IMPLICATIONS OF INVESTING UNDER DIFFERENT ECONOMIC CONDITIONS ON THE PROFITABILITY OF GULF OF MEXICO SHRIMP VESSELS OPERATING OUT OF TEXAS[1]

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ABSTRACT

Due to the inflationary trend in recent years coupled with fluctuating shrimp prices, the shrimp business has become a highly uncertain undertaking. The financial performance of a sample of the Gulf of Mexico shrimping fleet, operating out of the Texas coast, was examined over a 10-year period (1971-80). The results indicate that investments made in the early part of the 1970's performed better than those made in the latter part. Periods of low inflationary levels appeared to be more favorable to investments in the shrimp fishery than periods of high inflationary levels.

In terms of economic profits, steel vessels generally did better than wooden ones. Medium-sized vessels (18.6-20.0 m in overall length) were the most efficient vessels to operate in the Gulf of Mexico.

The Gulf of Mexico supplies a major share of the shrimp landed by commercial shrimp producers in the United States. From 1977 to 1981, Gulf shrimp landings accounted for 62% of the U.S. total. In 1981, 161 million kg of commercial shrimp valued at $463.4 million are landed in the United States. The Gulf of Mexico accounted for 76% of these landings and 87% of the value. Although the Gulf shrimp fishery is the most valuable in the United States, individual harvesters within the industry are not without their financial problems.

Of late, the high variability in shrimp landings and prices has created short-run uncertainty among shrimp producers (Caillouet and Patella 1978; Warren and Griffin 1980). Coupled with this, operating costs have been significantly increasing over the years, to the extent that, it has become quite difficult for fishermen to stay in business (Griffin et al. 1978).

There have been several costs and returns and/or investment analyses conducted on fishing vessels in recent years (Gates and D'Eugenio 1975; Noetzel 1977; Jones et al. 1979; Roberts and Saas 1979; Prochaska and Cato 1981); however, none have been concerned with the effect of inflation on investing in a fishing vessel. This paper uses the period 1971-80 to draw conclusions about the effect of low, medium, and high inflationary periods on return to investment. The study further examines the implication of unstable shrimp prices and rising costs of operations on the profitability of the shrimp industry in the Gulf of Mexico. Finally, the performance of wooden and steel hulled vessels in various size classes is compared.

METHODS

Data Description

The data used in this study are an accumulation of 5 yr of data collection, which have been reported in previous publications (U.S. Department of Commerce 1971-1980, 1971-1981; Griffin et al. 1974, 1976; Griffin and Nichols 1976; Warren and Griffin 1978). Although data were collected for other Gulf states, only data for vessels operating out of Texas are used in this study, since it is the only state for which data were available for all 5 yr that data were collected.

In the original studies, data were collected by personal interview in ports from Galveston to Port Isabel for 1971, 1973, 1974, 1975, and 1977 and estimated for the remaining years. Additional information was obtained from officials of various lending institutions which engage in shrimp vessel financing, from boat builders, and from the National Marine Fisheries Service.

Cost

The variable cost items for which data were gathered included ice, fuel, nets, supplies, repairs

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and maintenance, crew shares, payroll taxes, and packing charges. Fuel consumption by vessel class, for which primary data were unavailable, was estimated according to the following relationship:

$$Y_i = \frac{\Sigma \left(X_{ij} N_{ij}\right)}{\Sigma N_{ij}}$$

where Y_i = estimated number of gallons (1 gal = 3.79 l) used per year by vessel class i.
X_{ij} = actual number of gallons (1 gal = 3.79 l) used in year j by vessel class i.
N_{ij} = number of vessels in vessel class i in year j.

The nets, supplies, and repairs and maintenance variables were similarly adjusted like Y_i to account for unequal numbers of vessels in the sampling years. These variables were deflated into real terms, using the industrial price index, and the weighted average was determined. From the weighted average of the 5 yr for which data were available, adjusted nominal values were determined for the other years. Crew shares were estimated at 33% of value of catch. Packing charge was set at \$0.10 per pound (0.454 kg) of shrimp landings.

Fixed costs include insurance, depreciation, interest, and opportunity cost. Reported data were used to determine fixed charges for overhead items, while charges relating directly to investment—depreciation, insurance, and interest—were calculated in nominal dollars for new vessels. Overhead values for years that data were not available were calculated using the industrial price index in the same manner as with variable cost.

Insurance charges were set at 4% of new vessel cost. The standard straight-line formula was used to determine depreciation. In this study the terminal value of the vessel was calculated in two ways: 1) at 100% of original cost, and 2) at salvage value at the end of 1980. The market rates, which prevailed over the years, were employed in deriving the cost and returns budget.

Revenue

Catch relationships were estimated for years for which no data were available by utilizing the following formulation:

$$EC_{ij} = WC_i \, (TL/TL_j)$$

where $WC_i = \dfrac{\sum_j N_{ij} \cdot RC_{ij}}{\sum_j N_{ij}}$ and

$RC_{ij} = AC_{ij}/(TL_i/TL)$.
EC_{ij} = estimated catch by vessel class i for year j where j = 1971, 1972, ..., 1980.
TL_j = Texas landings for year j, = 1971, 1972, ..., 1980.
TL = average Texas landings for the 1971-80 period.
RC_{ij} = real catch of vessel class i in year j for the 5 yr vessel data were available.
AC_{ij} = actual catch of vessel class i for year j for the 5 yr vessel data were available.
N_{ij} = number of vessels of class i for year j for the 5 yr vessel data were available.

Exvessel[3] prices per pound of shrimp were adjusted according to the formula given below using the average value from the National Marine Fisheries Service data for Texas and that from the survey to generate exvessel prices for those 5 yr that data were not collected.

$$AP_{ij} = (A_i - B) + TP_j$$

where AP_{ij} = adjusted exvessel price per pound (0.454 kg) of shrimp for vessel i in year j.
TP_j = Texas prices as reported by the National Marine Fisheries Service for year j, where j = 1971, ..., 1980.
AI = average exvessel price per pound (0.454 kg) of shrimp for vessel i over the 5 yr data were available.
B = average exvessel price per pound (0.454 kg) of shrimp

[3]It is recognized that exvessel price of shrimp is greatly influenced by seasonal fluctuation in local supply as well as the size composition of catch (Caillouet and Patella 1981). However, this study implicitly accounts for such trends by employing primary data collected for 1971, 1973, 1974, 1975, and 1977. Therefore, the price represents a weighted average between the various shrimp sizes.

reported by the National Marine Fisheries Service.

Analyses

A computer program referred to as a budget generator was devised to organize and assimilate the data for various analyses. The program allowed data reports to be produced according to the desired vessel classifications, interest rate, percent financed, number of years financed, number of loan payments per year, depreciation method, crew share agreement, rate of packing charges, payroll tax rate, discount rate, and planning horizon. The program reported results in the form of annual costs and returns budgets and projected cash flow budgets.

The following analysis first examines a detailed annual income and cash flow statement for a vessel purchased new in 1971. This detailed annual income and cash flow is then compared for the same vessel operated under identical conditions, but purchased in 1977 and 1979. Next, six different types of vessels (three wood and three steel; Table 1) are compared by examining their net returns during the three different periods of investment. Finally, investment performance is analyzed through net present value (NPV).

In all the above analyses three investment periods (1971, 1977, 1979) are considered. A given vessel is assumed to be operated under identical conditions regardless of the investment period. Since the actual sale price of the vessel at the end of the investment period is determined by the economic environment at that time, a comparison is made between the effects of selling the vessel at a salvage value of 35 and 100% of the original price.

TABLE 1.—Number and types of Gulf of Mexico shrimp vessels surveyed operating out of Texas ports.

Vessel type[1]	1971	1973	1974	1975	1977
Wooden, 17.1-18.5 m	1	1	3	3	1
Wooden, 18.6-20.0 m	1	9	8	4	1
Wooden, 20.1-21.5 m	1	26	24	26	4
Steel, 18.6-20.0 m	0	14	19	21	17
Steel, 20.1-21.5 m	3	13	41	41	18
Steel 21.6-23.0 m	2	4	10	5	2

[1]Coast Guard registered length.

RESULTS

Detailed Annual Budgets and Cash Flow

Tables 2 and 3 represent detailed annual income and cash flow budgets for a newly financed 1971 steel vessel, 20.1-21.5 m in overall length. Over the 10-yr study period, annual revenue doubled although it decreased by 18.9% in 1974 and by 7.4% in 1980. The decrease could be attributed, in part, to the decrease in exvessel price for shrimp from \$4.23/kg to \$3.62 in 1974 and from \$8.38 to \$7.06 in 1980. Another contributing factor was poor landings recorded in those periods (Fig. 1).

TABLE 2.—Annual income statement for a steel vessel, 20.1-21.5 m. long, operating out of Texas ports, 1971 to 1980.

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980[1]	1980[2]
Revenues	78,100	95,798	99,903	80,978	99,498	132,799	142,272	155,733	164,638	152,479	152,479
Variable costs											
Ice	1,502	2,062	2,052	1,656	1,903	2,169	2,859	4,371	4,002	4,105	4,105
Fuel	6,515	6,515	9,523	20,549	21,551	22,052	23,055	25,060	40,095	47,613	47,613
Nets, supplies, groceries	8,348	8,186	9,220	11,263	12,559	13,357	14,287	15,334	17,319	20,028	20,028
Repair and maintenance	5,563	5,455	6,144	7,505	8,369	8,901	9,521	10,219	11,541	13,347	13,347
Crew shares	25,773	31,613	32,968	26,723	32,834	43,824	46,950	51,392	54,331	50,318	50,318
Packing	2,580	2,899	2,440	2,679	3,003	3,178	3,891	3,586	2,873	3,143	3,143
Total	50,281	56,730	62,347	70,375	80,219	93,481	100,563	109,962	130,161	138,554	138,554
Fixed costs											
Depreciation	9,084	9,084	9,084	9,084	9,084	9,084	9,084	9,084	9,084	9,084	9,084
Insurance	5,191	5,191	5,191	5,191	5,191	5,191	5,191	5,191	5,191	5,191	5,191
Interest (vessel loan)[3]	6,910	6,412	5,879	5,308	4,697	4,042	3,340	2,589	1,785	923	923
Overhead	3,423	3,357	3,781	4,619	5,150	5,477	5,859	6,288	7,102	8,213	8,213
Total	24,608	24,044	23,935	24,202	24,122	23,794	23,474	23,152	23,162	23,411	23,411
Total operating costs	74,889	80,774	86,282	94,576	104,341	117,275	124,037	133,114	153,323	161,965	161,965
Net revenue	3,211	15,024	13,621	−13,599	−4,843	15,524	18,235	22,619	11,315	−9,487	−9,487
Net return after tax[4]	266	9,405	8,158	−17,106	−8,672	8,916	11,140	14,377	5,100	−15,383	45,273
Current equity	33,611	39,101	42,531	28,724	19,718	32,096	41,324	43,328	39,530	43,282	73,609
Required return to equity	3,946	4,391	4,636	3,326	2,686	4,250	4,992	5,273	5,190	5,376	9,142
Economic profit	−3,680	5,014	3,522	−20,433	−11,357	4,667	6,148	9,104	−90	−20,758	36,130

[1]Vessel sold for salvage value.
[2]Vessel sold for original purchase price.
[3]Vessel was purchased for \$129,767; 75% financed at 7.1% interest.
[4]The difference between net revenue and net return after taxes includes owner's salary, social security tax for owner, and income tax.

TABLE 3.—Annual cash flow statement for a steel vessel, 20.1-21.5 m. long, operating out of Texas ports, 1971 to 1980.

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980[1]	1980[2]
Revenues											
Beginning cash balance	0	2,339	13,319	22,518	5,883	0	5,192	14,835	26,964	29,011	29,011
Receipt from shrimp	78,100	95,798	99,903	80,978	99,498	132,799	142,272	155,733	164,638	152,479	152,479
Capital receipts	0	0	0	0	0	0	0	0	0	38,930	129,767
Total cash inflow	78,100	98,137	113,222	103,496	105,381	132,799	147,463	170,568	191,602	220,420	311,257
Operating expenses											
Fuel	6,515	6,515	9,523	20,549	21,551	22,052	23,055	25,060	40,095	47,613	47,613
Other variable expenses	43,766	50,216	52,824	49,826	58,669	71,429	77,507	84,901	90,065	90,942	90,942
Fixed cash expenses	11,559	14,165	14,436	13,317	14,169	20,205	18,145	19,722	18,510	19,300	49,481
Total	61,840	70,896	76,783	83,692	94,389	113,686	118,707	129,683	148,670	157,855	188,036
Long- and short-term debt											
Long-term debt (principle)	7,011	7,509	8,042	8,613	9,224	9,879	10,581	11,332	12,136	12,998	12,998
Long-term debt (interest)	6,910	6,412	5,879	5,308	4,697	4,042	3,340	2,589	1,785	923	923
Total cash outflow	75,761	84,817	90,704	97,613	108,310	127,607	132,628	143,604	162,591	171,776	201,957
Cash situation											
Net cash balance	2,339	10,980	9,199	−16,635	−8,812	8,121	9,643	12,129	2,047	19,633	80,288
Cash available	2,339	13,320	22,518	5,883	−2,929	5,192	14,835	26,964	29,011	48,644	109,300
Ending cash balance	2,339	13,320	22,518	5,883	0	5,192	14,835	26,964	29,011	48,644	109,300
Net present value 0.1174										22,572	42,560

[1]Vessel sold for salvage value.
[2]Vessel sold for original price.

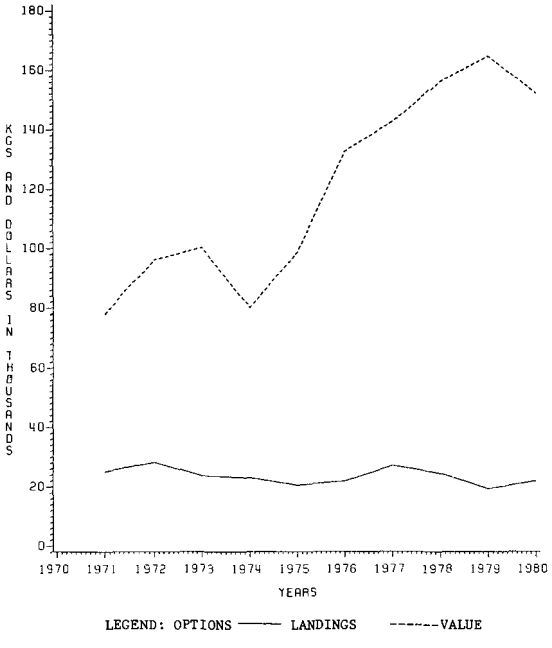

FIGURE 1.—Total Texas landings and value of landings for a typical steel vessel 20.1 to 21.5 m long by year.

There was no significant variation in total fixed costs during the 10 yr for two reasons: Depreciation and insurance charges were set at fixed levels, but while overhead charges increased gradually over the years, interest payments on vessel loans decreased by about the same margin. The highest total fixed cost incurred was $24,608 in 1971 and the lowest was $23,152 in 1978 (Table 2).

Total variable costs, on the other hand, increased by 175.5% over the 10-yr period. The highest increase of 18.4% occurred in 1979, and it was in direct response to an increase in fuel charges from $25,060 in 1978 to $40,095 in 1979 (Table 3). Expenditure on fuel showed a tremendous increase in 1974 by 115.7%; both of these increases were due to the sharp rise in fuel prices (Fig. 2).

In response to an increase in variable costs and relatively constant fixed costs, total operating

FIGURE 2.—Price of fuel and shrimp for a steel vessel 20.1 to 21.5 m long by year operating out of Texas ports.

costs more than doubled over the period 1971-80, from $74,889 to $161,965 (Table 2). The highest net revenue before taxes recorded was $22,619 in 1978. Losses were recorded in 1974, 1975, and 1980, and this could be due to the effects of inflation and poor harvest recorded in those years.

Terminal value has a critical effect on profitability. Decreased landings led to a substantial economic loss of $20,758 in 1980 (Table 2), when vessels were salvaged at 35% of their original values. Increasing the terminal value to 100% of cost resulted in a positive economic profit of $36,130, the highest obtained (Table 2). It was further observed that the net present value for the investment project increased by 72.5% when vessels were salvaged at their original costs rather than at the 35% level of their original values.

Investment in Different Time Periods

Tables 2 and 3 present the results of investing in a shrimp vessel in 1971. Considerable investment has been made in new shrimp vessels since 1977. Table 4 shows the annual increase and cash flow statements for purchasing the same steel vessel in 1977. Since the level of operations is held constant, revenue and variable costs are the same; fixed costs, however, changed dramatically.

In 1971, the value of the 20.1-21.5 m steel vessel was $129,767. In 1977, that same vessel cost $222,084, a 71.1% increase in price. The loan payment in 1971 was a little over $11,600/yr assuming a 10 yr note, but increased to $24,074/yr. If the vessel was purchased in 1971, profits were made in 1977 and 1978; for the vessel purchased in 1977, losses were incurred over the entire investment period. Losses were particularly substantial if the vessel was sold for salvage value at the end of 1980.

The cash flow statement shows that cash available was very low for 1977-79. There was about $35,000 difference in cash available in 1980, depending on whether the vessel had been sold for salvage value or for its original purchase price. For the vessel purchased in 1971, the net cash increase in 1977 was $9,643; and only $2,223 for the vessel purchased in 1977. In 1979 under the 1971 scenario, cash available would have increased $2,047; here it declined $6,252. Despite poor economic conditions, NPV was positive for both vessel sale prices, implying vessels would have had a greater return on investment than bonds purchased in 1977.

Table 5 shows the results of purchasing a vessel in 1979. The price of the vessel went up by about 26.8% since 1977, and substantial losses were incurred. The NPV is negative if the vessel is sold for its salvage value and positive if it is sold for 100% of its original purchase price. Short-term borrowing occurred when the vessel was purchased in 1979. In fact, the vessel owner had to borrow more than he was paying in principal on his original purchase note.

Economic Performance by Size and Construction

Figures 3 through 8 show variations in net revenue for the various vessel types used in the analysis. These variations follow a general pattern. For vessels purchased in 1971, net revenue peaked in 1972 and 1978 and dropped to minimum levels in 1974 and 1980. A major reason for this trend is that

TABLE 4.—Summarized annual income and cash flow statements for steel vessels, 20.1-21.5 m long, operating out of Texas ports, 1977 to 1980.

	1977	1978	1979	1980[1]	1980[2]
Income statement					
Value of landings	142,272	155,733	164,638	152,479	152,479
Total variable cost	100,562	109,961	130,160	138,555	138,555
Total fixed cost[3]	43,497	43,011	42,838	42,883	42,883
Net revenue	−1,787	2,761	−8,359	−28,959	−28,959
Economic profit[4]	−8,628	−5,006	−15,587	−43,663	−158
Cash flow statement					
Total cash inflow	142,272	157,956	172,165	313,654	375,838
Total cash outflow	140,049	150,429	170,890	180,396	187,041
Net cash balance	2,223	5,304	−6,252	131,983	187,522
Cash available	2,223	7,527	1,275	133,258	188,797
Net present value				12,759	47,954

[1]Salvage value set at 35% of original cost.
[2]Vessel sold for original purchase price.
[3]Vessel was purchased for $222,084; 75% financed at 7.93% interest.
[4]Economic profit is the net revenue adjusted for any changes in the value of operating inventories and capital items.

TABLE 5.—Summarized annual income and cash flow statements for steel vessels, 20.1-21.5 m long, operating out of Texas ports, 1979 to 1980.

	1979	1980[1]	1980[2]
Income statement			
Value of landings	164,638	152,479	152,479
Total variable cost	130,160	138,555	138,555
Total fixed cost[3]	61,449	63,668	63,668
Net revenue	−26,971	−49,745	−49,745
Economic profit[4]	−34,528	−68,559	−45,932
Cash flow statement			
Total cash inflow	164,638	383,999	421,689
Total cash outflow	184,132	215,631	218,132
Net cash balance	−19,493	187,861	223,049
Cash available	−19,493	168,368	203,556
Net present value		−9,355	18,140

[1]Vessel sold for salvage value.
[2]Vessel sold for original purchase price.
[3]Vessel was purchased for $269,210; 75% financed at 12.25% interest.
[4]Economic profit is the net revenue adjusted for any changes in the value of operating inventories and capital items.

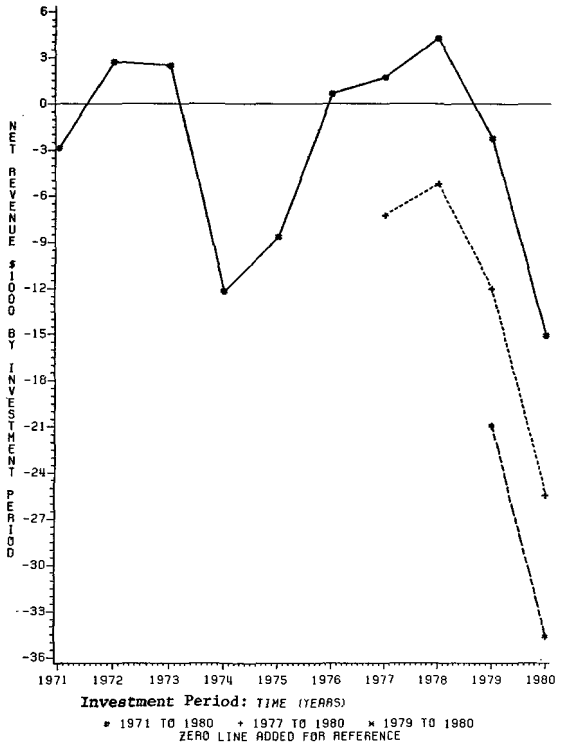

FIGURE 3.—Net revenue for a wooden vessel 17.1 to 18.5 m long operating out of Texas ports by investment period.

while tremendous increases in the value of landings were recorded in 1972 and 1978, 1974 and 1980 were the only periods in which the value of landings actually decreased. It can further be shown that fuel charges increased dramatically in 1974 and 1980 (Fig. 2), making those years particularly bad ones for Texas shrimp producers in terms of net revenue.

In general, steel vessels performed better economically than wooden vessels irrespective of the investment period. This may be attributed to the durability of steel vessels and their ability to operate under more adverse weather conditions than wooden vessels. The performance of 18.6-20.0 m steel vessels was particularly outstanding (Fig. 6) while the same size wooden types performed very poorly, recording losses throughout the study period (Fig. 4). As explained earlier, steel vessels are more durable and can spend more days offshore fishing than wooden vessels. Besides, steel vessels generally call for less maintenance and repair costs and attract a better quality crew than wooden ones. With the exception of the 17.1-18.5 and 18.6-20.0 m wooden vessels, which recorded losses over most of the period, all the other vessels performed satisfactorily.

Variation in Net Present Value

Evaluating the investments based on the net present value criterion, the 18.6-20.0 m steel vessels would be ranked as the best investments in the Gulf shrimp fishery (Table 6). Compared with the other vessel types, they consistently showed the highest net present values under all investment conditions examined. At the other end of the continuum lie the 18.6-20.0 m wooden vessels, which showed the poorest net present values under each investment condition, actually showing negative net present values and implying that investing in 18.6-20.0 m wooden vessels is not a feasible endeavor (Table 6).

With the exception of 18.6-20.0 m wooden vessels, 1971 investments showed the highest net present values, followed by those made in 1977. Investments made in 1979 were the least feasible; this may be attributed to unusually high capital

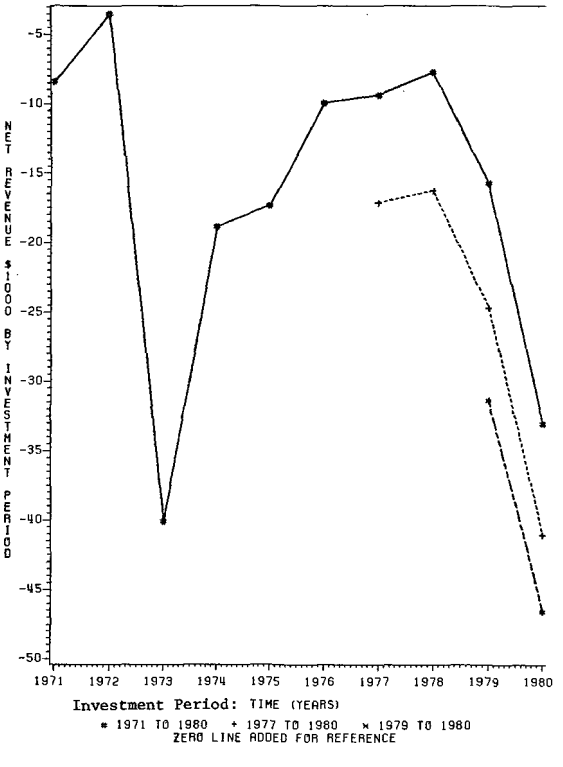

FIGURE 4.—Net revenue for a wooden vessel 18.6 to 20.0 m long operating out of Texas ports by investment period.

and high vessel costs, resulting in higher annual principal and interest payments.

SUMMARY AND CONCLUSIONS

Due to the inflationary trend in recent years, investments made in the early part of the last decade performed better than those made in the latter part. Steel vessels generally showed higher economic profits than wooden ones, and medium-sized vessels (18.6-20.0 m in overall length) were the most efficient vessels to operate in the Gulf of Mexico.

Shrimp production in the Gulf of Mexico has significant seasonal variations—periods of low shrimp landings and periods of abundant catch. Although the general trend in real prices was upward, high variability has created short-run uncertainty for shrimp producers. In general, after-tax net revenue was lowest in 1974; 1978 was the most favorable year of operation.

Vessel terminal value plays a major role in determining overall returns to investment. The NPV for the investment increased when the terminal value rose from 35 to 100% of the original vessel cost (Table 6). Based on the net present value criterion, the 18.6-20.0 m steel vessels once again proved to be the most feasible investment. Inves-

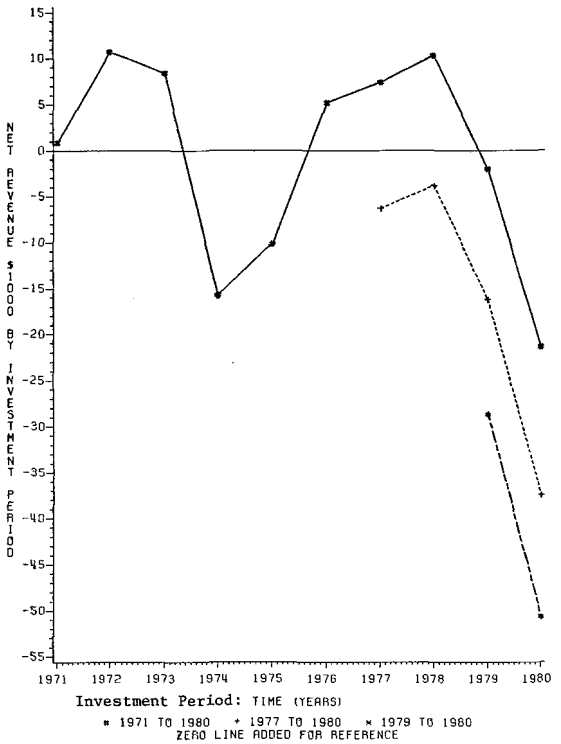

FIGURE 5.—Net revenue for a wooden vessel 20.1 to 21.5 m long operating out of Texas ports by investment period.

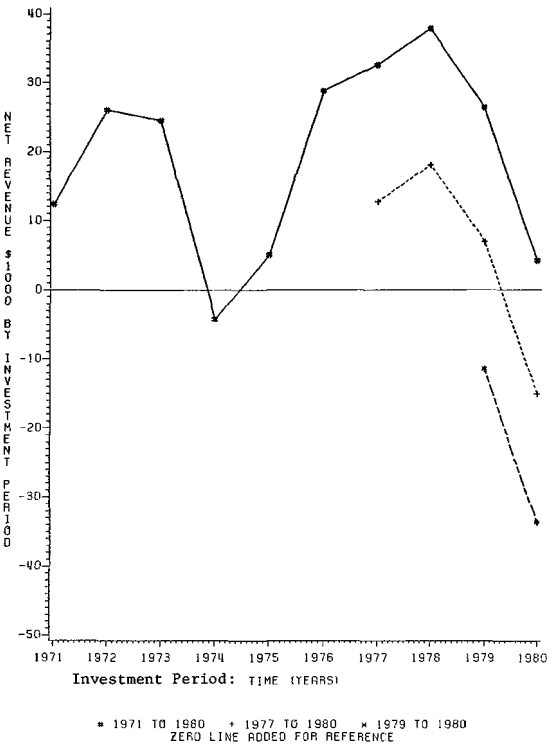

FIGURE 6.—Net revenue for a steel vessel 18.6 to 20.0 m long operating out of Texas ports by investment period.

TABLE 6.—Net present value for each investment period, salvage value, and vessel type for vessels operating out of Texas ports.

Investment period:	1971 to 1980		1977 to 1980		1979 to 1980	
Salvage value:	35%	100%	35%	100%	35%	100%
Vessel type						
Wooden, 17.1-18.5 m	−14,303	4,113	−16,166	2,019	−17,766	4,122
Wooden, 18.6-20.0 m	−70,622	−37,348	−49,898	−30,731	−32,431	−17,612
Wooden, 20.1-21.5 m	4,993	23,089	−18,368	6,834	−27,829	−9,667
Steel, 18.6-20.0 m	89,154	106,585	51,483	84,543	16,250	44,462
Steel, 20.1-21.5 m	22,572	42,560	12,759	47,954	−9,355	18,140
Steel, 21.6-23.0 m	13,385	35,352	−18,161	19,655	−27,528	1,212

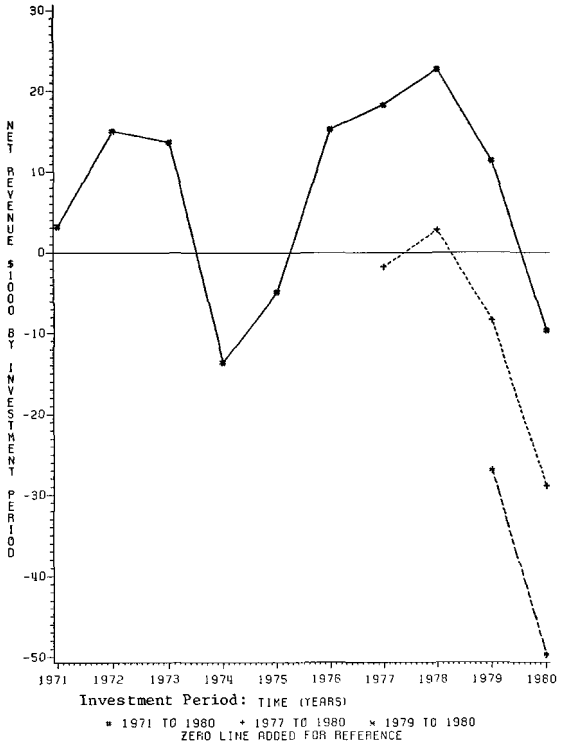

FIGURE 7.—Net revenue for a steel vessel 20.1 to 21.5 m long operating out of Texas ports by investment period.

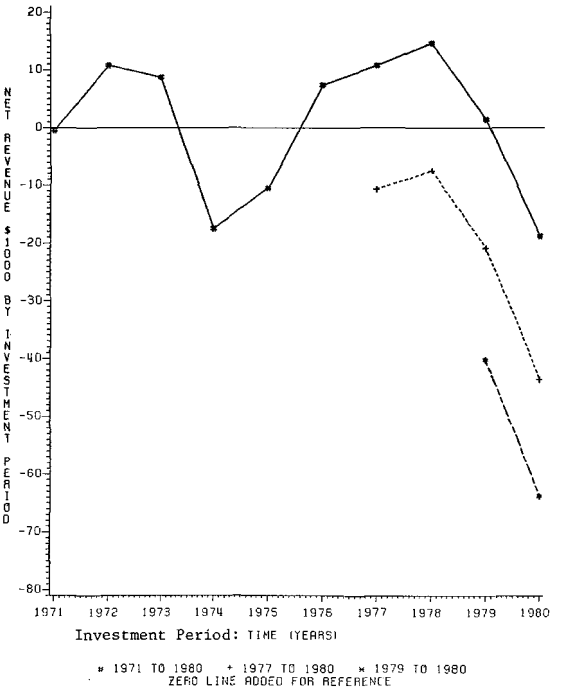

FIGURE 8.—Net revenue for a steel vessel 21.6 to 23.0 m long operating out of Texas ports by investment period.

tors should, however, bear in mind that based on this sample data similar-sized vessels built of wood are not feasible ventures.

It can be inferred from this study that in high inflationary periods, shrimp producers should avoid newly financed vessels. The resultant increases in costs of equity and debt capital are such that economic profit is eliminated. Investing in used vessels may be a viable alternative.

Results from this study further indicate that the economic performance of steel vessels is far superior to that of wooden vessels. Steel vessels can withstand adverse weather conditions much better than wooden ones and as a result, can spend longer days in offshore fishing. Steel vessels showed higher landings per trip than similar-sized wooden vessels. Therefore, the extra expense to purchase steel vessels may prove a worthy investment.

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LITERATURE CITED

CAILLOUET, C. W., AND F. J. PATELLA.
1978. Relationship between size composition and ex-vessel value of reported shrimp catches from two Gulf Coast States with different harvesting strategies. Mar. Fish. Rev. 40(2):14-18.

GATES, J. M., AND J. M. D'EUGENIO.
1975. Costs and returns of fisherman in the Massachusetts inshore lobster fishery. Univ. R.I., Dep. Resour. Econ., Mar. Reprint 60.

GRIFFIN, W. L., R. D. LACEWELL, AND W. A. HAYENGA.
1974. Estimated costs, returns, and financial analysis: Gulf of Mexico shrimp vessels. Mar. Fish. Rev. 36(12):1-4.

GRIFFIN, W. L., AND J. P. NICHOLS.
1976. An analysis of increasing costs to Gulf of Mexico shrimp vessel owners: 1971-1975. Mar. Fish. Rev. 38(3):8-12.

GRIFFIN, W. L., N. J. WARDLAW, AND J. P. NICHOLS.
1976. Economic and financial analysis of increasing costs in the Gulf shrimp fleet. Fish. Bull., U.S. 74:301-309.

GRIFFIN, W. L., J. P. NICHOLS, R. G. ANDERSON, J. E. BUCKNER, AND C. M. ADAMS.
1978. Costs and returns data: Texas shrimp trawlers, Gulf of Mexico, 1974-1975. Texas A&M Univ., Sea Grant Coll. Program Rep. TAMU-T-78-003.

HOPKIN, J., P. BARRY, AND C. B. BAKER.
1973. Financial management in agriculture. Interstate Printers and Publishers, Inc., Danville, Ill., 459 p.

JONES, T. M., J. W. HUBBARD, AND K. J. ROBERTS.
1979. Productivity and profitability of South Carolina shrimp vessels, 1971-75. Mar. Fish. Rev. 41(4):8-14.

NOETZEL, B. G.
1977. Revenues, costs, and returns from vessel operation in *major* U.S. fisheries. Div. Fish. Manage. Oper., Nat. Mar. Fish. Serv., NOAA, Wash., D.C., 23 p.

PROCHASKA, F. J., AND J. C. CATO.
1981. Economic conditions in the Gulf of Mexico shrimp industry: 1960-1981. Univ. Fla., Food Resour. Econ. Dep., Staff Pap. 180.

ROBERTS, K. J., AND M. E. SAAS.
1979. Financial aspects of Louisiana shrimp vessels, 1978. Louisiana State Univ., Sea Grant Coll. Program LSU-TL-79-007, 9 p.

ROBINSON, R. I., AND D. WRIGHTMAN.
1974. Financial markets: the accumulation and allocation of wealth. McGraw-Hill Book Co., New York, N.Y., 439 p.

U.S. DEPARTMENT OF COMMERCE.
1971-1981. Current fisheries statistics. Natl. Oceanic Atmos. Admin., Wash., D.C., var. p.

WARREN, J. P., AND W. L. GRIFFIN.
1978. Costs and returns trends for Gulf of Mexico shrimp vessels. Texas A&M Univ., Dep. Agric. Econ., Staff Pap. DIR 78-1, SP-4, 23 p.
1980. Costs and returns trends in the Gulf of Mexico shrimp industry, 1971-1978. Mar. Fish. Rev. 42(2):1-7.