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The Iowa property tax and farm enterprise selection

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THE IOWA PROPERTY TAX AND FARM ENTERPRISE SELECTION

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I. INTRODUCTION

The Iowa property tax has often been considered a hinderance to efficient resource allocation in the agricultural sector. The purpose of this study is to consider the effect of the property tax upon farm enterprise selection in Iowa.

In chapter two we will review the history and trends of the Iowa property tax. Emphasis will be upon its relative importance in the total tax structure beginning from its inception in 1838 until the present time.

In the third chapter an attempt is made to determine the extent to which the property tax is capable of being shifted. A theoretical discussion of the effect of the variation in risk and the concept of tax capitalization is also included.

The fourth chapter enumerates the variables that appear to be important in directing farm enterprise selection. The first part of this chapter is concerned primarily with those variables to be used in the emperical tests. The last part contains an explanation of the non-tested variables that must also be considered when we attempt to explain the choice of a particular farm enterprise.

In chapter five we have reproduced a number of the regression equations which were used to test the variables set out in chapter four. The first set of regressions is used to measure the variation in beef cow numbers and intensity of row cropping that can be explained by changes in the real and personal property taxes. The second part uses a number of regression equations to measure the relative significance of the independent variables.

II. THE PROPERTY TAX

A. History

The history of taxation in Iowa dates back to 1838 when the first Legislative Assembly of the Territory of Iowa met at Burlington (2). Prior to becoming a separate territory, by a United States Congressional Act on June 12, 1838, Iowa had been a part of the Territory of Wisconsin and therefore it was natural that the first revenue system would be patterned after the system that existed in Wisconsin prior to 1838. At that time, most of the revenue for territorial expenses was provided by the Federal Government but one of the first acts by the Legislative Assembly was the establishment of a county and territorial revenue system designed to bear the local tax burdens and also contribute a small percent to the Territorial budget.

A basic fundamental characteristic that the Iowa local tax system carried over from the Wisconsin Legislative Assembly and which remains a primary feature today is the concept of decentralization. Then as now the tax system for procuring local revenue has been administered by the county and/or township governments. This is in contrast to other revenue systems which are administered at the state and federal levels.

Certain problems arose with the administration of a decentralized revenue system and Iowa's early history was plagued by inequities in the general property tax. The primary source of inequality was in the assessment process. An intergovernmental struggle was carried on almost continuously until 1897 over who should have the power of review or equalization of assessed values. The system that evolved and has resulted in a satisfactory equilibrium between state and local power puts into the hands of local officials the problems of assessing property, a function considered to be the foundation of a property tax system. Also in the hands of the local officials is the task of administering the levy and collecting the revenue. But as Gronouski (7) points out, where the property tax is used to finance several layers of government, state participation becomes mandatory. Iowa's current program since 1947 strengthened supervisory power of the state tax commission and instituted an appointive county assessor system whose performance is checked by comparing assessment ratios over all of the counties in the state. This method has helped alleviate many of the inequities in tax administration in Iowa.

1. The decline of the general property tax

Practically beginning from the time of its inception, the general property tax as a percent of all tax revenue has steadily declined both for the United States and for the state of Iowa. Mabel Newcomer (22), in her article on the decline of the property tax in the United States, shows the relative impact of property taxes as a percent of all taxes on the state and local level, the state level, and the local level for selected years from 1902 to 1950. Following is an extract of her table:

Table 1. General property tax as a percent of all taxes (United States 1902-1950[a])

Year	State and local taxes	State taxes	Local taxes
1902	82.7%	51.2%	89.5%
1926	80.0	29.0	95.5
1931	75.3	20.0	95.2
1936	60.2	6.9	93.1
1941	48.2	3.4	92.2
1946	43.9	2.8	92.5
1950	42.4	1.8	89.2

[a]Source: (22, p. 40).

Table 2. Percentage of total taxes from property taxes for federal, state and local[a]

	Property	Other
1930	51%	49%
1932	59	41
1942	20	80
1950	14	86

[a]Source: (22, p. 50).

Table 3. Property taxes as a percent of all state and local taxes in Iowa[a]

Year	Percent
1929	80
1932	79
1940	59
1946	54
1950	50
1956	50

[a]Source: (24, p. 86).

For the State of Iowa alone the property tax as a percent of all state and local taxes is slightly higher than for the United States as a whole.

The 1929 percentage of all state and local revenues coming from the general property tax represents a decline from the percent that existed in 1838 (Table 3). As previously mentioned the state tax system as enacted by the Legislative Assembly provided for a small percent of the gross local tax revenue to be contributed to the Territorial Budget. This was set by the Assembly at 5 percent with the remainder of the total territorial revenue coming from the Federal Government. But for the most part, in the absence of Federal and State income taxes, gasoline taxes, etc., the general property tax was heavily relied upon to carry the revenue load. Later, with the declining importance of the general property tax, what sources of revenue took up the slack for the decreasing proportion of local tax revenue? Table 4 is an extract of another of Newcomer's tables showing the relative weight of various sources of local revenue from 1902 to 1951 for the United States.

Table 4. Principal sources of local revenue (in percent)[a]

	1902	1932	1942	1951
General property tax	73.2%	70.2%	60.7%	50.8%
Other taxes	9.6	6.4	5.2	7.0
State and federal aid	6.8	10.3	25.5	29.7
Charges and miscellaneous	10.4	13.0	8.7	12.5

[a]Source: (22, p. 41).

As indicated by the table, a good bit of the decline of property taxes as a percent of <u>total revenue</u> is replaced by state and federal aid. The emergence of the Federal Income tax and various state tax sources have become the main techniques for raising state and federal revenue.

In summary, what can we say about the role of the general property in Iowa and the United States? For the most part, as a percent of all revenue for state and local and for federal, state and local governments combined it has declined significantly. But for local governmental units alone the property tax has been virtually the only source of tax revenue. From "A Comparative Study of the Tax Systems of Iowa and the Surrounding States" we have accumulated the following data on property tax by type of government for the United States in 1932, 1942 and 1950.

Table 5. Property tax revenue as percentage of total tax revenue[a]

Type of government	1932	1942	1950
States	17.4	5.4	3.5
All local units	97.4	92.3	88.2
Counties	97.3	95.2	95.4
Cities	96.4	87.0	77.0
School districts	99.8	100.00	100.00
Other	95.5	96.2	95.2
All state and local	73.6	47.3	43.5

[a]Source: (18, p. 229).

It is obvious from these data that at the lower echelons of governmental administration the property tax is by far the chief source of revenue.

2. Rising property tax revenue

In spite of significant relative declines in personal and real property tax revenues the absolute magnitude of these funds has continued to rise. Considering that school districts get approximately 65 percent and county governments get 63 percent of their total revenues from property tax levies, it is apparent that increased costs for these functions will necessitate higher property tax demands. Such has been the case. In 1873 approximately $9,360,000 was collected in total state and local revenue (2) of which about 99 percent came from property taxes. Assuming that 20 percent of the total property tax at that time came from personal property this means that about $1,872,000 originated from personal property levies.

In 1962 the property taxes levied in the state of Iowa as reported by county auditors totaled $424,493,000 exclusive of monies and credits (15). Of this total, about 14% or $61,480,000 came from personal property, an increase of $60,608,000 over 1873. Thus, despite the relative decline in importance of both the general property and the personal property tax, the absolute amounts increased a good deal over their original levels. Further analysis of the personal property tax shows that approximately $25,875,000 or 6 percent of the general property tax collected in the state came from personal property levies in the rural districts while 8 percent came from personal property in cities and towns. A good share of the difference between rural and urban levels of personal property taxes is explained by the 1.4 percent coming from levies on the personal property in industrial and manufacturing plants. When compared to the magnitude of the Federal Budget, the property tax revenue coming from the rural districts seems inconsequential. But the cost of $139 million in real property taxes and $25 million in personal property taxes is rather substantial for Iowa farmers.

B. The Personal Property Tax

A knowledge of the background of the general property tax and its trends through the years is essential to understanding the role that has been played by the personal property tax levy. This is because the personal property tax has comprised a relatively stable share of total property tax from its beginning. As noted by Brindley (2) the percentage has rarely exceeded 20 and most of the time is around 16. From State Tax Commission reports for 1962 (15), the percent of total property taxes coming from personal property was 14. We can apply the same resume to personal property taxes that we used for the general property tax--a decreasing proportion as regards federal, state and local and state and local combined but a relatively constant proportion of <u>tax</u> revenues for local governmental units. Although Table 4 indicates that other sources of revenue are substituted for tax revenue on the local level, still a large and constant proportion of that part coming from taxes is the result of property tax levies.

Since the purpose of this paper is to take a look at the personal property tax as it affects resource allocation in the state of Iowa, we will be concerned primarily with the assessment of personal property and the subsequent collection of revenue comprising the $25,875,000 coming from rural personal property levies.

As previously pointed out the assessment of property is the foundation of a general property tax system. This is no less true for personal property taxes, but therein lies many of the criticisms and problems associated with the personal property tax--particularly in the agricultural sector of the state of Iowa. In the first place, the facts of local assessment even <u>with</u> state equalization tend to foster certain inequities throughout the state. With greater revenue requirements in some counties than in others and state limitations on certain mill rates for expenditures included in the county general fund, the necessity for different assessment levels becomes apparent. In the second place, as early as 1844 certain exemptions gave tax relief to specified classes of agricultural property. These exemptions, combined with unequal assessments, have stirred a considerable amount of controversy over the present handling of personal property taxes in the agricultural sector. Moreover, the idea has been put forth that inequalities in the tax bill between states has been partly responsible for maladjustment in resource allocation within the state of Iowa. For example, an excessively high personal property tax levied upon beef cows could discourage western cow-calf producers from locating herds in southern Iowa. This has, in part, accounted for the slow re-allocation of resources into non-row crop enterprises in some parts of the state.

To get a better understanding of the problems confronting an analysis of property taxes in Iowa, it is well to have in mind the basic regulations outlined in the Iowa Code covering personal property taxes and a feeling for the process of administering local property taxes. Following is an excerpt from the Iowa Code covering the relevant topics in reference to personal property and exemptions. Appendix A gives a brief explanation of the assessment and levying of property taxes in the state of Iowa.

Code of Iowa 1962 (13)

427.13 What taxable. All other property, real or personal, is subject to taxation in the manner prescribed, and this section is also intended to embrace:

. . . 2. Horses, cattle, mules and asses over one year of age.

3. Sheep and swine over nine months of age.

The fact that exemptions are included in the Iowa personal property tax regulations and further that these exemptions are fairly significant in the agricultural sector brings up the question of whether this sort of "discrimination" has any affect upon types of farm enterprises. To be more specific, does the fact that beef cows on Iowa farms are covered by the personal property tax make them a less profitable enterprise when, in the absence of such a levy, they would be the most profitable. Proponents of a movement to do away with personal property taxes on beef cows argue that most other livestock enterprises on Iowa farms are relatively free of this levy and for this reason show a greater profit than would beef cows.

For instance, in view of the law exempting all cattle under one year of age and swine and sheep under nine months it is possible for a farmer engaged in a feeder cattle operation to buy calves in the fall that were born the previous spring and feed them for well over a year and still not have to pay the personal property tax on them. Since only cattle that are one year old on the first of January would need to be listed with the assessor and since the calves this farmer bought in the fall would not be one year old until the following spring, they would be exempt for that year. Then, providing the cattle were sold prior to the next January first, there would not be a single dollar in property tax paid on this asset. The case for swine tends to be very lenient also because in rare cases are feeder pigs not marketed within nine months of age. As far as swine farrowing operations are concerned, sows will be subject to property taxes only if they are nine months old and held over the first of January which would normally be the case for early spring farrowing. A factor to be considered here, however, is that the taxable value of a sow is much lower relative to the dollar value of her production than would be the case with beef cows--especially if she is farrowing two litters per year. Therefore, the tax bill per dollar of output would be significantly less in swine than in calf production. Sheep would face much the same situation as swine with the exception that ewes tend to be held longer than sows and would be subject to more years of taxation. The tax bill per dollar of output in sheep would most likely fall between that found in swine and calf production.

In addition, beef cow owners feel that they are discriminated against in other ways. It is nearly impossible to conceal the age or existence of a beef cow while in the swine or feeder cattle business the inventories fluctuate considerably and where farmers are permitted to file their own property listings the temptation to omit such classes of livestock is much greater. Also, it is much more difficult to pin down the age of young livestock than beef cows. This analysis does not pretend to make a judgment regarding the honesty of assessors or farmers, but the intent is merely to point up certain administrative shortcomings in the personal property tax system. In any case, at the present time a personal property tax must be paid on each beef cow in the state of Iowa and cost considerations must take this into account. It must also be pointed out that dairy cows are obviously taxed in the same manner as beef cows, but the dairy enterprise was excluded from the study because of the numerous variables other than land quality--such as market proximity, capital requirements, specific skills--that have an influence upon a dairy enterprise and tend to make it a less efficient indicator of the enterprise an Iowa farmer may be inclined to follow as a result of tax pressures.

To get an idea of the relative burden of the personal property tax upon the cow-calf enterprise, the following table is a cost of production schedule for one unit of production or a beef cow-calf sold program.

With this sort of cost-price schedule, it becomes obvious that a tax bill of $3.77 per cow-calf unit, which represents the state average, constitutes a significant percent of costs and net income.

Table 6. Beef cow-calf sold[a]

Income:			
90% calf crop, 16% replacement rate			
Calf 450 lbs. X 24¢ X (90% X 84%)		=	81.65
Cull cow 1000 lbs. X 13¢ X 16%		=	20.80
	Total receipts		102.45
Costs:			
Corn 4 bu. @ $1.25			5.00
Hay 2 ton @ $16.00			32.00
Pasture 4 ton @ $6.00			24.00
Protein, salt, mineral			5.00
Breeding			5.00
Vet and medical			3.00
Power and fuel			3.50
Equipment			.45
Taxes and insurance			4.00
Miscellaneous			1.50
	Total costs		83.45
Income over costs			19.00

[a]Source: (28, p. 9).

III. ADJUSTMENTS TO THE PROPERTY TAX

When property taxes are imposed, what will be the resulting changes or adjustments in farm enterprise selection? Will the administration of a real estate or personal property levy influence the selection of a farm enterprise? To attempt answers to these questions, we must become familiar with the characteristics of property taxes. Are they paid by those upon whom the legal liability rests? Do farmers change their labor patterns to adjust for higher property taxes?

A. Incidence

To assess the value of a budgetary policy we must compare the actual total effect the imposition of the policy has upon the economy with the desired changes we had hoped to achieve by implementing it. With any budget policy we have a double edged knife which transfigures the economy from both the revenue and expenditure side. Therefore, if we are to analyze the total effect of a particular budget policy, we must follow the revenue raising process through to its final resting place and we must also make a thorough analysis of the total income transfer that arises when allocation is affected through the public sector rather than through the private sector. Also, we must compare the general welfare of the members of the economy before and after the budget policy to determine if a change in welfare has occurred. This is an insurmountable task from the standpoint of all public budgets taken together and analyzing one particular component, a property tax for example, is only slightly more illuminating. A complete analysis of the consequence of a property tax for instance would involve answering three questions. (1) Who, in the final analysis, must make the payment? (2) Who, after the revenue is spent and resources are transferred, actually benefits? (3) Are the marginal benefits accruing to those who gain from the tax policy greater than the loss of benefits to those making the payments?

A property tax levied for the purpose of building and maintaining a school will in the first instance bring about a transfer of resources from private to public use by taxing away private incomes and using the revenue to buy goods and services for the construction and administration of the school. If the project is successful, the community stands to gain more in terms of social welfare via the new educational system than the cost to the tax payers. The question is, does this project actually add to social welfare? Can we make a measurement of cost and benefit after year number one and unequivocally state that we are better off from having levied the tax and built the school house? The fact is, we don't know. In the first place we cannot measure one pupil's change in intelligence and attribute seventy five percent of the improvement to the property tax, twenty percent to federal aid to education and five percent to state aid to education. Furthermore after one year or after ten years we cannot say that the community is fifty percent better off because certain people are relatively poorer because of having to finance the school while others are much better off by benefiting from the new education. The point is, the total benefits accruing to society as the result of a particular budget policy and commensurate resource allocation are impossible to measure. However, we can attempt to measure the direct cost of these benefits by analyzing the incidence of the tax method used in the budget policy.

When we speak of the effect a particular tax ha- upon resource allocation we must necessarily be interested in the "incidence" of that tax. This is the total of all changes that occur from the moment the tax is paid until all incomes become adjusted to the original levy. Or according to Dosser (5), "the total redistributive effect on individual or group real incomes that a tax occasions is called simply its incidence". Thus when individual A's income is reduced by the tax and he cannot recover this loss, we say that the "incidence" is upon this individual and it is not necessary that A be the person who wrote the check to the government in fulfillment of the legal liability. The legal liability or "impact" may have been upon individual B but perhaps B was capable of recovering the total amount of his loss of income by "shifting" the tax to A. In this case, the impact of the tax would not be equivalent to the incidence of the tax; they would be different by as much as it is possible for B to shift the tax to A (Musgrave, 21). When it is impossible to shift the tax further then the incidence is completely determined.

It now becomes apparent that a study of changing resource allocation as the result of a particular tax must first fix the incidence of that tax. It would be ridiculous for instance to predict that a high tax upon the manufacturer of cigarettes would bring about a significant change in resource allocation from cigarette production to chewing gum. We know this because we are aware that such a tax can be shifted in total and that the producers of cigarettes will regain their lost income by charging more for the cigarettes and the consumer will ultimately pay the tax bill. However, it is not universally agreed that all taxes can be shifted in such a way that the incidence will always ultimately fall upon the final consumer. In some cases the individuals legally liable, or upon whom the impact of the tax falls, also bear the incidence because they are unable to shift it either forward to consumers or backward to sellers. Such is probably the case with the personal property tax paid by farmers although one should not dive headlong into this conclusion.

B. Shifting

Among the conditions necessary in order that a tax on production may be shifted to the purchaser, one of the most critical is a relatively inelastic demand curve for the products of the firm. For the single farmer, the demand for his product tends to be highly elastic if not perfectly elastic. In other words, in the case of pure competition where no producer individually can influence the market, a tax on production cannot be shifted to the purchaser of the products.

This condition appears in theory to present a situation where, in the short run, the tax impact is fully upon the the farmer but in the long run is partially shifted to the consumer. Suppose for example that perfect competition existed in farming and everyone was operating at the minimum point of long run average costs and economic profits were non-existent. Obviously, a tax on production would push up the cost curve and create economic losses. Adjustment would follow and marginal farmers could be expected to abandon the farm in the long run, and this would theoretically cause an upward shift in the industry supply schedule. Since the industry demand schedule is relatively inelastic the contracted supply would drive up prices. The higher prices paid by consumers for farm products would be part of the incidence of the property tax.

In practice there are primarily two things lacking in this analysis that tend to invalidate it. In the first place this technique assumes throughout that each farmer is an optimizer equating marginal cost and marginal revenue to maximize his total revenue. Also, it assumes a fixed technology throughout that does not allow for decreases in other cost areas to compensate for higher taxes on certain parts of the enterprise. Cost cutting techniques are cropping up continuously that tend to compensate for new and higher costs in other areas. Secondly, the farmer is not usually optimizing his profits and the imposition of a new cost can usually be absorbed when it cannot be shifted. And the tax can hardly be shifted by a restriction in supply and subsequent higher prices. Historically the number of farmers has been diminishing but the contraction of supply has not followed. Also, although Iowa is among the top states in cattle production, the shift in enterprises from beef cows to feeder cattle would hardly make a significant impact upon the supply of beef for the nation as a whole. For these reasons the pure competition model, although it comes close to portraying the economic situation, does not tell us much about tax incidence.

1. Shifting the personal property tax

In practice, it does not appear that the farmer has much chance of shifting the personal property tax. Since the tax on cows represents a fixed cost in the very short run, it may be spread out over greater output but this capability too is limited.[1] It is not likely that the farmer can hold out for more money from his calves to cover the tax cost. His chances of passing the added cost backward are also limited--at least in the short run. It is possible that in the long run his reduced profits and hence buying power could cause a shift in the demand schedule for inputs and result in lower prices, but this possibility suffers from the same drawbacks as those confronting higher product prices from restricted supply. The impact from this phenomenon in Iowa is hardly likely to make a great difference throughout the country and monopoly elements in industries supplying the farmer tend to cause a downward inflexibility in prices that farmers have to pay.

In summary it appears that the personal property tax on any livestock and for that matter the tax on machinery is not able to be shifted. The impact and the incidence of the tax

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[1]There appears to be three time periods associated with costs in beef cow-calf operations. The very short run is that period of time within which the size of the cow herd is fixed. In most cases this would be a year if the farmer was in the habit of breeding cows so that they would have their calves in the spring and if he normally got his replacement stock from his own herd. If he was accustomed to buying cows already bred, the very short run would be equal to the short run. Within this very short period the farmer can spread out the tax cost on cows by cutting death loses, using proper breeding techniques and thereby producing a higher percent of calves to cows. The short run would be the period within which the number of cows can be varied to take advantage of particular crop rotations that have more pasture. In this case the tax would be a variable cost depending upon the size of the herd. In the long run, all of the facilities on the farm can be varied to accommodate a larger herd of cows--fences can be changed, pasture land increased, etc.

are on the same individual. And this lack of shiftability is a desirable requisite if one is to say anything about the effect of the tax upon farm enterprise selection.

2. Shifting the real estate taxes

The possibility of shifting the property tax on real estate is more likely than is the case with the personal property tax. If the farmer is an owner-operator he faces the same short-run problems of shifting the tax as the farmer who pays the production tax on livestock. He is unlikely to be able to demand a higher price for his products or a lower cost for the inputs he buys. He cannot shift the tax either forward or backward.

In the case of tenancy we have a different sort of problem. If there is a high demand for farm land or more tenants than land available to rent, the conditions are ideal for shifting the real estate tax from the land owner to the tenant in the form of higher rent. Thus the impact would be upon the land owner and the incidence upon the renter because we have concluded that the farmer is not able to further shift the tax either forward or backward. It is not obvious however that a higher real estate tax is reflected in higher rent in the state of Iowa.

The majority of farm leases for renters call for payment of one half of the corn and soybeans and one-half to two-fifths of the oats plus a cash payment for permanent and rotation pasture land. This arrangement has not changed very much over the last decade or so. Assuming fixed proportions of grains going to the landlord and fixed pasture rent, about the only way the landlord has of retrieving his tax cost is through higher productivity. Based upon this one could conclude that the landlord has received a higher total revenue from his farm in the last few years, but this is not necessarily the result of demanding more rent but rather a characteristic of the lease agreements. Of course higher taxes could be paid by shifting the cost forward and charging a higher cash rent on pasture land or for the use of buildings. But according to Iowa State Extencion Economists (Kurtenbach) there appears to be absolutely no rationale for the level of cash rent paid for pasture land in Iowa and furthermore this level had not changed much over the last few years. The variation in rent payments is quite wide throughout the state ranging from $3-$13 per acre for permanent pasture in southern Iowa to $12-$18 for rotation pasture in the remainder of the state. This would lead one to question the likelihood of shifting the real estate tax by increasing rent costs commensurate with tax increases. On the contrary the tendency has been for landlords to share a larger part of the operating expenses, particularly grass seed, fertilizer, gasoline, etc.

Since a majority of the lease arrangements in Iowa are of the crop-share, cash for pasture variety, the threat of higher rent charges on pasture would tend to discourage high meadow rotations. This further limits the possibility of shifting the real estate tax to the tenant but it may also be part of the reason for a higher percent of row crops to total acres among tenant farmers compared to owner-operators. If the landlord is able to shift the tax to the tenant by higher rent on pasture or by demanding a higher percent of the grain produced, then the effect of the higher tax upon resource allocation will depend upon the reaction of the tenant with respect to how he behaves in the face of a smaller income. Here we encounter the problems of income effects, substitution effects and risk aversion for the individual farmer. This will be covered later in the chapter.

C. Capitalization

To the extent that a tax on property cannot be shifted, it may be capitalized. Capitalization or the transformation of a flow of wealth into a fund operates through the rate of interest on capital investments (Seligman, 25). If the value of an asset is fixed by its net produce, a tax that decreases this net produce will consequently render the asset less valuable. Suppose, for example, a tax is levied upon land only. The yield on other assets will then be higher than the yield on land. Therefore, if owners of land wish to sell it they must reduce the price to the point where the yield will be as high for land as for other assets. If an acre of land is expected to yield an annual income of $16 and the going interest rate on investments is 4%, the value of the land is 16/.04 = $400 per acre. If a 1% tax is levied on the value of land, the annual income will fall to $12, a reduction of $4. Since the going rate of interest for all investments is 4%, the reduction in land yield will reduce the value of the land to 12/.04 = $300 per acre. Subsequent buyers will be willing to pay only $300 per acre for the land after the tax. The tax will be "capitalized" into the value of the land. This is the phenomenon of capitalization and it is included in the concept of tax shifting because, like shifting, it operates to change the value of an asset. With capitalization, subsequent owners (after the imposition of the tax) will not bear any of the tax. Rather it will be paid by the owner at the time the tax is levied provided he cannot shift it.

The assumptions necessary before capitalization can occur are (von Mering, 27):

1. The new tax must be unequal. A tax levied upon the earnings of all assets equally will not alter the earning capacity of one relative to others and there will be no inducement to bid down the price of a particular asset.

2. Payment of the tax must be in the future. It must be continuous and the obligation to pay must rest with the owner.

3. The tax will be capitalized only to the extent that it cannot be shifted. If the tax is shifted by raising the price of the asset upon which it falls, obviously there will

be no decrease in value due to capitalization.

4. The taxed asset must be saleable. Personal taxes will not be capitalized.

Assuming that neither the real estate tax on land nor the personal property tax on beef cows can be shifted, will these taxes be capitalized into the value of land or beef cows? Daicoff (4) in his thesis on the capitalization doctrine points out that very little statistical analysis has been undertaken in the area of farm taxes and property values. He performed a cross section analysis for the United States as a whole, nevertheless, from Agricultural Research Service data for the years 1940-1950. This decade was chosen so that a sufficiently long period of time could elapse to allow a full reflection in value changes. From his regression analysis, the change in the dollar value per acre of real estate was best accounted for by a constant number of dollars (the intercept), a positive number (coefficient) times the dollar change in the tax levy per acre and a positive number times the dollar value of real estate per acre in 1940. Both parameters were significant at the 10% level and it could thus be stated with 90 percent probability that the tax parameter is positive; high taxes being associated with high land values. Also, the coefficient of correlation was .928 indicating that the variance in the dependent variable is well accounted for by the tax change and the 1940 value per acre. Daicoff's study seems to refute accepted economic theory that higher land taxes will mean lower land values. In two aggregate United States analyses he finds that the tax change is positively correlated to changes in property values. He also points out that public expenditure benefits may more than offset the negative tax effect and thereby account for the positive relation. This may be especially pertinent in the cities and towns since urban residents tend to demand more in terms of public services--police, fire, sanitation, etc. It would be less true in the rural districts because about the only public expenditure that farmers benefit from exclusively is for county roads. This benefit cannot be overlooked, however, as indicated in a study by the Nebraska Agricultural Experiment Station (23). There it was reported that, on the average, farmers living on dirt roads would be willing to pay $13 per acre more to be located on gravel while those already on gravel would pay only $2 more to be on pavement. If we can apply this analysis to Iowa's farm land the value of farm land does not stand to benefit much from added expenditures on county roads since nearly all of Iowa's farms are already connected by gravel roads.

Since the market for beef cows is relatively mobile between states and the productive life of a cow is short compared to an acre of land, capitalization as such will not occur in determining the value of beef cows. The value of a beef cow is determined primarily by the net return from the calf she produces. A tax upon the cow must be paid with the income from the calf and a higher tax will thus decrease the net return per cow. The primary effect of a tax that discriminates between states will be a relatively smaller number of beef cows in the state where higher taxes cut into net returns.

D. Income and Substitution Effects

The imposition of a property tax upon a farmer will induce him to (a) work more, (b) work less or (c) not change his working pattern. When a farmer becomes liable for a property tax, his income is reduced by the amount of the tax. He can be expected to react in one of two different ways: On the one hand he may be expected to work harder to maintain his before-tax standard of living. This course of action could be expected regardless of the nature of the tax. Either a fixed cost such as a land tax or a variable cost such as the personal property tax on beef cows will impel him to increase his labor intensity to regain his previous income. This tendency is called the "income effect" of an increase in taxes. A higher tax will bring forth a greater amount of labor from the individual farmer. But working in the opposite direction is a "substitution effect". A lower <u>rate</u> of income because of a higher tax on output will also tend to make leisure less expensive in terms of income foregone. If leisure is less expensive as income decreases more of it will be "purchased" and the intensity of labor will decrease. This is the substitution-effect of an increase in taxes and it is pushing in the opposite direction of the income effect. The substitution effect will hold only in the case of a tax that reduces the income of the marginal effort of the individual farmer. It is the reduction in total work effort that comes about because of a lower marginal income resulting from a higher tax on production. A tax on successive increments of income would be an example of the kind that induce the substitution effect. A higher fixed cost such as real estate taxes will not produce a substitution effect. Instead there will be only an income effect since the higher tax does not affect the income arising from added work effort.

A tax on beef cows will create both an income effect and a substitution effect. The income effect will reflect the farmer's attempt to regain his old standard of living and the substitution effect will reflect the lower price of leisure arising from the tax on his marginal effort. Whether the farmer works more or less depends upon which effect dominates. He will work more if the income effect dominates but less if the substitution effect dominates. If the substitution effect and the income effect cancel each other out there will be no change in the pattern of labor intensity.

A cross-section analysis of Iowa was made to determine whether or not differences in the use of farm land could be accounted for by different levels of real estate and/or personal taxes. The regression tests are shown in Chapter V.

E. Avoiding the Tax

The tax may not even have an impact effect if farmers take steps to avoid it. Avoidance would occur only when the farmer had at his command certain alternative enterprises which were free from the tax or at least taxed at a lesser rate. Even at this, enterprise substitution would occur only if the tax became large enough to neutralize a higher yielding enterprise and make it profitable to change to an untaxed enterprise that was inferior prior to the tax but more profitable afterward. In this way, the property tax that threatens to discriminate against a particular enterprise and consequently causes a shift away from that enterprise may induce a misallocation of resources even in the absence of tax payments. The threat of a property tax on cows that causes farmers to avoid that type of enterprise would consequently tend to increase the supply and decrease the income potential of alternative enterprises.

In consideration of shifting enterprises in Iowa from beef cows to feeder cattle, swine or sheep, a certain disequilibrium in livestock investment, not completely unlike the disequilibrium in the capital market referred to by Harberger (9), will result in a lower net income from all livestock enterprises. A shift of capital from the taxed to the untaxed assets in the cattle industry in Iowa must naturally compel Iowa farmers to import feeder stock from surrounding states.

At first glance one would theorize that a reduction in beef cows would necessarily reduce the number of feeder cattle. This is true if one is considering the country as a whole but from the standpoint of one state it does not necessarily follow. The reduction in cows in Iowa will put increased demands on out-of-state cow herds. The result will be that buyers will bid up the price of calves or feeder stock and thus make it profitable for out-of-state ranchers to expand their cow herds. Due to the lag in time between decisions to increase production and the subsequent market date, and assuming certain economies of scale in calf production, ranchers will tend to over-produce in response to increased demands. Consequently we inherit a large cattle population and lower prices. Of course a shift to swine or sheep could have a similar net effect on supply and prices in these enterprises.

F. Risk

The question also arises as to whether a reduction in income due to higher taxes or, for that matter, any other income reducing factor will change the amount of risk a farmer is willing to undertake in selecting his farm enterprise. Obviously, each individual farmer has his own degree of aversion to risk and the enterprise he selects will reflect this. Musgrave (21) treats this problem as it applies to investments carrying different percentages of risk. A similar analysis may be applied to the effect of taxes upon one type of enterprise independent of the other in the agricultural sector. We shall adapt Musgrave's risk aversion model to the farmer's enterprise selection and build our hypothesis upon it.

From Heady (10, p. 241) it is noted that cow herds with calves fattened have a significantly lower index of variability of income than do feeder yearlings or two-year old feeders. In other words beef cow herds tend to have fewer bad years and also fewer good years than found in feeder cattle. However, along with the greater risk associated with feeder cattle is the possibility of greater returns. These two concepts are shown by the left side of Figure 1.

In the southwest quadrant is the function showing the relationship between the percent of cows to cows plus feeder cattle and the yield accruing to the two enterprises. The horizontal axis shows the percent of cows to cows plus feeder cattle. As one moves to the left from zero, the relative number of feeder cattle declines. We move toward zero as the relative number of beef cows declines. The origin therefore would indicate a specialization in feeder cattle while the weight of beef cows increases as we move to the left. On the vertical axis is measured the yield resulting from various mixes of the two enterprises which increases as one moves down from zero. The slope of the function t_o tells us that yields are higher as one moves toward specialization in feeder

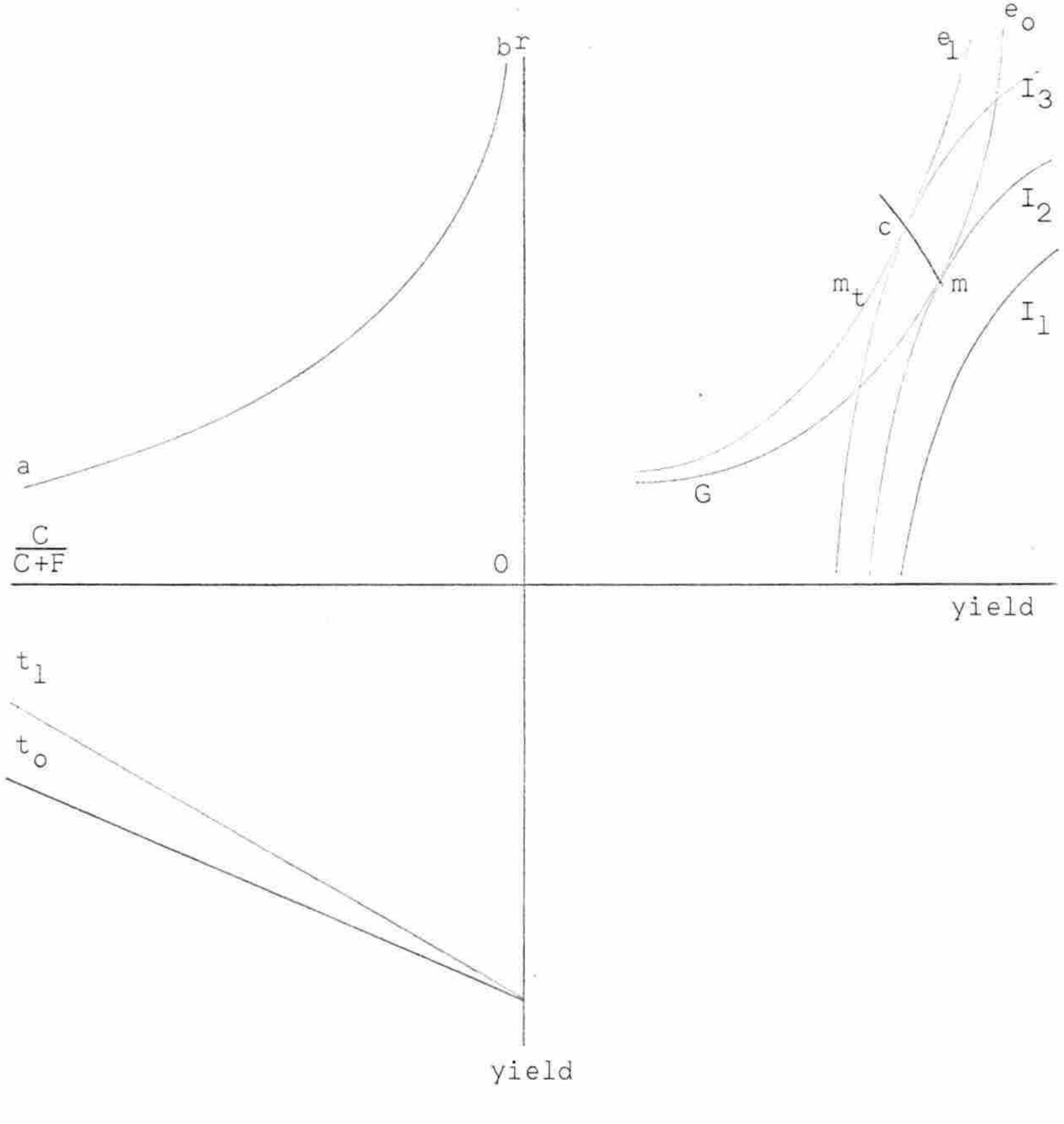

Figure 1. Derivation of optimum-asset curve

cattle and lower as we move toward beef cow-calf enterprises.

In the northwest quadrant we find the relationship between risk and the mix of cow to feeder cattle production. Again, measured on the horizontal axis is the percent of beef cows to cows plus feeder cattle. But on the vertical axis is the percent of risk r which increases from zero as we move up the vertical axis.

$r = -\sum_{i=1}^{k} q_i p_i$ where $q_1\ q_2\ .\ .\ .\ q_k\ q_{k+1}\ .\ .\ .\ q_n$ are the expected rates of return to the extent that $q_i < q_{i+1}$ and $q_k = 0$, and if the probability of the occurrence of q_i is p_i so that $\sum_{i=1}^{n} p_i = 1$.

Since the values of all q's from the beginning to q_k are negative, r is positive. The functional relationship between risk and beef cows is negative as shown by the curve a b. In other words, a relative increase in beef cow numbers represented by a movement to the left on the horizontal axis is followed by a decline in risk. Feeder cattle are the riskier enterprise as shown by a higher value of r as the factor F (feeder cattle) increases relative to cows.

A derivation of the two functions t_o and a b is shown in the northeast quadrant by e_o with risk measured on the vertical axis and yield measured on the horizontal axis. This "optimum investment function" shows the combinations of risk and yield we can expect by varying the enterprise mix. It is positively inclined indicating that expected yield is greater only if one assumes higher risk. It is important to point out that all points to the left of where this curve first becomes horizontal at G are inferior to G because a reduction in yield to the left of this point is not accompanied by a reduction in risk. Given the enterprise mix associated with point G, the substitutions of cash, which presumably involves no risk and no yield, for the enterprise combination will result in a movement from G down to the origin.

In this model the farmer's choice of risk and yield is determined by his indifference map given by indifference curves I_i. These are constructed under the assumption that his capital investment is fixed. They slope up and to the right becoming less steep as they move away from the horizontal axis and as they shift to the right with greater levels of utility. The reason for the decreasing slope becomes more obvious when we consider that at higher levels of risk, a higher yield is required to compensate for the increased risk while at low levels of risk, a great deal more risk will be substituted for a small increase in yield. The slopes of successive indifference curves flatten out when moving up and to the right. This is due to the diminishing marginal utility of income as income rises and the increase in marginal disutility of risk as risk rises. This assumes that at high levels of income it will take a greater increase in income to assume a given increase in risk than at lower levels of income.

The farmer will endeavor to move to higher indifference curves by moving up or down on his optimum investment function e_o. His optimum point will be where e_o is tangent to the highest indifference curve.

To this point the analysis of risk has not deviated significantly from what we found in Musgrave. The only variation concerns the nature of risk as one moves from all beef cows to a higher proportion of feeders (a b). We have assumed that any proportion of feeder cattle greater than zero will not decrease risk. Therefore we get a monotonically decreasing function sloping down to the left in the northwest quadrant of the diagram.

What happens as a per head tax is applied to beef cows? The first effect would appear to be a reduction of yield at every level of beef cow production from cow number one to the point where total assets were in cows. This is given by the new function t_1 which is different from t_o by the tax per cow times the number of cows. Of course where cows are zero, t_1 would equal t_o.

The reduction in yield due to the tax on beef cows will also bring about a shift in the optimum investment function. The new yield curve t_1 will give rise to a new investment function e_1 which is shifted to the left. This tells us that at the same level of risk before and after the tax, yield will be less after the tax. We have not told the whole story, however, about how the farmer will react to his new risk and yield situation as a result of the tax.

If we assume the same indifference map before and after the tax,[1] a shift of the optimum investment curve to the left will reduce yield with the same risk and the point m_t will be reached. But m_t does not lie on the highest indifference curve so the farmer can increase his total utility by shifting his investment to feeder cattle and move to the point where e_1 is tangent to the highest indifference curve. The points of equilibrium or maximum total utility will trace out the curve c m which slopes upward to the left as taxes are increased on beef cows. The adjustment of risk and yield seems to presuppose an income effect that will lead to more risk taking as income is decreased by the tax on cows. The income effect will eventually taper off after the point is reached where the added risk is not compensated for by the increase in yield. The question of what will happen in the extreme cases of very low yields on feeders relative to cows or high risk on beef cows appears irrelevant for the Iowa farmer because he can always abandon both enterprises rather than subject himself to a very low level of yield. Complete dependence upon the government land retirement

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[1]This also assumes that the indifference map of an individual is independent of the level of changes in risk and yield.

program may be a more desirable alternative in this instance. On the basis of this model of risk aversion and yield it is logical to hypothesize that an increase in the tax on beef cows would cause a shift into other enterprises. In Chapter V we shall make some empirical tests to accept or reject this hypothesis.

IV. EMPIRICAL MODELS

In our empirical tests, two models are used. The first model is intended to test the effect of property taxes on farm land-use intensity. The second includes a number of the dominant variables influencing farm enterprise selection in order that we may assess their relative importance. In the first part of this chapter we will list the test variables that will be used in each model. In the second part we will look at some of the non-tested variables that are important in selecting farm enterprises.

A. Tested Variables

1. Dependent variables

It is necessary that an indicator of enterprise selection be identified that will fit into our tax models. Since this study is primarily intended to establish the effect of property taxes upon enterprise selection and, furthermore, since cow-calf operations seem to bear the heaviest tax burden, it was decided to try and determine whether different property tax rates are in any way correlated with different beef cow numbers. Obviously, measuring beef cow numbers is not the only way to categorize a farm enterprise, but for our purposes it would appear to be the best for a number of reasons. In the first place, according to Heady (10), for farmers with limited resources the greatest return generally comes from the enterprise which maximizes on the scarcest resource. From data compiled by C. C. Malone (20) the feed requirement for hogs makes up about 80 percent of total cost while labor comprises 7 percent. In cattle fattening, feed costs make up 85 percent of total cost while 5 percent goes to labor. In the farm cow-calf herd 65 percent of total cost goes into feed and 10 percent goes into labor. From this it is evident that in areas where feed is abundant the greatest return will result from enterprises which require more feed relative to labor. Such is the case in the more productive areas of Iowa where feed is generally abundant relative to the labor input and feeder cattle and hogs are generally conceded to be the most profitable enterprise. As feed becomes more scarce relative to labor the cow-calf herd would appear to become more profitable. For this reason we divided Iowa's enterprises very generally into cow-calf production and other enterprises which for the most part would be hog production or cattle fattening. In this way a measure of the one variable, cow numbers, will give us a broad indication of land use intensity and the type of farming.

Also, in almost any area of the state if some sort of non-tillable land is available, stock cows will often be kept to utilize it. Thus the cow numbers will be a direct reflection of the percent of non-tillable land in use.

In our first model, in addition to using the livestock enterprise as an indicator of the predominance of the income or substitution effect associated with risk aversion, we will use a measure of land use intensity as another dependent variable to be tested with the real and the personal property tax.

a. Beef cow numbers The variable measuring beef cow numbers is well adapted to testing the hypothesis that a tax on beef cows will cause the farmer to assume greater risk in an effort to regain lost income (see the previous model adapted from Musgrave). The Annual Farm Census (14a) gives the number of beef cows two years old and older for each county in the state. In order to correct for differences in county size the total number of beef cows was divided by the total land area in farms for each county. The quotient, indicating the number of beef cows per acre, showed a statewide average of .0273. (See variable number 1. The table in Appendix C gives the number of head per 100 acres.)

A desirable characteristic of this variable is its high coefficient of variation measured by $C = S/\bar{X}$ where S is the standard deviation and $\bar{X}$ is the mean. (C values for all the variables are in Appendix C.) This must be explained either in terms of measuring error or by the fact that a wide variation in beef cow numbers does occur over the counties in Iowa. If each county actually had the same number of cows per acre but our data showed a high degree of dispersion, we would only conclude that there were errors in our measuring techniques. Granted the measuring techniques are not infallible; we, nevertheless, have no basis for expecting equal numbers of beef cows per acre for all counties in Iowa. On the other hand if we have aspirations for using this variable as an indicator of farm enterprises, we would hope for wide variation because there is a relatively wide variation in both land quality and tax burden.

It must be recognized of course that when one begins to average over a county wide area there is some risk of losing part of the information from the sample. For example a county could be topographically divided with half of the area being well suited for row crops and the remainder very rolling and unsuitable for row crops. Half would have a small number and half a large number of cows. In this case averaging beef cow numbers for every acre in the county would produce an outcome comparable to a county of median quality soil, throughout and the median number of beef cows when, actually, the two counties are very different. However, in an attempt to correct for this, the denominator was made to include all crop land plus both temporary and permanent pasture.

b. Land use intensity   Another dependent variable that may prove helpful in measuring farmer reaction to higher taxes is his intensity of land use. The hypothesis to be tested here is whether or not a change in taxes and thus income will explain any of the variation in the ratio of row crop acres to total land area. It must also be recognized that our analysis depends upon what we assume about optimal resource allocation by the individual farmer. In other words, we must assume the same level of efficiency or managerial ability before and after the change in taxes.

It is apparent that the potential yield of corn or soybeans that a farm is capable of producing would be very important in directing the use of the land resources. However, the yield data for crops in Iowa are calculated from the acres actually used for that crop. Therefore, the figures given for yields per acre are not very good predictors of the over all quality of the farm land in the county. If, for instance, only 10 percent of a county was topographically suited for corn production but if that 10 percent was capable of averaging 90 bushels per acre of corn the productive capacity of the total county would be biased if one were to look only at the corn yield per acre. To correct for this and get a better indicator of both land capability and intensity two methods evolved.

The first was to calculated the total dollars worth of corn produced, add this to the total dollars worth of soybeans produced and divide the sum by the total acres on farm land (see variable X_4, Appendix C). The result is a sort of cash output variable that gives the average dollars per acre from row crops in each county.[1] The second method was to simply add

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[1]It was the original intent of this study to isolate and pair off areas of equal soil quality and topography and then measure tax levels and beef cow numbers as a method of detecting the relationship that might exist between them. It was hoped that this technique would isolate and measure the personal property tax effect upon beef cow numbers. This meant that equal soil type areas would have to be measured on the same basis as stock cow numbers and mill rates. Unfortunately each of these measured variables encompassed different geographical boundaries. The mill rate is consistent only within each rural school district, the beef cow numbers are compiled only on a per township basis and soil associations follow boundaries completely independent of the previous two. Therefore, the only good observation would be of township size where the whole township was in the same soil association area and in the same taxing district. This observation would then be compared to another township of the same size coming from the same soil association area but from a different taxing district and therefore reflecting a different tax rate. A comparison could then be made to see if a variation existed in beef cow numbers. The problems of drawing a very large sample of this type became immediately obvious. It is discouraging just to isolate township size units that have the same soil type throughout; to say nothing of trying to find such units with a wide variation in tax rates.

Since the original reason for selecting areas with equivalent soil and topographic characteristics was to find land that had equal capacity for producing cash crops, it was decided that a better variable could be obtained by counties which had equal cash crop potentials. This kind of variable had the advantage of being easier to obtain at the same level as beef cow numbers and tax rates. This advantage seemed to considerably outweigh the disadvantages inherent in aggregating the data on the county level. Furthermore, by aggregating, it becomes possible to take a state wide sample rather than being restricted to areas that had been extensively soil mapped. We settled on two measures of land quality. Variables X_9, showing the ratio of row crops to total land in farms, and X_4 showing the estimated cash output per acre of all farm land in the county were chosen. It is recognized also that these variables do not give a correct indication of potential productivity for a particular county. Instead, they are measures of past performance but I am inclined to believe that farmers base decisions as much on past history as on future expectations.

the total acres of corn to the total acres of soybeans and divide this sum by total acres in farm land (see variable X_9). The second variable, X_9, proved to be the most useful because, although the two are highly correlated ($r_{4,9}$ = .924, see Appendix B), when used in regressions with X_4 it always assumed dominance. This could be due in part to the neutralizing behavior of corn and soybean yields per acre which are an integral part of variable X_4.

2. Independent variables

$\underline{X}_2$: The average mill rate for county rural districts. The average rural mill rate for a county is derived by dividing the total tax collected in all rural districts by the total assessed value of all property. This method corrects for exceptional variations in mill rates that may occur between rural tax districts in each county. Districts with a low total assessed value but a high mill rate will not bias the county average when calculated in this manner.

$\underline{X}_3$: Corn yield per acre. The state mean yield per acre for 1962 was 75.1 bushels with a range from 54.5 bushels in Decatur to 91.8 bushels in Cedar county.

$\underline{X}_4$: Ratio of cash output from corn and soybeans to the total farm land per county.

$\underline{X}_5$: Average farm size. This variable was included in some of the regression models on the basis of the hypothesis that a profitable beef-cow operation would have to be associated with a rather extensive use of the land resource. Ihnen (12) indicates that the average total cost curve for beef cow-calf production is similar to crop production in that it passes through decreasing and increasing stages. He maintains that labor requirements per head and cost per unit decline as acreage and the size of the beef cow herd increases. When the level of acreage and beef cow herds is reached where hay and pasture must be purchased, the cost per unit begins to increase. The correlation matrix (Appendix B) indicates that this variable is significantly correlated with only two other variables, X_8 ($r_{5,8} = -.3551$) and X_{18} ($r_{5,18} = -.4976$). As predicted, the sign of the regression coefficient is positive but the t value for regressions in which X_5 was used ranged from .9187 (significant only at 40%) to 2.7682**.[1] Although it helped explain some of the variation in each model in which it was used, it did not appear powerful enough to include in the final model.

$\underline{X_6}$: The ratio of assessed value to market value per acre for land and buildings (16). This variable was intended to detect the correlation between land quality as measured by either X_4 or X_9 and the ratio of assessed to market value. As expected, there is a negative correlation ($r_{1,4} = -.6632$ and $r_{1,9} = -.6980$) with both variables and they are significant

[1]In this and subsequent tests, ** indicates significance at 1 percent; * indicates significance at 5 percent.

at the .01 probability level. This bears out the notion that more valuable land tends to be assessed at a lower ratio. X_6 was not effective in either of the two regressions in which it was included and, in addition, the sign was reversed in the two equations. This variable too was eliminated from consideration in the final model.

$\underline{X}_7$: Taxes per acre as a percent of market value per acre. This variable was intended to weight the actual tax cost per acre according to land value. It was calculated by dividing average tax dollars per acre by the average market value per county. Variable X_7 was found to be highly correlated with many other variables but this is because of the makeup of the variable. Since it is calculated by using the mill rate, the assessed value and the market value, it is naturally very closely linked with the other variables that are derived from nearly the same data. It was also nonsignificant in the regression models in which it was used.

$\underline{X}_8$: Average real estate tax per acre. This variable is the product of the average rural mill rate times the average assessed value. The mean tax per acre for the state was $3.91 with a range from $1.85 in Monroe county to $6.00 in Polk county.

$\underline{X}_9$: Ratio of acres of corn and soybeans to the total farm land per county.

$\underline{X}_{15}$: The tax per head. This is calculated by multiplying the assessed value per cow by the average rural mill rate per county. The state-wide average in 1962 was \$3.77 with a range from \$2.28 in Dubuque county to \$5.24 in Polk county and a standard deviation of .530. The assessed values for beef cows were obtained from the state tax commission where averages for each county were compiled from township data submitted by the county assessors.

$\underline{X}_{16}$: Soybean yield per acre. The state mean yield per acre for 1962 was 27.1 bushels with a range from 19.1 bushels in Howard county to 33.3 bushels in Scott and Sac counties.

$\underline{X}_{17}$: Percent of farms operated by tenants. The economic rationale behind this variable was that tenant farmers tend to use the land more intensely, producing more row crops, less pasture and consequently keeping fewer cows. The owner-operator on the other hand will be more inclined to conserve his land and use less intense rotations, more pasture land, etc. The correlation coefficients supported the expectations in rather convincing fashion. X_{17} was highly significantly correlated with both X_1 ($r_{1,17} = -.5816$) and X_9 ($r_{1,9} = .8982$). The signs were also consistent in that tenancy was negatively correlated to beef cow numbers and positively correlated with intensity. As a sidelight, X_{17} was regressed on X_9 and below is the outcome.

$$X_9 = -.03037 + .00853\,X_{17}$$

$$T = +20.1311^{**} \qquad F = 405.26^{**}$$

$$R^2 = .81 \qquad R = .90^{**}$$

It is obvious that the relationship between X_9 and X_{17} can be attributed to more than just chance since t, F and R are all highly significant.

Beyond this point X_{17} proved of little use when thrown in with some of the other independent variables. Not only was the sign of the regression coefficient reversed in two regressions but in only one case did it reach a high level of significance and this was probably because there were only three other independent variables in the equation. Apparently its significance was absorbed by some of the other variables in the larger models.

X_{18}: Percent of buildings to land and buildings (assessed value). This variable was included on the *a priori* basis that the building requirement is greater for feeder cattle and swine operations than for beef cow enterprises. The correlation coefficient left some doubt about this; the correlation between X_1 and X_{18} was only + .0012, which is barely positive. Unlike X_{17}, which seemed to lose its significance when combined with other variables, X_{18} alone tells us very little but when combined with various other variables explains a large share of the variation in beef cow numbers.

B. Non-tested Variables

1. Economic

a. *Land quality* To get the total picture, we first find the farmer in a specific natural environment with respect to soil quality, topography and climate which we shall assume can be adequately categorized with our intensity or cash output variables. On the basis of this information alone, we would expect each farmer to concentrate on the enterprise in which his comparative advantage is the greatest. In central and northern Iowa the gently rolling topography, mild climate and highly productive soil favor the production of corn. And since the cash potential of this crop makes the opportunity costs of other crops rather high it becomes evident that the selection of a profit maximizing enterprise will most likely include the corn growing activity. On the other hand, as one moves into southern Iowa, the change in soil types and topography makes the selection of a maximum profit enterprise less clear cut. As the percent of tillable soil decreases and as productivity decreases due to poorer soil quality and topography the intense production of corn no longer remains an obvious maximum profit enterprise. If the corn yield per acre gets low enough, a point will be reached beyond where it is no longer the optimum enterprise. A substitute could very well be legumes or some form of permanent pasture.

One thing must be kept in mind regarding the alternatives available and the natural environments as they affect the state of Iowa. Whereas an intense corn production program in central Iowa is most likely the optimum profit plan, the alternatives are not nearly as restricted as the alternatives found in southern Iowa. For example, a Grundy county farm with a corn capability of 125 bushels per acre could also be an outstanding legume producing unit. A change in the relative cost or price structure could easily be followed by a subsequent switch in the farm enterprise. This farm would have an absolute advantage in almost any type of enterprises when compared to southern Iowa.

The flexibility we find in central and north central Iowa does not carry into the two southern tiers of counties. A relative change in prices for farm products would not reflect a concurrent change in types of farming in this area. If a farmer with a cow-calf operation suddenly experienced a sudden drop in beef prices but a rise in corn prices he would not be in as good a position to make the switch to corn as would the farmer in central Iowa.

Using two budget models, Ihnen (12) shows that the farm enterprise using a cow-calf activity could result in lower costs per unit of output for certain soils in south central Iowa. Budget model I was for producing crops only and renting out the pasture while model II was for crops and a cow-calf operation combined. Each model was applied to three types of farms, hilly, average, and upland in the same soil association area. In this case, the soil association was Shelby-Grundy-Haig because the study was concentrated in southern Iowa. Of the three farm types, upland was best suited to row crop production and hilly was least suited. Within each type of farm in each model he calculated the minimum average cost for five machinery combinations along with the acreage over which this minimum cost would apply. Below is an extract of the tables showing the cost per dollar of output for his two models.

Ihnen's study produces some interesting results as shown in the two tables. In both models the lowest cost per dollar of product was generally from the largest machinery combination and crop acreage within each type of farm. Also, within each model, the minimum average cost for a particular machinery combination was on the upland farm with hilly farms being highest in average cost. When we compare models we find more interesting results. The crop and cow-calf model (II) has a lower minimum average cost for each machinery combination on hilly farms than does the crop model (I) on hilly farms. On average farms, in comparing models we find that for each machinery combination the minimum average cost for II is less than I. But for upland farms the reverse is true; model I is superior, in terms of minimum average costs, to model II.

This study merely lends support to the theory that a crop and cow-calf enterprise may be more profitable on the poorer quality soil in southern Iowa. One of the assumptions of this study, however, is that there is no change in the total variable cost and total revenue for crop production alone in the two models. This implies that the machinery requirements for the cow-calf and crop model cannot be less than for the model with crops alone. In fact, one would be inclined to think from Ihnen's analysis that the machinery and equipment requirements would be somewhat higher for the cow-calf model.

Table 7. Model I--without livestock[a]

Costs per dollar of crop product for selected machinery combinations on the Shelby-Grundy-Haig farms

Machinery combination	Minimum average cost crop acreage	Minimum average cost
Hilly farm:		
2-plow	160	$1.30
3-plow	200	1.24
2-plow, 2 plow	280-320	1.14
2-plow, 3-plow	320	1.08
3-plow, 3-plow	320-360	1.09
Average farm:		
2-plow	160	1.13
3-plow	240	1.02
2-plow, 2-plow	280-320	1.00
2-plow, 3-plow	320-400	.93
3-plow, 3-plow	360-440	.93
Upland farm:		
2-plow	120	.73
3-plow	160	.62
2-plow, 2-plow	200	.67
2-plow, 3-plow	280-320	.58
3-plow, 3-plow	320	.57

[a]Source: (12, p. 114-139).

Table 8. Model II--crops and livestock[a]

Cost per dollar of crop and livestock product for selected machinery combination on the Shelby-Grundy-Haig farms

Machinery combination	Minimum average cost crop acreage	Minimum average cost
Hilly farm:		
2-plow	160-200	$1.06
3-plow	200	1.03
2-plow, 2-plow	280-360	.98
2-plow, 3-plow	320-360	.95
3-plow, 3-plow	320-360	.95
Average farm:		
2-plow	1.60	1.05
3-plow	240	.97
2-plow, 2-plow	280-360	.95
2-plow, 3-plow	320-440	.90
3-plow, 3-plow	320-480	.90
Upland farm:		
2-plow	120	.75
3-plow	160	.66
2-plow, 2-plow	200	.70
2-plow, 3-plow	280	.62
3-plow, 3-plow	280-320	.62

[a]Source: (12, p. 152).

b. Capital It is possible that personal property taxes on farm machinery may work in favor of rather than against the beef cow enterprise. If this sort of influence is to happen, we must assume that the machinery requirements are lower for cow-calf operations than they are for intense row crop operations. To test this assumption a group comparison was made between the average machinery compliment of the 12 counties of northwest Iowa where the median intensity ratio, X_9, is highest and the 11 counties in south central Iowa where the median intensity ratio is lowest and the total number of beef cows is highest. The machinery data is not complete because the only data available are for the number of tractors, grain combines, corn pickers, forage harvestors, hay balers, and motor trucks (14a). The dollar figures for each county were calculated by dividing the total number of each machine by the number of farms in each county to arrive at the number of or fraction of each machine per farm. The price per machine, as set out in the Iowa Farm Planning Manual (17), was depreciated by one-half and then multiplied times the number of machines per farm and totaled to get the average machinery compliment in dollars for each farm in a county. Much of the equipment used on Iowa farms is omitted in this comparison but the important items for pointing out county differences are included (see Table 9).

A comparison of the group means with the t test only

Table 9. The average value per farm for the major items of machinery

Northwest Iowa		South Central Iowa	
Buena Vista	$5964	Appanoose	$3345
Cherokee	6330	Clarke	3998
Clay	5561	Decatur	3735
Dickinson	6529	Lucas	4206
Emmet	5970	Madison	4410
Lyon	6232	Marion	4579
O'Brien	6028	Monroe	3527
Osceola	6194	Ringgold	4009
Palo Alto	5341	Union	4089
Plymouth	5689	Warren	3881
Pocahontas	6328	Wayne	3938
Sioux	5736		
Total	$71,902	Total	$43,717
$\bar{X}_1$ =	5992	$\bar{X}_2$ =	3974

$t_{\bar{X}_1-\bar{X}_2} = 8.656^{**}$ d.f. = 21

proves what is general knowledge. More machinery per farm is used for high row crop operations. This would mean a higher machinery tax base for northwest Iowa and higher personal property taxes. The difference between the means of the two sections, $2018, if taxed at the state average mill rate, 65.666, would account for about $12 difference for each farmer. This difference would not appear to go very far in justifying a shift out of high row crop intensity programs into beef cows to avoid the personal property tax. Adding a full line of machinery would not change the difference in total machinery value very much.

Capital availability is largely independent of environmental conditions except, as previously stated, where natural conditions put considerable restraint on profitable activities in the agricultural sector. This is apparent in Iowa as evidenced by the higher interest rates and tighter capital restrictions in southern Iowa. An element explaining a part of the difference in interest rates in central or northern Iowa and southern Iowa is the nature of the enterprise to be financed. Financial institutions are not at all reluctant to loan a high percentage on feeder cattle providing the farmer has feed available. This is considered a very safe chattel loan and the competition in this area of financing has held the rate low. The risk may be high for the farmer but it is low for the banker because at worst the selling price of the cattle need only cover the purchase price in order for the loan to be retired. Financing cow-calf or dairy herds involves more risk from the banker's standpoint because they tend to be longer in duration and the equity does not build up in a cow as rapidly as it does in a calf or yearling feeder. We find, therefore, higher interest rates and provisions for partial repayment in the financing of cow-calf operations. It should be pointed out that interest rates tend to be a function of the type of farming rather than the reverse. With regard to capital available for financing real estate, judging from the changes in land values there appears to be no particularly high concentration in any part of the state. Only in south central Iowa was a small downward trend in land prices detected (Maas, 19).

c. Labor We have been assuming throughout that the supply of labor is homogeneous and completely mobile over the entire state. This may be an unwarranted assumption. It is possible that some parts of the state have a more plentiful supply and a higher quality of farm labor than others. We ignored these variations due to the difficulty in measuring the quality and quantity of farm labor.

2. Institutional

Institutional characteristics are another important influence in the selection of farm enterprises. Government subsidy programs are a continuous phenomenon nowadays and many farmers plan their enterprises around them.

The educational background of farmers also comes under this category; both formally and from the standpoint of experience. It is logical to assume that a young aspiring farmer will be inclined to follow in his father's footsteps and engage in the type of farming where his experience would be most beneficial.

Another factor which may or may not be worth considering concerns the prestige associated with certain types of farming. Fattening beef cattle seems to capture the imagination of farmers more than swine or cow-calf operations. Perhaps the nature of the risk involved and the possibilities of making a large profit in a good year make fattening beef cattle more glamorous. Even after bad years, the adage that it's best to "get some hair off the back of the dog that bit you" seems to be reason enough to keep farmers coming back for more.

In the first part of this chapter we set out the variables which we planned to use in our regression analysis. In the second part we listed a number of variables which will not be tested but are important in determining farm enterprises. Most of the latter variables are extremely difficult to use in any sort of empirical analysis, particularly those in the institutional category. In the next chapter we will test those variables on which we have collected data by using the familiar regression techniques.

V. REGRESSION ANALYSES

In the first model in this chapter, four regression equations, M_1, M_2, M_3, and M_4, are used to measure the variation in beef-cow numbers and intensity of row-cropping that can be explained by changes in the real and personal property taxes. The second part will use a number of regression equations to measure the relative significance of the independent variables in order to construct a model showing the most dominant variables. A word of caution is in order when analyzing the models. In farm enterprise selection, the isolating of relevant decision making variables is risky business. And to attribute predictive relationships to these variables as they may influence types of farm enterprises is equally risky. The parametric values of the data we have collected must be placed in proper perspective. Tests of the regression coefficients are useful only for determining whether or not the variables have an effect that is significantly different from zero. And when evaluating the variables in each regression it must be kept in mind that there are many variables not included.

The value of the models to follow will not rest, therefore, on estimating specific coefficients for the independent decision making variables but rather in explaining variation that occurs in farm enterprises. Snedecor (26) also emphasizes that unless the multiple R^2 is at least

.80, regressions should not be used for predictive purposes.

A. Model I

To test the hypothesis that an increase in the tax per head will cause a reduction in the number of beef cows per acre, we will use the following regression with two variables:

Dependent X_1: beef cows per acre

Independent X_{15}: tax per head on cows

M_1: $X_1 = -.007778 + .009322\ X_{15}$

$t = 4.0673$ ** df = 97

$F = 16.544$ ** df = 1, 97

$R = .3817$ ** df = 97

In testing the null hypothesis that the parameter b is equal to zero, we must reject it at the .001 level. This tells us that if, in fact, the population parameter is zero, then the sample we got was a 1 in 1,000 chance. Or stated another way, we are 99.9% sure that this parameter is unequal to zero and positive. Likewise, the correlation coefficient ($R=.3817$) is also significant at the 1 percent level (for tests of significance see 26, p. 46, 174, 246).

Using only this regression equation would lead us to reject the hypothesis that increases in the personal property tax on cows will cause a shift in resource allocation from beef cows to other enterprises. And adding more variables and making the same test does not change the sign of the personal property tax variable as is evident from the following equation using the variables:

Dependent X_1: beef cows per acre

Independent X_3: corn yield per acre

X_8: real estate taxes per acre

X_{15}: tax per head for cows

X_{16}: soybean yield per acre

$$M_2: \quad X_1 = -.03379 + .000018\, X_3 - .01049\, X_8 + .01155\, X_{15} + .00211\, X_{16}$$

$t_3 = .1527$ $\qquad$ $t_8 = -9.9332^{**}$

$t_{15} = +7.3710^{**}$ $\qquad$ $t_{16} = +5.7907^{**}$

$F = 42.5^{**}$

$R = .802^{**}$

In this equation all regression coefficients but b_3 are highly significant. Adding the real estate tax and the corn and soybean yields actually reinforces the positive correlation between the tax on beef cows and the number of head per county.

We now have further support for the rejection of our hypothesis but we must not abandon completely the theory that taxing one asset against another will cause a money flight out of the taxed asset. Perhaps there are overriding effects working in the opposite direction that tend to overcompensate for the downward shift in cow numbers. We know for example that the cost of operating the local governments is relatively uniform for all counties in the state. The salaries for county officials, road maintenance and school expenses tend to stay nearly the same for every county. But some counties, particularly those in southern Iowa, do not have the high quality of farm land found in central Iowa and consequently the tax base is not as high. Since counties with low land value per acre must raise nearly the same revenue as the counties with high land values per acre, if given a smaller tax base, they have no recourse but to levy a higher mill rate. The regression perhaps explains that the high land quality counties where sufficient revenue can be raised with a low mill levy are also the counties with the small numbers of beef cows per acre and the low land quality counties where the mill rate must necessarily be high have larger numbers of beef cows per acre. It might be said that the mill rate is independent of the quality of a county in terms of soil since the tax base can be varied by altering the assessed value. But this is only partly true and a small amount of arithmetic will prove that, although the variation in assessment to market value ratios differ considerably, the mill rate must adjust even more.

Suppose for example that an average acre of land in Story County is worth $400 on the market while an average acre in Monroe County is worth $100. Let us also assume that the costs of local government are the same in both counties. From data on the ratio of assessed to market values for counties in Iowa we find the top value at 35 percent and the bottom at 20 percent. If we apply the 35 percent to Monroe County we get a tax base for one acre of $35. Applying the 20 percent ratio to Story County we get a tax base of $80 per acre. Therefore, to raise equivalent revenue from one acre, the mill rate in Monroe County would have to be over 200 percent greater. Obviously, statistics do not indicate this great a variation but the example illustrates the need for higher mill rates in the low land quality counties.

Using the land intensity variable as an indicator of farmer reaction to changes in taxes we use the following variables:

Dependent X_9: total row crops as a percent of farm land

Independent X_3: corn yield per acre

X_8: real estate taxes per acre

X_{15}: tax per head on beef cows

X_{16}: soybean yield per acre

$$M_3:\quad X_9 = .50615 - .0076\,X_3 + .09935\,X_8 - .10607\,X_{15} - .00195\,X_{16}$$

$t_3 = -\ .7373$ $\qquad$ $t_8 = +\ 11.0181^{**}$

$t_{15} = -7.9318^{**}$ $\qquad$ $t_{16} = -\ .6253$

$F = 53.6321^{**}$

$R = .8339^{**}$

In this model we use the same set of independent variables as in model M_2 except that for every coefficient the signs are reversed. We should reason from this that the correlation between dependent variables X_1 and X_9 is negative. Our correlation matrix supports this deduction. It is also interesting to observe the lack of significance the yields per acre of the row crops have in explaining variation in the intensity variable. The corn yield is significant only at the 50 percent level. Soybeans seem to explain less of the variation than corn does. A relatively high multiple R indicates that a good part of the variation from regression is explained by the variables used. It must be kept in mind however that the value of R is not an especially good indicator of the worth of a regression equation. As Snedecor (26, p. 438) points out, the value of R will never decrease if we keep adding new variables. The change in R may be slight but further increases in the number of variables will only increase the value of R. What we are more interested in is consistency in the signs of our regression coefficients and the independence of our independent variables.

In model M_2 and M_3 we found a highly significant variable in X_8 (tax cost per acre of real estate). Also, we find the signs reversed in both instances which indicates consistency within the assumptions we made regarding mill rates, the tax base and the cost of government. Perhaps some explanation is in order. The simple correlation coefficient between the ratio of assessed to market values, X_6, and the ratio of intensity, X_9, is negative and highly significant. With $r_{6,9} = -.6980$ this tells us that if the correlation is actually zero, the probability of getting a sample "r" this size is .01. This means, assuming that intensity is a reasonable measure of land value, that as land value goes up the ratio of assessed value to market value decreases. This is nothing new to students of the real property tax. When we compare variable X_6 to X_8 we also find a highly significant negative correlation ($r_{6,8} = -.5539$). As the ratio of assessed to market values increases, the tax per acre decreases. Accounting for this, as previously pointed out, is that in counties where the market value of land is low the ratio of assessed to market value is high. Also the mill rate is high, but the difference in assessed value between the highest valued and the lowest valued counties is so great that in spite of a higher mill rate in the low tax base counties, the tax revenue per acre will be less. It follows from this that the correlation between the tax bill, X_8, and land quality, X_9, will be positive and highly significant ($r_{8,9} = .6990$). Also, the high negative correlation between X_1 and X_9 seems to be part of the reason for a high negative correlation between X_1 and X_8:

$$M_4: \quad X_1 = .06095 - .00859\, X_8 \qquad \begin{array}{l} t = -\,6.7956^{**} \\ R = +\,.5679^{**} \\ F = 46.1814^{**} \end{array}$$

In summary, the four regressions tested indicate that (1) the beef cow variable is not directly reduced by higher personal property (2) that this reversal can probably be adequately explained in terms of other land quality and tax characteristics; and (3) that the livestock variable and the real estate tax variable operate in the direction we hypothesized but for different reasons. The tax on real estate is a function of the land quality and the number of cows per acre is also a function of land quality which gives the two variables, real estate taxes and beef cow numbers, a consistent relationship but does not necessarily prove that beef cow numbers are a function of the real estate tax.

B. Model II

In model II, the regressions are intended to compare the relative significance of the empirical data we have selected to explain the variation in beef cow numbers. Once again we must evaluate the tested variables with the knowledge that many other variables are omitted. Starting with the largest number of independent variables, we naturally get the largest multiple correlation coefficient. Our problem is to cast off the irrelevant variables and add certain new ones in order to get a more meaningful model and still not sacrifice too much in terms of goodness of fit:

Dependent X_1: beef cows per acre

Independent 3: corn yield per acre
9: total row crops as a percent of farm land
15: tax per head on beef cows
16: soybean yield per acre
17: percent of tenancy
18: percent of buildings to land and buildings

M_5: Variable (X)	b value (intercept)	t value	(Probability of a greater value)
Dependent 1	+.02599		
Independent 3	-.000084	- .8348	(.50)
9	-.094217	-6.6555	(.01)
15	+.002698	+1.7542	(.10)
16	+.001602	+4.7046	(.01)
17	+.000028	+ .1886	
18	-.000452	-3.3443	(.01)

$R = +.858^{**}$ $F = 42.79^{**}$

From this model we find that two of the variables, corn yield and tenancy, do not appear to be significant when combined with the other variables in this model. However, before throwing them out, they were checked out with a smaller model, M_6, below:

M_6: Variable	b value	t value	(Probability of a greater value)
Dependent X_1	+.032693	2.9934	
X_3	+.000206	+2.2102	(.05)
X_9	-.125135	-7.9874	(.01)
X_{15}	+.001558	+ .866	(.40)
X_{17}	+.004426	+2.9025	(.01)

$R = +.790^{**}$ $F = 39.00^{**}$

After looking at these two models, certain points of interest come out. In the first place it becomes obvious that X_9, which measures the ratio of row crops to total farm land, is the most significant variable. This was to be expected since we reasoned that beef cows would not be as plentiful in areas where the land resource was used more intensely. On this basis, the large negative regression coefficient was anticipated. It is also evident that our variable of interest, X_{15}, is not carrying much weight. We find also that X_3 and X_{17} take up some of the slack from having dropped X_{18} and X_{16}. Nevertheless the fit on M_6 is not as good as the fit on M_5 as indicated by the reduction in the value of R.

On the basis of a priori economic reasoning, it would appear that X_{17} (tenancy) would tend to have less effect upon enterprise selections than such things as corn and soybean yields and the intensity ratio. Therefore, X_{17} was replaced by X_{16} and the following regression run:

M_7: Variable		b value	t value	(Probability of a greater value)
Dependent	1	+.008205	+ .7472	
Independent	3	-.000134	- 1.2630	(.40)
	9	-.084774	-11.5270	(.01)
	15	+.002433	+ 1.5017	(.20)
	16	+.001944	+ 5.7750	(.01)
		R = +.835**	F = 54.2**	

In this model, we see that perhaps soybean yield, X_{16}, takes up some of the significance of corn yield. Also we see a second shift in the sign of the X_3 coefficient. This would lead us to wonder about the nature of the effect of this variable. We note also that X_{15} picks up slightly. The high significance of X_{16} is not easy to justify economically. This variable is not particularly highly correlated with any of the others. Nevertheless, in each regression where this variable was used its regression coefficient proved to be greater than zero at the 1 percent level of significance. It is not always wise to include in the model a variable that cannot be justified on an a priori economic basis, but further research into possible reasons for the power of soybean yields discloses that in the state of Iowa there is not a particularly high correlation between land quality and soybean yields. A look at the data tells us that in north central and northeast Iowa where beef cow numbers are well below the average, the yields per acre of soybeans in these two sections of the state are also below the state average for all counties but three (see Appendix c). Of the 20 counties in south central and southwest Iowa, 12 are above the state average in soybean production while 17 of the 20 are above the state average in stock cow numbers. In general, the northern half of the state does not have the same edge in soybean yields that it enjoys in corn yields; but in southern Iowa, and particularly in southwest Iowa, every one of the 10 counties is above the state average. The level of soybean yields, therefore, does not indicate that the land is of particularly high quality as in the case of corn yields. This does not mean, however, that soybean acreage should be excluded from variable X_9 since the important factor in variable X_9 is row crop acres and soybeans and corn are by far the most important row crops in Iowa.

For the next model we add the real estate tax variable to model M_7 so that we can look at it in combination with the previous regression:

M_8: Variable		b value	t value	(Probability of a greater value)
Dependent	1	-.004495	- .4061	
Independent	3	-.000025	- .2414	
	8	-.004740	-3.3920	(.01)
	9	-.057887	-5.4825	(.01)
	15	+.005405	+3.0559	(.01)
	16	+.002000	+6.259	(.01)
		R = +.855**	F = +50.52**	

The inclusion of X_8 does not make a very large difference in the multiple correlation coefficient. The real and personal property tax variables are both highly significant in this regression, but relative to the intensity variable, X_9, they do not explain much of the variation in beef-cow numbers. When the tax variables are included separately they do not show very high significance, but when used together each shows high significance. In addition, X_3 once again shows a lack of significance which seems to be convincing evidence for excluding it from the final model.

In the final model, M_8 was changed to exclude both corn yield, X_3, and real estate taxes, X_8, and include the building ratio, X_{18}:

M_9:	Variable	b value	t value	(Probability of a greater value)
Dependent	1	+.026137	+ 2.2899	
Independent	9	-.093529	-13.5427	(.01)
	15	+.002579	+ 1.7005	(.10)
	16	+.001440	+5.7101	(.01)
	18	-.000475	-3.8340	(.01)
		R = +.857**	F = 64.86**	

We see by the R and F values of this regression that the substitution of X_{18} for X_3 and X_8 slightly improved the regression. Comparing this with our first regression in this model, M_5, we see only a .001 reduction in the multiple correlation coefficient but a much larger F value and we have reduced the number of independent variables by two. A desirable characteristic of M_9 is the lack of interdependence between the independent variables. The highest simple correlation coefficient is $r_{9,15} = -.491$. From an ecomonic standpoint there also appears to be little reason for expecting a great deal of interdependence between these variables.

Suppose we subtract some variables from this regression and observe the effect. Taking away X_{18} and X_{16} will leave only X_9 and our variable of interest, X_{15}. We get the following:

M_{10}:	Variable	b value	t value	(Probability of a greater value)
Dependent	1	+.056486	+6.1176	
Independent	9	-.080047	-9.5041	(.01)
	15	+.000458	+ .2431	
		R = .7482**	F = 61.05**	

We see that by taking away X_{16} and X_{18} we get a sizeable drop in the multiple correlation coefficient. The significance of the regression does not change substantially as indicated by F. It is also obvious that when paired with X_9 alone, X_{15} does not prove significant. In other words, in this regression we cannot say with any degree of assurance that the regression coefficient for X_{15} is different from zero. When the regression is run using only X_9 as an independent variable the multiple regression coefficient is still $r_{1,9} = +.7480$. The point is, the variable X_9 when used alone with X_{15} apparently neutralizes the variation accounted for by X_{15}.

From an _a priori_ economic point of view, the variable X_9, measuring the ratio of row crops to total land in farms, is a peculiar variable. On the one hand it appears to be a good indicator of a farmer's behavior in reaction to changes in his income. On the other hand it appears to be a good indicator of land production capability, and for this reason is useful in explaining variation in beef cow numbers. It fits on either side of the equation and perhaps this should be sufficient justification for omitting it altogether.

VI. CONCLUSION

From the time of its inception in 1830, the Iowa property tax has continued to decline in relative importance. There has not been a great change, however, in the ratio of personal to real property tax revenue. Personal property tax revenue has ordinarily accounted for around 14-20 percent of total property tax revenue. In spite of a decline relative to other forms of revenue, the total amount collected annually from property tax levies has steadily increased. This is the result of a greater demand for public services at all levels of government. Not only have the federal and state governments assumed greater fiscal responsibilities but local governments, which receive a major proportion of their funds from property taxes, have also increased their expenditures.

In Iowa a substantial percent of the property tax revenue comes from the agricultural sector. The Iowa farmer is not in a very good position to shift property taxes either forward to the consumer or backward to the seller of farm inputs. The characteristics of the demand for farm products do not permit a farmer to raise the selling price of his output independently of other farmers. The incidence of a tax on land or on beef cows will generally fall upon the owner of the asset. There is not much evidence that land owners, when a change in taxes is imposed, will have to bear the full burden of capitalization because land values have not decreased commensurate with tax increases. The trend has been toward higher rather than lower land values in the face of increasing taxes.

The intensity of labor input as taxes change will depend upon each farmer's reaction to changes in income. Taxes such as the real estate levy which reduces a farmer's income by a fixed amount will probably impel him to work harder to regain his lost income. On the other hand, the imposition of a tax upon a farmer's income will not always produce a uniform effort to increase the labor input. The substitution effect of a tax on additional increments of income, that induce a farmer to desire more leisure, may outweigh the desire to work harder in order to regain lost income. In this respect, there is no technique for anticipating the behavior of individual farmers.

The degree of risk a farmer is willing to assume is also determined by his particular aversion to risk. Each farmer will have his own marginal disutility of risk and marginal utility of income and the enterprise he selects will reflect this. Assuming decreasing marginal utility of income and increasing marginal disutility or risk, a higher tax per head on beef cows would lower the net income from cows and encourage a shift into higher risk enterprises. However, the empirical tests do not bear this out.

Using empirical data to explain variations in farm enterprises can produce some vague results. For purposes of regression analyses, there are no obvious measures of the intensity of land use which can be used to categorize farm enterprises. To serve this purpose we used as dependent variables two measures, the number of beef cows per acre and the ratio of row crops to total farm land in each county. The latter of these variables was also used as a measure of land quality and included as an independent variable in the regressions on beef cow numbers. As expected, the tests attributed a great deal of the variation in beef cow numbers to the quality of the land. In addition to land quality a number of other explanatory variables were included. Farm size, the level of personal and real property taxes, the ratio of the value of buildings to land and buildings, and the percent of farm tenancy were all included. None of these, including the variables of interest--property tax levels, were particularly good indicators of the type of farm enterprise selected as measured by beef cow numbers. In other words, the regression analyses do not support the hypothesis that high personal property taxes are an obstacle to the transition of resources into beef cow production.

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IX. APPENDIX A

The first step toward arriving at the final millage levy for each taxing district is to determine the revenue requirements for each of the four major local government functions, school funds, county road maintenance, city and town funds and the county general fund. Of these four categories, the general fund is the only one in which the tax bill is spread uniformly over all property in the county both rural and urban.

Within the general fund, certain appropriations, such as the auditor's fund, must be raised with a mill rate that is limited by state statutes. Assuming that these mill rates are as high as they can go within the limits of the state laws, in order to increase the revenue for such funds the tax base must be enlarged by raising assessed property values over the entire county. For example, if the state limits the mill rate for the auditor's fund at 2 mills and the auditor needs $4000 on which to operate, the tax base would have to be at least $2,000,000 ($4000/.002 = $2,000,000).

From this it is apparent that the county assessor must keep in the back of his mind the needs of the county general fund each time he assesses property in his county. Part of the fluctuations that arise in the county general fund are explained by the fluctuations in the tax base.

Does this mean that the different revenue requirements that arise among school districts are raised by varying the assessment level or the tax base within each school district? The answer is no. School revenues are determined by using the tax base that is settled upon for purposes of the general fund and the necessary mill rate for each school district is determined by dividing the needed revenue for the school in that district by the total assessed value of all property within the school district. This quotient (or millage) is then added to the millage for the general fund.

The mill rate for raising urban funds and the mill rate for county roads are determined in the same manner used in calculating the rate for school districts. These levies are also added to the school and general fund levies to determine the total millage for each taxing district. It must be kept in mind, however, that the revenue for county roads is raised from the rural districts only and the revenues for urban areas is raised within the corporate limits of the city or town.

To summarize by illustration, a typical rural tax district would be required to contribute revenue for the county general fund and the county road fund. The rates for each being uniform throughout the county. In addition, each rural district would have a unique school levy and the different school mill rates account, in large part, for the variation in taxes that exist between school districts. Likewise, an urban district would be responsible for the general fund, its unique school levy and the urban taxes.

The assessor's main problem therefore is to (1) give consideration to all factors that determine the value of property and (2) bear in mind the county revenue needs when arriving at the actual value of property. When the actual value is determined for personal property, he then takes 60 percent of this to arrive at the assessed value. In practice, the actual value does not represent what the property would bring if put up for public auction but it too is a percent of the market or sale value. For example, the actual value of cows 3 years old and over as listed in the 1964 Iowa Personal Property Price Guide (14b) is $90 and assessed value therefore is $54. Obviously, the market value of most cows is well above $90 but this figure has been calculated to raise sufficient revenue and apparently it is not considered out of line when compared to other assessed property.

X. APPENDIX B

Table 10. Correlation matrix

Variable	1	2	3	4	5	6
1	+1.0000					
2	+.3669	+1.0000				
3	-.0927	-.2040	+1.0000			
4	-.6470	-.4327	+.4920	+1.0000		
5	+.0790	-.0825	-.1762	-.0112	+1.0000	
6	+.4822	+.1888	-.3137	-.6632	+.1950	+1.0000
7	+.5328	+.7763	-.3294	-.7074	+.0705	+.6754
8	-.5679	-.0631	+.4710	+.7754	-.3551	-.5539
9	-.7480	-.4895	+.3417	+.9243	+.0662	-.6980
15	+.3817	+.9926	-.2102	-.4318	-.0774	+.1879
16	+.1463	-.2709	+.6612	+.4514	-.0371	-.2111
17	-.5816	-.5083	+.3815	+.8687	+.2277	-.5452
18	+.0012	+.2574	-.1727	-.3259	-.4976	+.0655

Table 10. (Continued)

Vari-able	7	8	9	15	16	17	18
7	+1.0000						
8	-.3975	+1.0000					
9	-.7464	+.6990	+1.0000				
15	+.7803	-.0656	-.4912	+1.0000			
16	-.3538	+.3107	+.2630	-.2764	+1.0000		
17	-.6666	+.5967	+.8982	-.5058	+.3970	+1.0000	
18	+.1707	+.0389	-.3558	+.2516	-.3231	-.4959	+1.0000

XI. APPENDIX C

Variables

1. Number of stock cows per acre

2. Mill rate for county rural districts

3. Average corn yield

4. Cash value output per acre

$$\frac{\text{(corn produced (\$1) + soybeans produces (\$2.15))}}{\text{Total acres in farm land}}$$

5. Average farm size

6. Ratio of assessed value to market value per acre of land and buildings

7. Taxes per acre as a percent of market value per acre

8. Real estate tax bill per acre

9. Row crops as a percent of total acres in farm land (intensity)

15. Tax bill per cow in dollars

16. Average soybean yield

17. Percent of tenancy on farms

18. Percent of buildings to land and buildings (assessed values)

Table 11. County data

	X_1	X_2	X_3	X_4	X_5	X_6
	Per (100 Acres)	(Mills)	(Bushels)	(Dollars)	(Acres)	(%)
Northwest						
Buena Vista	1.5	61.722	77.9	37.18	199	23
Cherokee	1.7	55.201	81.6	34.45	223	24
Clay	1.7	55.847	75.4	34.66	229	22
Dickinson	2.0	65.707	63.2	27.89	235	26
Emmet	1.6	60.610	71.2	36.12	320	25
Lyon	1.6	55.494	68.1	29.47	214	23
O'Brien	1.0	51.923	77.8	39.59	204	22
Osceola	1.1	56.481	70.3	34.10	212	21
Palo Alto	1.3	63.825	69.0	35.52	277	28
Plymouth	2.1	48.720	74.4	30.49	218	26
Pocahontas	1.4	54.165	76.2	40.35	219	22
Sioux	.6	53.630	79.5	37.84	185	22
North Central						
Butler	1.8	64.979	74.5	30.62	187	24
Cerro Gordo	2.0	63.041	73.5	31.06	201	21
Floyd	1.9	70.645	77.4	31.72	189	29
Franklin	1.7	50.060	70.8	37.67	198	21
Hancock	1.7	62.246	69.1	32.24	206	20
Humbolt	1.1	60.670	81.9	42.19	217	23
Kossuth	1.5	53.877	74.1	37.38	217	22
Mitchell	1.2	59.649	72.0	29.24	200	23
Winnebago	1.3	68.099	73.9	32.52	176	21
Worth	1.7	69.304	68.3	28.67	192	20
Wright	1.2	51.678	77.5	40.83	210	22
Northeast						
Allamakee	3.5	62.861	71.2	9.26	214	32
Black Hawk	1.4	66.580	83.8	31.94	170	23
Bremer	.6	73.675	71.3	23.69	150	27
Buchanan	1.7	70.553	70.7	23.36	169	24
Chickasaw	2.2	62.853	64.3	20.64	176	28
Clayton	2.0	71.170	62.8	11.59	183	32
Delaware	1.2	61.466	72.2	21.40	171	30
Dubuque	2.4	40.020	75.4	16.42	181	32
Fayette	1.6	60.610	71.2	36.12	320	25
Howard	2.5	66.955	54.8	17.01	195	26
Winneshiek	2.7	66.650	62.2	12.79	174	30

Table 11. (Continued)

	X_1	X_2	X_3	X_4	X_5	X_6
	Per (100 Acres)	(Mills)	(Bushels)	(Dollars)	(Acres)	(%)
West Central						
Audubon	2.8	69.404	81.8	24.88	191	28
Calhoun	2.2	56.598	81.8	42.86	218	21
Carroll	3.0	42.435	83.7	9.58	194	22
Crawford	3.2	63.810	79.0	23.12	214	28
Greene	2.1	58.864	83.3	42.78	239	25
Guthrie	4.2	75.497	77.2	21.98	208	27
Harrison	1.9	72.162	79.7	28.18	228	28
Ida	2.4	63.271	83.7	31.31	218	26
Monona	1.4	73.235	68.5	25.30	276	29
Sac	2.6	56.810	80.1	34.24	214	25
Shelby	2.6	54.258	83.7	29.15	204	26
Woodbury	1.7	73.389	68.3	24.25	202	31
Central						
Boone	1.2	59.257	85.8	38.82	183	25
Dallas	2.5	60.134	83.4	35.20	202	24
Grundy	2.4	56.505	86.9	40.61	193	24
Hamilton	1.0	61.502	81.6	44.10	195	23
Hardin	2.0	61.185	84.2	37.54	188	24
Jasper	3.5	68.577	81.0	27.94	194	21
Marshall	3.5	61.943	86.3	34.07	191	24
Polk	1.9	92.047	81.4	34.19	164	21
Poweshiek	4.9	68.030	85.2	27.32	199	27
Story	1.4	71.456	84.2	40.76	192	23
Tama	4.0	55.488	86.1	29.06	195	24
Webster	1.8	67.472	81.5	41.80	209	21
East Central						
Benton	3.6	62.150	88.2	32.63	206	23
Cedar	3.3	64.587	91.8	34.28	181	25
Clinton	2.2	67.560	89.5	33.22	176	21
Iowa	5.2	62.549	81.6	23.43	207	25
Jackson	4.5	69.617	80.7	15.54	206	27
Johnson	4.1	75.537	81.1	24.98	172	22
Jones	2.7	73.617	84.2	23.77	185	25
Linn	2.6	75.996	75.5	24.93	145	26
Muscatine	2.7	66.529	82.2	28.39	188	21
Scott	2.3	69.151	79.1	37.00	147	21

Table 11. (Continued)

	X_1	X_2	X_3	X_4	X_5	X_6
	Per (100 Acres)	(Mills)	(Bushels)	(Dollars)	(Acres)	(%)
Southwest						
Adair	5.8	69.202	74.6	18.91	214	31
Adams	5.2	63.952	73.6	17.74	221	36
Cass	4.3	62.206	81.8	24.36	209	31
Fremont	2.2	67.338	73.6	31.86	267	28
Mills	1.9	59.925	76.9	31.96	253	26
Montgomery	3.2	56.499	79.7	26.64	217	28
Page	3.5	60.908	71.3	23.49	212	32
Pottawattamie	1.8	62.887	80.0	30.01	204	26
Taylor	5.1	67.432	64.8	14.41	207	33
South Central						
Appanoose	4.7	74.981	61.4	11.40	204	28
Clarke	5.4	78.731	61.3	11.14	235	30
Decatur	4.6	78.665	54.5	8.35	244	35
Lucas	4.6	80.114	61.1	10.37	224	30
Madison	5.5	66.753	77.8	18.81	214	27
Marion	3.1	72.010	75.1	19.96	185	29
Monroe	4.3	75.030	57.5	8.76	228	31
Ringgold	4.9	87.864	85.2	10.42	262	27
Union	5.6	67.038	65.7	14.08	223	28
Warren	3.9	89.031	71.5	19.03	201	24
Wayne	5.0	68.956	57.7	12.23	246	27
Southeast						
Davis	3.7	80.495	66.3	11.12	209	27
Des Moines	3.5	77.170	90.5	32.68	167	24
Henry	3.2	73.886	79.5	27.27	178	22
Jefferson	3.3	66.244	69.2	19.91	186	26
Keokuk	3.8	63.150	76.1	24.74	188	29
Lee	2.7	74.557	77.9	20.31	178	22
Louisa	2.9	75.453	78.6	30.42	224	22
Mahaska	2.7	57.102	82.6	29.62	167	27
Van Buren	3.9	83.191	74.5	14.67	211	27
Wapello	3.2	82.915	69.7	18.57	149	27
Washington	2.5	63.639	80.1	30.07	191	26

Table 11. (**Continued**)

	X_1	X_2	X_3	X_4	X_5	X_6
	Per (100 Acres)	(Mills)	(Bushels)	(Dollars)	(Acres)	(%)
ΣX_i	270.517	6500.944	7433.5	2666.958	20045	2544
$\bar{X}$	2.73		75	26.94	202.5	25.7
S	1.3		9.5	9.48	29.7	3.58
$C = \frac{S}{\bar{X}}$	.50		.13	.33	.15	.14

Table 11. (Continued)

	X_7	X_8	X_9	X_{15}	X_{16}	X_{17}	X_{18}
	(%)	(Dollars)	(%)	(Dollars)	(Bushels)	(%)	(%)
Northwest							
Buena Vista	.014	4.57	53	3.54	28.1	65	12
Cherokee	.013	3.94	47	3.16	30.3	35	28
Clay	.013	3.93	51	3.24	28.1	61	14
Dickinson	.014	3.86	38	3.94	23.8	62	23
Emmet	.015	4.30	56	3.46	27.0	65	21
Lyon	.012	3.76	47	3.16	26.1	63	15
O'Brien	.012	4.03	56	2.98	29.0	67	17
Osceola	.013	3.83	54	3.22	25.1	66	21
Palo Alto	.016	4.49	56	3.64	26.9	58	13
Plymouth	.012	3.35	43	2.79	29.7	55	17
Pocahontas	.013	4.24	60	3.10	26.5	68	15
Sioux	.012	4.18	52	3.06	29.7	63	20
North Central							
Butler	.016	4.17	44	3.69	26.2	55	25
Cerro Gordo	.013	4.15	47	3.59	24.1	55	32
Floyd	.020	5.47	46	4.02	25.4	49	23
Franklin	.013	4.30	52	3.35	26.6	55	26
Hancock	.013	4.28	53	3.57	22.8	62	22
Humbolt	.013	4.65	58	3.48	27.7	67	20
Kossuth	.012	3.91	57	3.08	25.7	64	18
Mitchell	.014	3.61	46	3.41	24.2	48	30
Winnebago	.015	4.63	49	3.88	25.0	54	25
Worth	.015	4.08	49	3.95	21.2	52	28
Wright	.012	4.20	58	2.96	27.3	69	24
Northeast							
Allamakee	.019	2.21	15	3.59	22.4	26	37
Black Hawk	.015	4.84	40	3.56	30.6	50	29
Bremer	.019	5.01	37	4.21	24.2	38	38
Buchanan	.017	4.05	37	4.02	24.0	39	30
Chickasaw	.016	3.37	37	3.59	20.8	35	28
Clayton	.022	3.70	20	4.06	21.4	32	40
Delaware	.017	4.02	32	3.51	22.8	40	36
Dubuque	.011	2.42	23	2.28	26.1	26	34
Fayette	.015	4.30	56	3.46	27.0	65	21
Howard	.016	3.14	36	3.81	19.1	39	33
Winneshiek	.020	3.21	24	3.80	19.6	31	29

Table 11. (Continued)

	x_7	x_8	x_9	x_{15}	x_{16}	x_{17}	x_{18}
	(%)	(Dollars)	(%)	(Dollars)	(Bushels)	(%)	(%)
West Central							
Audubon	.019	4.27	32	3.98	28.8	45	23
Calhoun	.013	4.62	60	3.26	28.8	72	17
Carroll	.010	3.10	45	2.42	30.3	56	23
Crawford	.018	3.77	30	3.66	28.5	51	21
Greene	.015	4.61	57	3.42	29.6	70	14
Guthrie	.019	3.72	31	4.30	27.8	44	20
Harrison	.019	3.47	38	4.13	27.2	53	26
Ida	.017	4.50	40	3.63	29.9	60	13
Monona	.020	3.81	41	4.28	21.7	55	27
Sac	.013	5.34	44	3.84	33.3	41	36
Shelby	.014	3.75	36	3.10	28.9	54	18
Woodbury	.021	4.40	39	4.19	21.1	45	17
Central							
Boone	.015	4.85	50	3.38	30.0	60	21
Dallas	.014	4.19	47	3.44	29.1	60	24
Grundy	.013	4.80	50	3.24	30.9	63	23
Hamilton	.015	5.29	60	3.57	28.8	67	22
Hardin	.015	4.71	48	3.49	29.0	60	23
Jasper	.016	3.96	36	3.91	29.8	54	24
Marshall	.015	4.61	42	3.56	30.5	61	20
Polk	.016	6.00	48	5.24	27.8	58	33
Poweshiek	.018	4.34	34	3.88	31.6	52	26
Story	.015	5.40	53	4.09	29.8	66	20
Tama	.014	3.94	36	3.15	29.2	49	24
Webster	.015	5.15	58	3.84	28.4	65	16
East Central							
Benton	.015	4.84	40	3.56	30.6	50	29
Cedar	.015	5.04	39	3.73	31.3	48	28
Clinton	.015	4.35	39	3.88	28.2	50	32
Iowa	.015	3.53	31	3.64	27.2	40	32
Jackson	.018	3.22	20	3.98	26.0	30	29
Johnson	.016	4.82	32	4.07	30.1	37	31
Jones	.019	4.31	30	4.23	28.0	42	30
Linn	.017	5.53	36	4.37	25.6	42	38
Muscatine	.014	4.18	38	3.80	24.9	48	30
Scott	.013	5.34	44	3.84	33.3	41	36

Table 11. (Continued)

	X_7	X_8	X_9	X_{15}	X_{16}	X_{17}	X_{18}
	(%)	(Dollars)	(%)	(Dollars)	(Bushels)	(%)	(%)
Southwest							
Adair	.021	3.43	27	4.16	28.4	44	22
Adams	.020	2.95	25	3.62	30.2	43	15
Cass	.018	3.77	31	3.62	29.1	45	18
Fremont	.017	3.80	45	3.85	31.2	61	25
Mills	.014	3.54	44	3.25	30.7	58	24
Montgomery	.014	3.38	35	3.23	30.2	54	36
Page	.017	3.68	34	3.51	29.7	47	23
Pottawattamie	.016	4.07	39	3.58	29.2	54	24
Taylor	.022	3.14	23	3.90	27.3	38	20
South Central							
Appanoose	.020	2.06	20	4.27	25.9	28	24
Clarke	.024	2.47	19	4.59	25.7	37	23
Decatur	.023	2.16	16	4.50	24.4	35	23
Lucas	.023	2.55	18	4.57	25.1	30	25
Madison	.017	2.97	27	3.86	28.9	35	27
Marion	.022	3.79	29	4.13	27.3	41	23
Monroe	.020	1.85	16	4.28	25.4	24	22
Ringgold	.023	2.58	19	5.03	24.8	36	16
Union	.017	2.47	22	3.83	27.4	40	21
Warren	.022	4.15	30	5.20	26.5	42	32
Wayne	.019	2.09	22	3.94	25.2	30	22
Southeast							
Davis	.021	2.28	19	4.66	24.6	27	24
Des Moines	.016	4.68	40	4.39	30.1	43	26
Henry	.016	4.30	37	4.25	28.7	40	18
Jefferson	.018	3.24	31	3.79	27.2	35	23
Keokuk	.016	3.30	35	3.64	28.4	47	24
Lee	.017	3.05	29	4.26	26.0	28	24
Louisa	.016	4.16	43	4.29	26.3	46	18
Mahaska	.014	3.62	38	3.26	30.3	46	25
Van Buren	.021	2.61	23	4.78	25.4	25	24
Wapello	.020	3.87	29	4.73	26.8	33	34
Washington	.016	4.31	40	3.64	31.2	49	28

Table 11. (Continued)

	X_7	X_8	X_9	X_{15}	X_{16}	X_{17}	X_{18}
	(%)	(Dollars)	(%)	(Dollars)	(Bushels)	(%)	(%)
ΣX_i	1.625	387.51	38.2	372.80	2685.3	4832.6	2397.2
$\bar{X}$	.0164	3.91	38.6	3.77	27.12	48.8	24.21
S	.0031	.8565	.1196	.5305	2.97	12.597	6.16
$C = \frac{S}{\bar{X}}$	.19	.22	.38	.14	.11	.26	.26