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## ALTERNATIVE METHODS OF ACCOUNTING FOR LIVESTOCK CAPITAL FORMATION: AN APPLICATION TO SOUTHERN U.S. AGRICULTURE\*

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### INTRODUCTION

This paper presents empirical estimates of livestock capital formation and disposition on farms in 14 southern U.S. states during 1974.<sup>1</sup> Livestock capital is defined to include dairy and beef breeding cows.<sup>2</sup> Concern with measuring the formation and disposition of livestock capital stems from the demand for knowledge of its importance as farm input, output and investment and from its inconsistent treatment given it in current USDA statistical series and the subsequent impact on farm income measurement.<sup>3</sup>

The objectives of this study are to present new information on dairy and beef cow capital formation and disposition via development of a cow capital flows account, and to provide a perspective on the importance of this information by incorporating it into estimates of farm income.

### COW CAPITAL FLOWS

Presently, a significant amount of unrecorded and confusingly classified livestock production and utilization takes place within the farming sector. This arises from the statistical recording of all livestock production activities as current account activities. For

slaughter animals or those utilized within one accounting period this is satisfactory, but for cattle used to produce milk and calves, such treatment is inconsistent with that given other capital items.

During 1974, Economic Research Service sponsored surveys to begin measuring capital formation in the cattle sector. This information supplements regular SRS cattle reports, enabling separation of cattle production into its uses as intermediate input into current production, inventory changes and home consumption; but it tells little about cattle capital formation and subsequent utilization. Currently, SRS reports beginning and ending annual inventories for many types of livestock (Table 1).

Such reports, however, provide no information on the actual number (gross flows) of animals moving into and out of each class.<sup>4</sup> It is these and other flows that should be quantified in order to define beef and dairy cows as capital items. Estimated gross additions to beef and dairy cow herds are derived from the new survey data. These additions represent entry into the dairy or beef breeding herd of new animals (first-calf) from the replacement herd (Table 2).

Value changes reflect differences in both price and quantities, but in this instance, negative price change completely overshadows positive quantity change. The price effect is clearly shown by the

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\*The views expressed are the authors' and do not necessarily represent those of the U.S.D.A.

<sup>1</sup>These states include Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.

<sup>2</sup>While this paper is restricted to dairy and beef breeding cows, similar consideration could be accorded other livestock held for breeding, such as bulls, hogs, or sheep as well as nonlivestock home produced capital such as homebuilt machinery, buildings or land improvements. See [10].

<sup>3</sup>The nature of the problem of "own account" capital formation, of which dairy and beef cows are just a part, and its potential impact on USDA statistical series are discussed in more detail in [9], [10].

<sup>4</sup>Gross inflows must be known to properly identify all investment activity. Adding a beef cow to a herd, for example, is a conceptually different investment than adding a slaughter heifer or steer. The type and amount of expenses accruing are different, and the actual return differs in pattern and form, e.g., the possibility of obtaining a calf.

**TABLE 1. CATTLE INVENTORY NUMBER CHANGES, SOUTHERN UNITED STATES, 1974<sup>1</sup>**

	January 1, 1975	January 1, 1974 -1000 head-	Net addition
Milk cows	2,171	2,215	-44
Beef cows	21,285	19,307	1,978
Milk cow replacements	671	664	7
Beef cow replacements	4,363	3,713	650
<b>TOTAL</b>	<b>28,490</b>	<b>25,899</b>	<b>2,591</b>

<sup>1</sup> From [6, pp. 6-8].

change in value due to price. This number measures the difference in value of the lesser inventory quantity when weighted by beginning and end of period prices.

Table 2 represents a simple but important expansion of published SRS inventory changes. It clearly demonstrates, with \$1.022 billion in new investment, that a substantial amount of livestock production and utilization information is not clearly reported in published series. Although the new information is an important addition to basic inventory data, it does not fully describe flows into the capital account for dairy and beef cows.

To better describe these capital flows, the

**TABLE 2. COW INVENTORY CHANGES AND ADDITIONS, NUMBERS AND VALUES AS COMPARED TO GROSS FLOWS, SOUTHERN UNITED STATES, 1974**

Jan. 1, Inventory	Number (1000 head)	Value (mil. dol.)	Number (1,000 head)	Value (mil. dol.)
1975 1	21,285	4,170	2,171	779
1974 1	19,307	6,845	2,215	959
Change	1,978	-2,675	-44	-180
Changes due to price 2	-	-3,060	-	-162
Gross addition 3	3,198	895	283	127

<sup>1</sup> Prices used for valuation computed using simple averages, by state, of the Dec. 15 and Jan. 15 prices given in [7], for those months. Quantities from Table 1. Beef cows are assumed to weigh 1000 pounds each. Dairy cows are priced on a per-head basis.

<sup>2</sup> The lesser of the Jan. 1, 1974 or Jan. 1, 1975 inventory valued at Jan. 1, 1975 prices, less the same quantity valued at Jan. 1, 1974 prices. This number represents the capital gains or losses on animals remaining in the herd throughout the entire period.

<sup>3</sup> Gross inflow of animals into these herds. Actual numbers given by survey results. Market price used for dairy cows is the price per head received by farmers for replacements in each state. Beef cow price is the price received by farmers for all slaughter cows. Both prices are found in the [7]. Beef cows are assumed to weigh 1000 pounds each.

authors propose a cow capital flows account (Table 3). The capital flows account framework is a commonly accepted method of presenting and organizing data on the sources of formation and disposition of production capital.<sup>5</sup> The format of the account is the gross capital formation-gross capital disappearance identity. Gross capital disappearance is the sum of capital consumption and sale to slaughter. Gross capital formation is the sum of fixed capital formation, net inventory changes and net capital disappearance. Net capital disappearance is a balancing item accounting for the difference between gross capital disappearance and the sum of fixed capital formation and net inventory changes. By definition, gross capital formation must equal gross capital disappearance.

**TABLE 3. CAPITAL FLOWS ACCOUNT FOR BEEF AND DAIRY COW HERDS, SOUTHERN UNITED STATES, 1974**

-millions of dollars-			
A. Fixed capital formation 1	-2,200	D. Fixed capital consumption 3	498
1. Additions to cowherds	1,022	1. Beef	393
a. Beef	895	2. Dairy	105
b. Dairy	127	E. Sales of cows for slaughter 4	418
2. Valuation adjustment	3,222	1. Beef	380
a. Beef	-3,060	2. Dairy	38
b. Dairy	-162		
B. Net additions to replacements inventory 2	174		
1. Beef	172		
2. Dairy	2		
C. Net capital disappearance	2,942		
1. Beef	2,766		
2. Dairy	176		
Gross capital formation	916	Gross capital disappearance	916

<sup>1</sup> All fixed capital formation estimates are derived and explained in Table 2.

<sup>2</sup> Value of physical change in replacement inventories. Quantities are from Table 1 valued at the 1974 state average slaughter price for 750 pound steers and heifers from [7].

<sup>3</sup> Straight line depreciation over six years on difference between market value and assumed \$125 salvage value. Market price used for dairy cows is the price received by farmers for replacements in each state. Beef cow price is the price received by farmers for all slaughter cows. Both prices series are found in [7].

<sup>4</sup> Quantities are derived from special survey. Market prices for both dairy and beef cows are the annual average state price received by farmers for all slaughter cows from [7]. Both dairy and beef cows are assumed to weigh 1000 pounds each.

<sup>5</sup> The basic justification and format for capital flows accounts are found in [1], [3], [10]. An application of capital flows accounting is found in [2].

Fixed capital consumption measures the quantity of capital consumed in the production of output during 1974. Present statistical series deduct the entire value of purchased cows at time of purchase and of home-produced cows during their development period. This is incorrect treatment for capital items. For both dairy and beef cows, depreciation is calculated on the average of beginning and ending inventory numbers, on the assumption that all additions and subtractions to the herds occur uniformly throughout the year. Straight line depreciation is estimated on the difference between the replacement value and an assumed salvage value of \$125 per head. On the advice of USDA dairy and beef specialists, a six-year useful life is assumed. Using this procedure, capital consumption is estimated at about one-half billion dollars.

Sales of dairy and beef cows measure only those sold from the farm sector for slaughter. Cow sales among farmers for use in breeding herds are not measured. Intrafarm transactions are assumed to cancel. Estimates of 1,533 thousand beef cows and 155 thousand dairy cows sold for slaughter are derived from special summary data.<sup>6</sup> Their total value is estimated at \$418 million.

On the gross capital formation side, the first component of fixed capital formation is the value of additions of first-calf dairy and beef heifers from the replacement herd (Table 2). These replacements may be purchased from other farmers or raised on his own places. The distinction is important in later discussion of farm income measurement. For ease of presentation, however, the focus will be on total replacements, regardless of source. According to survey results, about 3.5 million new heifers were added to southern herds in 1974 (Table 2; 3.2 million beef heifers and .3 million dairy heifers) at a total value of just over a billion dollars.

The other component of fixed capital formation is the valuation adjustment; that is, the change in value of the herds arising solely from a change in price. As suggested earlier, this negative price effect completely overwhelms the quantity effect, resulting in a \$2.2 billion decline in the value of fixed capital formation.

The second major element in gross capital formation is the value of net additions to replacement inventories. This figure quantifies the value of the annual change in the number of heifers, 500 pounds and over, to be added to cow herds in future years. During 1974, survey results suggest that 650 thousand beef heifers and seven thousand dairy

heifers were added to replacement inventory. These replacement heifers are assumed not to be fixed capital formation. Instead, they are considered current goods-in-process (albeit capital goods). As such, they are considered inventory items and, as the capital flows account includes an inventory of current account items, we record them there. Similar treatment is given to unfinished industrial plants in the national accounts.

The final element in gross capital formation is net capital disappearance. In a completely and accurately-specified capital flows account, net capital disappearance measures whether the value of farm capital livestock is greater (negative) or smaller (positive) than the year before. Accordingly, the value of southern farmers' dairy and beef cow and replacement herds declined by \$2.9 billion in 1974. This was due to the severe decline in livestock prices and the small decrease in dairy cow numbers.

#### IMPLICATIONS FOR FARM INCOME ESTIMATES

How important are these findings in the overall picture of farm economic activity in the South? In other words, how much will farm income estimates change if the capital flows information is included into the present *Farm Income Statistics (FIS)* system? The information in Table 4 shows that these

TABLE 4. INCOME FROM FARMING FOR SOUTHERN UNITED STATES UNDER DIFFERENT CONCEPTS, 1974

Item	Current 1	Adjustment	Alternative
	concept		concept
	-million dollars-		
Cash receipts from farm marketings	25,310	-561	24,749
Government payments to farmers	194	-	194
Other farm income	283	-	283
Nonmoney income	2,157	2,200	-43
Realized gross farm income	27,944	-2,761	25,183
Farm production expenses	21,561	355	21,916
Farm operators' realized net income	6,383	-3,116	3,267
Net change in farm inventories 2	971	-534	437
Farm operators' total net income	7,354	-3,650	3,704

<sup>1</sup> Farm income account framework and all estimates are found in [4] and [5].

<sup>2</sup> Value is computed on the physical changes in inventories of dairy and beef cows from Table 1 and the dairy replacement prices and cow slaughter prices used previously.

<sup>6</sup> Supplement A, December 1974 Enumerative Survey, Statistical Reporting Service, USDA.

flows may be very important to the southern farm economy. If only cow capital flows from Table 3 are incorporated into the present system, total net farm income for these 14 southern states would decline by half.

Analytically, the more useful information is why including the new information makes this dramatic change. To better analyze this comparison, Table 4 was constructed to present a simple definition of the present method of estimating farm income, the adjustments made necessary using the cow capital flows, and the resulting adjusted estimates. All the basic component series which comprise farm income measures are affected except government commodity program payments to farmers and other farm income.

Cash receipts from farm marketings is money received from the sale of characteristic farm outputs. In the present system, this includes sales of dairy and beef cows among farmers and by them to other sectors. Including cow sales in current account receipts biases the estimate of the sale of current output upward. According to survey results (Table 3), \$418 million in extra-sectoral slaughter sales occurred during the year. In addition, farmers sold \$252 million worth of first-calf herd replacements.<sup>7</sup> However, not all this amount can be deducted from cash receipts. The reason is that *FIS* cattle receipts estimates include only interstate livestock sales. All intra-state sales are assumed to be among farmers and therefore cancel. The problem, then, is estimating interstate sales of young replacement animals. To generate this estimate, *FIS* information on interstate livestock purchases was combined with Census of Agriculture estimates of total livestock purchases during 1970 to derive a ratio of interstate to total livestock purchases.<sup>8</sup> This ratio, .569, is applied to total replacement sales (purchases) for 1974 to yield an interstate estimate of \$143 million. Combining slaughter sales with interstate replacement sales gives a total decrease in cash receipts of \$561 million.

In the present system, realized nonmoney income measures the value of home-produced food and fuel and the imputed rental value of farm dwellings. To this, the value of fixed capital formation (minus \$2,200 million from Tables 2 and 3) was added on the assumption that real wealth changes are income and therefore should be included in the income statement. Another reason is that since capital disappearance through depreciation as an expense to balance the account is being measured, capital

acquisition should also be measured. Presently this is not done, but if it were, farm income accounts would be conceptually more closely linked to capital stocks account in the *Balance Sheet of the Farming Sector*. The large negative addition of fixed capital formation more than offsets nonmoney income from other sources, leaving net negative nonmoney income of \$43 million.

The increase in farm production expenses is the net effect of opposite changes in two expenditure components. The first component is reduction in the expense category "livestock purchases" owing to the purchase of cow replacements. This accounts for less than two percent of total livestock purchases and simply offsets the livestock cash receipts for the sale of interstate replacements (\$143 million) deduction discussed earlier. The other item is consumption of farm capital. Added depreciation is \$498 million, a 17 percent increase. The net effect is a \$355 million increase in farm production expenses.

The difference between farm operators' realized and total net income is the value of the net change in farm inventories. Inventory changes generally measure the value of changes in the quantities on hand of finished output, raw materials and works-in-process. Dairy and beef cows as capital items should not be included, whereas replacement herd heifers should be included. In the present system all livestock is included. If value of the change in beef and dairy cows is deducted, value of changes in farm inventories declines by 55 percent.

Total impact of above adjustments radically changes current estimates of farm income. Income declines from \$7.4 million to \$3.7 billion. Interpreting these values requires substantial caution, however. There are three reasons. First, changes in the income picture demonstrated apply to only one year, in this case 1974. The magnitude and direction of the difference between the current and alternative concept of measuring farm income may differ greatly in other years. Second, some may question the advisability and even the legitimacy of including capital gains, i.e., the valuation adjustment resulting from price changes, in the capital flows and income accounts. The impact of these price changes on some of the results of this study is quite substantial. By eliminating valuation adjustments, the value of breeding herd capital formation (Table 3) increases from \$-3,222 million to \$1,022 million. This results in a decrease in net capital disappearance from \$2,942

<sup>7</sup> Actually the survey estimated purchases of replacement cows rather than sales. For convenience sake we are assuming that purchases within the region equal sales, i.e. there are no net imports from other regions.

<sup>8</sup> Total livestock purchases were \$7,599 million [8] and interstate livestock purchases were \$4,324 million [4].

million to \$-280 million. Removing the valuation adjustment from nonmoney income in the income account (Table 4) reduces the income change from \$-3,650 million to \$-428 million, a five percent rather than a 50 percent decline in farm income.

It appears to be perfectly reasonable to include a separate estimate of the effect of price changes in a capital flows account. Capital gains is the logical companion to the value of physical additions. Together they make up the total change in the value of formation of capital stocks over a given time period. With respect to the income series, capital gains can be theoretically justified as a source of income and therefore can be included within the

account. However, like other income components, capital gains should be clearly identified so that they may be included or excluded to fit user needs.

Third, we have superimposed only capital account treatment of dairy and beef cows on the present farm income estimating system. Completeness requires that every other capital asset be given similar treatment. Doing so may provide a completely different farm income picture, which is not the purpose of this paper. Its purpose is to present new information on production and utilization of dairy and beef cows as fixed capital goods. An attempt was made to attach significance to the findings by demonstrating how they could be entered, reasonably and consistently, into estimates of farm income.

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