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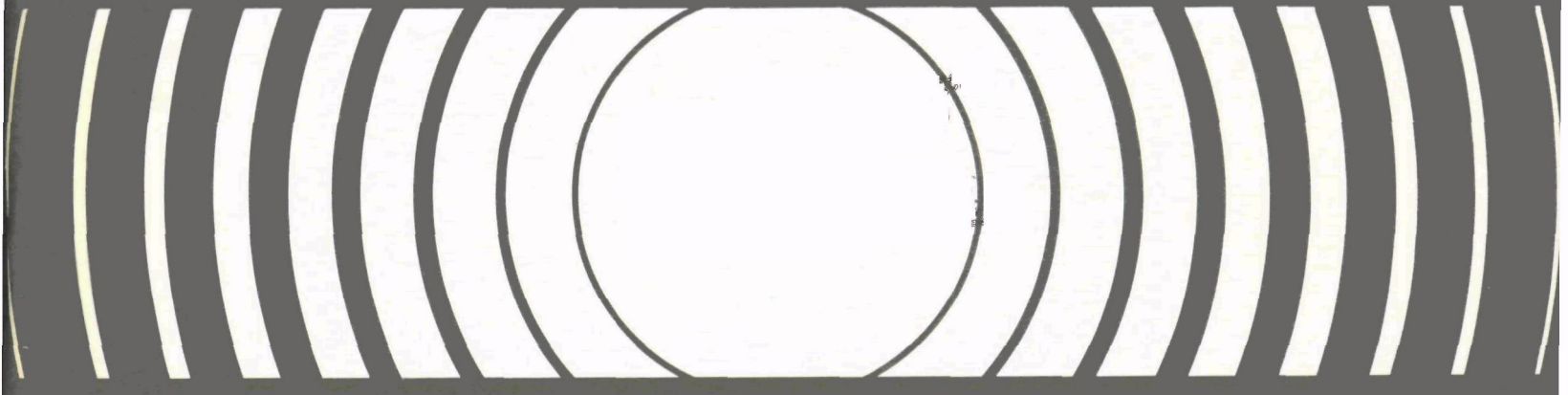
The Cost Of Implementing Protective Action Guides For Food



Cost of Implementing Protective Action Guides for Food

Dr. Byron Bunger

Office of Radiation Programs
U.S. Environmental Protection Agency
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1. INTRODUCTION

Protective Action Guides (PAGs) provide direction to public and private sector officials to aid them in making decisions to protect the public in case of accidents that release radiation or radioactive materials to the environment. Expressed in terms of projected radiation dose, PAGs may address a variety of protective actions to be taken after such an event. The protective action being considered in this analysis is the withdrawal of food from public consumption.

There are three stages in establishing the dose level for ingestion PAGs. The first stage is to determine the dose level that would satisfy basic health criteria. Foods that would cause a dose equal to or higher than this level would be unacceptable for use. The second stage is to examine the economic costs and benefits of the removal of foods that would cause a lower dose than meet health criteria to determine if there is net benefit for a more stringent standard of removal. Additional food that would cause an exposure whose value is judged to be equal to or greater than the level at which the incremental costs equal the incremental benefits would be withdrawn from consumption if the associated exposures were smaller than those established on purely health grounds. A third stage would consider the level at which withdrawal of contaminated food would incur health problems. This report addresses the second of these stages.

To aid in establishing the radiation dose at which cost may serve as a basis for removal of food from markets, this study develops estimates of the cost society would bear if food that had reached various stages in the farming to retail sale chain were removed from production or sales. No attempt is made in this report to establish PAG values. The study approaches cost issues in two ways. First, it measures the sum of consumer and producer surpluses associated with withdrawals of some key foods in significant quantities, based on the own-price elasticity of demand -- defined as the percent change in the quantity of a good demanded due to a one percent increase in its own price -- for the farm product and the variable costs sunk into production at various stages. Second, it examines the effects of major analogous events such as the drought which claimed fourteen percent and 20 percent respectively of the U.S. wheat and soybean harvests in 1988.

By integrating these two approaches, an understanding of the nature and magnitudes of the economic effects associated with implementing protective action for food is reached. These approaches are applied to 11 agricultural products representing the major categories of food types -- wheat, tomatoes, soybeans, snapbeans, milk, lettuce, eggs, chicken, beef, sweet corn, and

oranges. The analyses measure the overall costs to society and how the costs are distributed among affected farmers, other farmers growing the same crop but out of the area impacted, and consumers in the United States.

1.1 GENERAL DESCRIPTION OF METHODOLOGY

The method for measuring changes in economic welfare -- *i.e.*, changes in social costs or social benefits -- used in this study is to measure changes in consumer and producer surpluses based on specific assumptions and data. This approach is both conceptually sound and practical to implement.[1] The study assumes a linear demand curve for each farm product established by using recent prices and quantities as reported by the U.S. Department of Agriculture and "own-price elasticities of demand" for the product. The maximum size of product removals were based on the amount of the product grown in the state that produces the most of that product. These data are shown in Tables 1 and 2.

The demand curve for the individual farm products is critical to measurement of both consumer and producer surplus. A reduction in the quantity of a product placed on the market leads to a higher price, other things constant. The size of the price hike depends on the nature of the demand curve. For producers, the change of total revenue depends on the quantity demanded and on the slope of the demand curve at the initial price-output combination. Figure 1 depicts the linear demand curve HK for wheat based on data in Tables 1 and 2. Supply 1 is the initial supply curve and Supply 2 is the supply curve when all the wheat produced in Kansas is removed from market. Assumptions regarding the supply curves are discussed below. Point C is the initial price-quantity combination. The price of wheat increases by FE as supply decreases by BA.

Consumer surplus is the area below the demand curve and above the equilibrium price. Producer surplus is the area above the supply curve and below the equilibrium price. On Figure 1, the initial consumer surplus is the area HCE and the initial producer surplus is the area ECBO. A decrease in supply from Supply 1 to Supply 2 increases the price from OE to OF, reduces consumer surplus to HGF -- which is clearly smaller -- and changes producer surplus to FGAO -- which may be smaller or larger than before, but in this case is larger. The sign of changes in producer surplus will be discussed in more detail below. The loss of consumer surplus is depicted by the trapezoid FECG which is composed of the rectangle FEDG and the triangle GDC. The gain in producer surplus in this example is FOAG - EOBC. Because EOAD is common

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[1]William Baumol, Economic Theory and Operations Analysis, 4th ed. (Englewood Cliffs, New Jersey: Prentice-Hall, 1977), pp. 497-500.

Table 1: Prices and quantities of farm commodities, averages for 1983-5, by U.S. and leading state

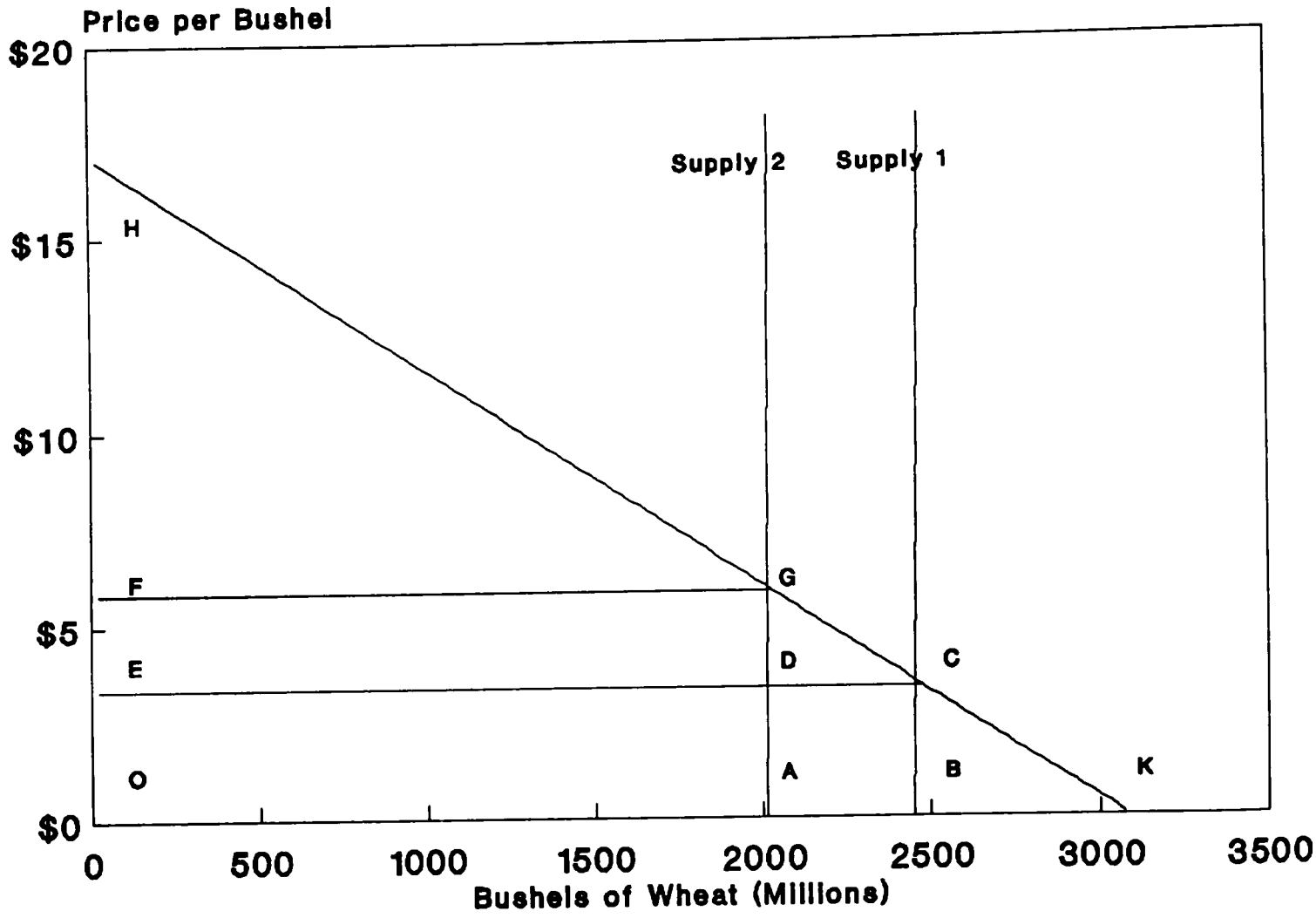
		United States		State With Highest Output			
Commodity	Unit of Measure	Price	Quantity	Name of State	Price	Quantity	Percent of US Output
WHEAT	BUSHELS	$3.36	2,479,788,667	KANSAS	$3.28	437,533,333	17.6
TOMATOES	CWT	$24.63	28,399,667	FLORIDA	$27.73	13,893,333	48.9
SOYBEANS	BUSHELS	$6.25	1,865,055,333	ILLINOIS	$6.38	311,201,667	16.7
SNAPBEANS	TONS	$166.67	652,003	WISCONSIN	$148.00	231,543	35.5
MILK *	POUNDS	$0.13	139,937,000,000	WISCONSIN	$0.12	24,620,000,000	17.6
LETTUCE	CWT	$11.40	61,343,667	CALIFORNIA	$11.30	43,961,667	71.7
EGGS *	DOZEN	$0.65	5,693,208,333	CALIFORNIA	$0.50	682,375,000	12.0
CHICKEN *	POUNDS	$0.32	18,356,867,000	ARKANSAS	$0.34	3,007,852,000	16.4
BEEF *	POUNDS	$0.73	39,946,992,000	TEXAS	$0.78	5,320,460,000	13.3
SWEET CORN	CWT	$12.77	15,407,667	FLORIDA	$13.57	4,703,000	30.5
ORANGES	BOXES	$7.77	184,346,667	FLORIDA	$8.07	120,066,667	65.1

* data not available for all three years
Source: USDA, AGRICULTURAL STATISTICS 1986

Table 2: Farm level own price elasticities of demand

	Source and Value		
Commodity	George & King	Other	ID of Other
WHEAT	-0.244	-0.2	DOA ERS
TOMATOES	-0.355		
SOYBEANS		-0.79	Hertel & Tsigas "Oilseeds"
SNAPBEANS	-0.234		
MILK	-0.32	-0.513	Hertel & Tsigas "Dairy"
LETTUCE	-0.095		
EGGS	-0.225		
CHICKEN	-0.602		
BEEF	-0.416	-0.407	Hertel & Tsigas "Red Meats"
SWEET CORN		-0.320	George & King, RETAIL "Other Fresh Vegitables"
ORANGES	-0.455		

Figure 1. Linear Demand Curve



to both areas, the difference is FEDG - DABC. The combined reduction in consumer and producer surplus is therefore equal to FEDG - GDC + FEDG - DABC, or - GDC - DABC because FEDG is in both measures with opposite sign.

Each of these areas has significance to the analysis of the cost of withdrawing food from use. GDC is the "deadweight loss" of consumer surplus; DABC is the loss of revenues to the Kansas farmers whose wheat is kept from market; and FEDG is the increase in revenues enjoyed by all other wheat farmers and at the same time the additional expenditures made by consumers for the remaining wheat. Before the decrease in supply FEDG was part of consumer surplus, afterwards it is part of producer surplus. This transfer of wealth is a major distributional aspect of any reduction in supply.

Demand for nearly all agricultural products has been measured to be "inelastic" in most studies performed to date. This means that consumers make relatively small adjustments in purchases in response to changes in price. Therefore, and of interest in this study, consumers respond to a reduction in the quantity available by bidding up the price by a relatively large amount compared to the size of the reduction. This leads to a seemingly perverse result: when the quantity of farm products allowed to go to market is reduced, the total revenue collected by all farmers increases. However this gain is collected by farmers other than the ones whose crops were removed from market. The affected farmers' revenues fall to zero. FEDG measures the gain experienced by other wheat farmers and DABC the loss borne by affected wheat farmers. FEDG will exceed DABC when demand is inelastic, so the change in producer surplus is positive when demand is inelastic and negative when demand is elastic.

Market behavior is analyzed by investigating the interaction of the demand and supply curves. Therefore it is also necessary to make explicit the assumptions regarding the supply curve on which the study is based. The major assumption regarding the supply curve is that supply of the harvest of an agricultural crop is fixed once planting decisions are made, except for random factors such as weather. This is characterized as a vertical supply curve. When the harvest is reduced due to a PAG, the vertical supply curve is shifted to the left by a corresponding amount.

Given these assumptions the area under the demand curve and between the two vertical supply curves -- Supply 1 and Supply 2 -- is the total welfare loss due to the withdrawal of food from use. These quantities are measured for each of the 11 farm products studied in the following chapter. The major distributional effects of withdrawing crops from market include the two components of welfare loss -- the deadweight loss of consumer surplus and the loss of revenues by affected farmers -- as well as the large transfer of money from consumers to farmers. The

latter quantity is not part of the overall welfare loss attributable to the protective action; rather it is a transfer from consumers surplus to producer surplus, shown in Figure 1 as FEDG. Thus the distributional effects -- large losses by consumers including both the deadweight loss and increased expenditure on the remaining crop, large gains by farmers other than those directly affected by the protective action, and complete losses by farmers directly affected by the protective action -- must be considered as well as the net overall welfare effect.

1.2 SELECTION OF FOODS FOR STUDY

Food products were selected from major categories of foods as delineated by the U.S. Department of Agriculture. These categories are: 1) grains, from which wheat was selected; 2) cotton, tobacco, sugar crops, and honey; 3) oilseeds, fats, and oils, which is represented in the study by soybeans; 4) vegetables and melons, represented by lettuce, tomatoes, snapbeans and sweet corn; 5) fruits, tree nuts, and horticultural specialties, represented by oranges; 6) hay, seeds and minor field crops; 7) cattle, hogs and sheep, represented by beef; and 8) dairy and poultry products, represented by milk, eggs, and chicken. The selection is intended to identify farm products that are widely used and for which good data are available.

2. MEASUREMENT OF THE ECONOMIC EFFECTS OF PROTECTIVE ACTION

The method used in this study, discussed in more detail below, measures the losses to consumers and producers in dollars. Figure 2 and Table 3 show the results for 100 percent losses of the output of the states that produce the most of the commodity in question. The welfare losses to society for the commodities studied range from $4.4 billion for beef to $1 hundred million for snapbeans and sweet corn. Smaller increments of loss were also calculated and are given in Section 2.3 below. Before discussing these results, more detail is provided regarding methodology and data.

2.1 METHODOLOGY

Measuring changes in consumer and producer surpluses is a widely accepted operational method of evaluating welfare losses due to changes in the price or availability of a product. There are both theoretical and practical considerations in the application of this technique. One theoretical issue in the measurement of consumer surplus concerns the implicit change of the consumer's income as the price of the commodity is changed. Although very interesting conceptually, this issue leads to only very small differences in the measurement of consumer surplus. Implicit changes in consumer income are ignored here. A second theoretical issue that is less easily ignored is the question of whether to approach the measurement of consumer and producer surplus in a partial or a general equilibrium framework. The partial equilibrium framework assumes that the prices of other goods and services remain constant even though there is a second order shift in the demand for them. General equilibrium analysis is more complex because the effects of the initial shift must be traced through the entire economy.

Several recent articles have used the general equilibrium approach in measuring the own-price elasticities of demand -- defined above -- and the cross-price elasticities of demand -- defined as the percent change in the demand for a good due to a one percent change in the price of another good -- for groupings

Figure 2. Commodities Ranked by Welfare Loss

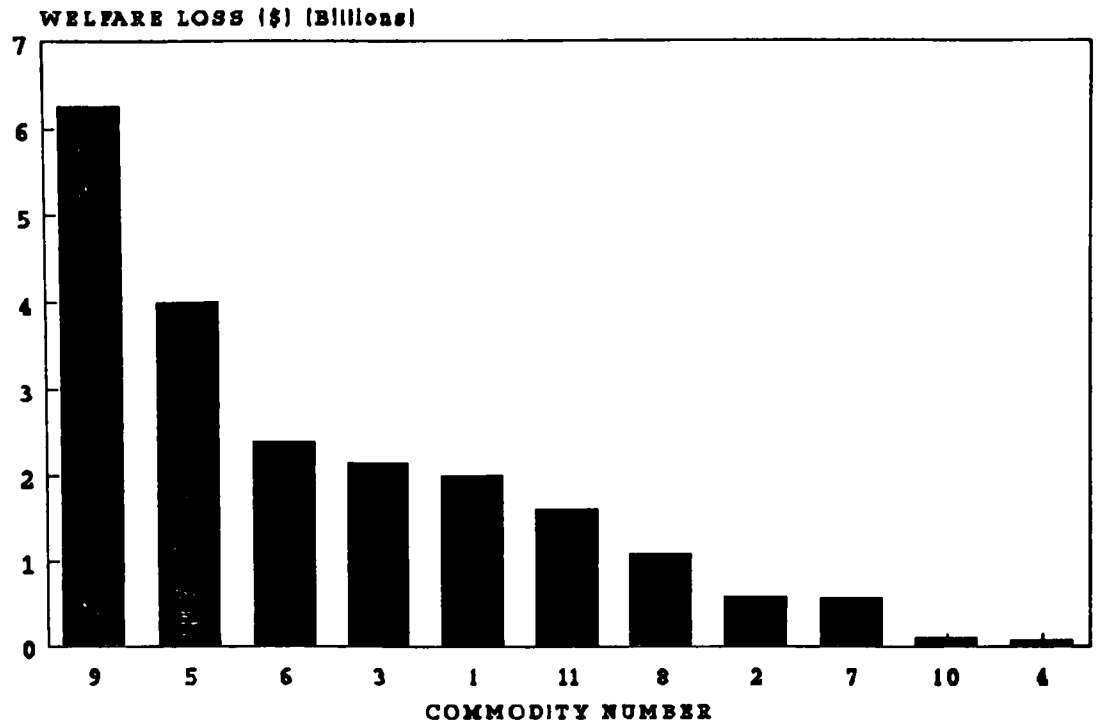


Table 3: Summary of total, national welfare losses by crop

Commodity	Commodity Number	Total Welfare Loss Nationwide
BEEF	9	$6,250,279,173
MILK	5	$4,001,976,386
LETTUCE	6	$2,391,459,007
SOYBEANS	3	$2,150,417,321
WHEAT	1	$1,999,655,380
ORANGES	11	$1,601,316,769
CHICKEN	8	$1,093,502,554
TOMATOES	2	$578,050,352
EGGS	7	$561,762,037
SWEET CORN	10	$88,677,520
SNAPBEANS	4	$67,873,695

of agricultural products.[2] These studies simultaneously measure a set of own-price and cross-price elasticities in a theoretically correct way, but have been applied to product groups rather than individual products.

A third theoretical issue is the shape of the demand curve. Closely related to this issue is the question, for how large a perturbation can the elasticity be expected to hold? Two specifications of the demand curves that can be derived using the available data are constant elasticity demand curves and linear demand curves. As their name suggests, constant elasticity demand curves have the same elasticity at all points on the demand curve. As the quantity demanded gets smaller, the downward slope of these curves gets steeper. On the other hand, linear demand curves have constant slope, but the own-price elasticity of demand is different at each point on the curve. Regardless of the nature of the curve, it must be assumed that the elasticity of the curve holds only in the neighborhood of the mean of the data used in estimating the curve. Whether the size of changes in supplies of agricultural products used in this study is too large to be considered to be in this neighborhood is an open question. However, the information presented in Section 3 of this study suggests that the perturbations used in this study are within the range of common experience. The smaller perturbations calculated, such as 10 or 20 percent of the whole product of the leading state, rather than 100 percent, are likely to result in more accurate measures of welfare loss. Linear demand curves are used in this study.

As indicated in graphs and tables in Section 2.3, there is one component of the welfare measure that is quite reliably measured and does not depend on the technical theoretical issues raised above. DABC in Figure 1 is an important component of welfare loss and is easily and accurately measured. It is the amount of product taken off the market times the market price that would have been in effect if the product had not been removed from market. In some cases it constitutes a very large part of the welfare loss. In all cases it is the lower limit to an estima-

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[2]Thomas W. Hertel and Marinos E. Tsigas, "General Equilibrium Analysis of Supply Control in U.S. Agriculture," Purdue University, April 1989.

Thomas W. Hertel et. al., "Competing Farm Level General Equilibrium Demand Elasticities for Agricultural Commodities," Research Bulletin No. 988 of the Agricultural Experiment Station, Purdue University, W. Lafayette, Indiana.

Michael K. Wohlgenant, "Demand for Farm Output in a Complete System of Demand Functions," American Journal of Agricultural Economics, May 1989, pp. 241-252.

tion of the loss. In Section 2.3, the size of the loss attributable to DABC in Figure 1 is compared to the loss attributable to GDC, the deadweight loss of consumer surplus.

Costs of production are also a factor in estimating the welfare losses due to the withdrawal of food from use. The timing of the protective action, that is, during what part of the year the nuclear event occurs that necessitates its application, determines the amount of variable costs that would have been saved by withholding variable resources after the protective action has been implemented. At one extreme, if the protective actions were applied after harvest is completed and the product stored safely, but before expenditures on seeds and other variable inputs for the next planting were made, the welfare losses borne by farmers would be reduced by the savings on these items. At the other extreme, if the protective action were applied to products just harvested, all the variable cost of production for that agricultural product would have been spent, and no savings would be possible.

Because the normal state of affairs is for farmers to plant and harvest, and spend the associated amounts on variable inputs, and because the welfare losses being measured in this study are changes from the status quo, the welfare losses discussed above assume the second extreme case. Therefore any differences between the maximum expenditure on variable costs and the amount actually spent should be subtracted from the amounts estimated. Another way of putting it is that the welfare losses measured under the demand curve in Figure 1 are worst case losses. The information needed to estimate variable cost by time are available for wheat and soybeans. The matter is discussed in more detail in Sections 2.3.1 and 2.3.3.

2.2 DATA

Two types of data are required for this study: 1) Relatively unprocessed data regarding price, quantity, dates of planting, and production costs for various agricultural products and 2) highly processed data in the form of price elasticities of demand. With regard to the first type of data, the U.S. Department of Agriculture's book *Agricultural Statistics, 1986*, their handbook *Usual Planting and Harvesting Dates for U.S. Field Crops*, (USDA SRS Agricultural Handbook 628, April 1984), and their report *Economic Indicators of the Farm Sector Costs of Production, 1987*, (USDA ERS) provided the needed information. Elasticities of demand are not so easily found.

In 1971 P. S. George and G. A. King published a matrix of farm level own-price elasticities and cross-price elasticities for 49 agricultural products. This is the most complete set of farm level elasticities ever published. However, current researchers have two critiques of this data. The first is that the George

and King elasticities are dated because they are based on consumer tastes, income and prices and the population size of the 1950's and 1960's. The second is that the techniques George and King used in deriving farm level elasticities of demand from retail level elasticities of demand are based on fixed linear production functions that do not allow for substitutions due to changing prices. These researchers, for example Wohlgenant and Hertel who were referenced above, have developed a more flexible theoretical approach in the form of computable general equilibrium models and various econometric techniques that allow theoretically correct measurements of elasticities to be made. But unfortunately, these techniques are expensive to use in that they require large amounts of data. Therefore the results that have been presented to date are for small numbers of highly aggregated groups of agricultural products. In this study, the George and King farm price elasticities are used except as otherwise noted in Table 2.

The following sections apply the data to the 11 individual agricultural products that are the subject of this study.

2.3 RESULTS

2.3.1 Wheat

Table 4 and Figure 3 show the loss of farm revenue by farmers affected by withdrawal of food from use for 1 year, dead weight welfare loss, and total welfare loss nationwide if all the wheat in Kansas had to be removed from market immediately after harvest. The prices and quantities used in these calculations are shown in Table 5, as U.S. price and production for 1983 through 1985. Wheat averaged $3.36 per bushel nationwide. During these years, Kansas grew 18 percent of the wheat produced in the United States of 0.4 billion of the 2.5 billion bushels produced.

The loss of farm revenues to affected farmers in the event of withdrawal of 100 percent of Kansas wheat would be $1.5 billion, the dead weight welfare loss of $0.5 billion is 27 percent of the nearly $2 billion total welfare loss nationwide. As shown in Table 5, almost $5 billion would be transferred from consumers to the rest of U.S. farmers outside the affected region. Figure 3 and Table 4 show that smaller reductions in wheat coming to market result in dead weight losses that are smaller relative to total welfare losses than the dead weight losses due to larger removals. For example a 100 percent removal results in a dead weight loss equal to 26.6 percent of total welfare loss while a removal of 20 percent results in a dead weight loss equal to only 6.7 percent of total welfare loss.

Two issues concerning the timing and magnitude of variable costs affect the cost of withdrawal of food from use. Figure 4a shows the timing of cumulative, total, variable, cash expenses (re

Table 4: Welfare losses due to removal of wheat from market

Farm Level Own Price Elasticity of Demand: -0.244

Amount of Commodity Removed: Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	437,533,333	bushels	1,468,653,556	531,001,825	1,999,655,380	26.6%
90%	393,780,000	bushels	1,321,788,200	430,111,478	1,751,899,678	24.6%
80%	350,026,667	bushels	1,174,922,844	339,841,168	1,514,764,012	22.4%
70%	306,273,333	bushels	1,028,057,489	260,190,894	1,288,248,383	20.2%
60%	262,520,000	bushels	881,192,133	191,160,657	1,072,352,790	17.8%
50%	218,766,667	bushels	734,326,778	132,750,456	867,077,234	15.3%
40%	175,013,333	bushels	587,461,422	84,960,292	672,421,714	12.6%
30%	131,260,000	bushels	440,596,067	47,790,164	488,386,231	9.8%
20%	87,506,667	bushels	293,730,711	21,240,073	314,970,784	6.7%
10%	43,753,333	bushels	146,865,356	5,310,018	152,175,374	3.5%

Figure 3. Welfare Losses Due to Removal of Wheat

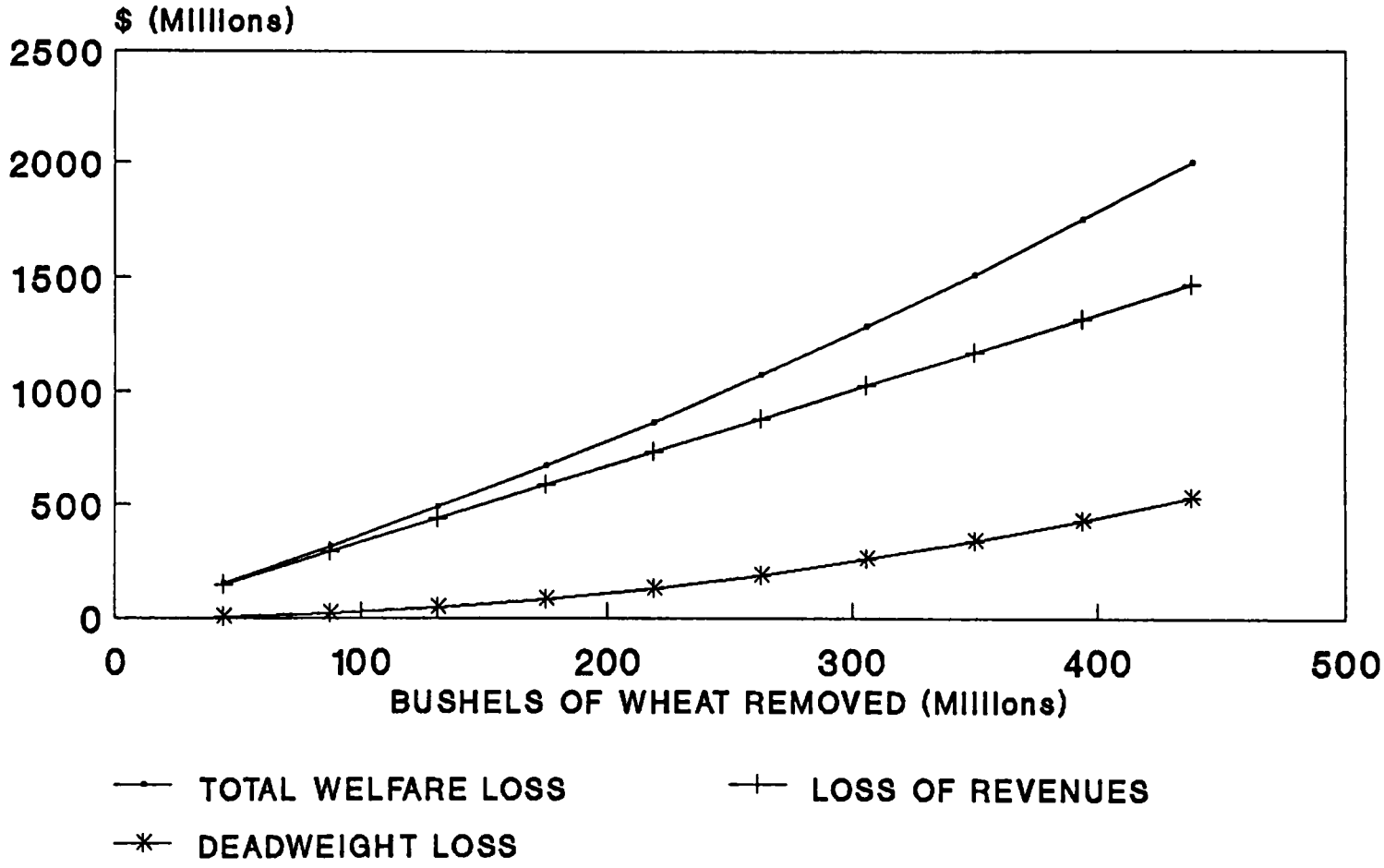


Table 5: Worksheet on wheat

INITIAL PRICE:	$3.36
INITIAL QUANTITY:	2,479,788,667 BUSHELS
INITIAL REVENUE:	$8,323,823,958
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.244
CHANGE IN QUANTITY:	
	-18%
	(437,533,333)BUSHELS
CHANGE IN PRICE:	$2.43
NEW PRICE:	$5.78
PERCENT CHANGE IN PRICE:	72%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$3,488,414,744
LOSS OF REVENUES TO FLORIDA:	($1,468,653,556)
GAIN TO REST OF NATION'S TOMATO FARMERS:	$4,957,068,300

PRODUCTION

(in bushels)

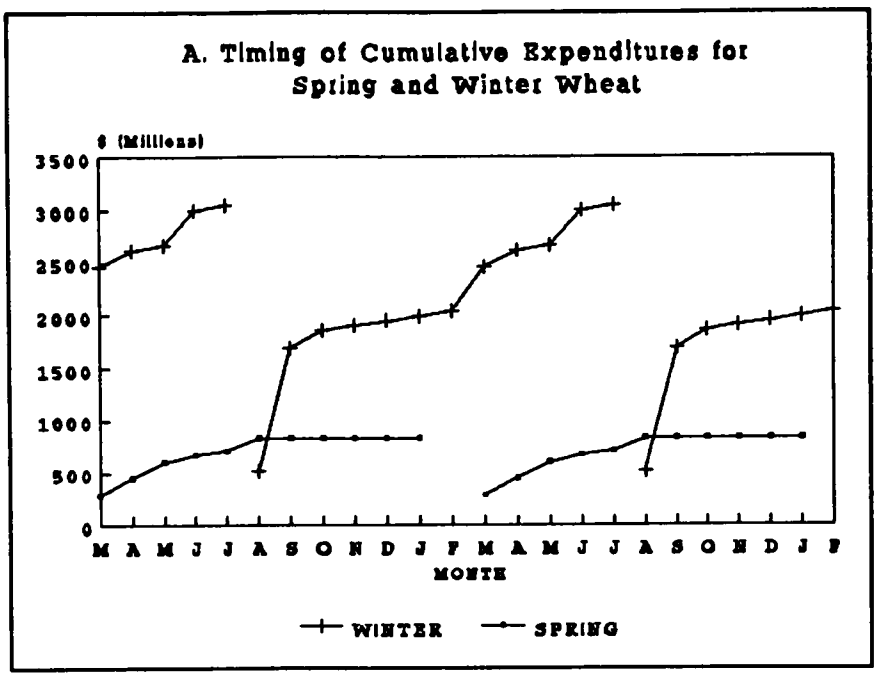
YEAR	1983	1984	1985	MEAN
KANSAS	448,200,000	431,200,000	433,200,000	437,533,333
U.S.	2,419,824,000	2,594,777,000	2,424,765,000	2,479,788,667

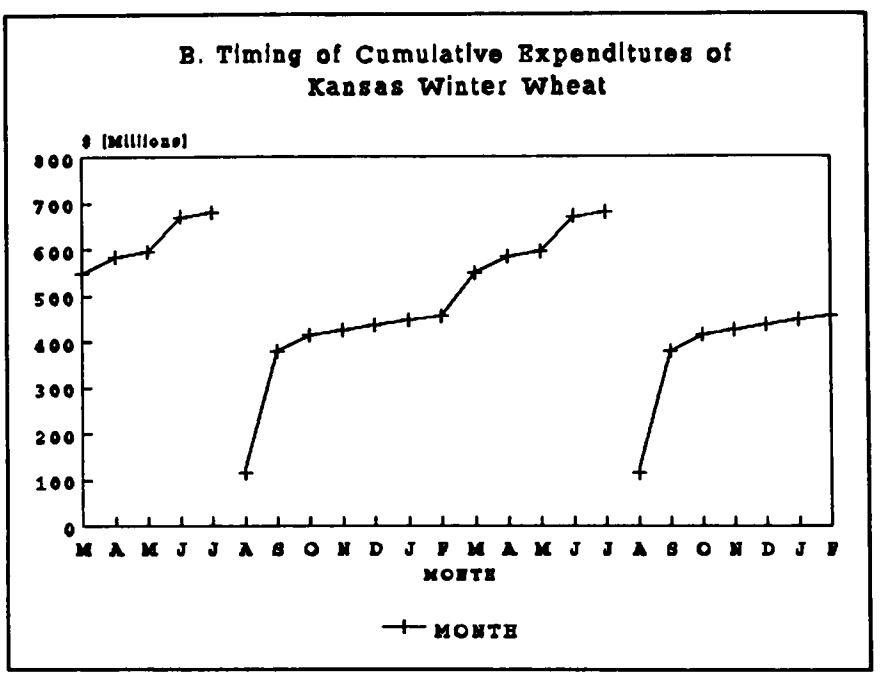
PRICE

($ per bushel)

YEAR	1983	1984	1985	MEAN
KANSAS	$3.46	$3.32	$3.05	$3.28
U.S.	$3.53	$3.38	$3.16	$3.36

Figure 4. Timing and Expenditure for Wheat





ferred to here as variable costs) sunk in production of spring and winter wheat. The values shown on Figure 4a are for the nation as a whole. Using Figure 4a, it can be seen how U.S. farmers would adjust their planting schedules in response to a decision to withdraw food from use. For example, should a decision affecting Kansas winter wheat -- Kansas only grows winter wheat -- occur in September 1990, after all winter wheat had been planted, the first adjustment in planting would be for the spring wheat crop in March 1991 and the first harvest reflecting these adjustments would occur in August or September 1991.

Referring to Figure 4b, which shows the timing of variable costs of Kansas winter wheat, it can be seen that only 17 percent of variable costs would have been spent by the beginning of September, but 56 percent would have been spent by the beginning of October.Referring to the savings that Kansas farmers could realize if the decision for protective action occur early enough in the season, Figure 4b shows that variable costs Kansas wheat farmers could avoid would total $681 million. This entire amount would be saved if the decision were made in early July, after the previous harvest was safely in and before fertilizer and seeds have been applied for the next crop. This saving is about 46 percent of the total revenue Kansas farmers realize from their wheat. If the protective action is applied to harvested wheat none of the variable cost can be recovered. Fixed costs could not be recovered, unless the fields could be used for another activity that was not as sensitive to radioactivity as wheat. The savings in variable costs are subtracted from total welfare loss. For example, if 100 percent of Kansas wheat producers were advised to not plant a crop, $681 million would be subtracted from the nearly $2 billion welfare loss that was listed in Table 4.

2.3.2 Tomatoes

Table 6, Figure 5, and Table 7 depict the results obtained for tomatoes. Forty-nine percent of the U.S. tomato crop is grown in Florida -- an average of 14 million cwt. of the just over 28 million cwt. grown nationwide. Deadweight loss would be 41 percent of total welfare loss nationwide -- $0.24 billion of $0.58 billion.

With respect to distributional effects, the gain to non-affected farmers at the expense of consumers -- $0.49 billion -- is over 1.4 times the $0.34 billion loss borne by affected farmers. At low levels -- 10 percent of the Florida crop -- a smaller 6.4 percent of the total welfare loss is dead weight loss. Dead weight loss is lost to all of society. It is also more subject to error in calculations than loss of farm revenues -- so at these lower level, the total welfare loss is less subject to

Table 6: Welfare losses due to removal of tomatoes from market

Farm Level Own Price Elasticity of Demand: -0.355

Amount of Commodity Removed			Loss of Farm Revenue in Affected Area	Dead Weight Welfare Loss	Total Welfare Loss Nationwide	Dead Weight as a Percent of Total Loss
Percent of Largest State Production	in Units	Units	(in $)	(in $)	(in $)	
100%	13,893,333	cwt	342,239,111	235,811,241	578,050,352	40.8%
90%	12,504,000	cwt	308,015,200	191,007,105	499,022,305	38.3%
80%	11,114,667	cwt	273,791,289	150,919,194	424,710,483	35.5%
70%	9,725,333	cwt	239,567,378	115,547,508	355,114,886	32.5%
60%	8,336,000	cwt	205,343,467	84,892,047	290,235,513	29.2%
50%	6,946,667	cwt	171,119,556	58,952,810	230,072,366	25.6%
40%	5,557,333	cwt	136,895,644	37,729,799	174,625,443	21.6%
30%	4,168,000	cwt	102,671,733	21,223,012	123,894,745	17.1%
20%	2,778,667	cwt	68,447,822	9,432,450	77,880,272	12.1%
10%	1,389,333	cwt	34,223,911	2,358,112	36,582,024	6.4%

Figure 5: Losses Due to Removal of Tomatoes

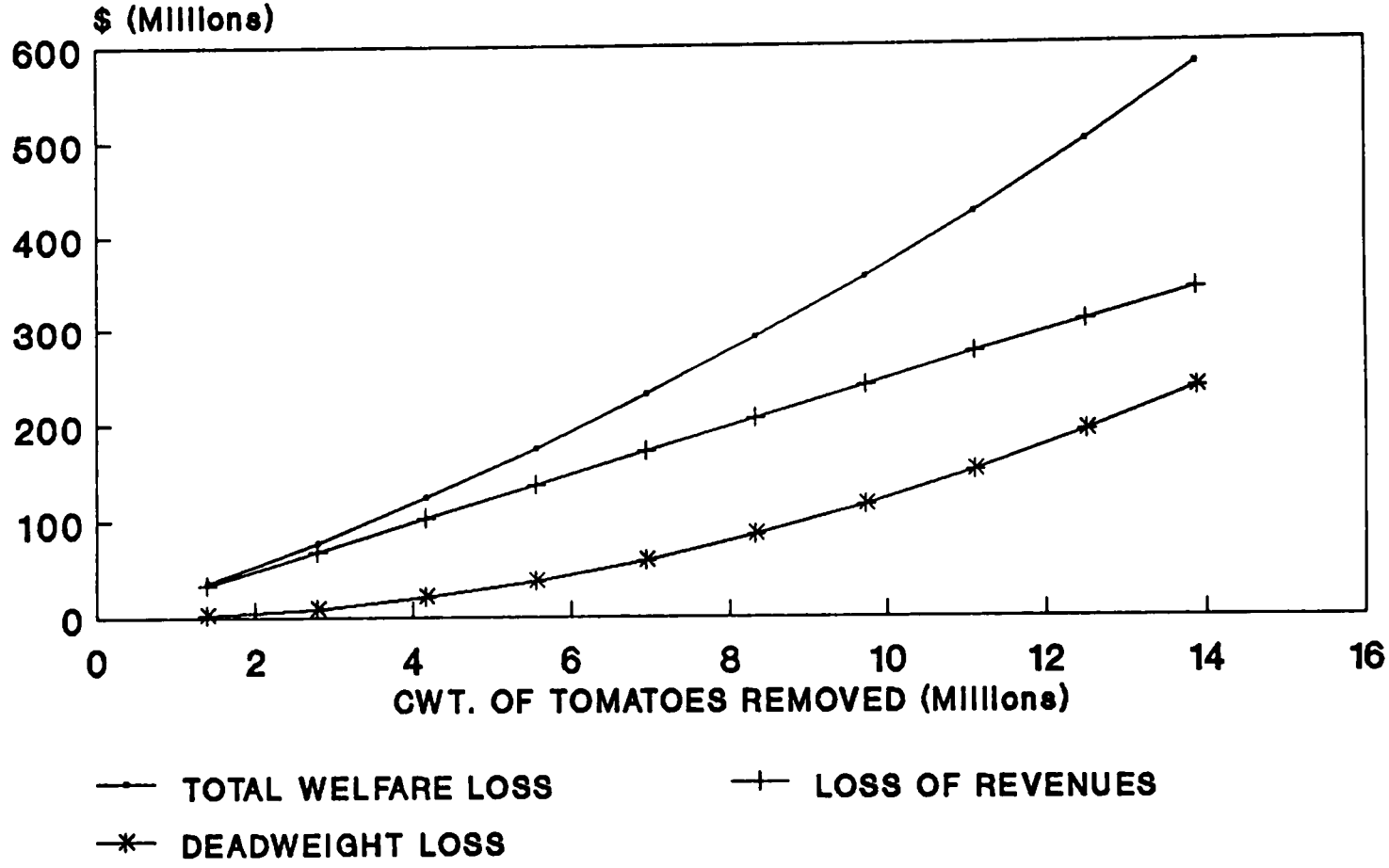


Table 7: Worksheet on tomatoes

INITIAL PRICE:	$24.63 /CWT
INITIAL QUANTITY:	28,399,667 CWT
INITIAL REVENUE:	$699,578,456
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.355 (G&K, pp. 64-5.)
CHANGE IN QUANTITY:	
	-49%
	(13,893,333)CWT
CHANGE IN PRICE:	$33.95 /CWT
NEW PRICE:	$58.58 /CWT
PERCENT CHANGE IN PRICE:	138%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$150,192,241
LOSS OF REVENUES TO FLORIDA:	($342,239,111)
GAIN TO REST OF NATION'S TOMATO FARMERS:	$492,431,353

PRODUCTION
(in cwt)

YEAR	1983	1984	1985	MEAN
FLORIDA	13,664,000	13,886,000	14,130,000	13,893,333
U.S.	27,237,000	28,189,000	29,773,000	28,399,667

PRICE
($ per cwt)

YEAR	1983	1984	1985	MEAN
FLORIDA	$27.60	$26.60	$29.00	$27.73
U.S.	$24.10	$25.60	$24.20	$24.63

errors based on violations of assumptions regarding elasticities and shapes of demand curves.

2.3.3 Soybeans

Table 8, Figure 6, and Table 9 provide the results for soybeans. Soybeans have a small deadweight loss -- less than 10 percent of total welfare loss -- even if 100 percent of the soybeans in Illinois were withdrawn from use. This is due to a relatively "high" elasticity of -0.79. Soybeans are not very inelastic. The total welfare loss due to loss of 100 percent of Illinois soybeans is $2.2 billion.

Cumulative cost data, depicted in Figure 7 is available for soybeans grown in Illinois. One crop per year is planted around April and harvested by October. The $668 million expenditure in Illinois is 17 percent of the total national cash expenditure on variable costs of growing soybeans. As shown in Table 8, a total welfare loss of $2.2 billion would occur if a protective action decision affected 100 percent of an Illinois harvest of soybeans. If the decisions were made between November and March, the total welfare loss would be reduced by $668 million to $1.5 billion. Figure 7 can also show how much the savings would be if the action occurred during the growing season. For example, if it were initiated at the end of July $379 million of variable costs, or about 57 percent, could be avoided.

2.3.4 Snapbeans

Table 10, Figure 8, and Table 11 provide the results for snapbeans. Thirty-six percent of U.S. snapbeans are grown in Wisconsin -- 232,000 tons compared to 652,000 tons. Demand for them is relatively inelastic at -0.234. Table 10 and Figure 8 show that total welfare loss due to a withdrawal of 100 percent of Wisconsin's snapbeans would be $68 million.

Distributionally, other farmers would gain $106 million at consumer expense, dead weight losses would total $29 million, and loss of revenue by farmers directly affected by the withdrawal would be $39 million.

2.3.5 Milk

Table 12, Figure 9, and Table 13 depict milk. If all the milk produced in a year in Wisconsin were removed from market, the total welfare loss would be $4 billion. Affected farmers would loose $3.1 billion of this and consumers would loose an additional deadweight loss of $0.9 billion -- 22 percent of the total. Approximately $8 billion would be lost to non-affected farmers by consumers due to a 55 percent increase in the price of milk.

Table 8: Welfare losses due to removal of soybeans from market

Farm Level Own Price Elasticity of Demand: -0.79

Amount of Commodity Removed						
Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	311,201,667	cwt	1,945,010,417	205,406,904	2,150,417,321	9.6%
90%	280,081,500	cwt	1,750,509,375	166,379,593	1,916,888,968	8.7%
80%	248,961,333	cwt	1,556,008,333	131,460,419	1,687,468,752	7.8%
70%	217,841,167	cwt	1,361,507,292	100,649,383	1,462,156,675	6.9%
60%	186,721,000	cwt	1,167,006,250	73,946,486	1,240,952,736	6.0%
50%	155,600,833	cwt	972,505,208	51,351,726	1,023,856,934	5.0%
40%	124,480,667	cwt	778,004,167	32,865,105	810,869,271	4.1%
30%	93,360,500	cwt	583,503,125	18,486,621	601,989,746	3.1%
20%	62,240,333	cwt	389,002,083	8,216,276	397,218,360	2.1%
10%	31,120,167	cwt	194,501,042	2,054,069	196,555,111	1.0%

Figure 6. Losses Due to Removal of Soybeans

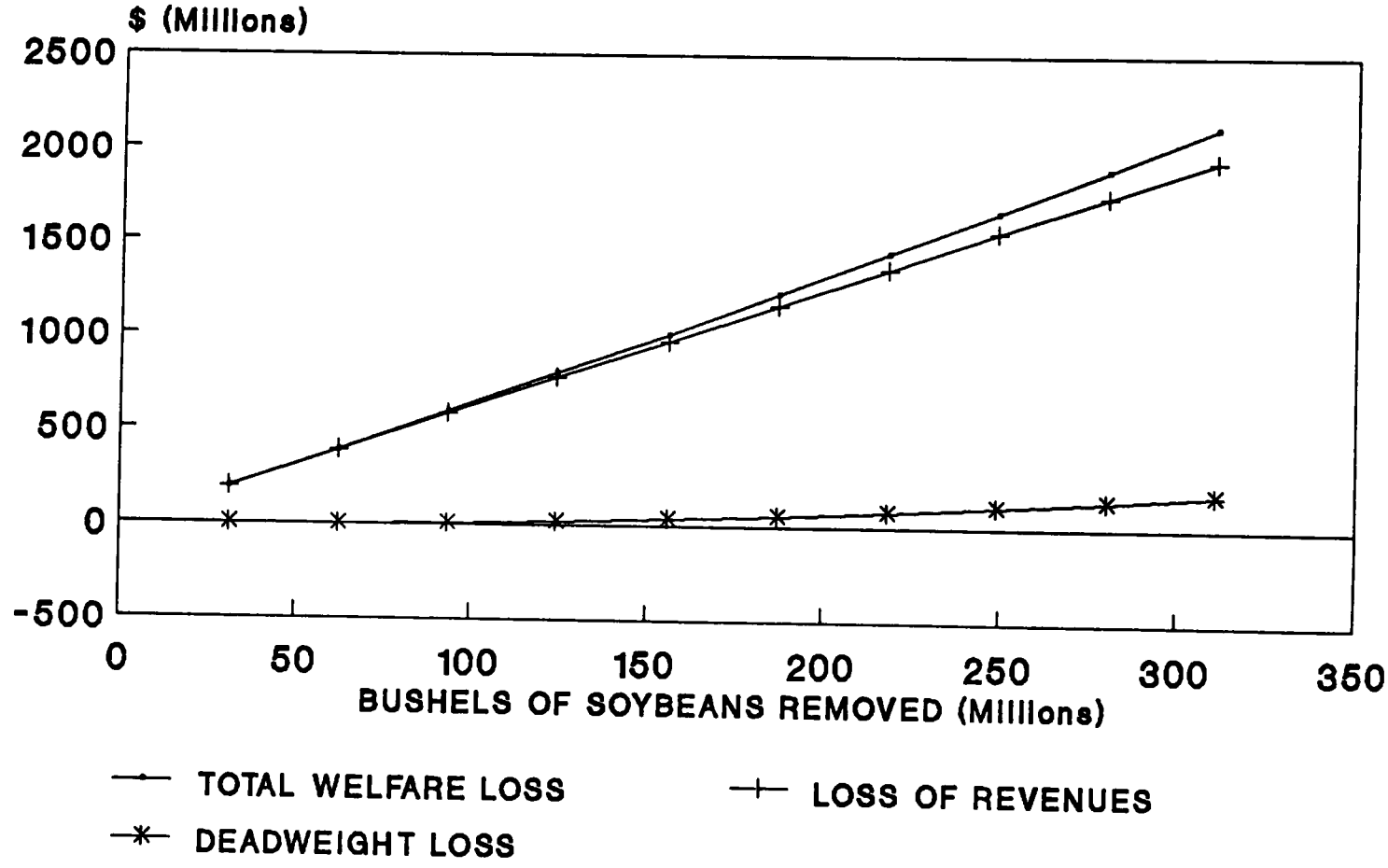


Table 9: Worksheet on soybeans

INITIAL PRICE:	$6.25 $/BUSHEL
INITIAL QUANTITY:	1,865,055,333 BUSHELS
INITIAL REVENUE:	$11,656,595,833
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.79
CHANGE IN QUANTITY:	
	-17%
	(311,201,667)BUSHELS
CHANGE IN PRICE:	$1.32 $/BUSHEL
NEW PRICE:	$7.57 $/BUSHEL
PERCENT CHANGE IN PRICE:	21%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$106,214,277
LOSS OF REVENUES TO ILLINOIS:	($1,945,010,417)
GAIN TO REST OF NATION'S SOYBEAN FARMERS:	$2,051,224,693

PRODUCTION
(in bushels)

YEAR	1983	1984	1985	MEAN
ILLINOIS	266,975,000	284,130,000	382,500,000	311,201,667
U.S.	1,635,772,000	1,860,863,000	2,098,531,000	1,865,055,333

PRICE
($ per bushel)

YEAR	1983	1984	1985	MEAN
ILLINOIS	$7.94	$5.85	$5.35	$6.38
U.S.	$7.81	$5.78	$5.16	$6.25

Figure 7. Timing of Expenditures for Soybeans

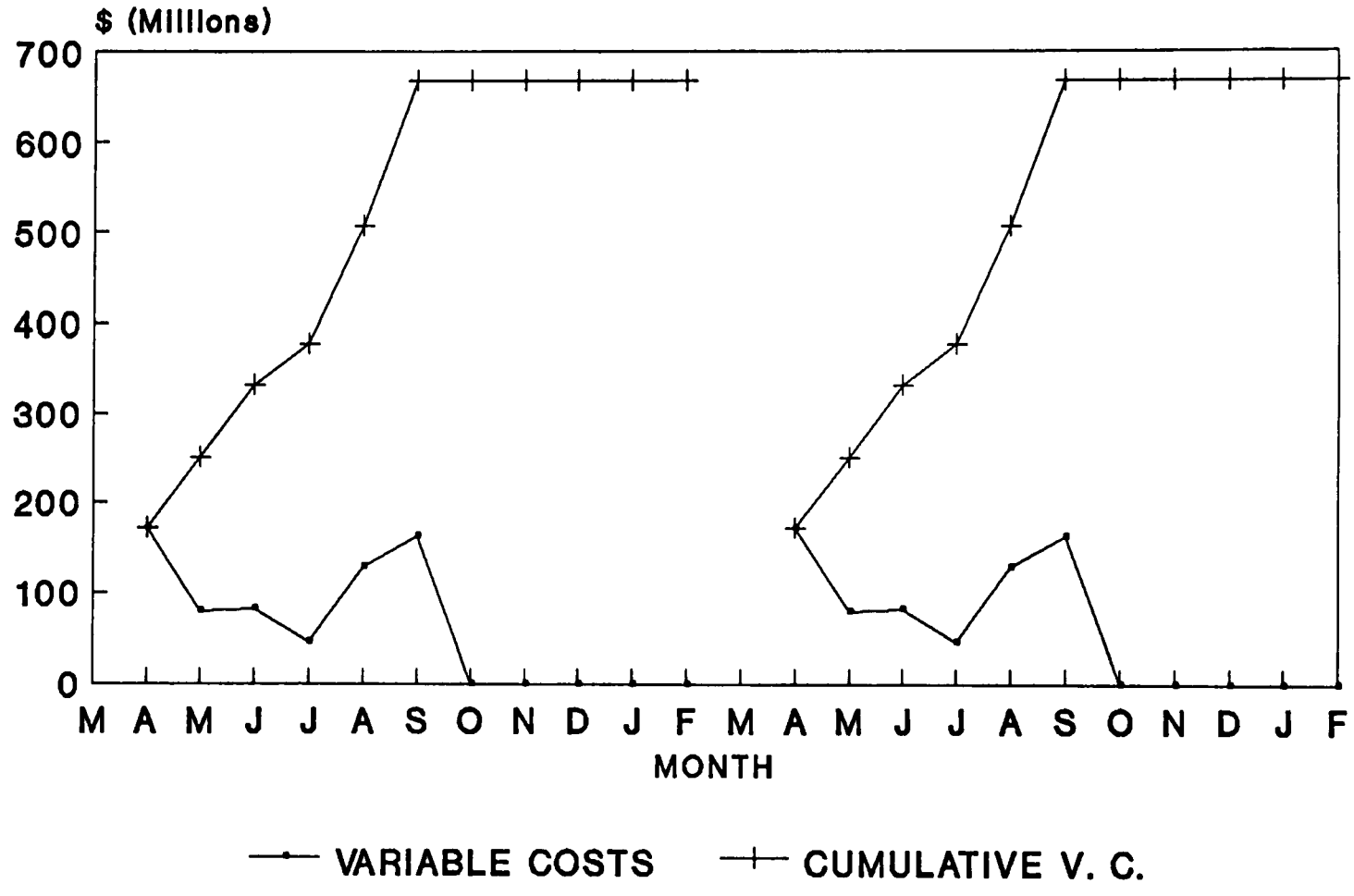


Table 10: Welfare losses due to removal of snapbeans from market

Farm Level Own Price Elasticity of Demand: -0.234

Amount of Commodity Removed						
Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	231,543	tons	38,590,556	29,283,140	67,873,695	43.1%
90%	208,389	tons	34,731,500	23,719,343	58,450,843	40.6%
80%	185,235	tons	30,872,444	18,741,210	49,613,654	37.8%
70%	162,080	tons	27,013,389	14,348,739	41,362,127	34.7%
60%	138,926	tons	23,154,333	10,541,930	33,696,264	31.3%
50%	115,772	tons	19,295,278	7,320,785	26,616,063	27.5%
40%	92,617	tons	15,436,222	4,685,302	20,121,525	23.3%
30%	69,463	tons	11,577,167	2,635,483	14,212,649	18.5%
20%	46,309	tons	7,718,111	1,171,326	8,889,437	13.2%
10%	23,154	tons	3,859,056	292,831	4,151,887	7.1%

Figure 8. Losses Due to Removal of Snapbeans

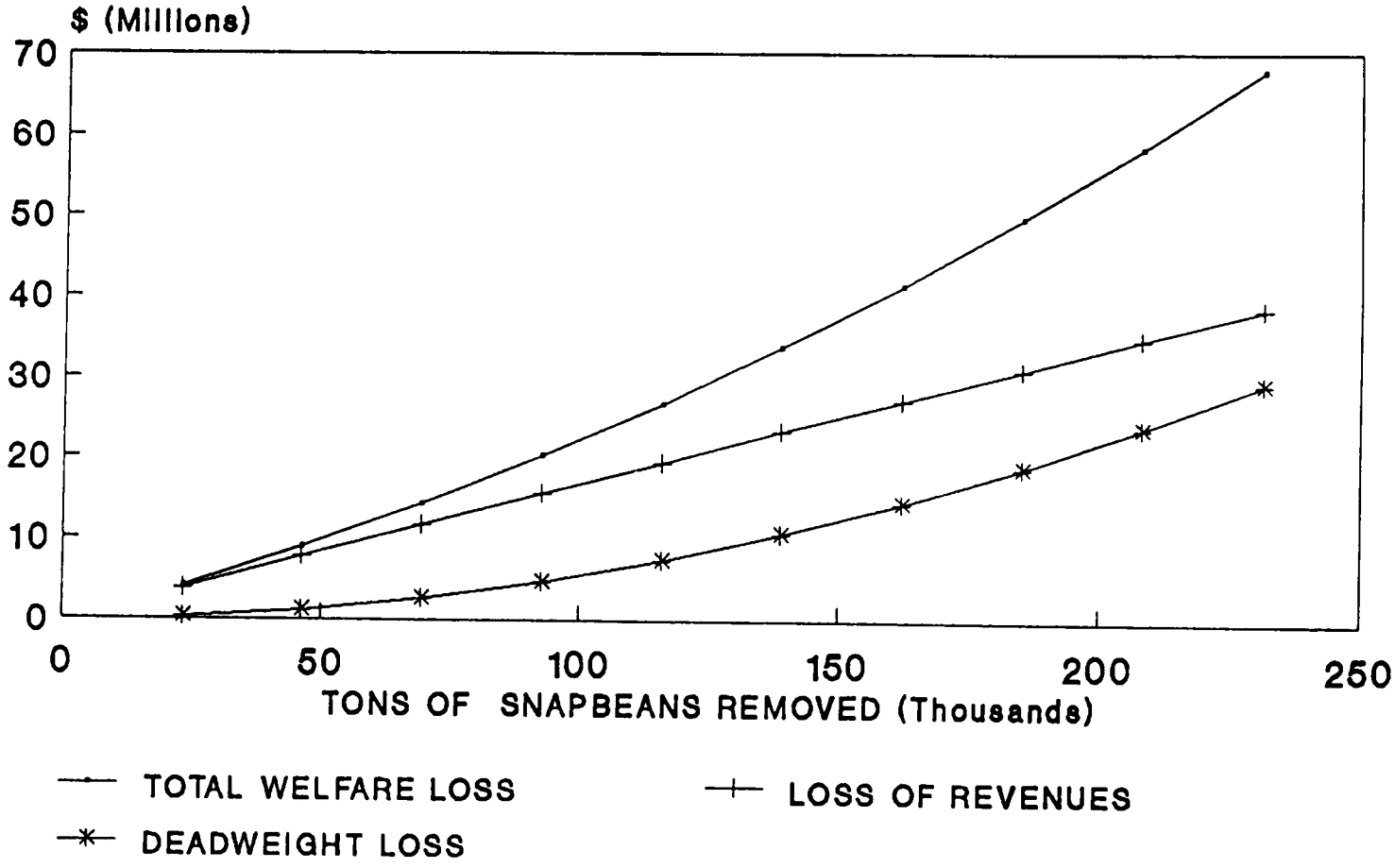


Table 11: Worksheet on snapbeans

INITIAL PRICE:	$166.67 $/TON
INITIAL QUANTITY:	652,003 TONS
INITIAL REVENUE:	$108,667,222
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.234
CHANGE IN QUANTITY:	
	-36%
	(231,543)TONS
CHANGE IN PRICE:	$252.94 $/TON
NEW PRICE:	$419.61 $/TON
PERCENT CHANGE IN PRICE:	152%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$67,760,069
LOSS OF REVENUES TO :	($38,590,556)
GAIN TO REST OF NATION'S FARMERS:	$106,350,624

PRODUCTION
(in tons)

YEAR	1983	1984	1985	MEAN
WISCONSIN	210,680	235,130	248,820	231,543
U.S.	587,410	666,110	702,490	652,003

PRICE
($ per ton)

YEAR	1983	1984	1985	MEAN
WISCONSIN	$140.00	$152.00	$152.00	$148.00
U.S.	$160.00	$171.00	$169.00	$166.67

Table 12: Welfare losses due to removal of milk from market

Farm Level Own Price Elasticity of Demand: -0.32

Amount of Commodity Removed						
Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	24,620,000,000	pounds	3,139,050,000	862,926,386	4,001,976,386	21.6%
90%	22,158,000,000	pounds	2,825,145,000	698,970,373	3,524,115,373	19.8%
80%	19,696,000,000	pounds	2,511,240,000	552,272,887	3,063,512,887	18.0%
70%	17,234,000,000	pounds	2,197,335,000	422,833,929	2,620,168,929	16.1%
60%	14,772,000,000	pounds	1,883,430,000	310,653,499	2,194,083,499	14.2%
50%	12,310,000,000	pounds	1,569,525,000	215,731,597	1,785,256,597	12.1%
40%	9,848,000,000	pounds	1,255,620,000	138,068,222	1,393,688,222	9.9%
30%	7,386,000,000	pounds	941,715,000	77,663,375	1,019,378,375	7.6%
20%	4,924,000,000	pounds	627,810,000	34,517,055	662,327,055	5.2%
10%	2,462,000,000	pounds	313,905,000	8,629,264	322,534,264	2.7%

Figure 9. Losses Due to Removal of Milk

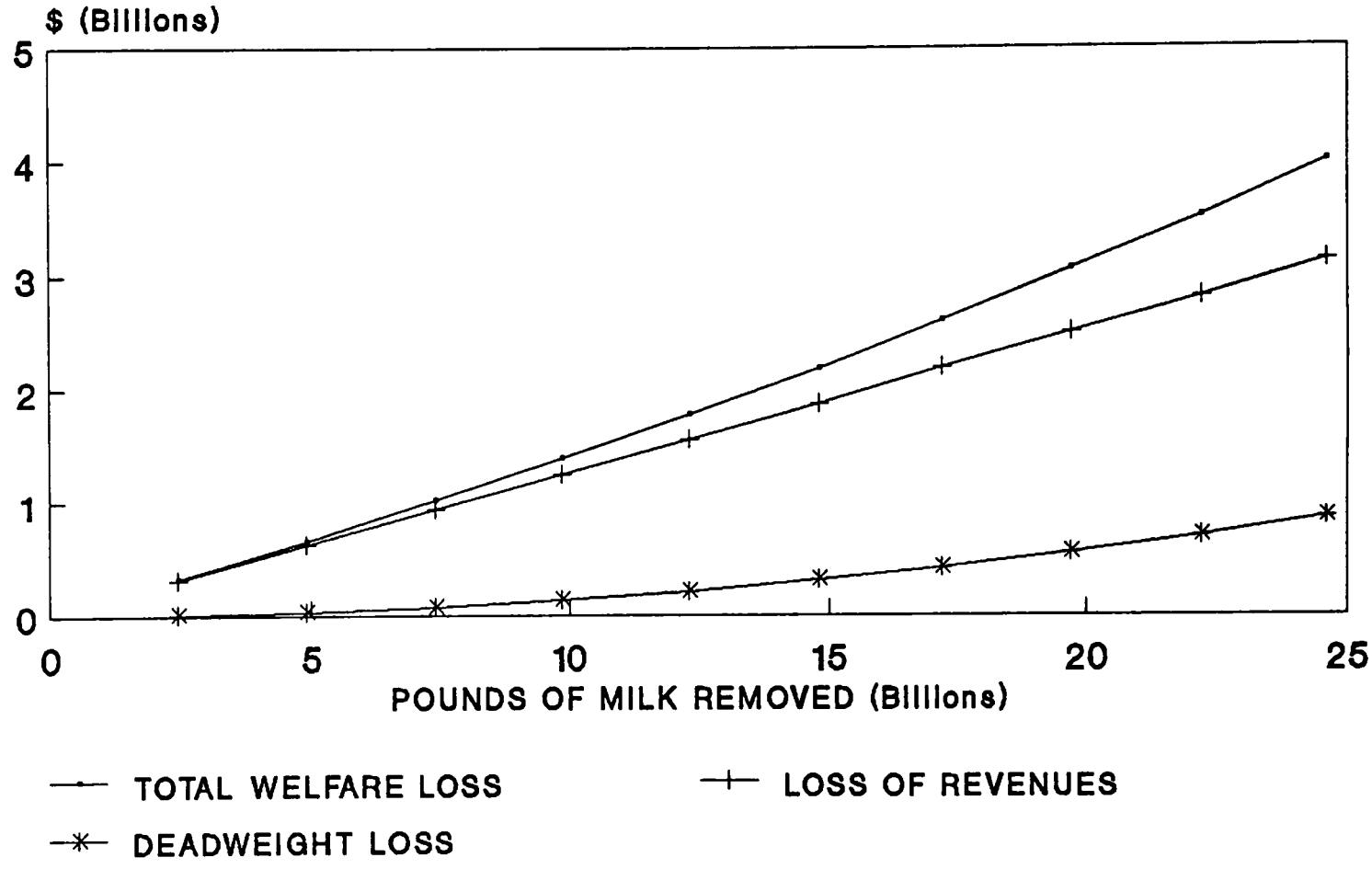


Table 13: Worksheet on milk

INITIAL PRICE:	$0.13 /POUND
INITIAL QUANTITY:	139,937,000,000 POUNDS
INITIAL REVENUE:	$17,841,967,500
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.32 (G&K, p. 64.)
CHANGE IN QUANTITY:	
	-18%
	(24,620,000,000)POUND
CHANGE IN PRICE:	$0.07 /POUND
NEW PRICE:	$0.20 /POUND
PERCENT CHANGE IN PRICE:	55%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$4,944,628,478
LOSS OF REVENUES TO WISCONSIN:	($3,139,050,000)
GAIN TO REST OF NATION'S DAIRY FARMERS:	$8,083,678,478

PRODUCTION
(in pounds)

YEAR	1983	1984	1985	MEAN
WISCONSIN	n.a	n.a	24,620,000,000	24,620,000,000
U.S.	n.a	n.a	139,937,000,000	139,937,000,000

PRICE
($ per pound)

YEAR	1983	1984	1985	MEAN
WISCONSIN	n.a	n.a	$0.12	$0.12
U.S.	n.a	n.a	$0.13	$0.13

2.3.6 Lettuce

Table 14, Figure 10, and Table 15 present the results for lettuce. Seventy-two percent of all lettuce grown in the United States in 1983 through 1985 was grown in California. Coupled with an own price elasticity of -0.095 -- *i.e.*, very inelastic demand -- a withdrawal of all of the California crop would increase prices by 754 percent -- from $11.40/cwt. to $97.40/cwt.

Total welfare loss would be $2.4 billion. Seventy-nine percent of this would be deadweight loss. Consumers would pay $1.5 billion in higher prices.

2.3.7 Eggs

Table 16, Figure 11 and Table 17 provide details of egg production. Although one state, California, produces more eggs than any other, the percentage of United States egg production that occurs there is only a modest 12 percent. Removal of this amount of eggs from the United States market would increase prices by 54 percent, from $0.65 per dozen to $1 per dozen. Farmers would lose about $441 million and there would be a dead weight loss of $120 million if 100 percent of California eggs were withheld from market.

The dead weight loss would constitute a moderate 21 percent of total welfare loss nationwide. Dispersion of the egg crop keeps the relative magnitude of the dead weight loss low despite the very inelastic demand for eggs.

2.3.8 Chicken

Table 18, Figure 12, and Table 19 provide the information regarding chicken. Price elasticity for chicken is a moderate -0.602, and only 16 percent of chickens are grown in the leading chicken state, Arkansas. A 100 percent removal of these chickens from market would increase prices by only 27 percent. Dead weight losses are 12 percent and less as the size of the removal is decreased. Increased prices would transfer $1.3 billion from consumers to farmers unaffected by the protective action. Total welfare loss would be $1.1 billion.

2.3.9 Beef

Table 20, Figure 13, and Table 21 provide the results for beef. Although Texas produces the largest amount of beef, the percentage of U.S. beef produced there is a relatively small 18 percent. The total welfare loss if all of this beef were removed from market would be over $6 billion, of which $5 billion would be lost revenue for impacted ranchers. The dead weight loss is under 18 percent. Consumers would pay an extra $10 billion in higher prices. This amount would be received by non-affected

Table 14: Welfare losses due to removal of lettuce from market

Farm Level Own Price Elasticity of Demand: -0.095

Amount of Commodity Removed			Loss of Farm Revenue in Affected Area	Dead Weight Welfare Loss	Total Welfare Loss Nationwide	Dead Weight as a Percent of Total Loss
Percent of Largest State Production	in Units	Units	(in $)	(in $)	(in $)	
100%	43,961,667	cwt.	501,163,000	1,890,296,007	2,391,459,007	79.0%
90%	39,565,500	cwt.	451,046,700	1,531,139,766	1,982,186,466	77.2%
80%	35,169,333	cwt.	400,930,400	1,209,789,445	1,610,719,845	75.1%
70%	30,773,167	cwt.	350,814,100	926,245,044	1,277,059,144	72.5%
60%	26,377,000	cwt.	300,697,800	680,506,563	981,204,363	69.4%
50%	21,980,833	cwt.	250,581,500	472,574,002	723,155,502	65.3%
40%	17,584,667	cwt.	200,465,200	302,447,361	502,912,561	60.1%
30%	13,188,500	cwt.	150,348,900	170,126,641	320,475,541	53.1%
20%	8,792,333	cwt.	100,232,600	75,611,840	175,844,440	43.0%
10%	4,396,167	cwt.	50,116,300	18,902,960	69,019,260	27.4%

Figure 10. Losses Due to Removal of Lettuce

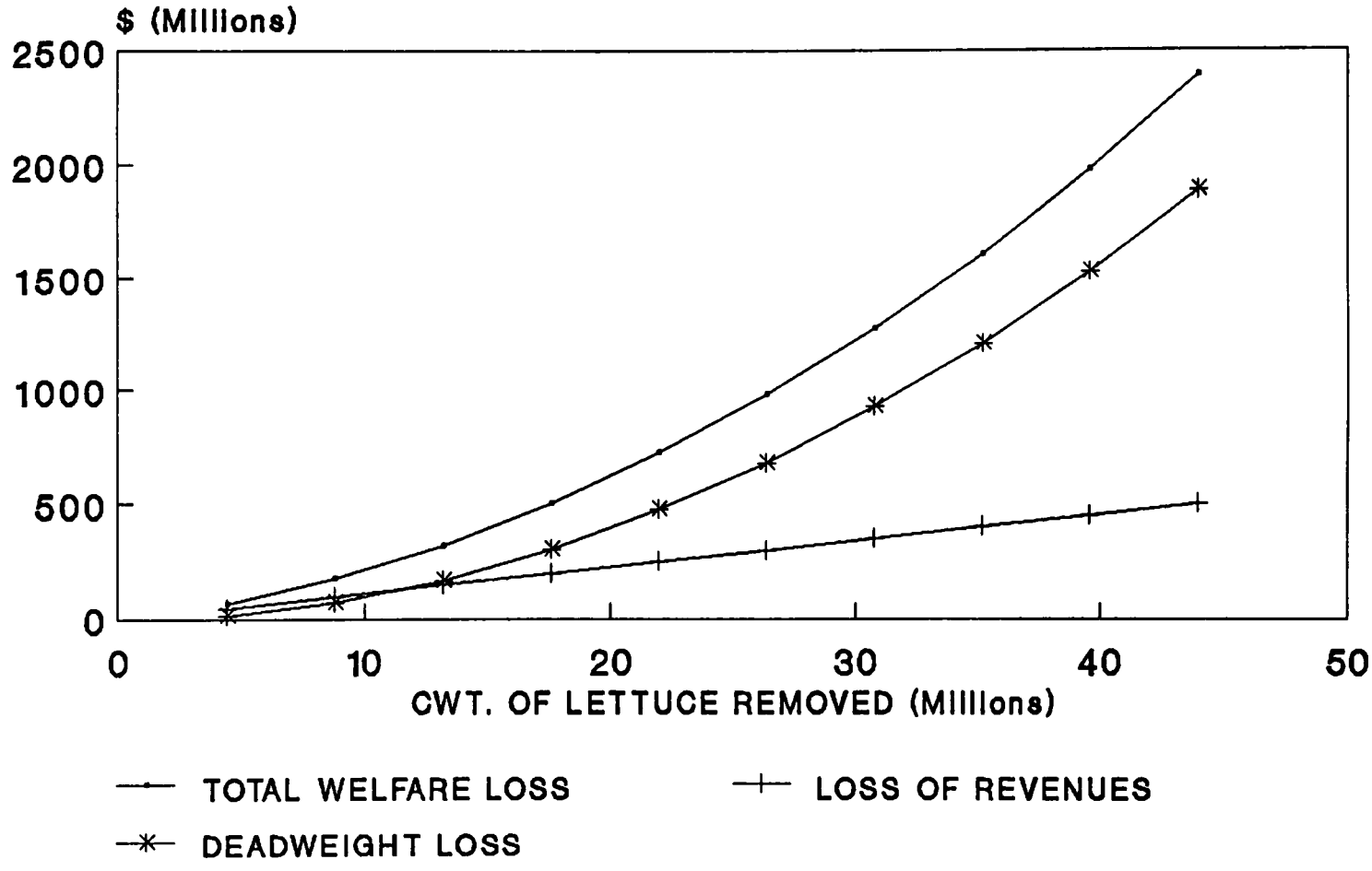


Table 15: Worksheet on lettuce

INITIAL PRICE:	$11.40 /CWT
INITIAL QUANTITY:	61,343,667 CWT
INITIAL REVENUE:	$699,317,800
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.095
CHANGE IN QUANTITY:	
	-72%
	(43,961,667)CWT
CHANGE IN PRICE:	$86.00 /CWT
NEW PRICE:	$97.40 /CWT
PERCENT CHANGE IN PRICE:	754%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$993,644,986
LOSS OF REVENUES TO CALIFORNIA:	($501,163,000)
GAIN TO REST OF NATION'S LETTUCE FARMERS:	$1,494,807,986

PRODUCTION
(in cwt.)

YEAR	1983	1984	1985	MEAN
CALIFORNIA	41,689,000	47,273,000	42,923,000	43,961,667
U.S.	57,969,000	64,309,000	61,753,000	61,343,667

PRICE
($ per cwt.)

YEAR	1983	1984	1985	MEAN
CALIFORNIA	$12.20	$10.70	$11.00	$11.30
U.S.	$12.30	$11.00	$10.90	$11.40

Table 16: Welfare losses due to removal of eggs from market

Farm Level Own Price Elasticity of Demand: -0.22

Amount of Commodity Removed						
Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	682,375,000	dozens	441,496,625	120,265,412	561,762,037	21.4%
90%	614,137,500	dozens	397,346,963	97,414,984	494,761,946	19.7%
80%	545,900,000	dozens	353,197,300	76,969,864	430,167,164	17.9%
70%	477,662,500	dozens	309,047,638	58,930,052	367,977,689	16.0%
60%	409,425,000	dozens	264,897,975	43,295,548	308,193,523	14.0%
50%	341,187,500	dozens	220,748,313	30,066,353	250,814,665	12.0%
40%	272,950,000	dozens	176,598,650	19,242,466	195,841,116	9.8%
30%	204,712,500	dozens	132,448,988	10,823,887	143,272,875	7.6%
20%	136,475,000	dozens	88,299,325	4,810,616	93,109,941	5.2%
10%	68,237,500	dozens	44,149,662	1,202,654	45,352,317	2.7%

Figure 11. Losses Due to Removal of Eggs

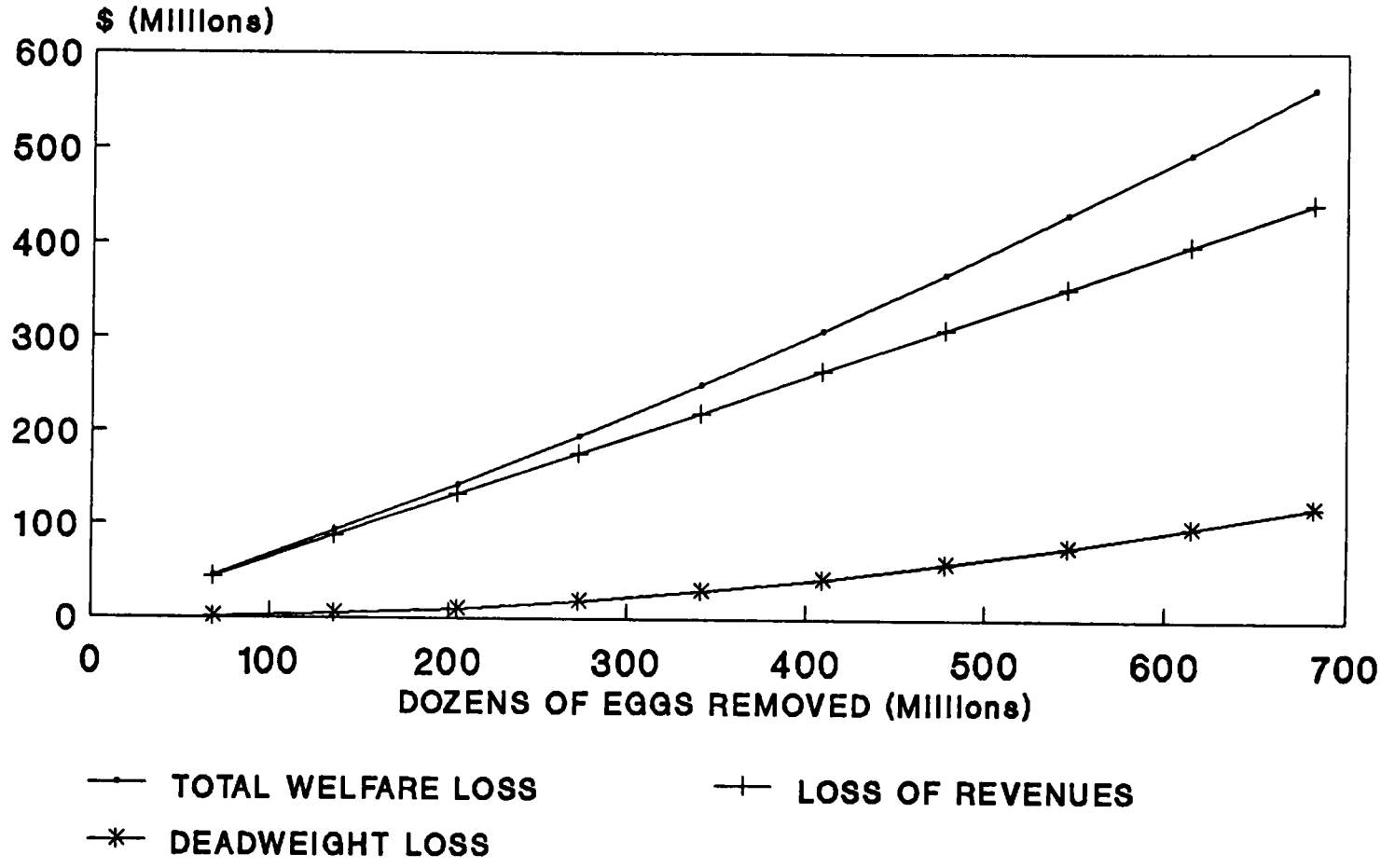


Table 17: Worksheet on eggs

INITIAL PRICE:	$0.65 /DOZEN
INITIAL QUANTITY:	5,693,208,333 DOZEN
INITIAL REVENUE:	$3,683,505,792
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.22
CHANGE IN QUANTITY:	
	-12%
	(682,375,000)DOZEN
CHANGE IN PRICE:	$0.35 /DOZEN
NEW PRICE:	$1.00 /DOZEN
PERCENT CHANGE IN PRICE:	54%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$1,324,775,392
LOSS OF REVENUES TO CALIFORNIA:	($441,496,625)
GAIN TO REST OF NATION'S EGG RANCHERS:	$1,766,272,017

PRODUCTION
(number of eggs)

YEAR	1983	1984	1985	MEAN
CALIFORNIA	n.a.	8,325,000,000	8,052,000,000	8,188,500,000
U.S.	n.a.	68,230,000,000	68,407,000,000	68,318,500,000

PRICE
($ per dozen)

YEAR	1983	1984	1985	MEAN
CALIFORNIA	n.a.	n.a.	$0.50	$0.50
U.S.	n.a.	$0.72	$0.57	$0.65

Table 18: Welfare losses due to removal of chicken from market

Farm Level Own Price Elasticity of Demand: -0.602

Amount of Commodity Removed						
Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	3,007,852,000	pounds	962,512,640	130,989,914	1,093,502,554	12.0%
90%	2,707,066,800	pounds	866,261,376	106,101,830	972,363,206	10.9%
80%	2,406,281,600	pounds	770,010,112	83,833,545	853,843,657	9.8%
70%	2,105,496,400	pounds	673,758,848	64,185,058	737,943,906	8.7%
60%	1,804,711,200	pounds	577,507,584	47,156,369	624,663,953	7.5%
50%	1,503,926,000	pounds	481,256,320	32,747,478	514,003,798	6.4%
40%	1,203,140,800	pounds	385,005,056	20,958,386	405,963,442	5.2%
30%	902,355,600	pounds	288,753,792	11,789,092	300,542,884	3.9%
20%	601,570,400	pounds	192,502,528	5,239,597	197,742,125	2.6%
10%	300,785,200	pounds	96,251,264	1,309,899	97,561,163	1.3%

Figure 12. Losses Due to Removal of Chicken

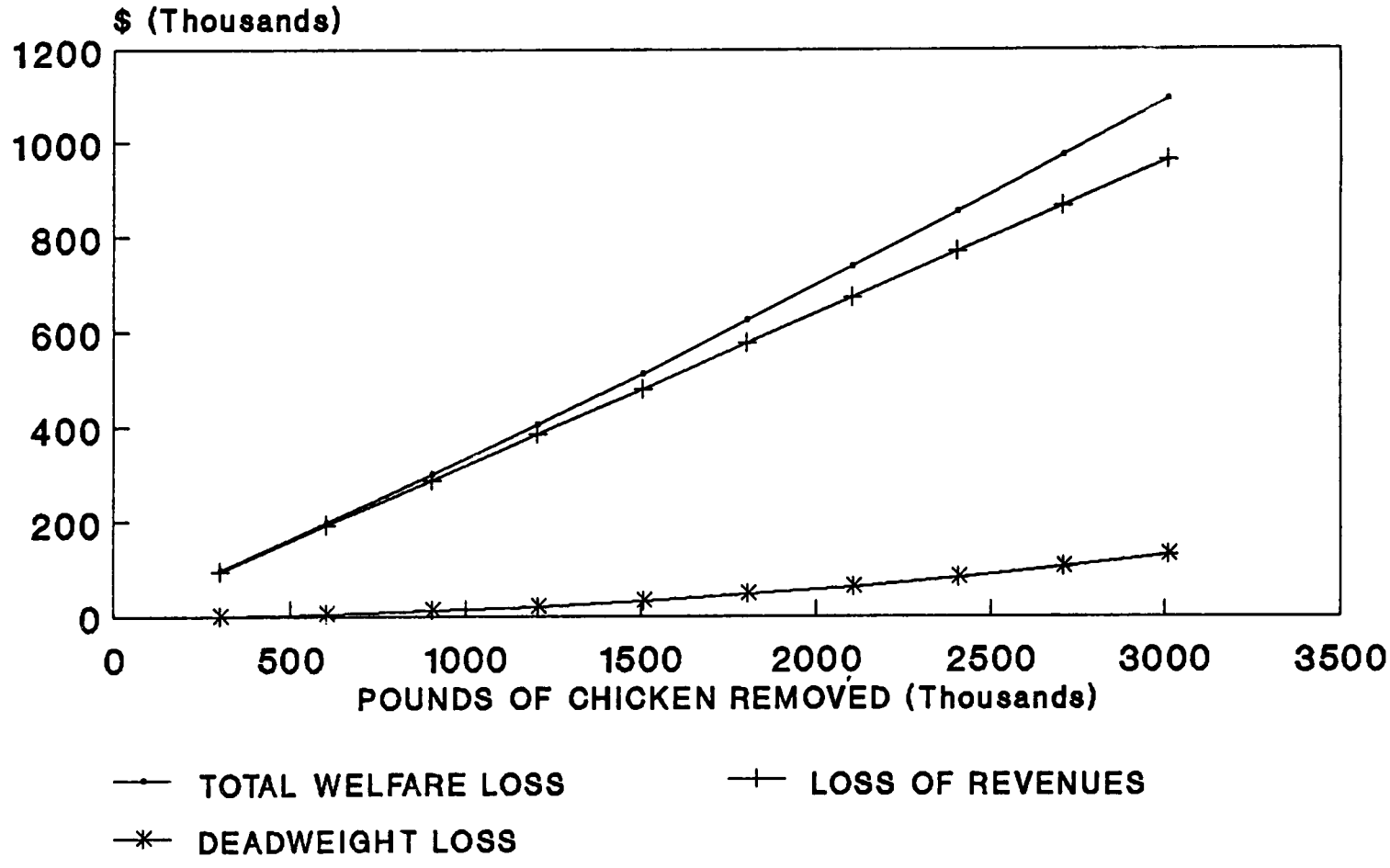


Table 19: Worksheet on chicken

INITIAL PRICE:	$0.32 /POUND
INITIAL QUANTITY:	18,356,867,000 POUNDS
INITIAL REVENUE:	$5,874,197,440
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.602 (G&K, p. 64.)
CHANGE IN QUANTITY:	
	-16%
	(3,007,852,000)POUND
CHANGE IN PRICE:	$0.09 /POUND
NEW PRICE:	$0.41 /POUND
PERCENT CHANGE IN PRICE:	27%
CHANGE IN TOTAL REVENUE TO ALL CHICKEN PRODUCER	$374,365,738
LOSS OF REVENUES TO ARKANSAS:	($962,512,640)
GAIN TO REST OF NATION'S CHICKEN PRODUCERS:	$1,336,878,378

PRODUCTION
(in pounds)

YEAR	1983	1984	1985	MEAN
ARKANSAS	n.a.	2,899,856,000	3,115,848,000	3,007,852,000
U.S.	n.a.	17,862,944,000	18,850,790,000	18,356,867,000

PRICE
($ per pound)

YEAR	1983	1984	1985	MEAN
ARKANSAS	n.a.	$0.35	$0.32	$0.34
U.S.	n.a.	$0.34	$0.30	$0.32

Table 20: Welfare losses due to removal of beef from market

Farm Level Own Price Elasticity of Demand: -0.416

Amount of Commodity Removed						
Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	7,048,237,941	pounds	5,156,710,837	1,093,568,337	6,250,279,173	17.5%
90%	6,343,414,147	pounds	4,641,039,753	885,790,353	5,526,830,106	16.0%
80%	5,638,590,353	pounds	4,125,368,669	699,883,735	4,825,252,405	14.5%
70%	4,933,766,559	pounds	3,609,697,586	535,848,485	4,145,546,071	12.9%
60%	4,228,942,765	pounds	3,094,026,502	393,684,601	3,487,711,103	11.3%
50%	3,524,118,971	pounds	2,578,355,418	273,392,084	2,851,747,503	9.6%
40%	2,819,295,176	pounds	2,062,684,335	174,970,934	2,237,655,269	7.8%
30%	2,114,471,382	pounds	1,547,013,251	98,421,150	1,645,434,401	6.0%
20%	1,409,647,588	pounds	1,031,342,167	43,742,733	1,075,084,901	4.1%
10%	704,823,794	pounds	515,671,084	10,935,683	526,606,767	2.1%

Figure 13. Losses Due to Removal of Beef

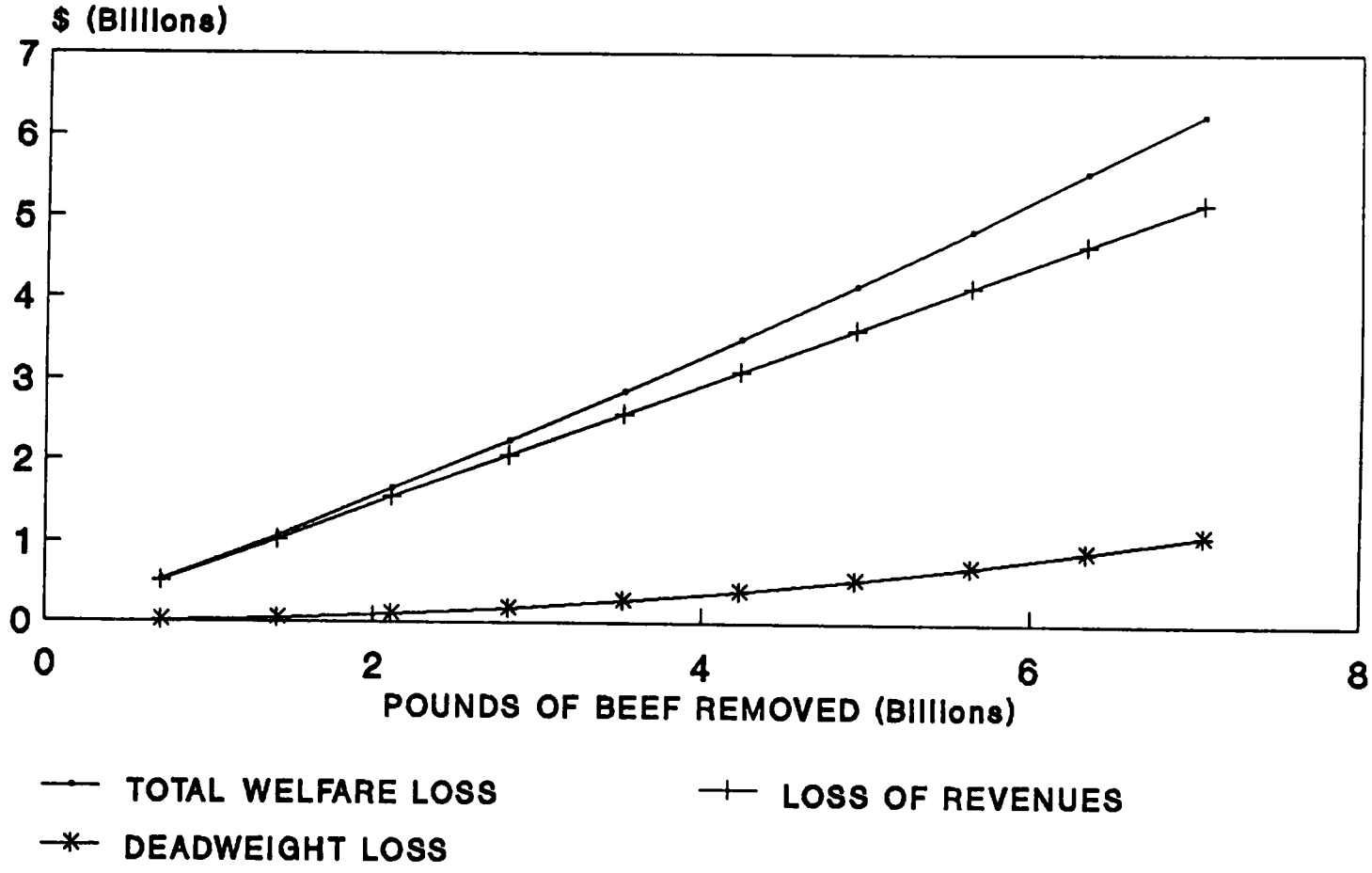


Table 21: Worksheet on beef

INITIAL PRICE:	$0.73	$/POUND
INITIAL QUANTITY:	39,946,992,000	POUNDS
INITIAL REVENUE:	$29,226,466,000	
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.416	
CHANGE IN QUANTITY:		
	-18%	
	(7,048,237,941)	POUNDS
CHANGE IN PRICE:	$0.31	$/POUND
NEW PRICE:	$1.04	$/POUND
PERCENT CHANGE IN PRICE:	42%	
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$5,052,092,002	
LOSS OF REVENUES TO KANSAS:	($5,156,710,837)	
GAIN TO REST OF NATION'S WHEAT FARMERS:	$10,208,802,839	

PRODUCTION
(in pounds)

YEAR	1983	1984	1985	MEAN
TEXAS	n.a.	n.a.	5,320,460,000	5,320,460,000
U.S.	n.a.	n.a.	39,946,992,000	39,946,992,000

PRICE
($ per pound)

YEAR	1983	1984	1985	MEAN
TEXAS	n.a.	n.a.	$0.78	$0.78
U.S.	n.a.	n.a.	$0.73	$0.73

ranchers. Ranch level beef prices would increase from $0.73 per pound to $1.04 per pound.

2.3.10 Sweet Corn

Table 22, Figure 14, and Table 23 provide the results for sweet corn. Thirty-one percent of this crop is grown in Florida. A total welfare loss of $89 million would occur if an amount of sweet corn of this magnitude were withdrawn from market. Of this amount, 32 percent, or $29 million would be dead weight loss. In addition to the dead weight loss consumers would loose nearly $130 million to farmers in higher prices.

2.3.11 Oranges

Table 24, Figure 15 and Table 25 depict the results for oranges. Sixty-five percent of all oranges grown in the United States are now grown in Florida. Removal of this amount from market would increase farm level prices by 143 percent from $7.77 per box to $18.90 per box. Florida farmers would loose nearly $1 billion. Consumers would loose $0.7 billion in higher prices and another $0.7 billion in dead weight losses. The dead weight loss would be 42 percent of the total welfare loss nationwide of $1.6 billion.

Just as the most severe impact on lettuce could only happen in California, the most severe impact on oranges could only happen in Florida. Other crops that are not as concentrated geographically would have correspondingly smaller maximum repercussions from a single event.

Table 22: Welfare losses due to removal of sweet corn from market

Farm Level Own Price Elasticity of Demand: -0.32

Amount of Commodity Removed			Loss of Farm Revenue in Affected Area	Dead Weight Welfare Loss	Total Welfare Loss Nationwide	Dead Weight as a Percent of Total Loss
Percent of Largest State Production	in Units	Units	(in $)	(in $)	(in $)	
100%	4,703,000	cwt.	60,041,633	28,635,886	88,677,520	32.3%
90%	4,232,700	cwt.	54,037,470	23,195,068	77,232,538	30.0%
80%	3,762,400	cwt.	48,033,307	18,326,967	66,360,274	27.6%
70%	3,292,100	cwt.	42,029,143	14,031,584	56,060,728	25.0%
60%	2,821,800	cwt.	36,024,980	10,308,919	46,333,899	22.2%
50%	2,351,500	cwt.	30,020,817	7,158,972	37,179,788	19.3%
40%	1,881,200	cwt.	24,016,653	4,581,742	28,598,395	16.0%
30%	1,410,900	cwt.	18,012,490	2,577,230	20,589,720	12.5%
20%	940,600	cwt.	12,008,327	1,145,435	13,153,762	8.7%
10%	470,300	cwt.	6,004,163	286,359	6,290,522	4.6%

Figure 14. Losses Due to Removal of Sweet Corn

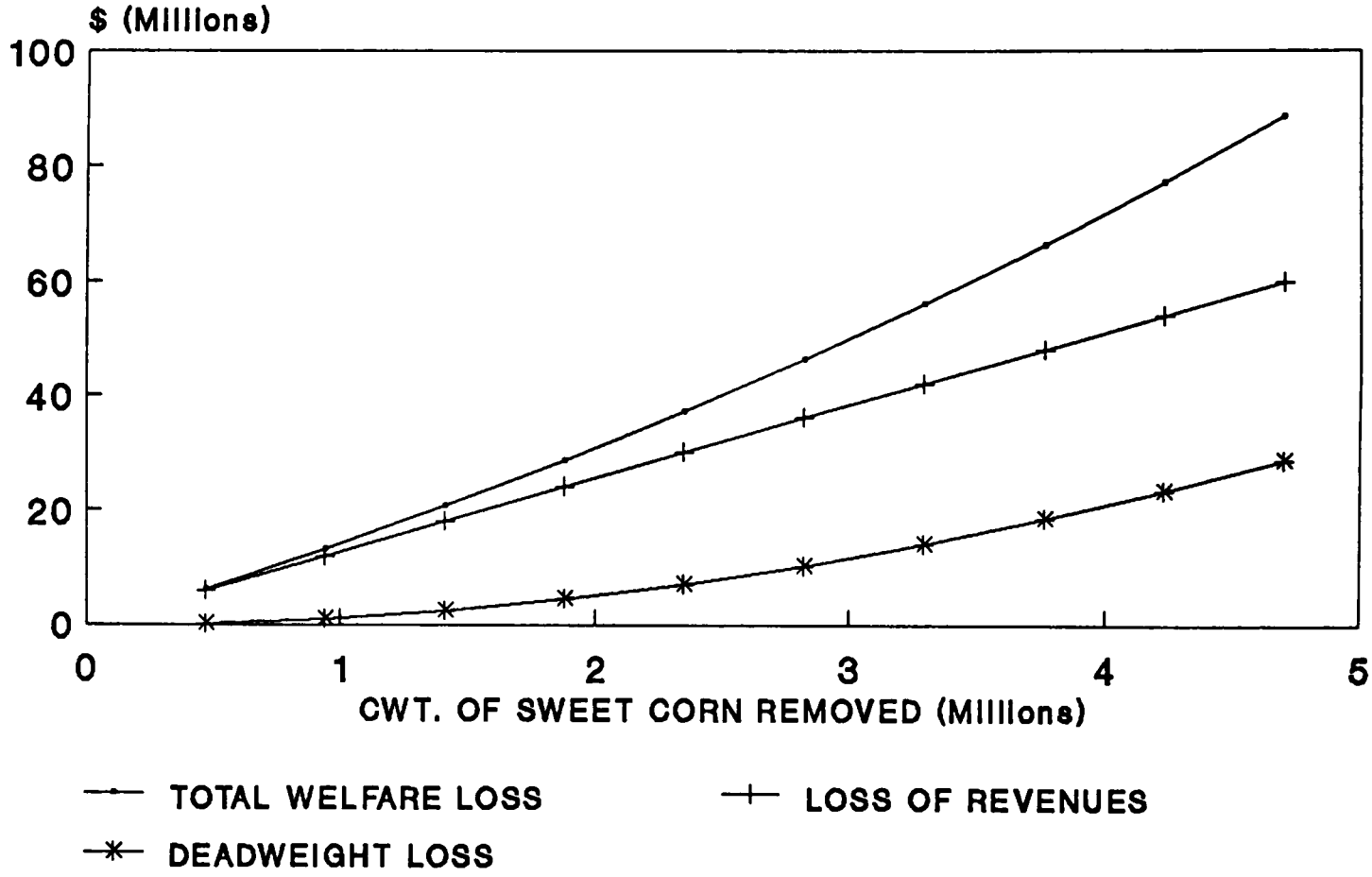


Table 23: Worksheet on sweet corn

INITIAL PRICE:	$12.77 /CWT	
INITIAL QUANTITY:	15,407,667 CWT	
INITIAL REVENUE:	$196,704,544	
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.320	(G&K, RETAIL "oth vegitables", pp.
CHANGE IN QUANTITY:		
	-31%	
	(4,703,000)CWT	
CHANGE IN PRICE:	$12.18 /CWT	
NEW PRICE:	$24.94 /CWT	
PERCENT CHANGE IN PRICE:	95%	
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	$70,316,698	
LOSS OF REVENUES TO FLORIDA:	($60,041,633)	
GAIN TO REST OF NATION'S SWEET CORN FARMERS:	$130,358,332	

PRODUCTION
(in cwt)

YEAR	1983	1984	1985	MEAN
FLORIDA	4,898,000	4,621,000	4,590,000	4,703,000
U.S.	14,868,000	15,589,000	15,766,000	15,407,667

PRICE
($ per cwt)

YEAR	1983	1984	1985	MEAN
FLORIDA	$12.80	$13.40	$14.50	$13.57
U.S.	$12.50	$13.10	$12.70	$12.77

Table 24: Welfare losses due to removal of oranges from market

Farm Level Own Price Elasticity of Demand: -0.455

Amount of Commodity Removed						
Percent of Largest State Production	in Units	Units	Loss of Farm Revenue in Affected Area (in $)	Dead Weight Welfare Loss (in $)	Total Welfare Loss Nationwide (in $)	Dead Weight as a Percent of Total Loss
100%	120,066,667	boxes	933,318,222	667,998,546	1,601,316,769	41.7%
90%	108,060,000	boxes	839,986,400	541,078,823	1,381,065,223	39.2%
80%	96,053,333	boxes	746,654,578	427,519,070	1,174,173,647	36.4%
70%	84,046,667	boxes	653,322,756	327,319,288	980,642,043	33.4%
60%	72,040,000	boxes	559,990,933	240,479,477	800,470,410	30.0%
50%	60,033,333	boxes	466,659,111	166,999,637	633,658,748	26.4%
40%	48,026,667	boxes	373,327,289	106,879,767	480,207,056	22.3%
30%	36,020,000	boxes	279,995,467	60,119,869	340,115,336	17.7%
20%	24,013,333	boxes	186,663,644	26,719,942	213,383,586	12.5%
10%	12,006,667	boxes	93,331,822	6,679,985	100,011,808	6.7%

Figure 15. Losses Due to Removal of Oranges

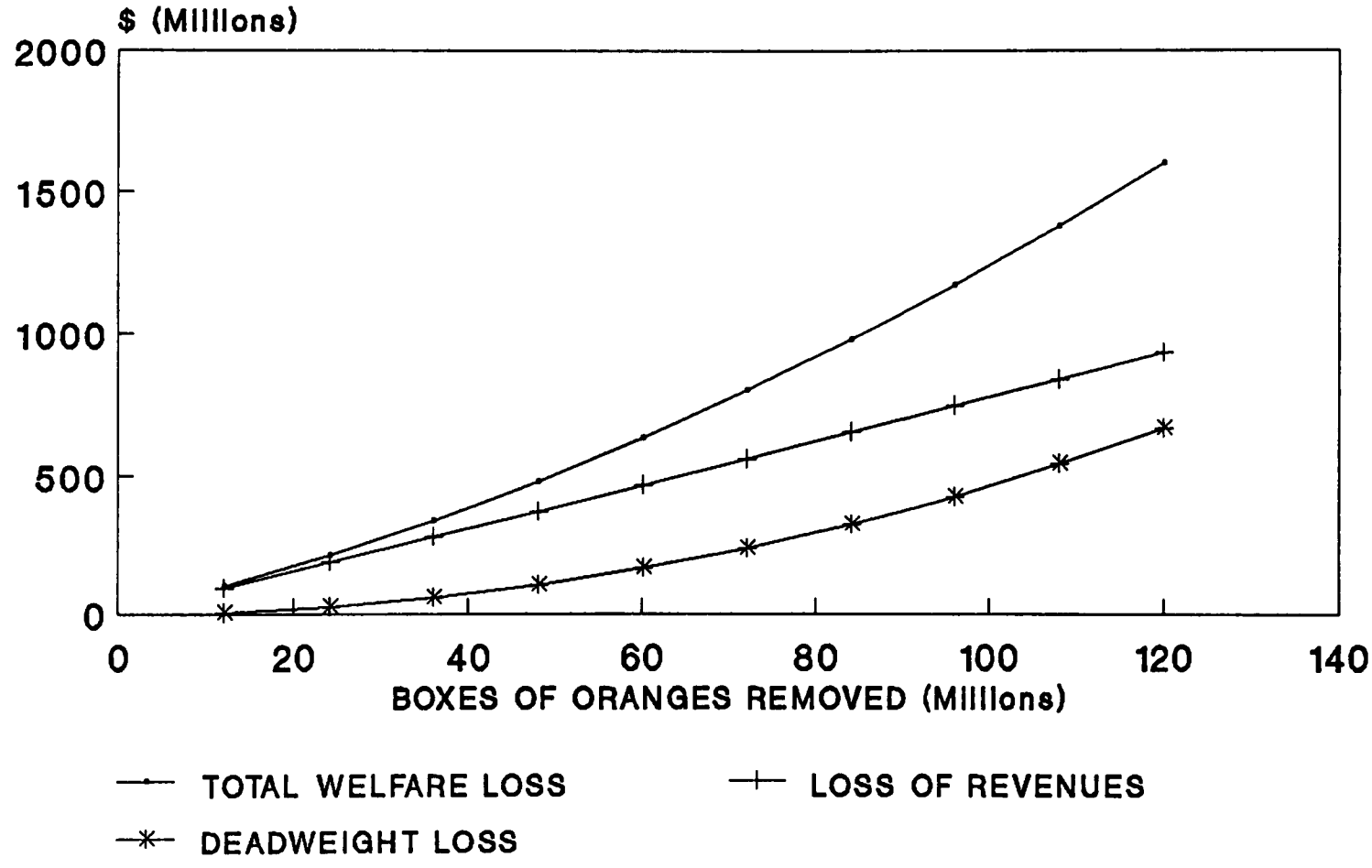


Table 25: Worksheet on oranges

INITIAL PRICE:	$7.77 $/BOX
INITIAL QUANTITY:	184,346,667 BOXES
INITIAL REVENUE:	$1,432,988,089
FARM LEVEL PRICE ELASTICITY OF DEMAND:	-0.455
CHANGE IN QUANTITY:	
	-65%
	(120,066,667)BOXES
CHANGE IN PRICE:	$11.13 $/BOX
NEW PRICE:	$18.90 $/BOX
PERCENT CHANGE IN PRICE:	143%
CHANGE IN TOTAL REVENUE TO ALL FARMERS:	($218,066,475)
LOSS OF REVENUES TO FLORIDA:	($933,318,222)
GAIN TO REST OF NATION'S ORANGE GROWERS:	$715,251,747

PRODUCTION
(in boxes)

YEAR	1983	1984	1985	MEAN
FLORIDA	139,600,000	116,700,000	103,900,000	120,066,667
U.S.	225,180,000	169,510,000	158,350,000	184,346,667

PRICE
($ per box)

YEAR	1983	1984	1985	MEAN
FLORIDA	$6.85	$7.71	$9.65	$8.07
U.S.	$5.85	$7.69	$9.78	$7.77

3. ANALOGOUS EVENTS

Random events often cause supply reductions of the magnitudes described in section 2.3. In this section, these events are used to serve as a check on the calculated results of section 2.3 and to identify other issues of concern. For example, two of the crops studied, wheat and soybeans, were affected by the drought of 1988.

3.1 THE EXPERIENCE WITH SOYBEANS

The drought of 1988 reduced that year's soybean production by about twenty percent, from 1,923 million bushels in 1987 to 1,539 million bushels in 1988,[3] a 384 million bushel decrease. This compares to the 311 million bushel production by Illinois, the leading state in the production of soybeans, which accounts for 17 percent of the nation's soybean output. The predicted increase in price in section 2.3.3, based on a 17 percent reduction, is 21 percent, to a high price of $7.57 per bushel. The change in price observed in 1988 was 25 percent, to an estimated $7.40 per bushel.

Perhaps more notable than the fact that the predicted change in price is close to the actual change in price when the relative magnitudes of the reductions are taken into account, is the fact that year to year fluctuations in output of soybeans are sometimes larger than the ones considered in this study. In the 8 years, 1981 through 1988, there were two such occurrences. In addition to the 20 percent drop in output due to the 1988 drought, a 25 percent drop in soybean output nationwide occurred in 1983. This drop in output was accompanied by a 40 percent increase in the price to nearly $8 per bushel. This means that the potential economic dislocations due to protective actions estimated in this study for soybeans are within the realm of common experience and that of existing data.

3.2 THE EXPERIENCE WITH WHEAT

The drought of 1988 reduced the U.S. wheat harvest by 14 percent from the 1987-88 level of 2,107 million bushels to 1,811 million bushels in the 1988-89 season. This is slightly less than Kansas' production of 18 percent of the U.S. wheat crop. Wheat prices rose by about 45 percent between the 1987-88 season and the 1988-89 season. This is substantially less that the 72 percent increase predicted if Kansas wheat were removed from the market. However, if the calculation of section 2.3.1 were applied to a 14 percent reduction a 57 percent increase in price

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[3]U. S. Department of Agriculture, Economic Research Service, "Table 7," Oil Crops, Situation and Outlook Report, OCS-21, April 1989, p. 33.

would be predicted, which is closer to the 45 percent that happened. A 14 percent reduction in the U.S. wheat crop also occurred in the 1986-87 season.

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