in the reconstruction process, withdrawing it from agricultural production. Data obtained from interviews with our sample of households shows that about four percent fewer people planted corn in 1976 than before the earthquake and about two percent less the following year. Furthermore, interview data show that 33.8% of our respondents worked on reconstruction projects for pay.

Evidence of the fact that one cause of the drop in production was a withdrawal of labor from agriculture and shifting it into reconstruction is the fact that production jumped back to near to or above pre-earthquake levels for all products except rice in 1978-79. By this time reconstruction programs had slowed down and opportunities for employment in such activities had severely decreased. This table shows that since 1978, for the most part, agricultural production has remained high.

It is of course difficult to say whether the earthquake had an effect on agricultural production, given the data available, since other factors such as normal price fluctuation or weather cycles could produce the observed post-earthquake two-year drop in production. We are inclined, however, to believe that the withdrawal of labor from agricultural production for use in reconstruction played a role in the observed reduction in agricultural production.

It should be remembered, however, that even though production was down slightly during the two years following the earthquake, production was still proportionately high compared to the years before 1975-76. From 1970-71 to 1974-75 the average annual production of corn was 711 thousand tons. During the two years following the earthquake it averaged 831 thousand tons. Furthermore, since 1975-76, the last pre-earthquake year, corn production has averaged 933 thousand tons, a substantial increase of 31 percent over the pre-earthquake years. Ordinarily this increase should have resulted in

lower prices for agricultural products since population was not growing at this rate. However, there were a number of factors contributing to inflationary pressures on prices including increased costs of all products related to world inflationary trends associated with oil price increases and perhaps more importantly, the sudden influx of hundreds of millions of dollars of disaster relief funds.

In the next section of this report data on actual prices, agricultural production and PL-480 food distribution will be examined using sophisticated statistical techniques to determine whether or not there was an actual change in prices following the earthquake and whether their price change, if any, can be attributed to PL-480 food distribution.

Examination of Prices for Corn and Beans

Monthly price data for black beans and for two types of corn, white and yellow, were obtained from the Guatemalan Ministry of Agriculture. These figures represent average monthly prices for the whole country and indicate neither weekly fluctuations nor local variations in prices. They are gross statistics reflecting what happened to prices for the country on the average, month by month, beginning in January, 1973 and continuing through August of 1979.[1] All prices are for one hundred weight units and thus reflect prices paid the "farmer," not per pound prices paid by the consumer.

Until transportation was restored and markets returned to "normal," price fluctuations may have been severe in some isolated markets.[2] These local variations would not appear in these national level statistics.

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[1]The Ministry of Agriculture collects prices from all major regional markets in constructing these price data.

[2]Some food critics argue that this was a short time, perhaps a matter of a couple of weeks.

However, it is believed that transportation lines to and from Guatemala City were restored within one or two months and that prices across regions stabilized within a relatively short time.

Data on PL-480 food distribution of corn and beans come from the U.S. Embassy in Guatemala City. As noted above, there is some possible disagreement as to the reliability of these figures. However, since the analysis will focus on monthly variations over a several year period, if errors in the relative amounts distributed during these months are relatively constant, the statistical effects of PL-480 food distribution will remain the same, regardless of which figures are used. In other words, if the differences between the two sets of figures represent some constant multiplier, the estimations of PL-480 effects in the statistical models will not differ (though certainly estimates for particular months could differ).

Production data were subject to considerable variation, depending on source. Three separate sources were consulted in an attempt to verify these data: The Guatemalan Ministry of Agriculture (MOA), the Food and Agriculture Organization of the United Nations (FAO), and the Economics Research Service of the U.S. Department of Agriculture (ERS). Upon careful examination, the ERS figures appeared most reliable. The ERS utilizes a variety of sources in compiling its figures, including "...U. S. Agricultural attaches, FAO, and other international organizations' commodity reports, and estimates made by country analysts in the International Economics Division of the ERS, USDA." Confidence in these data as opposed to those obtained from other sources was born out empirically when all three sources were "tested" for their fit to the price data using a variety of statistical models that employed several different time lags. In these manipulations ERS production data conformed substantially better to the

price data than data from other sources.

In sum, the following analysis is based on what are considered to be the best available data after making many inquiries and comparisons of figures from many different sources.

PL-480 Distribution of Beans and Price Impact

The U. S. Embassy in Guatemala reports that approximately eleven million pounds of pinto beans were distributed by CARE and CRS from February 1976 through March 1978. Ninety-five percent of this amount was distributed between July 1976 and June 1977, as is shown in Table 7-10 and Figure 7-3. Prices for black beans before the earthquake (January 1973 through January 1976) averaged $15.98 per hundred weight. For the period of highest distribution levels (June 1976 through July 1977), the average price was $16.79 per hundred weight. Table 7-11 shows monthly and yearly averages. Figure 7-4 depicts monthly prices graphically. Before examining any possible relationship between PL-480 bean distribution and prices, a more detailed look at actual prices is needed. Bean prices for the 1975 calendar year averaged $17.42. In January 1976, the impact of 1975-1976 harvests was felt as prices fell to $15.93 per hundred weight. In February, the month of the earthquake, prices jumped to $17.12. This was probably due to hoarding of food and perhaps some speculation in the grain market since in nearly all other years prices for the month of February continued to fall. Between March 1976 and March 1977, prices fluctuated between fourteen and sixteen dollars per hundred weight. Beginning in March 1977, with beans at $15.28, a steep climb in price began, peaking at $31.52 in November of that same year.

The average monthly increase during this period would be over $2.00 per month. Prices more than doubled over an eight month period. Let

Table 7-10

CARE and CRS Distribution of Commodities in Guatemala
July 1973 to March 1980 (in thousand pounds)

Period	Wheat Flour	CSM (Corn Soy Milk)	Non - Fat Powdered Milk	Soybean Oil	Rolled Oats	Bulgur	Sorghum Grits	WSDM (Whey Soy)	Yellow Corn	WSB (Wheat Soy Blend)	Incaparina	Soy Fortified Rice	Pinto Beans	TOTAL
Jul-Dec.73	2,364	1,440	537	503	255	138	-	-	-	390	-	-	-	5,617
Jan-Jun.74	2,283	1,918	337	667	63	197	-	-	-	536	-	-	-	6,001
Jul-Dec.74	2,312	1,907	1	514	323	263	424	38	493	56	-	-	-	6,331
Jan-Jun.75	2,894	1,665	86	521	191	1,368	1,090	432	536	275	19	-	-	9,077
Jul-Sep.75	609	811	107	301	200	426	442	421	14	321	56	-	-	3,708
Oct-Dec.75	381	789	66	217	231	223	178	330	552	383	28	-	-	3,378
Jan-Jun.76	4,045	2,814	158	1,267	1,257	1,458	983	1,144	795	3,209	9	-	69	18,108
Jul-Sep.76	2,197	1,676	909	810	805	978	751	175	1,493	1,211	-	-	3,143	14,150
Oct-Dec.76	579	910	648	445	333	591	368	307	1,424	871	-	-	2,412	8,888
Jan-Mar.77	1,420	170	703	444	12	733	639	470	1,466	999	-	-	2,813	9,869
Apr-Jun.77	1,442	560	1,200	738	605	676	157	364	722	448	-	-	2,006	8,918
Jul-Sep.77	1,567	461	1,083	568	203	949	296	410	28	71	-	-	430	6,066
Oct-Dec.77	1,233	674	995	655	433	711	734	584	-	327	-	-	59	6,415
Jan-Mar.78	1,783	1,328	694	636	482	741	498	884	-	212	-	-	41	7,299
Apr-Jun.78	1,288	2,011	1,078	676	324	581	94	165	-	114	-	-	-	6,331
Jul-Sep.78	1,278	1,771	1,320	758	523	248	21	29	-	149	-	-	-	6,097
Oct-Dec.78	375	1,536	1,199	654	394	1,081	2	8	-	174	-	-	-	5,423
Jan-Mar.79	771	2,117	1,261	692	163	1,516	-	-	-	160	-	-	-	6,680
Apr-Jun.79	1,911	1,161	1,336	825	188	76	-	-	-	200	-	1,157	-	6,854
Jul-Sep.79	871	1,595	1,500	807	450	17	-	-	-	179	-	1,115	-	6,534
Oct-Dec.79	702	1,571	1,609	768	412	9	-	-	-	192	-	1,633	-	6,896
Jan-Mar.80	264	1,138	797	408	376	5	-	-	-	224	-	750	-	3,962

FIGURE 7-3

THOUSANDS OF POUNDS

PINTO BEANS

DISTRIBUTED THROUGH PL480 PROGRAMS

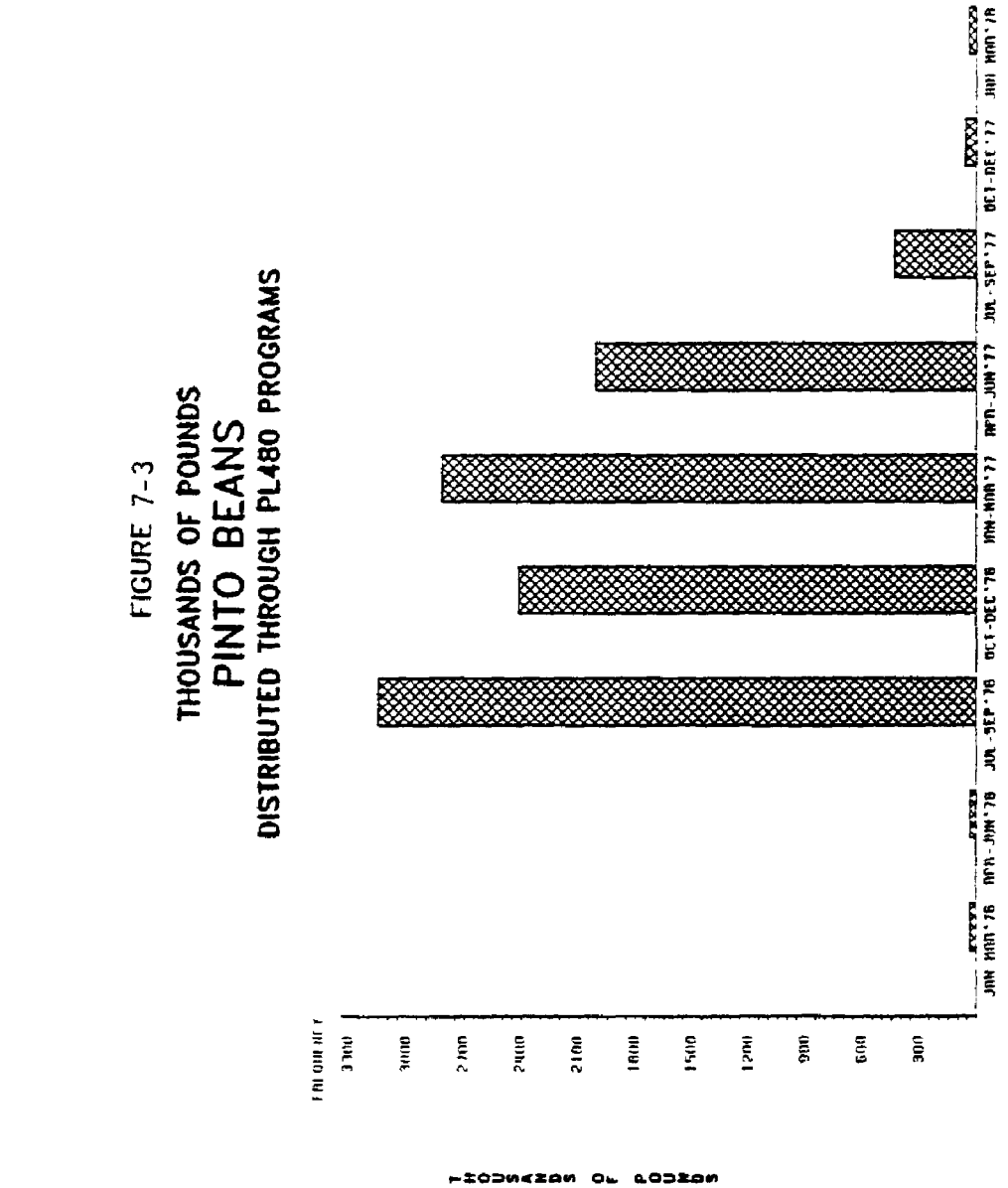


TABLE 7-11

Average Monthly Prices per Hundred Weight for Black Beans

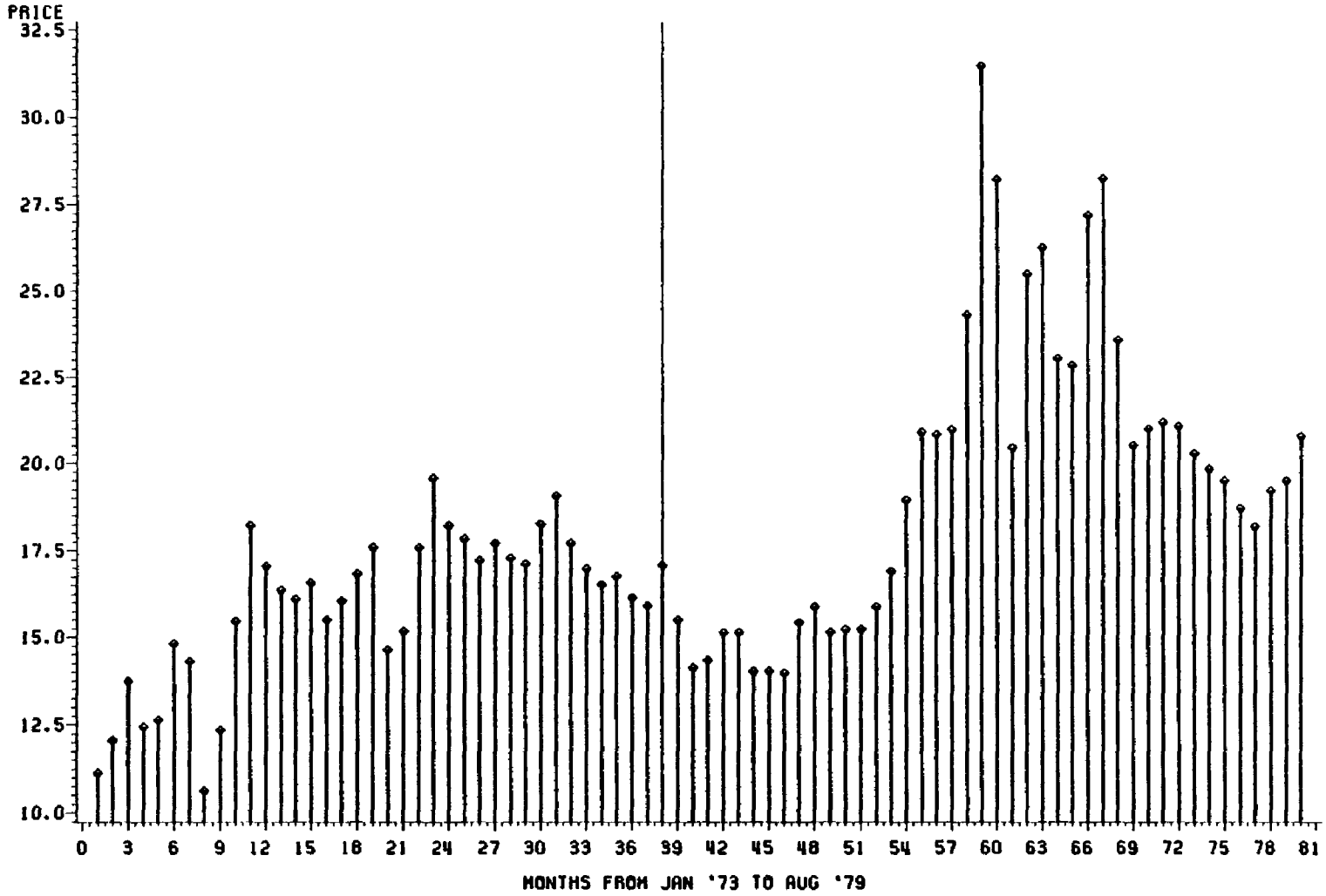
Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
1973	11.15	12.08	13.75	12.47	12.66	14.85	14.33	10.66	12.36	15.48	18.24	17.08	13.76
1974	16.39	16.13	16.61	15.53	16.09	16.86	17.63	14.68	15.20	17.61	19.61	18.26	16.77
1975	17.88	17.24	17.76	17.33	17.15	18.30	19.12	17.75	17.00	16.57	16.79	16.17	17.42
1976	15.93	17.12	15.54	14.15	14.36	15.17	15.18	14.06	14.05	14.01	15.47	15.92	15.08
1977	15.19	15.28	15.28	15.91	16.93	18.99	20.95	20.88	21.02	24.35	31.52	28.24	20.37
1978	20.48	25.55	26.29	23.09	22.90	27.22	28.27	23.60	20.57	21.05	21.22	21.12	23.44
1979	20.32	19.86	19.53	18.75	18.22	19.24	19.54	20.83					

Source: Indeca.

FIGURE 7-4

BLACK BEANS

MONTHLY PRICES PER HUNDRED-WEIGHT
JANUARY 1973 – AUGUST 1979



MONTH #38 IS FEB.1976

us now see what factors help account for these changes in price.

The simplest way of statistically testing for a PL-480 distribution impact on price would be a regression equation of the form:

$$PRICE_t = \alpha + \beta_1 (\text{Pre E.Q. Price Trend}_t) + \beta_2 (\text{Impact Price Trend}_t) + \beta_3 (\text{Amount of PL-480}_t) + \beta_4 (\text{Post Impact Price Trend}_t) + U_t,$$

where the three trends are time trend variables and U_t is a random disturbance term. The time trend variables are simply the upward or downward trend in prices over the time period in question: pre-earthquake, the time period where earthquake/PL-480 food related impact might have occurred, and the time period after which this impact may be presumed to have ended.

The inclusion of the time trend variables has the statistical consequence of removing the effects of linear time trends associated with such things as inflation and fluctuation in supply from the data so that β_3 represents the linear effect of PL-480 food distribution on prices. These trend variables can be interpreted as proxies for excluded variables which have linearly affected prices over time. That is, they remove the effects of such things as inflation, and changes in production which affect supply, and therefore, price.

While this model has the advantage of simplicity, there may be other factors which are related to both price and the quantity of PL-480 food distribution. Obviously, the level of production should be included since we wish to separate the effects of bumper harvests in the 1975-76 agricultural year from the effects of PL-480 food distribution programs. We also know that there are normal seasonal variations during the year due to when harvest occurs, holding back and storing part of the harvest for sale at a later date, and other reflections of "normal" marketing activities. Thus, in order to estimate PL-480 impact fairly, we should remove these normal seasonal cycles or variations of price during the year.

This is accomplished by including quarterly effects in the model.[1] While our model is now somewhat more complex, the data are better fitted by the model and the measure of PL-480 impact is the net effect after removing normal quarterly changes in prices.

One problem remains before the model is complete. This problem is to define the appropriate time periods. For the pre-earthquake time trend this is simply the thirty-seven months from January 1973 through January 1976. The appropriate impact time period is, however, more problematic. Selecting a time period which is either too long or too short could lead to erroneous conclusions concerning non-PL-480 related earthquake effects. A compromise solution is to include two possible impact periods. These periods should be in increments of twelve months since it takes us to the same point in the agricultural cycle. Hence, our model now takes the following form:

$$\begin{aligned} PRICE_t = \alpha &+ \beta_1 \text{ (Jan.'73-Jan.'76 trend}_t\text{) (pre earthquake period)} \\ &+ \beta_2 \text{ (Feb.'76-Jan.'77 trend}_t\text{) (first impact yr.following earthquake)} \\ &+ \beta_3 \text{ (Feb.'77-Jan.'78 trend}_t\text{) (second impact yr. following earthquake)} \\ &+ \beta_4 \text{ (Feb.'78-Aug.'79 trend}_t\text{) (post earthquake period)} \\ &+ \beta_5 \text{ (Production}_t\text{) (amount of beans produced)} \\ &+ \beta_6 \text{ (PL-480 Distribution}_t\text{) (amount of PL-480 beans distributed)} \\ &+ \beta_7 \text{ (Quarter 1}_t\text{) (quarterly effect of first quarter)} \\ &+ \beta_8 \text{ (Quarter 2}_t\text{) (quarterly effect of second quarter)} \\ &+ \beta_9 \text{ (Quarter 3}_t\text{) (quarterly effect of third quarter)} \\ &+ U_t \end{aligned}$$

Each β value in this equatation ($\beta_1 - \beta_9$) represents the amount of change in price we may expect for each unit of increase in the independent variable.

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[1] Quarterly effects for black beans are based on the calendar year.

For the time trend variables (β_1 - β_4) the units are months; for production, the unit is one metric ton; for PL-480 food distribution, one thousand pounds; and the quarterly effects represent deviations from the fourth quarter's effect on prices. This renders the least constrained test of the hypothesized impact.

If we examine the regression in Table 7-12 we can see that the estimate for PL-480 distribution effect on bean prices is -.003.[1,2] This may be interpreted as the effect of increasing PL-480 distribution one thousand pounds on detrended prices, controlling for yearly production levels and normal quarterly fluctuations. In other words, an increase of one thousand pounds of PL-480 beans would produce, on the average, three tenths of one cent reduction in the price of black beans per hundred weight.

This model "explains" roughly 62% of the variance in prices over the six and 3/4 year period. It must be remembered that this leaves 38% of the variance unexplained. No doubt petroleum prices have at times had great sudden impacts on the market, and these are only partly taken into account with the time trend variables. In addition, the FAO apparently was working with the MOA to stabilize prices after about 1975. It is unclear what impact, if any, these policies had on prices, but the possibility exists that their activities are both covarying with PL-480 distribution levels for a time (and are thus absorbed into this estimate) and that such activities

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[1] Significant first order auto correlation necessitated the use of GLS estimation techniques. The AUTOREG procedure of SAS (Statistical Analysis System) was utilized in all regressions reported in this paper.

[2] It should be noted that several models were used in attempting to "best fit" the data. Lagging various numbers of months and including PL-480 - quarterly interaction effects failed to provide any significant increment to R^2 or substantively different results.

TABLE 7-12

Regressions of Price of Black Beans/100 wt. on PL-480 Food Distribution and Control Variables

First Order Auto-regressive Solutions:

	With PL-480 Effect: R^2 = .6167				Without PL-480 Effect: R^2 = .5090			
Component	β value	SEE	t	Prob.	β value	SEE	t	Prob.
Intercept	23.4892	2.3241	10.107	.0001	23.3044	2.5850	9.015	.0001
Pre-E.Q. trend	.1883	.0480	3.923	.0002	.1713	.0548	3.125	.0026
Feb.'76-Jan.'77 trend	.1482	.0368	4.031	.0001	.1149	.0401	2.866	.0055
Feb.'77-Jan.'78 trend	.1726	.0255	6.771	.0001	.1398	.0282	4.960	.0001
Feb.'78-Aug.'79 trend	.1446	.0179	8.065	.0001	.1422	.0210	6.763	.0001
PL-480 *	-.0030	.0012	-2.464	.0162	-	-	-	-
Production **	-.1410	.0357	-3.953	.0002	-.1344	.0391	-3.440	.0010
Quarter #1 ***	-1.7488	.7070	-2.474	.0158	-1.7736	.7285	-2.434	.0174
Quarter #2 ***	-2.4204	.7556	-3.203	.0020	-2.5165	.7933	-3.172	.0022
Quarter #3 ***	-1.9802	.7087	-2.794	.0067	-2.0223	.7318	-2.764	.0073

*PL-480 effects are lagged one month and measured in thousands of pounds.

**Production figures for black beans are entered in October and are measured in metric tons.

***Quarterly effects are defined in terms of the calendar year.

contribute to the "noise" left in the data. An additional possibility is that large quantities were held back during the first few months after the earthquake and later released into the market in larger than normal amounts.

Figures 7-5 and 7-6 summarize pictorially the actual and predicted prices and the estimated PL-480 impact over time. Figure 7-5 graphs actual prices and predicted prices by month. Here, noise in the data is most evident during the pre-earthquake time period while the fit of the model to the data during the impact period is actually rather good. Figure 7-6 represents the estimated PL-480 effect plotted over time.[1] Those points above the "zero" line represent decrements to price while those below the line represent increments to price. One can readily see that there is a fair amount of dispersion about this line. And while we can think of no arguments for how PL-480 imports could raise prices, such points are clearly evident in this plot. We can only remind the reader that a certain amount of noise seems unavoidable in models utilizing data such as these and that estimates are "averaged" and may be in error for any specific month.

Nevertheless, it seems fairly conclusive that PL-480 distribution had a measurable impact on the prices of black beans. This impact was on the order of three-tenths of a cent per 1000 pounds increase in levels of distribution. During some months (most likely August - October 1976) prices may have been affected by as much as $2.15 per hundred weight. It should

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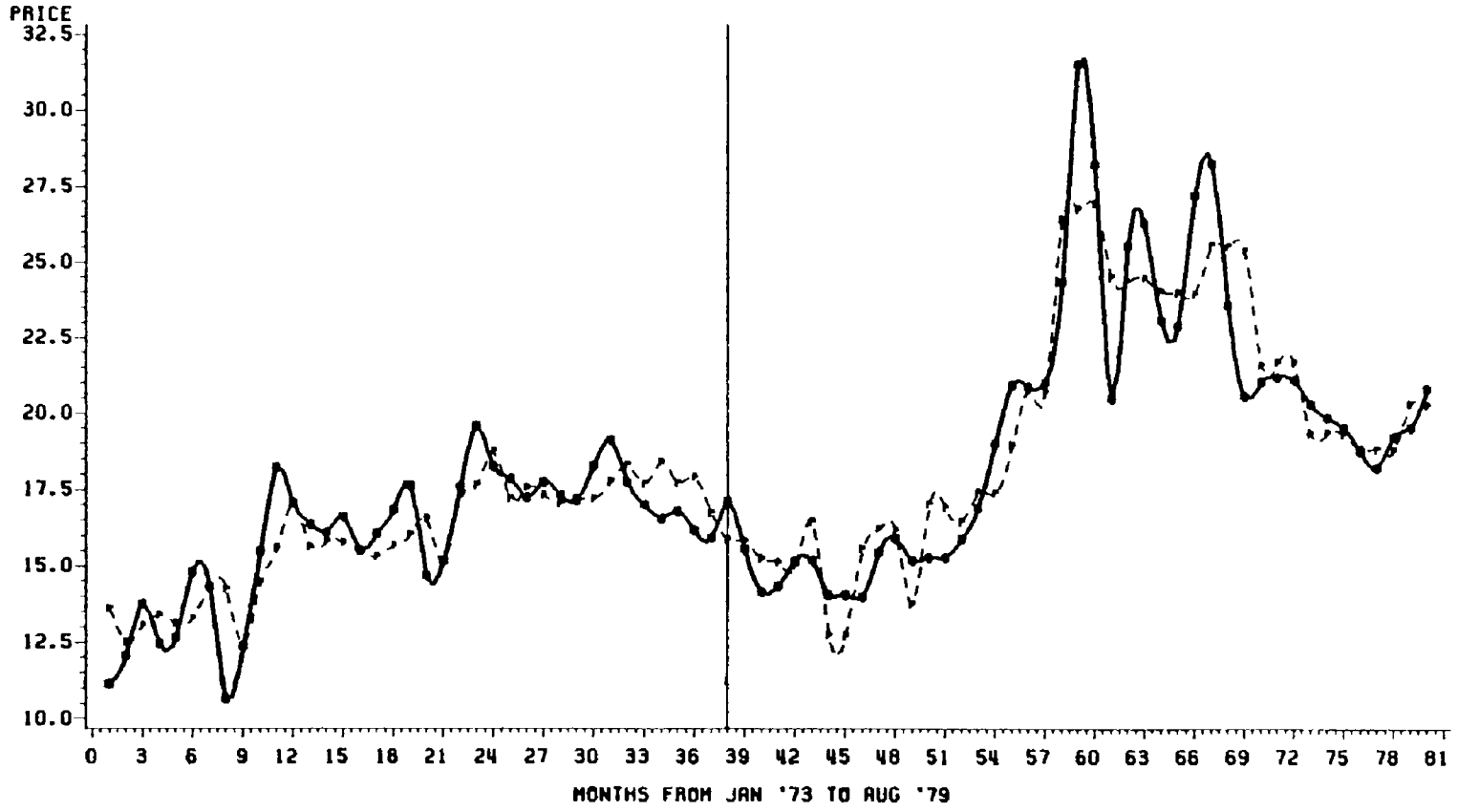
[1] A plot of these values based on a model utilizing all 80 time points results in some distracting estimates prior to the time that actual PL-480 distributions of beans began. The autoregressive model was therefore re-estimated for two time periods: (1) the pre-earthquake and pre-distribution time period - through January, 1976; and (2) the period from February, 1976 through August, 1979. Estimates of the PL-480 effect were nearly identical for the model utilizing all 80 time points (-.0034) and the model utilizing only the post earthquake period (-.0030). It is interesting to note that the R^2 for the January 1973 through January 1976 period is only .3568, while the model for the February 1976 through August 1979 time period has an R^2 of .8396. The plot of differences between a model containing the PL-480 effect and a model not containing such an effect (Figure 6) represents point estimates from the February 1976 through August 1979 time period.

FIGURE 7-5

BLACK BEANS

ACTUAL & PREDICTED MONTHLY PRICES
JANUARY 1973 – AUGUST 1979



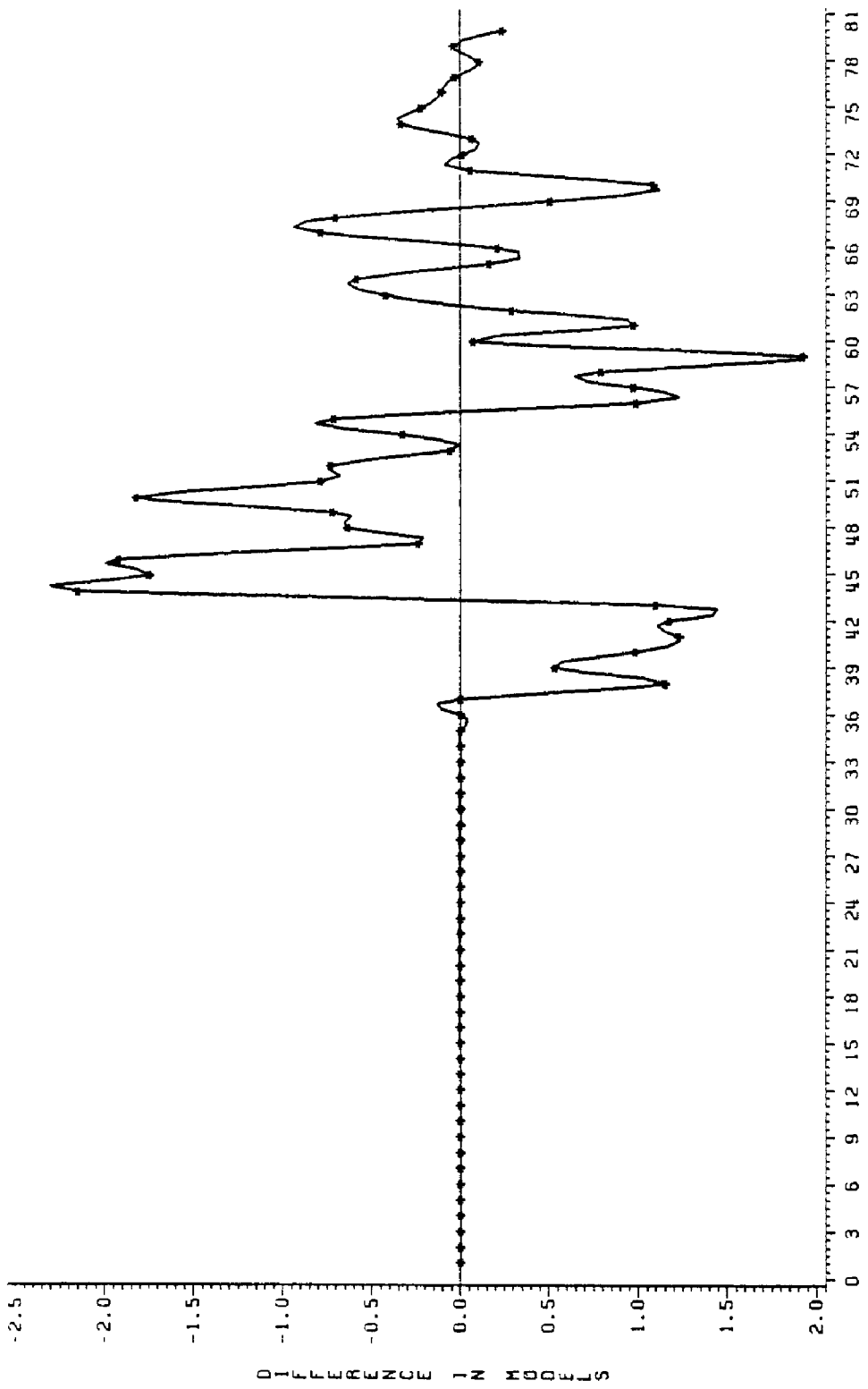
HEAVY LINE IS ACTUAL PRICE
LIGHT LINE IS PREDICTED PRICE

VERTICAL LINE AT
MONTH 38 = FEB. 1976

FIGURE 7-6

BLACK BEANS

ESTIMATED DIFFERENCES IN PRICE ASSOCIATED WITH PL480 BEAN DISTRIBUTION: JANUARY 1973 – AUGUST 1979



also be noted that prices one year later seemed to have more than made up these losses and in fact are higher than the overall model would predict.

PL-480 food distribution's impact accounts for some of the variance during the impact period. This is evident in the increment to R^2. Could there have been other earthquake related effects on price? The answer is undoubtedly yes, though we have no direct measures of these other variables. The closest we can get to measuring these effects are our linear time trend variables; that is, one way of defining an earthquake effect would be a change in trend during the earthquake period. In the case of beans, even though the estimates appear to be substantially lower during the first twelve months after the quake, there are not statistically significant differences between the estimates.

Price Impact of PL-480 Distribution of White and Yellow Corn

Approximately seven and one-half million pounds of yellow corn were distributed by CARE and CRS from January 1976 through September 1977.[1] Eighty-seven percent of this was distributed by March of 1977. Table 7-10 and Figure 7-7 show that some corn was distributed prior to the earthquake (July,'74 - Dec.1975). The effects of this corn distribution in regular PL-480 food programs are included along with corn handed out after the earthquake. While only yellow corn was distributed, white and yellow corn may be considered substitutable and it is thus reasonable to assume that an impact could be detected on either type corn. Though very similar in their outcomes, the analyses are presented in separate tables.

Tables 7-13 and 7-14 present the regression analyses of corn prices on essentially the same regressors used in the analysis of bean prices. Table 7-15 and Figure 7-8 give average prices for white corn - 1973-1979. Table 7-16

[1] U. S. Embassy figures.

FIGURE 7 -7

THOUSANDS OF POUNDS

YELLOW CORN

DISTRIBUTED THROUGH PL480 PROGRAMS

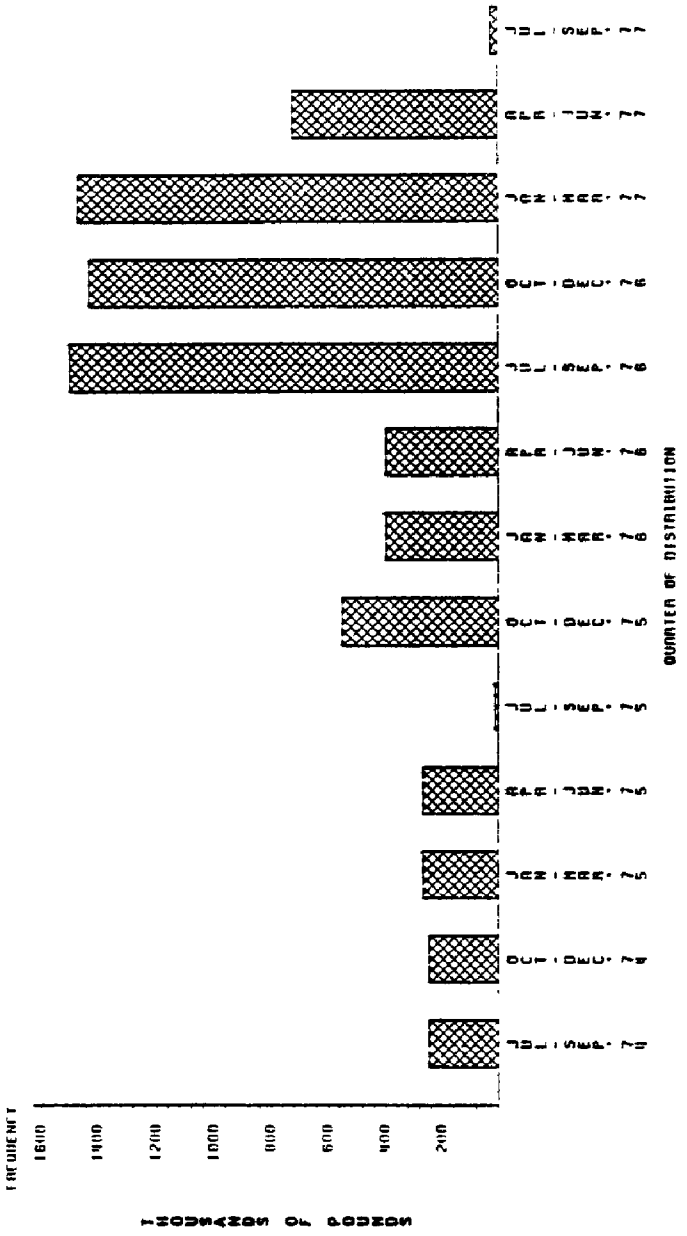


TABLE 7-13

Regressions of Price of White Corn/100 wt. on PL-480 Distribution and Control Variables

First Order Auto-regressive Solutions:

	With PL-480 Effects: R^2 = .6779				Without PL-480 Effect: R^2 = .6740			
Component	β value	SEE	t	Prob.	β value	SEE	t	Prob.
Intercept	9.3789	1.2952	7.448	.0001	9.7001	1.2358	7.849	.0001
Pre E.Q. Trend	.0826	.0132	6.251	.0001	.0800	.0130	6.150	.0001
Feb.'76-Jan.'77 trend	.0543	.0123	4.408	.0001	.0480	.0115	4.170	.0001
Feb.'77-Jan.'78 trend	.0605	.0086	7.011	.0001	.0591	.0085	6.911	.0001
Feb.'78-Aug.'79 trend	.0558	.0077	7.252	.0001	.0570	.0076	7.465	.0001
PL-480 *	-.0011	.0008	-1.414	.1617	-	-	-	-
Production **	-.0065	.0019	-3.492	.0008	-.0070	.0018	3.806	.0003
Quarter 1 ***	.1220	.1915	.637	.5262	.1209	.1926	.628	.5322
Quarter 2 ***	1.0673	.2047	5.213	.0001	1.0787	.2055	5.248	.0001
Quarter 3 ***	.9265	.1912	4.844	.0001	.9325	.1923	4.848	.0001

*PL-480 in thousands of pounds.

**Production measured in metric tons; entered in October.

***Quarterly effects are dummy variables expressed as deviations from the fourth quarter. Quarter 1 begins in December for this model.

TABLE 7-14

Regressions of Price of Yellow Corn/100 wt. on PL-480 Food Distribution and Control Variables

First Order Auto-regressive Solutions:

With PL-480 Effects: R^2 = .5726					Without PL-480 Effect: R^2 = .5702			
Component	β value	SEE	t	Prob.	β value	SEE	t	Prob.
Intercept	8.0602	1.3498	5.971	.0001	8.3785	1.3124	6.384	.0001
Pre-E.Q. Trend	.0900	.0146	6.174	.0001	.0883	.0144	6.148	.0001
Feb.'76-Jan.'77 trend	.0552	.0131	4.208	.0001	.0506	.0124	4.080	.0001
Feb.'77-Jan.'78 trend	.0569	.0095	6.014	.0001	.0560	.0094	5.982	.0001
Feb.'78-Aug.'79 trend	.0503	.0084	5.997	.0001	.0516	.0083	6.235	.0001
PL-480 *	-.0009	.0008	-1.116	.2681	-	-	-	-
Production **	-.0048	.0020	-2.400	.0190	-.0053	.0019	-2.706	.0085
Quarter 1 ***	.1449	.1951	.742	.4603	.1455	.1954	.745	.4590
Quarter 2 ***	.8109	.2116	3.832	.0003	.8189	.2116	3.870	.0002
Quarter 3 ***	.8128	.1949	4.171	.0001	.8156	.1951	4.180	.0001

* PL-480 in thousands of pounds.

** Production measured in metric tons, entered in October.

*** Quarterly effects are dummy variables expressed as deviations from the 4th quarter. First quarter begins in December.

TABLE 7-15

Average Monthly Prices per 100 Weight for White Corn

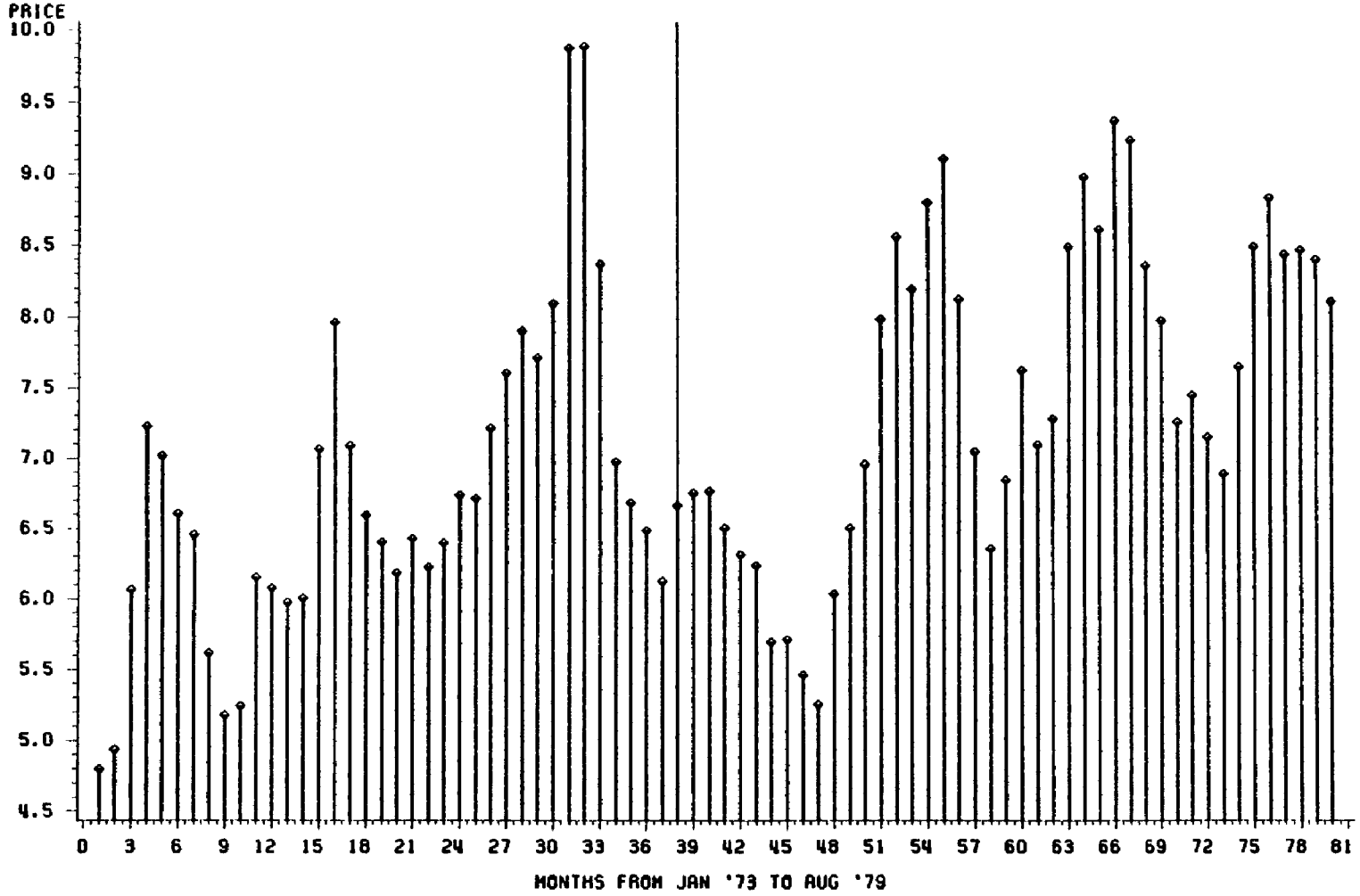
Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
1973	4.80	4.94	6.07	7.23	7.02	6.61	6.46	5.62	5.18	5.25	6.16	6.08	5.95
1974	5.98	6.01	7.07	7.97	7.09	6.60	6.41	6.19	6.43	6.23	6.40	6.74	6.69
1975	6.72	7.22	7.61	7.91	7.72	8.10	9.88	9.89	8.37	6.98	6.69	6.49	7.80
1976	6.13	6.67	6.76	6.77	6.51	6.32	6.24	5.70	5.72	5.47	5.26	6.04	6.13
1977	6.51	6.96	7.99	8.56	8.20	8.80	9.11	8.13	7.05	6.36	6.85	7.03	7.62
1978	7.10	7.28	8.49	8.98	8.61	9.38	9.24	8.36	7.98	7.26	7.45	7.15	8.10
1979	6.89	7.65	8.49	8.83	8.44	8.47	8.40	8.11					

Source: Indeca.

FIGURE 7-8

WHITE CORN

MONTHLY PRICES PER HUNDRED-WEIGHT
JANUARY 1973 – AUGUST 1979



MONTH #38 IS FEB 1976

TABLE 7-16

Average Monthly Prices per 100 Weight for Yellow Corn

Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
1973	4.79	4.91	5.14	6.50	6.42	6.07	5.87	5.29	4.92	5.59	6.55	6.45	5.71
1974	6.22	5.13	6.90	7.77	7.03	6.90	6.62	6.33	6.52	6.41	6.60	6.84	6.69
1975	7.03	7.31	7.70	7.92	7.85	8.07	9.90	10.25	8.43	7.35	6.98	6.78	7.95
1976	6.57	6.73	6.78	6.82	6.72	6.75	6.51	6.00	5.93	5.61	5.46	6.14	6.34
1977	6.60	7.04	7.99	8.60	8.02	8.76	8.68	7.93	6.79	6.15	6.63	7.00	7.51
1978	7.22	7.16	7.48	8.29	8.21	8.67	8.67	8.18	7.67	7.26	7.69	7.61	7.83
1979	7.99	7.42	8.00	8.00	7.96	7.84	7.92	8.00					

Source: Indeca.

and Figure 7-9 give these figures for yellow corn. The regression equation used to establish corn price effects is as follows:

$$\text{PRICE} = \alpha + \beta_1 (\text{Pre E.Q. trend}_t) + \beta_2 (\text{Feb. '76 - Jan. '77 trend}_t) + \beta_3 (\text{Feb. '77 - Jan. '78 trend}_t) + \beta_4 (\text{Feb. '78 - Aug. ' 79 trend}_t) + \beta_5 (\text{Production}_t) + \beta_6 (\text{PL-480 distribution}_t) + \beta_7 (\text{quarter } 1_t) + \beta_8 (\text{quarter } 2_t) + \beta_9 (\text{quarter } 3_t) + U_t$$

From these tables, we see that the estimates for PL-480 impact are not significantly different from zero. From this analysis, we are forced to conclude that PL-480 distribution of corn had no significant effect on prices (per 100 wt.). The PL-480 distribution of corn, it should be remembered, represented a much smaller proportion of total production than did beans.

However, there could still be an impact on prices after the earthquake due to factors not explicitly included in the model. One test for these effects would be a series of "t" tests for differences in the coefficients of the time trend variables. Table 7-17 summarizes these tests.

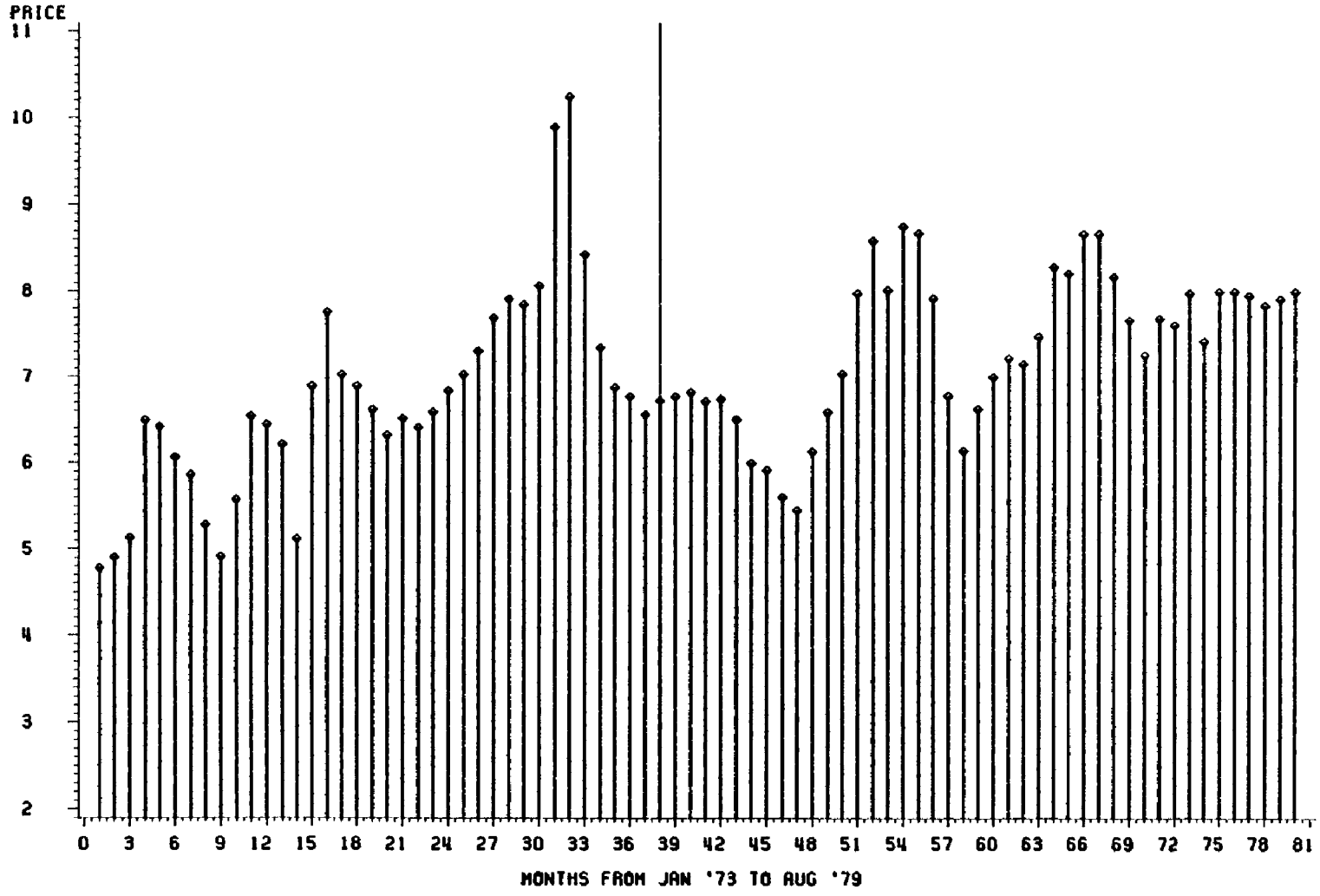
It is evident that the rate of increase during the pre-earthquake period is significantly different from any trend in prices since. Another way of saying this is that during these post-earthquake time periods, prices showed a decrease in the rate of increase: prices did not increase as fast as they had from January 1973 through January 1976. It should be remembered that these are "averaged" estimates for twelve month periods. We can look to the actual price data (Figures 7-8 and 7-9) for a detailed accounting of price month by month.

Alternative explanations for lower than expected prices during the years following the earthquake must consider the bumper harvest of 1975-1976 and record harvest since, in addition to the petroleum situation in

FIGURE 7-9

YELLOW CORN

MONTHLY PRICES PER HUNDRED-WEIGHT
JANUARY 1973 – AUGUST 1979



MONTH #38 IS FEB 1976

TABLE 7-17

White Corn

	Jan.'73-Jan.'76	Feb.'76-Jan.'77	Feb.'77-Jan.'78
Feb.'76-Jan.'77	3.654*		
Feb.'77-Jan.'78	2.387*	1.651	
Feb.'78-Aug.'79	2.576*	1.389	.459
Feb.'76-Aug.'79	2.616		
	Yellow Corn		
Feb.'76-Jan.'77	3.965*		
Feb.'77-Jan.'78	3.314*	.747	
Feb.'78-Aug.'79	3.690*	.101	.869
Feb.'76-Aug.'79	3.699		

*Significant at .05 level or greater

Guatemala. Lacking price data on agricultural inputs, we can not directly test their significance. But it does seem probable that production levels were primarily responsible for the lower than expected observed prices.

Fugure 7-10 shows actual prices and predicted prices for white corn; Fig. 7-11 shows these figures for yellow corn. The actual price figures appear in Tables 7-15 and 7-16. Figure 7-1 shows annual production figures for 1972-1980 in metric tons.

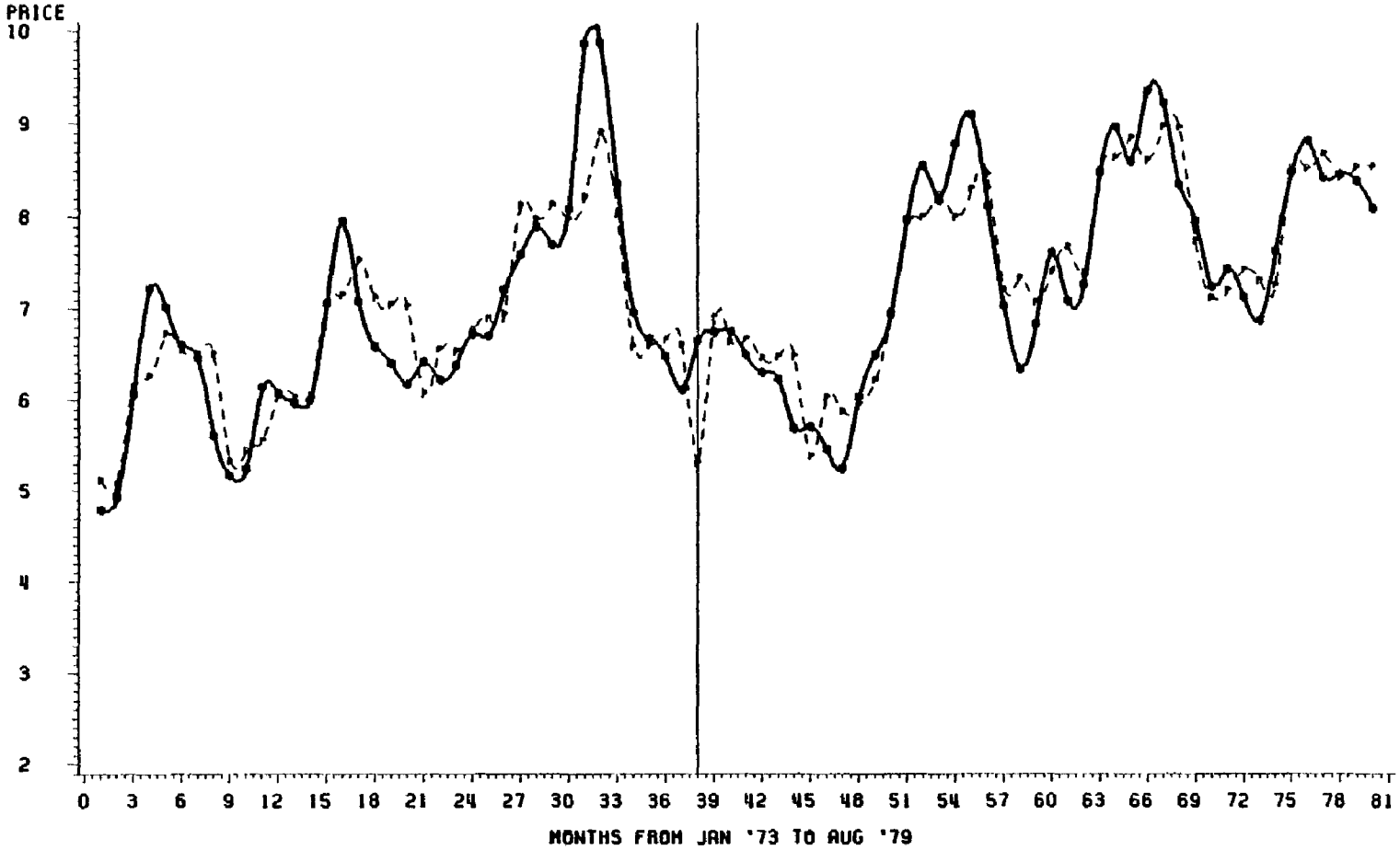
Summary

Lower than expected prices were noticed for corn and beans after the February 1976 earthquake. Some food critics pointed to PL-480 food

FIGURE 7-10

WHITE CORN

ACTUAL & PREDICTED MONTHLY PRICES
JANUARY 1973 – AUGUST 1979



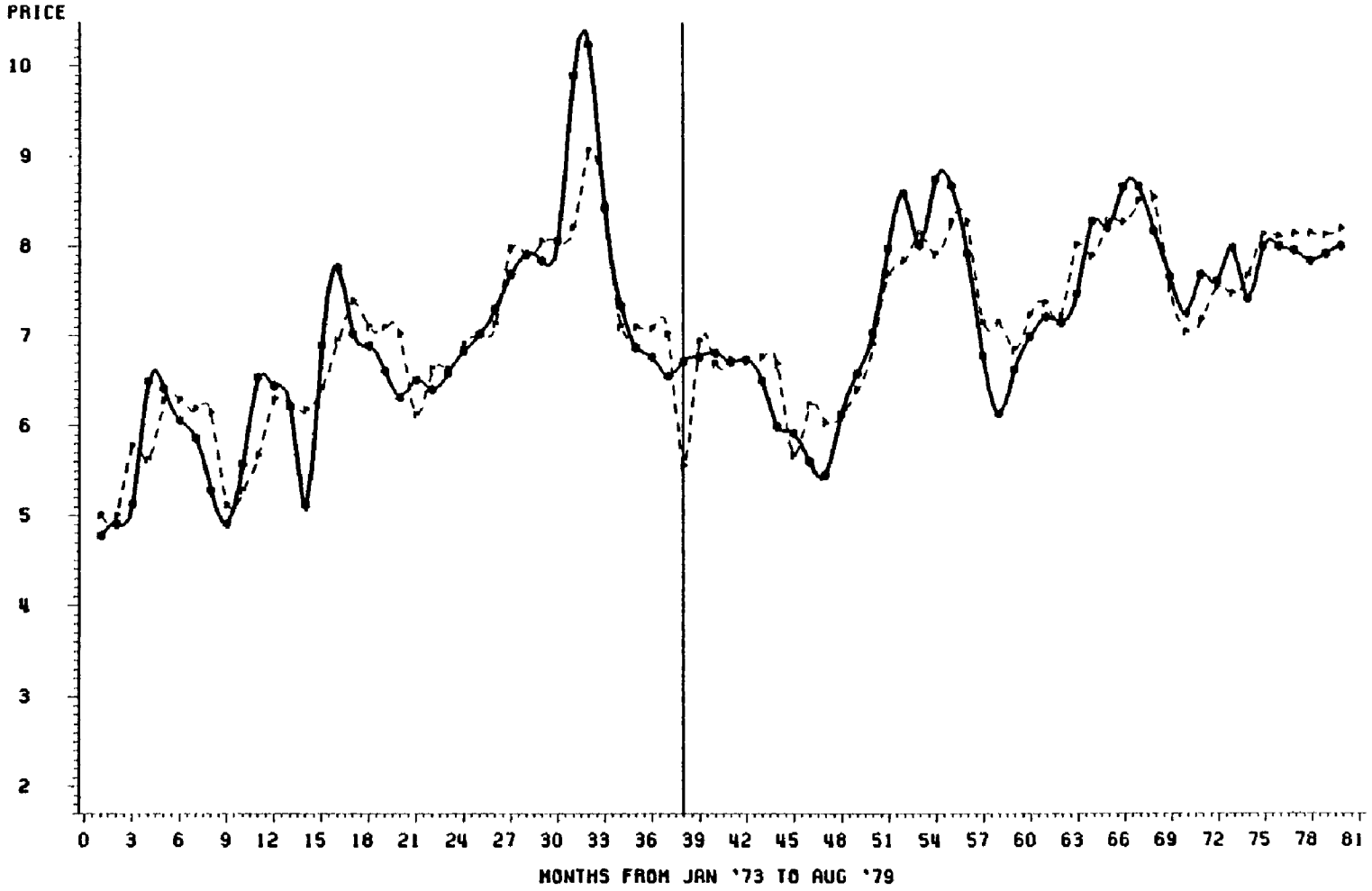
HEAVY LINE IS ACTUAL PRICE
LIGHT LINE IS PREDICTED PRICE

VERTICAL LINE AT MONTH 38 = FEB. 1976

FIGURE 7-11

YELLOW CORN

ACTUAL & PREDICTED MONTHLY PRICES
JANUARY 1973 – AUGUST 1979



HEAVY LINE IS ACTUAL PRICE
LIGHT LINE IS PREDICTED PRICE

VERTICAL LINE AT
MONTH 38 = FEB. 1976

distribution as the culprit. In the case of beans, there appears to be empirical evidence that this was indeed the case. The total cost to farmers of course depends on the volume sold and the timing of this sale. Caution should be exercised in attempting to apply the statistical model to any single month but in order to attach some meaning to these figures, a "worst case" scenario based on this model may be useful.

Assuming that bean prices were affected by as much as $2.15 per hundred weight for a particular month and that a farmer sold four hundred pounds of beans, simple multiplication tells us that this farmer lost $8.60 due to PL-480 food distribution by selling beans that month. This scenario is for an individual farmer. For the wholesale middleman or larger scale farmer, the net loss due to PL-480 food distribution could have been multiplied several fold. Those who bought beans as the 1975-76 harvest reached market and planned to sell during the summer months when prices were highest could not do so at a profit. From the actual prices in Table 7-11 (or Fig.7-4)we can see that prices remained at or below the January 1976 price until May 1977. By July, prices reached $20.95 per one hundred weight and by November of that year, $31.52 per one hundred weight. These conclusions partially support the contention of food program critics that PL-480 food distribution negatively affected prices, at least for beans during the first year following the earthquake.

In the case of corn, food critics' claims that PL-480 food distribution affected prices could not be supported with our data. Undoubtedly, prices were not as high during 1976 as they had been in 1975 or were in 1977. But the bumper harvest of 1975-76 appears to have been the main cause of this deflation in price. No significant covariation in price and PL-480

distribution levels could be found, once production levels, on-going linear trends in prices, and normal quarterly variations were statistically removed. This, in spite of trying different lag periods for PL-480, interaction effects and different data sources for production. We must, however, remind the reader that in certain isolated local markets PL-480 corn distribution may have significantly depressed prices. Nevertheless, with respect to average prices for major regional markets, no significant effect could be found for corn prices.

It should be remembered that we have dealt with prices for large quantities (hundred weight units). These prices represent what farmers received for their crops and are the appropriate prices to examine in attempting to address the concerns of PL-480 food critics. Though we expect that prices for small quantities (pounds) roughly parallel the prices per hundred weight, it should not be assumed that they also indicate what the consumer paid.