California Agriculture's Profit Performance

by
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The profit performance of California agriculture will ultimately determine its future role in the national economy. This may be even more apparent when considering the viability of agriculture within other states to give context to California's performance. To remain viable, agriculture in each location must offer a rate of return on investments that is both competitive relative to those from alternative investments and sufficient in absolute dollars to cover producers' financial obligations. California's agricultural sector has led the nation in total sales each year for over half a century, indicating that farmers and ranchers in California are doing many things right. But what has been their reward?

This article examines California agriculture's profitability over time and places it into context by comparing it with the performance of other states and the national average. Economic theory suggests that in the long run input markets adjust to approximately equalize agriculture's marginal rates of return over locations. However, in the short run, agriculture's marginal rates of return may not equalize across states or regions due to factor immobility, and factor and output price distortions. Differences in the general level of profitability across states suggest that factor markets have not fully adjusted and that factor and commodity price distortions persist. Furthermore, differences in marginal rates of return in global commodity markets indicate that factor price equalization and factor endowment convergence have yet to fully integrate all commodity markets. This means that the relative profitability of agriculture in each location identifies agricultural sectors most likely to prosper or decline under the pressure of current global economic conditions. The empirical results reported here show that California's farmers and ranchers, on average, have done well in the past and that the state's production agriculture sector has characteristics that lead to a positive outlook for the future.

Summary of Research Methods

Profitability of the agricultural sectors of each state was assessed using returns on assets data from the USDA Economic Research Service's (ERS) Web site www.ers.usda.gov/data/FarmBalanceSheet/Fbsdmu.htm. State-level annual data from 1960 to 2002 were used. A "safety-first" criterion was used with the data to evaluate the level of risk facing agricultural producers. Next, the two main sources of returns to farm and ranch owner-operators, income from current operations and capital gains, were examined to determine their affect on profit patterns and the long-run viability of production agriculture. Finally, locations where production agriculture is most likely to prosper or decline were identified by comparing the most profitable five states and the five least profitable states.

Rates of Return and Profitability

The ERS estimates two measures of profitability: the rate of return on assets (ROA) from current income and the total economic rate of return, including capital gains for the farm business sector. The total rate of return on assets is divided into two components: current income as a percentage of assets and unrealized capital gains/losses as a percentage of assets:

$$\text{Total ROA} = \frac{\begin{pmatrix}\text{returns from current income} \\ \text{+ returns from capital gains}\end{pmatrix}}{\text{average value of farm assets}} \hat{E}$$

This study uses total ROA as its primary measure of profits, although both sources of returns are evaluated.

Safety-First Decision Criteria

Safety-first criteria are alternative performance measures and widely used tools for decision-making under risk. Safety-first models create a rank ordering of decision alternatives by placing constraints upon the probability of failing to achieve certain goals of the firm. All safety-first models have some safety threshold or minimum income goal that serves as the basis for performance measurements. Thus, a farmer's objective is to earn at least some designated minimum level of return with at least the desired level of probability.

Empirical applications of safety-first models often use a measure called the "Probability of Loss" (PL),

or "risk of ruin," that incorporates the minimum income goal. The PL indicates the probability (in percentage terms) that a producer will generate a return below some critical level. The PL is found by comparing the expected profitability of an investment to a given profitability threshold, k, and then, based upon the variability of profits (measured by the standard deviation), determining the probability that the threshold will not be reached. The value of k is usually made zero, but it can be made any critical level of return. By making $k = 0$, the PL is the chance of suffering a loss. If some other value is used for k, such as the return needed to cover all financial obligations (or opportunity costs), the estimated PL represents the probability of earning insufficient returns to cover k (i.e., the chance of defaulting on some obligations).

Results

Table 1 shows the average returns on assets earned by agriculture in individual states, regions and the entire United States for the 1960-2002 period. Note, first, the wide range of returns across states. The top five states in terms of profit performance and their total ROA for the entire period are North Carolina 9.3 percent, Florida 8.6 percent, Georgia 8.0 percent, California 7.7 percent, and Vermont 7.6 percent. The five states with the lowest total ROA results are West Virginia -7.6 percent, New Hampshire -2.9 percent, New Mexico -0.4 percent, Oregon 0.3 percent, and Pennsylvania 0.3 percent.

Second, there are some patterns in the relative contributions in returns for the top and bottom states. For the strong-performing states (including California), a majority of total ROA usually comes from current income (profits from agricultural production). Vermont is the only one of those five states to get a bigger contribution from capital gains (i.e., real estate appreciation) than from current income. For Vermont, growth in residential demand for land over the period fueled the nation's highest capital gains to farmland owners. For the least profitable states, the main source of return

Table 1. Avg. Rates of Return by State and Region, 1960-2002

	Return on Assets			St. Dev. of Total ROA
	Current Income	Capital Gains	Total	
		(percent)		
Connecticut	2.00	2.67	4.67	4.40
Delaware	5.07	2.21	7.28	6.52
Maine	-0.21	1.47	1.26	5.89
Maryland	1.58	1.50	3.07	5.29
Massachusetts	0.71	3.44	4.15	4.72
New Hampshire	-4.07	1.21	-2.86	9.16
New Jersey	0.96	2.50	3.46	5.30
New York	-0.18	3.69	3.51	4.32
Pennsylvania	-1.50	1.75	0.25	4.43
Rhode Island	2.38	3.69	6.07	8.25
Vermont	0.98	6.63	7.61	5.97
NORTHEAST	-0.03	2.56	2.54	3.65
Michigan	0.58	2.16	2.74	5.41
Minnesota	2.65	1.76	4.41	8.06
Wisconsin	1.54	2.59	4.13	5.39
LAKE STATES	1.82	2.13	3.95	6.22
Illinois	3.61	0.89	4.51	8.19
Indiana	2.87	0.88	3.75	8.27
Iowa	4.72	0.82	5.54	9.21
Missouri	1.30	0.80	2.09	7.01
Ohio	1.24	2.32	3.56	6.95
CORN BELT	3.13	1.06	4.18	7.83
Kansas	3.51	0.34	3.86	6.90
Nebraska	4.56	0.61	5.17	6.89
North Dakota	3.23	0.65	3.89	7.64
South Dakota	4.43	2.27	6.70	6.61
N. PLAINS	3.97	0.83	4.80	6.57
Kentucky	2.44	2.05	4.49	4.91
North Carolina	8.04	1.24	9.28	6.67
Tennessee	0.05	2.11	2.15	5.04
Virginia	0.64	1.02	1.66	5.30
West Virginia	-5.74	-1.86	-7.60	9.10
APPALACHIAN	2.58	1.45	4.04	4.59
Alabama	4.28	2.34	6.62	5.20
Florida	6.73	1.92	8.64	5.23
Georgia	5.72	2.32	8.04	5.80
South Carolina	3.07	0.25	3.32	5.43
SOUTHEAST	5.50	1.92	7.42	4.48
Arkansas	5.58	-0.73	4.84	6.99
Louisiana	3.95	0.51	4.45	7.30
Mississippi	3.99	0.44	4.42	6.96
DELTA	4.62	-0.02	4.60	6.58
Oklahoma	1.16	0.05	1.21	5.83
Texas	2.07	0.88	2.95	5.18
S. PLAINS	1.87	0.71	2.58	4.92
Arizona	3.88	2.65	6.54	5.91
Colorado	2.85	1.15	4.00	5.96
Idaho	3.74	1.67	5.42	6.09
Montana	2.28	2.07	4.34	7.07
Nevada	1.16	1.99	3.14	6.46
New Mexico	2.87	-3.28	-0.41	7.34
Utah	0.81	0.49	1.30	6.59
Wyoming	1.16	1.83	2.99	6.25
MOUNTAIN	2.67	1.24	3.90	5.51
California	6.41	1.27	7.68	5.57
Oregon	1.17	-0.85	0.32	5.61
Washington	4.77	1.28	6.05	5.94
PACIFIC	5.41	0.97	6.39	4.95
Alaska	-0.06	2.67	2.61	12.49
Hawaii	3.22	1.85	5.07	5.41
U.S. TOTAL	3.04	1.26	4.30	5.26

"ROA" = return on assets. "St. Dev." = standard deviation of the time series.

Table 2. Summary Data from States with Strong or Weak Returns

	Strong States					Weak States				
	NC	FL	VT	GA	CA	WV	NH	NM	OR	PA
Debt to asset ratio	14.27	16.19	13.74	14.53	20.41	8.81	10.66	12.74	13.47	12.26
Farm Numbers, 2001	56,000	44,000	6,600	50,000	85,000	20,500	3,100	15,000	40,000	59,000
Farms, % drop from 1960 to 2001	73.6	12.0	50.0	55.4	21.3	56.4	55.7	17.6	14.9	44.3
Average farm size, 2001 (ac)	162	232	203	220	315	179	135	2,876	443	130
Value of Production, 2001 ($/ac)	1,061	661	455	565	995	144	422	53	218	634
State Rank	4	9	14	11	5	39	16	48	35	10
Net farm income, 2001 ($/ac)	352	212	102	209	136	13	30	19	15	126
State Rank	3	6	13	7	10	47	37	42	45	11
Net farm income, 2001 ($/farm)	57,163	49,230	20,613	45,971	42,827	2,327	4,062	54,643	6,646	16,416
State Rank	3	5	23	7	8	50	48	4	45	30
Probability of Loss, 1960-2001, k=0(%)	8.5	5.2	10.2	8.7	8.5	79.7	61.0	52.4	47.6	47.2
Probability of Loss, 1960-2001, k=4(%)	21.8	19.2	27.4	24.8	25.5	89.8	76.4	72.6	73.9	79.7
1960-69 ROA from income (%)	5.03	5.16	1.70	4.91	4.58	-3.43	-0.46	2.76	-0.28	-0.81
1960-69 ROA from capital gains (%)	2.35	2.67	10.55	4.37	0.94	-0.35	1.23	-3.04	-1.28	3.67
1970-79 ROA from income (%)	5.31	6.33	2.17	4.31	7.41	-4.69	-3.75	3.00	1.34	-1.27
1970-79 ROA from capital gains (%)	4.44	6.47	9.24	5.24	4.26	3.08	5.30	1.35	3.36	5.41
1980-89 ROA from income (%)	6.05	7.72	2.32	4.94	7.48	-5.78	-3.19	1.87	2.04	-1.13
1980-89 ROA from capital gains (%)	-4.01	-0.83	4.01	-3.52	-2.22	-9.18	0.54	-8.04	-6.72	-2.70
1990-2002 ROA from income (%)	13.96	7.47	-1.52	8.02	6.22	-8.31	-7.67	3.64	1.48	-2.49
1990-2002 ROA from capital gains (%)	1.97	-0.05	3.64	3.00	1.90	-1.18	-1.43	-3.37	0.76	0.87

weakness varies from East to West. The more densely populated eastern states of New Hampshire, West Virginia and Pennsylvania all had negative returns from current income and better results from capital gains (although West Virginia had negative returns from capital gains). New Mexico and Oregon both had negative ROA from capital gains, but positive returns from current income. These results appear to illustrate the "urban influence" on farmland values.

Disaggregating the national average results by source over time (Table 2) leads to two general conclusions. First, as expected, returns from capital gains (which reflect changes in valuations based on expected future income) were much more volatile than actual returns from current income over the 1960-2002 period. Second, the variability of returns, especially from capital gains, was smaller during the 1960s and 1990s, compared to the volatile 1970s and 1980s. Jointly these results show that sources of returns are important in determining the economic prospects of agriculture; nationally, current income has been a less-risky source of returns, making states with adequate income more viable than areas with agricultural sectors relying on capital gains. These results are expanded upon for the strong and weak-performing states later.

The sensitivity of a state's agricultural sector to variance in returns can be indicated by the probability of loss for different levels of total returns. Two rows near the center of Table 2 show the probability that average producers in the strong/weak states would not meet some specified minimum total return, expressed as k. One row (for $k = 0$) shows that average California agricultural producers have a 8.5 percent probability of earning returns that fall below the breakeven point (i.e., zero total returns). The next row shows that average California agricultural producers have a 25.5 percent probability of failing to earn a 4 percent total return, the national average rate of return for agriculture over the 1960-2002 period.

The PL results in Table 2 show that as opportunity costs increase, a significantly higher percentage of agricultural producers must consider diversifying outside of agriculture or leaving the sector entirely. It is very unlikely that a risk-averse producer will be satisfied with the national average 47.6 percent chance of failing to reach a 4 percent total return when less risky nonagricultural investments are available as alternatives. However, California's profit and risk performance is much stronger than the national average, meaning that our state's agricultural sector has much brighter prospects.

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Implications of the Strong/Weak States' Results

Assessing results from the five states with the highest average total returns and the five states with the lowest average returns over the 1960-2002 period is enlightening. To begin, the middle row of Table 2 shows that the average net income per farm in 2001 for each of the ten states was below the U.S. average non-farm household income of $58,208. This illustrates that a farm (or state or region) may, on average, generate good returns while not producing enough income to support a family. Thus, most farm households supplement the farm with off-farm income.

Conversely, New Mexico is an example of how a state with less available off-farm income can adjust. The average value of New Mexico's production, $53 per acre, is very low due to the dominance of livestock grazing in the state's agricultural output. However, the very large average farm/ranch size of 2,876 acres enables New Mexico to generate average net farm income of $54,643.

Income versus capital gains patterns over time show differences between East and West. Of the five weak states, the two western states, New Mexico and Oregon, both had higher average ROA from farm income levels during 1990-2002 than they did during the 1960s. For the three eastern states, ROA from farm income levels went from bad to worse between the two periods. The trend in capital gains was lower between the 1960s and the 1990-2002 period for all the weak states except Oregon. For the five strong states, only California had higher average returns in the 1990-2002 period, compared to the 1960s, from both sources of returns. The three southern strong states all had better ROA from farm income levels in the later period, but lower levels of capital gains. Thus, the source of returns is important when assessing state profit performance.

Finally, farm numbers decreased much more in the East than in the West over the 1960-2002 period. North Carolina, the state with the highest average total returns over the period, decreased its farm numbers by 73.6 percent. This is not due simply to consolidating farms into larger units because North Carolina still has the smallest average farm size (162 acres) of the five strong states. The small average size and high income per acre indicate a significant number of, and contribution by, intensive livestock operations.

Consolidation is occurring across American agriculture, but there may be more potential for further consolidation in the East compared to the West. Consolidation of farms in the central and western sections of the country is difficult because the average farm size is already large. Of the 10 states in Table 2, the three western states are those with the largest average farm sizes. This implies that the high rates of exit from agriculture in eastern states are likely to continue if farmers do not subsidize their incomes using off-farm sources. Off-farm income will continue to slow U.S. and California farm exits. However, off-farm employment is not available to many farmers in sparsely populated sections of the country, putting them at risk.

What Do the Strong/Weak Performing States Have in Common?

In general, the strong-performing states (especially Florida and California) produce crop portfolios that include a significant amount of high-value fruits and vegetables and North Carolina and Georgia have significant intensive livestock industries (e.g., hogs and poultry). Also, contracting is a common practice (especially in Florida, North Carolina, and California) in the markets for many of these commodities. Forward contracting reduces price and income volatility over time, thus reducing producers' risk exposure. That enables more producers to accept the risks inherent

in high-value commodity production.

The weak-performing states had less in common with each other, although most had a higher percentage of their cash receipts coming from livestock grazing, rather than intensive crop and livestock enterprises, compared to the strong states. However, other financial characteristics showed common trends in these states.

Table 3. Comparing the Strong and Weak States

Strong States	Weak States
High-value, intensive crop and livestock	Low-value (e.g., livestock grazing)
Diversified products; contracting	Generally undiversified, bulk products
Large-scale operations	Generally smaller-scale operations
High debt/asset ratios	Low debt/asset ratios
High asset turnover ratios	Low asset turnover ratios

Financial data for the weak-performing states show they have a low operating profit margin and a low asset turnover ratio. New Hampshire, Pennsylvania and West Virginia all had negative operating profit margins in each of the four decades. Also, Oregon and Pennsylvania had generally low asset turnover ratios (i.e., low efficiency in assets use), compared to the strong-performing states, while the turnover ratios were especially low in New Hampshire, New Mexico and West Virginia. The positive operating margins in the two western states indicate that the agricultural sectors there may generate more "normal" total returns once the capital asset markets adjust factor prices downward. In the eastern states, non-agricultural demand for agricultural assets is unlikely to allow factor prices to decline enough for those agricultural sectors to significantly improve their profitability.

A brief list of general observations about differences between the five strong and five weak states (Table 3) indicates that the pressures to earn profits are pushing farmers and ranchers to produce more risky enterprises on larger, more efficient operations. This requires more money so as to maintain a reasonably low debt ratio to maintain a safe level of risk exposure. Obviously, the requirement of a larger scale of operation for technical efficiency means that the current trend of consolidation of small- and medium-scale production operations into large-scale operations is inevitable. In short, profit pressures are causing American agriculture to industrialize.

Concluding Comments

In general, the empirical results show trends in rates of return that are consistent with economic trade and development theories, but there are constraints unique to each state's agriculture. Agricultural income is generally higher in states like California that are able to produce significant amounts of fruit and vegetable crops plus intensive livestock enterprises. Returns are generally lower in areas dominated by livestock grazing, rather than intensive crop and livestock production. This supports other economists' conclusions that geographic areas with different factor endowments (i.e., resources) must expect to generate different rates of return because those regions cannot produce an identical set of goods and the costs of immobile inputs cannot adjust sufficiently to equalize commodity returns. This means that California's rates of return are likely to remain relatively high compared to those for the remainder of American agriculture. Although California's profit-per-farm average of $42,827 in 2001 was below the 2001 U.S. average non-farm household income of $58,208, farm consolidation will be slowed by the state's relative abundance of off-farm income that comes from the close proximity of agricultural and urban centers. Thus, California agriculture's future depends partly on how well our rural-urban interface is managed.

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