1/84	Cont. rel.	5/1/84
Cont. rel.	6/1/84	Cont. rel.	6/1/84
Cont. rel.	7/1/84	Cont. rel.	7/1/84
Stop rel.	8/1/84	Stop rel.	8/1/84
Release	8/6/84		
Stop rel.	10/1/84		

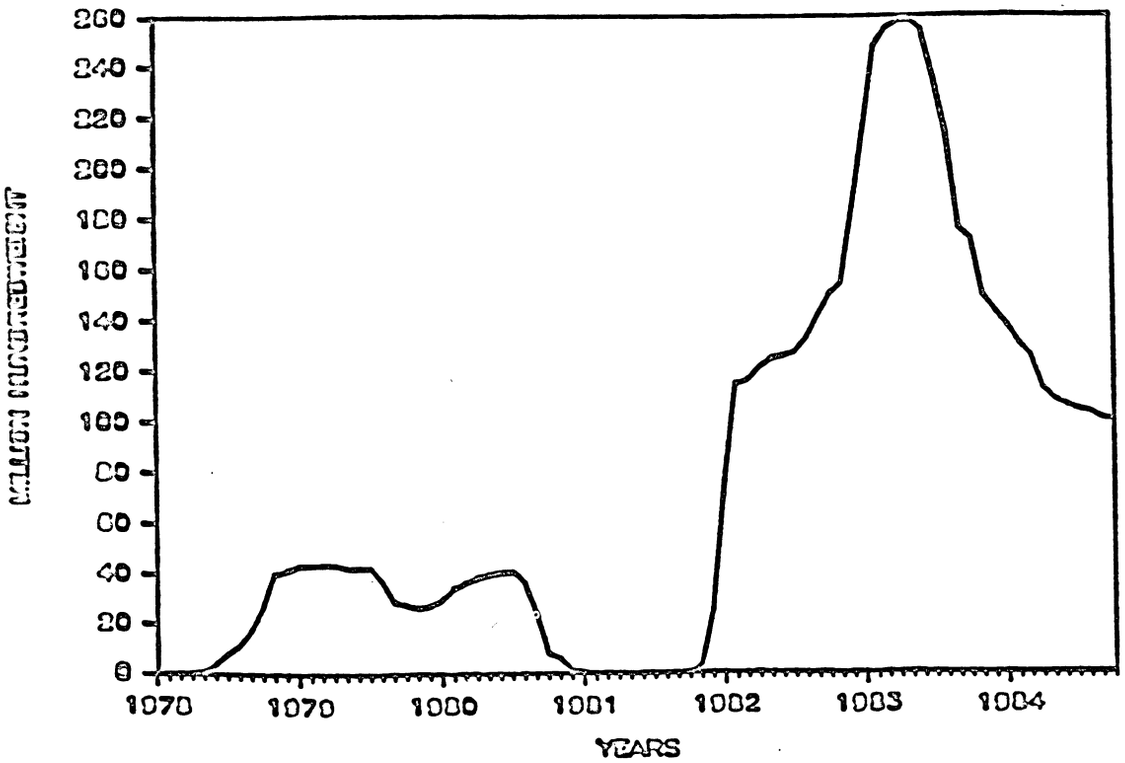
Table 5. Release history for sorghum reserves

Reserve I		Reserve II		Reserve III		Reserve IV	
Release	6/22/79	Release	7/2/80	Release	8/29/80	Release	8/3/83
Stop rel.	8/1/79	Call	7/25/80	Stop stor. pay.	10/3/80 1/	Cont. rel.	10/3/83
Release	9/6/79			Call	10/31/80	Stop rel.	11/1/83
Stop rel.	10/31/79						
Release	7/2/80						
Call	7/17/80						

1/ Except for Minnesota and South Dakota.

FIGURE 2

SORGHUM IN U.S. FOR



CHANGE IN U.S. SORGHUM FOR

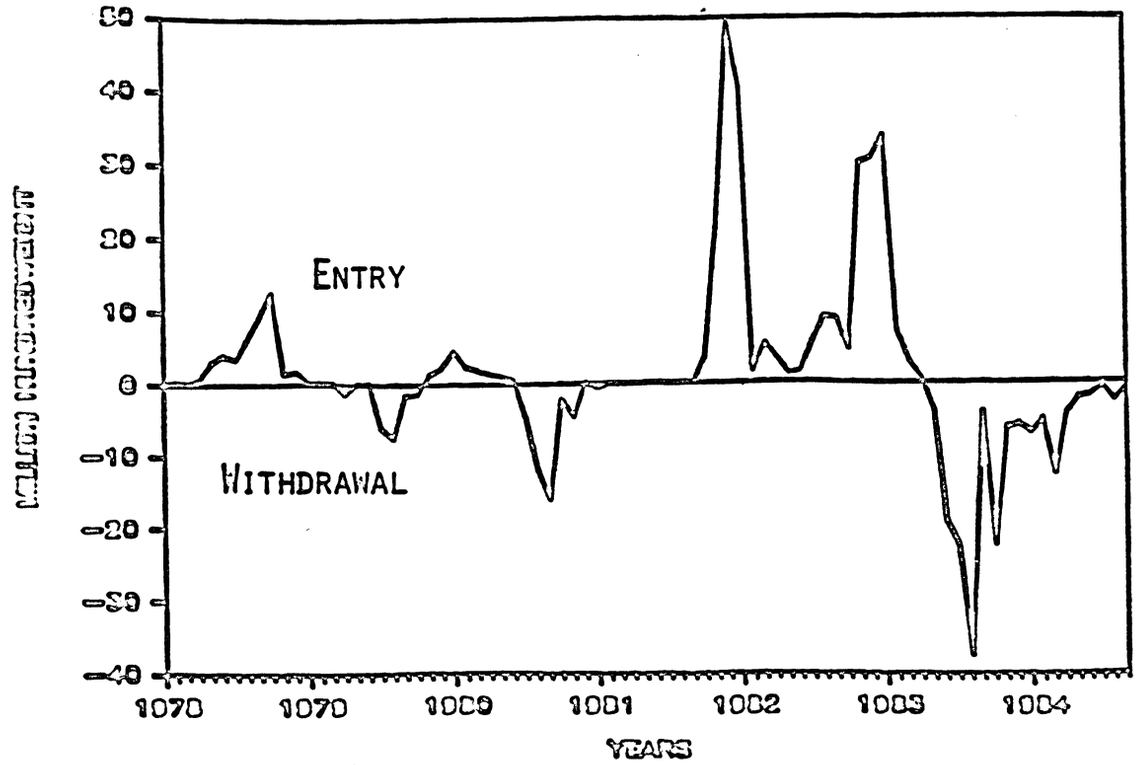
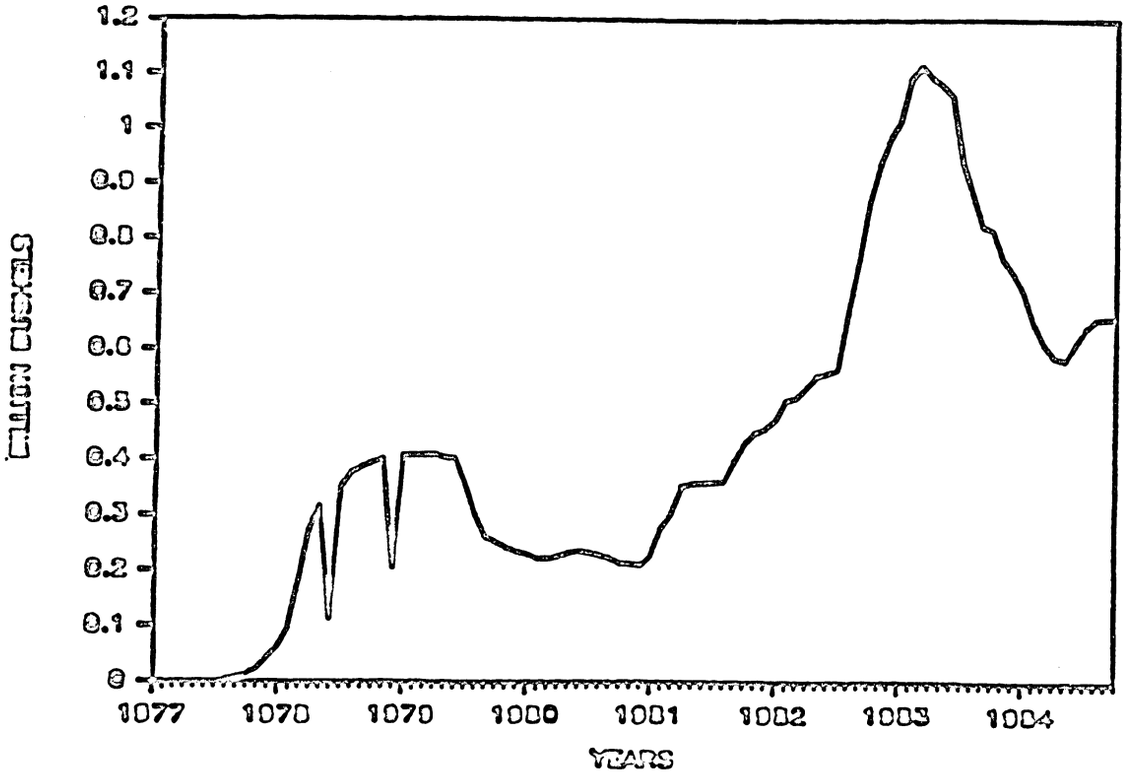


FIGURE 3

WHEAT IN U.S. FOR



CHANGE IN U.S. WHEAT FOR

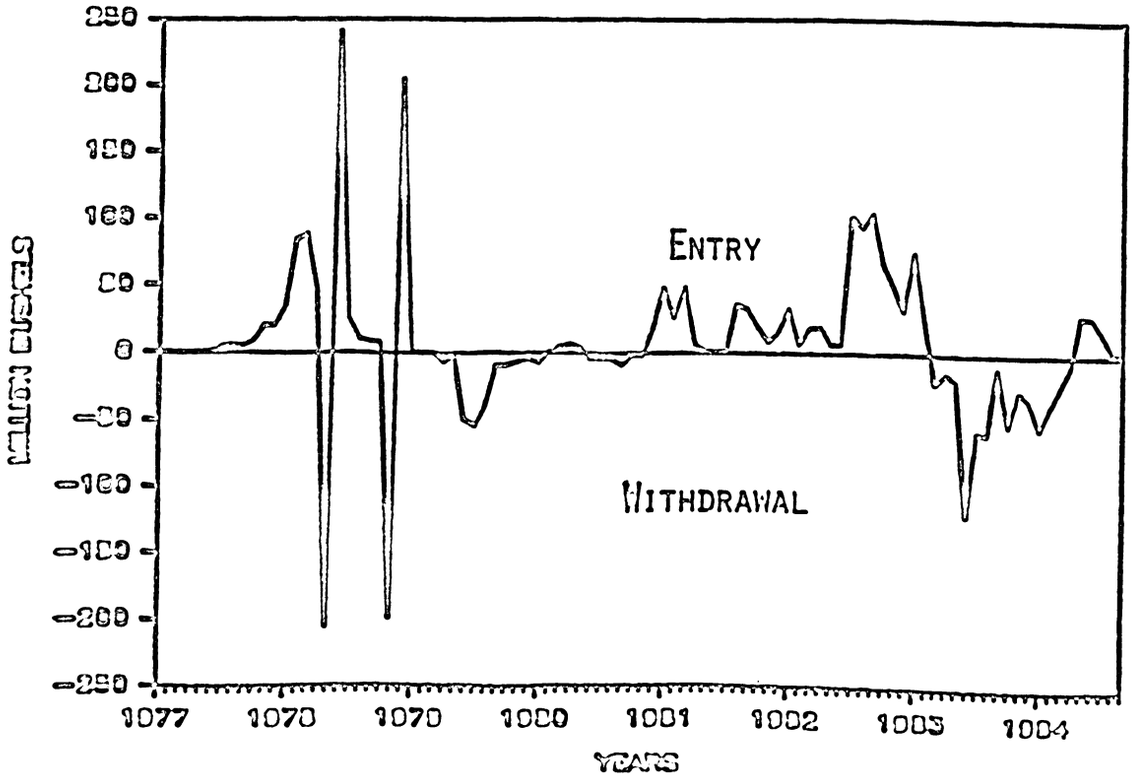


Table 6. Release history for wheat reserves

Reserve I		Reserve II		Reserve III	
Release	5/16/79	Release	1/18/80	Release	10/20/80
Cont. rel.	6/30/79	Stop rel.	3/3/80	Cont. rel.	12/1/80
Cont. rel.	7/2/79	Release	7/8/80	Stop rel.	1/6/81
Cont. rel.	8/1/79	Stop rel.	9/5/80		
Cont. rel.	9/4/79				
Cont. rel.	9/28/79				
Cont. rel.	10/31/79				
Cont. rel.	11/30/79				
Cont. rel.	12/30/79				
Cont. rel.	1/31/80 1/				
Cont. rel.	2/29/80 2/				
Cont. rel.	3/31/80 2/				
Stop rel.	5/2/80				
Release	5/8/80				
Cont. rel.	6/30/80 3/				
Cont. rel.	8/6/80 4/				
Stop rel.	9/5/80				
Release	10/20/80				
Cont. rel.	12/1/80 5/				
Stop rel.	1/6/81				

1/ Except for Idaho, Minnesota, North Dakota, and South Dakota.
2/ Except for Minnesota and South Dakota.
3/ Except for Colorado, Kansas, Michigan, Missouri, New Mexico, Oklahoma, Oregon, Texas, and Washington.
4/ Except Idaho.
5/ Except for Colorado, Idaho, Oregon, Utah, Washington, and Wyoming.

Table 7. Increase in total stocks due to a one-bushel increase in FOR stocks

Study	Period	Corn	Sorghum	Wheat
		Bushels		
Sharples and Holland (1981)	1978	--	--	0.6-0.87
Gardner (1981)	1977-78	0.39	--	.26
Just (1981)	1977-79	.50	--	.20
Meyers and Ryan (1981)	1978-80	.6-.8	--	.6-.8
Salathe, Price, and Banker (1984)	1983	.25	0.16	.70

-- = Not reported.
Sources: (2), (3), (4), (5), and (7).1/

1/ Italicized numbers in parentheses refer to items listed in the References at the end of this report.

as low as 0.2 bushel reported by Just to almost 0.87 bushel estimated by Sharples and Holland. The differences suggest that perhaps the rate of substitution is not constant at all price and inventory levels, and that it may differ during periods of price increases compared with price declines (7).

Most of the studies agree that the FOR has bolstered grain prices, especially wheat, although there is some disagreement over how much prices have risen as a result of the program. In general, the FOR loan rate seems to have augmented the regular loan rate in providing a price floor but has been less successful in reducing price variability. Salathe and others argue that the FOR has not contributed significantly to price stability, a conclusion affirmed by Gardner. Just has argued that the FOR may have actually contributed to price destabilization, at least in its initial phase when program provisions underwent frequent changes.

The focus of most of the research has centered on the effects of the FOR on national price. Little attention has been given to its effect on individual States or marketing regions. Because of the uniform provisions of the FOR program, producer response may vary from region to region because of the spatial variation in market conditions. For example, when reserves are in release status, do producers in Iowa respond in the same manner as producers in Pennsylvania? While cash prices in surplus regions such as Iowa may fall below national averages, prices in deficit areas (where grain consumption exceeds production) such as Pennsylvania typically exceed national averages. Yet, as discussed previously, the release status of the reserve program is determined when a 5-day moving average national price exceeds the established release price. The reserve program thus may have a differential impact when viewed from a regional perspective.

Burnstein (1) examined the rates of response to the release status across regions during the periods when wheat was in release status: October 27 to December 29, 1979, and January 12 to March 19, 1980. Table 8 summarizes his findings. The table presents the redemption rate of various States for the release of wheat, as well as average farm prices during those months. The two periods show producers' rates of redemption just prior to and following a change in the release price. For the first period (October 24-December 26, 1979), the release price was $3.29 a bushel. Following the suspension of grain sales to the USSR in January 1980, the release price was raised to $3.75 a bushel.

From these results, Burnstein identified three major determinants of redemption rates:

1. Expected rate of return. When reserves go into release status, the storage subsidy is discontinued and the producer must decide whether to continue in the reserve. Producers will continue only if the expected return per bushel of FOR grain is greater than the actual return if the grain was immediately released onto the market. The table demonstrates that producers generally choose to redeem their loans in those States where prices were higher. Also, redemption rates were generally higher for grain stored in off-farm facilities, reflecting the higher storage costs of commercial facilities.

Table 8. Wheat reserve activity, October-December 1979 and January-March 1980

Production regions	October 24 - December 26, 1979					January 12 - March 19, 1980				
	Average farm price			Redemption rate		Average farm price			Redemption rate	
	Oct.	Nov.	Dec.	Total	Off-farm	Jan.	Feb.	Mar.	Total	Off-farm
	Cents/bu.			Percent 1/		Cents/bu.			Percent 1/	
Central and Southern Plains:										
Colorado	356	369	365	5.7	10.3	368	356	339	12.1	22.0
Nebraska	373	381	380	6.1	11.8	373	365	339	12.4	20.4
Kansas	391	393	387	7.3	11.9	371	377	352	17.6	22.3
Texas	395	407	409	15.6	16.5	397	390	368	23.0	22.8
Oklahoma	413	415	406	12.5	13.1	398	387	372	17.2	19.6
Northern Plains:										
South Dakota	397	383	344	7.6	15.9	352	340	342	9.6	22.6
Montana	380	374	370	5.8	20.6	363	361	355	9.3	22.1
Minnesota	388	382	360	6.6	14.3	363	355	355	5.1	9.1
North Dakota	423	403	363	6.4	7.6	369	362	364	7.1	9.1
Eastern Corn Belt:										
Missouri	390	377	382	5.0	14.9	389	377	368	30.8	24.4
Indiana	400	370	394	1.1	1.6	408	407	385	5.2	6.6
Illinois	394	402	395	20.6	0	406	406	389	28.4	51.9
Ohio	417	399	413	27.9	17.9	409	416	395	29.8	87.5
Pacific Northwest:										
Idaho	368	369	361	9.7	28.0	338	355	354	15.6	17.7
Oregon	393	385	379	9.8	6.1	372	388	374	7.1	11.6
Washington	401	402	390	11.1	17.8	386	397	385	7.2	12.4

1/ Redemptions as a percent of total FOR stocks and FOR stocks stored in off-farm facilities prior to the date when the reserve is in release status.

Source: (1).

2. Availability of onfarm and off-farm storage facilities. Associated with the cost of storage is the availability of storage facilities. As competing crops are harvested, pressure is placed on available storage space. This is particularly true in the Corn Belt States where soybeans must compete with corn for binspace. Not surprisingly, off-farm redemption rates in the Eastern Corn Belt tended to be higher than those in other regions, particularly in States such as Missouri and Ohio where commercial rates for storage are high.

3. Price differentials among wheat classes. Most of the reserves are located in the Central and Southern Plains where hard red winter wheat is the dominant class. Redemption rates showed some variation in regions where other classes of wheat were more dominant.

While useful in identifying some of the factors experiencing variations in redemption rates across States, Burnstein's study did not address the effect of FOR release on State prices. Would grain price in a State with large FOR stocks be affected disproportionately in relation to the national price if large volumes of stocks are released onto the market? Conversely, would release of FOR stocks have only minimal effects on grain prices in States where FOR levels are quite small relative to total stocks? Thus, because it alters local available supplies, FOR release may affect State-U.S. price differentials. An analysis of how release activities affect State prices is presented in the following sections.

Grain Price Differentials

Grain prices in deficit areas tend to be higher than those in surplus areas. For example, while corn prices received by Iowa farmers in October 1982--the active time of harvesting the 1982 corn crop--averaged $1.99 a bushel, farmers in Georgia received $2.30 a bushel. The 31-cent price differential basically reflected the cost of handling and transporting corn from Iowa (a surplus corn-producing State) to Georgia (a deficit State). Meanwhile, farmers in Nebraska were paid $2.14 for a bushel of corn, which was lower than the price in Georgia but higher than that in Iowa.

What is less well known is the specific grain price relationship between the State and the national level. Are corn prices in surplus producing States necessarily lower than the U.S. average price? Why do farmers in Illinois tend to receive corn prices higher than the national level? Does the price differential vary in response to the seasonal pattern of corn prices? What are the other factors (e.g., domestic consumption, grain exports, transportation cost) which cause the price differential to vary from month to month? To what extent does the release of FOR stocks contribute to the movement in price differentials? This section begins the inquiry of the above questions by illustrating how the grain price differentials vary among States for corn, sorghum, and wheat. The objective of the section is to show that on average grain price differentials are to be expected and that there are economic reasons for them. The readers are encouraged to refer to appendix figure 1 when following the discussion below. All price differentials are expressed in 1972 dollars hereafter unless indicated otherwise.

Corn

South Dakota, Minnesota, Iowa, Wisconsin, and Nebraska are examples of surplus producing States where corn prices averaged below national averages during 1978-84. Corn production in South Dakota increased drastically from 37 million bushels in 1976 to 127 million in 1977. South Dakota corn production is estimated at 194 million bushels in 1984. In the absence of easy access to the river system, interstate shipments of corn from South Dakota must be made by a truck and rail combination, which is more expensive than barge. Due to relatively high transshipment cost, corn prices in South Dakota are sufficiently below the national average so that South Dakota can effectively compete for interstate or export shipments of corn (app. fig. 1). During 1978-84, corn prices in South Dakota averaged about 13 cents (in 1972 dollars) a bushel below the national average, or 30 cents in 1984 dollars (table 9).

Aside from 1983, Minnesota has been producing corn at about 700 million bushels annually in recent years, a level quite comparable with corn production in Indiana. Despite Minnesota's access to Great Lakes, the long distance from Gulf ports makes Minnesota less effective in competing for export shipments than States like Illinois, Indiana, and Iowa. As a result, corn prices in Minnesota averaged about 11 cents a bushel (in 1972 dollars) lower than the national average during the past 7 years (table 9).

Iowa, the leading corn-producing State since 1978, is one of the largest surplus States. The 1984 crop is estimated at 1.4 billion bushels, nearly 20 percent of U.S. production. Besides being consumed in Iowa, corn has been shipped to the Southeast for poultry feeding and to the Gulf ports via the Mississippi River. The large volume of interstate shipments and export sales--924 million bushels in 1977--together with access to the Mississippi River helped narrow the corn price differential between Iowa and the United States. Also, because Iowa accounts for such a large portion of U.S. production, its prices heavily influence the U.S. price. Corn prices received by farmers in Iowa averaged only 4.8 cents (in 1972 dollars) a bushel lower than the U.S. average (table 9).

Wisconsin, although an important corn-producing State, typically produces only about half of the volume in Minnesota. A good portion of corn produced in the State is used as the primary source of energy in dairy feed rations. In recent years, however, cash grain production has risen in the southern portion of the State. In addition, access to Great Lakes and a somewhat shorter distance to the Gulf ports brings higher corn prices for the volume exported than in nearby Minnesota. Consequently, corn prices received by farmers in Wisconsin averaged only about 4 cents a bushel (in 1972 dollars) lower than the U.S. price, compared with the 11-cents-a-bushel price differential in Minnesota (table 9).

The locational shift of cattle feedlots from the Corn Belt to the Central Plains since the 1970's has increased feed use of corn in Nebraska. Although monthly corn prices received by farmers in Nebraska averaged about 8 cents a bushel below the U.S. level in late 1983 and early 1984, at other times, corn prices in Nebraska on average have not greatly differed from the U.S. level. The release of FOR stocks and PIK entitlements, expanded wheat feeding, and relatively less severe drought in Nebraska all contributed to the widened price differentials in late 1983 and early 1984. With corn production exceeding 750 million bushels in recent years (excluding 1983), Nebraska corn

Table 9. Average State-U.S. corn price differentials for selected States, 1978-84

State	All months	During release months	During nonrelease months	Difference between release and all months
		Cents per bushel ($1972)		
Nebraska	-1.43	-2.46	-0.98	-1.03
Iowa	-4.84	-4.44	-5.01	+0.40
Illinois	3.27	3.41	3.22	+0.14
Indiana	4.07	6.65	2.94	+2.58
Ohio	3.98	5.61	3.26	+1.63
Minnesota	-11.15	-10.71	-11.35	+0.44
North Carolina	19.09	23.24	17.27	+4.15
Kansas	7.79	7.50	7.92	-0.29
Pennsylvania	23.66	30.52	20.65	+6.86
Georgia	21.52	23.79	20.52	+2.27
South Dakota	-13.37	-13.10	-13.49	+0.27
Wisconsin	-3.95	-2.22	-4.71	+1.73
		Cents per bushel ($1984)		
Nebraska	-3.21	-5.52	-2.20	-2.31
Iowa	-10.86	-9.97	-11.24	+0.89
Illinois	7.34	7.65	7.23	+0.31
Indiana	9.13	14.93	6.60	+5.80
Ohio	8.93	12.59	7.32	+3.66
Minnesota	-25.03	-24.04	-25.47	+0.99
North Carolina	42.85	52.16	38.76	+9.31
Kansas	17.48	16.83	17.78	-0.65
Pennsylvania	53.10	68.50	46.35	+15.40
Georgia	48.30	53.39	46.06	+5.09
South Dakota	-30.01	-29.40	-30.28	+0.61
Wisconsin	-8.87	-4.98	-10.57	+3.89

farmers received only 1.4 cents (in 1972 dollars) a bushel, or 3.2 cents in 1984 dollars, below the national average during 1978-84 (table 9). Unlike Illinois, where barge shipments of corn can generally be made via the Mississippi River all year, Nebraska ships most of its corn by rail to either the Pacific or the Gulf ports for export. Alternatively, corn can be consumed within the State (mainly for cattle feeding) or shipped to other States. Part of the interstate shipments can eventually be further shipped to a Gulf port for export via the Mississippi River. Nebraska-U.S. corn price differentials tend to be narrower than normal when there is a strong export demand from the Far East (mainly Japan) for U.S. corn, especially since 1980 when unit-train rates from Nebraska to Pacific ports became more common.

Illinois has been second only to Iowa in corn production since 1978. Yet despite being a corn surplus State, its prices have been above the national average. Easy access to the Mississippi and Illinois Rivers makes barge shipments of corn from Illinois to Gulf ports possible at a low rate. Favorable unit-train rates also provide land-locked areas within Illinois access to the Atlantic and Gulf export ports. In 1977, Illinois accounted for 38 percent of the total volume of corn shipped to ports for export and was the leading corn export State. Declining spot rates for barge shipments in recent years further expanded corn shipments to the Gulf. Export sales of corn from Illinois in 1977 were twice the amount from Iowa, even though the latter is the leading corn-producing State. Thus, corn prices in Illinois averaged 3.3 cents a bushel (in 1972 dollars) higher than the national average during 1978-84 (table 9).

Contrary to the experience of many surplus States, corn prices received by farmers tend to be above the national average in deficit States such as Pennsylvania, North Carolina, and Georgia. Inshipments of corn from the Corn Belt have been made into the deficit States for dairy production in Pennsylvania, for poultry feeding in Georgia, and for hog and poultry feeding in North Carolina. Corn prices in these receiving States have to be high enough to account for handling and transshipment costs from the Corn Belt before the shipments take place. During 1978-84, corn prices in these States averaged more than 20 cents a bushel (in 1972 dollars) above the national average (table 9).

Sorghum

The Northern Plains region has been known as one of the sorghum surplus areas. During 1978-84, sorghum prices received by farmers in Nebraska averaged 12.4 cents per hundredweight (in 1972 dollars) lower than the national average (table 10). In the meantime, sorghum prices in Kansas averaged only 4.7 cents per hundredweight lower than the U.S. average. The main reasons for this difference are: (1) Kansas has a shorter distance to ship sorghum to the Gulf port for exports than Nebraska and (2) sorghum in Kansas can be shipped to the Texas Panhandle area at a lower transportation cost than from Nebraska.

Production in Missouri has risen in recent years, particularly in the southeastern corner of the State where soybeans or sorghum are being double-cropped with wheat. Unlike other surplus States such as Kansas and Nebraska, prices in Missouri have tended to be slightly above the U.S. average due in part to the proximity of the growing poultry industry in Southern States (table 10).

Table 10. Average sorghum price differentials for selected States, 1978-84

State	All months	Release months	Nonrelease months	Difference between release months and all months
			Cents per cwt ($1972)	
Kansas	-4.65	-4.80	-4.62	-0.15
Texas	15.48	17.74	15.12	+2.26
Nebraska	-12.35	-15.49	-11.85	-3.14
Missouri	.025	-9.70	1.59	-9.73
Oklahoma	7.65	8.12	7.57	+.47
			Cents per cwt ($1984)	
Kansas	-10.44	-10.78	-10.37	-.34
Texas	34.74	39.82	33.94	+5.07
Nebraska	-27.72	-34.77	-26.60	-7.05
Missouri	.056	-21.77	3.57	-21.84
Oklahoma	17.17	18.22	16.99	+1.05

Oklahoma and Texas both have access to the Texas High Plains terminal market which generally commands a price premium over Kansas City. For example, No. 2 yellow sorghum was priced at around $5.70 per hundredweight at Texas High Plains on April 12, 1984, while the same quality was sold for only $5.36 per hundredweight at Kansas City. In addition, sorghum can be shipped to the Gulf easily from Oklahoma and Texas with the shortest distance among major sorghum-producing areas. Therefore, sorghum prices in Texas and Oklahoma tend to be higher than national average.

Wheat

Wheat prices vary depending on variety, grain quality, and access to domestic and international markets. Hard red winter wheat grown in the Plains, for example, commands a premium over soft red winter wheat produced in the eastern Corn Belt (Illinois, Indiana, Ohio, and Missouri). Similarly, soft white wheat grown in the Pacific Northwest and hard red spring and durum wheat grown in Minnesota, Montana, North Dakota, and South Dakota command a premium over winter wheat. In addition, export prices tend to command a premium over terminal cash market prices and cash grain bids at country elevators. For example, on April 12, 1984, No. 1 hard red winter wheat with ordinary protein content was offered at an FOB price of $4.29 a bushel at the Gulf. At the same time, the terminal market price at Kansas City was $3.92 per bushel, and cash grain bids at Kansas City ranged from $3.85 to $3.90 per bushel.

Kansas, Nebraska, Oklahoma, and Texas are the most important hard red winter wheat producing States. Nebraska wheat prices have tended to be lower than the national average, more so than those in Kansas (table 11). By contrast, Oklahoma wheat prices actually averaged higher than the national average during 1978-84 (table 11). Wheat farmers in Kansas and Nebraska have access to terminal markets such as Kansas City and Omaha. However, easier access from Kansas City to the Gulf ports primarily via rail than from Omaha contributes to higher wheat prices at Kansas City than at Omaha. Thus, Kansas wheat prices tend to be higher than those of Nebraska. Similarly, shipments of wheat from Oklahoma to the Gulf by rail brought higher wheat prices to producers in Oklahoma because of the shorter distance to the Gulf.

Wheat prices in Washington average higher than the national average because of the easy access to Pacific ports and a preference for this wheat in Asian markets. For example, No. 2 or better soft white wheat was priced at $4.12 a bushel on April 12, 1984, in the Pacific port. Meanwhile, No. 1 hard red winter wheat with ordinary protein content was sold for only $3.92 a bushel at the Kansas City terminal market and cash bids offered by country elevators ranged from $3.85 a bushel to $3.90. Therefore, wheat prices in Washington averaged 15.3 cents (in 1972 dollars) higher than the national average during 1978-84 (table 11).

Effects of FOR Release on State and U.S. Grain Prices

Monthly State grain prices respond to changing supply and demand conditions in the State, the State's composition of grain stocks (free stocks vs. CCC-owned inventories and FOR), release status of the FOR, transportation costs, and supply and demand conditions outside of the State (including international markets). To capture all the economic relationships completely in an econometric model, a complicated simultaneous equation system would be needed. An example of this complexity is that the rate at which grain is

Table 11. Average State vs. U.S. wheat price differentials for selected States, 1978-84

State	All months	Release months	Nonrelease months	Difference between release months and all months
			Cents per bushel ($1972)	
Kansas	-4.24	-5.60	-3.86	-1.36
Nebraska	-8.77	-10.96	-8.18	-2.20
North Dakota	3.87	12.52	1.51	+8.70
Oklahoma	1.54	4.02	0.87	+2.49
Washington	15.28	6.25	17.74	-9.03
Missouri	-6.28	0.06	-8.01	+6.34
South Dakota	1.15	3.72	0.45	+2.57
Montana	-.94	-4.49	0.03	-3.55
			Cents per bushel ($1984)	
Kansas	-9.52	-12.57	-8.66	-3.05
Nebraska	-19.69	-24.60	-18.36	-4.94
North Dakota	8.69	28.10	3.39	+19.53
Oklahoma	3.46	9.02	1.95	+5.59
Washington	34.29	14.03	39.82	-20.27
Missouri	-14.09	.13	-17.98	+14.23
South Dakota	2.58	8.35	1.01	+5.77
Montana	-2.11	-10.08	.07	-7.97

released from the FOR possibly affects State grain prices, but simultaneously depends on those same grain prices. To complicate the matter further, producers may respond to the release status of FOR stocks by choosing to redeem the reserve loan and sell the grain on the open market or by leaving grain in the reserve in hope of selling it at a higher price which will offset storage charges. Meanwhile, the release of grain may affect U.S. grain prices which, in turn, may further affect State-U.S. grain price differentials. Therefore, the complex economic model should also encompass all the factors that farmers consider in deciding on loan redemption, such as their expectations of market prices and release status, storage charge, and possible loss of any loan interest waivers. In addition, different stockholding policies by grain processors and handlers during tight supply and large supply periods may also affect State-U.S. price differentials.

Obviously, a perfectly specified model, detailing the many behavioral relationships for each State, would be a difficult and costly endeavor. For purposes of this study, we have employed two different approaches to determine effects of releasing reserve stocks on State-U.S. price differentials for each selected State and for corn, sorghum, and wheat. First, a simple two-equation simultaneous system was developed to account for the fact that while the reserve activities may affect State grain prices, the relationship is interdependent with U.S. grain prices since the activities may also affect the U.S. prices. This system was then used to separately determine effects of releasing FOR stocks on State and U.S. grain prices and, thereby, the effects on State-U.S. grain price differences. Second, a single-equation price differential model was developed to directly measure effects of releasing reserve on State-U.S. grain price differentials. This section presents the specification and estimated results of the indirect, two-equation system, while the following section will cover results of the effects measured directly by price differential equations.

The simple two-equation simultaneous system has the following specification:

$$P_{us} = f\left[\Sigma D_i, \frac{S}{U}, \frac{CCC + FOR}{U}, \Delta(FOR), EXP, T, PC_{us}\right] \quad (1)$$

$$P_i = f\left[P_{us}, \Sigma D_i, \frac{S}{U}, \frac{CCC + FOR}{U}, \Delta(FOR)\right] \quad (2)$$

where

P_i = deflated grain price received by farmers in State i (monthly; dollars per bushel for corn and wheat, and dollars per hundredweight for sorghum).

P_{us} = deflated grain price received by farmers in the United States (monthly; dollars per bushel for corn and wheat, and dollars per hundredweight for sorghum).

ΣD_i = a set of 11 monthly dummy variables (for example, when prices are for December, the dummy for December = 1 and for other months = 0).

S = quarterly beginning total stocks in U.S. or State i (mil. bu.).

U = quarterly U.S. or State grain disappearance ($U_t = S_{t+1} - S_t$) (mil. bu.).

CCC = monthly CCC inventories at the beginning of the month in U.S. or State i (mil. bu.).

FOR = monthly FOR stocks at the beginning of the month in U.S. or State i (mil. bu.).

Δ(FOR) = net change in FOR stocks in U.S. or State i during the month (mil. bu.) (positive value means net entry and negative value means net release).

EXP = U.S. grain exports during the month (mil. bu.)

T = a time trend variable (March 1978=1, April 1978=2, etc.)

PC_{us} = deflated competing grain prices received by farmers in the United States (monthly; dollars per bushel).

In this model, P_i and P_{us} are considered endogenous variables and the rest are all exogenous variables. Equations were estimated using monthly or quarterly data for 1978-84. This period covers the existence of the reserve and omits the mid-1970's when large changes in global supply and demand caused large price variability. To properly capture the relationship between State grain prices and the stocks-to-use ratio, we deflated the grain price variables both at the State and U.S. level by the implicit GNP price deflator (1972=100). Total stocks and use data for States are not available on a monthly basis. Grain use was approximated by calculating the disappearance of quarterly total grain stocks. Also, new crop production was added to total stocks to more accurately reflect quarterly disappearance after the harvest of the new crop. To the extent that the receiving State has a large volume of inshipments and does not have adequate storage facilities, grain use constructed in this way underestimates the true grain use in the State. Effects of releasing FOR stocks on State grain prices are expressed in 1972 dollars unless indicated otherwise.

The major statistical problems with this model are that many of the causal relationships are not estimated. Changes in the U.S. price, State grain use, and changes in FOR stocks all likely affect the State price. However, the State price also may affect the U.S. price, State use, and the level of FOR activity. We assume that State prices from previous months have an important effect on State use and reserve activity in the current month. If true, that would lessen the bias introduced by not explicitly accounting for the effect of State grain prices on State use and FOR changes. The effect of a State's price on the U.S. price is likely large for major producing States. In order to account for this effect, the equation was also reestimated with the difference between the State and U.S. price as the dependent variable (that is, the U.S. price was moved to the left hand side of the equation). The results of this latter specification are reported in a later section. The use of monthly or quarterly data tends to introduce autocorrelation bias in the regression analysis. However, this bias was corrected through the Cochrane-Orcutt procedure.

Estimated relationships for corn

The above two-equation model was estimated by two-stage least squares (TSLS) for monthly State grain prices during 1978-84. It is of interest to see if the reserve activities affect U.S. corn and sorghum prices, based on the following first-stage estimates:

$$P_{us} = \alpha + \Sigma D_i - \underset{(-2.167)^*}{.129 \frac{S}{U}} + \underset{(1.645)}{.109\left(\frac{CCC + FOR}{U}\right)} - \underset{(-1.341)}{.00022 \ \Delta(FOR)}$$

$$+ \underset{(2.469)}{0.0015 \ EXP} - \underset{(-1.012)}{.0019 \ T} \qquad R^2 = .703$$

D-W statistic = 1.95

*Figures in parentheses are t-ratios.

where α and ΣD_i are the constant term and a set of seasonal dummies not shown here. The release of FOR stocks showed a less than significant effect on U.S. corn prices, consistent with our past experience.

The result tends to confirm our expectations that rising stocks relative to use tends to depress U.S. prices, and more grain isolated in CCC and FOR stocks has been associated with stronger prices. The level of reserve activity (change in FOR stocks) does not have the expected sign but the relationship is weak (as indicated by low t-ratio). Exports are the key variable in explaining U.S. corn prices.

According to second-stage estimates, corn prices received by farmers in each State followed U.S. prices very closely, suggesting that State prices tended to be affected by changing supply and demand conditions of other States (table 12).2/

As indicated earlier, corn prices in Nebraska were below the national average most of the time. The large volume of corn FOR stocks in Nebraska accounted for nearly 30 percent of the national reserve stocks in August 1984. Prior to the disbursement of the payment-in-kind (PIK) entitlements in September 1983, corn FOR stocks in Nebraska reached 527 million bushels, about 72 percent of total stocks in the State. FOR and CCC stocks together accounted for 94 percent of total State stocks. In June 1984, corn FOR stocks in Nebraska were reduced to 153 million bushels as a result of payment of PIK entitlements and FOR release in late 1983 and early 1984. Nevertheless, CCC and FOR stocks still accounted for 60 percent of total stocks in June 1984. Thus, as expected, the ratio of CCC and FOR stocks to corn use turned out to be a significant factor affecting corn prices in Nebraska. Large isolated CCC and FOR stocks (relative to corn use) have strengthened corn prices in Nebraska relative to U.S. prices, but only slightly. As expected, a rise in total stocks relative to use tended to lower State prices. A change in FOR stocks was found to be not statistically significant; a release of 100 million bushels of FOR stocks, as occurred in August 1983 prior to the release of PIK entitlements, tended to lower corn prices by 3.6 cents a bushel in 1984

2/ In light of this finding, we also ran a simple regression of State grain prices against U.S. prices and a dummy variable to indicate the release status of FOR. The regression results reaffirm that the release of FOR mostly did not significantly affect State prices in relation to U.S. prices.

Table 12. Estimated corn price equations for selected States, 1978-84[1/]

State	Explanatory variables				R^2	D-W statistic
	P_{us}	$\frac{S}{U}$	$\frac{CCC + FOR}{U}$	$\Delta(FOR)$		
Nebraska	0.633	-0.0278	0.0310	0.00016	0.68	1.98
	(3.27)	(-1.64)	(1.650)	(.776)		
Iowa	.623	-.0286	-.0117	-.0000623	.71	1.91
	(2.619)	(-1.183)	(-.303)	(-.700)		
Illinois	1.294	.0872	-.0449	.000612	.75	1.83
	(5.78)	(2.332)	(-.807)	(.714)		
Indiana	1.440	.0616	-.0643	.000319	.76	1.85
	(6.155)	(.835)	(-.744)	(2.56)		
Ohio	1.318	.0208	-.0849	.00269	.72	1.82
	(5.343)	(.575)	(-.667)	(1.269)		
Minnesota	.507	-.0222	-.0289	-.000219	.67	1.95
	(1.99)	(-.991)	(-.643)	(-.310)		
North Carolina	1.299	.101	-.314	-.111	.80	2.03
	(5.77)	(1.448)	(-1.35)	(-2.757)		
Kansas	.783	.0422	-.0358	.00213	.65	1.92
	(3.152)	(.984)	(-.833)	(.236)		
Pennsylvania	1.933	.00931	-.166	.0811	.77	1.90
	(6.829)	(.271)	(-.507)	(1.60)		
Georgia	1.050	.0378	-.339	-.0679	.74	1.87
	(4.328)	(1.89)	(-2.067)	(-.792)		
South Dakota	.723	-.0143	.104	-.00948	.73	2.22
	(3.335)	(-.597)	(1.967)	(-1.501)		
Wisconsin	.938	.0011	.0269	-.00041	.71	1.86
	(4.304)	(.0418)	(.493)	(-.146)		

1/ Intercept and seasonal dummies are not reported. Numbers in parentheses are t-ratios, and D-W statistic refers to the Durbin-Watson statistic.

dollars or 1.6 cents in 1972 dollars. The modest effect could simply reflect the small percentage that the change in FOR stocks has represented in terms of total stocks (about 15 percent in August 1983) compared with the large ratio between FOR and total stocks.

Unlike Illinois, where outshipments of corn (mainly to the Gulf for export) are relatively large, Iowa corn was largely used for domestic hog and cattle feeding (55 percent in 1977). This may explain why a large stocks-to-use ratio has been associated with weakened corn prices in Iowa, relative to U.S. prices. The release of stocks did not weaken corn prices in Iowa, relative to U.S. prices. The ratio of FOR stocks to total stocks in Iowa has historically been lower than that in Nebraska. For example, the ratio in Iowa was 0.31 in June 1984, compared with 0.44 in Nebraska. Also, the release of Iowa FOR stocks tends to be much smaller relative to total stocks: nearly 2 percent in August 1983, compared with 15 percent in Nebraska.

Corn prices in Illinois are very sensitive to the variation of corn export demand at the Gulf, but are relatively unaffected by wheat prices because of its distance from wheat areas. With easy access to the Mississippi River all year, Illinois price responds very quickly to an increase in corn exports in the Gulf port. Because of the export-market orientation of Illinois corn, interstate shipment of corn from Illinois in 1977 was twice that from Iowa. However, large but unmeasured insnipments of corn into Illinois distort corn use statistics as calculated for this analysis, leading to an unexpected sign for the stocks-to-use variable. Despite its large corn production, Illinois had relatively small FOR stocks, slightly over 5 percent of national total in August 1984. In addition, the ratio of FOR stocks to total stocks in Illinois has been lower than in Nebraska and Iowa. In June 1984, the ratio in Illinois was only 0.11, compared with 0.44 in Nebraska and 0.31 in Iowa. As demand for Illinois corn grows, the ratio of CCC and FOR stocks to corn use declines, leading to higher corn prices with a negative regression coefficient of the CCC-and-FOR-stocks-to-corn-use variable. The release of FOR stocks in Illinois tended to be relatively small, suggesting that the release itself had virtually no effect on corn prices.

Although a portion of the corn produced in Indiana is shipped out for exports (a third of production in 1977), corn sales from Indiana have not been as heavily centered on export markets as Illinois. The release of FOR stocks appeared to significantly affect corn prices. In August 1983, released FOR stocks accounted for only about 13 percent of total stocks in Indiana. A release of 1 million bushels of FOR corn stocks tended to weaken corn price in Indiana by 0.03 cents a bushel.

Corn prices in Ohio also followed U.S. prices very closely. A higher ratio of CCC and FOR stocks to total stocks did not significantly strengthen corn prices. However, a small volume of FOR stocks (0.5 percent of the national total in August 1984) suggests that the release of FOR stocks had less than a significant effect on corn prices and that was verified. For example, while FOR stocks in Indiana reached 108 million bushels in August 1983, FOR stocks in Ohio amounted to only 44 million.

Large stocks relative to corn use tended to reduce corn prices received by farmers in Minnesota, but the effect was not statistically significant. Releasing FOR stocks did not have a significant effect on corn prices in Minnesota. In August 1983, when corn FOR was in release status, the volume of FOR stocks released accounted for only about 14 percent of total stocks.

Kansas has maintained a ratio of FOR to total stocks at 30 percent or above during 1978-84, probably related to the high rate of commodity program participation. In addition, corn FOR stocks in Kansas were relatively large, nearly 20 percent of the U.S. level in August 1984. As a result, corn prices in Kansas followed U.S. prices closely. Like the U.S. corn price equation, the release of FOR stocks did not significantly affect corn prices in Kansas.

North Carolina, Pennsylvania, and Georgia are deficit States selected for study. Stocks-to-use ratio has little effect on grain prices in these States, since stocks tend to be small (all less than 1.5 percent of the U.S. total in August 1984) relative to grain use. However, large but unmeasured inshipments of grain into these States distort corn use statistics as calculated for this analysis. Therefore, significant or modestly significant coefficients of the variable appear in the equations for Georgia and North Carolina. As deficit areas, these States have small CCC and FOR stocks relative to corn use, which largely depends on the size of animal inventories. As the demand for corn grows in these States, corn prices rise. Therefore, the CCC and FOR stocks-to-use ratio turned out to be either insignificant or inversely related to corn prices in these States, as expected. The release of FOR stocks in these States was not sufficient to stem the tide of rising prices. Corn prices frequently continued to rise or stayed relatively high during release months in these States because of tight supply or strong demand. Consequently, the release of FOR was found to coincide with the rising corn prices in North Carolina and, to a lesser degree, Georgia.

South Dakota and Wisconsin show similar patterns of corn price relationships, primarily because they are surplus corn-producing States. A higher ratio of CCC and FOR stocks to corn use strengthened corn prices in South Dakota. The release of FOR stocks in South Dakota and Wisconsin is believed to have no significant effect on corn prices, since, for example, corn FOR stocks in South Dakota tended to be very small: 3.5 percent of the national total in August 1984. Thus, the same kind of relationship between the release of FOR stocks and grain prices in deficit States apply to South Dakota, i.e., the release of FOR tended to be associated with rising grain prices.

Estimated Relationships for Sorghum

Like the U.S. corn price equation, the first-stage estimate of the U.S. sorgnum price equation shows that releasing FOR stocks did not weaken sorghum price received by farmers. A large stocks-to-use ratio tended to soften sorgnum prices, while a large ratio of CCC and FOR stocks relative to total use strengthened prices. The positive coefficient of corn prices (PC_{us}) suggests tnat sorgnum prices tend to follow corn prices closely due to substitutability of the two feed grains. The first-stage estimate of the U.S. sorghum prices is:

$$P_{us} = \alpha + \Sigma D_i \underset{(-2.770)^{*}}{- .101 \frac{S}{U}} + \underset{(2.446)}{.091\left(\frac{CCC + FOR}{U}\right)} + \underset{(.456)}{.00059 \ \Delta(FOR)}$$

$$\underset{\cancel{(-2.48)}\ (-.248)}{- .00091 \ EXP} + \underset{(11.418)}{1.440 \ PC_{us}} \underset{(-2.741)}{- .00376 \ T} \qquad R^2 = .809 \quad \text{D-W statistic} = 1.88$$

*Figures in parentheses are t-ratios.

Kansas and Nebraska are two sorghum surplus States selected for study. Since these two States are important sorghum-producing areas, State sorghum prices tend to be closely related to U.S. prices. Large stocks relative to sorghum use tended to weaken sorghum prices in Kansas, but less than significantly (table 13). A high ratio of CCC and FOR stocks to sorghum use made less free stocks available to respond to growing market demand and thereby modestly strengthened sorghum prices in Kansas. The release of FOR stocks typically accounted for 5 percent of total stocks in Kansas and slightly over 5 percent of total stocks in Nebraska. Therefore, releasing sorghum FOR stocks has not significantly affected sorghum prices in these two States.

The Southern Plains region has been known as a sorghum deficit area. In Texas, use of sorghum as feed grain has been declining and corn use rising. Even so, sorghum supplies tended to be smaller than usage (including exports), making inshipments of sorghum from other States necessary. For example, the volume of sorghum received by Texas from other States reached about 150 million bushels in 1977. Texas was the largest recipient State of sorghum, accounting for nearly 60 percent of total interstate shipments. Therefore, as demand for sorghum grows in Texas, sorghum prices tend to rise. However, FOR stocks in 1978 averaged 6 million bushels, accounting for only about 3 percent of sorghum consumption (230 million bushels). Thus, as demand for sorghum grows, the ratio of CCC and FOR stocks to sorghum use declines, which is associated with strengthening sorghum prices in Texas. As expected, the release of FOR stocks did not significantly affect sorghum prices in Texas and Oklahoma since, for example, volume of FOR released in August 1983 accounted for only 3 percent of total stocks. Similar situations were found for Oklahoma, based on the same reasons given for Texas.

Table 13. Estimated sorghum price equations for selected States: 1977-84[1/]

State	Independent variables				R^2	D-W statistic
	P_{us}	$\frac{S}{U}$	$\frac{CCC + FOR}{U}$	$\Delta(FOR)$		
Kansas	0.928	-0.0084	0.0141	-0.0285	0.73	2.09
	(9.534)	(-.554)	(.716)	(-.742)		
Texas	1.167	.0339	-.0420	.00305	.81	1.89
	(12.167)	(1.554)	(-1.267)	(.566)		
Nebraska	.974	.0039	-.0084	.00045	.75	2.09
	(10.999)	(.375)	(-.703)	(.1806)		
Missouri	1.000	.0404	-.112	-.0238	.78	2.32
	(9.668)	(1.298)	(-1.544)	(-.398)		
Oklahoma	.959	-.0048	-.0022	-.0118	.65	2.07
	(8.224)	(-1.59)	(-.084)	(-.197)		

1/ Numbers in parentheses are t-ratios. Intercept and seasonal dummies are not reported.

The release of sorghum FOR stocks in Missouri typically accounted for a very small proportion of total stocks. In August 1983, for example, the release of 0.7 million bushels of FOR stocks in Missouri accounted for only 5 percent of

total stocks. In addition, sorghum FOR stocks were very small in Missouri: 0.8 percent of the U.S. total in August 1984. Therefore, release of FOR stocks itself did not have a significant effect on sorghum prices.

Estimated Relationships for Wheat

Like the U.S. corn and sorghum price equations, the first-stage equation estimated for the U.S. wheat prices shows that the release of FOR stocks did not significantly affect U.S. wheat prices. Similar to corn and sorghum, U.S. wheat prices tended to be affected by exports, stocks-to-use ratio, and the ratio of CCC and FOR stocks to total use. The first-stage equation is estimated as:

$$P_{usw} = \alpha + \Sigma D_i - \underset{(-2.313)^*}{.137}\frac{S}{U} + \underset{(1.60)}{.0474}\left(\frac{CCC + FOR}{U}\right) - \underset{(-.242)}{0.00042}\ \Delta(FOR)$$

$$+ \underset{(1.796)}{0.000461}\ EXP \qquad R^2 = .436$$

$$\text{D-W statistic} = 1.97$$

*Figures in parentheses are t-ratios.

Like corn and sorghum prices, State wheat prices as estimated by TSLS closely followed U.S. prices (table 14). Higher stocks-to-use ratios, reflecting

Table 14. Estimated wheat price equations for selected States: 1977-84[1/]

State	Independent variables				R^2	D-W statistic
	P_{us}	$\frac{S}{U}$	$\frac{CCC + FOR}{U}$	$\Delta(FOR)$		
Kansas	1.173	-0.0127	0.0134	-0.00358	0.503	1.75
	(5.573)	(-2.112)	(.567)	(-1.387)		
Nebraska	1.228	-.0135	.00111	-.00804	.445	1.65
	(4.871)	(-1.079)	(.0569)	(-1.081)		
North Dakota	1.036	-.0179	.018	-.000814	.501	2.067
	(3.822)	(-1.066)	(.482)	(-.275)		
Oklahoma	1.327	-.00071	.00583	-.00208	.454	1.742
	(5.376)	(-.0505)	(.237)	(-.742)		
Washington	1.128	-.0249	.0788	-.000955	.449	2.066
	(5.207)	(-2.485)	(2.244)	(-.424)		
Missouri	1.263	.538	-.293	-.0331	.564	2.035
	(6.438)	(1.761)	(-2.287)	(-.806)		
South Dakota	.993	.00183	.00495	-.00424	.417	2.229
	(3.699)	(.111)	(.195)	(-.744)		
Montana	.874	-.00762	.0292	-.00600	.349	1.740
	(3.272)	(-.563)	(.742)	(-1.267)		

1/ Numbers in parentheses are t-ratios. Intercept and seasonal dummies are not reported.

large wheat supplies, generally weakened State wheat prices, with the relationship being especially strong in Washington and Kansas. The same relationship also held for Nebraska and North Dakota, although less strong. By contrast, higher CCC and FOR stocks relative to wheat use tended to strengthen State wheat prices, as expected. The relationship was especially strong in Washington.

The release of FOR wheat stocks, in all cases, did not seem to affect State wheat prices significantly. This is not surprising in view of the very small ratio of the volume of FOR released to total stocks. For example, in July 1979 when the wheat FOR was in release status, only 17.5 million bushels of wheat were released from FOR in Kansas, accounting for about 7 percent of total stocks.

Effects on State-U.S. Grain Price Differentials

The analysis to this point has focused on explaining State grain price movements as a result of changes in U.S. prices, stocks, use, and FOR activity. This section examines the same issues but employs an alternative statistical formulation. State-U.S. grain price differentials are estimated directly. These differentials, rather than State or U.S. price levels, are the variables to be explained using regression analysis. This method avoids the criticism of the State equations reported earlier that State prices affect U.S. prices and not accounting for that causality introduces a bias in the price level equations.

The remainder of this section discusses the implications of the estimated price equations reported earlier. Price difference equations typically have a smaller explanatory ability than price level equations (lower R^2); these equations are no exception. The remaining explanatory variables are the same as those used in the earlier State equations: State stocks, use, and FOR stock changes.

Corn

A very insightful analysis is to compare average State-U.S. corn price differences during months when the reserve is in release status, during months when it is not in release, and during all months (table 9). The table tends to support conclusions reached earlier: deficit States in the East and Southeast with small stocks have actually had their prices rise relative to the U.S. price when the corn FOR was in release. Eastern Corn Belt States generally have had the same experience, partly also because of low FOR stocks. The central and western Corn Belt States have had little or no change in their State-U.S. price differences, with the notable exception of Nebraska, where State prices fell relative to the U.S. price.

If the release of corn FOR stocks had materially depressed many State prices relative to the U.S. average prices during 1978-84, the difference between the State-U.S. price differentials during release months and during all months would be negative for many States (last column of table 9). However, in only 2 of the 12 selected States, Nebraska and Kansas, were these differences negative.

Of course, the comparisons in table 9 are approximations of reserve effects. They do not account for different State supply, demand, and reserve activity

Table 15. Estimated corn price differential equations for selected States: 1978-84[1/]

State	Dependent variable	Independent variables: $\frac{S}{U}$	$\frac{CCC + FOR}{U}$	Δ(FOR)	R^2	D-W statistic
Nebraska	$PNE-P_{us}$	-0.00093	0.0445	0.000168	0.41	2.02
		(-.169)	(.711)	(2.247)		
Iowa	$PIO-P_{us}$	-.00602	.0198	-.000099	.40	1.94
		(-1.187)	(3.042)	(-.191)		
Illinois	$PIL-P_{us}$	.0352	-.0305	-.000237	.55	2.09
		(.606)	(-3.764)	(-2.017)		
Ohio	$POH-P_{us}$	-.0066	-.0734	-.000812	.39	1.88
		(-.651)	(-2.12)	(-1.319)		
Indiana	$PIN-P_{us}$	-.0127	-.0255	-.000497	.49	2.03
		(-.646)	(-.905)	(-1.417)		
Minnesota	$PMN-P_{us}$	.00118	.0152	.00015	.35	1.70
		(.171)	(.878)	(.711)		
North Carolina	$PNC-P_{us}$	.0382	-.272	-.0731	.63	1.65
		(1.298)	(-2.950)	(-4.312)		
Kansas	$PKA-P_{us}$	-.0039	.00838	.00405	.46	1.70
		(-.193)	(.484)	(1.169)		
Pennsylvania	$PPA-P_{us}$	.00123	-.240	-.0386	.37	1.70
		(.058)	(-1.06)	(-1.17)		
Georgia	$PGA-P_{us}$	.00912	-.145	-.0508	.52	2.00
		(1.211)	(-2.296)	(-.183)		
South Dakota	$PSD-P_{us}$	-.0279	.0546	-.00085	.35	1.62
		(-2.06)	(1.758)	(-.310)		
Wisconsin	$PWI-P_{us}$	-.0108	.0472	-.000319	.73	1.79
		(-1.168)	(2.585)	(-.339)		

1/ Numbers in parentheses are t-ratios. Intercept and seasonal dummies are not reported.

situations. The regression results discussed in this section attempt to account for these situations. The estimated price difference equations are presented in table 15.

Corn prices received by farmers in Nebraska have been mostly below the national average since 1971 (app. fig. 1). The State-U.S. price differential was drastically reduced and Nebraska corn prices actually exceeded the national average in the fall of 1981 as FOR stocks in Nebraska nearly doubled in one year. By the fall of 1982, Nebraska corn prices exceeded the national average by as much as 20 cents a bushel, as the stocks tripled in 2 years. Apparently, the higher reserve loan rates offered by the FOR program in 1981 and 1982 encouraged grain producers to place their corn in the reserve and thereby strengthened prices. The release of FOR stocks together with the disbursement of PIK entitlements in late 1983 and early 1984, by contrast, weakened Nebraska corn prices and widened the price differential. In August 1983, there was a net reduction of about 101 million bushels of FOR corn stocks in Nebraska. FOR release and PIK acquisition further reduced FOR stocks by more than 200 million bushels in September 1983. Regression results suggest that a 100-million-bushel reduction in FOR corn stocks in Nebraska has tended to widen the real price differential between Nebraska and the United States by 1.7 cents a bushel, or 3.8 cents a bushel in 1984 dollars (table 15).

This result is very compatible with the change in price that would be implied by the Nebraska equation in table 12. There, a 100-million-bushel drop in FOR stocks is associated with a widening of the Nebraska-U.S. price differential by 1.6 cents (in 1972 dollars) a bushel, or 3.6 cents in 1984 dollars.

A large total stocks-to-use ratio has tended to widen the price differential between Iowa and the national average (table 15). Conversely, tight supply or strong demand has tended to narrow the price differential. Higher CCC and FOR stocks relative to corn use in Iowa also have been associated with a narrower differential. The reduction of FOR stocks did not significantly affect the corn price differential, since the reduction has mostly accounted for less than 10 percent of total stocks. This is apparent in the very small change, 0.4 cents a bushel, between price differentials during release and all months (table 9) and in regression results in table 12.

As indicated earlier, when market demand for Illinois corn (especially exports) grows, inventory holders respond by shipping corn to other States or to the Gulf via the Mississippi River. Prices offered to Illinois farmers have tended to be higher than U.S. prices because of this demand and low transportation costs via barge. The analysis of price differences indicates that a reduction in FOR stocks in Illinois has been associated with a widening Illinois-U.S. corn price difference (table 15). This relationship is mitigated by the results in tables 9 and 12.

During 1978-84, corn prices in Indiana averaged 4.1 cents (in 1972 dollars) a bushel above the national average. Corn prices during release months, however, averaged 6.7 cents a bushel higher, an increase of 2.6 cents a bushel. As in the case for Illinois, the analysis of price differences in table 15 suggests a widening price difference when corn was in release. However, based on table 12, the release of FOR stocks tended to have an opposite effect. The same situation prevailed in Ohio.

There is virtually no relationship between changes in FOR stocks and Minnesota-U.S. corn price differentials (table 15). This is consistent with

the finding that price differentials between Minnesota and the U.S. averaged 0.4 cent a bushel less during release months, and reaffirmed by the regression results in table 12. Higher CCC and FOR stocks relative to corn use made less free stocks available to the open market and thereby modestly strengthened corn prices.

The change in FOR stocks has been inversely related to the State-U.S. corn price differentials for North Carolina, Pennsylvania, and Georgia. Since release of FOR stocks occurred during times of strong market demand or tight supply, corn prices tended to rise or continued to stay at a relatively high level in these corn deficit areas, despite release status. During 1978-84, corn price differentials during release months averaged 6.9 cents a bushel higher than those calculated from all months in Pennsylvania and 4.2 cents higher in North Carolina. This is consistent with regression results in table 12 for North Carolina and Georgia and table 14 for all three States, which also suggest that the release of FOR stocks tended to be associated with higher price differentials. Since CCC and FOR stocks have been relatively small over time, variation of corn use tended to have a greater effect on price differentials than the change in CCC and FOR. As demand for corn grows in these States, corn prices have tended to rise to attract inshipments, compensating for lack of stocks.

Sorghum

The comparison of State-U.S. price differences for sorghum during release months, nonrelease months, and all months is in table 10. The table indicates virtually no effect of reserve release activity on Kansas, widening price differences as prices weaken in Nebraska and Missouri relative to the U.S. price, and widening differences as prices strengthen in Texas and Oklahoma relative to the U.S. price.

The Northern Plains region has been known as a surplus sorghum producing area. Most sorghum prices in Kansas and Nebraska have been below the national average (app. fig. 1). The worldwide food shortage that occurred in the summer of 1973, however, boosted sorghum prices in Kansas and Nebraska to record highs: $4.44 per hundredweight in Kansas and $4.26 in Nebraska, 80 and 60 cents per hundredweight higher than the U.S. level, respectively. However, Kansas-U.S. price differentials were 0.15 cents (in 1972 dollars) a bushel wider than average during release months and Nebraska-U.S. differentials were 3.14 cents (in 1972 dollars) wider. In 1984 dollars, the differences amounted to 0.63 cents per hundredweight for Kansas and 7.05 cents per hundredweight for Nebraska (table 10).

How much did the release of FOR stocks contribute to the differences? Analyses reported earlier indicated that change in FOR stocks did not appear to be a significant factor affecting U.S. sorghum prices or State prices for Kansas and Nebraska (tables 10 and 13). This is consistent with regression results in table 16, which suggests that a release of FOR stocks of 10 million hundredweight, at most, weakened sorghum prices in Kansas by only 1.2 cents per hundredweight (in 1972 dollars) relative to U.S. prices. No significant effect of releasing FOR stocks on sorghum prices in Nebraska was found.

The release of FOR stocks was found to have no effect on sorghum prices in Texas and Oklahoma. Sorghum price differentials widened during release months by 2.3 cents per hundredweight in Texas, and 0.47 cent in Oklahoma, all in 1972 dollars.

Table 16. Estimated sorghum price differential equations for selected States: 1978-84[1/]

State	Dependent variable	Independent variables: $\frac{S}{U}$	$\frac{CCC + FOR}{U}$	Δ (FOR)	R^2	D-W statistic
Kansas	PKS-P_{us}	-.00837 (-.707)	0.0266 (1.990)	0.00118 (.427)	0.27	2.00
Texas	PTX-P_{us}	.279 (2.053)	-.0608 (-3.172)	.00183 (.582)	.49	1.86
Nebraska	PNE-P_{us}	.00775 (.855)	-.00206 (-.222)	.000229 (-.0934)	.22	1.88
Missouri	PMO-P_{us}	.0203 (.478)	-.0426 (-.469)	-.165 (-2.102)	.33	1.94
Oklahoma	POK-P_{us}	-.0339 (-1.475)	.0211 (1.084)	.0109 (.235)	.34	2.06

1/ Numbers in parentheses are t-ratios. Intercept and seasonal dummies are not reported.

In 1982/83, Missouri sorghum production slightly exceeded its consumption. But, the volume of sorghum FOR stocks in Missouri accounted for about only 4 percent of annual sorghum use in 1983/84, or 0.8 percent of U.S. total. Therefore, the release of FOR stocks itself is not expected to have a significant effect on Missouri-U.S. sorghum price differentials. Despite the release of FOR and PIK entitlements after the summer of 1983, sorghum prices during the release months in Missouri continued to surge and exceeded the national average. Therefore, the release of FOR stocks tended to be associated with higher sorghum prices in Missouri during release months when supply was tight, compared with all months.

Wheat

State-U.S. price differentials for wheat during 1978-84 are presented in table 11. Compared with U.S. prices, State prices fell during release months for Kansas, Nebraska, Washington, and Montana. However, State prices became relatively stronger in North Dakota, Oklahoma, Missouri, and South Dakota. Estimated price equations reported earlier showed that FOR changes did not significantly affect price levels for any State relative to the U.S. price (table 14). Estimated price difference equations imply similar conclusions for all the selected States (table 17).

Price difference analysis indicates that release of reserves had no effect on State-U.S. price differences for all the selected States.

Wheat prices in the Dakotas averaged higher than the national average because during 1978-84 durum and other spring wheats commanded price premiums over winter wheat because of their end-use demands. Wheat price differentials widened in the Dakotas during release months compared with all months--8.7 cents a bushel more in North Dakota and 2.6 cents more in South Dakota. Table 17, however, shows that the release of FOR stocks contributed little to the change in wheat price differences between the Dakotas and U.S. The release of 1.4 million bushels of FOR wheat stocks in November 1980 in North Dakota, less than 0.5 percent of total wheat stocks at that time for example, was not enough to exert any measurable negative effect on wheat prices.

Wheat prices in Washington have averaged considerably higher than the national average. Differentials between Washington and U.S. prices narrowed by 9 cents a bushel (in 1972 dollars) during the release months of 1978-84. Table 17, however, shows that the release of FOR stocks contributed little to the change in Washington-U.S. wheat price difference.

Summary of Estimated Effects

The statistical analysis just presented provides a variety of measures of the relationship between stocks and State farm prices of grain during 1978-84. The following are the primary conclusions of this analysis:

- The higher total stocks were relative to use in a State, the lower that State's monthly price tended to be relative to the U.S. average price. This was generally the case for important grain producing States considered in this study, although the relationship was not statistically significant in some cases.

Table 17. Estimated State and U.S. wheat price differential equations for selected States: 1978-84[1/]

State	Dependent variable	Independent variables: $\frac{S}{U}$	$\frac{CCC + FOR}{U}$	Δ(FOR)	R^2	D-W statistic
Kansas	PKS-P_{us}	-0.00884 (-1.619)	0.0103 (.977)	-0.000472 (-.643)	0.214	1.656
Nebraska	PNE-P_{us}	-.0010 (-.104)	.0087 (.643)	.00257 (.791)	.194	1.988
North Dakota	PND-P_{us}	-.00337 (-.357)	.00106 (.051)	-.000106 (-.063)	.379	1.936
Oklahoma	POK-P_{us}	.00010 (.011)	-.0098 (-.672)	.000907 (.527)	.197	1.756
Washington	PWA-P_{us}	-.0213 (-2.162)	.0601 (2.057)	.00145 (.598)	.196	2.153
Missouri	PMO-P_{us}	.0446 (1.915)	-.111 (-1.144)	-.01514 (-.482)	.281	1.672
South Dakota	PSD-P_{us}	.0097 (.711)	-.0157 (-.764)	-.00116 (-.253)	.276	1.792
Montana	PMT-P_{us}	.0202 (1.483)	-.0583 (-1.463)	-.00252 (-.510)	.247	1.935

1/ Numbers in parentheses are t-ratios. Intercept and seasonal dummies are not reported.

- For a given level of total stocks in a State at the start of a month, the more that were isolated from the market by being CCC-owned or in the FOR, the higher the State's monthly price tended to be relative to the U.S. average. This was the case for many of the important grain producing States studied, although the relationship was not statistically significant for many other States.

- Release of FOR stocks had little or no measurable effect on lowering State-U.S. monthly grain price differentials for most of the States studied. Conversely, entry of stocks into the reserve had little or no relative price strengthening effects for most States.

- Only in Nebraska and Indiana for corn did release of FOR stocks materially lower each State's monthly grain prices relative to the U.S. average. Conversely, these States generally experienced price increases relative to the U.S. price when entry into the reserve was substantial.

- In corn-deficit States such as North Carolina and Georgia where use exceeds production, release of FOR stocks was associated with rising State prices relative to the U.S. average, or changes that were statistically insignificant. In these States, released FOR stocks were very small, and their price effects were apparently overwhelmed by strong demand relative to supply, a condition necessary for release status in the first place. The statistical models may not have been discriminating enough to separate the supply and demand effects on prices in some of the States.

- In corn surplus States such as Illinois where FOR stocks were relatively small and transportation costs to major terminal and export markets were relatively low, release of FOR stocks was also associated with rising State prices relative to the U.S. average.

Table 18 provides a summary of the estimated relationship between the release of a given level of a State's FOR stocks during a month and the drop in that State's farm price relative to the U.S. average farm price. This section presented two estimated price equations for each State, and the estimated effect from them provides the range on the price effects in the table. If the statistical relationship was weak (t-ratio less than 1.5) for both equations, the effect of released FOR stocks on prices was considered to be zero. For this reason the effects of the FOR on sorghum and wheat is ignored since the effects were not significantly different from zero. If one equation had a statistically weak effect and the other was strong, the weak effect was considered to be zero, and the range was taken to include that affect. Corn in Nebraska is an example.

If released FOR stocks were associated with rising State prices relative to the U.S. average, and the relationship was statistically strong in both equations, the effect is indicated by an R (for rise). Corn in North Carolina is an example. If one equation showed a weak effect, the weak effect was considered zero and the range was considered to include that. Corn in Indiana is an example.

This analysis has focused on the comparison of State prices with U.S. average prices. Although it would be very complex to make State-by-State comparisons,

Table 18. Relationship between monthly release of State FOR stocks and drop in State-U.S. farm price differentials (1984 dollars)1/

State	Corn FOR release (mil. bu.)				
	1	5	10	50	100
	Cents per bushel				
Nebraska	0-.04	0-.2	0-.4	0-1.9	0-3.8
Iowa	0	0	0	0	0
Illinois	R-0	R-0	R-0	R-0	n.a.
Indiana	0-.07	0-.04	0-0.7	0-3.6	n.a.
Ohio	0	0	0	0	n.a.
Minnesota	0	0	0	0	0
North Carolina	R	R	n.a.	n.a.	n.a.
Kansas	0	0	0	0	n.a.
Pennsylvania	0-8.1	n.a.	n.a.	n.a.	n.a.
Georgia	0	n.a.	n.a.	n.a.	n.a.
South Dakota	R-0	R-0	n.a.	n.a.	n.a.
Wisconsin	0	0	0	0	0

1/ The price effect is indicated by a range from the two estimated equations for each State. If the estimated price effect from an equation is statistically weak (t-ratio less than 1.5) it is considered to be zero. An estimated effect that showed an increase in a State's price relative to the U.S. price is indicated by R (for rise).

n.a. = level of released stocks is outside the range of experience.

some implications may be inferred from the table. As an example, consider farmers in Nebraska during a month when 200 million bushels of corn are released from the State's reserve stocks. The statistical analyses suggest that Nebraska farm prices relative to the U.S. average could be expected to drop by as much as 7.6 cents a bushel in 1984 dollars. However, if Nebraska farmers are looking east toward Illinois markets, rather than at U.S. average prices, they could observe a greater effect because Illinois farm prices have generally risen relative to U.S. prices during release status. Suppose Illinois farmers release 50 million bushels of corn. The statistical analyses suggest (from the price difference equation and in 1984 dollars) Illinois prices could rise by as much as 2.7 cents a bushel relative to the U.S. price. Thus, that month, Nebraska price relative to Illinois prices could have fallen by as much as 10.3 cents a bushel.

Obviously, the estimated effects also work with changes in opposite direction. Entry of 200 million bushels of Nebraska corn into the reserve during a month and 50 million in Illinois could lead to a rise in Nebraska prices relative to the U.S. price by 7.6 cents a bushel and relative to Illinois prices by 10.3 cents.

However, it is important to note that all grain price effects of releasing FOR stocks presented in this section are based on monthly averages. The effects on weekly or daily bases could prove to be more significant than monthly effects. In addition, the effect on local markets could be more severe than what is indicated at the State level. Congestion in transportation and storage facilities resulting from the release of FOR stocks could cause local prices to fall more than the State level.

THE FARMER-OWNED RESERVE RELEASE MECHANISM

Grain in the FOR is in release status when the national average market price for a commodity is equal to or greater than the announced release price for 5 consecutive days. This regulation follows the legal requirements for operating a producer-owned storage program:

> ... the Secretary may prescribe by regulation ... conditions designed to induce producers to redeem and market the wheat or feed grains securing such loans without regard to the maturity dates thereof whenever the Secretary determines that the market price for the commodity has attained a specified level, as determined by the Secretary. (7 U.S.C. 144e(b).)

This section reviews the events which occur when the reserve is in release and examines the concept of the "market price" which is used to determine release status.

Consequences of Releasing the FOR

When the release level is reached by the national average market price, the minimum release period is the remainder of the month in which release is announced plus the next month. If the market price continues to exceed the release level at the end of this initial period of release, release status remains in effect for another month. The following events occur when the reserve is in release:

- Reserve loans may be repaid by farmers and the grain sold without penalty.

- For 1981 and later crops, release status means that the reserve is closed to further entry. Entry may resume only when the reserve is no longer in release and the level of the reserve does not exceed any announced maximum.

- After the second consecutive month that the national average market price equals or exceeds the release price (i.e., if release is continued after the initial release period), storage payments cease and the waiver of interest on the second and third year of the reserve loans is cancelled. Such waivers have been in effect since March 29, 1978. When storage payments cease, unearned advances must be reimbursed to the Government. Storage payments and interest waivers resume when the market price falls below the release price.

National Average Market Price

The national average market price for a commodity is a 5-day moving average of adjusted daily prices. Each daily commodity price is a simple average of that day's prices for selected grades of the commodity in specified terminal markets. That simple average is then adjusted to make it represent a U.S. average farm price for the commodity for that day.

Adjusted daily prices in major markets are used because the U.S. average farm price for a commodity is not available on a daily basis. Farm prices are estimated by the Statistical Reporting Service (SRS) and are reported and published on the last day of each month in Agricultural Prices. The publication contains mid-month U.S. and State average farm prices for the current month, and it contains the previous month's farm prices. The mid-month price is an average of the prices received by farmers during the 13th through the 17th days of the month.

The grades and markets used to compute the adjusted daily prices are shown in table 19. These prices are reported daily and published weekly by the Agricultural Marketing Service (AMS) in Grain and Feed Market News. The AMS prices are based on personal telephone interviews of buyers and sellers in each market. The prices are considered to be "representative" of the market on a given day. The daily major-market price for each commodity is a simple average of the quoted prices for the grades and markets listed in table 19. The adjustment factor subtracted from this average is the previous month's difference between the following prices: 1) the simple average of the daily major market prices for the 13th through the 17th and 2) the mid-month farm price reported by SRS. Table 20 provides an example of the computation of the 5-day national average price for corn during early November 1984.

The 5-day Average: Pros and Cons

The following advantages of the 5-day moving average market price support its use:

- Timeliness. The adjusted price is available on a daily basis. The mid-month farm price is available only once a month. Surges in export sales or perceived crop losses could cause a sharp run up in prices

Table 19. Crop grades and markets used to compute daily national average farm prices

Crop	Grade	Market
Wheat	(1) No. 1 hard red winter, ord. protein	Kansas City
	(2) No. 1 dark northern spring, 14% protein	Minneapolis
	(3) No. 1 soft white wheat	Portland
Corn	(1) No. 2 yellow	Kansas City
	(2) No. 2 yellow	Omaha
	(3) No. 2 yellow	St. Louis
	(4) No. 2 yellow	Minneapolis
Sorghum	(1) No. 1 yellow	Texas High Plains
	(2) No. 1 yellow	Kansas City
Barley	(1) No. 2 feed	Minneapolis
Oats	(1) No. 2 white heavy	Chicago
	(2) No. 2 white heavy	Minneapolis

immediately following (but not caused by) the release of the mid-month farm prices. Market prices could rise and stay above the release price, but 3-4 weeks would pass before the reserve could be released if the mid-month price were used to determine release. Release would have to wait until a new mid-month price was reported. This delay could cause a loss of marketing opportunities for farmers and it could unduly restrict cash market supplies.

- Cost. The adjusted price is computed from readily available data. Implementation of weekly or daily surveys to compute a daily price received by farmers would be very costly.

- Simplicity of method. The computation of the 5-day market price is very simple. Data are readily obtained by all market participants from SRS and AMS publications. Market participants can readily follow the Department's computations, minimizing suspicion of unwarranted manipulations by reserve administrators.

- Representativeness. Four markets for corn and three markets for wheat are considered in the price calculation. While not all grain moves through these markets, these are major price-determining markets. The prices discovered in these markets are information used by grain elevators and other buyers throughout the country to help establish their offer prices. Thus, although price levels may differ in other regions of the country because of transportation costs and other factors, price movements in these other regions would generally be expected to follow movements in the major markets. The differences in

Table 20. National average market prices for corn, early November 1984

Date	Simple average major markets 1/	Adjustment factor 2/	Adjusted daily price	5-day moving average market price
		Dollars per bushel		
October:				
31	2.70	0.08	2.62	3/2.63
November:				
1	2.74	.10	2.63	3/2.61
2	2.71	.10	2.61	3/2.60
3 Saturday				
4 Sunday				
5	2.66	.10	2.56	3/2.60
6	2.67	.10	2.57	3/2.60
7	2.70	.10	2.60	2.60
8	2.72	.10	2.62	2.59
9	2.74	.10	2.64	2.60
10 Saturday				
11 Sunday				
12 Holiday				
13	2.73	.10	2.63	2.61
14	2.71	.10	2.61	2.62
15	2.71	.10	2.61	2.62
16	2.71	.10	2.61	2.62

1/ Average of daily prices for No. 1 yellow corn in Kansas City, Omaha, St. Louis, and Minneapolis.

2/ For the October 31 calculation, the factor is the difference between the simple average daily prices in major markets and the national average farm price for September 13-17, 1984. For the November 1-14 calculations, the factor is based on the difference between those prices for October 13-17.

3/ Computation requires adjusted daily prices for late October. The 5-day moving average prices for November 1, 2, 5, and 6 include October prices less the November adjustment factor of $.10 a bushel.

price levels between the major markets and other selling points are then reflected in the adjustment factor that is applied to the daily major-market prices.

Despite the advantages cited, there are a number of problems with the 5-day moving average market price which have been a cause of criticism:

- The adjustment factor. The difference between the daily simple average major market price and the actual U.S. farm price likely changes frequently, even daily. However, the adjustment factor--an estimate of this difference--remains fixed for 30 days. Further, the adjustment factor is reported with a half-month delay; thus at the end of any

Table 21. Recent adjustment factors for wheat, corn, and sorghum

Period	Wheat	Corn	Sorghum
	Dollars per bushel		
1982Nov.	0.63	0.12	0.28
Dec.	.67	.21	.48
1983Jan.	.62	.13	.48
Feb.	.63	.12	.53
Mar.	.62	.19	.74
Apr.	.66	.19	.70
May	.64	.19	.65
June	.59	.12	.36
July	.68	.11	.59
Aug.	.69	.14	.44
Sept.	.58	.16	.52
Oct.	.52	.03	.20
Nov.	.55	.10	.46
Dec.	.47	.10	.27
1984Jan.	.48	.06	.21
Feb.	.51	.07	.32
Mar.	.47	.01	.30
Apr.	.47	.12	.46
May	.53	.10	.56
June	.50	.10	.33
July	.65	.11	.43
Aug.	.60	.07	.57
Sept.	.47	.12	.40
Oct.	.43	.08	.41

month, the adjustment factor being used is out of date by one and one-half months. If the adjustment factor is larger than the actual price difference, the 5-day moving average price would understate actual farm prices. This could possibly unduly delay release of the reserve. If the adjustment factor is less than the actual price difference, the 5-day average would overstate the farm price. This could trigger release of the reserve and keep it in release when farm prices do not support such a decision. Table 21 shows how the adjustment factor has changed from month to month during the past 2 years. There have been very large changes at times. The factor used to adjust corn prices during September 1983 was $0.16 a bushel, yet the actual price difference in mid-September (not known until it was reported on September 30th) was only $0.03. Thus, during mid-September, the 5-day moving average market price understated actual market prices.

- Representativeness. The assumed similarity in movement between prices in major markets and prices elsewhere may not hold. In this case, the small number of major markets used would not be sufficient. Wheat is particularly vulnerable to this weakness because only one major market is considered for each of three wheat classes and no market is considered for soft red winter and durum. Exclusion of markets where prices differ significantly from the major markets would bias the 5-day average market price. Application of the adjustment factor--to the extent that it is accurate--would mitigate this bias. In the case of corn, the exclusion of Chicago terminal markets in computing the daily corn price may raise another representativeness issue about national average corn price so calculated.

A related issue is whether a simple average of the daily major-market prices, rather than some other averaging method, best reflects U.S. prices. A simple average does not reflect the volume of grain sold at each price. A simple average is used because data on the volume of grain sold in each major market are not available. If one market has an aberrant price, but very little grain was sold in that market relative to total grain sales, the simple average would not reflect the light sales. It would weight the price the same as any other day, thus giving the aberrant price more significance than it deserves. A weighted average would eliminate this criticism.

Alternative 5-day Moving Average Prices

The representativeness of the 5-day moving average price may be improved by using a weighted rather than a simple average. Assuming the use of the same major markets and the same method to compute the adjustment factor as described above, an issue is to select the appropriate weights from available data. The weights selected depend on what the 5-day average price is supposed to represent. It could represent all U.S. prices, prices in major production centers, or prices in areas where the reserve is concentrated. These alternatives suggest that the following weights are candidates:

- Marketings. States would be assigned to each major market on the basis of proximity. Weights would be monthly marketings within the designated major-market area as a proportion of total marketings.

- Production. Weights would be annual production within the designated major market area as a proportion of U.S. annual production.

- Reserve holdings. Weights would be monthly FOR holdings within the designated major market area as a proportion of total farmer-owned reserves.

The first weighting scheme is designed to better approximate an average farm price received by all U.S. farmers. Broader coverage would require additional major markets. The second weighting scheme better approximates prices faced by growers responsible for most production. It is likely that the weights under these first two schemes would be very similar. The third scheme interprets the appropriate market price to be representative of an average price received by farmers in areas where reserve holdings are largest. Although these three alternatives to the current method would give different average daily major-market prices, the adjustment factors would also be different. Thus, it is likely that the adjusted 5-day moving average price

under the alternatives would not have given a very different pattern of reserve releases and closings than witnessed under the current method.

Table 22 presents a comparison of the daily, simple-average major-market price as currently computed and used by ASCS and a daily, weighted-average price. The prices are for a single day in the middle of each month beginning in June 1983, just prior to the sharp price increases as a result of the 1983 drought. The weights are based on average production during 1983 and 1984 in key Corn Belt States. Table 23 indicates the assignment of States to the major markets.

The Kansas City market represents States accounting for 4 percent of the total corn production in the seven States. Omaha represents States accounting for 53 percent; St. Louis, 28 percent; and Minneapolis, 15 percent. These percentages were used to weight the major-market prices. As indicated in table 22, the weighted-average prices are generally below the simple-average prices, reflecting the greater emphasis given to the lower priced Omaha market.

The largest differences between the simple and weighted averages occurred during the 1983 drought (August 15). The weighted average did not rise and fall as much as the simple average.

The simple and weighted averages may also be compared after adjustment to farm price levels. An adjustment factor was estimated by simply subtracting the mid-month farm price from the simple and weighted averages for the single day shown in the table. Because the daily weighted-average price generally is below the simple-average price, the weighted-average adjustment factor generally is less than the simple-average factor. Consequently, the adjusted simple- and weighted-average prices are about the same. The major difference occurred during the drought of 1983. Then, the Omaha market did not react as much as the other markets. The lower weighted-average price during the drought was more consistent with the farm price (differing by only 5 cents a bushel) than was the simple average (which exceeded the mid-month farm price by 23 cents).

The comparison of simple- and weighted-average prices for a single day presented in table 22 suggests a close relationship between the two price series most of the time. However, it also suggests that when prices deviate sharply from average, the two series could give a different pattern of reserve releases and closings. In particular, the calculation for August 15 suggests that the simple average would likely have led to release of the reserve earlier than the production-weighted average. This example examined prices for only a single day and for only one alternative weighting scheme. The next section extends this example to compare the current 5-day moving average formula with alternatives.

Effects of Alternative 5-day Averages on Release

Another example was constructed in order to more closely scrutinize the pattern of reserve releases and closings under alternative 5-day moving averages. The period chosen for study was August and September 1984. Corn in Reserve IV was released on August 6, 1984, when the 5-day moving average price reached $3.16 a bushel, 1 cent above the release price. The 5-day moving average reached its high for the period of $3.23 a bushel on August 28, 1984, 2 cents below the release price for Reserve V. Prices trended down thereafter, and reserve IV was removed from release status on October 1, 1984.

Table 22. Production-weighted 5-day moving average farm prices for corn

Date	Major-market prices				Simple average	Weighted average 1/	Mid-month farm price	Estimated adj. factor 2/		Adj. daily price 3/	
	Kansas City	Omaha	St. Louis	Minneapolis				Simple	Weighted	Simple	Weighted
	Dollars per bushel										
1983:											
June 15	3.25	3.09	3.27	3.14	3.19	3.15	3.08	0.11 (.11)	0.07	--	--
July 15	3.34	3.17	3.35	3.25 1/4	3.28	3.24	3.12	.16 (.14)	.12	3.17	3.17
Aug. 15	3.72 1/2	3.56	3.84 1/2	3.59 3/4	3.68	3.50	3.45	.23 (.16)	.05	3.52	3.38
Sept. 15	3.37 1/4	3.20	3.48 1/2	3.24 1/2	3.33	3.29	3.37	-.04 (.03)	-.08	3.10	3.24
Oct. 14	3.45 1/4	3.32	3.52	3.27 3/4	3.39	3.37	3.30	.09 (.10)	.07	3.43	3.45
Nov. 15	3.49 1/4	3.28 3/4	3.62 1/2	3.34 1/2	3.44	3.40	3.30	.14 (.10)	.10	3.35	3.33
Dec. 15	3.28	3.09 1/2	3.33	3.04 1/2	3.19	3.16	3.14	.05 (.06)	.02	3.05	3.06
1984:											
Jan. 16	3.27	3.08 3/4	3.43	3.02 3/4	3.20	3.18	3.15	.05 (.07)	.03	3.15	3.16
Feb. 15	3.13	2.95 1/2	3.23 1/2	2.94 1/2	3.07	3.04	3.06	.01 (.01)	.02	3.02	3.01
Mar. 15	3.40 1/4	3.27	3.57	3.34 1/4	3.40	3.37	3.25	.15 (.12)	.12	3.39	3.35
Apr. 16	3.45 3/4	3.32	3.60 1/2	3.43 3/4	3.46	3.42	3.36	.10 (.10)	.06	3.31	3.30
May 15	3.46	3.30 1/2	3.58 1/2	3.43	3.45	3.41	3.36	.09 (.10)	.05	3.35	3.35
June 15	3.52 1/4	3.35 1/4	3.56	3.45 1/4	3.47	3.43	3.36	.11 (.11)	.07	3.38	3.38
July 16	3.39	3.29 1/2	3.47 1/2	3.41	3.39	3.37	3.32	.07 (.07)	.05	3.28	3.30
Aug. 15	3.31 1/2	3.15 1/2	3.34 1/2	3.24 1/4	3.26	3.21	3.13	.13 (.12)	.08	3.19	3.16
Sept. 14	3.22 1/2	3.01 1/2	3.15 1/2	3.09 1/4	3.12	3.07	3.00	.12 (.08)	.07	2.99	2.99
Oct. 15	2.86	2.74 1/2	2.87	2.77	2.81	2.79	2.72	.09 (.03)	.07	2.69	2.72
Nov. 15	2.78 1/4	2.63 3/4	2.79 1/2	2.63 1/2	2.71	2.69	2.59	.12 (.13)	.10	2.62	2.62

-- = Cannot be computed from data in table.

1/ Weights are Kansas City, 0.04; Omaha, 0.53; St. Louis, 0.28; and Minneapolis, .15. These weights are based on 1983 and 1984 corn production.

2/ Simple and weighted averages in table less mid-month farm price. Actual adjustment factor based on 5-day average of daily prices is in parentheses.

3/ Simple and weighted averages in table less estimated adjustment factor of the previous month.

Table 23. States used to construct production-weighted average farm prices

Major market	States
Kansas City	Kansas, Missouri (50 percent)
Omaha	Iowa, Nebraska, South Dakota
St. Louis	Illinois, Missouri (50 percent)
Minneapolis	Minnesota

Three alternative daily average price series were constructed (table 24). They were: 1) a simple average (the same as in table 22 and the current method employed by ASCS), 2) a production-weighted average (same as in table 22), and 3) a reserve-weighted average. The reserve-weighted average was constructed using the same States and assignment to major markets as in table 23, and the weights were the volume of reserve corn in each State at the start of the month. On July 1, 1984, States assigned to the Kansas City market accounted for 2 percent of reserve corn; Omaha, 68 percent; St. Louis, 7 percent; and Minneapolis, 23 percent.

Four 5-day moving average adjusted price series were constructed using the three daily price series. The first three series, simple, production-weighted, and reserve-weighted 5-day averages, were constructed using adjustment factors derived from the reported mid-month farm price. The 5-day average based on the simple average of major-market prices is the one used by ASCS to determine release status. In table 24, that average shows Reserve IV being released on August 6. The production- and reserve-weighted daily prices are lower than the simple average because of the heavier weights given to States with lower prices. However, the adjustment factors are also lower; thus, there is generally a difference of only a few cents between the 5-day average adjusted prices based on the simple, production-weighted, and reserve-weighted daily prices. The production- and reserve-weighted prices also would have caused Reserve IV to be released but not until August 7, only a day later than the actual release.

A fourth 5-day average series was constructed based on the reserve-weighted daily prices. However, the adjustment factor was derived using a reserve-weighted average of State mid-month farm prices, rather than the reported U.S. mid-month farm price. If the average daily major-market price is weighted to emphasize reserve holdings, it may be argued that such a price should not be adjusted to represent U.S. average farm prices. Such a price should be adjusted to represent farm prices in areas where reserves are being held. Thus, the States listed in table 23 were used to construct a reserve-weighted mid-month farm price. The weight on each State's mid-month farm price was the reserves in that State at the start of the month as a share of total reserves in the seven States. This construction caused the adjustment factor to rise compared with that used for the other reserve-weighted 5-day average, because the reserve-weighted mid-month farm price was below the reported U.S. mid-month price:

Mid-month farm price	July 1984	August 1984
	Dollars per bushel	
U.S. average	3.32	3.13
Reserve-weighted	3.24	3.06

The 5-day moving average based on the reserve-weighted average of major-market prices and adjusted with a factor based on reserve-weighted farm prices would not have caused Reserve IV to be released during August 1984. This, of course, assumes that the same major-market prices would have prevailed had the reserve not been released. The average reaches a maximum of $3.12 a bushel on August 24 and 27, 11 cents below the maximum reached by the 5-day average in current use. (Note that if this reserve-weighted formula had been in use and had Reserve IV not been released on August 6, major-market prices might have gone higher and could possibly have reached the point where the reserve was released.)

This fourth 5-day average price series is tantamount to raising the release price. The failure of this 5-day average to reach the reserve IV release level means that, for release, the whole structure of U.S. corn prices would need to rise high enough for average farm prices in reserve-holding areas to approach release levels. Table 24 suggests that U.S. average farm prices would have to have been about 10 cents a bushel higher than they were during August 1984 to reach the Reserve IV release level. Thus, use of this reserve-weighted average is equivalent to raising the reserve IV release level by 10 cents a bushel.

Price Differences Between States and Months

There likely would be almost no differences in prices between States and months for the production- and reserve-weighted 5-day average prices (second and third alternatives in table 24) compared with the current 5-day formula (first alternative). However, some differences could be expected with the reserve-weighted 5-day average based on the reserve-weighted mid-month farm prices. This alternative would require higher U.S. farm prices in order to reach a given release price. Once release was reached, reserve withdrawals would cause the U.S. farm price to move toward an equilibrium level determined by demand and available supply. This equilibrium level would likely be the same regardless of which 5-day average price alternative were used. Thus, a 5-day average price series, which requires farm prices prior to release to be above the levels caused by the currently used 5-day average, would result in farm prices dropping once the reserve were released. Price differences between months could be greater than under the current method (fig. 4).

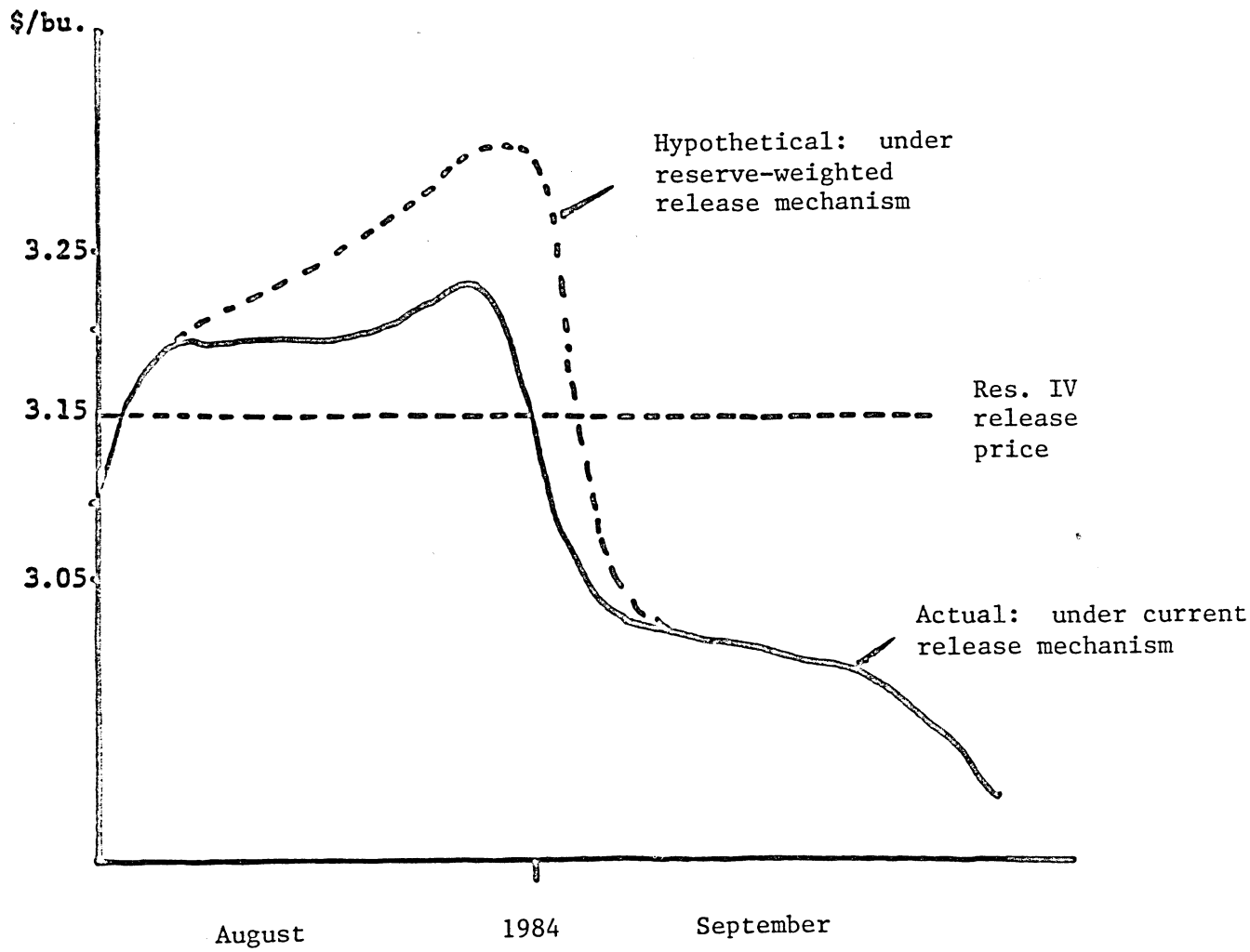
What happens to price differences between States is uncertain. The price differences would depend on whether the level of reserves in one State would change relative to the level in another. Higher U.S. farm prices would cause the pace of reserve redemptions in all States to accelerate, but this may not change the relative levels of reserves in each State. Suppose that, under the current 5-day formula, farm prices in the lower price States were not high enough to cover redemption charges when in release status, but that they were high enough in other States. Now suppose use of an alternative 5-day average formula causes a boost in U.S. average farm prices so that redemption charges are covered in all States. In this latter case, reserves would now be

Table 24. Alternative 5-day moving average adjusted prices for corn, August-September, 1984

Adjustment factor and date	Average daily prices			5-day moving average adjusted			
	Simple	Production weighted 1/	Reserve weighted 2/	Simple 3/	Production weighted	Reserve weighted	Reserve weighted 4/
	Dollars per bushel						
Adj. factor				-0.07	-0.05	-0.01	-0.09
Aug. 1	3.18	3.14	3.10	3.10	3.08	3.08	3.00
2	3.24	3.20	3.16	3.10	3.08	3.08	3.00
3	3.23	3.19	3.15	3.12	3.10	3.10	3.02
6	3.27	3.23	3.19	5/ 3.16	3.14	3.13	3.05
7	3.27	3.23	3.18	3.17	5/ 3.15	5/ 3.15	3.07
8	3.22	3.18	3.14	3.18	3.15	3.15	3.07
9	3.25	3.20	3.16	3.18	3.15	3.15	3.07
10	3.24	3.20	3.15	3.18	3.16	3.15	3.07
13	3.23	3.18	3.14	3.17	3.15	3.14	3.06
14	3.24	3.20	3.17	3.17	3.14	3.14	3.06
15	3.26	3.23	3.19	3.17	3.15	3.15	3.07
16	3.30	3.26	3.22	3.18	3.16	3.16	3.08
17	3.23	3.19	3.16	3.18	3.16	3.17	3.09
20	3.17	3.13	3.09	3.17	3.15	3.16	3.08
21	3.22	3.19	3.14	3.17	3.15	3.15	3.07
22	3.31	3.27	3.24	3.18	3.16	3.16	3.08
23	3.30	3.26	3.23	3.18	3.16	3.16	3.08
24	3.34	3.30	3.25	3.20	3.18	3.18	3.10
27	3.30	3.25	3.21	3.22	3.20	3.20	3.12
28	3.24	3.18	3.14	3.23	3.20	3.20	3.12
29	3.19	3.13	3.08	3.20	3.17	3.17	3.09
30	3.16	3.11	3.04	3.18	3.14	3.13	3.05
31	3.08	3.06	3.03	3.12	3.09	3.09	3.01
Adj. factor				-.12	-.08	-.05	-.12
Sept. 3	3.09	3.06	3.02	3.03	3.03	3.01	2.94
4	3.12	3.09	3.05	3.01	3.01	2.99	2.92
5	3.12	3.09	3.05	2.99	3.00	2.99	2.92
6	3.10	3.07	3.03	2.98	2.99	2.99	2.92
7	3.15	3.12	3.08	3.00	3.01	3.00	2.93
10	3.15	3.11	3.07	3.01	3.02	3.01	2.94
11	3.13	3.10	3.06	3.01	3.02	3.01	2.94
12	3.09	3.05	3.04	3.00	3.01	3.01	2.94
13	3.12	3.07	3.05	3.01	3.01	3.01	2.94
14	3.03	2.98	2.93	2.98	2.98	2.98	2.91
17	3.04	2.99	2.96	2.96	2.96	2.96	2.89
18	3.03	2.99	2.97	2.94	2.94	2.94	2.87
19	2.98	2.93	2.91	2.92	2.91	2.91	2.84
20	2.98	2.94	2.91	2.89	2.89	2.89	2.82
21	2.95	2.92	2.89	2.88	2.87	2.88	2.81
24	2.94	2.90	2.85	2.86	2.86	2.86	2.79
26	2.91	2.87	2.84	2.83	2.83	2.83	2.76
27	2.89	2.84	2.82	2.81	2.81	2.81	2.74
28	2.84	2.80	2.79	2.79	2.79	2.79	2.72

1/ Weights are Kansas City, .04; Omaha, .53; St. Louis, .28; and Minneapolis, .15.
2/ Weights are Kansas City, .02; Omaha, .68; St. Louis, .07; and Minneapolis, .23.
3/ 5-day average currently used by ASCS.
4/ Adjustment factor based on difference between reserve-weighted major-market daily prices for 13th-17th of the previous month and reserve-weighted mid-month State farm prices.
5/ Reserve IV release price equalled or exceeded.

Figure 4. The Effect of a reserve-weighted release mechanism on farm prices



redeemed in the lower price States, and compared with the current formula, it is possible that their reserves would fall relative to the higher priced States. This change in the relative level of reserves could narrow the price differences between States. However, the change in the price difference would depend on how sensitive each State's price was to changing reserve levels.

An Alternative Release Mechanism

Operating the farmer-owned reserve on the basis of a national average farm price and a single trigger or release price has the advantage of simplicity. However, problems and inequities may result from such a simple procedure. For example, at the time of release, the farm price of corn or other grain in a particular State may be unusually low relative to the national average price. If release continued beyond the initial period, the State price could fall even more relative to the national price, particularly if significant reserve stocks were located in the State. Even if the State price held steady or gained slightly against the national average, it could stay below the cost of redeeming reserve grain. Nevertheless, farmers in the State would have to refund any unearned storage payments just as farmers must do in other States where prices may be relatively higher and where redemption may be profitable.

On the other hand, the farm price of corn in a particular State may be unusually high relative to the national average. Selling from the reserve could be profitable for farmers in that State and, from the standpoint of price stability, be desirable as well. Yet, the farmers could not benefit from the sale of reserve grain as long as the national average price was below the release price. An example of this situation occurred in the summer of 1983. The farm price for durum wheat was unusually high relative to the average price for all wheat. But, because the national average price was below the single release price for all wheat, durum growers lost the opportunity to profitably redeem their reserve grain.

One way to address these problems is to set release prices in each State by adjusting the single national release price by the normal difference between the average farm price for a State and the national average price. Thus, if the Georgia corn price were historically 115 percent of the national average price, the release price for Reserve IV corn in Georgia would be 115 percent of $3.15 or $3.62 a bushel. Georgia farmers could sell reserve corn without penalty when the farm price in the State reached $3.62.

Operating the reserve according to adjusted State release prices and State farm prices would tend to more closely maintain the normal price differentials among States than a single release price applicable nationwide. Furthermore, taking individual State circumstances into account in operating the reserve is not without precedent. Exemptions from stoppage of storage payments during release status were granted in 1980 to farmers in States where prices were unusually low relative to the national average price. The exemptions were based on the statutory authority granted to the Secretary of Agriculture by the Food and Agriculture Act of 1977, and were made for two reasons: 1) grain prices in some States were not high enough to cover loan redemption costs, and 2) loan rates may be set too high to the point that they exceeded true commodity values.

Example of State Release Prices

To illustrate how the reserve program might work with release prices varying by State, corn release prices were calculated for Georgia, Nebraska, and Ohio. These release prices were compared with farm prices in the States during the summer of 1983 to determine if release dates would have differed from what actually occurred.

The release prices were based on the percentage differences between the average monthly farm prices for the State and for the nation. Data for the 60 months prior to July 1983 were used to calculate average prices (table 25).

Table 25. Example State release prices for corn

States	Average price	Ratio of State price to U.S. price	Release prices	
			Reserve IV	Reserve V
	$/bu.		------ $/bu. ------	
Georgia	2.94	1.153	3.63	3.75
Nebraska	2.54	.996	3.14	3.24
Ohio	2.62	1.027	3.24	3.34
United States	2.55	1.000	3.15	3.25

To determine release status in each State, adjusted, 5-day moving average farm prices were derived following the formula being used by ASCS to estimate the U.S. average daily price. That is, the daily price for a State is equal to the average price in the four major U.S. markets for that day minus the difference between the four-market average during the 13th through the 17th of the previous month and the mid-month State farm price. For example, the four-market price averaged $3.19 a bushel during mid-June 1983, and the mid-June farm price for Nebraska was $3.03. So, estimated daily farm prices in Nebraska in July were equal to the four-market daily average minus 16 cents.

Effects of State Release Prices

State farm prices were compared to release prices beginning in July 1983 (table 26). The data for the United States are those used by ASCS to determine release status. Release dates for Reserves IV and V are indicated by R4 and R5, respectively.

Table 26 suggests that specifying release prices by State may make a difference in release dates. In the example, each reserve was released in all three States within about 3 weeks. However, it is easy to see that if prices in the four major markets had stabilized or turned down after mid-July, the reserves in Georgia and Nebraska may not have gone into release at all.

The reserves that were released in July were reviewed on September 1 to see if they were to remain in release status. Because the adjusted price (using mid-August prices to determine the adjustment) for Nebraska on that date was 2 cents below the release price for Reserve IV, that reserve would have been closed in Nebraska. Reserve IV would have remained in release status in Ohio

Table 26. Estimated daily farm prices and reserve release status, July-August 1983

Item	United States	Georgia	Nebraska	Ohio
		Dollars per bushel		
Reserve IV release	3.15	3.63	3.14	3.24
Reserve V release	3.25	3.75	3.24	3.34
Adjustment in July	.11	-.24	.16	.01
Daily price:				
7-01	3.08	3.43	3.03	3.18
7-04		HOLIDAY		
7-05	3.08	3.43	3.03	3.18
7-06	3.09	3.44	3.04	3.19
7-07	3.09	3.44	3.04	3.09
7-08	3.11	3.46	3.06	3.21
7-11	3.13	3.48	3.08	3.23
7-12	3.14	3.49	3.09	3.24 (R4)
7-13	3.14	3.49	3.09	3.24
7-14	3.14	3.49	3.09	3.24
7-15	3.15 (R4)	3.50	3.10	3.25
7-18	3.15	3.50	3.10	3.25
7-19	3.15	3.50	3.10	3.25
7-20	3.18	3.53	3.13	3.28
7-21	3.19	3.54	3.14 (R4)	3.29
7-22	3.21	3.56	3.16	3.31
7-25	3.24	3.59	3.19	3.34 (R5)
7-26	3.25 (R5)	3.60	3.20	3.35
7-27	3.24	3.59	3.19	3.34
7-28	3.26	3.61	3.21	3.36
7-29	3.25	3.60	3.20	3.35
Adjustment in August	0.14	-0.23	0.19	0.02
Daily price:				
8-01	3.23	3.60	3.18	3.35
8-02	3.24	3.61	3.19	3.36
8-03	3.27	3.64 (R4)	3.22	3.39
8-04	3.29	3.66	3.24 (R5)	3.41
8-05	3.32	3.69	3.27	3.44
8-08	3.33	3.70	3.28	3.45
8-09	3.34	3.71	3.29	3.46
8-10	3.36	3.73	3.31	3.48
8-11	3.39	3.76 (R5)	3.34	3.51
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
9-01	3.32	3.62	3.12	3.53

based on the adjusted price for that State. The underlying cause for Reserve IV being closed in Nebraska was that the farm price in the State rose only 18 cents a bushel from mid-July to mid-August; nationwide, prices gained 33 cents; and in Ohio they jumped 42 cents. Thus, the adjustment factor for Nebraska rose sharply in September relative to the factor used in Ohio and, presumably, many other States.

Conclusion

Specifying release prices by State could have the following effects:

- An abnormally wide basis--the difference between the national average price and the State price--could mean the FOR would not be released in the State even though the estimated national average price equalled or exceeded the national release price. The effect would be to narrow the basis.

- An abnormally narrow basis may mean that the reserve would be released in the State even though the national average price was less than the national release price. The effect would be to widen the basis.

- Specifying release prices by State would complicate the reserve program. To minimize complications, release prices could be set only for those States where reserve quantities were significant.

- Another possibility is to use a State's release price, not to determine release, but only to determine if release should continue in the State after the initial period.

- Other things equal, the reserve as currently operated is more likely to be released toward the end of the marketing year when prices respond to declining commercial grain stocks. Establishing State release prices is not likely to significantly affect this tendency. One effect of having separate release prices would be a reduced probability of releasing reserves in Southern States when crops are being harvested in mid-to-late summer. This could strengthen prices, especially if early entry into the reserve were allowed.

- Having State release prices would not completely eliminate all the perceived inequities of the current program. For example, farmers in the same State may sell in different markets: corn prices in western Iowa may be more influenced by the Omaha market; in eastern Iowa, by the St. Louis market. One market could make reserve redemption profitable while the other did not. Another example would be the situation where a farmer in one State could take advantage of a price rally to profitably sell grain from the reserve while a farmer in a neighboring State would not have that opportunity even though selling in the same market.

- Great care would have to be taken in setting release prices because a small difference can be critical in determining release or continuing release status.

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Appendix table 1. Quantity of wheat, corn, and sorghum in U.S. FOR, 1977-84[1/]

Year/month	Wheat	Corn	Sorghum
	--- 1,000 Bu.	---	1,000 cwt.
1977 Jan	0	0	0
Feb	0	0	0
Mar	0	0	0
Apr	0	0	0
May	0	0	0
Jun	0	0	0
Jul	628	0	0
Aug	5,030	0	0
Sep	10,431	0	0
Oct	15,046	0	0
Nov	24,324	0	0
Dec	44,536	0	0
1978 Jan	64,412	0	0
Feb	99,295	0	0
Mar	183,864	2,075	396
Apr	272,855	5,185	525
May	318,842	11,857	1,340
Jun	113,243	75,963	4,271
Jul	354,537	104,139	8,333
Aug	379,604	142,319	11,624
Sep	389,675	212,029	17,888
Oct	397,697	315,470	27,184
Nov	405,020	455,614	39,806
Dec	205,133	599,324	41,123
1979 Jan	410,409	717,058	42,925
Feb	411,023	730,836	43,082
Mar	411,155	733,856	43,318
Apr	411,708	735,938	43,445
May	404,677	729,541	41,957
Jun	403,051	733,551	42,049
Jul	353,739	732,933	42,247
Aug	298,661	690,800	36,168
Sep	259,745	585,192	28,519
Oct	250,076	549,927	27,023
Nov	240,890	536,812	25,720
Dec	234,244	551,230	26,992
1980 Jan	230,015	585,969	29,207
Feb	221,765	645,398	33,649
Mar	222,625	715,421	35,901
Apr	227,037	756,702	37,683
May	233,998	797,608	38,971
Jun	237,500	856,618	39,883
Jul	233,064	871,434	40,406
Aug	228,844	866,105	35,777
Sep	224,082	789,791	23,771
Oct	214,416	636,408	7,723
Nov	212,748	587,337	5,610
Dec	210,464	565,188	924

See footnote at end of table. -- Continued

Appendix table 1. Quantity of wheat, corn and sorghum in U.S. FOR, 1977-84--Continued[1/]

Year/month	Wheat	Corn	Sorghum
	--- 1,000 Bu. ---		1,000 cwt.
1981 Jan	229,123	709,301	1,090
Feb	277,977	979,046	321
Mar	303,772	908,417	193
Apr	353,165	821,803	76
May	359,442	438,690	34
Jun	360,199	372,868	33
Jul	360,566	345,738	106
Aug	362,503	280,193	59
Sep	398,640	224,443	25
Oct	431,146	185,350	10
Nov	450,937	189,012	3,585
Dec	459,154	349,507	24,712
1982 Jan	475,389	788,091	74,179
Feb	508,824	1,207,005	114,431
Mar	515,175	1,205,676	115,850
Apr	534,609	1,169,828	121,153
May	554,585	1,472,734	124,320
Jun	560,366	1,486,067	125,305
Jul	566,992	1,329,731	126,766
Aug	669,785	1,334,056	132,196
Sep	763,317	1,353,264	141,087
Oct	868,868	1,388,070	149,660
Nov	935,811	1,446,180	154,023
Dec	986,317	1,648,090	183,886
1983 Jan	1,018,054	2,097,060	214,492
Feb	1,093,753	2,542,936	248,215
Mar	1,117,071	2,681,344	255,270
Apr	1,094,975	2,739,970	257,981
May	1,080,993	2,752,948	258,434
Jun	1,060,624	2,755,968	254,485
Jul	940,899	2,658,396	235,429
Aug	883,751	2,452,318	212,942
Sep	824,791	1,906,182	175,297
Oct	815,442	1,839,073	171,239
Nov	762,920	1,499,927	148,894
Dec	736,618	1,399,149	142,725
1984 Jan	702,622	1,303,992	137,036
Feb	648,065	1,187,801	129,962
Mar	610,664	1,104,668	124,899
Apr	587,719	852,559	112,251
May	580,829	674,549	107,915
Jun	611,168	588,709	105,760
Jul	639,789	538,874	103,849
Aug	655,941	494,660	103,178
Sep	657,914	447,827	100,467
Oct	659,047	426,129	99,745

1/ Quantity represents beginning monthly stocks.

Appendix table 2. Corn production and stock data for selected States, August 1984

State	1984 production (estimated)	Total stocks June 1, 1984	FOR stocks August 1984	CCC stocks August 1984	Cash price August 1984
	Million bushels				Dollars/bushel
Georgia	1/79.1 (1.1)	18.5 (0.6)	0.3 (.01)	0.98 (0.5)	3.09
Illinois	1235.1 (16.5)	291.1 (8.9)	27.0 (5.5)	26.9 (13.5)	3.20
Indiana	690.0 (9.2)	122.2 (3.8)	12.6 (2.5)	11.7 (5.9)	3.24
Iowa	1435.1 (19.1)	500.1 (15.4)	133.3 (27.0)	61.7 (30.9)	3.05
Kansas	101.8 (1.4)	51.5 (1.6)	92.7 (18.8)	1.8 (0.9)	3.23
Minnesota	682.7 (9.1)	262.1 (8.0)	93.2 (18.8)	12.7 (6.4)	3.03
Nebraska	761.6 (10.2)	346.9 (10.6)	135.0 (27.3)	51.6 (25.8)	3.04
N. Carolina	148.5 (2.0)	15.5 (0.5)	1.2 (0.2)	.2 (0.1)	3.06
Ohio	431.2 (5.8)	81.7 (2.5)	2.5 (0.5)	.7 (0.4)	3.26
Pennsylvania	137.8 (1.8)	45.4 (1.4)	.5 (0.1)	0 (0.0)	3.80
S. Dakota	194.4 (2.6)	72.2 (2.2)	17.3 (3.5)	2.8 (1.4)	2.98
Wisconsin	353.6 (4..7)	160.7 (4.9)	15.1 (3.1)	6.0 (3.0)	3.22
United States	7497.8 (100.0)	3257.8 (100.0)	494.6 (100.0)	200.0 (100.0)	3.12

1/ Numbers in parentheses are percentages of U.S. totals.

Appendix table 3. Sorghum production and stock data for selected States, August 1984

State	1984 production (estimated)	Total stocks June 1, 1984	FOR stocks August 1984	CCC stocks August 1984	Cash price August 1984
	Million cwt.				$/cwt.
Kansas	114.0 (25.2) 1/	61.5 (29.2)	32.2 (31.2)	13.9 (29.4)	4.60
Missouri	52.1 (11.5)	6.2 (3.0)	.8 (.8)	0.4 (13.5)	4.84
Nebraska	69.2 (15.3)	47.1 (22.9)	29.4 (28.5)	12.3 (26.6)	4.38
Oklahoma	9.5 (2.1)	3.5 (1.7)	3.5 (3.4)	0.3 (0.6)	4.97
Texas	106.8 (23.6)	72.9 (35.5)	31.5 (30.5)	19.3 (40.8)	4.48
United States	451.7 (100.0)	205.6 (100.0)	103.2 (100.0)	47.3 (100.0)	4.55

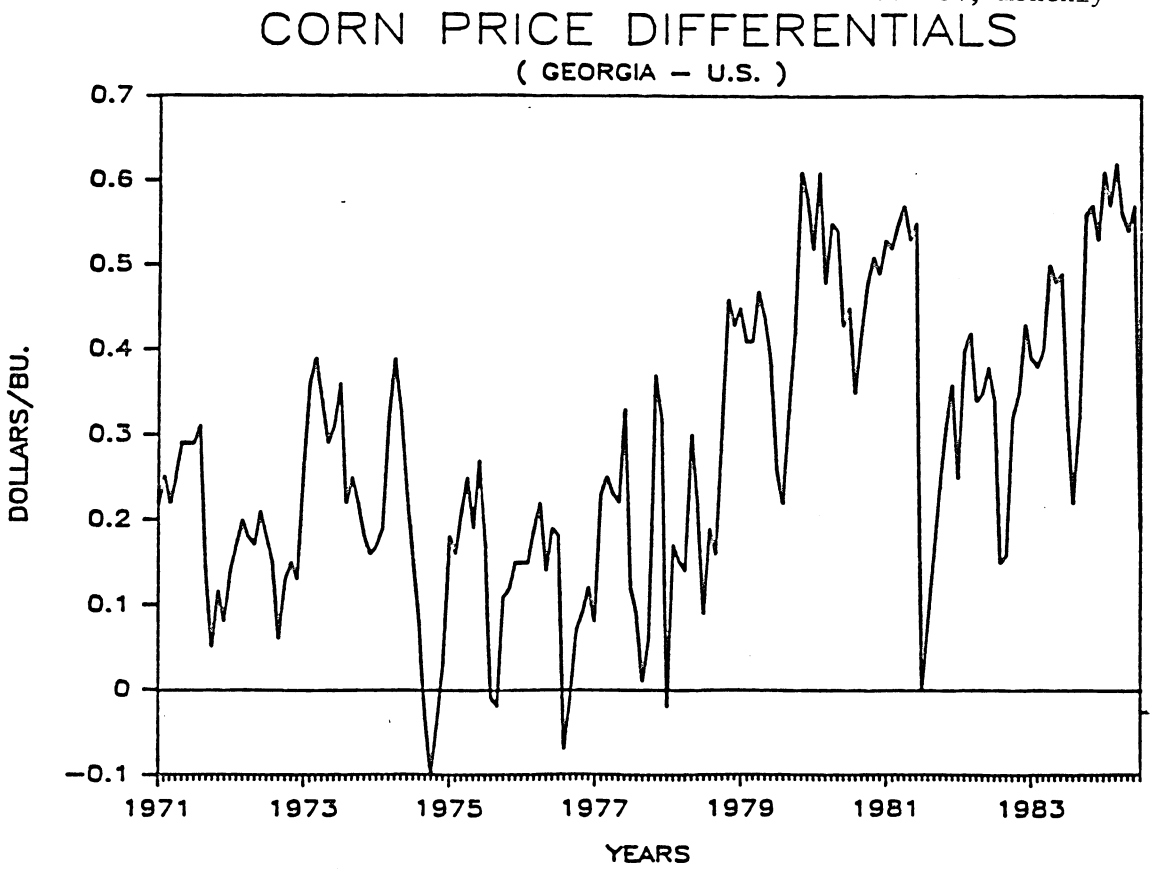
1/ Numbers in parentheses are percentages of U.S. totals.

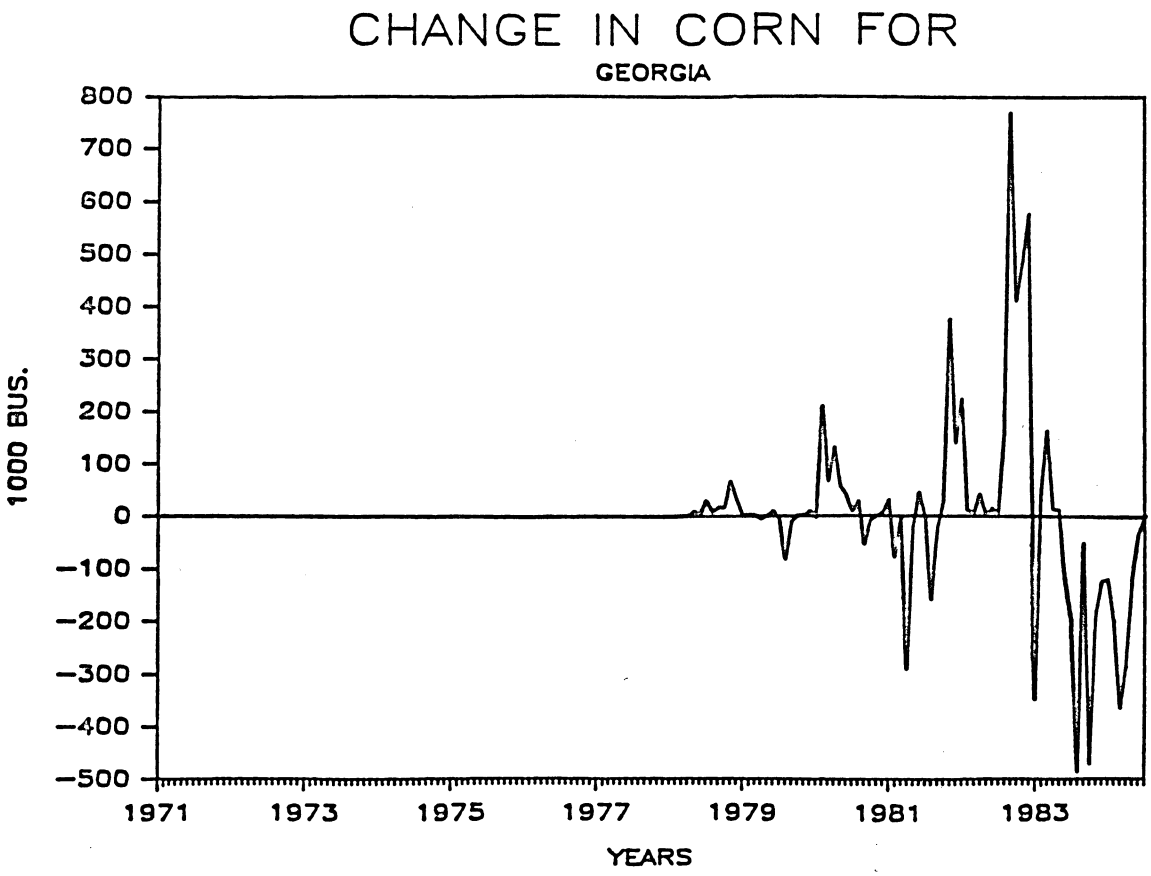
Appendix table 4. Wheat production and stock data for selected States, April, 1984

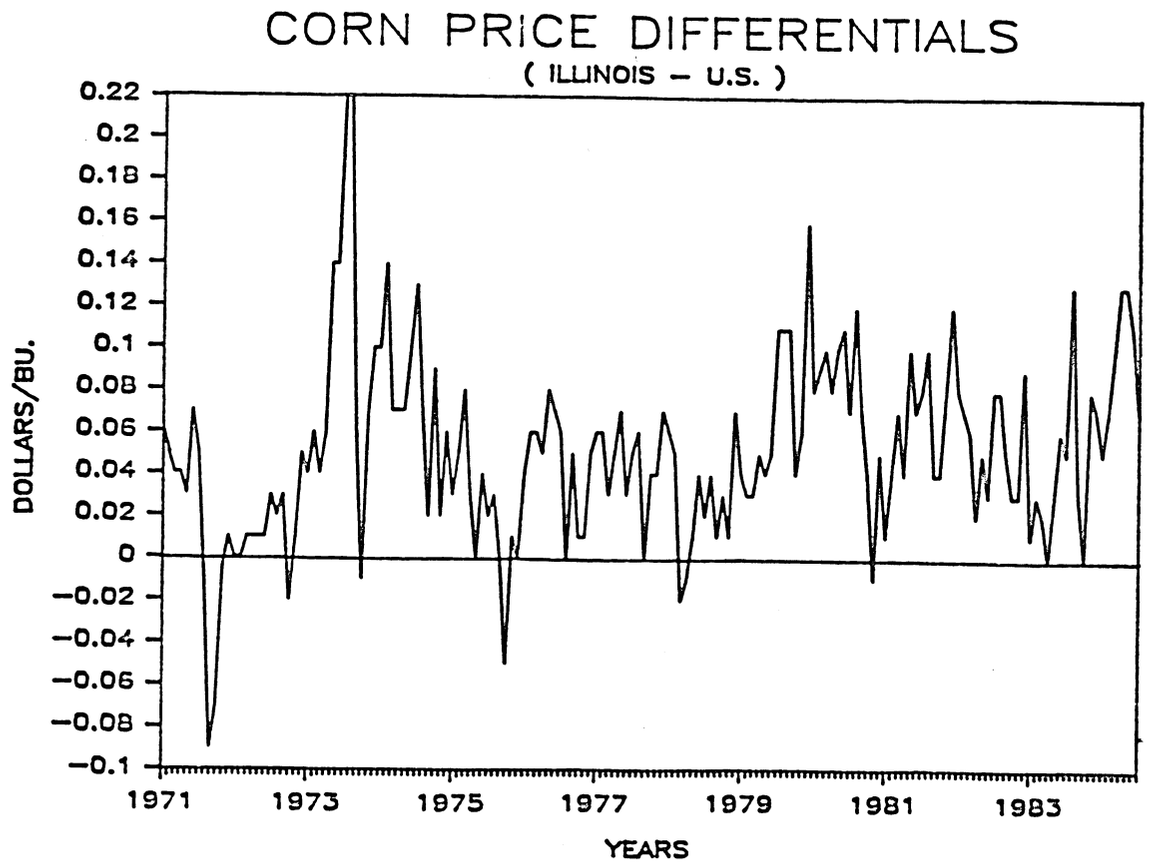
State	1984 production (estimated)	Total stocks April 1, 1984	FOR stocks April 1984	CCC stocks April 1984	Cash price April 1984
	Million bushels				Dollars/bushel
Kansas	429.0 1/(16.7)	324.7 (18.5)	86.7 (14.8)	32.0 (19.1)	3.50
Missouri	86.1 (3.3)	29.1 (1.7)	2.4 (.4)	2.6 (1.6)	3.54
Montana	106.4 (4.1)	122.7 (7.0)	57.3 (9.8)	9.4 (5.6)	3.76
Nebraska	82.8 (3.2)	94.1 (5.4)	27.9 (4.7)	9.0 (5.4)	3.48
N. Dakota	281.8 (11.0)	273.0 (15.6)	145.2 (24.7)	29.7 (17.8)	3.81
Oklahoma	190.8 (7.4)	109.8 (6.3)	38.7 (6.6)	10.3 (6.2)	3.53
S. Dakota	116.6 (4.5)	104.8 (6.0)	46.9 (8.0)	6.8 (4.1)	3.80
Washington	159.2 (6.2)	123.0 (7.0)	43.7 (7.4)	8.2 (4.9)	3.72
United States	2570.3	1752.8	587.8	167.0	3.63

1/ Numbers in parentheses are percentages of U.S. totals.

Appendix figure 1. State-U.S. grain price differentials and Change in FOR stocks for selected States: 1971-84, monthly



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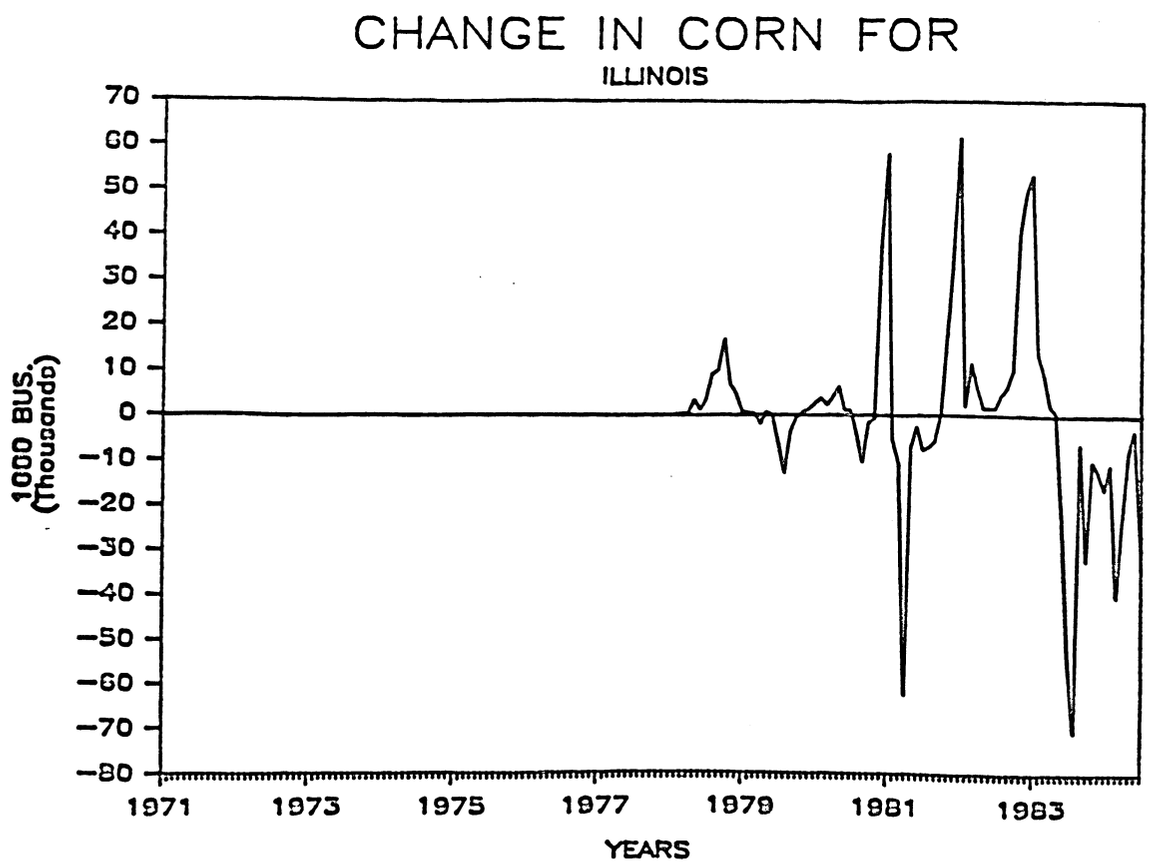
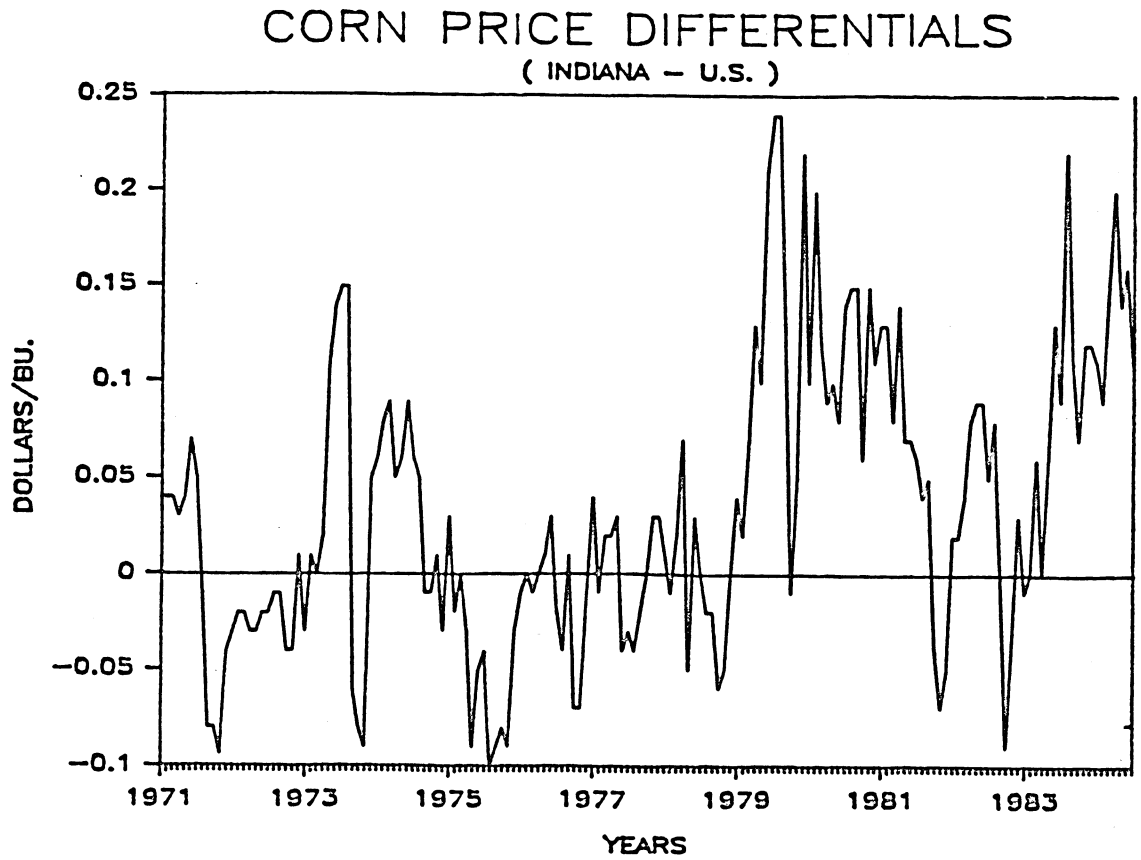
(ILLINOIS – U.S.)
DOLLARS/BU.
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
−0.1
1971
1973
1975
1977
1979
1981
1983
YEARS


CHANGE IN CORN FOR
ILLINOIS
1000 BUS.
(Thousands)
70
60
50
40
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
1971
1973
1975
1977
1979
1981
1983
YEARS


CORN PRICE DIFFERENTIALS
(INDIANA – U.S.)
DOLLARS/BU.
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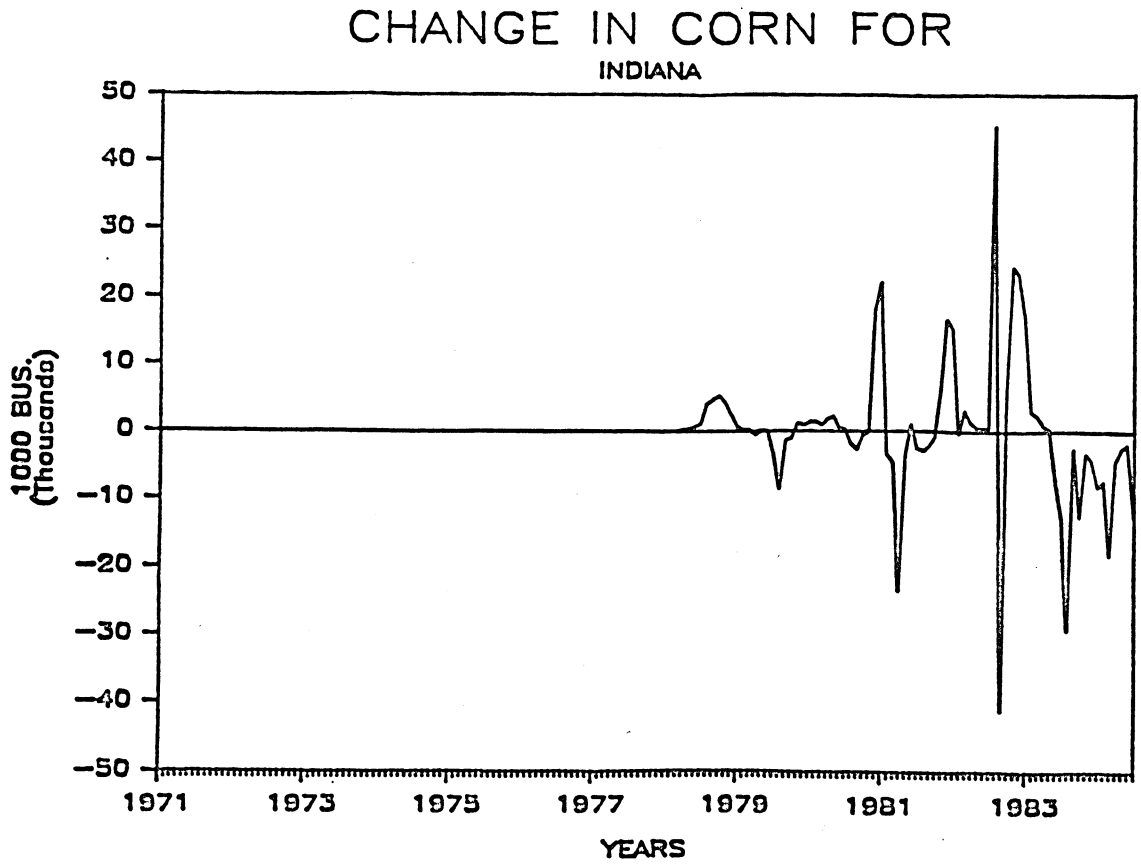
0.15
0.1
0.05
0
−0.05
−0.1
1971
1973
1975
1977
1979
1981
1983
YEARS


CHANGE IN CORN FOR
INDIANA
1000 BUS.
(Thousands)
50
40
30
20
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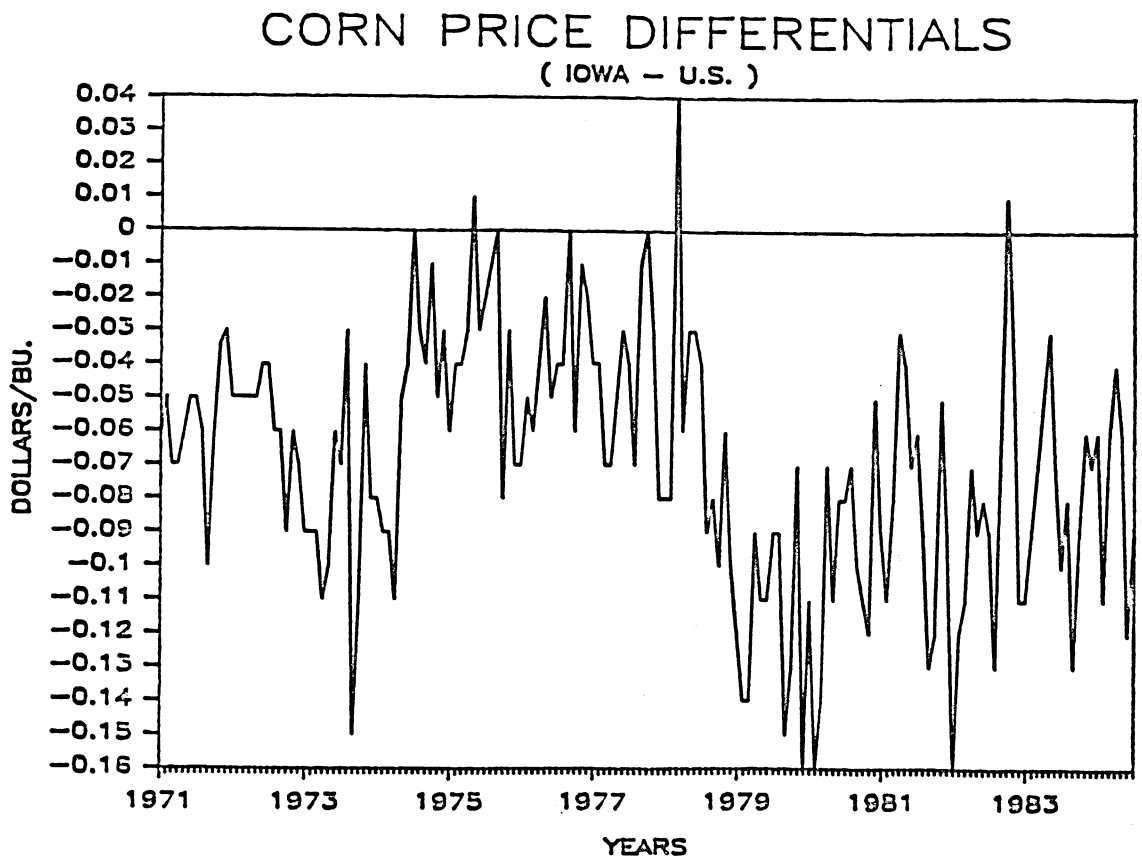
−50
1971
1973
1975
1977
1979
1981
1983
YEARS


CORN PRICE DIFFERENTIALS
(IOWA – U.S.)
DOLLARS/BU.
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0.03
0.02
0.01
0
−0.01
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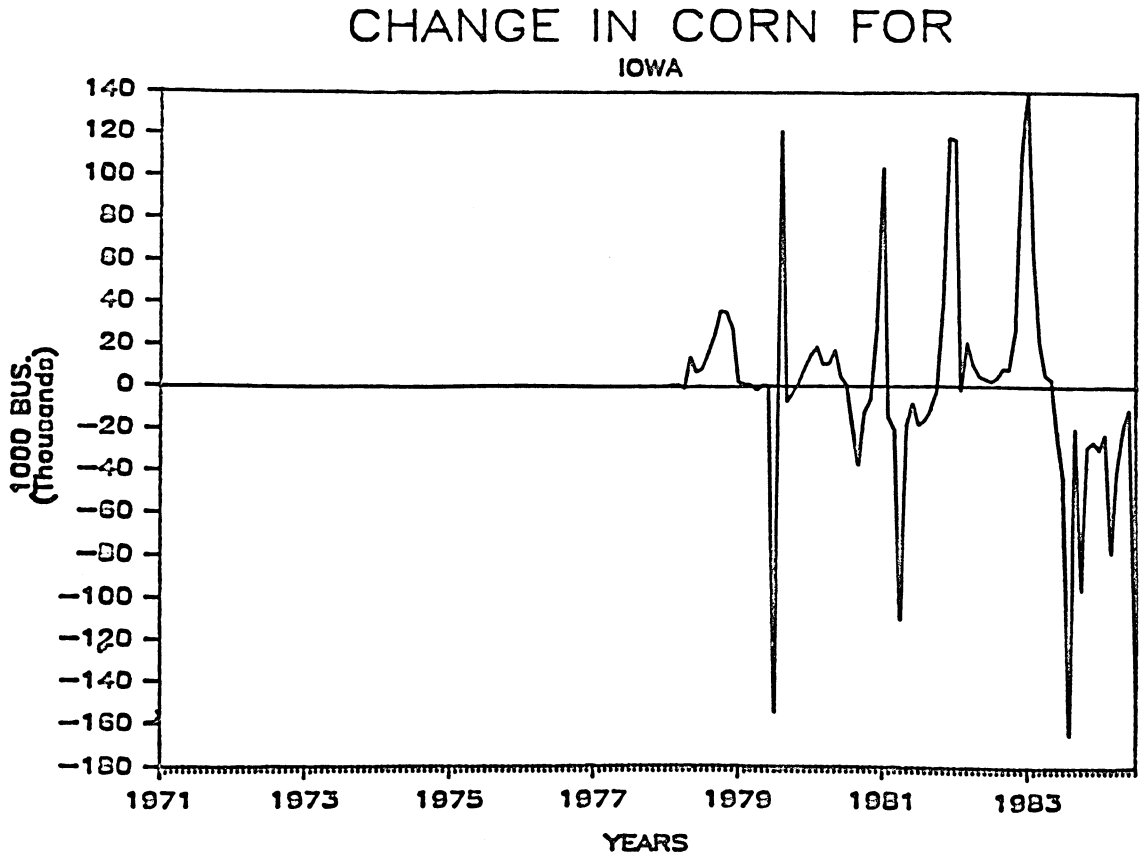
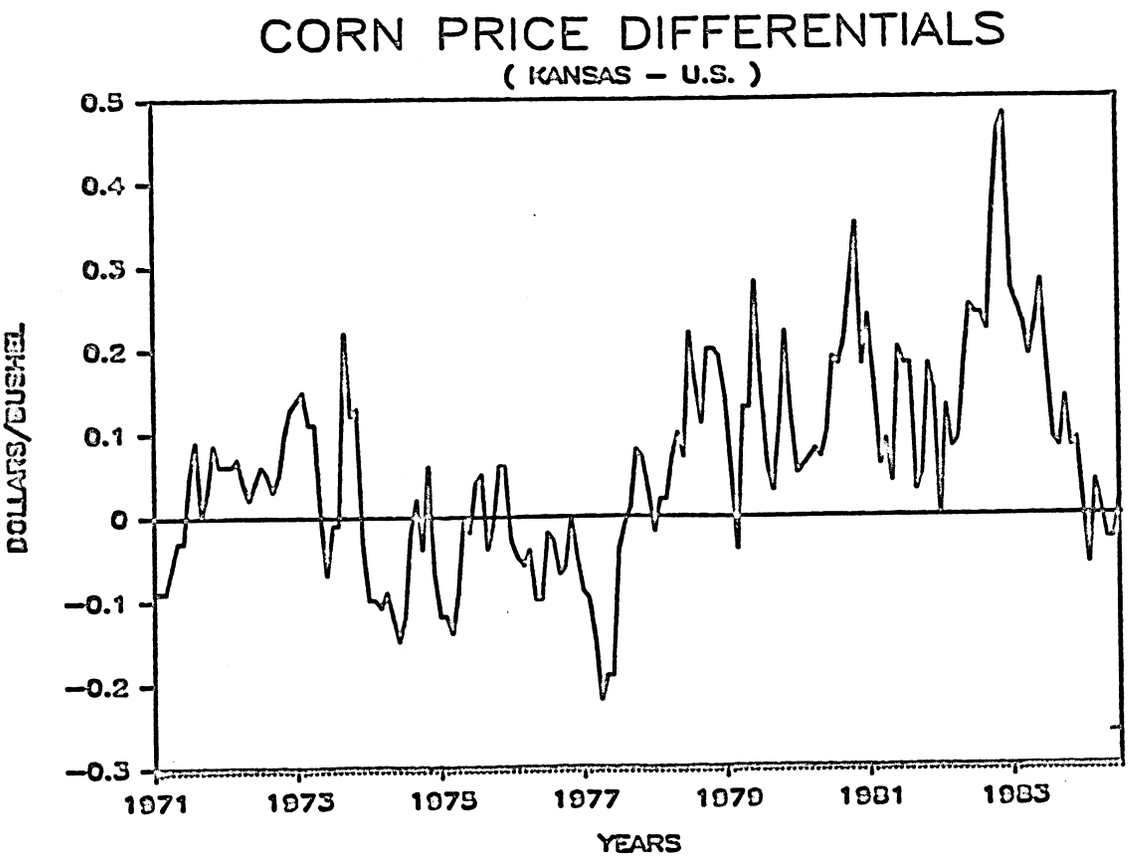
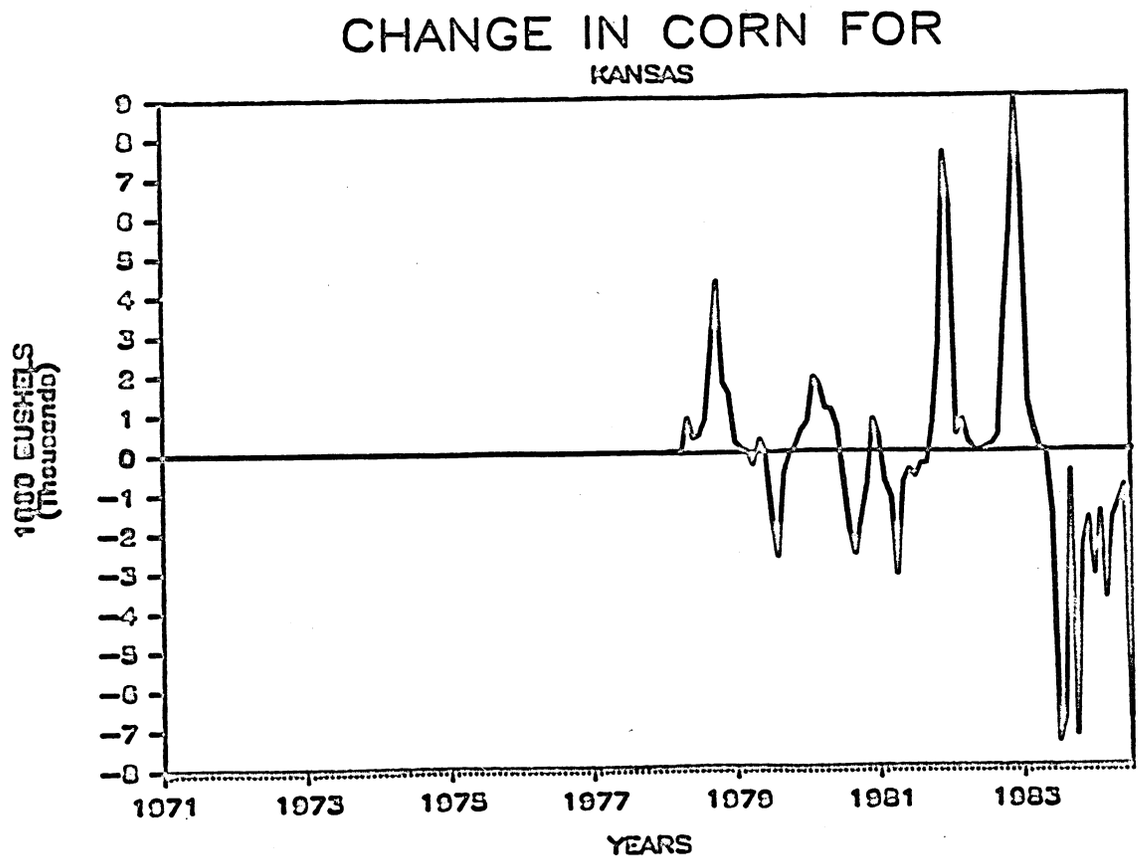
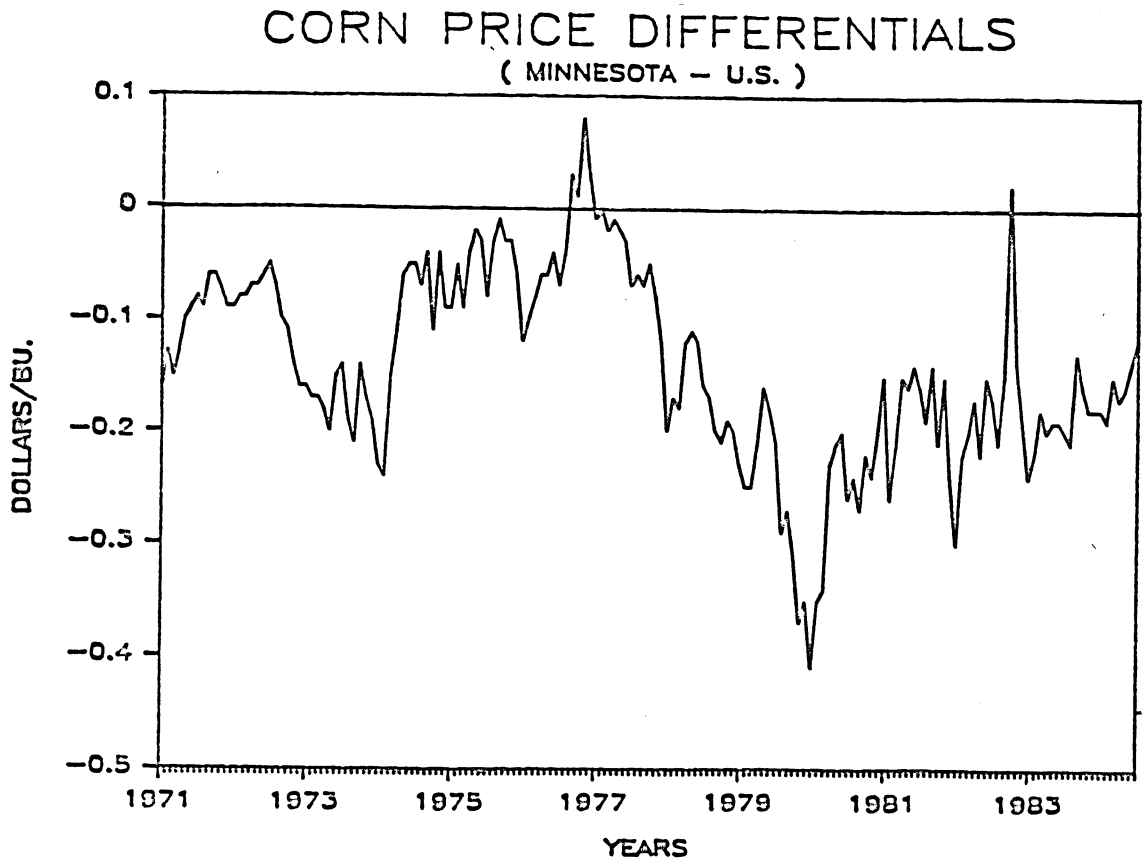
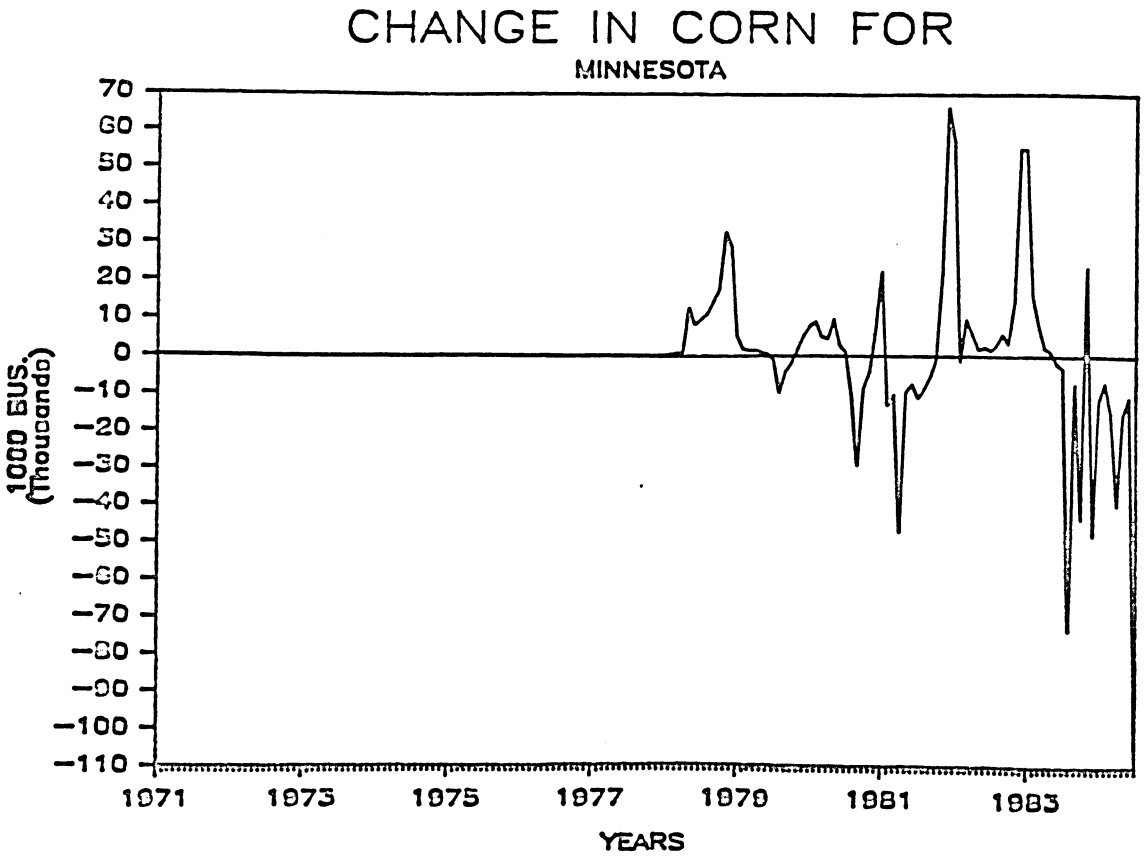
−0.03
−0.04
−0.05
−0.06
−0.07
−0.08
−0.09
−0.1
−0.11
−0.12
−0.13
−0.14
−0.15
−0.16
1971
1973
1975
1977
1979
1981
1983
YEARS

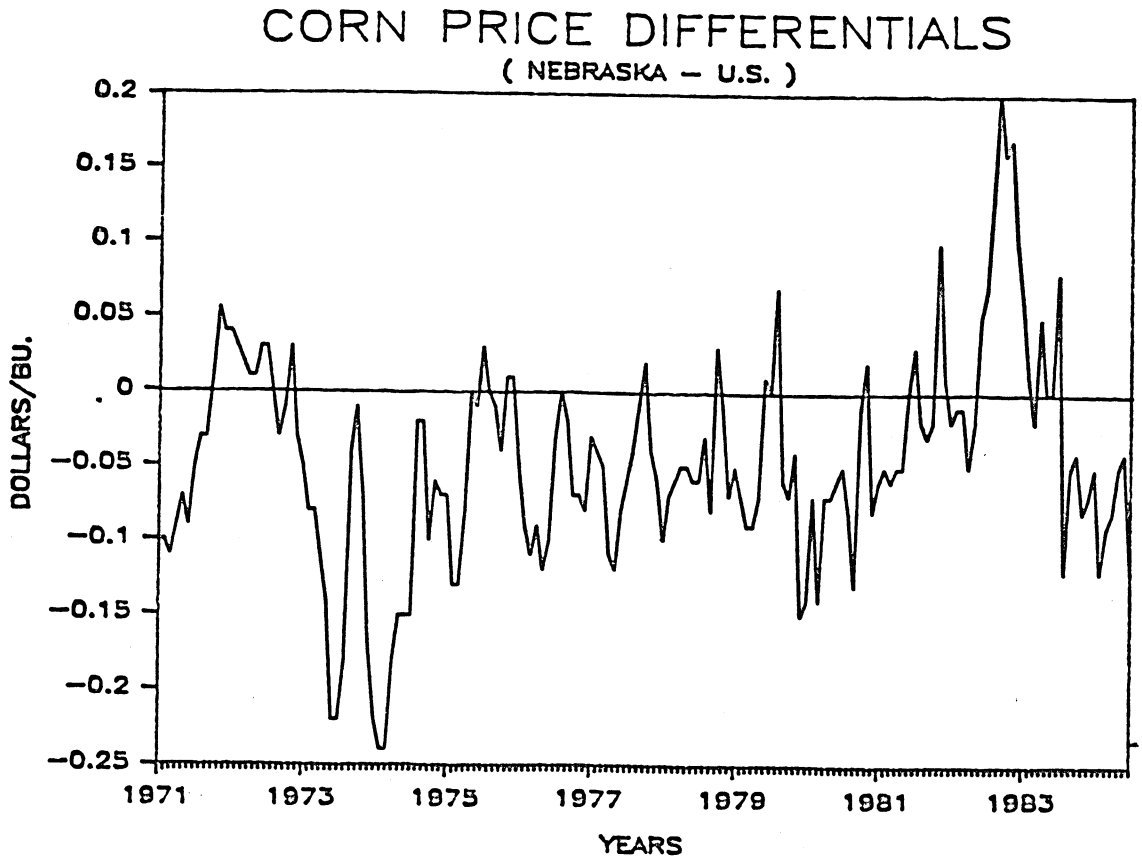

CHANGE IN CORN FOR
IOWA
1000 BUS.
(Thousands)
140
120
100
80
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
1971
1973
1975
1977
1979
1981
1983
YEARS

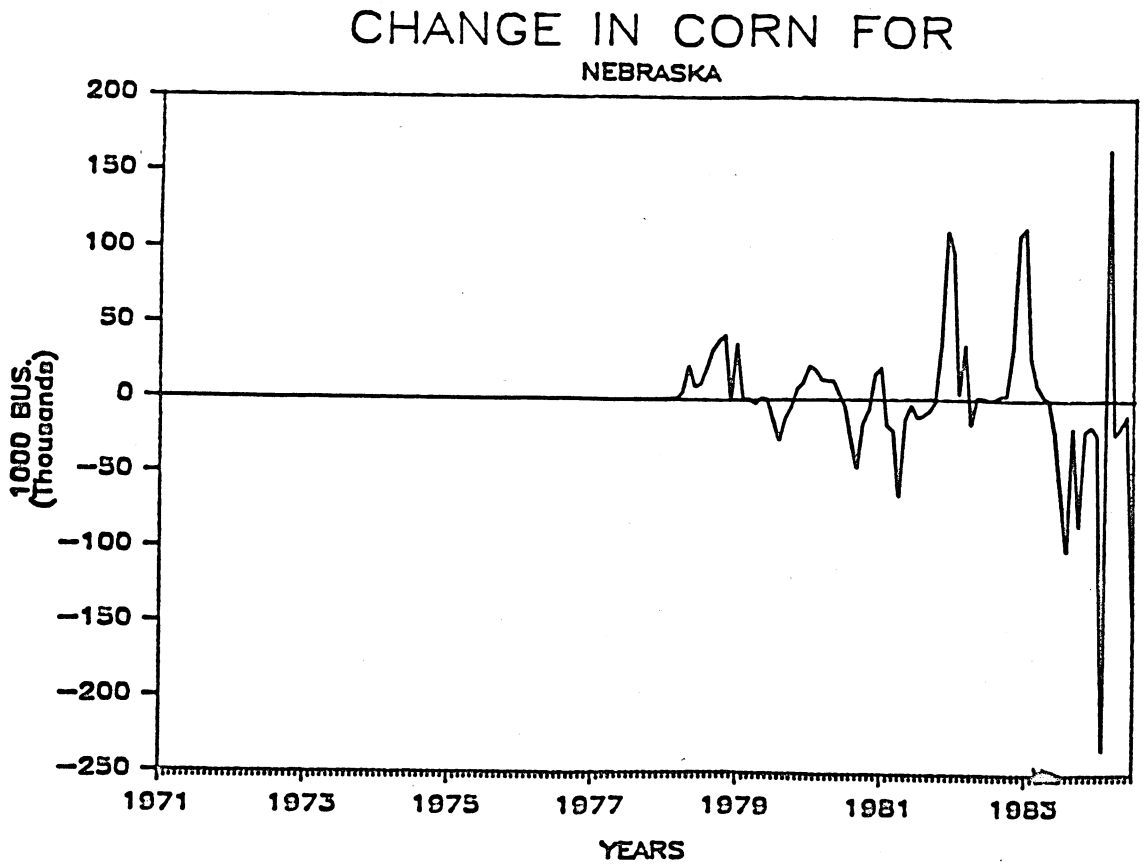

CORN PRICE DIFFERENTIALS
(KANSAS – U.S.)
DOLLARS/BUSHEL
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
1971
1973
1975
1977
1979
1981
1983
YEARS

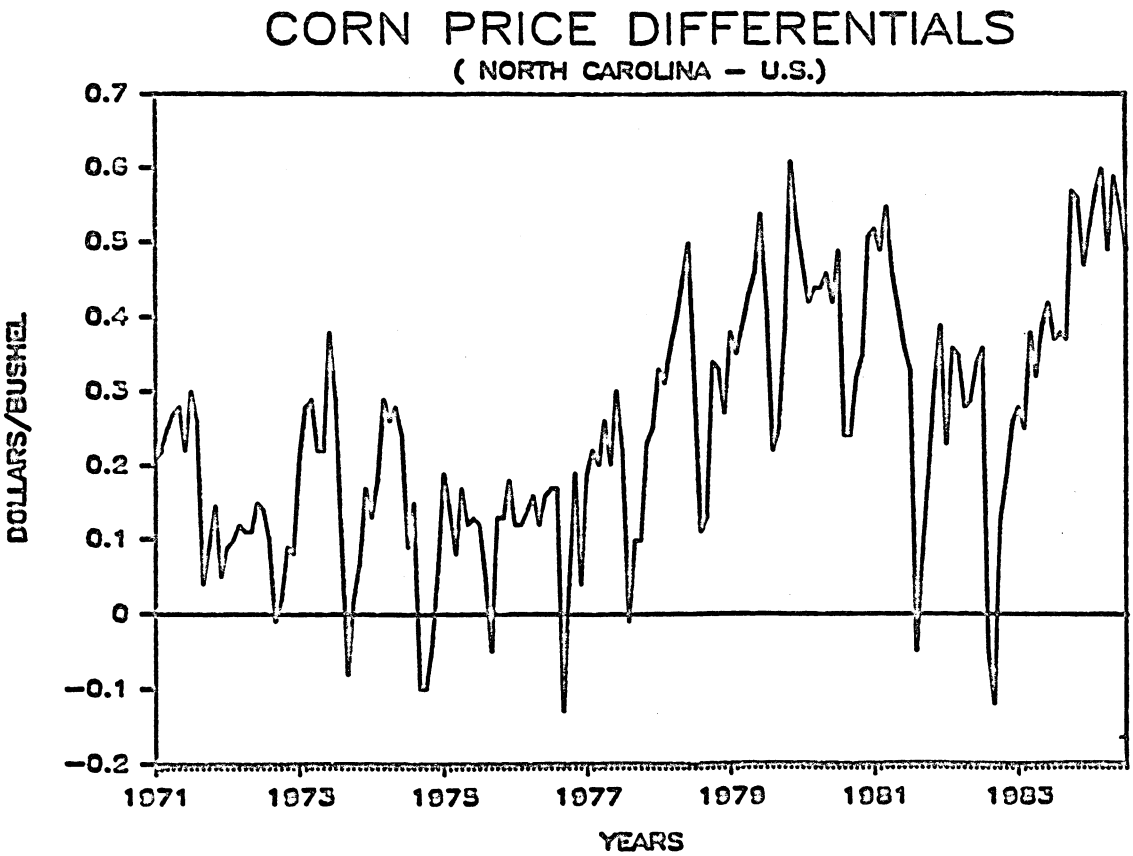

CHANGE IN CORN FOR
KANSAS
1000 BUSHELS
(Thousands)
9
8
7
6
5
4
3
2
1
0
−1
−2
−3
−4
−5
−6
−7
−8
1971
1973
1975
1977
1979
1981
1983
YEARS

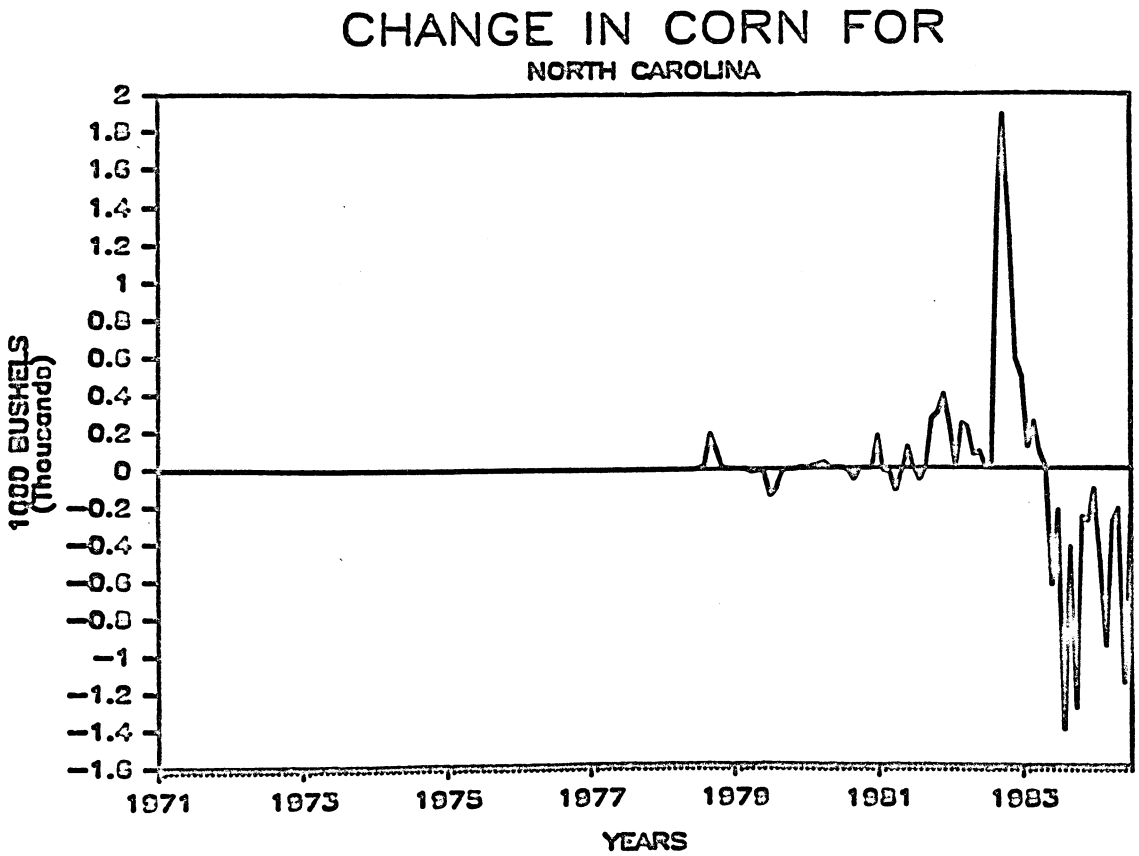

CORN PRICE DIFFERENTIALS
(MINNESOTA – U.S.)
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
DOLLARS/BU.
1971
1973
1975
1977
1979
1981
1983
YEARS

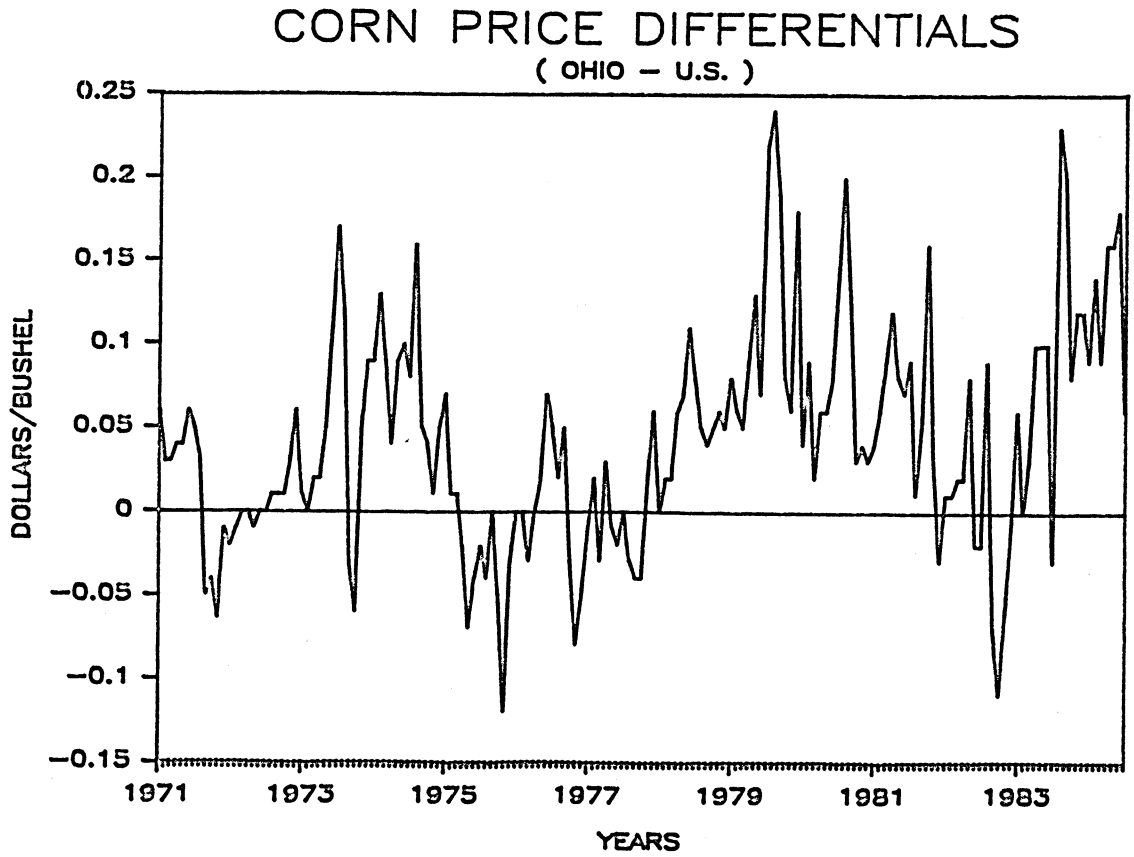

CHANGE IN CORN FOR
MINNESOTA
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1000 BUS.
(Thousands)
1971
1973
1975
1977
1979
1981
1983
YEARS

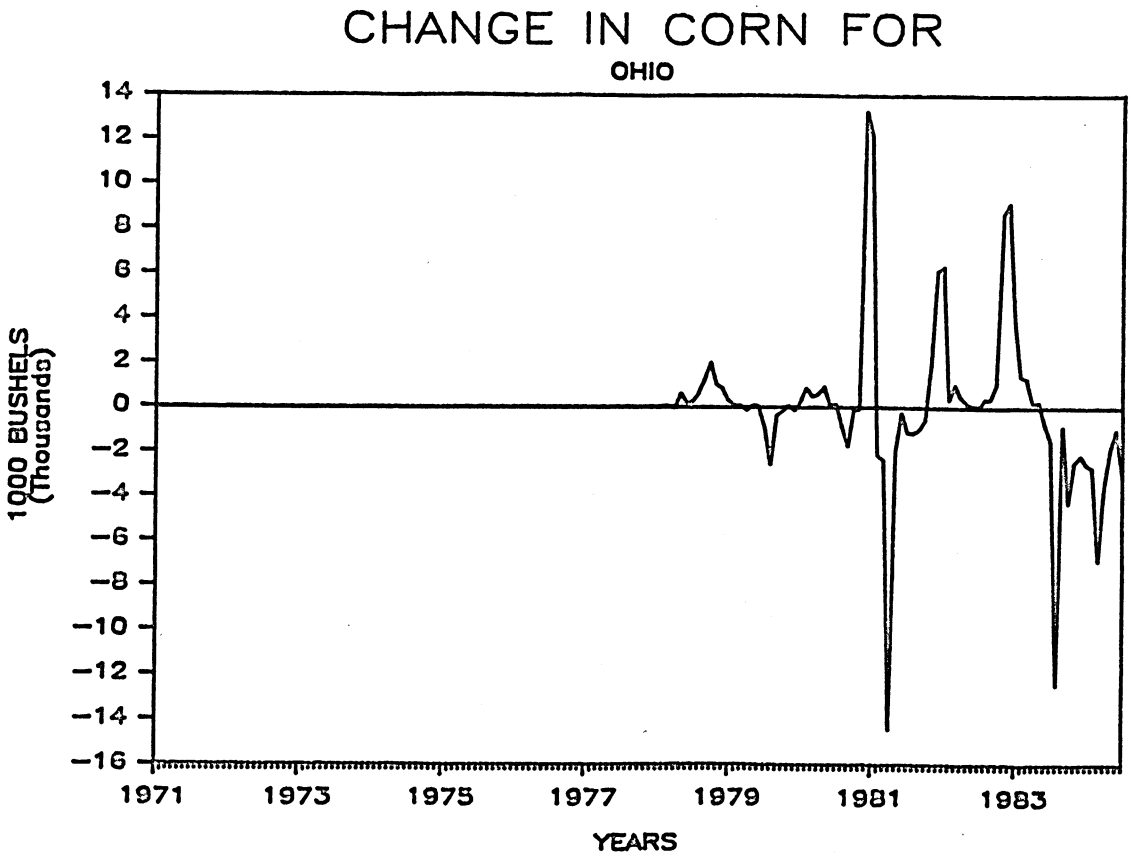

CORN PRICE DIFFERENTIALS
(NEBRASKA – U.S.)
DOLLARS/BU.
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
1971
1973
1975
1977
1979
1981
1983
YEARS

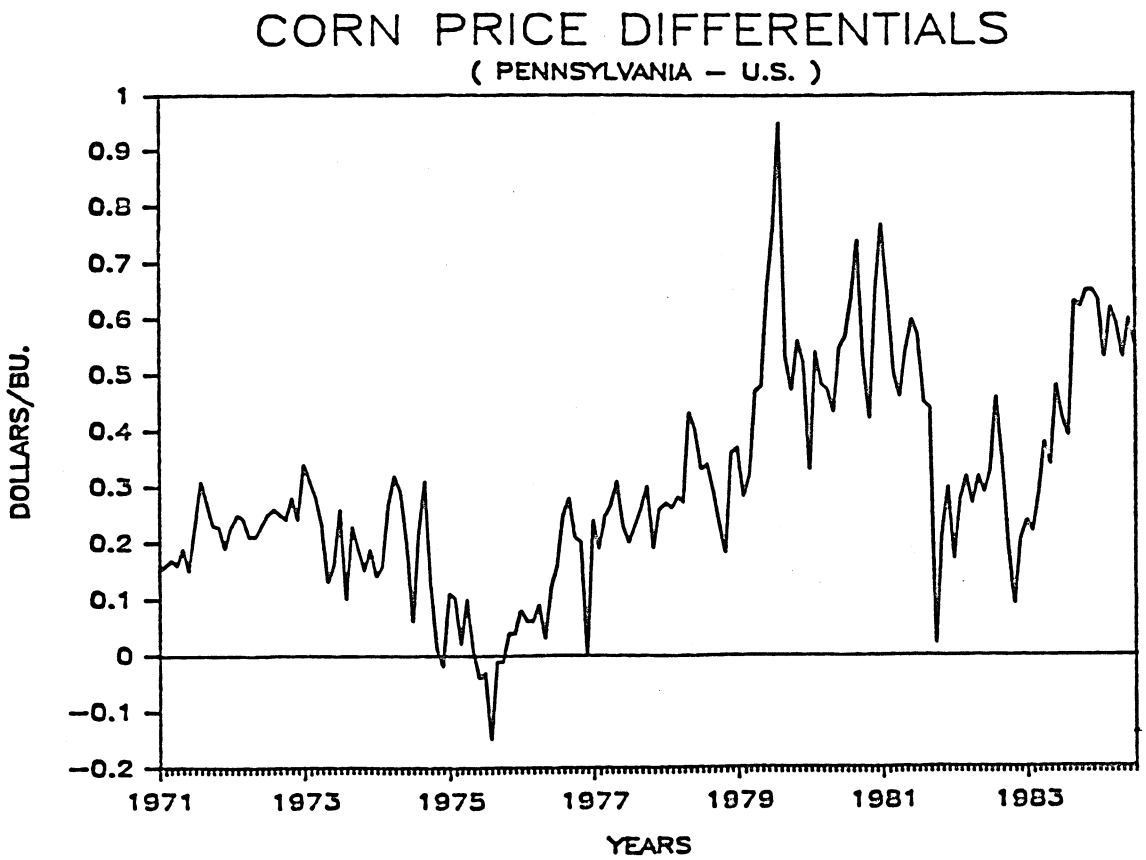

CHANGE IN CORN FOR
NEBRASKA
1000 BUS.
(Thousands)
200
150
100
50
0
-50
-100
-150
-200
-250
1971
1973
1975
1977
1979
1981
1983
YEARS

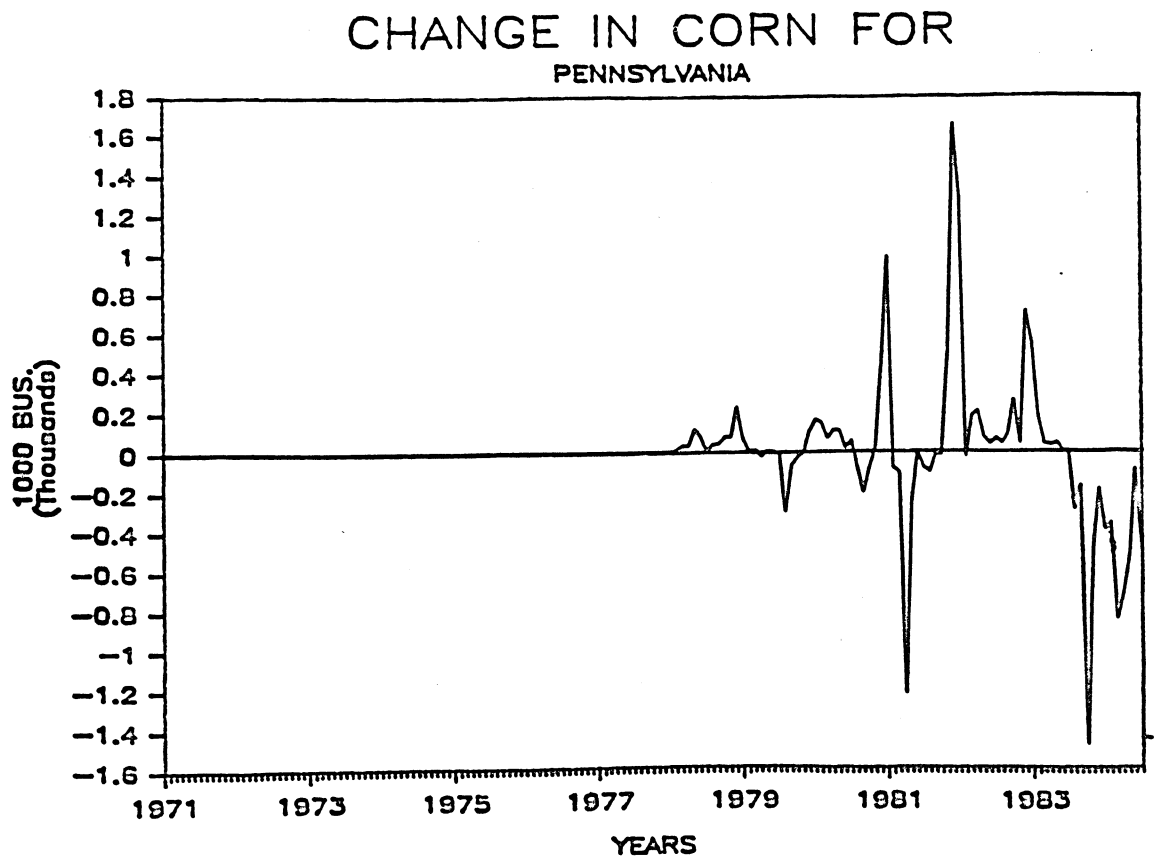

CORN PRICE DIFFERENTIALS
(NORTH CAROLINA – U.S.)
DOLLARS/BUSHEL
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
1971
1973
1975
1977
1979
1981
1983
YEARS

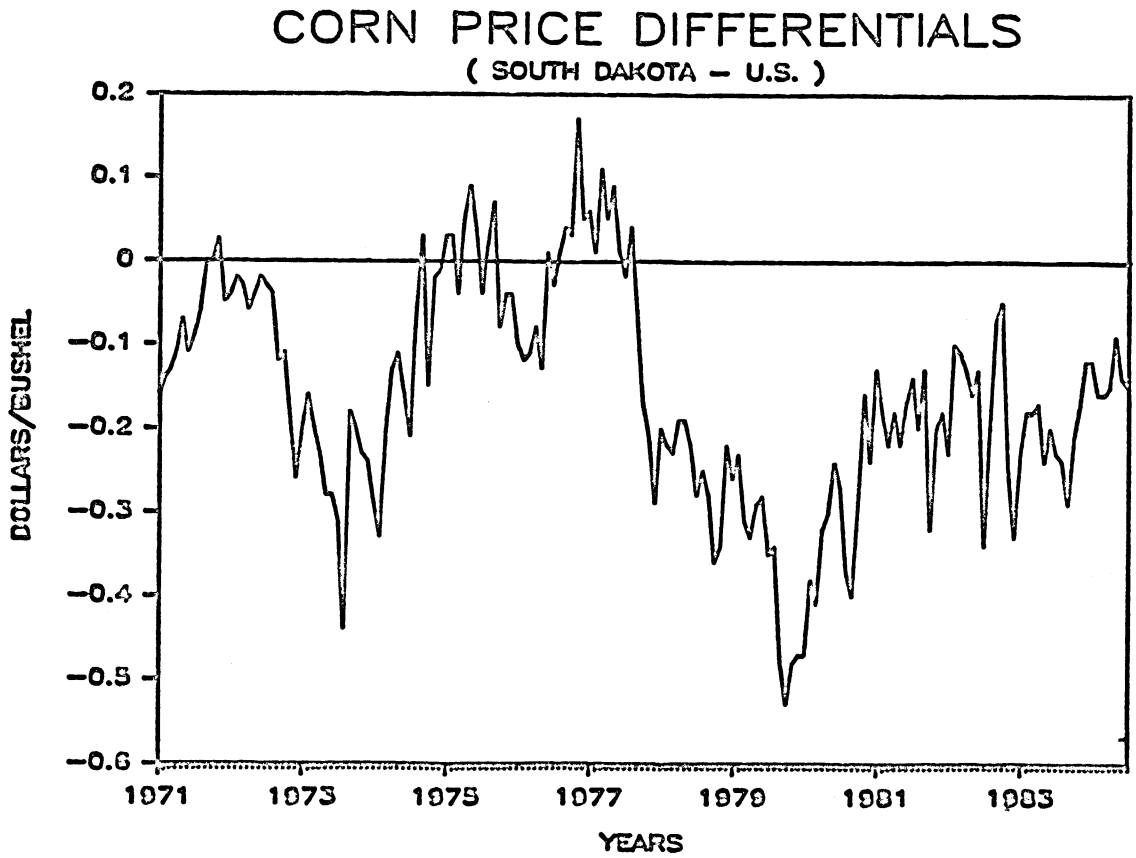

CHANGE IN CORN FOR
NORTH CAROLINA
1000 BUSHELS
(Thousands)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
1971
1973
1975
1977
1979
1981
1983
YEARS

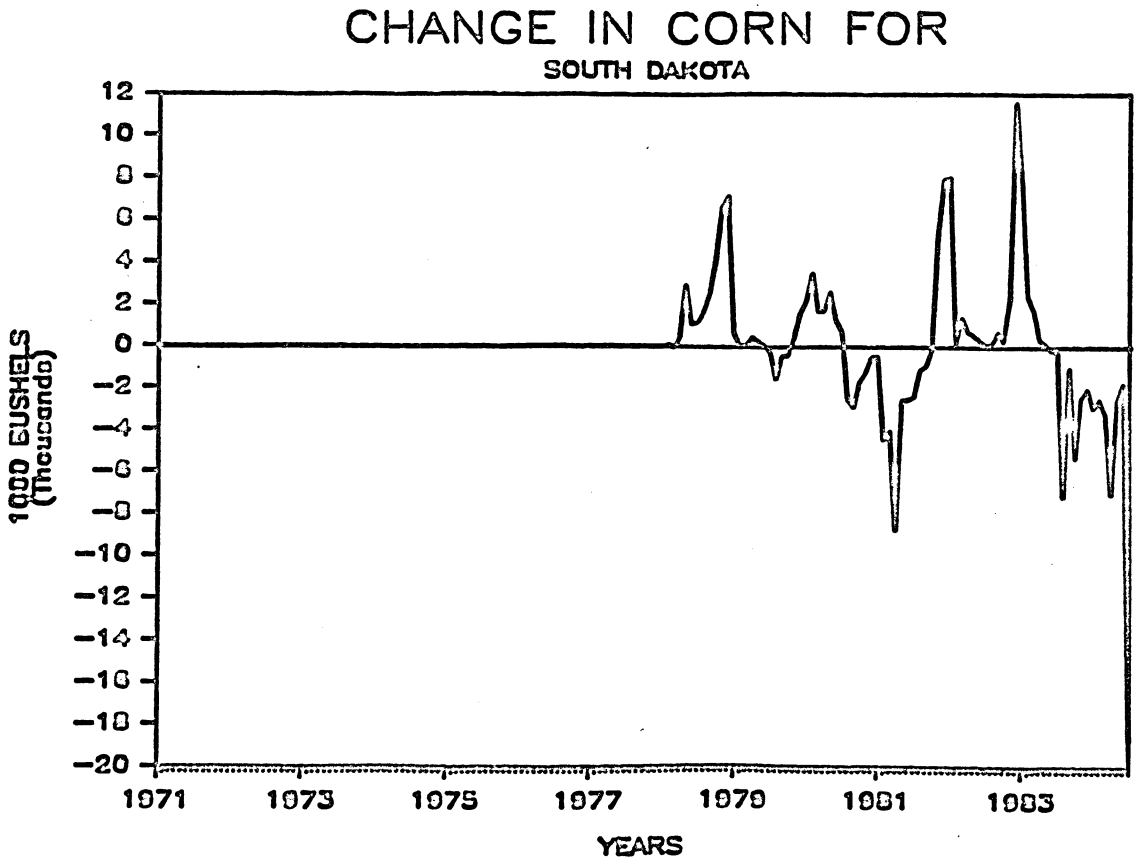

CORN PRICE DIFFERENTIALS
(OHIO – U.S.)
DOLLARS/BUSHEL
0.25
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
1971
1973
1975
1977
1979
1981
1983
YEARS

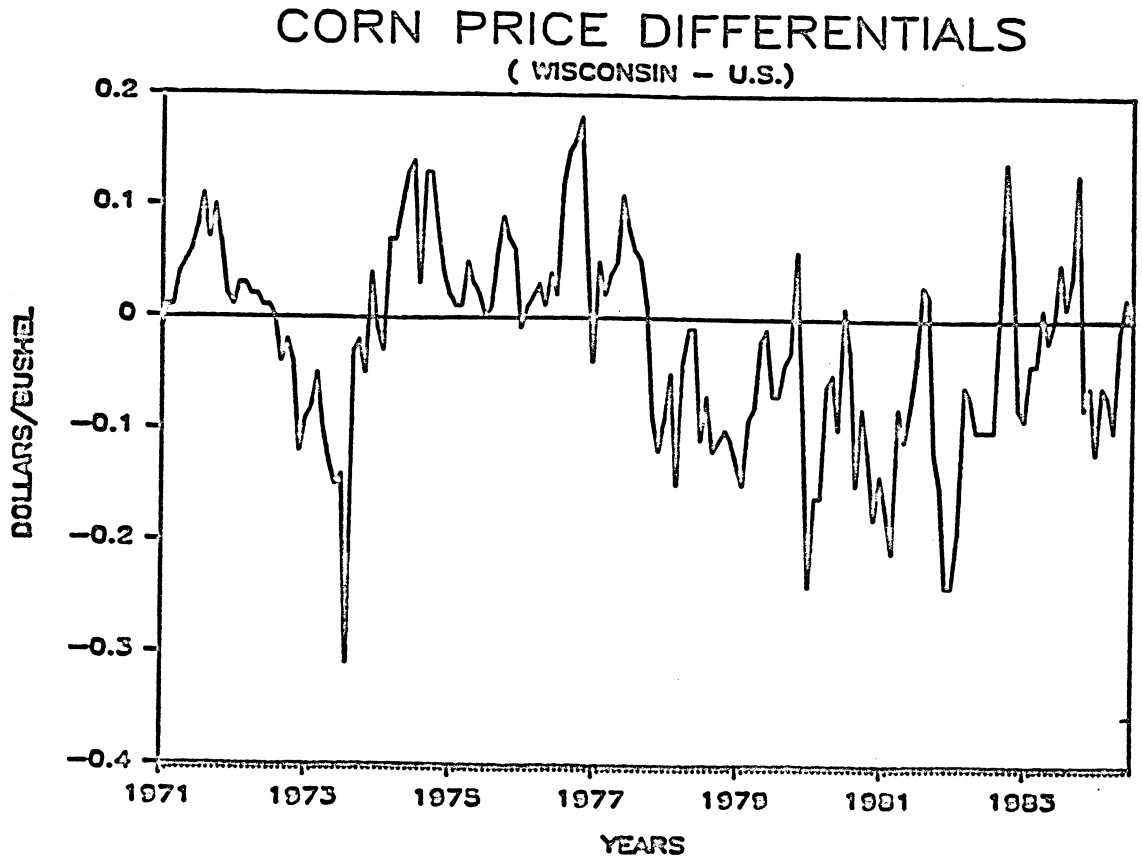

CHANGE IN CORN FOR
OHIO
1000 BUSHELS
(Thousands)
14
12
10
8
6
4
2
0
−2
−4
−6
−8
−10
−12
−14
−16
1971
1973
1975
1977
1979
1981
1983
YEARS

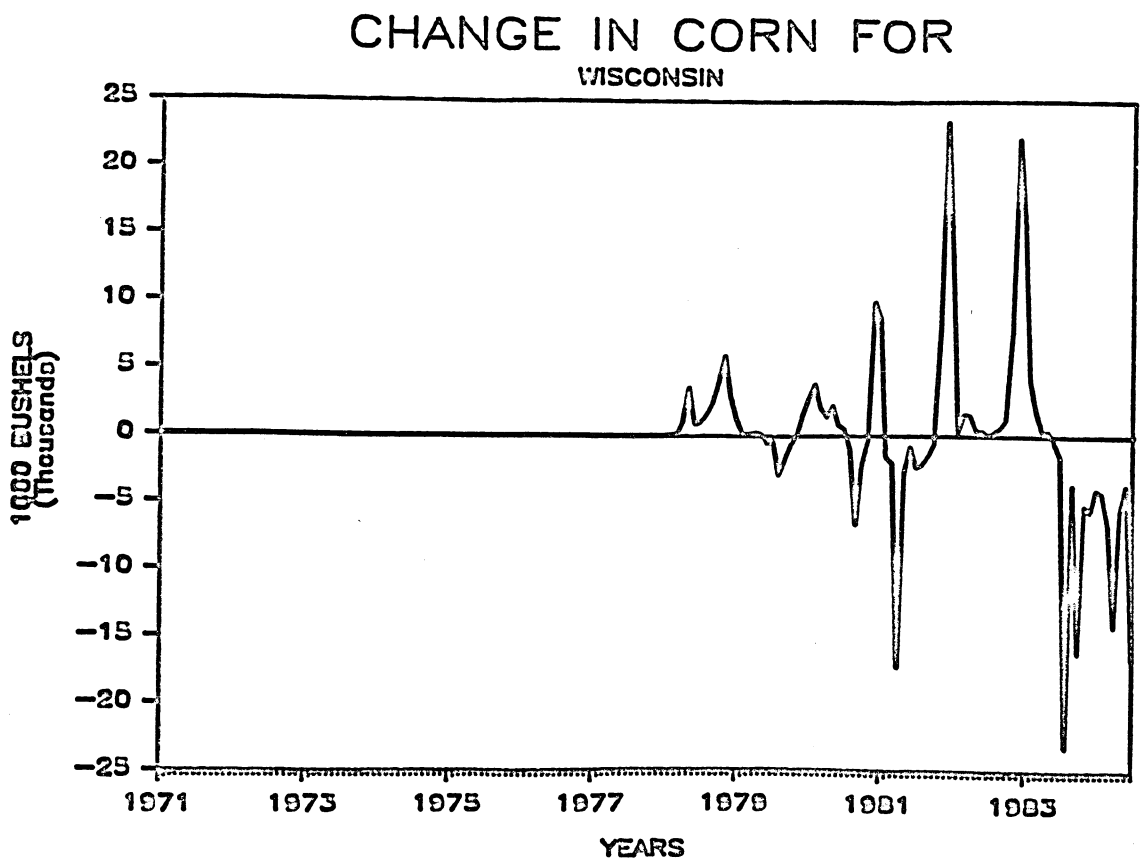

CORN PRICE DIFFERENTIALS
(PENNSYLVANIA – U.S.)
DOLLARS/BU.
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
1971
1973
1975
1977
1979
1981
1983
YEARS

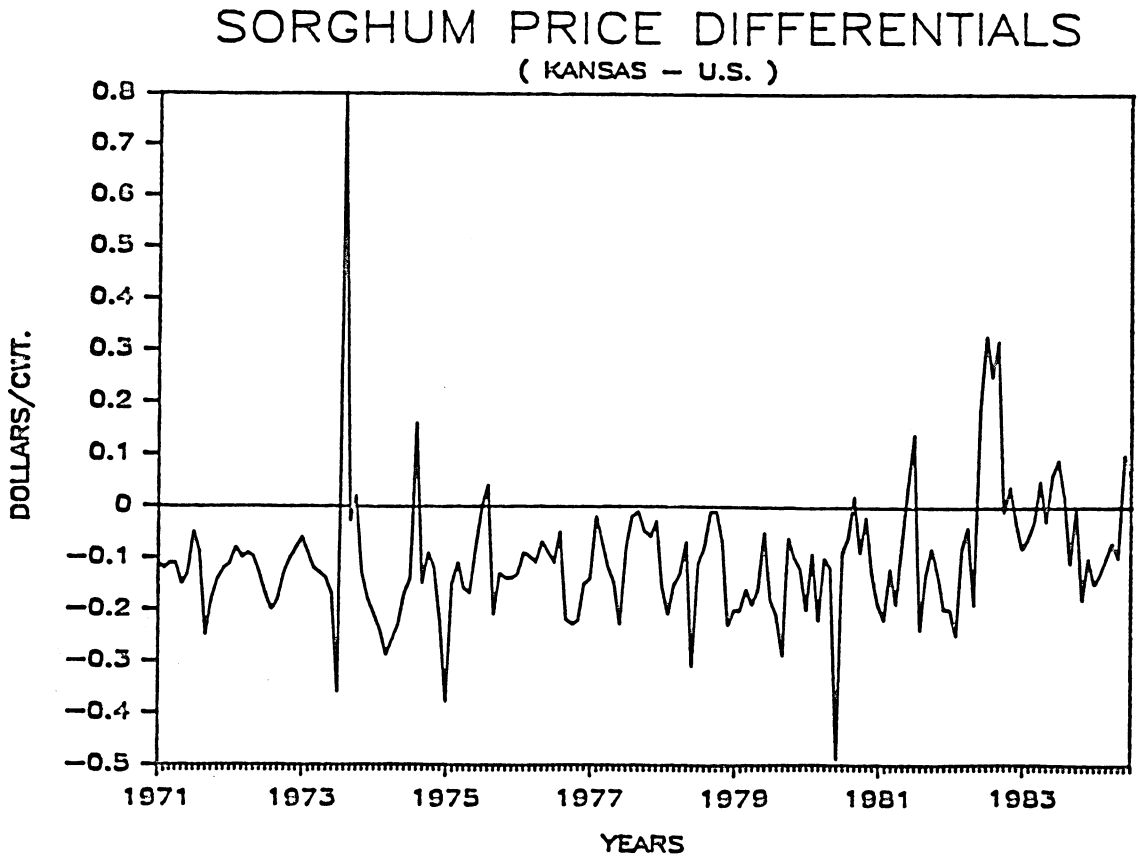

CHANGE IN CORN FOR
PENNSYLVANIA
1000 BUS.
(Thousands)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
1971
1973
1975
1977
1979
1981
1983
YEARS

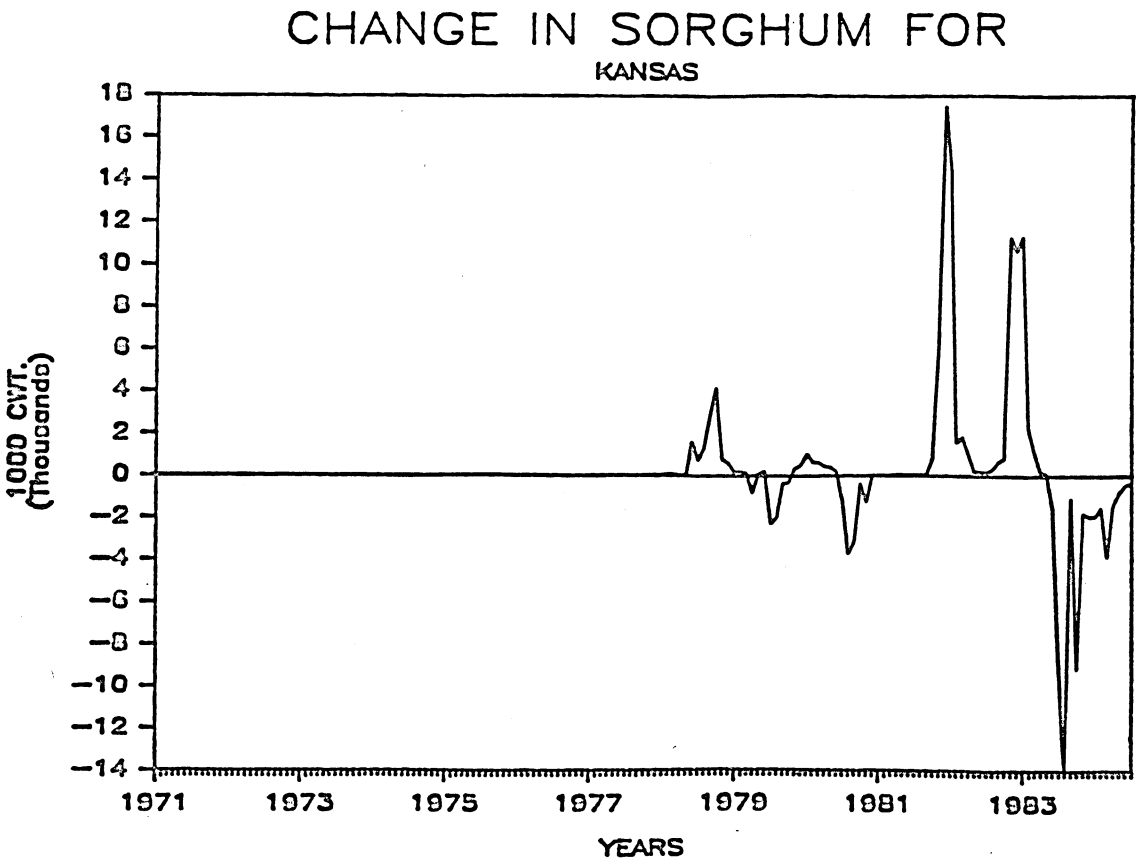

CORN PRICE DIFFERENTIALS
(SOUTH DAKOTA – U.S.)
DOLLARS/BUSHEL
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
1971
1973
1975
1977
1979
1981
1983
YEARS

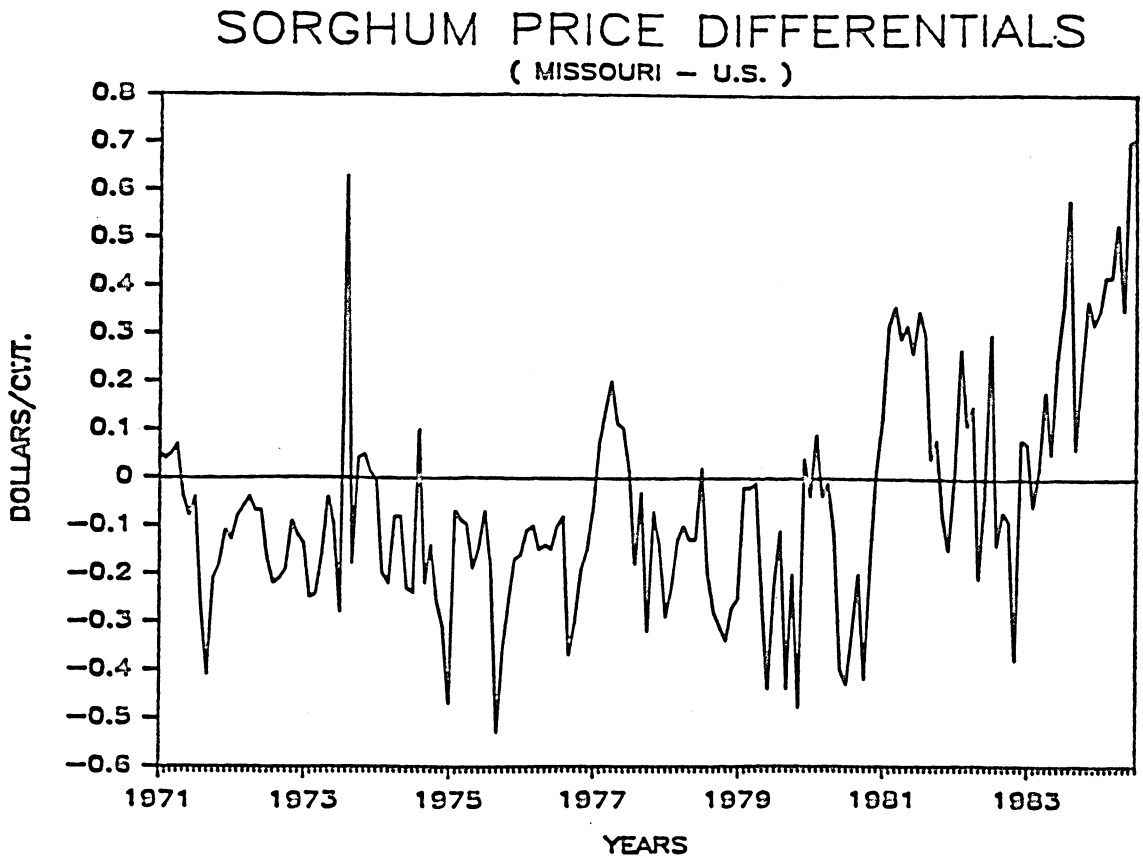

CHANGE IN CORN FOR
SOUTH DAKOTA
1000 BUSHELS
(Thousands)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
1971
1973
1975
1977
1979
1981
1983
YEARS

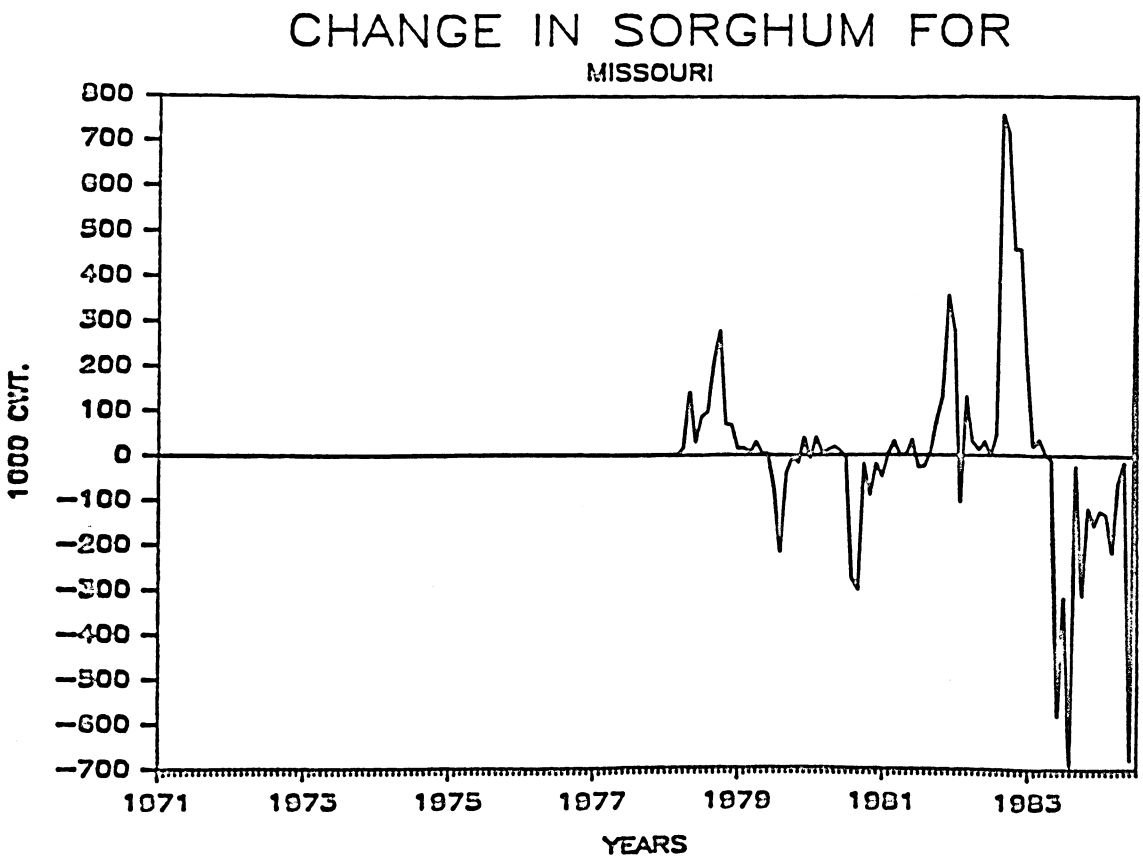

CORN PRICE DIFFERENTIALS
(WISCONSIN – U.S.)
DOLLARS/BUSHEL
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
1971
1973
1975
1977
1979
1981
1983
YEARS

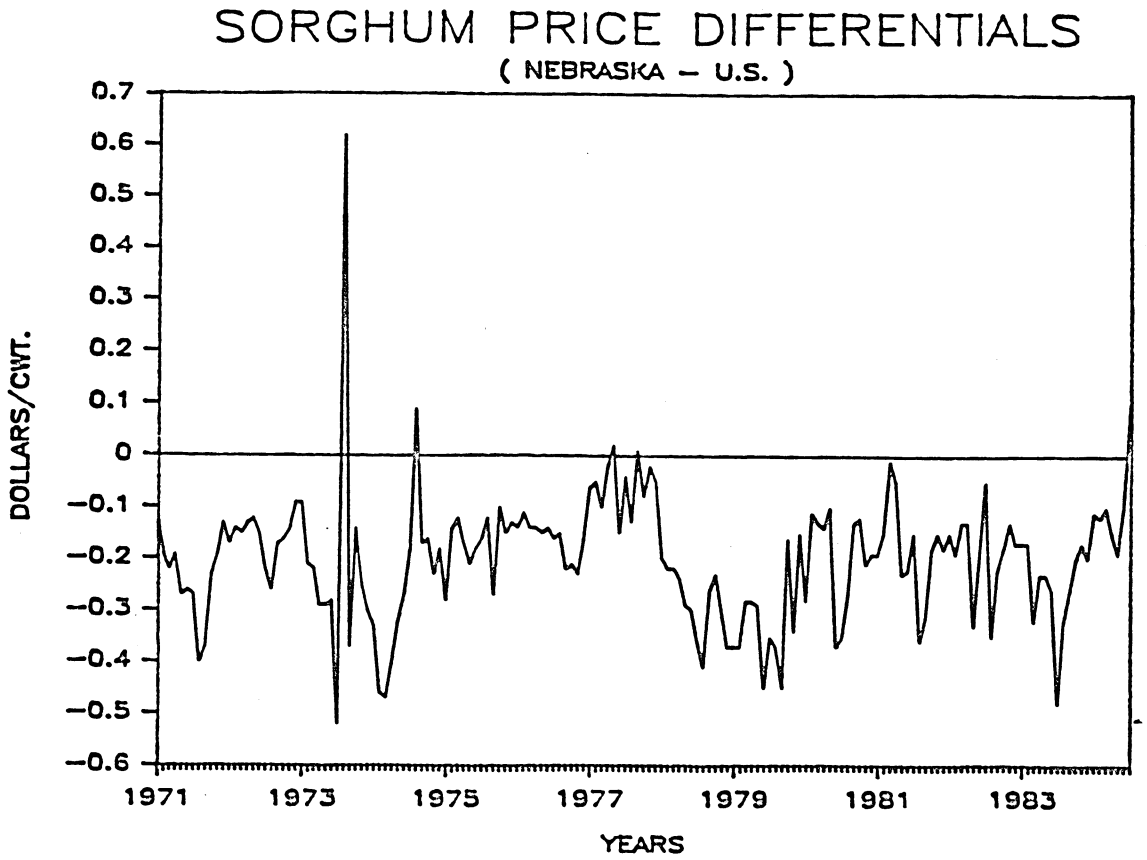

CHANGE IN CORN FOR
WISCONSIN
1000 BUSHELS
(Thousands)
25
20
15
10
5
0
−5
−10
−15
−20
−25
1971
1973
1975
1977
1979
1981
1983
YEARS

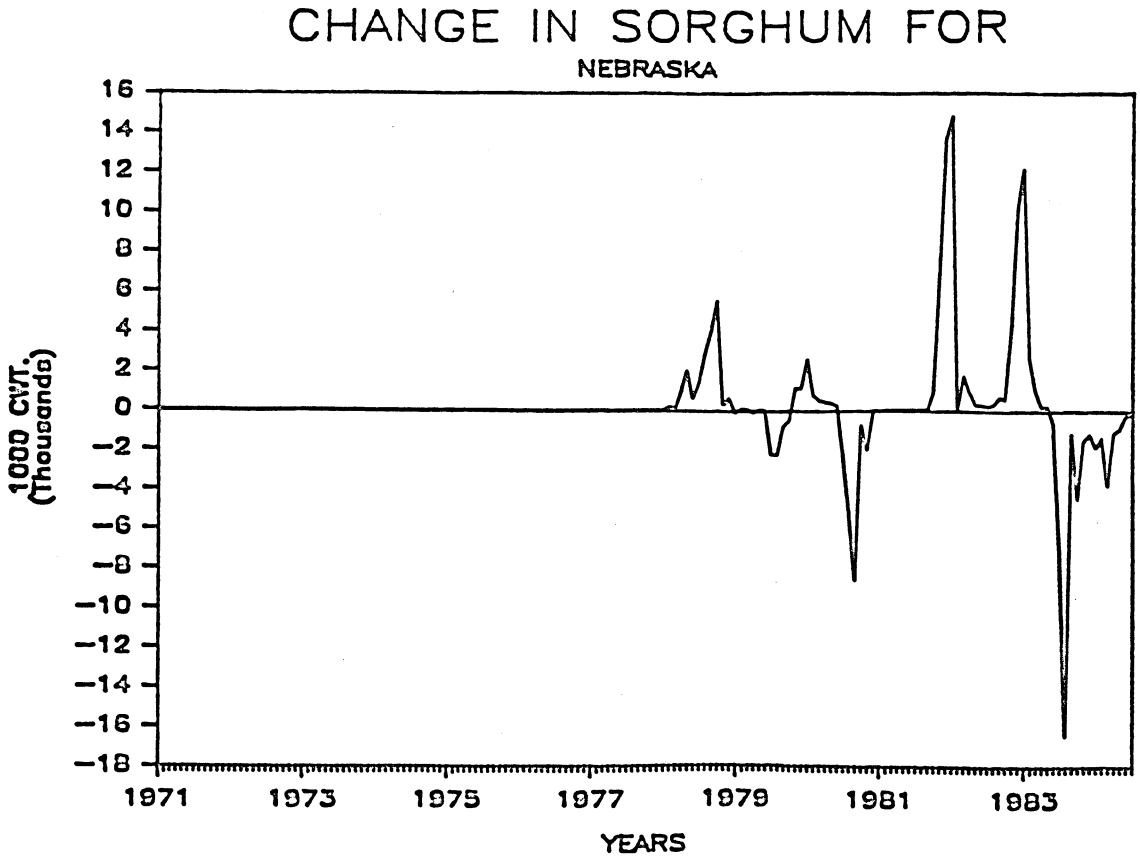

SORGHUM PRICE DIFFERENTIALS
(KANSAS – U.S.)
DOLLARS/CWT.
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
1971
1973
1975
1977
1979
1981
1983
YEARS

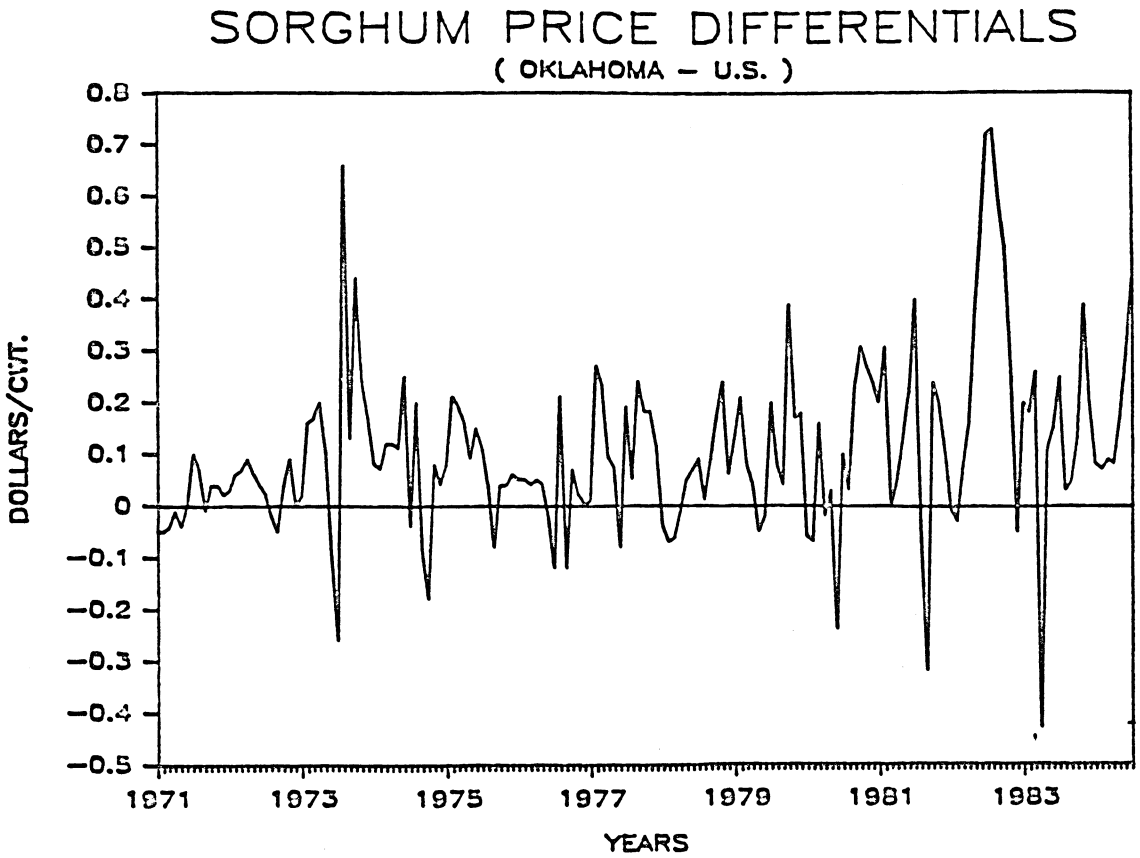

CHANGE IN SORGHUM FOR
KANSAS
1000 CWT.
(Thousands)
18
16
14
12
10
8
6
4
2
0
−2
−4
−6
−8
−10
−12
−14
1971
1973
1975
1977
1979
1981
1983
YEARS

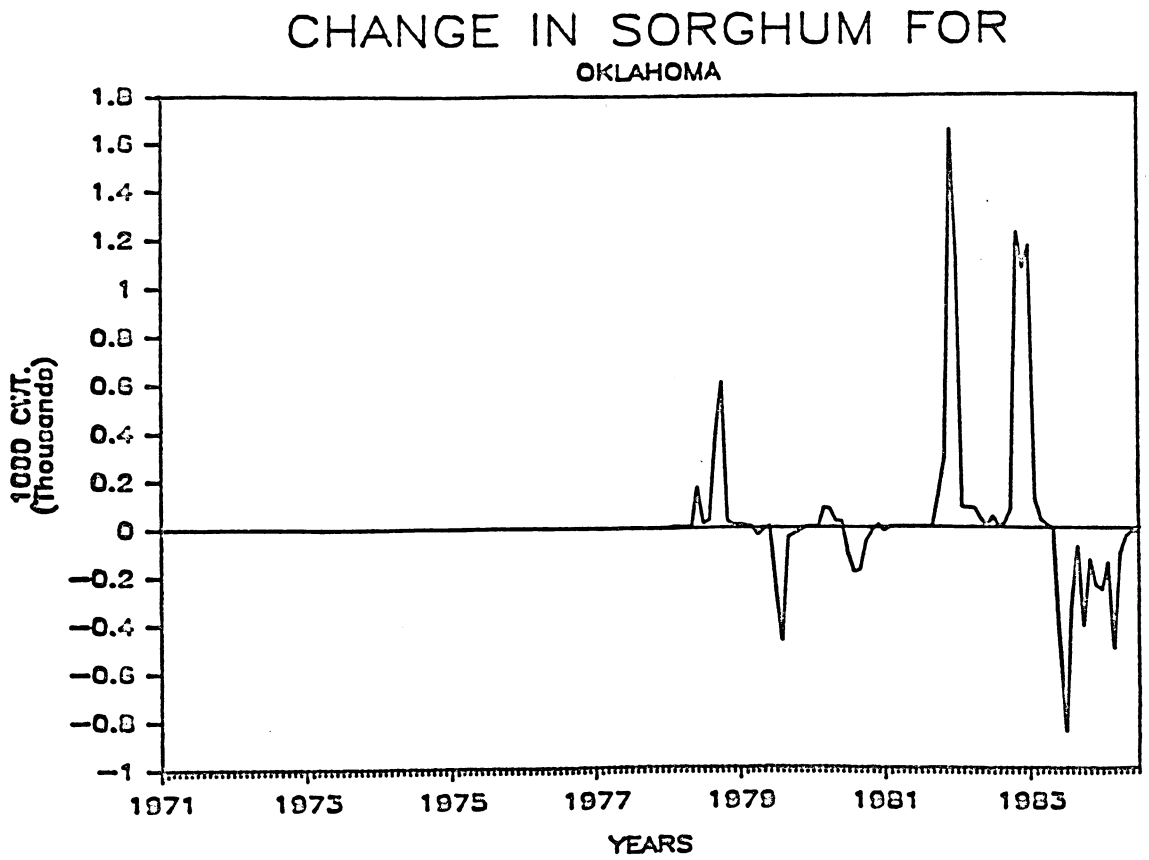

SORGHUM PRICE DIFFERENTIALS
(MISSOURI – U.S.)
DOLLARS/CWT.
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
1971
1973
1975
1977
1979
1981
1983
YEARS

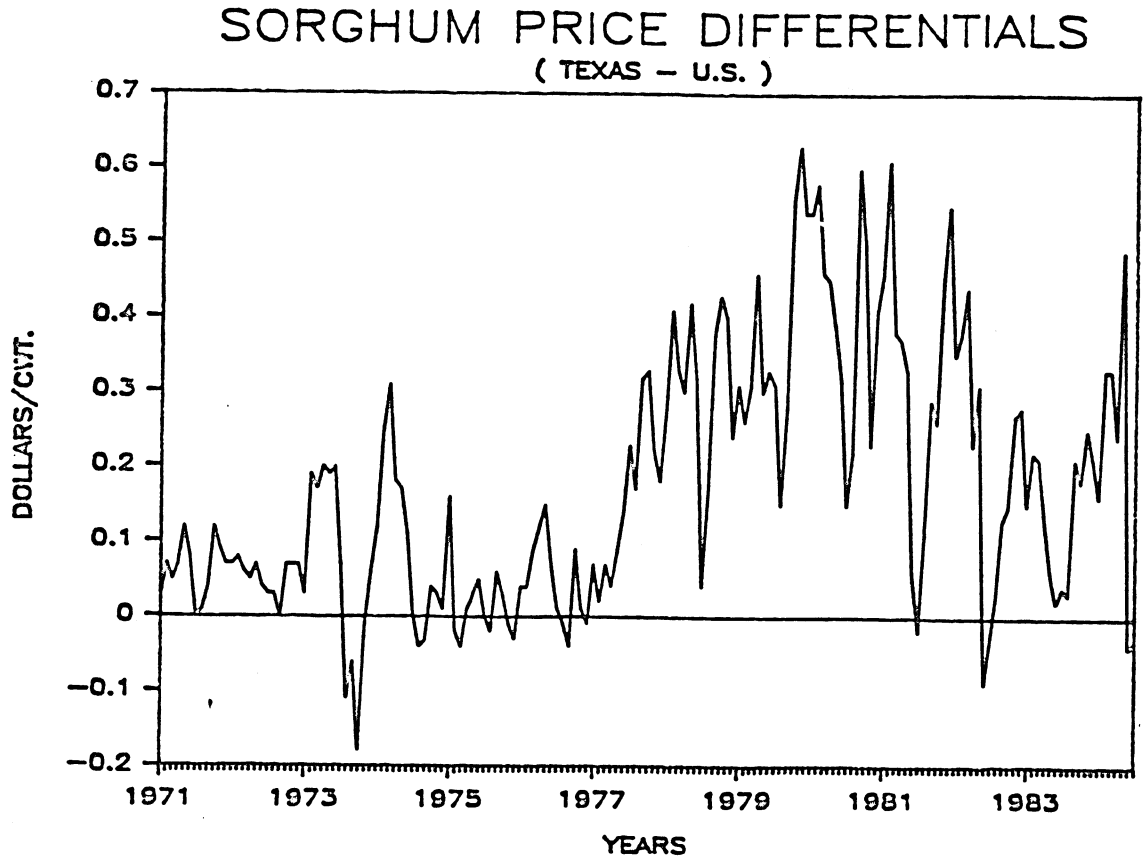

CHANGE IN SORGHUM FOR
MISSOURI
1000 CWT.
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
1971
1973
1975
1977
1979
1981
1983
YEARS

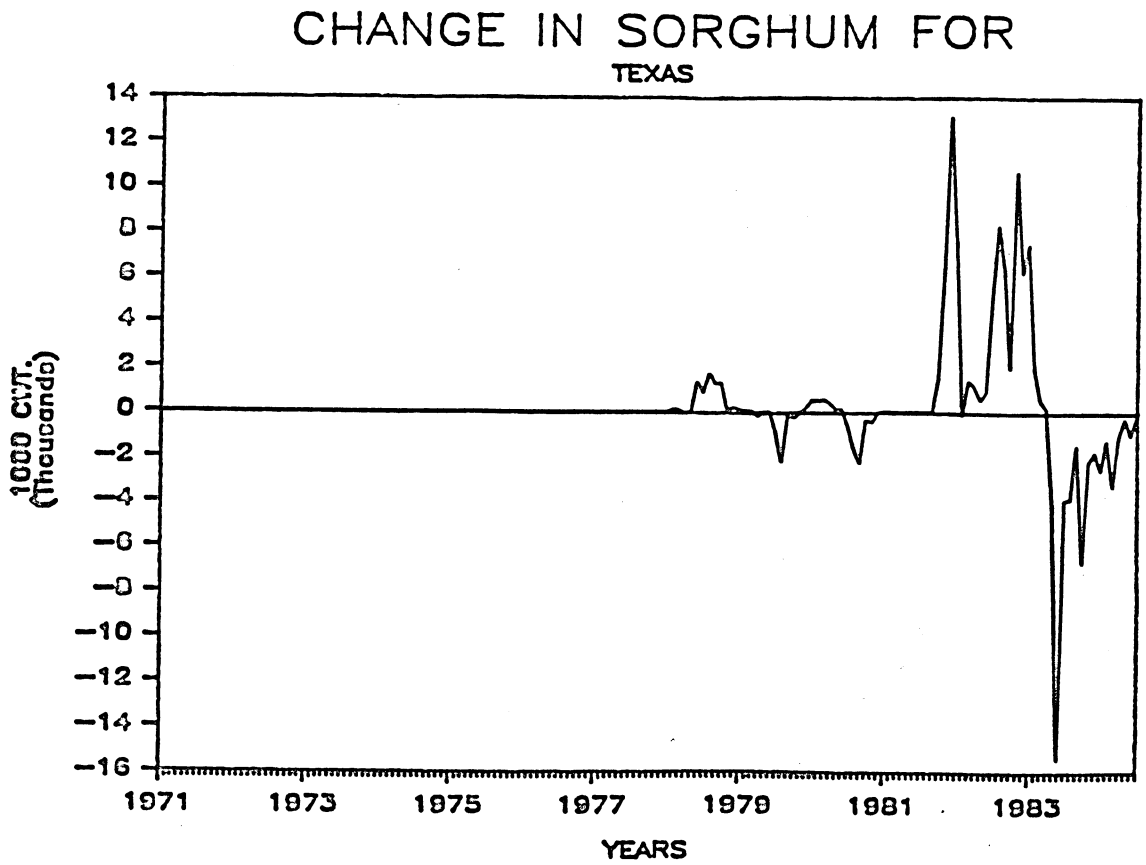

SORGHUM PRICE DIFFERENTIALS
(NEBRASKA – U.S.)
DOLLARS/CWT.
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
1971
1973
1975
1977
1979
1981
1983
YEARS

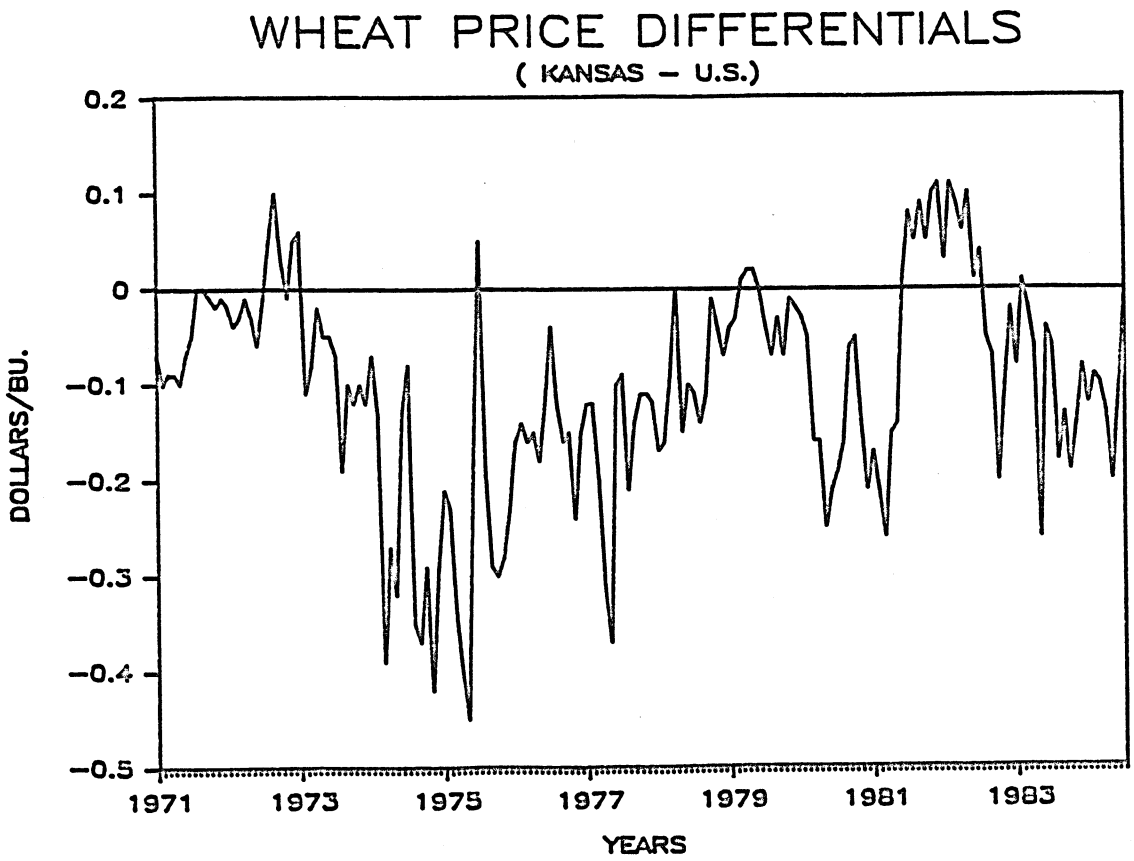

CHANGE IN SORGHUM FOR
NEBRASKA
1000 CWT.
(Thousands)
16
14
12
10
8
6
4
2
0
−2
−4
−6
−8
−10
−12
−14
−16
−18
1971
1973
1975
1977
1979
1981
1983
YEARS

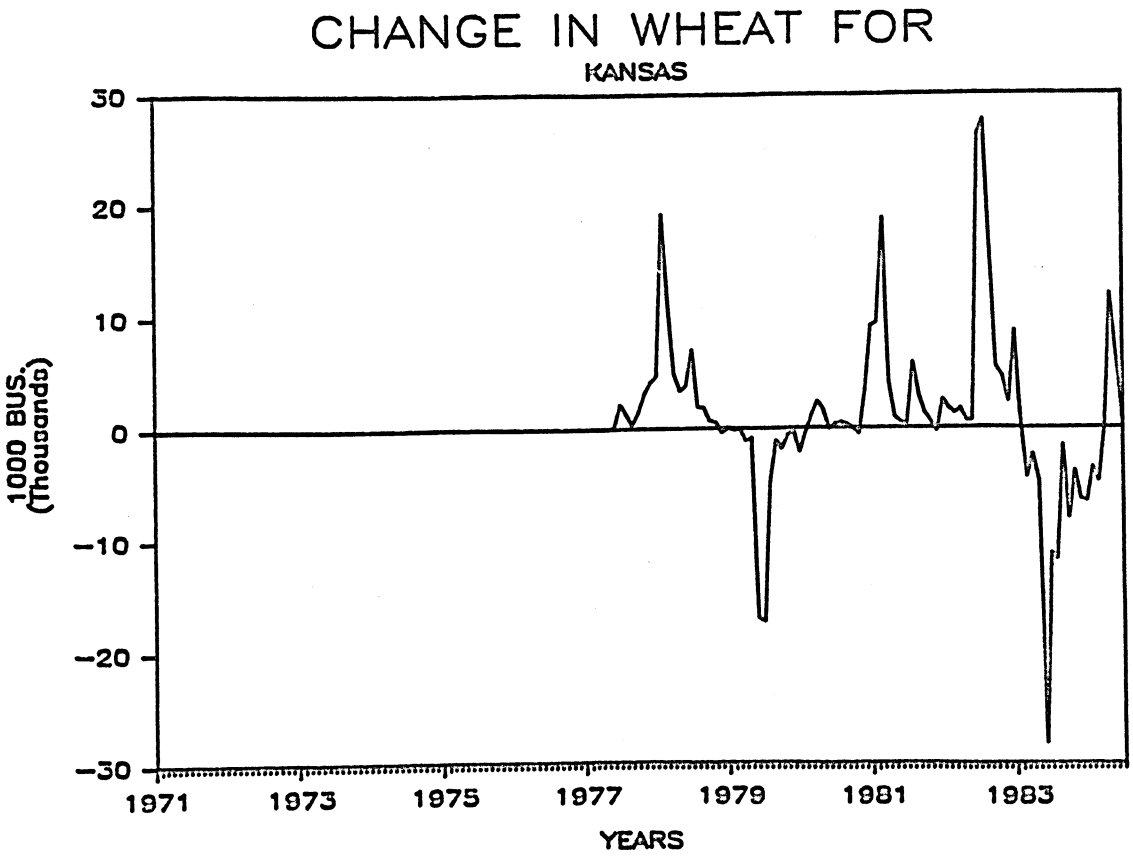

SORGHUM PRICE DIFFERENTIALS
(OKLAHOMA – U.S.)
DOLLARS/CWT.
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
1971
1973
1975
1977
1979
1981
1983
YEARS

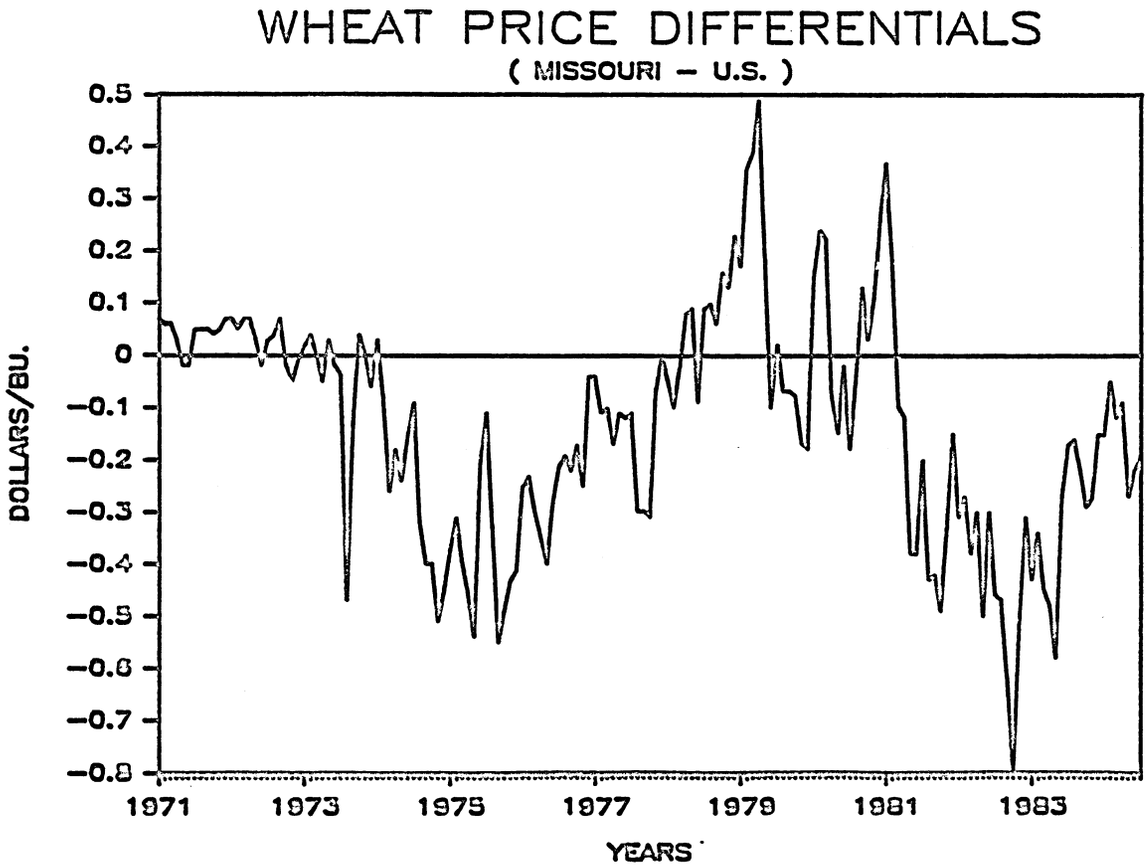

CHANGE IN SORGHUM FOR
OKLAHOMA
1000 CWT.
(Thousands)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
1971
1973
1975
1977
1979
1981
1983
YEARS

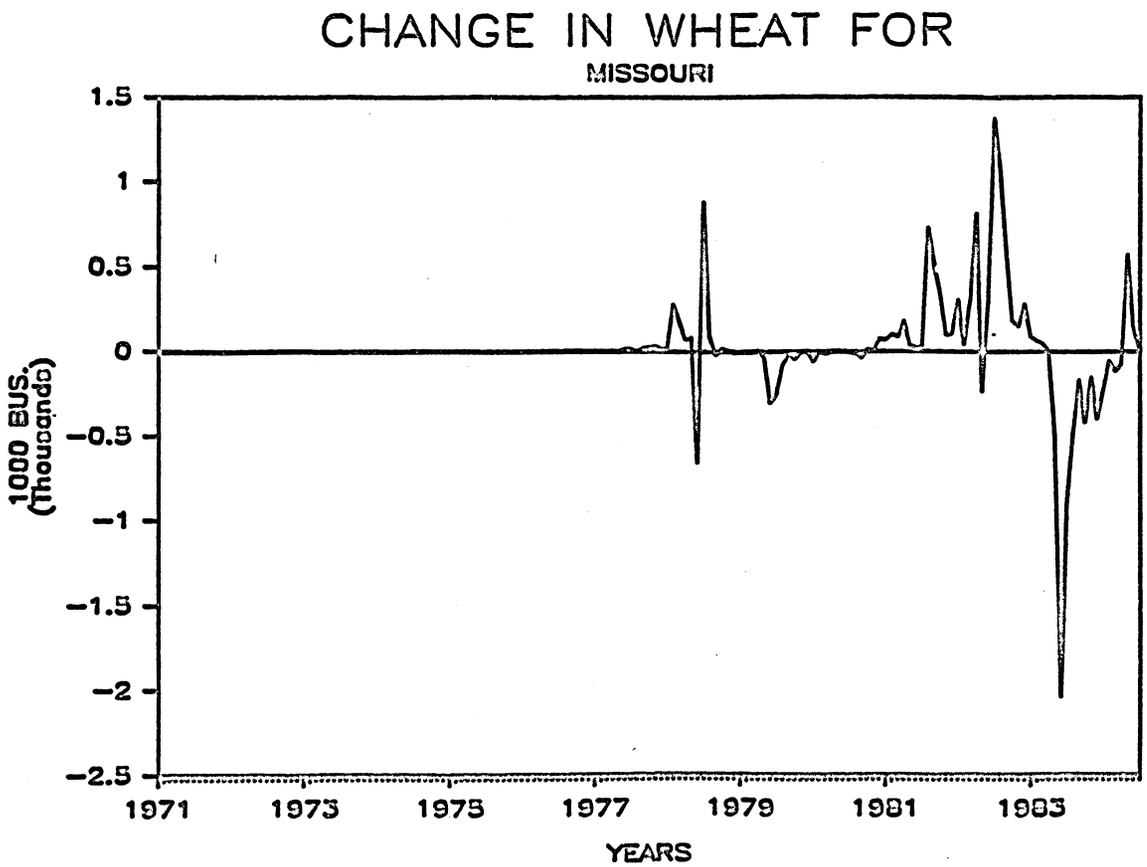

SORGHUM PRICE DIFFERENTIALS
(TEXAS – U.S.)
DOLLARS/CWT.
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
1971
1973
1975
1977
1979
1981
1983
YEARS

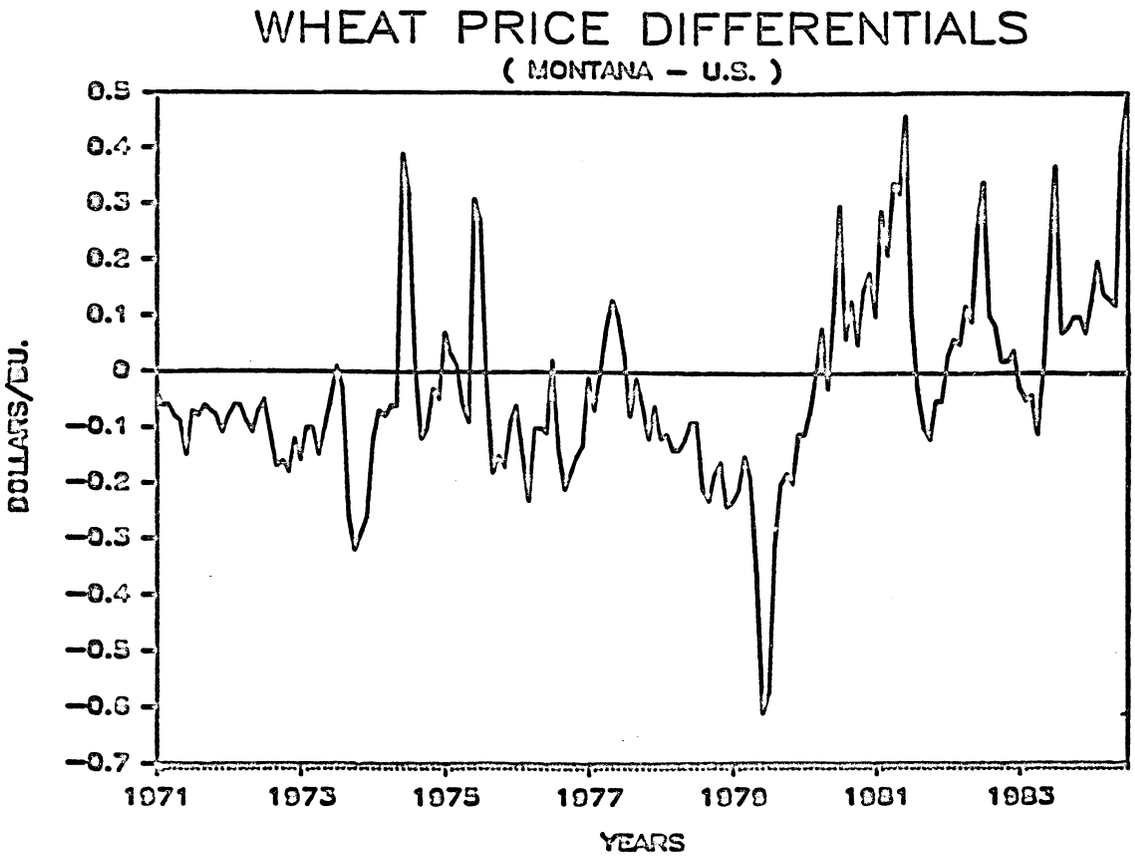

CHANGE IN SORGHUM FOR
TEXAS
1000 CWT.
(Thousands)
14
12
10
8
6
4
2
0
−2
−4
−6
−8
−10
−12
−14
−16
1971
1973
1975
1977
1979
1981
1983
YEARS

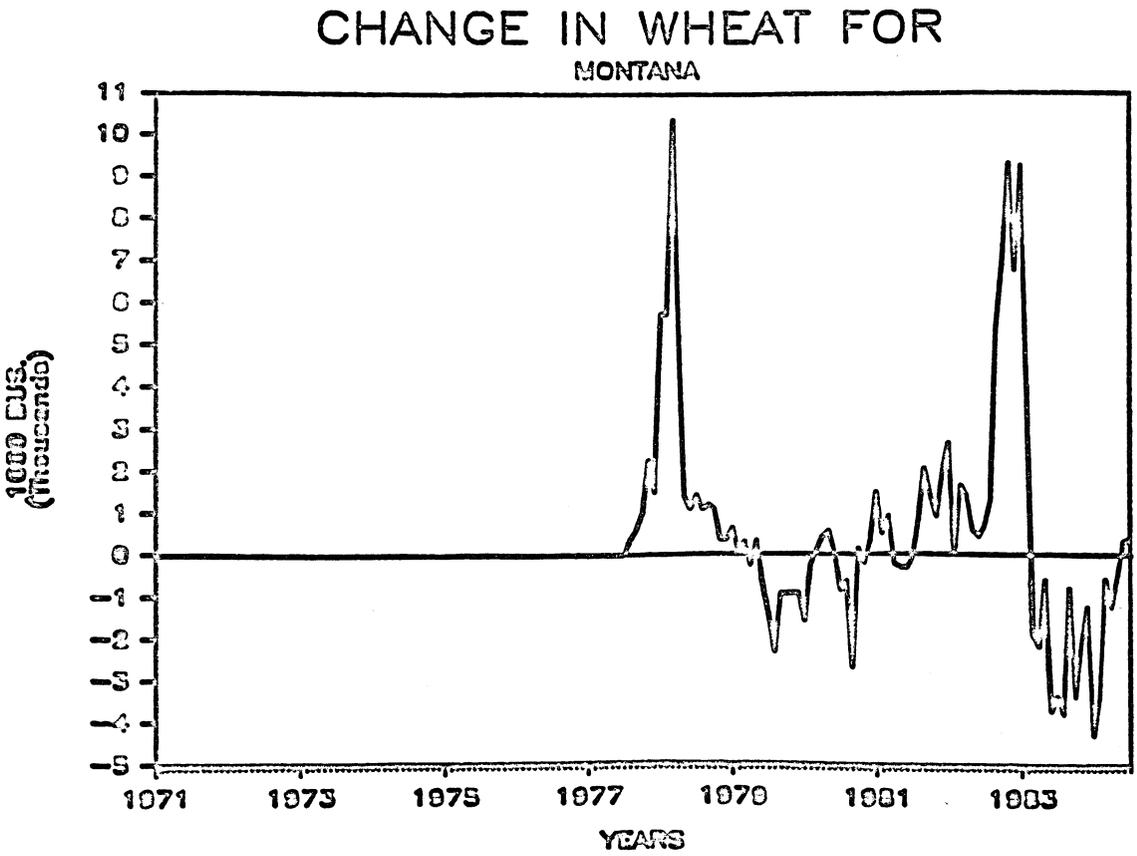

WHEAT PRICE DIFFERENTIALS
(KANSAS – U.S.)
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
DOLLARS/BU.
1971
1973
1975
1977
1979
1981
1983
YEARS

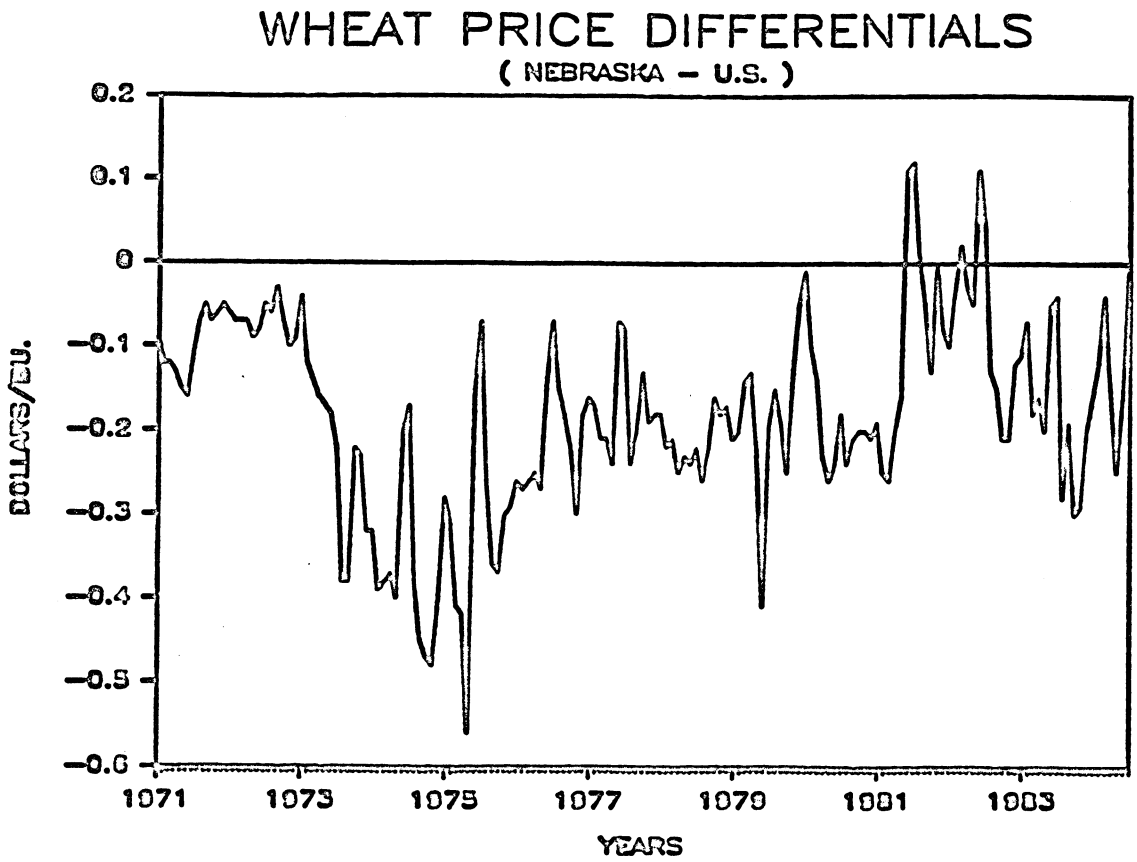

CHANGE IN WHEAT FOR
KANSAS
30
20
10
0
−10
−20
−30
1000 BUS.
(Thousands)
1971
1973
1975
1977
1979
1981
1983
YEARS

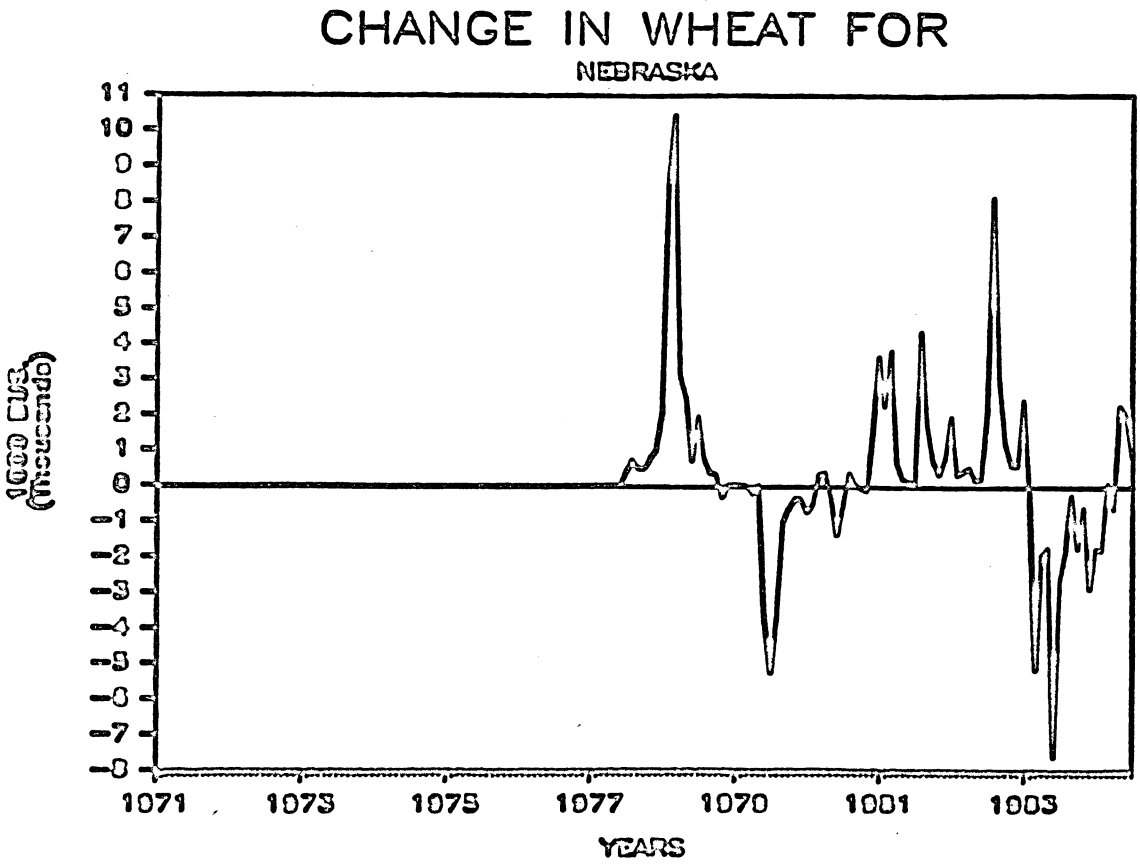

WHEAT PRICE DIFFERENTIALS
(MISSOURI – U.S.)
DOLLARS/BU.
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
−0.7
−0.8
1971
1973
1975
1977
1979
1981
1983
YEARS

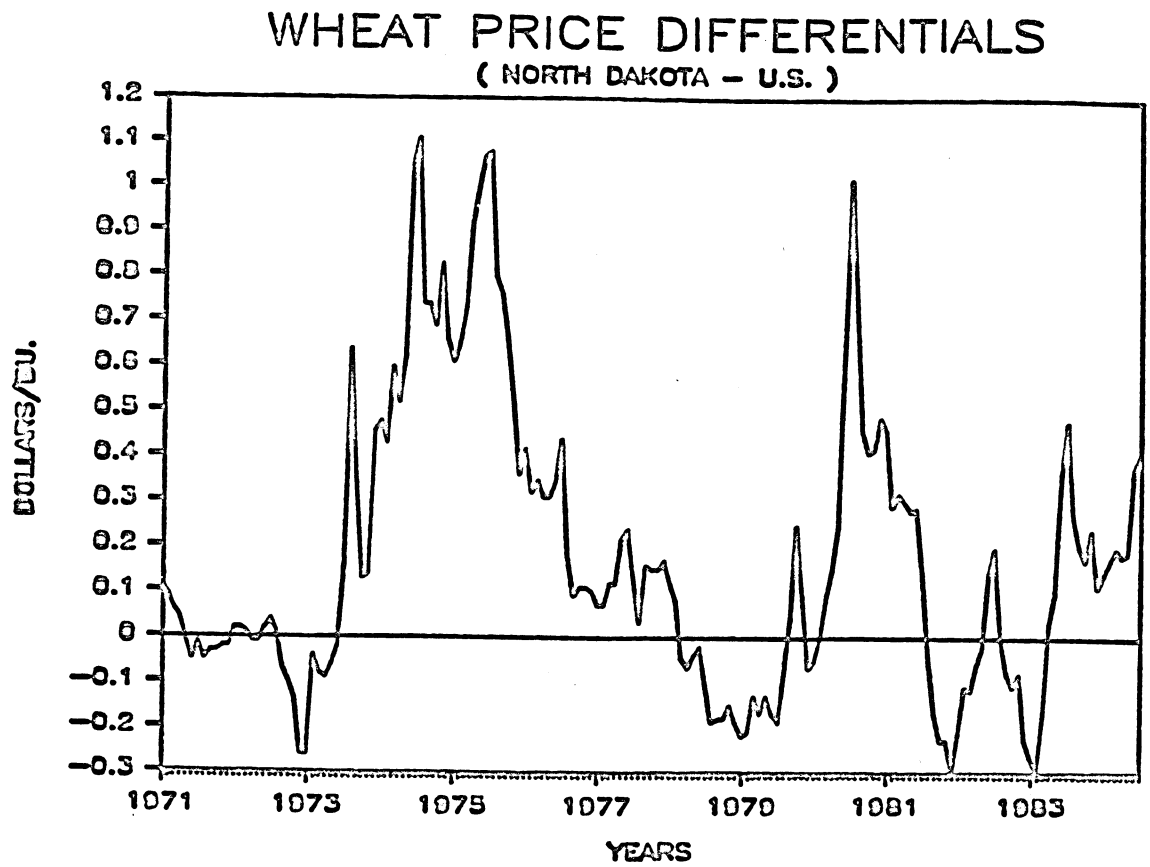

CHANGE IN WHEAT FOR
MISSOURI
1000 BUS.
(Thousands)
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
1971
1973
1975
1977
1979
1981
1983
YEARS

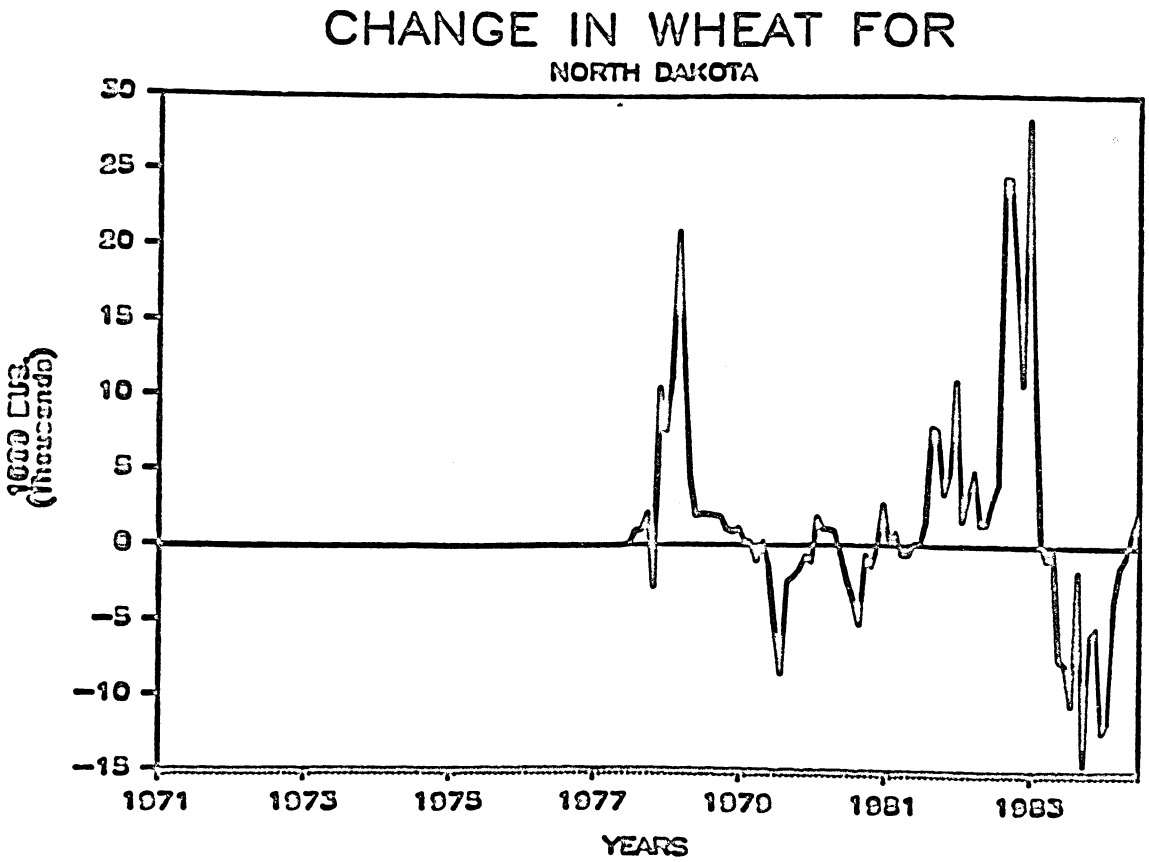

WHEAT PRICE DIFFERENTIALS
(MONTANA – U.S.)
DOLLARS/BU.
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
1971
1973
1975
1977
1979
1981
1983
YEARS

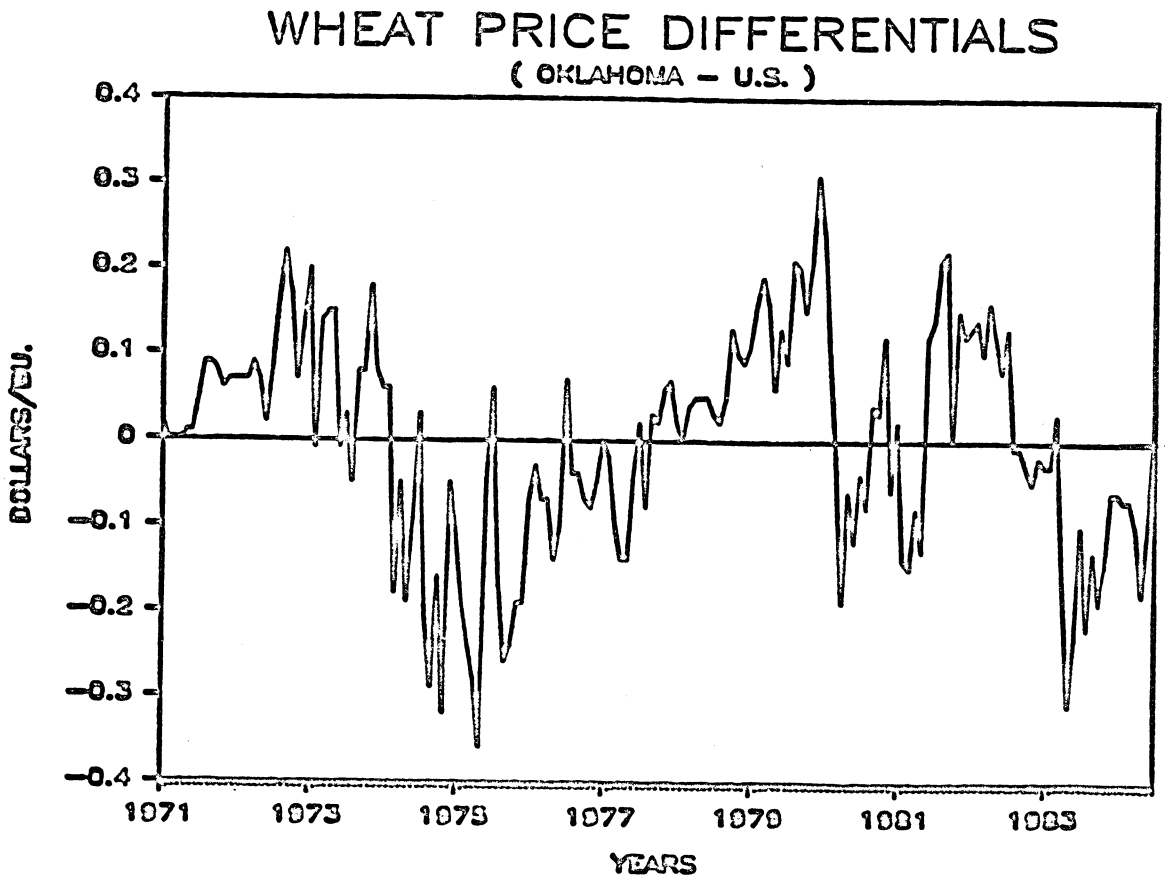

CHANGE IN WHEAT FOR
MONTANA
1000 BUS.
(thousands)
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
1971
1973
1975
1977
1979
1981
1983
YEARS

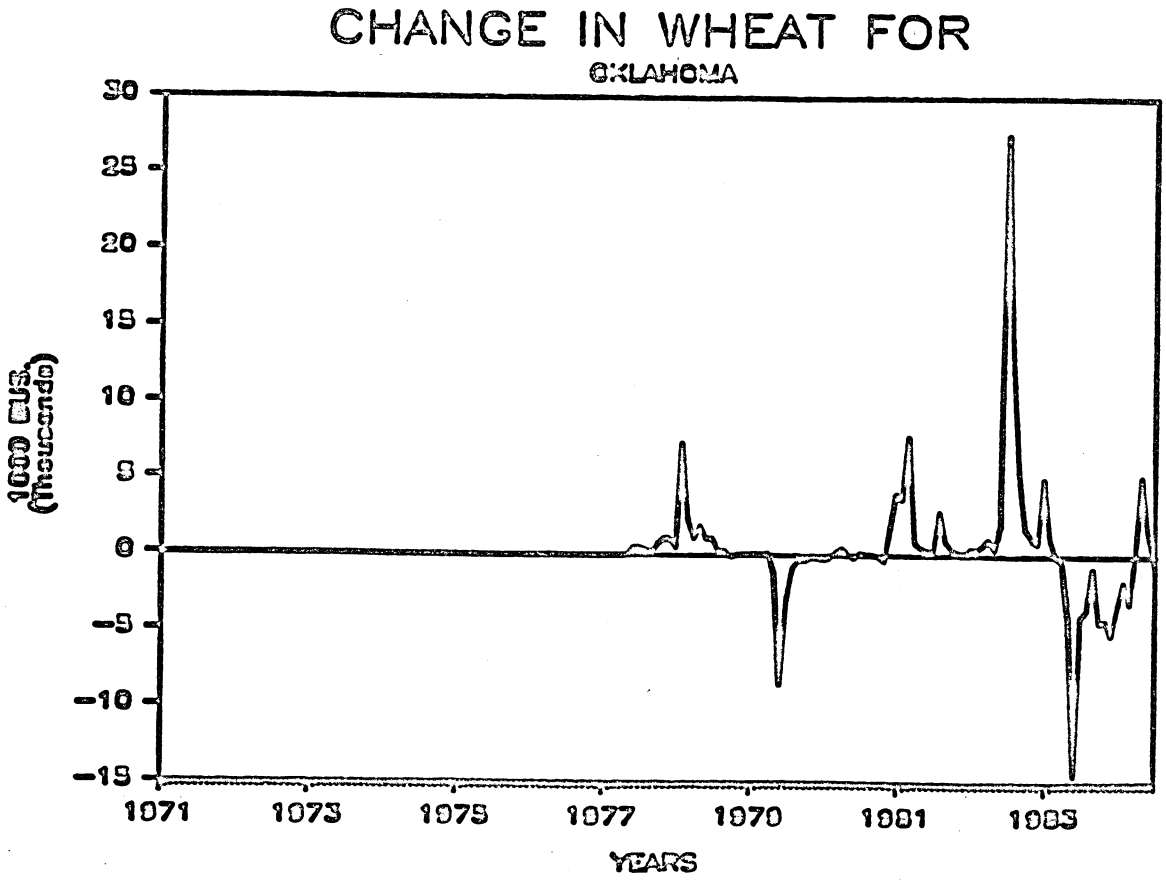

WHEAT PRICE DIFFERENTIALS
(NEBRASKA – U.S.)
DOLLARS/BU.
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
1071
1073
1075
1077
1079
1081
1083
YEARS

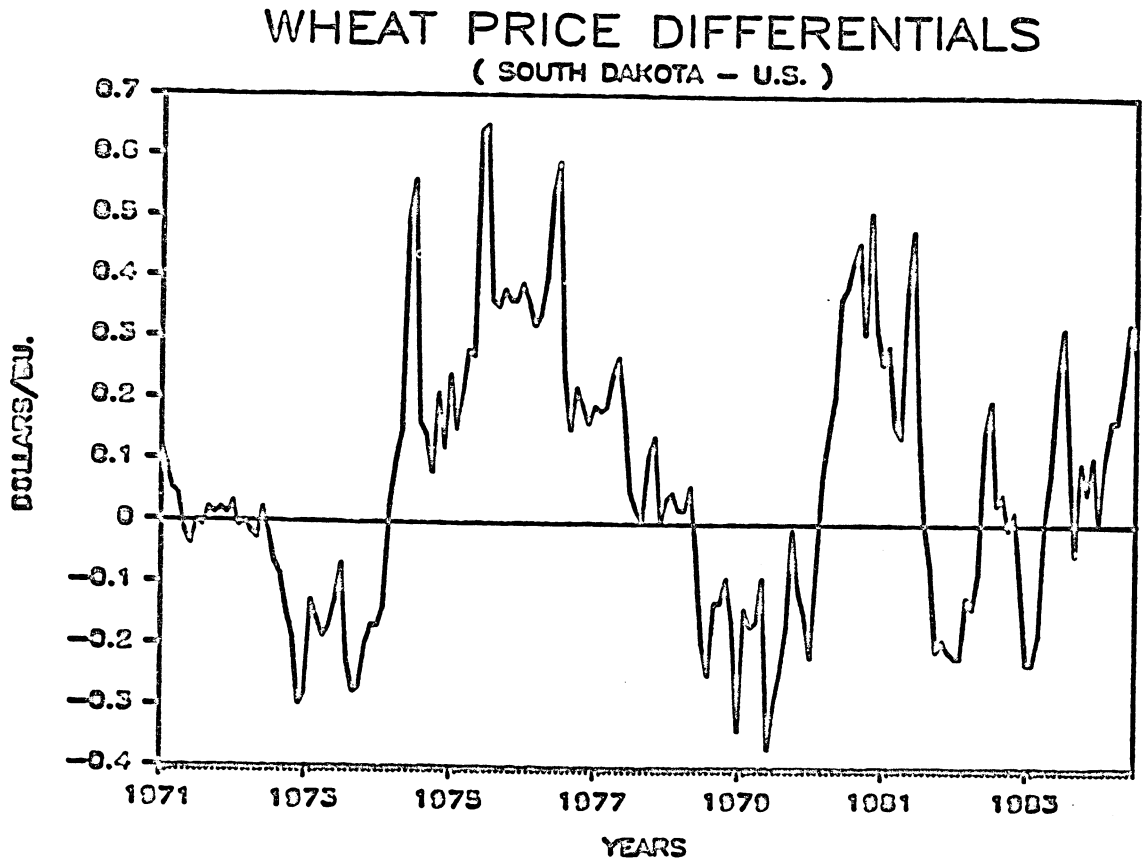

CHANGE IN WHEAT FOR
NEBRASKA
1000 CWT
(thousands)
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
1071
1073
1075
1077
1079
1081
1083
YEARS

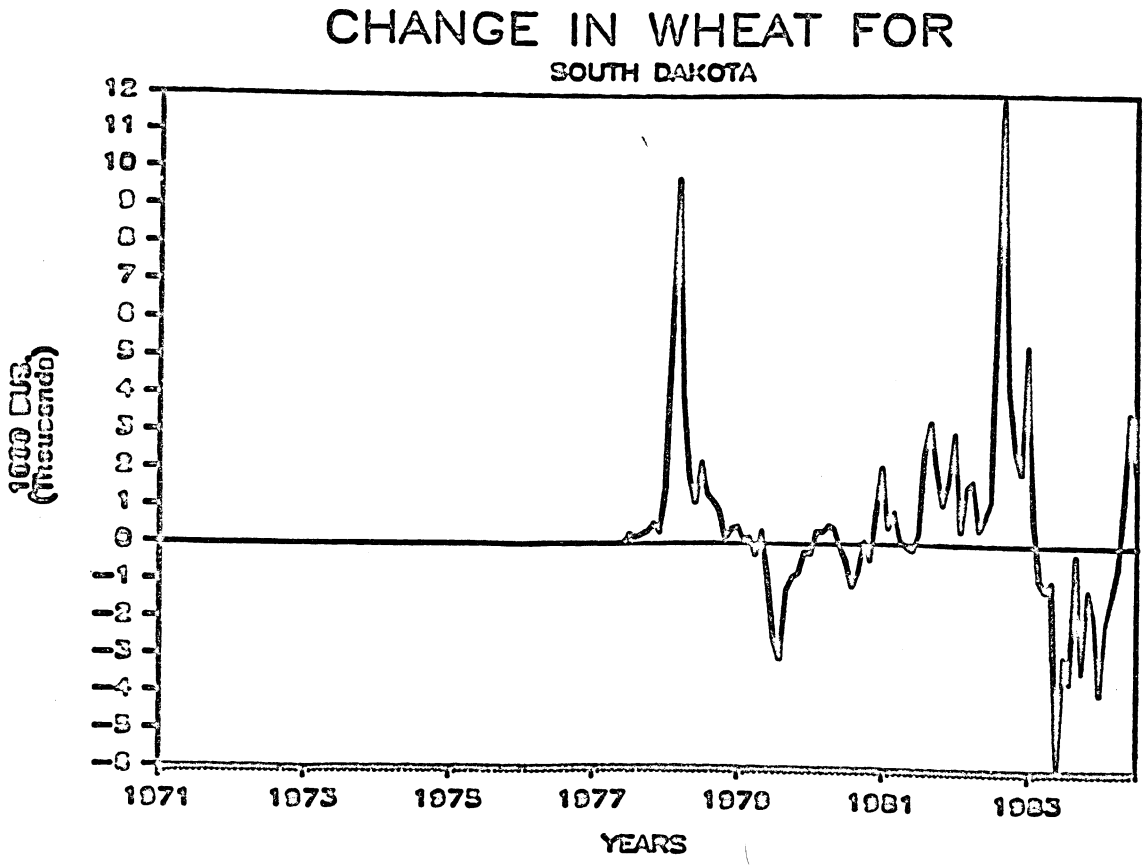

WHEAT PRICE DIFFERENTIALS
(NORTH DAKOTA – U.S.)
DOLLARS/BU.
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
1971
1973
1975
1977
1979
1981
1983
YEARS


CHANGE IN WHEAT FOR
NORTH DAKOTA
1000 BUS.
(thousands)
30
25
20
15
10
5
0
-5
-10
-15
1971
1973
1975
1977
1979
1981
1983
YEARS


WHEAT PRICE DIFFERENTIALS
(OKLAHOMA – U.S.)
DOLLARS/BU.
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
1971
1973
1975
1977
1979
1981
1983
YEARS

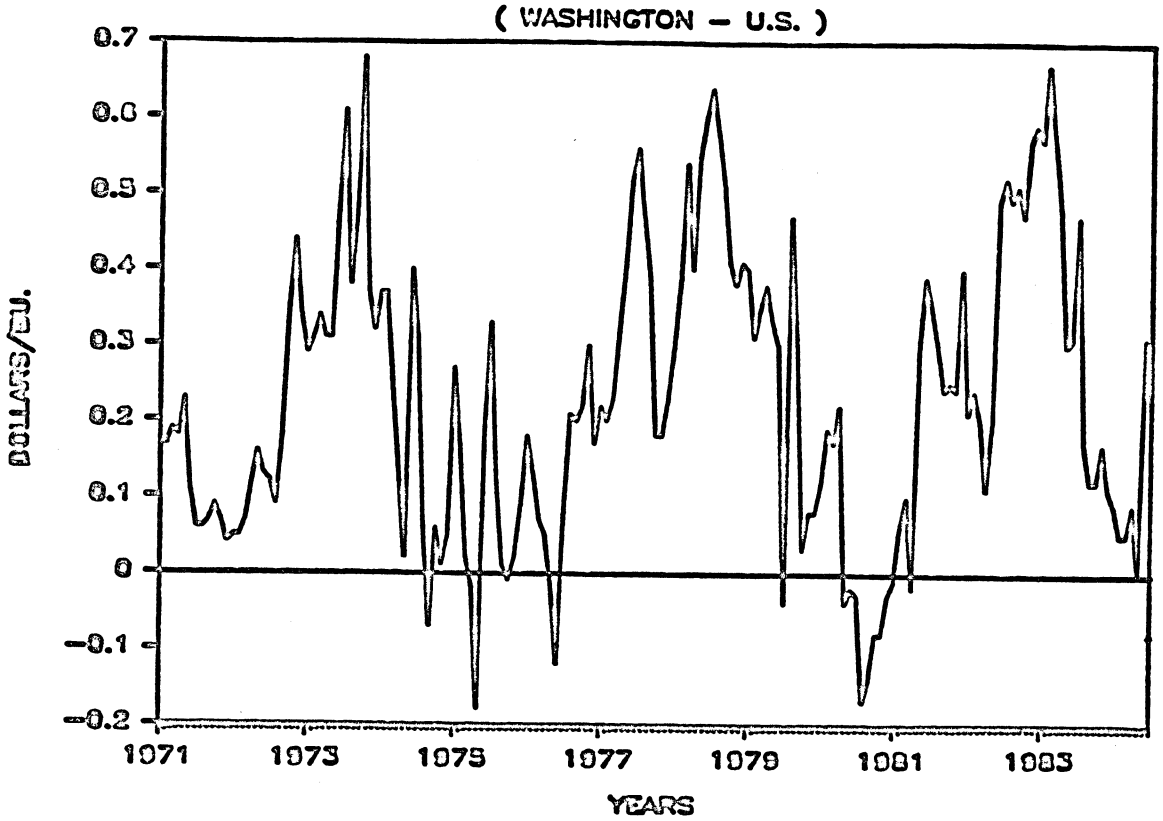

CHANGE IN WHEAT FOR
OKLAHOMA
1000 BUS.
(Thousands)
30
25
20
15
10
5
0
-5
-10
-15
1971
1973
1975
1977
1979
1981
1983
YEARS


WHEAT PRICE DIFFERENTIALS
(SOUTH DAKOTA – U.S.)
DOLLARS/BU.
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
1971
1973
1975
1977
1979
1981
1983
YEARS


CHANGE IN WHEAT FOR
SOUTH DAKOTA
1000 BUS.
(thousands)
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
1971
1973
1975
1977
1979
1981
1983
YEARS

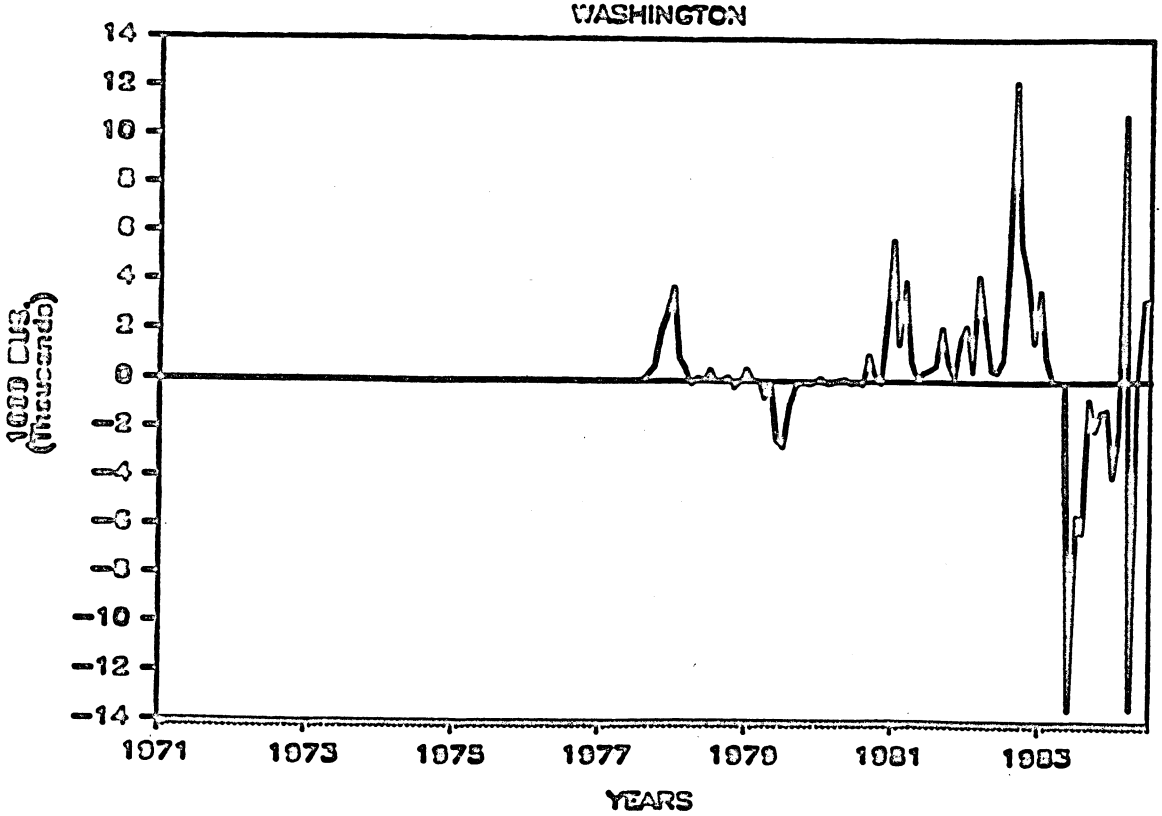
WHEAT PRICE DIFFERENTIALS

(WASHINGTON – U.S.)



CHANGE IN WHEAT FOR

WASHINGTON



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