Estimating and Forecasting Imputations in U.S. Agriculture's Valued Added Accounts: The Case of Rent

By
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Abstract

Explicit rental income is a market-determined measure of the income farmers pay for the rental services they receive as tenants living in dwellings owned by others. Imputed rental income measures the income farmers "pay" for the rental services they receive as tenants living in dwellings which the farm operation owns. It is "imputed" in that its value is not directly observable in the marketplace. Including imputed rental income when accounting for the farm sector's value added increases the value of agricultural sector production and net farm income. The share of the value of agricultural sector production contributed by gross imputed rental value income is inversely related to the size of the farm operation. Both the income returns to farm business assets (ROA) and income returns to farm equity (ROE) are larger when omitting imputed rental income. However, including net imputed rental income stabilizes net farm income over time. Given that imputed rental income is a measure of economic activity rather than returns to farm business investment, the USDA does not include imputed rental income in its calculation of farm sector ROA and ROE.

Key Words: imputed rental income, net farm income, ROE, ROA.

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In this paper we introduce the concept of imputed rental income, explain how the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) measures it for the U.S. farm sector, and review Gardner's rationales for when to include and exclude this concept in different measures of farm sector profits. We use data obtained from USDA/ERS value added statements and balance sheets from 1910-2004 to examine the long run impact of imputed rental income on measures of farm profits and profitability. We use annual data from 1995-2004 to discuss the more recent short run impact that imputed rental income concept has had on these measures.

Understanding Imputed Rental Income in National Income Accounting

Rental income for the purpose of national income accounting is both explicit and implicit in form. For example, if Farmer Jones lives in Farmer Smith's dwelling and Farm Smith lives in Farmer Jones dwelling, both might pay rent to each other. The value of these rental services provided during this period is determined explicitly in the market place and measured by the amount of cash paid or the check written. The value of these explicit rental services produced that year is considered part of the nation's output of goods and services (GDP), either as part of net rental income or as a personal consumption expenditure.

In value added accounting for the U.S. farm sector, farmer operators who live in homes owned by the farm operation are regarded as wearing two hats. The first hat reflects their role as the landlord-owner. The second hat represents them in their role as the tenant-occupant. The concept assumes that owner-occupants are in the rental business and are renting the houses in which they live. This view is consistent with that used in the U.S. national income and product accounting for annual economic activity.

If Farmer Jones and Farmer Smith choose to live in their own dwellings, the same rental services are considered for the purpose of accounting for value added even though no money exchanges hands. In this case, no rental service has been explicitly valued by a market-place exchange.

The amount that would have changed hands had the owner and occupier been different persons is called imputed rental income. In many cases, an imputation called for in principle is not done in actual practice. In theory the imputed rent on farm machinery and equipment as well as home-cooked meals should be included in farm value added. For practical considerations, only the imputed net rental income from dwellings are included as part of the farm sector's measure of annual value of production. Value added accounting for the U.S. farm sector, as well as the Bureau of Economic Analysis for U.S. national income and product accounting, considers both explicit and implicit rent in the determination of economic value.

Farm operators who live in dwellings owned by the farm operation are considered to be in the rental business with themselves as their customers. This non-cash rental income is referred to as gross imputed rental income. Operators as landlords incur expenses and thus may have a profit or loss from their rental business. The difference between this gross rental income and the related expenses is referred to as net imputed rental income. Governments tax explicit but not implicit rental income. However, there have been arguments made in the academic literature supporting the adoption of a tax on implicit rental income (Bourassa and Hendershott).

Imputed Rental Income from Farm Dwellings

In the value added accounting approach to net farm income, ERS recognizes two forms of rental payments. The first is an explicit rental payment from farm operators as tenants to non-operator landlords. This is one of the three categories of payments to stakeholders which represents the difference between net value added and net farm income. The second is imputed rental income where the farm operator is both owner and tenant for the same dwelling. ERS applies the concept of imputed rental income to the operator's dwelling, hired labor dwellings, and other dwellings owned by the farm operation.

Gross imputed rental value of farm dwellings is rental income "earned" by the farm operator as the owner-occupant who as the landlord "rents" his/her dwelling to him/herself. Since no money changes hands there is no market-determined value, the value of the rent must be "imputed" by agricultural economists working for the ERS. For the purpose of value added accounting, gross imputed rental income is categorized as *revenues from services and forestry* and is used along with two other categories (value of livestock production and value of crop production) to calculate the farm sector's *value of agricultural sector production.*

ERS offsets this imputed rental income by expenses associated with the farm operators' dwellings: depreciation or capital consumption, insurance, interest, repair and maintenance, property taxes, and non-monetary compensation to hired labor. The difference between gross imputed rental value and associated expenses is called n*et imputed rental value of farm dwellings* and in theory can be positive, negative, or zero.

Calculating Imputed Rental Income for the U.S. Farm Sector

Each year the ERS makes two different estimates for farm sector dwelling values based on two different data sources: the ARMS survey and sector data. These two data sources are used to create national estimates (for the 48 continental states) of dwelling values both for farm operator dwellings and for all other dwellings owned by the farm operation.

To calculate *gross imputed rental income or value,* ERS allocates its national estimate for operator dwellings based on its annual ARMS survey for dwellings owned by the farm operation among 9 different and increasing ranges of dwelling value: under $20,000; $20-$40,000; $40-$60,000; $60-$80,000; $80-$100,000; $100-$120,000; $120-$150,000; $150-$200,000; and over $200,000. This allows the ERS to obtain the percent of total operator dwelling value for U.S farm sector falling into each of the nine categories for each year. The percentages for each of these nine value ranges obtained from ARMS data are then applied to the national estimate (for

the 48 contiguous states) for farm operator dwelling value obtained from sector data to estimate the total dollar value for the sector-derived U.S. estimate falling into each of the nine ranges of value.

The total dwelling value for each of the 9 ranges is then multiplied by the rent/value ratio for that range. These nine rent/value ratios are estimated every 10 years by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce (the last estimate being for 1991). These ratios are calculated by the BEA for urban dwelling values. The sum of the nine products of the rent-to-value ratios and their respective classes' total dwelling values give the annual estimate of gross imputed rental income for farm operator dwellings for the U.S. The same approach is used to estimate annual *gross imputed rental income for all other farm dwellings.*

Gross imputed rental income from labor dwellings not calculated in the same manner as above. Rather, it is set equal to non-monetary compensation of farm labor based on one question included in each year's ARMS survey which obtains from the operator-respondent the cash value of all commodities, feed, fuel, housing, meals, other food, utilities, vehicles for personal use, and any other non-cash payment for farm work, including meat, poultry, other livestock and livestock products, berries, firewood, fruits and vegetables, etc., and excluding home gardens (unless expenses were recorded previously in the survey) for workers who are not household members.

Gross imputed rental income is the total of the 3 sources of gross imputed rental income: farm operator dwellings, all other farm dwellings (relatives of farm owners and partners as tenants), and hired labor dwellings. In all 3 cases the dwellings must be owned by the farm operation as defined by the ARMS survey.

The expenses associated with the earning of imputed rental income from farm dwellings are placed into 6 expenditure categories (depreciation or capital consumption, insurance, interest, repair and maintenance, property taxes, and hired labor non-monetary compensation). In practice the expenses for farm dwellings are not separately accounted for but are included with similar expenses in the value added table.

The difference between gross imputed rental income and its associated expenditures is *net imputed rental income*.

The Purpose of Farm Income Data

In an article published in 1992 in the American Journal of Agricultural Economics, Bruce Gardner noted that USDA's farm income accounting serves two purposes: first, as a measure of farm household well being (in conjunction with income earned from off-farm sources); second, as a measure of returns to the farm business. He warned that these two purposes being served in the same accounting document would result in "conceptual ambiguity" and lead to a confusion of conversation between economists and farmers. Furthermore, net farm income in accounting for U.S. agriculture is not conceptually equivalent to net farm income under the more familiar financial accounting done for the individual farm, leading to even more confusion Gardner noted that farmers see farm income as returns to their efforts and investment in farming and that

inclusion of imputed income distorted measures of returns to farm business investment. Gardner suggested excluding imputed rental income from farm income.

The USDA follows Gardner in that it uses two approaches to calculating farm profits; one with net imputed rental income (giving "net farm income") and the other without (giving "returns to operators"). *Returns to operators* differ from net farm income by the amount of net imputed rental income. Furthermore, farm sector profitability ratios such as returns on assets (ROA) and equity (ROE) use as farm profits its calculation of returns to operators and the related assets and equity from balance sheet data which excludes farm operation dwellings.

Imputed Rental Income's Contribution to Farm Profits

We now present tables showing the impact or contribution of imputed rental income's inclusion on measures of farm profits. We show this impact on farm profits both over the long run by using 10-year averages over different periods from 1910-2004 and over the short run by using annual data from 1990-2004. We show the impact on farm profitability over the short run by calculating and comparing 2 measures of profitability (ROE and ROA) both with and without imputed rent from 1990-2004.

Since 1910, gross imputed rent's (GRent) share of the value of agricultural sector production (VASP) has been both small and relatively stable (Table 1). Our analysis of averages over different subintervals from 1910-2004 shows gross imputed rent accounting for as low as 4.56 cents of every dollar of the value of agricultural sector production to a high of almost 8 cents during 1930-1939. More recently, gross imputed rental income value from the farm operations' dwellings has remained relatively constant as a share of the farm sector's value of agricultural sector production (Figure 1). Gross imputed rental income has averaged about 4.83 percent or about a nickel for each dollar of the farm sector's gross value of production (Table 2). Later tables will show that imputed rental income has been a force for stability in national income accounting of farm profits.

Imputed rental income has an increasingly greater impact on farm profits the smaller the farm operation. Table 3 shows the impact of the imputed rental income's inclusion in farm income accounting for farms of different size classes (different ranges of value of agricultural sector production per farm operation). This table shows the percent of the value of agricultural sector production (VASP) coming from gross imputed rental income. Note that the larger the farm's size of operation, the smaller the role imputed rental income plays in its profit structure. These percentage shares are remarkably robust from 1996-2004.

Whereas gross imputed rent has been remarkably stable across time, net imputed rent (NRent) has been more volatile, particularly beginning in the 1960s. Figure 2 shows the increase in both the level and volatility in net imputed rent's share of net farm income in the 20th Century. The large and rapid increase in net imputed rent's share of net farm income in the 1970s and 1980s reflects the stable upward trend in farm dwelling values in contrast to highly volatile changes in non-rental returns to operators during this period (Table 4). One possible explanation for this trend is the increasing percentage of the farm population owning rather than renting their homes and other dwellings, the increasing value of farm operation dwellings since World War II, and

the change in the socio-economic demographics of the small farm operators. Given that this same trend is not as obvious in gross imputed rental value over the same period, another reason may be that the expense involved in renting the farm dwelling to the farm owner-operator has declined as a share of farm total expenses since the first half of the 20th Century. The double-digit percentages from 1970-1989 reflect unusually high shares of net farm income with respect to net farm income from 1976-1983. During this eight-year period net imputed rental income's share rose each year, starting at 13.9 percent in 1976 and rising to 41.5 percent in 1983. This eight-year trend shows that during a period of financial crises when net farm income from crops and livestock is depressed, net imputed rent's relative stability can act to offset declines in net farm income. However, it is important to remember that income from gross imputed rent does not affect net farm *cash* income.

The last ten years has shown that net imputed rents' contribution to net farm income has "settled down" in contrast to the earlier fluctuations. Figure 3 shows how net imputed rent's share of net farm income has varied about its 10-year average from 1995-2004, accounting for more than 9 cents on each dollar of net farm income earned during this period (Table 5). Net imputed rent's share "spiked" in 2002 to over 14 percent, which is consistent with earlier periods in which rent's share rises as the value of production from crops, livestock, and other farm sources declines. Given the increase in size in farms over time and that larger farmers are less dependent on net rent as a source of net farm income, it is anticipated such spikes will diminish in the future.

On average, inclusion of net imputed rental income increases our estimate of farm sector profits by about 10 percent. Table 6 gives the percentage change in net farm profits resulting from inclusion of imputed rental income in the calculation of net farm income (here, percentage change net farm profits = ((net farm income – returns to operators) / (returns to operators)) * 100. Since 1995, including net imputed rental income has increased net farm profits by as little as 7.25 percent (or 7 and one-quarter cents on the dollar) to as high as 16.86 percent. Figure 4 graphically shows the percentage change in net farm profits from 1995-2004 as a result of including imputed rental income in value added accounting. Again, volatility in this measure is a result of volatility in the non-rent measures of net farm income. As net returns to farming (which excludes net rent) decline sharply due to sharp declines in crop and or livestock value of production, net rent's contribution sharply increases.

Net imputed rent per farm has increased both in nominal and real (inflation-adjusted) dollars since 1995 (Table 7). Nominal dollars are adjusted for inflation by using the CPI: All Urban Consumers over the period with the base period 1982-1984. The average American farm operation has seen its net income rise from $1,879 to $2,639 from 1995-2004, a 40.4 percent increase. In inflation-adjusted terms, net imputed rent per farm has increased by over 13 percent over this same period.

Imputed Rental Income's Contribution to Farm Profitability

We present tables showing the impact or contribution of imputed rental income's inclusion on accounting measures of farm profitability from 1995-2004. We show the impact on farm profitability over the near-term by calculating and comparing 2 popular measures of farm sector

profitability used by the ERS/USDA: returns on equity (ROE) and returns on assets (ROA) both with and without imputed rent from 1995-2004. ROA shows returns to all investors (both owners and creditors) whereas ROE reflects returns solely to owners.

The returns are calculated using only income. A more accurate measure of total returns would include capital gains and losses on the farm operation's dwellings as well.

Table 8 shows the rate of returns to farm business assets with (ROA with) and without (ROA w/o) net imputed rental income. The final column (Difference) shows the marginal impact that including net imputed rental income has on this measure of profitability. A negative figure indicates that inclusion of the net imputed rental income when accounting for farm profits reduces this measure of profitability.

In every year, including net imputed rental income reduces farm sector ROA. On average, the reduction in ROA from including net rental income was 0.22. Including net imputed rental income reduces returns to owners and lenders by 22 cents for each dollar invested in the farm business assets. Returns to owned dwellings are less than those of other farm assets. The bottom line is that including dwelling values as part of the farm business adds more to farm assets (denominator) than it does to return on those assets (numerator), reducing this measure of farm business profitability.

Inclusion of farm operation dwellings has an even larger negative impact on measures of profitability for farm owners. Table 9 shows the rates of return to farm business equity with (ROE with) and without (ROA w/o) net imputed rental income. The final column shows the difference or contribution (ROE with less ROE w/o) resulting from including net imputed rental income in farm sector value added accounting. A negative figure indicates that inclusion of the net imputed rental income concept in accounting for farm profits reduces this measure of profitability. In each year, including net imputed rental income reduces ROE. On average, the reduction in ROE from including net rental income was 0.82. Including net imputed rental income reduces returns to owners by 82 cents for each dollar of owners' capital invested in the farm business assets.

Summary

In summary, imputed rental income increases farm sector value of agricultural sector production and net farm income. This is because the net imputed rental income value of farm dwellings (gross imputed rental value less associated expenses) is estimated each year by the USDA to be positive. The share of VASP contributed by gross imputed rental value income is inversely related to the size of the farm operation. Finally, imputed rental income reduces farm profitability measures. Returns to farm business assets (ROA) and returns to farm equity (ROE) are larger without imputed rental income. However, these profitability measures ignore capital gains or losses on the farm dwellings. Net imputed rental income does act to stabilize farm net income.

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Table 1. Gross Imputed Rent's Share of VASP, 1910-2004

Period	GRent / VASP (%)
1910-1919	**5.87**
1920-1929	**6.61**
1930-1939	**7.99**
1940-1949	**4.69**
1950-1959	**4.96**
1960-1969	**5.71**
1970-1979	**5.75**
1980-1989	**5.33**
1990-2004	**4.56**

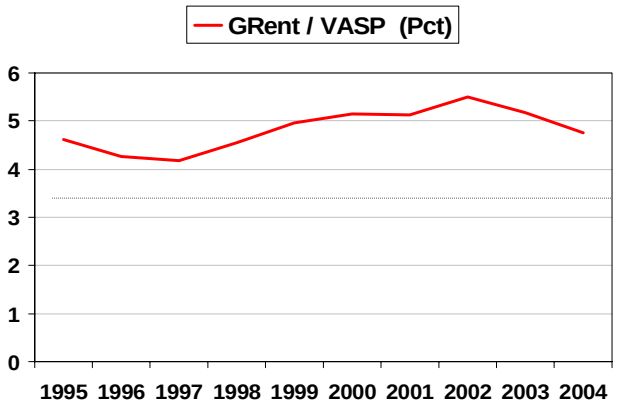
Source: Economic Research Service, USDA.

Table 2. Gross Imputed Rent's Share of VASP, 1995-2004

Year	GRent / VASP (Pct)
1995	**4.62**
1996	**4.27**
1997	**4.18**
1998	**4.55**
1999	**4.96**
2000	**5.16**
2001	**5.14**
2002	**5.50**
2003	**5.18**
2004	**4.76**
Average	**4.83**

Source: Economic Research Service, USDA.

Figure 1. Gross Imputed Rent's Share of VASP, 1995-2004



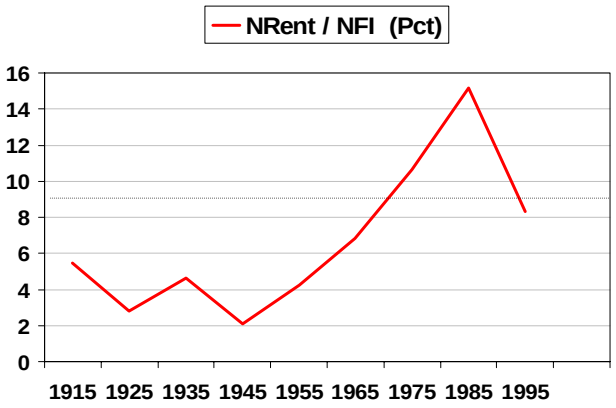
Source: Economic Research Service, USDA.

Table 3. Gross Imputed Rent's Percentage Share of VASP By Farm VASP

	$1 mill. & Over	$500,000 $999,999	$250,000 $499,999	$100,000 $249,999	$50,000 $99,999	$20,000 $49,999	$20,000 & below
1996	0.3	0.9	1.4	2.8	7.2	17.0	48.9
1997	0.1	0.7	1.3	2.8	6.4	17.5	50.6
1998	0.2	0.7	1.6	3.2	6.7	18.1	46.0
1999	0.2	0.7	1.4	2.7	6.5	19.3	51.4
2000	0.2	0.7	1.3	4.1	6.7	20.0	51.0
2001	0.2	1.0	1.4	3.8	8.9	22.0	54.3
2002	0.2	0.8	1.5	3.9	8.4	23.7	52.3
2003	0.2	0.8	1.6	3.4	8.3	23.6	57.6
2004	0.2	0.9	1.7	3.8	8.6	27.5	59.8
Avg.	**0.2**	**0.8**	**1.5**	**3.3**	**7.5**	**21.1**	**52.6**

Source: Economic Research Service, USDA.

Figure 2. Net Imputed Rent's Share of Net Farm Income, 1910-2004



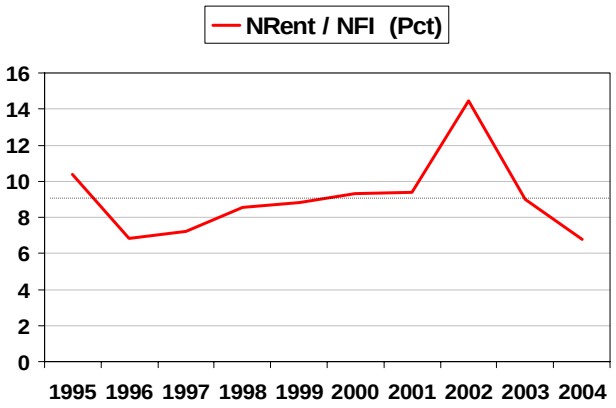
Source: Economic Research Service, USDA.

Table 4. Net Imputed Rent's Share of Net Farm Income, 1910-2004

Period	NRent / NFI (Pct)
1910-1919	**5.46**
1920-1929	**2.80**
1930-1939	**4.66**
1940-1949	**2.12**
1950-1959	**4.27**
1960-1969	**6.83**
1970-1979	**10.66**
1980-1989	**15.20**
1990-2004	**8.33**

Source: Economic Research Service, USDA.

Figure 3. Net Imputed Rent's Share of Net Farm Income, 1995-2004



Source: Economic Research Service, USDA.

Table 5. Net Imputed Rent's Share of Net Farm Income, 1995-2004

Year	NRent / NFI (Pct)
1995	10.37
1996	6.85
1997	7.23
1998	8.54
1999	8.85
2000	9.34
2001	9.36
2002	14.43
2003	8.99
2004	6.76
Average	9.07

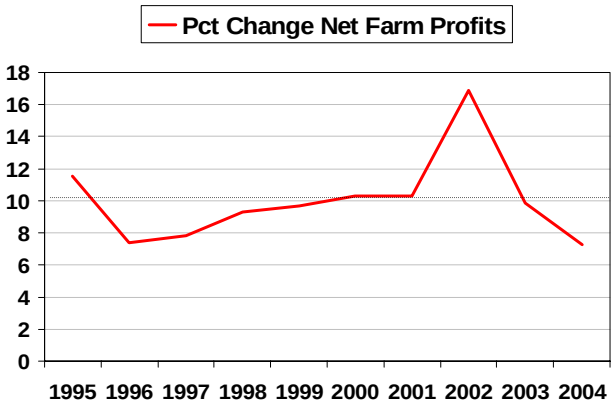
Source: Economic Research Service, USDA.

Table 6. Imputed Rent's Impact on Net Farm Profits, 1995-2004

Year	Pct Change Farm Profits
1995	11.57
1996	7.36
1997	7.80
1998	9.34
1999	9.70
2000	10.30
2001	10.33
2002	16.86
2003	9.87
2004	7.25
Average	10.04

Source: Economic Research Service, USDA.

Figure 4. Percentage Change in Net Farm Profits, 1995-2004



Source: Economic Research Service, USDA.

Table 7. Net Imputed Rent per Farm, 1995-2004

Year	Nominal Dollars	Real Dollars
1995	1,879	1,233
1996	1,844	1,175
1997	1,694	1,056
1998	1,836	1,126
1999	1,930	1,158
2000	2,106	1,223
2001	2,246	1,268
2002	2,471	1,374
2003	2,515	1,367
2004	2,639	1,397

Source: Economic Research Service, USDA.

Table 8. Returns to Assets (ROA)

Year	ROA with Rent (Pct)	ROA w/o Rent (Pct)	Difference (Pct)
1995	4.93	5.08	-0.15
1996	6.55	6.91	-0.36
1997	5.62	5.92	-0.30
1998	5.07	5.30	-0.23
1999	4.94	5.16	-0.22
2000	4.83	5.04	-0.20
2001	4.72	4.91	-0.19
2002	3.45	3.47	-0.02
2003	4.78	4.98	-0.20
2004	5.91	6.25	-0.35
Average	**5.08**	**5.30**	**-0.22**

Source: Economic Research Service, USDA.

Table 9. Returns on Equity (ROE)

Year	ROE with Rent (Pct)	ROE w/o Rent (Pct)	Difference (Pct)
1995	3.74	4.41	-0.66
1996	5.35	6.55	-1.19
1997	4.47	5.44	-0.98
1998	3.94	4.75	-0.81
1999	3.83	4.60	-0.77
2000	3.72	4.44	-0.72
2001	3.73	4.46	-0.73
2002	2.54	2.87	-0.33
2003	3.94	4.73	-0.79
2004	5.10	6.22	-1.12
Average	**4.04**	**4.86**	**-0.82**

Source: Economic Research Service, USDA.