Inducing shifts from crop production to beef on dryland farms in Montana
by Charles A Carpy

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Agricultural Economics at Montana State College
Montana State University

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The primary objective of this study was to determine cattle prices necessary to shift cropland from the production of wheat to the production of range forage for beef. The budget method was used to describe the costs over the shifting period. Shifts both with and without the use of the conservation reserve were investigated.

The prices for calves per cwt. required to induce a shift on these selected farms ranged from $69.61 on low yielding spring wheat to $84.32 on higher yielding spring wheat. Comparable figures for winter wheat are $58.52 and $92.95. These prices apply to shifts without the conservation reserve. The conservation reserve can be used to subsidize the costs of shifting land use, in fact payments under the program would yield higher returns under most cirucmstances than the cattle enterprise. The findings of the study indicate that a cow-calf operation is not a ready substitute for wheat production on these dryland farms.

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Any errors or omissions in this study are the responsibility of the author.

ABSTRACT

Beef production has often been considered a ready substitute for wheat production on dryland farms in the Northern Great Plains. This study investigated this hypothesis using selected dryland wheat-cattle farms in Montana. These farms were selected and described in previous work. Two model organizations were used: (1) spring wheat-cattle, and (2) winter wheat-cattle.

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CHAPTER I

INTRODUCTION

The Problem

Is it profitable, or under what conditions would it be profitable, for Montana farmers to shift from wheat to beef production? In order to answer this question a farm operator must make estimates of, (1) the various ways the shift can be made, (2) the timing and physical limitations imposed by the methods, and (3) the physical product now, during and after the shift. Having done this he must estimate relevant costs and prices which may prevail during and after the shift. The maximum time an operator is willing to consider for completing the shift is determined by the probable duration and level of these estimated prices and costs. This study is concerned with those aspects of time and price determinations which make shifts profitable.

Historical Setting

Historically, problems of shift between crop and livestock enterprises have been continuous in the Northern Plains since the production of wheat and cattle began in the region during the late 1800's. Two periods in history have witnessed major shifts to wheat of sufficient proportions to create national policy problems. The first problem period occurred soon after World War I, the after effect of a war-induced expansion in wheat acreage. The second occurred during the great drought and depression of the 1930's. Both were periods of surplus production.

Demand for wheat during and after World War II again stimulated increased wheat production. National acreages of wheat increased from 66 million in 1954 to 84 million in 1949. By 1949, exports and domestic use tapered off and large wheat stocks threatened to accumulates. Acreage restrictions were invoked for 1950, dropping the acreage to 71 million. But the Korean Conflict created a new demand; prices increased, acreage restrictions were removed, and plantings increased to about 78 million acres. Greatly reduced demand since 1952 has resulted in large wheat stocks. Acreage controls and marketing quotas have again been invoked. Up to the present these restrictions have not solved the problem of reducing the accumulated surplus. Production from the 55 million acre minimum allotment in 1956 is still more than sufficient to supply our annual needs at the publicly-supported price for wheat.

Present Situation

One of the problems at present is how to reduce these surpluses without reducing the income of the farmer to a point where he can no longer survive. The recently enacted Soil Bank Plan is aimed at alleviating this problem. The plan consists of two parts: (1) the acreage reserve, and (2) the conservation reserve.

> The purpose of the acreage reserve program is to assist producers to divert a portion of their cropland from the production of excessive supplies of agricultural commodities by compensating them for reducing their acreage below their allotment, or

in the case of corn, their Soil Bank corn base or allotment, whichever is in effect.1/

The conservation reserve program is a long-term program designed to carry out the policy of the Act by assisting farmers to divert a portion of their cropland from the production of excessive supplies of agricultural commodities and to carry out soil-, water-, forest-, and wild-life-conservation practices. In carrying out this program, the Secretary will enter into contracts with producers (1) to share costs of establishing approved conservation practices on the conservation reserve and (2) to make annual payments to such producers for maintaining the conservation uses for the term of the contract.2/

One of the major unknowns of this program is whether the size of payments are sufficient to induce the farmer to place part of his acreage in either or both of the acreage or conservation reserves. A situation where the soil bank practices and provisions can be incorporated in shifting to an alternative enterprise could greatly offset the cost of shifting and make this alternative more attractive. Range forage for beef production is one of these alternatives.

In some dryland areas of Montana, one of the major enterprise alternatives to grain production has been, and is, forage for beef production. Technological advances in both the wheat and cattle industries have served in effect to substantially enlarge the transition area between the two; i.e., these techniques have made it possible to produce wheat and cattle in areas where production prior to these advances was restricted to one or

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1/ Commodity Stabilization Service and Commodity Credit Corporation, Department of Agriculture, Soil Bank Bulletin 201, Title 6--Agricultural Credit, Section 485.202.

2/ Ibid., Section 485.152.

the other. Development of new disease and drought resistant, stronger stemmed, higher producing varieties has caused a significant impact on wheat production. The livestock industry has been affected by new and faster means of range revegetation, water diversion and range usage, and livestock husbandry practices. These developments have not only changed the level of physical production, they have also changed the rates at which such shifts can be made. Both these factors partially determine the margin at which land use is shifted from livestock to crop production and vice versa.

Technological advances have generally made the physical shift much easier, but at the same time they have increased the economic difficulty of making the shift. The development of large fixed capital items specific to particular enterprises has resulted in relatively higher fixed, and lower variable costs. This situation creates a rigidity in the farm organization, since reduction in output of one type of product generally brings about diseconomies associated with a high fixed cost-low machine use.

A shift from one enterprise to another takes place within the framework of a certain physical, economic, and institutional environment. The shift is generally caused by either a profit relationship favorable to one product over the other or government programs restricting production or marketing in a given enterprise. The shift itself is a reallocation and recombination of factors of production, adding some and liquidating others,

so as to produce more of one product (e.g., beef) and reducing or eliminating another product (e.g., wheat). One of the costs of shifting is the loss of income between the time old assets are liquidated and newly acquired assets produce income. This necessitates financing of some sort. Either internal or external sources of capital can be used.

Before proceeding further, it is important at this point to determine what the entrepreneur has as a goal in his operations. Why does he want to shift? Assuming that the goal is of an economic nature, what is he trying to maximize? In brief, Kenneth E. Boulding states:

> It may seem surprising that the question, "What does the entrepreneur maximize?" (What is the measure of profitability of an enterprise?) should still be a matter of dispute, for this is perhaps the most fundamental question in all of economic theory. Nevertheless, the question is not altogether easy to answer. If we look at a single enterprise, . . . , it would seem fairly evident that we will always prefer a large present value to a smaller [present value of an income stream] . . . . This is the most generally accepted solution. If, however, we regard the enterprise not as a single unit but as a continuously repeated series of operations, it can be shown that . . . where the internal (average) rate of return is the greatest gives the best result.

* * * * *

> It may be said, however, that the entrepreneur does not wish merely to accumulate capital forever; what he wants is an income stream of consumption rather than a maximum rate of accumulation. It is not difficult to . . . [determine] what period of investment . . . gives the maximum income stream. Suppose that the entrepreneur at the conclusion of each process withdraws the growth in capital from the enterprise and starts each repetition of the process with the amount of capital with which it began. . . . It is clear that maximizing the internal rate of return . . . yields a higher income payments stream than maximizing the discounted net revenue. . . .

> Even if interest is deducted from the receipts of the enterprise it can be shown that the maximum net income stream from a repeated investment is given when the internal rate of return is maximized. . . .3/

This goal of maximization is highly dependent upon future income and since future income can seldom be determined with certainty, the expectations of the future are very important. Again, in brief, Kenneth E. Boulding states:

> It is difficult to exaggerate the importance of expectations in determining the course of economic life. It is clear that the quantity of any commodity which people are willing to buy or sell depends not merely upon its current price but also on what people believe will be the future course of its price. Thus expectations help to determine prices at any time. But what determines the expectations? This is unfortunately a problem about which we know all too little, and it does not seem possible to make any clear a priori judgments about it.4/

The decision of whether to shift made by the individual operator must be based on his assumptions as to the expected costs and prices during and following the period of the shift. The wisdom of his decision to shift or not is dependent upon the accuracy of his prediction of prices and costs which do in fact prevail during this time. His decision can lead to four possible results: (1) choose to shift and be right, (2) choose not to shift and be right, (3) choose to shift and be wrong, and (4) choose not to shift and be wrong. One of the factors which could influence a decision is the seriousness of the consequences due to error in (3) as

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3/ Kenneth E. Boulding, Economic Analysis, (3rd. Ed.; New York: Harper & Bros., 1955), pp. 868-870.

4/ Ibid., pp. 880-881.

opposed to (4). The likelihood that a shift will take place is inversely related to the length of time required to complete the shift and finance it. Confidence in predictions of future economic conditions generally decreases as the period of time into the future lengthens. Thus, a situation favorable to a shift may not bring one about if the length of time required is of such duration that unfavorable changes are likely to occur.

The problem of shifting from wheat to beef production is affected by five main factors: (1) the physical rate of transferring non-specific factors of production from wheat to beef, (2) maintenance of an adequate income during the transition, (3) credit available to the operator, (4) the price relationship between the products of the two enterprises, and (5) the costs of resources specific to the two enterprises. Associated with these price relationships would be some expectation as to the duration of a favorable relationship and probable changes in the cost of production. The operator can determine his position with respect to the first three with a fair degree of certainty. However, the duration and favorability of price relationships is a factor over which he has virtually no control. Programs designed to remove the uncertainty of this factor could induce shifts from wheat to beef which would not be made under present circumstances.

Previous Work

Two circulars have preceded this study; the first by Dwight Blood Delineating Firms Sensitive to Shift Between Wheat and Range Forage,

September, 1954;[5] the second by Terry Norman Forage-Crop Substitution on Dryland Units Sensitive to Shift, March, 1956.[6]

In Blood's study a method was established for delineating areas which are sensitive to shifts on the basis of non-price variables alone--i.e., natural and climatological factors which affect patterns of land use.

From observations made on 156 wheat farms and 118 cattle ranches a function Z was derived:

$$Z = X_1 - 63.92209\ X_2 - 1881.479\ X_3$$

Where Z = a type of index number for discriminating between groups according to departure from a critical value of Z, determined in the analysis;

X_1 = Total acres operated,

X_2 = Ratio of leased to owned land, and

X_3 = Total annual precipitation in inches.

The hypothesis is that the above three variables are sufficient to discriminate between wheat and cattle ranches.

Results from the study indicate that 26 per cent of the cattle ranches in the area with an average of (1) 17.1" precipitation, (2) about 26 per cent of the land operated under lease and (3) 3,672 acres of land were found susceptible to shifts toward dryland crop production.

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[5] Dwight M. Blood, Delineating Firms Sensitive to Shift Between Wheat and Range Forage, Mimeograph Circular 84, Montana Agricultural Experiment Station, Bozeman, Montana, September, 1954.

[6] Terry Norman, Forage-Crop Substitutions on Dryland Units Sensitive to Shift, Mimeograph Circular 92 Montana Agricultural Experiment Station, Bozeman, Montana, March, 1956.

Similarly, about 21 per cent of the wheat farms with comparable averages of (1) 15 inches precipitation, (2) 22 per cent of land leased and up to 3,975 total acres were found susceptible to shifts toward range forage production. The study also indicates the necessity for considering each farm in its own internal and external environment in reaching ultimate decisions relative to shifting.

Norman's study developed the situation facing the operator of combination wheat-beef organizations in both the spring and winter wheat areas. Subareas were selected within these general wheat areas which conformed closely to the precipitation criterion in Blood's circular for defining shift sensitive units. A sample was then drawn from farms which fit the other two criteria and a field survey was taken of them. Budgets were constructed from these surveys for the organization and operation of two representative units. One faced the alternative of range beef cattle vs. spring wheat; the other, range beef cattle vs. winter wheat. These budgets were not only used to describe these units, but also to classify expense items according to enterprise.

Once the expense items had been established for each enterprise, in a given operation, it was possible to test the economic feasibility of shifting from one enterprise to another. This analysis was accomplished through a series of prices which, after a matured shift, would yield a net farm income from the new organization equal to the net farm income from the old organization (Table I). These prices would not induce the

shift since they would not replace income lost during transition nor would they cover the cost of the transition.

To implement the analysis, two sets of assumptions were made, one relating to production relationships and the other to time periods for enterprise adjustment: (1) A constant rate of product substitution between shiftable limits, and marginal costs of resources specific to each enterprise are a linear function of output. (2) Decisions to shift enterprise organizations are assumed to be based on completed adjustment, with no problems in financing the adjustment.

The prices which would yield a net farm income on shifted units equal to the income realized before shifting are summarized in Table I.

TABLE I. SUMMARY OF PRICES DETERMINED IN NORMAN'S STUDY.*

Direction of Shift From Present Organization	Price Required For		Given the 1954 Price of	
Spring Wheat Area				
To Livestock	Beef:	$19.98/cwt.	Wheat:	$ 2.12/bu.
To Wheat	Wheat:	$ 1.51/bu.	Beef:	$16.01/cwt.
Winter Wheat Area				
To Livestock	Beef:	$29.10/cwt.	Wheat:	$ 2.05/bu.
To Wheat	Wheat:	$ 1.52/bu.	Beef:	$16.48/cwt.

*Source: Terry Norman, op.cit., Derived from Table XXIII, p. 77.

Research Problem

This study, as well as the two by Blood and Norman, are part of a larger study entitled Economic Analysis of Capital Investments Required in Marginal Shifting Between Range and Dryland Cropping currently being

carried on at Montana Agricultural Experiment Station. The present study uses the farms and the limits of the shift established in previous work as a point of departure and attempts to describe the price conditions necessary to induce a shift as well as to describe the transition period facing the farm operator. It identifies the "break even" prices after such a shift has been made. It explores some of the possible means by which shifts in resource use can be brought about, specifically an evaluation of the effects of present farm programs on the feasibility of shifting cropland to range use is made.

CHAPTER II

THE PROCEDURE

Budget Analysis of Time Series

When contemplating an enterprise shift, there are three time relationships to consider, (1) the pattern and size of the income stream during the shift, (2) the net worth position at the completion of the shift, and (3) the expected rate of return for the firm at the end of the shift. These must be considered for both the shifted and unshifted firm and, of course, compared.

The first relationship requires a production time schedule over the years of the shift. Budgets were made for each year of the shift. These give us the expected annual income during the shift. The operator must put some minimum limit on income to cover family living and income taxes during the shift. This limit will vary from individual to individual depending on his particular cost of family living as well as his liability for income tax.

To determine the net worth at the completion of the shift, it was necessary to compound net annual reinvestable income (net farm income less income tax liability and operator's withdrawals) over the period of the shift and add it to the beginning net worth. This net reinvestable income is taken from the budgets.

The rate of return at the completion of the shift is the ratio of net income to net worth at that point.

A shift is profitable when the following conditions are met: (1) the income over the shift is adequate to meet family living expenses after taxes, (2) the shifted firm's net worth position at the completion of the shift is equal to or greater than the unshifted firm and (3) the rate of return is greater for the shifted firm.

The Models

Having established the criteria for analyzing a shift, our next concern is how to proceed with the problem at hand, namely, a shift from wheat to beef on selected dryland units in Montana. Previous work has established model farms in both the spring and winter wheat areas and the extent of their respective shifts.7/ Norman points out that all cropland is not shiftable for the following reason: "The remaining . . . acres in crop may be thought to be fixed either by rent agreements or lack of stock water. As a matter of fact these are commonly found to be limiting factors."8/ Some changes have been made in the organization and costs used in Norman's circular. Costs for grain and hay production were developed from a field survey taken in 1955 by the U.S.D.A. These are more up-to-date and more accurately represent costs met by farm operators in Montana. Leased land is considered as owned for our purposes.9/ This assumption will not change the results significantly and, at the same time, it

7/ Ibid. pp. 30-55.

8/ Ibid., p. 62.

9/ Ibid., Table III, p. 31.

permits concentration on the shifting problem without encumbering it with too much detail. Even though some of the cropland is changed from leased to owned, the restriction on the number of shiftable acres is retained. The minor enterprises such as chickens, hogs, milk cows, etc. used mainly for home consumption have been eliminated. These enterprises contribute little if anything to farm income and are not involved in the shift, so their absence has no effect on the end results.

The resources for these farms are summarized in Tables II and III. A more detailed breakdown is found in Appendix A.

TABLE II. LAND AND LIVESTOCK ON MODEL FARMS.

Item	Unit	Spring Wheat Farms	Winter Wheat Farms
Land:[a]			
Wheat	Acre	424	372
Barley	Acre	86	139
Oat Hay	Acre	50	--
Fallow	Acre	560	511
Total Cropland	Acre	1,120	1,022
Pasture	Acre	1,967	1,846
Hay	Acre	88	84
Headquarters & Waste	Acre	98	192
Total		3,273	3,144
Livestock:[b]			
Bulls	Head	4	4
Cows	Head	106	102
Replacement Heifers	Head	16	11
Total		126	117
Cropland Shiftable to Range Forage[c]	Acre	646	800

[a] Terry Norman, op.cit., p. 35. The oat enterprise (not oat hay) was eliminated and those acres were listed as barley.

[b] Ibid., p. 41. Adjusted for elimination of minor enterprises.

[c] Ibid., p. 61.

TABLE III. INVESTMENT IN RESOURCES ON MODEL FARMS.

Item	New Cost	Average Investment
Spring Wheat Farms:	Dollars	Dollars
Land[a]	93,036	93,036
Structures	19,122	9,311
Equipment	24,529	13,244
Livestock[b]	19,881	19,881
Total	156,568	135,472
Winter Wheat Farms:		
Land[a]	108,480	180,480
Structures	22,765	12,870
Equipment	24,187	13,088
Livestock[b]	18,693	18,693
Total	174,115	153,131

[a] Land values closely approximate current market values. See Table XI and XII for values used.

[b] Livestock values are based on a calf selling price of $18.50 per cwt., taken from U. S. Department of Agriculture, Agricultural Research Service, Agricultural Price and Cost Projection for Use in Making Benefit and Cost Analyses of Land and Water Resource Projects, (Unpublished data, Washington D. C., June, 1956), p. 26.

Why aren't shifts taking place on these units under present conditions? If we look at the net incomes presented below (Table IV), it becomes apparent why these shifts are not taking place.

TABLE IV. NET FARM INCOME ON MODEL FARMS.

Area	Normal Wheat Yield Per Acre	Net Farm Income	
		Present Organization	Shifted Organization
	Bushel	Dollars	Dollars
Spring	8	3,092	1,116
	12	6,735	2,793
	16	10,377	4,605
Winter	10	3,324	635
	15	7,553	2,052
	20	11,781	3,200

The prices used to determine net farm income in Table IV are: spring wheat--$1.90 per bushel, winter wheat--$1.80 per bushel, barley--$0.90 per bushel and calves--$18.50 per cwt. Budgets showing costs before and after shift are found in Appendix B.

What price for calves would be required to induce a shift on these units, assuming the prices for grain? The problem thus becomes one of estimating beef prices necessary for profitable shifts.

Assumptions Specific to the Problem

With this as the initial objective, the first step is to develop a production time schedule for each farm and budget them over the period of the shift. This requires certain assumptions and estimates with respect to yields, costs, prices, and time span for completing the shift. The following estimates and assumptions are pertinent to the study:

1. A constant rate of product substitution over the extent of the shift, i.e., all shiftable acres are identical in physical production of either wheat or beef. In the spring wheat area this will be a shift of 646 acres from the grain enterprise to range forage. In the winter wheat area the shift will be 800 acres from grain to range forage.
2. Yields are constant over time. To get some indication of the effect of yield levels on shifts, three levels of wheat yields are used in each area; 10, 15, and 20 bushels per acre

for winter wheat and 8, 12, and 16 bushels per acre for spring wheat.

3. The conversion of cropland to range forage is as follows:

TABLE V. GRAZING RATES FOR CONVERTED CROPLAND

Area	Normal Wheat Yield Per Acre	Acres Required Per Animal Unit Per Grazing Season
	Bushel	Acres
Spring	8	30
	12	22
	16	15
Winter	10	21
	15	16
	20	15

These conversion rates are based on estimates of 14 county extension agents from each area. The grazing rates pertain only to the cropland that is shifted. The original pasture has a different carrying capacity (15.6 acres per cow) and is constant for all three yield levels in the same area.

4. All costs except beef inputs were taken from secondary data and adjusted to reflect 1954 costs. These costs are held constant throughout the period of the shift. Part of the cost of the production of beef is the beef animals purchased for this enterprise. These costs are a function of the price of beef required for a profitable shift and are determined simultaneously with this required price. Costs are found in the budgets in Appendix B.

5. The ratios of prices among bulls, cows, calves, and heifers are constant. (Table VI)

TABLE VI. PRICE INDEX FOR CATTLE*

Disposition and Item	Price Index for Whole Animals In Terms of Calves	Price Index for Cwt. in Terms of Calf Price
Sell:		
Calves	1.000	1.000
Cows	1.396	.558
Bulls	2.216	.572
Buy:		
Bulls	4.654	--
Heifers	1.463	--
Inventory Values:		
Cows	2.184	--
Bulls	3.435	--
Heifers	1.463	--

*Indexes for animals sold, per animal and per cwt., based on relationship between classes developed by Terry Norman, op.cit., Table V, p. 65. The ratio among prices received for the three classes of cattle sold is consistent at various price levels, e.g., Ibid., p. 74.

6. The rate of return on reinvestable income is 4.5 per cent on those funds invested outside the farm.

7. The time period allowed in which to finance the shift is ten years.

Production time schedules for these farms appear in Appendix C, Tables I, II, III, VII, VIII, and IX. These schedules show the physical changes which take place during the shift. It will be noted that one column is headed "Year 0"; this is the unshifted organization in all cases and the departure point for the shift. Year 10 in all cases is the last

year of the shift period. It also represents the final shifted organization.

In addition to the above shifts, the prices necessary to induce shift where a five year conservation reserve contract is employed in the shift will be determined. The average reserve payment in Montana is $9 per acre with a $5000 maximum annual payment. Besides the annual payment, the cost of establishing a grass stand is shared by the government. The cost-sharing payment will cover 80 per cent of the cost for seed and allow 80 cents an acre for drilling. Production time schedules for the shift employing the conservation reserve are found in Appendix C, Table IV, V, VI, X, XI, and XII.

CHAPTER III

CALCULATIONS

Tables in Appendix D summarize the budgets prepared from the production time schedules (Appendix C). Income tax liability and an allowance for family living have been left out in these calculations. The tax rate is determined by the level of net income and thus becomes a function of the price of beef. The calculation becomes too complex to warrant doing this. Leaving out an allowance for family living does not affect the calculated beef price because this figure appears in both the shifted and unshifted farms and cancels out when the incomes from the two are equated.

To estimate the price of beef which will make a shift profitable, the future value of all the reinvestable income to the end of year 10 for both the shifted and unshifted farms are equated. The required price of beef is then determined. The calculation in equation form is:

$$R_0\left(\frac{(1.045)^{10} - 1}{.045}\right) = R_1\ (1.045)^9 + R_2\ (1.045)^8 + \cdots + R_9\ (1.045) + R_{10}$$

Where: R_0 = annual reinvestable income of the unshifted farm

$R_1, R_2, \ldots, R_{10}$ = annual reinvestable income of the shifting firms from year 1 through year 10.

R_0 through R_{10} for all yield levels and both areas are a function of the price of calves (P_b) required for a profitable shift. P_b is not the price per cwt., but rather the price for a 400 pound calf. Appropriate calculations must be made to express the prices on a cwt. basis (see Table VII.).

TABLE VII. ESTIMATED PRICES REQUIRED FOR A PROFITABLE SHIFT.

Farm*	Price Required for Calves			
	Without Conservation Reserve		With Conservation Reserve	
	Per Head (P_b)	Per Cwt.	Per Head (P_b)	Per Cwt.
Spring Wheat	Dollars	Dollars	Dollars	Dollars
8	278.46	69.61	28.52	7.13
12	328.72	82.18	213.30	53.32
16	337.30	84.32	328.17	82.04
Winter Wheat				
10	234.07	58.52	106.67	26.67
15	291.03	72.76	259.32	64.83
20	371.80	92.95	408.67	102.17

*In all tables and in the text to follow, the farms and areas will be designated by the notation in this column, e.g., Spring Wheat 12 stands for the spring wheat farm with a 12 bushel per acre normal wheat yield.

Using the above prices, the calculations which permit an analysis of the shifts according to the three points discussed at the beginning of Chapter II are set up. This time, however, the income tax liability and operator's withdrawal are included. Assuming that the above prices actually occurred, would it be profitable to shift to beef?

First annual net income is calculated by applying the calf prices (P_b) in Table VII to the net farm income figures found in Appendix D tables. This converts them to a dollar value for each year. With these figures the calculations found in Appendix E are made. This gives net reinvestable income. In the same tables is also found the accumulated cash balance resulting from the accumulation of the reinvestable income which does not go toward the purchase of additional beef. This is the same operation as compounding the net reinvestable income to the end of year 10. Net worth at the beginning and end of the shift as well as the

average annual net income before and after the shift are then determined. An average net income is used because cattle sales are not constant from year to year. To calculate the rates of return, the annual net income is divided by the net worth. These operations are summarized in Tables VIII-X.

TABLE VIII. NET WORTH AT BEGINNING AND END OF SHIFT PERIOD.

Farm Yield	Calf Price Per Cwt.	Beginning	End	
			Unshifted	Shifted
	Dollars	Dollars	Dollars	Dollars
Spring Wheat		Without Conservation Reserve		
8	69.61	190,399	349,912	253,162
12	82.18	203,902	416,547	421,190
16	84.32	206,206	443,741	451,063
		With Conservation Reserve		
8	--	--	--	--
12	53.32	172,894	315,836	318,271
16	82.04	203,755	431,733	443,675
Winter Wheat		Without Conservation Reserve		
10	58.52	193,565	319,304	321,475
15	72,76	207,953	398,591	403,475
20	92.95	228,356	482,533	491,111
		With Conservation Reserve		
10	26.67	161,382	191,235	192,453
15	64.83	199,942	372,548	378,697
20	102.17	237,669	507,949	520,144

Note that values for Spring Wheat 8--with Conservation Reserve are left out of the above and remaining tables. The price required to induce a shift under this condition is unrealistically low because of the $5000 conservation reserve payment. The conservation reserve payment is so large with respect to total income that it requires a very low calf price over the period of the shift to equate the compounded incomes of the shifted and unshifted farms.

TABLE IX. AVERAGE ANNUAL NET INCOME BEFORE AND AFTER SHIFT.

Farm	Calf Price Per Cwt.	Before	After	
			Unshifted	Shifted
	Dollars	Dollars	Dollars	Dollars
Spring Wheat		Without Conservation Reserve		
8	69.61	21,719	28,897	29,422
12	82.18	29,941	39,510	40,014
16	84.32	34,365	45,054	45,737
		With Conservation Reserve		
8	--	--	--	--
12	53.32	19,426	25,858	24,252
16	82.04	32,624	42,883	44,461
Winter Wheat		Without Conservation Reserve		
10	58.52	17,173	22,831	23,414
15	72.76	26,331	34,910	35,548
20	92.95	37,547	48,985	49,898
		With Conservation Reserve		
10	26.67	6,150	7,493	5,301
15	64.83	23,587	31,354	31,128
20	102.17	40,737	52,900	55,148

TABLE X. RATE OF RETURN BEFORE AND AFTER SHIFT.

Farm	Before	After	
		Unshifted	Shifted
	Per Cent	Per Cent	Per Cent
Spring Wheat		Without Conservation Reserve	
8	11.41	8.26	8.33
12	14.68	9.48	9.50
16	16.66	10.15	10.14
		With Conservation Reserve	
8	--	--	--
12	11.23	8.19	7.62
16	16.01	9.93	10.02
Winter Wheat		Without Conservation Reserve	
10	8.87	7.15	7.28
15	12.66	8.76	8.80
20	16.44	10.15	10.16
		With Conservation Reserve	
10	3.81	3.92	2.75
15	11.80	8.42	8.22
20	17.14	10.41	10.60

There is one more calculation which is of interest, namely the "break-even" price or that price which gives equal net farm income to both the unshifted organization and shifted organization. Note that the incomes equated do not include a return on accumulated capital. This price is strictly a measure for comparing the two organizations and is not influenced by the cost of the shift or the point in time when the comparison is made. A higher calf price favors the shifted organization, a lower price favors the unshifted organization.

TABLE XI. BREAK-EVEN PRICES.

Farm	"Break-Even" Price Required Per Cwt. of Calves
Spring Wheat	Dollars
8	53.32
12	67.46
16	69.37
Winter Wheat	
10	45.42
15	59.72
20	76.89

The method of calculating the "break-even" prices in Table XI is different than the method used by Norman.[10] He determined a net farm income for the unshifted farm and then calculated a price for beef which would give the shifted farm the same net farm income it received before shifting. (The net farm income of the unshifted farm includes some income from the sale of beef. Thus, if Norman's "break-even" prices were to prevail in the market, the unshifted farm would have a higher income than the

[10] Ibid. pp. 56-79.

one that shifted from wheat to beef.) The calculation of his prices in equation form is:[11]

$$N_vFI - L_m = A_w (Q_wP_w - E_a) + C(Q_bP_b - E_c)$$

Where: N_vFI = net farm income above variable and specific expense

L_m = receipts from minor livestock enterprise net of variable expense

A_w = acres of wheat

Q_w = bushels of wheat per acre

P_w = price of wheat

E_a = crop expense variable and specific to crop

C = number of cows

Q_b = turnoff per cow

P_b = price of beef per cwt.

E_c = livestock expense variable and specific to livestock

The left side of this equation is the net farm income of the unshifted farm and is constant throughout Norman's work, i.e., one for the spring wheat farm and one for the winter wheat farm. It is based on a calf price of $18.80 per cwt., a spring wheat price of $2.12 per bushel, and a winter wheat price of $2.05 per bushel.

The "break-even" price in this study is calculated by the following equation:

$$a P_b + X = b P_b + Y$$

Where: P_b = price for 400 pound calf

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[11] Ibid., p. 60.

a = number of calf units sold on unshifted farm

b = number of calf units sold on shifted farm

X = net farm income less gross income from livestock on unshifted farm

Y = net farm income less gross income from livestock on shifted farm

This equation determines the price of beef which will give both the shifted and unshifted farms equal incomes under the calculated price.

The difference between the "break-even" price and price required to make a shift profitable in some cases is quite large. At the same time the differences in net farm income over the last five years of the shift are relatively small. The reason for this is the small change in livestock sales associated with the shift, e.g., the increase in livestock sales between the shifted and unshifted Winter Wheat 20 is only 36.736 calf equivalents. This increase in livestock sales offsets a loss in sales of 1771 bushels of wheat and 924 bushels of barley. In this example the difference in the average net farm income (excluding a return on accumulated cash) of the shifted farm using "break-even" and "shifting" prices is $2360 in favor of the latter. Yet it takes $16.06 per cwt. to make up this difference.

CHAPTER IV

ANALYSIS, DISCUSSION, AND CONCLUSIONS

Analysis of the Shift

An analysis of the shifts considering the three points mentioned in the first part of Chapter II supports the method used to estimate the minimum prices for beef required to make a shift profitable without including a provision for income tax liability. It seems reasonable to expect the accuracy of this method to be inversely related to the size of the fluctuations in taxable income because of the nature of income tax rates.

The pattern and size of the income stream over the shift is adequate in all cases under the selected price conditions. (See Appendix E)

In all cases the shifted farms have a slightly larger net worth at the end of the shifting period. This advantage is due to the appreciation of the heifers used to increase the herd. If the value of the herd increase was limited to the purchase price of the additional animals rather than the inventory value, the difference in net worth between the unshifted and shifted farms at the end of year 10 would be negligible.

The rate of return is essentially the same for both the shifted and unshifted farms in all cases except Spring Wheat 12--with Conservation Reserve and Winter Wheat 10--with Conservation Reserve. In both these cases the price required to induce a shift is below the "break-even" price. This situation occurs when the conservation reserve payment gives a better net return on the acres in the program than a wheat enterprise (50% fallow) on those same acres.

It is evident that in the last two situations shifts should not be attempted without anticipating "break-even" prices at the completion of the shift or some type of subsidization which would bring net income up to where it would be equivalent to the net income enjoyed under the "break-even" price.

The calculated prices which must prevail over the extent of the shift for it to be profitable are specific to the organizations and assumptions in this study. How would a change in these assumptions (pages 16, 17, and 18) affect the calculated prices?

A changing rate of product substitution over the shiftable acres could change the extent of the shift. An all or nothing shift is no longer the solution. A smaller shift would be profitable even with lower beef prices.

Another point to consider is that it is not physically possible to shift all the cropland to grass for beef production. It would be better to completely eliminate the wheat enterprise, sell all the equipment specific to that enterprise, and have idle acres if the converted assets could bring a greater return in some other form of investment. If this were done a shift would be profitable with lower beef prices than those determined in this study.

There seems to be no practical alternative to the assumption that yields are constant over time. The unpredictability of Montana yield patterns makes it impossible to select a ten year sequence of yields which can be considered as typical or representative.