

**PORT REHABILITATION AND EXPANSION:
THE MAKAR PROJECT IN THE PHILIPPINES**

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ABSTRACT

In this paper we report on an evaluation of the feasibility of a port improvement investment at General Santos City in the Philippines. For an analysis of this project, which is an expansion of an existing facility, the financial and economic analyses are conducted of the port, with and without the project. To identify the variables that would have an important impact on the project's net present value and to assess the nature of the variability of the returns from this investment, sensitivity and risk analyses are carried out. From these analyses we find that the proposed expansion plan of the port is neither financially nor economically justified. The mean and median of both financial and economic incremental net present values (NPVs) are significantly negative, showing that the financial and economic NPVs with the project are much lower than those without the project. This project turns out to be one that is sensitive to the time at which the project is started. The country will benefit if the project is postponed, but it should be postponed for a decade. Even with the expected poor financial and economic performance, the project does have major beneficiaries. The shippers of goods and livestock, and the shipowners will receive substantial benefits from the project. They will be strong and vocal proponents of this project because, while they receive most of the benefits of the project, they pay only a small share of the cost. Although this project is to be financed through a foreign assistance program, the funds should instead be used to finance other projects that are economically more productive. This study clearly demonstrates the gains that could be made if international assistance were spent on economically sound projects rather than subsidizing low return investments that benefit a select few.

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I. INTRODUCTION

Inter-island shipping is a major industry in the Philippines because of the archipelagic nature of the country. There are 7,000 islands which form three main groups: Luzon in the north; Visayas in the center; and Mindanao in the south (Figure 1).

Makar Port, located in General Santos City at the northern side of Sarangani Bay in Mindanao, lies along the main north-south trading axis which skirts Mindanao on its western shore. Sarangani Bay is a well protected deep bay. The virtual absence of typhoons in the area makes it an excellent location for a port. This has enticed private firms to build three private wharfs within 20 kilometers of Makar. There are three other major public ports in Mindanao: Davao, Cagayan de Oro, and Polloc. These ports and Makar provide the major access to inter-island and foreign trade.¹

The port is strategically located in an agriculturally productive area of the Philippines. With its hinterland extending to 80-90 km. inland, it coincides with the province of South Cotabato which is responsible for the production of 23% of the Philippines' corn, 40% of its pineapples, and 8% of its coconuts. The major outbound cargos through the port are: corn, fruits and vegetables, copra, live animals, and palay and rice. On the other hand, the main inbound cargos are: general cargo, bottled cargo, fertilizers, and sugar and wheat.

Even though the port is presently not congested, it has the following limitations to efficient and effective shipping:

¹Louis Berger International, Inc., "Makar Wharf, General Santos Feasibility Study Final Report" Manila, Philippines, September 30, 1993, p. 6-39.

- (1) it has a docking length of only 561 meters, insufficient to accommodate large vessels. Only 7 vessels of small average length can be accommodated in the port
- (2) the deck has a designed live loading of only 200-300 lbs. per square foot at a time, a support capacity insufficient for heavy equipment
- (3) the mean low water depth can only accommodate ships of 7.5 meter draft or less, inhibiting the port's long term ability to service ships particularly those engaged in foreign trade
- (4) there is no emergency generator. The port depends entirely on the Mindanao power grid, and there are two to fifteen electricity outages every month
- (5) there is lack of navigational aids which does not permit the entrance of ships into Sarangani bay for berthing at night, and
- (6) there is limited container handling facilities at the port²

As a result of these limitations, a number of improvements must be made if the port is to continue to handle cargo efficiently as throughput increases in the coming years.

II. PROJECT DESCRIPTION

A. Project Objectives and Scope

The Makar Port Improvement Project was identified as part of a general infrastructure development project consisting of roads, airports, telecommunications and seaport designed to accelerate the economic development of the General Santos City area. In addition, a major fishing port and a corn storage facility are currently being planned. These projects were proposed for funding under the Philippine Assistance Program (PAP).

The PAP grew out of the interest of a bipartisan group of U.S. legislators that established an aid fund of \$200 million to promote economic development in support of the restored democracy in the Philippines. It seeks to promote equitable and sustainable economic growth in the Philippines. The principal goal is to alleviate poverty in the countryside

²Louis Berger International, Inc., p. xv.

through production oriented activities outside the National Capital Region. To be included in the PAP, projects should be located in one of the 16 economic development zones, one of which is General Santos City and its hinterland.³

The objectives of the project are to increase the capacity and improve the efficiency of cargo handling facilities at the port to accommodate future flows. The project will involve an extension of the existing wharf by 150 meters of quay, with a 15 meter mean low water depth capable of accommodating much larger vessels. Organizational measures and repairs to the existing facilities will be undertaken with the project. It will also involve the construction of a container storage yard, a livestock terminal, an operations office, and an equipment maintenance building. The project will also include installation of communication facilities, navigational aids, and container handling facilities.

B. Project Cost and Financing

The project will cost approximately 635 million pesos⁴ based on the cost estimates provided by the engineering consultant. Seventy five percent of the total project cost will be provided as a grant by the US Agency for International Development (USAID) and the other 25% will be provided from counterpart contribution by the Philippine government. A summary of the project costs is shown in the Table 1.

³Louis Berger International, Inc., p.2-17.

⁴Peso is the Philippine currency and in Year 1 of the analysis is equal to .037 US dollar.

Table 1
Project Costs and Financing
('000 Pesos)

PROJECT COST

Phase I

A. General Repairs	13,806
B. Non-construction Measures	2,572
C. Container Yard I	36,464
D. Navigational Aids	484
Subtotal - Phase I	53,327

Phase II

A. Wharf Extension/Container Yard II	514,562
B. Livestock Terminal	67,004
Subtotal - Phase II	581,566
Total Cost	634,893

FINANCING

A. USAID Grant	476,170
B. Philippine Government	158,723
Total Financing	634,893

Source of basic data: Louis Berger International, Inc., pp.11-5-11-39.

C. Project Life

For purposes of this study, the time horizon for the project is taken as 16 years. The investment will be made in the first four years while liquidation will take place in year 16. Investment for Phase I which involves repairs to the existing facilities will be undertaken in the first two years. Phase II which involves the purchase of private property, relocation of a native community, construction of buildings, and installation of equipment will start in Year 1 and end in Year 4.

III. TRAFFIC FORECAST

One of the major determinants of the success of a port project is the growth of cargo traffic. Cargo traffic will depend on the economic growth of the area serviced by the port. In this section, a forecast of cargo traffic is presented after analyzing the economic prospects of the region. This forecast is the basis for estimating the number of ships calling on the port in future. The forecasted traffic and number of ships are important inputs to the financial analysis which is discussed in the next section.

A. General Assumptions and Forecast Throughout

Per capita income in the Philippines is forecasted to increase at an annual average real growth rate of 1% in the coming years with a slightly higher growth rate for South Cotabato. Also, the improving income distribution in the country is expected to continue. These developments, coupled with low median incomes and high population growth rates, imply an expanding market for South Cotabato's agricultural products such as pork, chicken, beef, fruits, and vegetables. Given that the area is a small producer in the Philippine market, it is assumed that local production can be marketed at a constant (or even increasing) real price.⁵ Furthermore, it is assumed that the rural road system will be at least minimally adequate to get products to market and that the port will be able to handle the traffic.

⁵Louis Berger International, Inc., p.7-30

Based on these assumptions and the analysis of the factors considered most likely to determine the level of local supply and demand, Louis Berger International (1993) forecasted the main commodities handled at Makar Port. Results of this forecast are shown in table 2.

B. Containerization Trends

Containerized traffic increased its share in total cargo handled at Makar Port from zero in 1970 to 20% in 1980 and 48% in 1990. This trend is expected to continue in the future because shippers and shipping lines: (a) are now familiar with container technology; (b) recognize the benefits it offers such as reduced pilferage, losses, and delays due to inclement weather; and (c) are adapting their vessels and operating procedures to use more containers and to use them more efficiently.

The prediction for containerized traffic is made both for inbound and outbound traffic. The forecast for containerized inbound traffic is expected to increase to 67% of total inbound tonnage by Year 10. If it increases further, better quayside handling equipment and more storage space will be needed. These improvements are assumed in the projections for the later period, with the container share of inbound traffic peaking at 73% in Year 15 (Table 3). On the other hand, outbound container traffic is expected to increase its share of total outbound tonnage from 56% in Year 1, to 67% in Year 5 and 73% in Year 10.

C. Forecasted Number of Ship Calls

The total and containerized cargo forecasts form the basis for estimating the number of ship calls at Makar Port up to the Year 15. The number of ship calls was arrived at by analyzing the types of ships that frequented the Makar Port and taking into consideration the containerization trend (Table 4). The analysis revealed that bigger ship callings in the future will result into more cargo per ship. The average cargo per ship call is expected to increase from 1,254 tons in Year 1, to 1,573 and 1,657 tons in Years 10 and 15, respectively (Table 5).

Table 2
Forecasted Outbound and Inbound Cargos
Through Makar Port, Years 1 to 15, With the Project Case
(Unit: tons)

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	...Yr. 10	...Yr. 15
Outbound Cargo							
Corn*	200,000	328,000	371,000	416,000	462,000	590,000	505,000
Live animals	32,999	34,319	35,692	37,120	38,640	46,968	57,144
Canned fish*	13,480	13,378	13,268	13,151	13,022	12,449	11,717
Animal feeds w/o corn	10,548	10,548	10,548	10,548	10,548	10,548	10,548
Palay & rice	18,067	18,248	18,430	18,614	18,801	19,670	20,768
Fruits & vegetables	55,791	57,465	59,189	60,964	62,793	72,795	84,389
Copra*	56,661	52,137	47,113	42,589	37,565	28,248	27,837
Vegetable oils	6,000	6,000	6,000	6,000	6,000	6,000	6,000
General cargo	81,216	86,495	92,117	98,105	104,481	143,149	196,126
Subtotal outbound	474,762	606,590	653,357	703,091	753,850	929,827	919,529
Inbound Cargo							
Live animals	4,822	4,822	4,822	4,822	4,822	4,822	4,822
Animal feeds	8,382	8,717	9,066	9,428	9,806	11,930	14,515
Fertilizers	58,052	62,653	65,094	67,652	70,265	89,690	100,369
Cement	15,173	15,931	16,728	17,564	18,442	23,538	30,041
Sugar & wheat	23,786	24,737	25,727	26,756	27,826	33,855	41,189
Bottled cargo	67,656	71,038	74,590	78,320	82,236	104,956	133,954
General cargo	126,038	132,340	138,957	145,905	153,200	195,256	249,546
Subtotal Inbound	303,909	320,238	334,984	350,447	366,597	464,047	574,436
Total cargo	778,671	926,828	988,341	1,053,538	1,120,447	1,393,874	1,493,965

Source: Louis Berger International, Inc., p.7-70

*Note: Outbound cargo of corn is increasing in the first decade, and then begins to decline after year 10. Canned fish and copra, on the other hand, decline over time. These trends are due to the local people's likely switch to other economic activities.

Table 3

Forecasted Outbound, Inbound, and Total Containers
Through Makar Port, Years 1 to 15
(000 tons)

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	...Yr. 10	...Yr. 15
Outbound							
Containerized traffic	266	348	383	420	460	623	672
Total outbound traffic	474	606	653	703	754	930	920
Percentage of containerized traffic	56.12%	57.43%	58.65%	59.74%	61.01%	66.99%	73.04%
Inbound							
Containerized traffic	135	150	166	182	200	309	419
Total inbound traffic	304	320	335	350	367	464	574
Percentage of containerized traffic	44.41%	46.88%	49.55%	52.00%	54.50%	66.59%	73.00%
Total							
Containerized traffic	401	498	549	602	660	932	1,091
Total traffic	778	926	988	1,053	1,121	1,394	1,494
Percentage of containerized traffic	51.54%	53.78%	55.57%	57.17%	58.88%	66.86%	73.03%

Table 4

**Forecasted Number of Ship Calls and Average Cargo Per Ship, Years 1-15,
With Project**

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	...Yr 10	...Yr 15
Number of Ship Calls	621	726	763	803	842	888	901
Average Cargo Per Ship (tons)	1254	1277	1295	1312	1331	1573	1657

Source: Louis Berger International, Inc. p.7-82

IV. FINANCIAL ANALYSIS

In this section, the situations with and without the project are analyzed from the financial point of view. The major assumptions and data used in building the cash inflows and outflows are reported, and the cash flow statements along with their corresponding NPVs and real internal rates of return (IRR), for all the cases are presented.

A. Cases

In the without project case, a number of improvements must be made to the current port to enable it to continue handling cargo efficiently as throughput increases with time. These measures are necessary just to preserve the current level of functioning of the port. They consist of the removal of all heavy equipment from the deck along with the repair of the wharf and the existing electrical and sanitary facilities at a cost of 13.8 million pesos. However, the analysis shows that even with these improvements the port will reach its capacity by Year 4 to move cargo between ship and wharf. Thus, the total annual cargo throughput for this case is assumed to be the same for Years 4 through 15.⁶ In the with project case, there will be expansion of capacity with total investment of approximately 635 million pesos. The difference between the with and without case is the incremental project.

B. Revenue Assumptions

Port revenues vary directly with the tonnage handled or cleared (throughout) except for items such as earnings from rental of warehousing and container yards or other buildings and storage yards.

The average revenue per ton of cargo handled is presently pegged at 18.85 pesos. This tariff rate has remained unchanged since 1985. For purposes of this study, it is assumed that a planned 25% nominal increase in tariff will be approved by the Philippine Ports Authority in Year 1. Therefore, an average revenue per ton of 23.55 pesos is used in the projections. Further increases in tariff are assumed to take place every five years to make up for the loss in real value through inflation in the intervening years.

⁶Louis Berger International, Inc., p.9-15.

The revenue forecast is derived from the year by year cargo tonnage forecast and the yearly income from rentals of the container yard.

C. Operating Expense Assumptions

For the existing facilities, operating costs that include personnel services and maintenance and operating expenses are computed at 9.761 million pesos. These are expected to increase by the amount of inflation which is assumed at 10% per annum.

The operating expenses for the new facilities comprise salaries and wages for managerial, skilled/semiskilled labor. Also included are fuel and other utility items like electricity, water, telephone and office supplies. All these costs are expected to increase annually by the rate of inflation.

D. Other Assumptions

Straight line depreciation is used to obtain residual values. A real financial discount rate of 9 percent is used in the computation of the net present values. All the foregoing assumptions are shown in table 5.

E. Cash Flows and Results

The cash flow statements, from the total investment perspective, for the case in which the tariff rates are adjusted every five years are shown in tables 6, 7, and 8. A graph of the real net cash flows for with and without project cases is shown in figure 2.

The summary of results shown in Table 9 reveals that undertaking the project is not financially attractive. While both NPVs with and without the project are positive, 12.5 million Pesos and 20.8 million Pesos, respectively, the NPV with the project is significantly lower than the NPV without project. The incremental financial NPV therefore is negative (-8.3 million Pesos). This implies that it is better from financial perspective if the alternative of just making improvements on the port or the without project case is undertaken.

The differing results can be attributed to the size of the investments. The project requires about 635 million pesos while the without project case only needs 13.8 million pesos in investment. The incremental benefits brought about by the project are not sufficient to justify the huge upfront investment required.

Table 9
Financial NPVs With Tarrif Rates Adjusted Every Five Years
(Thousand Pesos)

With Project	12,451
<u>Without Project</u>	<u>20,777</u>
Incremental	(8,326)

Calculations are also made under assumption that the tariff rates are annually adjusted for inflation. Table 10 shows that the NPVs of both with and without project cases are significantly improved. However the NPV without project is still higher than the NPV with project. This again results in the negative NPV of the incremental project (-4.4 million Pesos). However, there is an improvement in the incremental NPV from -8.3 to -4.4 million Pesos if tariffs are annually adjusted.

Table 10
Financial NPVs With Tariff Rates Adjusted Every Year
(In Thousand Pesos)

With Project	41,071
<u>Without Project</u>	<u>45,443</u>
Incremental	(4,372)

Table 5
Table Of Parameters

A. Project cost and Financing
(in thousand pesos)

Phase I

A. General Repairs		
1. Repair of Existing Wharf		7258
2. Repair of Existing Electrical & Sanitary Utilities		6548
	Subtotal	13806
B. Non-construction measures		
1. Communication Equipment		2022
2. Management Improvements		550
	Subtotal	2572
C. Container Yard I		
1. Container Yard I		31252
2. Emergency Generator		5213
3. Equipment		
	Subtotal	36464
D. Navigational Aids		484
	Subtotal - Phase I	53,327

Phase II

A. Wharf Extension/Container Yard II		
1. Wharf Extension, CYII, Dredging, Fill, Office		329860
2. Gate House/Scale/Fence		6645
3. Equipment Maintenance Bldg.		11236
4. Equipment II		142780
5. Communication Equipment II		247
6. Emergency Generators II		8138
7. Relocation of Badjao Community		4489
8. Property Purchase		11167
	Subtotal Phase II-A	514562
B. Livestock Terminal		67004
	Subtotal - Phase II - A & B	581565
	Project Total - phase I & II	634,892

B. Working Capital

1. Accounts receivable (% of port revenues)	10%
2. Accounts Payable (% of operating costs)	15%
3. Cash Balance (% of port revenues)	5%

C. Discount Rate

1. Nominal Discount Rate	19.90%
2. Real Discount Rate	9.00%

D. Depreciation

1. Equipment	15 years
2. Buildings	25 years
3. Existing Facilities	3821 thousand pesos per annum

E. Funding Source

USAID Grant	75%
Gov. of the Philippines Counterpart	25%

F. Operating Costs**WITH PROJECT****1. Personnel Salaries**

Position	Average Rate Per Month	No.required per Month	Cost per month
Managerial	4250	3	12750
Skilled	3250	62	201500
Semi-skilled	2667	10	26670
Total salaries			240920

2. Fuel cost:

Cost per liter = 8 Pesos per liter

Consumption (in liters):	Per Month (litters)	Per Year (litters)
Emergency Generator I	600	7200
Container Yard II	54000	648000
Emergency Generator II	1200	14400
Livestock Terminal	3000	36000
Total		

3. Electricity

	Pesos/mo. (P'000)	Total/annum (P'000)
Navigation Aids	300	4
Container Yard II	1000	12
Livestock Terminal	14175	170
Total		186

4. Water

Container Yard II	500	6
Livestock Terminal	20900	251
Total		257

5. Telephone

Container Yard II	500	6
Livestock Terminal	500	6
Total		12

6. Office Supplies

Container Yard II	1000	12
Livestock Terminal	1000	12
Total		24

7. Miscellaneous - Nav. aids

200	2.4
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WITHOUT PROJECT**1. Personnel Services**

4939 thousand pesos/annum

2. Maintenance & Operating Exp.

4822.4 thousand pesos/annum

Total

9761.4

G. Opportunity Costs:

- Value of existing facilities 93309 thousand pesos
- Loss of rental income from transit sheds 1100 thousand pesos/annum starting 1991

*** Residual value of existing facilities in Year 15

35994

H. Revenue Assumptions

Ratio of Foreign Ships calling at Makar Port (based on Yr. 1 data)

Number of foreign ships	29
Total number of ships	642
Ratio of foreign ships to total	4.52%
Ratio of Local Ships calling at Makar	95.48%

WITH PROJECT:

1. Other income 2500 thousand pesos per annum
2. Rental of Container Yard II 1000 thousand pesos per annum starting in Yr. 5 to increase in real terms by 1,000 per year until Yr. 13 and will remain constant thereafter
3. Rental of Container Yard I 3000 thousand per annum starting in Yr. 2
4. Port Revenue:
Revenue/ton of cargo handled (*) 23.55 Pesos/ton assuming a 25% increase in tariff rates is approved by PPA

	Year	1	2	3	...5	6	...10	...15
5. Average cargo per ship (tons)		1254	1277	1295	1331	1376	1573	1657
6. Estimated no. of ships calling		621	726	763	842	851	887	902
7. Estimated throughput		778670	926829	988341	1120447	1171201	1395415	1493944

WITHOUT PROJECT:

1. Other income 2431 thousand pesos per annum
2. Revenue/ton of cargo handled* 23.55 Pesos/ton assuming a 25% increase in tariff rates is approved by PPA

	Year	1	2	3	...5	6	...10	...15
6. Est. maximum cargo/annum		778670	926829	988341	1053537	1053537	1053537	1053537
7. Estimated no. of ships calling		621	726	763	803	803	803	803

* in the base case, the tariff rate is adjusted every five years. The rate of adjustment is the inflation index in the year the tariff is adjusted.

TABLE 6: CASH FLOW STATEMENT IN REAL PESOS - WITH PROJECT
(In Thousand Pesos)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RECEIPTS																
Port Revenues - local	14893	16181	15738	15294	21715	20781	19880	18997	26581	25400	23444	21638	29239	27027	24943	
Port Revenues - foreign	3445	3661	3498	3347	4671	4293	3945	3622	4871	4474	4080	3720	4965	4534	4134	
Total port revenues	18338	19843	19236	18641	26387	25074	23825	22619	31452	29875	27524	25358	34204	31561	29076	
Rental income from Container Yard I		3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	
Rental income from Container Yard II					1000	2000	3000	4000	5000	6000	7000	8000	9000	9000	9000	
Other Income	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	
USAID Grant	22148	155088	219215	79719												
Government Contribution																
Liquidation Values:																
Existing Facilities																35994
New Facilities:																
Communication Equipment I																297
Container Yard I																16051
Emergency Generator I																765
Navigation Aids																71
Wharf extension, Container Yard II																221888
Gate house/scale/fence																4470
Equipment Maintenance Bldg.																7558
Equipment II																45735
Communication Equipment II																79
Emergency Generators II																2888
Livestock Terminal																41009
Total Cash Receipts	42986	180430	243951	103859	32887	32574	32325	32119	41952	41375	40024	38858	48704	46061	43576	376804
EXPENDITURES																
Investment cost-non tradable	24443	108223	153285	49006												
Investment cost-tradable	5088	98560	139002	57285												
Opportunity cost of existing facilities	93309															
Operating Cost:																
Existing Facilities	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	
New Facilities																
Loss of rental income from term. shed	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	
Change in Cash balance	817	249	60	58	472	54	51	48	544	64	18	17	558	23	19	(1322)
Change in Accounts Receivable	1807	342	120	115	944	109	103	96	1089	128	37	34	1115	47	38	(2643)
Change in Accounts Payable	(665)	(860)	(133)	(133)	(1486)	(256)	(256)	(256)	(256)	(256)	(256)	(256)	(256)	(256)	(256)	2561
Total Expenditures	135660	217376	303194	117193	19809	19785	19777	19766	21255	19814	19677	19672	21295	19692	19680	(1404)
NET CASH FLOW	(92674)	(36946)	(59244)	(13333)	13078	12789	12548	12353	20696	21560	20347	19185	27409	26369	23897	378209
NET PRESENT VALUE AT	9%	10,760														
INTERNAL RATE OF RETURN																

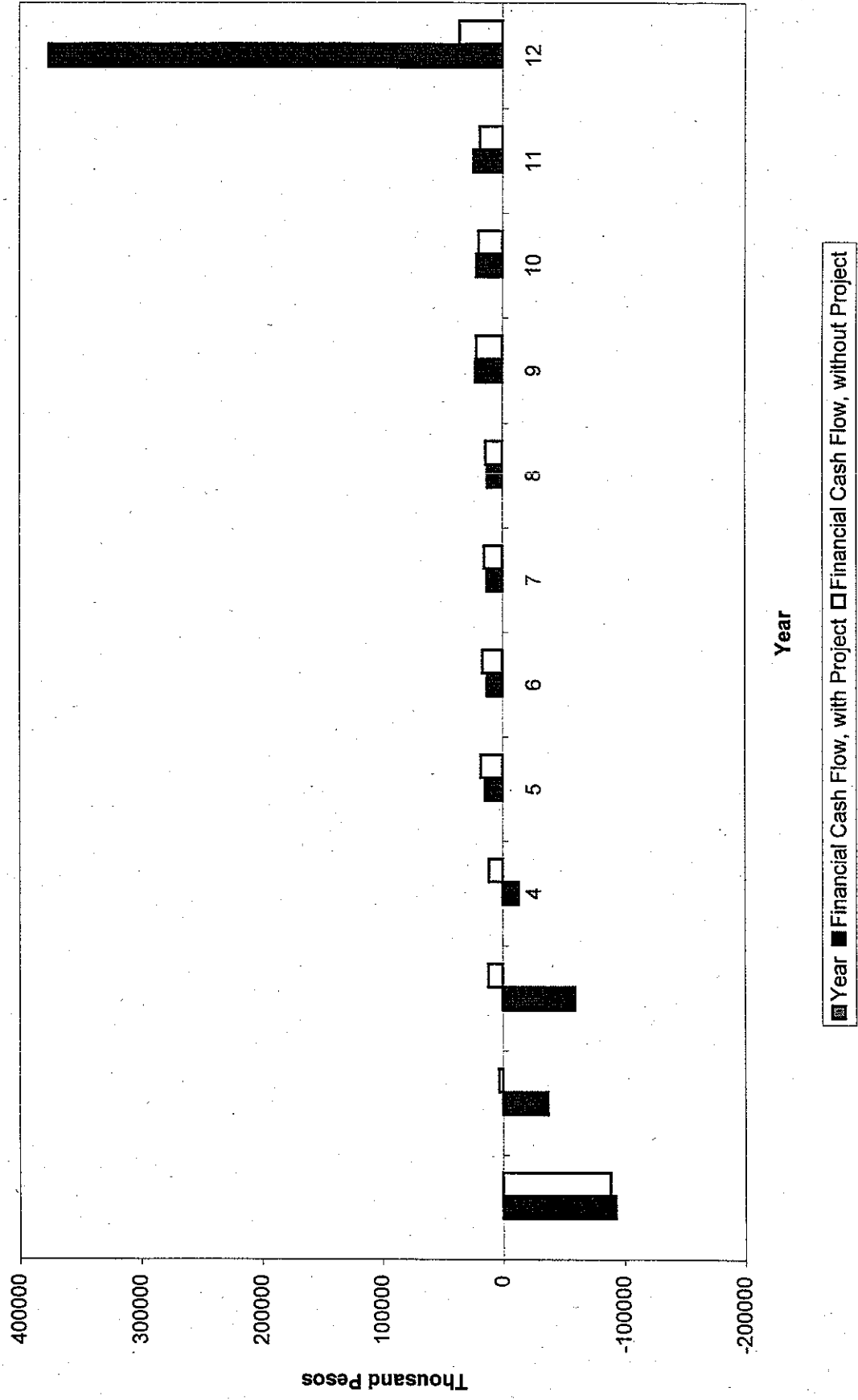
TABLE 7: CASH FLOW STATEMENT IN REAL PESOS - WITHOUT PROJECT
(In Thousand Pesos)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RECEIPTS																
Port Revenues - local	14893	16181	15738	15294	20356	18505	16823	15294	20356	18505	16823	15294	20356	18505	16823	
Port Revenues - foreign	3445	3661	3498	3347	4455	4050	3682	3347	4455	4050	3682	3347	4455	4050	3682	
Total port revenues	18338	19843	19236	18641	24811	22555	20505	18641	24811	22555	20505	18641	24811	22555	20505	
Rental income from Container Yard I																
Rental income from Container Yard II																
Other Income	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	
USAID Grant																
Government contribution																
Liquidation Values:																
Existing Facilities																
New Facilities:																
Communication Equipment I																
Container Yard I																
Emergency Generator I																
Navigational Aids																
Wharf extension, Container Yard II																
Gate house/scale/fence																
Equipment Maintenance Bldg.																
Equipment II																
Communication Equipment II																
Emergency Generators II																
Livestock Terminal																
Total Cash Receipts	20769	22274	21667	21072	27242	24986	22936	21072	27242	24986	22936	21072	27242	24986	22936	35994
EXPENDITURES																
Investment cost-non tradable	1812	4228														
Investment cost-tradable	2330	5436														
Opportunity cost of existing facilities	93309															
Operating Cost:																
Existing Facilities	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	9761	
New Facilities																
Loss of rental income from transit shed																
Change in Cash balance	817	249	60	58	393				393				393			(932)
Change in Accounts Receivable	1807	342	120	115	786				786				786			(1864)
Change in Accounts Payable	(665)	(860)	(133)	(133)	(133)	(133)	(133)	(133)	(133)	(133)	(133)	(133)	(133)	(133)	(133)	1331
Total Expenditures	109171	19157	9808	9801	10808	9628	9628	9628	10808	9628	9628	9628	10808	9628	9628	(1465)
NET CASH FLOW	(88403)	3117	11859	11270	16434	15358	13308	11443	16434	15358	13308	11443	16434	15358	13308	37459
NET PRESENT VALUE AT	9%	19,453														
INTERNAL RATE OF RETURN		12.00%														

TABLE 8: INCREMENTAL CASH FLOW STATEMENT IN REAL PESOS
(In Thousand Pesos)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RECEIPTS																
Port Revenues - local					1359	2276	3057	3703	6225	6895	6621	6344	8883	8522	8120	
Port Revenues - foreign					216	243	263	275	416	425	398	373	510	484	452	
Total port revenues					1576	2519	3320	3978	6641	7319	7019	6717	9393	9006	8572	
Rental income from Container Yard I		3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	
Rental income from Container Yard II					1000	2000	3000	4000	5000	6000	7000	8000	9000	9000	9000	
Other Income	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
USAID Grant	22148	155088	219215	79719												
Government Contribution																
Liquidation Values:																
Existing Facilities																
New Facilities:																
Communication Equipment I																297
Container Yard I																16051
Emergency Generator I																765
Navigation Aids																71
Wharf extension, Container Yard II																221888
Gate house/scale/fence																4470
Equipment Maintenance Bldg.																7558
Equipment II																45735
Communication Equipment II																79
Emergency Generators II																2888
Livestock Terminal																41009
Total Cash Receipts	22217	158157	222284	82788	5645	7588	9389	11047	14710	16388	17088	17786	21462	21075	20641	340810
EXPENDITURES																
Investment cost-non tradable	22631	103995	153285	49006												
Investment cost-tradable	2758	93124	139002	57285												
Opportunity cost of existing facilities																
Operating Cost:																
Existing Facilities																
New Facilities																
Loss of rental income from term. shed					9017	9017	9017	9017	9017	9017	9017	9017	9017	9017	9017	
Change in Cash balance	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	
Change in Accounts Receivable					79	54	51	48	151	64	18	17	164	23	19	(390)
Change in Accounts Payable					158	109	103	96	302	128	37	34	329	47	38	(779)
Total Expenditures	26489	198219	293386	107392	9001	10157	10148	10138	10447	10186	10049	10044	10487	10064	10051	61
NET CASH FLOW	(4272)	(40063)	(71103)	(24604)	(3356)	(2569)	(759)	909	4263	6202	7039	7742	10976	11011	10589	340750
NET PRESENT VALUE AT 9%																
INTERNAL RATE OF RETURN																

Figure 2 - Real Financial Cash Flow



V. SENSITIVITY AND RISK ANALYSES OF FINANCIAL APPRAISAL

A. Sensitivity Analysis

A sensitivity analysis is conducted to determine the impact of changes in key variables on the project's financial NPVs. The variables tested are: percentage change in total cargo handled per annum, real increase in operating cost, project cost, and inflation rate (Appendix, tables 1-4). The results indicate that the project is most sensitive to variations in the inflation rate and the total cargo handled per annum. The sensitiveness of the project's financial NPV to inflation and changes in total cargo handled are summarized in Tables 11 and 12. That the results are sensitive to inflation rate is to be expected since changes in the tariff rates are assumed to be adjusted once every five years by the cumulated inflation since the last tariff adjustment.

Table 11**Sensitivity of Financial NPVs to Inflation**

(In Thousand Pesos)

<u>inflation rates</u>	<u>Financial NPV (W/ Project)</u>	<u>Financial NPV (W/O Project)</u>	<u>Financial NPV (Incremental)</u>
1%	23182	60359	(37177)
2%	21521	57363	(35842)
3%	19992	54477	(34485)
4%	18588	51695	(33107)
5%	17301	49010	(31709)
6%	16127	46417	(30290)
7%	15060	43910	(28850)
8%	14094	41485	(27391)
9%	13226	39138	(25912)
10%	12451	36864	(24413)
11%	11766	34660	(22894)
12%	11168	32523	(21356)
13%	10652	30450	(19798)
14%	10217	28438	(18221)
15%	9859	26484	(16625)
16%	9576	24585	(15009)
17%	9366	22740	(13374)
18%	9227	20946	(11720)
19%	9155	19202	(10046)
20%	9151	17504	(8354)
21%	9210	15852	(6642)
22%	9333	14244	(4911)

Table 12

Sensitivity of Financial NPVs To Changes in Total Cargo Handled per Year

(In Thousand Pesos)

% change in average cargo tonnage	Financial NPV <u>(W/ Project)</u>	Financial NPV <u>(W/O Project)</u>	Financial NPV <u>(Incremental)</u>
-20%	(29097)	(2364)	(26734)
-18%	(24943)	1559	(26501)
-16%	(20788)	5482	(26269)
-14%	(16633)	9404	(26037)
-12%	(12478)	13327	(25805)
-10%	(8323)	17250	(25573)
-8%	(4168)	21173	(25341)
-6%	(13)	25096	(25109)
-4%	4142	29018	(24877)
-2%	8296	32941	(24645)
0%	12451	36864	(24413)
2%	16606	40787	(24180)
4%	20761	44709	(23948)
6%	24916	48632	(23716)
8%	29071	52555	(23484)
10%	33226	56478	(23252)
12%	37380	60400	(23020)

B. Risk Analysis

The critical variables that were identified in the sensitivity analysis as having the biggest impact on NPV, inflation rate and changes in the annual total cargo handled, are further specified according to the likely distribution of values they may take in the future. The assigned probability distributions and range limits of the change in the values of the selected risk variables are shown in Table 13.

The range limits (1 - 50%) and probability distribution (step) for inflation were determined after analyzing the inflation rate in the Philippines last 15 years (Appendix, table 5). On the other hand, the range limits for the change in cargo handled was taken as +/- 20% of the forecasted annual cargo traffic.

Table 13

Risk Variables and Probability Distributions

Risk variable	Probability Distribution	Base Value	Range	Probability
Inflation rate, Years 2 through 16	step	.10	.01-.05	.133
			.05-.10	.400
			.10-.15	.200
			.15-.20	.133
			.20-.50	.133
% Change in cargo handled, Years 1 through 15 ⁷	normal	Mean	Min. value	Max. value
		0%	-20%	20%

The results of the risk analysis show that there is a wide range of values for the NPV with project case (Table 14). The standard deviation and variance are significantly higher

⁷The inflation rate and percentage change in total cargo handled each year are modeled separately.

than those without project case. On the other hand, both mean and median of NPV with project are lower than those of NPV without project. The mean and median of financial incremental NPV are both negative, -19.4 million and -22.2 million Pesos, respectively. Figures 3-5 show the cumulative charts for NPVs with, without, and incremental project cases. It is noteworthy that the probability of negative incremental NPV is almost 90 percent.

Table 14
Financial Risk Analysis Results
(in thousand pesos)

Statistics	Financial NPV (with project)	Financial NPV (without project)	Financial NPV (incremental)
Mean	12,598	31,952	-19,354
Median	11,805	32,583	-22,166
Stand. Deviation	8,631	7,090	10,782
Variance	74,495,215	50,271,951	116,245,321
Minimum	-12,908	5,053	-36,676
Maximum	54,636	50,202	36,644

Figure 3
Cumulative Chart - Real Financial NPV, with Project

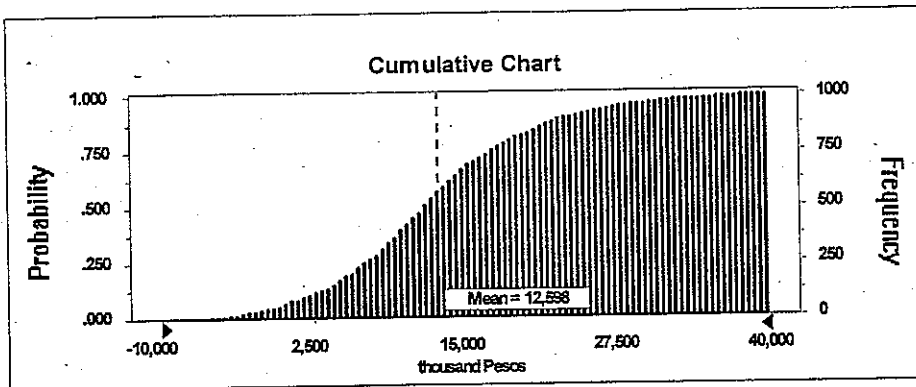


Figure 4
Cumulative Chart - Real Financial NPV, without Project

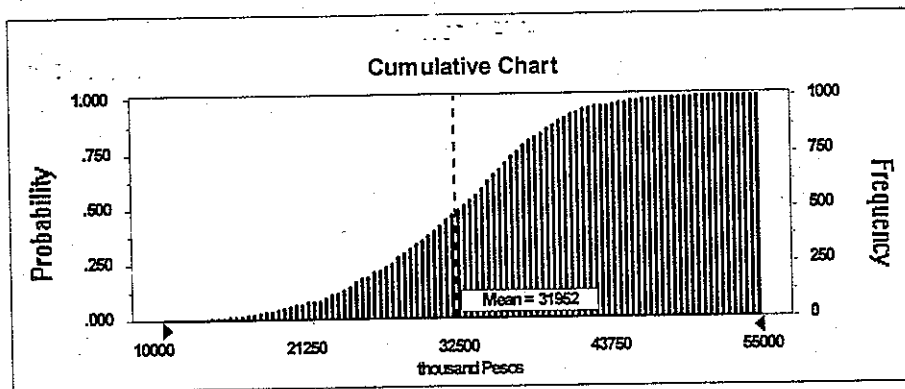
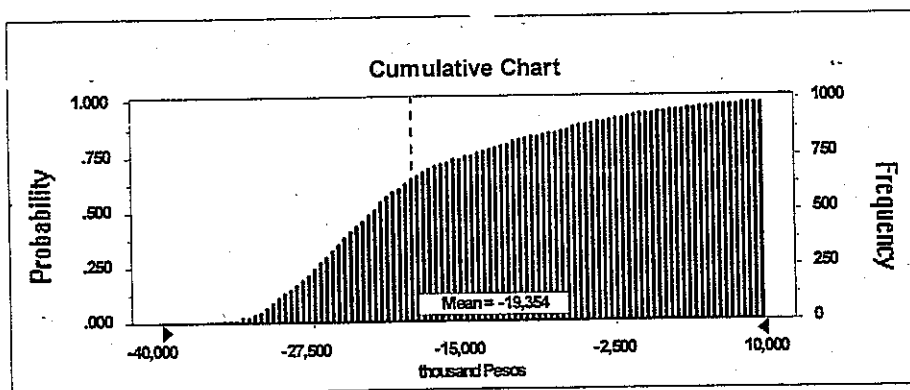


Figure 5
Cumulative Chart - Real Financial Incremental NPV



VI. ECONOMIC ANALYSIS

The major economic benefits of a port project are summarized below:

a. reduced turn-around time of ships in port. This is often the largest single benefit and it is essential to estimate both the waiting time and the time of berth. Irrespective of the fact that the benefits accrue initially to foreign shipowners, it should be included as an economic benefit to the country on the understanding that with a competitive shipping industry the benefits will ultimately flow through to the national economy through lower fare rates

b. transport cost savings made possible by the use of bigger ships which carry the goods at lower cost per ton of cargo

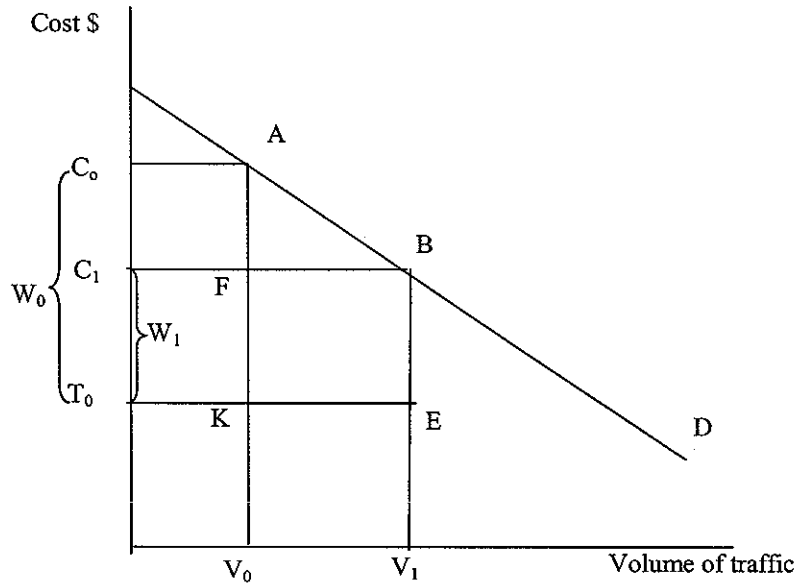
c. reduced time period that goods spend in ports and on ships. This will free the capital tied up in goods and thus give indirect financial benefits to the country as a whole; and

d. benefits of economic externalities derived from stimulating or making possible increased national activity including exports. This activity is often difficult to measure and should only be included when the activity could not take place if the port project were not undertaken.⁸

In this study the economic benefits of the project are considered to be the economic values of: (a) incremental revenues generated due to expanded capacity; (b) savings due to the reduction in ship waiting time; and (c) savings because of reduction in animal weight loss effected by the construction of a livestock terminal. A graphical representation of these benefits is shown in Figure 6.

⁸UNCTAD, "Port Development: A Handbook for Planners in Developing Countries", United Nations, New York, 1985, p.3.

Figure 6
Graphical Representation of Economic Benefits



Where,

D represents the demand or benefits of the services provided by the project

T_0 = real financial tariff rate

W_0 = cost of ship waiting time and animal weight loss, without the project

W_1 = **cost of ship waiting time and animal weight loss, with the project**

C_0 = total cost faced by shipowners/shippers, without the project ($T_0 + W_0$)

C_1 = total cost faced by shipowners/shippers with the project ($T_0 + W_1$)

V_0 = volume of traffic, without project

V_1 = volume of traffic, with project

The incremental economic benefits of the project are the economic value of the revenues generated from the incremental volume (V_0V_1EK) and the savings in waiting time and animal weight loss realized from the project of the existing level of traffic volume V_0 (C_1FAC_0) and incremental volumes (ABF).

The economic value of the incremental revenues generated by the project is equal to the sum of the financial revenues generated from local and international shipping. The latter are adjusted for the foreign exchange premium because they result in an inflow of foreign exchange.

Due to the infrequent changes in the nominal tariffs the real price charged has fallen to the point that by the time the project starts, the real tariff is 25% lower than it was five years before. We start by assuming that the shippers are currently in equilibrium with a total composite cost of shipping of C_0 and volume V_0 . Consequently, the lower real rates of tariff charged will result in an increase in the waiting time and congestion at the port. After the project, the composite cost will fall to C_1 because of the reduction in waiting time and other costs. It is assumed again that the shippers are in a market equilibrium at the new price and volume.

It could be the case that at either point A or point B, after the project is built, there is a gap between the total composite cost and the economic price reflected by what the shippers are willing to pay. If the willingness to pay is greater than the composite cost, we will have biased the economic benefits downward in our analysis. However, from the information and observations available, it would seem that at the margin the waiting time and congestion costs will close the gap between the tariff charged and the shippers' willingness to pay.

The value of the reduction in ship waiting time was estimated from the expected number of hours that the ships would save because of the faster turn-around at the port and the resulting reduction in the ships' operating costs, including fuel, lubricating oils and the crew's salary and food. On the other hand, the savings from the reduction in animal weight loss were estimated from the forecasted volume of livestock that will pass through the port, the expected reduction in weight loss because of shorter waiting time and better protection provided by the new animal terminal, and the liveweight wholesale price of the animals. In 1993 Louise Berger International estimated these reductions in ship waiting time and in animal weight loss and the results are shown in table 15.

Table 15
Economic Benefits of Project
(Thousand Pesos)

	Yr.4	Yr.5	...Yr.10	...Yr.15
Reduction in ship waiting time	25,484	31,264	35,444	36,491
Reduction in animal weight loss		13,331	16,204	19,715

Source: Louis Berger International, Inc., p. F-16

For the economic analysis, the financial values of the cost items are transformed into economic values with the help of conversion factors derived for the National Economic Development Agency of the Government of the Philippines.⁹

In a number of cases, the conversion factors for items which had a foreign exchange component were greater than 1 because of the high foreign exchange premium of 15%. This premium is created because of the relatively high average rate of tariffs in the Philippines. For example, the conversion factor for port revenues generated from international shipping is 1.15 because of this foreign exchange premium.

The procedure used in computing the conversion factor for an item made up of several components was to first estimate the economic value of each component by multiplying its financial value by the corresponding commodity specific conversion factor, unadjusted for the foreign exchange premium. Next, the foreign exchange externality was computed for components that were internationally traded by multiplying the economic value by the rate of foreign exchange premium. The adjusted economic value was obtained by adding the foreign exchange externality to the unadjusted economic value. Finally, the

⁹ National Economic Development Agency, "Project Development and Evaluation Manual", Manila 1999.

conversion factor was computed by dividing the total adjusted economic value by the financial value.

The conversion factors and the economic cash flows are shown in tables 17-19. Table 16 summarizes the results of the economic analysis. It shows that implementing the project would result in a large negative NPV. In the economic analysis, the USAID grant is not treated as an incremental economic inflow of benefits but is considered as having an opportunity cost. This is the correct treatment since the funds could be used elsewhere if they were not used to finance this project.

Table 16
Economic NPVs
(Thousand Pesos)

With Project	(105,576)
Without Project	25,683
Incremental	(131,259)

TABLE 17: CASH FLOW STATEMENT (ECONOMIC) - WITH PROJECT
(In thousand Pesos)

	CFB	1	2	3	4	5	6	7	8	9	10	15	16
RECEIPTS:													
Port revenues - local	1.000	14893	16181	15738	15294	21715	20781	19880	18997	26581	25400	24943	
Port revenues - foreign	1.150	3962	4211	4023	3849	5372	4937	4537	4165	5601	5146	4754	
Total Port Revenues		18854	20392	19761	19143	27087	25718	24416	23162	32183	30546	29696	
Benefit to ship owners due to reduction in ships' waiting time	(*)				25484	31264	33539	34400	34437	34938	35444	36491	
Benefits to shippers due to red. in animal weight loss	(*)					13331	13906	14480	15055	15629	16204	19715	
Rental income from Container Yard I	1.000	0	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	
Rental income from Container Yard II	1.000					1000	2000	3000	4000	5000	6000	9000	
Other Income	1.000	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	
USAID Grant													
Government Contribution													
Liquidation Values:													
Existing Facilities	0.934												33619
New Facilities:													0
Communication Equipment I	0.918												272
Container Yard I	0.942												15116
Emergency Generator I	0.973												744
Navigation Aids	0.961												68
Wharf extension, Container Yard II	0.925												205169
Gate house/scale/fence	0.938												4195
Equipment Maintenance Bldg.	0.943												7124
Equipment II	0.950												43465
Communication Equipment II	0.920												73
Emergency Generators II	0.974												2815
Livestock Terminal	0.924												37876
Total Cash Receipts		21354	25892	25261	50127	78182	80663	81796	82154	93250	93694	100402	350535
EXPENDITURES:													
Investment cost-non tradable	(*)	23494	100461	141822	45422								
Investment cost-tradable	(*)	4773	92595	130373	54059								
Opportunity cost of existing facilities	0.934	87152											
Operating Cost:													
Existing Facilities	0.972	9491	9491	9491	9491	9491	9491	9491	9491	9491	9491	9491	
New Facilities	1.003	0	0	0	0	9044	9044	9044	9044	9044	9044	9044	
Loss of rental income from trans. shed	1.000	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	
Change in Cash balance	1.018	832	254	61	59	480	55	52	49	554	65	20	(1345)
Change in Accounts Receivable	1.018	1839	348	122	117	961	111	105	98	1108	130	39	(2690)
Change in Accounts Payable	0.983	(654)	(845)	(131)	(131)	(1460)	(252)	(252)	(252)	(252)	(252)	(252)	2516
Total Expenditures		128027	203404	282838	110117	19617	19549	19541	19530	21046	19579	19442	(1519)
Net Cash Flow		(106672)	(177512)	(257577)	(59990)	58566	61114	62256	62624	72204	74114	80960	352054
Net Present Value		10%	(105,376)										
Internal Rate of Return			7.16%										

(*) Economic values are estimated separately.

TABLE 18: CASH FLOW STATEMENT (ECONOMIC) - WITHOUT PROJECT
(In Thousand Pesos)

CFs	1	2	3	4	5	6	7	8	9	10	15	16
RECEIPTS:												
Port revenues - local	14893	16181	15738	15294	20356	18505	16823	15294	20356	18505	16823	
Port revenues - foreign	3962	4211	4023	3849	5123	4657	4234	3849	5123	4657	4234	
Total Port Revenues	18854	20392	19761	19143	25479	23163	21057	19143	25479	23163	21057	
Benefit to ship owners due to reduction in ships' waiting time												
Benefit to ship owners due to reduction in inventory cost												
Rental income from Container Yard I												
Rental income from Container Yard II												
Other income	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	2431	
USAID Grant												
Government contribution												
Liquidation Values:												
Existing Facilities												
New Facilities:	0.934											33619
Communication Equipment I	0.918											
Container Yard I	0.942											
Emergency Generator I	0.973											
Navigation Aids	0.961											
Wharf extension, Container Yard II	0.925											
Gate house/scale/fence	0.938											
Equipment Maintenance Bldg.	0.943											
Equipment II	0.950											
Communication Equipment II	0.920											
Emergency Generators II	0.974											
Livestock Terminal	0.924											
Total Cash Receipts	21285	22823	22192	21574	27910	25594	23488	21574	27910	25594	23488	33619
EXPENDITURES:												
Investment cost-non tradable	1676	3912										
Investment cost-tradable	2177	5079										
Opportunity cost of existing facilities	87152											
Operating Cost:												
Existing Facilities	9491	9491	9491	9491	9491	9491	9491	9491	9491	9491	9491	
New Facilities												
Loss of rental income from term. shed	832	254	61	59	400				400			(949)
Change in Cash balance	1839	348	122	117	800				800			(1897)
Change in Accounts Receivable	(654)	(845)	(131)	(131)	(131)	(131)	(131)	(131)	(131)	(131)	(131)	1308
Change in Accounts Payable	102513	18238	9543	9536	10561	9360	9360	9360	10561	9360	9360	(1538)
Total Expenditures	(871228)	4584	12649	12038	17349	16234	14128	12214	17349	16234	14128	35157
NET CASH FLOW												
NET PRESENT VALUE AT 10%		25,683										
INTERNAL RATE OF RETURN		14.459%										

TABLE 19: INCREMENTAL CASH FLOW STATEMENT (ECONOMIC)
(In Thousand Pesos)

	1	2	3	4	5	6	7	8	9	10	15	16
RECEIPTS:												
Port revenues - local					1359	2276	3057	3703	6225	6895	8120	
Port revenues - foreign					249	280	303	316	478	488	520	
Total Port Revenues					1608	2556	3359	4020	6704	7383	8639	
Benefit to ship owners due to reduction in ships' waiting time				25484	31264	33539	34400	34437	34938	35444	36491	
Benefit to shippers due to red. in animal weight loss					13331	13906	14480	15055	15629	16204	19715	
Rental income from Container Yard I		3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	
Rental income from Container Yard II		0	0	0	1000	2000	3000	4000	5000	6000	9000	
Other Income	69	69	69	69	69	69	69	69	69	69	69	
USAID Grant												
Government Contribution												
Liquidation Values:												
Existing Facilities												
New Facilities:												
Communication Equipment I												272
Container Yard I												15116
Emergency Generator I												744
Navigational Aids												68
Wharf extension, Container Yard II												205169
Gate house/scale/fence												4195
Equipment Maintenance Bldg.												7124
Equipment II												43465
Communication Equipment II												73
Emergency Generators II												2815
Livestock Terminal												37876
Total Cash Receipts	69	3069	3069	28553	50272	55070	58308	60581	65340	68100	76914	316916
EXPENDITURES:												
Investment cost-non tradable	21818	96550	141822	45422								
Investment cost-tradable	2596	87515	130373	54059								
Opportunity cost of existing facilities												
Operating Cost:												
Existing Facilities					9044	9044	9044	9044	9044	9044	9044	
New Facilities					1100	1100	1100	1100	1100	1100	1100	
Loss of rental income from term. shed				1100	1100	1100	1100	1100	1100	1100	1100	
Change in Cash balance					80	55	52	49	154	65	20	(397)
Change in Accounts Receivable					160	111	105	98	308	130	39	(793)
Change in Accounts Payable					(1329)	(121)	(121)	(121)	(121)	(121)	(121)	1208
Total Expenditures	25514	185165	273295	100581	9056	10190	10181	10170	10485	10219	10082	19
NEI CASH FLOW	(25445)	(182096)	(270226)	(72028)	41216	44880	48127	50410	54854	57881	66832	316898
NEI PRESENT VALUE AI	10%	(131,259)										
INTERNAL RATE OF RETURN												

VII. RISK ANALYSIS OF ECONOMIC APPRAISAL

A risk analysis of the economic appraisal was conducted with the variables used in the financial risk analysis and the savings from the reductions in ship waiting time and animal weight loss. The mean values are those used in the base case presented above. The range limits and the assigned probability distribution for the former are the same as those in Table 13, while those for the latter are shown in Table 20. In modeling the risk variables, the savings due to the reduction in animal weight loss was positively correlated (correlation coefficient = .90) with the savings from the reduction of ship waiting time since the faster turnaround of ships would lead to lower animal weight loss.

Table 20

Range Values and Probability Distributions of Savings in Ship Waiting Time and Animal Weight Loss

Risk Variable	Probability	Base Value	Range Value	
	Distribution		Min.	Max.
% Change in the savings due to reduction of ship waiting time, Years 4 through 15	normal	deterministic forecast mean	-20%	20%
% Change in the savings from the reduction of animal weight loss, Years 5 through 15 ¹⁰	normal	deterministic forecast mean	-20%	20%

¹⁰The percentage change in the savings due to the reductions in ship waiting time and animal weight loss each year are modeled separately.

Table 21 summarizes the results of the economic risk analysis. Figures 7-9 show the cumulative charts of NPVs with, without, and incremental project cases. Note that the probability that the expansion and incremental projects have negative economic NPVs is 100 percent. On the other hand the probability that the without project NPV is negative is 0 percent.

Table 21
Economic Risk Analysis Results
(Thousand Pesos)

Statistics	Economic NPV (with project)	Economic NPV (without project)	Economic NPV (incremental)
Mean	-104,541	36,909	-141,450
Median	-104,725	37,624	-143,353
Stand. Deviation	7,874	6,915	9,500
Variance	62,002,231	47,816,722	90,244,013
Range Minimum	-127,465	10,554	-164,545
Range Maximum	-75,863	54,367	--98,765

Figure 7
Cumulative Chart - Economic NPV, With Project

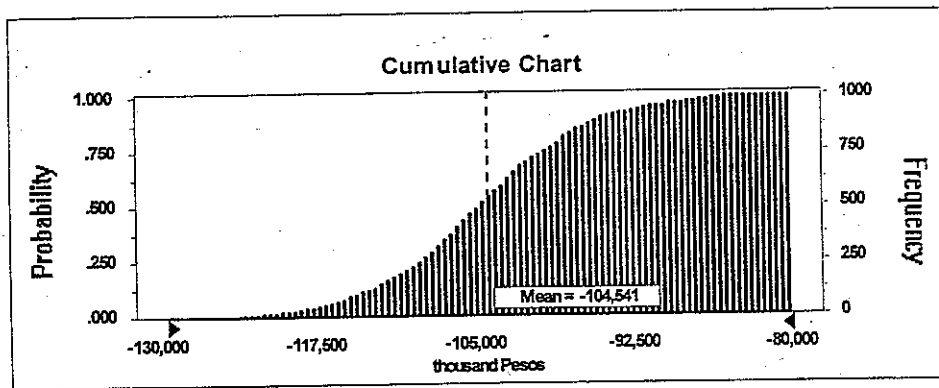


Figure 8
Cumulative Chart - Economic NPV, Without Project

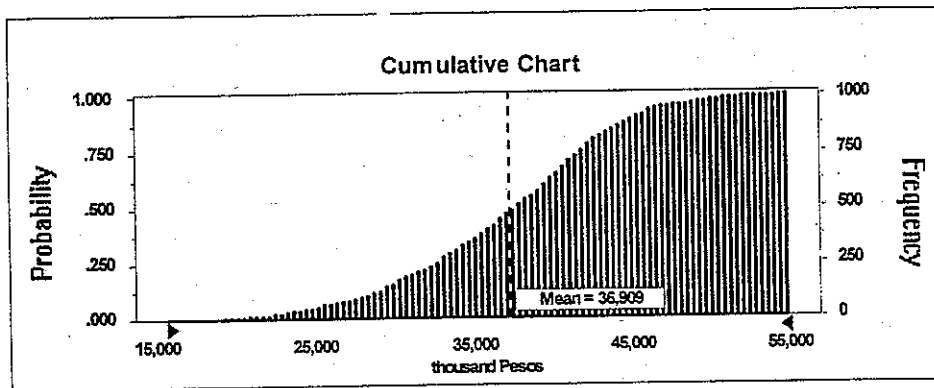
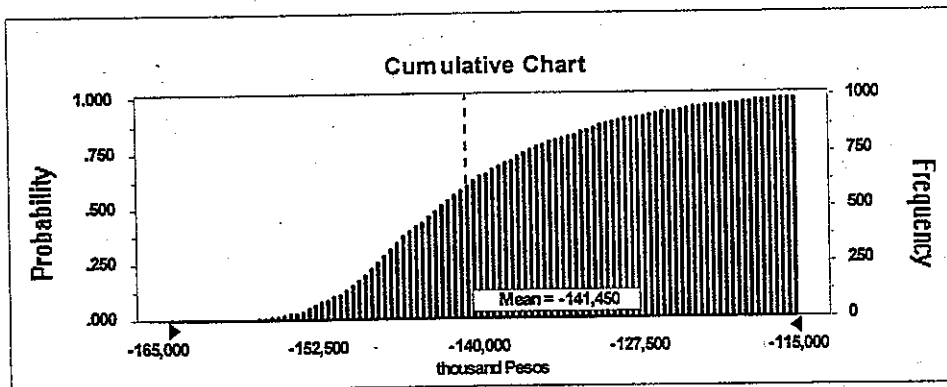


Figure 9
Cumulative Chart - Economic Incremental NPV



VIII. DISTRIBUTIVE ANALYSIS

Projects generate externalities when the economic and financial cash flows differ. This project has externalities as evidenced by the fact that the conversion factor for a number of items is not equal to 1. The total externalities can be computed using the values derived in the base case.

$$\begin{aligned}\text{NPV}_{\text{ext}} &= \text{NPV}_e - \text{NPV}_{fe} \\ &= -131,259 - (-20695) = -110,564 \text{ million pesos}\end{aligned}$$

Where,

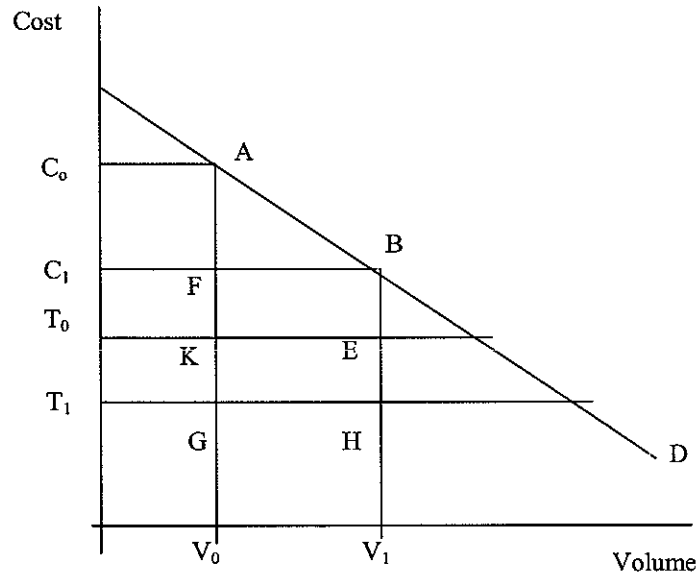
$$\text{NPV}_{\text{ext}} = \text{NPV of externalities}$$

$$\text{NPV}_e = \text{NPV of economic cash flows}$$

$$\text{NPV}_{fe} = \text{NPV of financial cash flows using the economic discount rate}$$

A better understanding of the project's externalities to shipowners/shippers can be made by taking a look at a graphical representation (Figure 10). The tariff rate in a future period, T1, is less than that of the preceding period, To, because the tariff rate is only adjusted every five years. This will enable the shipowners/shippers to gain because they will be paying less than the real cost of tariff. The total externalities can be represented as the difference between the incremental economic and financial benefits. As discussed earlier, the incremental economic benefits are equal to the economic value of the incremental revenue (VoV1EK) and the savings in ship waiting time and animal weight loss accruing to the volume of traffic that would occur without project (C1FACo), plus this same type of savings for the incremental volumes (ABF).

Figure 10
Graphical Representation of External Ties



Where,

- To = real financial tariff rate in a period
- T1 = real financial tariff rate in subsequent period
- Wo = cost of ship waiting time and animal weight loss, without the project
- W1 = cost of ship waiting time and animal weight loss, with the project
- Co = total cost faced by shipowners/shippers, without the project ($T_0 + W_0$)
- C1 = total cost faced by shipowners ($T_1 + W_1$)
- Vo = volume, without project
- V1 = volume, with project

The area GHBF represents the waiting and other costs incurred by the shippers in addition to tariff for the incremental volume. Because this reflects real economic resource costs this amount must be subtracted from the gross incremental benefits of V_0V_1BA

arising from the increased volume. On the other hand, the incremental financial benefits are equal to the difference between the financial benefits with (OV1HT1) and without the project (OV0KTo). It can also be expressed as $VoV1HG - T1GKTo$. Thus, the externalities falling to shipowners/shippers can be expressed in the following equations:

$$\text{Incremental economic benefits} = VoV1EK + ToKACo - T1GFC1 + ABF \quad (1)$$

$$\begin{aligned} \text{Incremental} \\ \text{financial benefits} \end{aligned} = VoV1HG - T1GKT \quad (2)$$

$$\begin{aligned} \text{Externalities} \\ (1)-(2): \end{aligned} = VoV1EK + ToKACo - T1GFC1 + ABF - (VoV1HG - T1GKTo) \quad (3)$$

$$\text{Where, } VoV1EK = VoV1GH + GHEK \quad (4)$$

Substituting Equation 4 into Equation 3 results into:

$$\begin{aligned} & VoV1GH + GHEK + ToKACo - T1GFC1 + ABF - VoV1GH + T1GKTo \\ \text{or } & GHEK + ToKACo - T1GFC1 + ABF + T1GKTo \end{aligned}$$

Where,

$GHEK$ = transfer to shipowners/shippers due to lag in the adjustment of tariff for the incremental volume

$ToKACo - T1GFC1$ = savings in ship waiting time and animal weight loss accruing to shipowners/shippers for the present volume

ABF = savings in ship waiting time and animal weight loss accruing to shipowners/shippers for incremental volume

$T1GKTo$ = transfer to shipowners/shippers due to lag in the adjustment of tariff for the present volume

In this project the externalities, both negative and positive, are primarily distributed between the government and the shippers/shipowners. The gains of the shippers/shipowners

as well as the externalities falling to the government are shown in Table 22. Local shipowners and shippers will gain about 188 million pesos from the savings due to reduced ships' waiting time. Shippers will gain most or all of this since the shipowners are expected to pass on a large proportion of their savings to their customers given the competitive nature of the interisland shipping industry.

Livestock shippers would be the big winners if this project is implemented. They are expected to realize savings of more than 77 million pesos from the reduction of animal weight loss.

The externalities to the government are both positive and negative. The positive externalities are due to tariff and taxes generated as a result of the project. The negative externalities are due to the opportunity cost of the investment. The net effect is a negative externality amounting to more than 375 million pesos.

These results show clearly the dilemma in which the government is likely to find itself. The local livestock owners, shippers, and shipowners will be strongly in favor of the project. The U.S. as the provider of the funds wants to see the people in such poor regions of the country benefit from its assistance. Unfortunately, because this project is very much inferior in its economic productivity to the norm or average projects being undertaken in the Philippines, it should not be approved. This case illustrates the large benefits that can be realized through strong efforts to identify projects that have high economic returns, rather than to just select those which have a vocal local constituency.

TABLE 22: DISTRIBUTIVE ANALYSIS OF INCREMENTAL CASH FLOWS
(In thousand Pesos)

ITEM	(A)		(B)		<u>Analysis of Externalities</u>	
	PV Financ. @ Financial Discount Rate of 9.00%	PV Financ. at Economic Discount Rate of 10.00%	PV-Economic at Economic Discount Rate of 10.00%	PV of Externalities (B - A)	Government	Shipowners/ Shippers
RECEIPTS:						
Port revenues - local	26212	24009	24009	0		
Port revenues - foreign	1810	1669	1919	250	250	
Total Port Revenues	28022	25677	25928	250	250	
Benefit to ship owners/shippers due to reduction in ships' waiting time			187684	187684		187684
Benefit to livestock shippers due to reduction in animal wt. loss			77025	77025		77025
Rental income from Container Yard I	23358	22100	22100			
Rental income from Container Yard II	26143	23895	23895			
Other Income	606	577	577			
USAID Grant	410496	404200		(404200)	(404200)	
Government Contribution						
Liquidation Values:						
Existing Facilities						
New Facilities:						
Communication Equipment I	81	71	65	(6)	(6)	
Container Yard I	4407	3842	3619	(224)	(224)	
Emergency Generator I	210	183	178	(5)	(5)	
Navigational Aids	19	17	16	(1)	(1)	
Wharf extension, Container Yard II	60917	53118	49116	(4002)	(4002)	
Gate house/scale/fence	1227	1070	1004	(66)	(66)	
Equipment Maintenance Bldg.	2075	1809	1705	(104)	(104)	
Equipment II	12556	10949	10405	(543)	(543)	
Communication Equipment II	22	19	17	(2)	(2)	
Emergency Generators II	793	691	674	(18)	(18)	
Livestock Terminal	11259	9817	9067	(750)	(750)	
Total Cash Receipts	582192	558037	413076	(144961)	(409670)	264709
EXPENDITURES:						
Investment cost-nontradable	284898	280673	260925	(19749)	(19749)	
Investment cost-tradable	249422	245332	230517	(14815)	(14815)	
Opportunity cost of existing facilities						
Operating Cost:						
Existing Facilities						
New Facilities	47382	44000	44135	135	135	
Loss of rental income from term. shed	9665	9203	9203			
Change in Cash balance	233	223	227	4	4	
Change in Accounts Receivable	465	446	454	8	8	
Change in Accounts Payable	(1180)	(1145)	(1126)	20	20	
Total Expenditures	590885	578732	544335	(34397)	(34397)	
NET CASH FLOW	(8693)	(20695)	(131259)	(110564)	(375272)	264709

$$NPV (\text{Externalities}) = NPV_o - NPV_o^f$$

$$\text{Or, } -110,564 = -131,259 - (-20,695)$$

IX. DEFERRING THE IMPLEMENTATION OF THE PROJECT

The financial and economic analyses reveal that the project should not be implemented in Year 1 as planned, because it will yield negative financial and economic NPVs for the incremental project. The potential benefits of this project, however, are expected to grow over time as demand for the port service is pushed up with economic growth and development. Is it then economically beneficial from the country's point of view if the project is to be postponed? The following economic analysis of timing will address the effect of postponing the implementation of the project.

This port rehabilitation and expansion project is characterized by the continuous increasing net benefits with calendar time. We assume that investment costs are independent of calendar time; or investment costs in real terms are not changed over time. The project should start if the economic benefits become less than the economic costs due to postponing. The economic benefits of postponing are represented by economic opportunity cost of capital that will be earned if investments are delayed by one year. The costs of postponing are the foregone net benefits, which is the present value of the difference in net economic benefits in the fifth year of the cash flow profiles of with and without projects.

The benefits of postponing are:

$$r^* K_1 + \frac{r^* K_2}{(1+r)} + \frac{r^* K_3}{(1+r)^2} + \frac{r^* K_4}{(1+r)^3} = r^* PV(K)$$

Where,

$K_1, \dots, K_4$ are economic values of investment in years 1-4, respectively

K is the economic value of total investment, or;

$$K = \sum_{i=1}^4 K_i$$

The costs of postponing are represented by:

$$PV(\text{Benefits foregone}) = PV(B^w - B^{w/o}).$$

Where,

B^w and $B^{w/o}$ are net economic benefits with and without project case, respectively, in the fifth year in the cash flow profiles.

Then the decision is made by comparing $r*PV(K)$ and $PV(\text{benefits foregone})$.

If $r*PV(K) > PV(\text{Benefits foregone})$, then postpone.

If $r*PV(K) < PV(\text{Benefits foregone})$, then start.

Table 23 and figure 11 show the basis for decision to undertake or postpone the investment. Since the real values of investment are assumed to be independent of calendar time, the benefits of postponing [$r*PV(K)$] are constant at more than 50 million Pessos, while the costs of postponing (or the net benefits foregone) are increasing over time. It is evident that the project should not be undertaken even in year 12, however.

Table 23

Timing Analysis – Start or Postpone Investment¹¹

Year	2	3	4	...8	9	10	11	12
$r*PV(K)$	50347	50347	50347	50347	50347	50347	50347	50347
$PV(\text{Benefit Foregone})$	30786	32994	34954	41589	42900	45090	45679	46201
Decision	postpone	postpone	postpone	postpone	postpone	postpone	postpone	postpone

¹¹ The costs and benefits of postponement are estimated based on the data in economic cash flow statements for with and without project case. Both the interest rate and discount rate are the same as the economic opportunity costs of capital of 10 percent.

Figure 11
Timing Analysis: cost - Benefit of Postponing

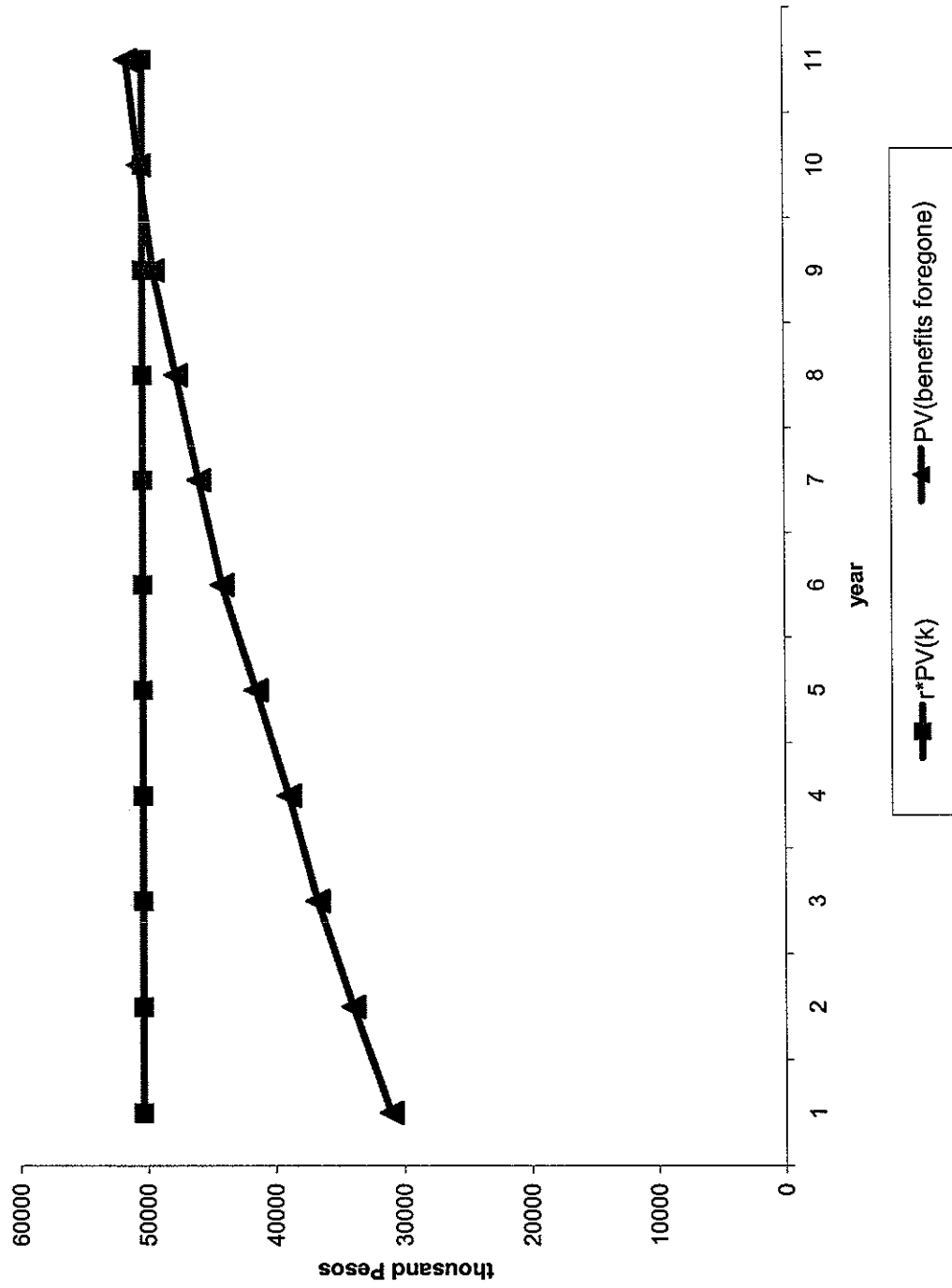
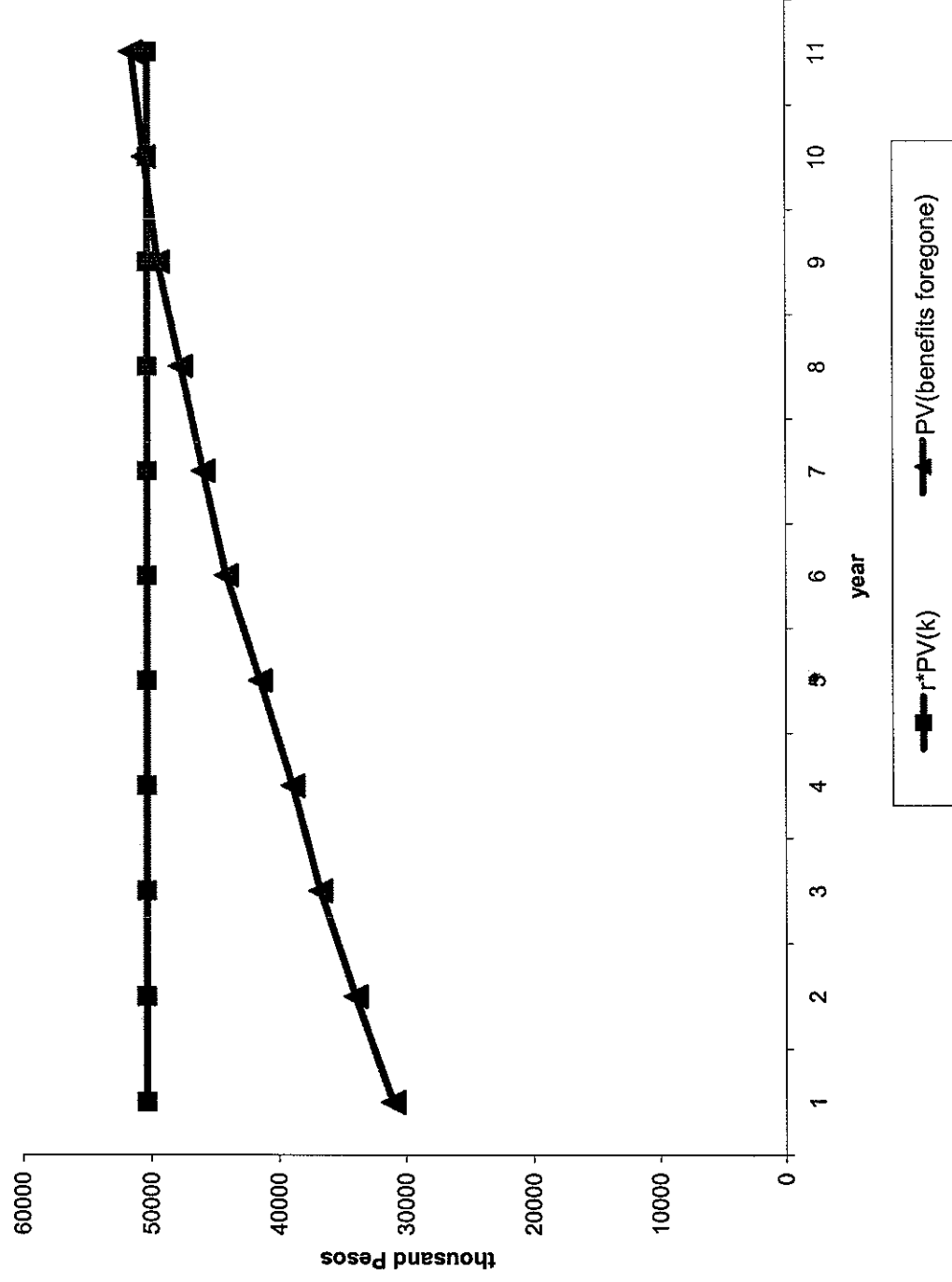


Figure 11
Timing Analysis: cost - Benefit of Postponing



X. CONCLUSIONS

The main conclusions resulting from a detailed financial, risk, economic, and distributive analyses of the project are the following:

1. The project does not look attractive from the financial perspective because it will generate a negative incremental NPV. The incremental NPV is improved if tariff rates are adjusted for annual inflation. However, even if this happens, the project should not be undertaken as planned because the alternative of making repairs to the port to enable it to function properly would yield a much higher NPV.
2. The main variables that affect the project's financial NPV are inflation and the percentage change in total annual amount of cargo. The risk analysis reveals that both mean and median of the incremental NPV are negative and that the probability of negative incremental NPV is as high as 90 percent.
3. The economic analysis shows that the project should not be implemented because of the large negative NPV. The main reason for this is opportunity cost of the USAID grant. Again, the alternative of just repairing the port shows positive economic NPV.
4. Delaying the implementation of the project will improve the economic NPV of the incremental project. However, with our projections, even if the project is delayed until year 12, the economic incremental NPV is still likely to be negative.
5. In terms of distributive effects, the government would lose (as compared to investing in a project with a normal economic return) if the project is implemented with negative externalities amounting to about 376 million pesos (as compared to investing in a project with a normal economic return). On the other hand, shipowners/shippers and livestock shippers would gain with positive externalities of 188 million and 77 million pesos, respectively.

The financial and economic analyses show that the project should not be undertaken because it yields negative NPVs, both financially and economically. The alternative action of repairing the port should be implemented. However, the limitation of doing this is that the port will reach its maximum capacity in four years time and congestions would ensue thereafter. Given this scenario, the scale and implementation period of the project should be reviewed to determine whether scaling it down and delaying the implementation of the scaled down version would result in a feasible project.

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APPENDIX

Table A.1
Sensitivity Analysis - Impacts of Changes in Inflation Rates to Financial NPVs

<u>inflation rates</u>	<u>Fin. NPV</u> <u>(W/ Proj)</u>	<u>Fin. NPV</u> <u>(W/O Proj)</u>	<u>Fin. NPV</u> <u>(Increm.)</u>
1%	23032	42124	(19092)
2%	21211	39263	(18052)
3%	19515	36496	(16982)
4%	17938	33820	(15882)
5%	16476	31230	(14754)
6%	15126	28723	(13597)
7%	13883	26295	(12412)
8%	12743	23943	(11199)
9%	11703	21663	(9960)
10%	10760	19453	(8693)
11%	9909	17309	(7400)
12%	9149	15230	(6081)
13%	8476	13212	(4736)
14%	7888	11253	(3365)
15%	7381	9351	(1969)
16%	6954	7503	-549
17%	6605	5708	897
18%	6330	3963	2367
19%	6128	2266	3862
20%	5997	616	5380
21%	5934	(989)	6923
22%	5939	(2550)	8490

Table A.2
Sensitivity Analysis - Impacts of Changes in Average Cargo Tonnage to Financial NPVs

<u>% chg. In avr. Cargo tonnage</u>	<u>Fin. NPV (W/ Proj)</u>	<u>Fin. NPV (W/O Proj)</u>	<u>Fin. NPV (Incr.)</u>
-20%	(30451)	(16293)	(14158)
-18%	(26330)	(12718)	(13612)
-16%	(22209)	(9144)	(13065)
-14%	(18088)	(5569)	(12519)
-12%	(13967)	(1995)	(11972)
-10%	(9846)	1580	(11426)
-8%	(5725)	5155	(10879)
-6%	(1603)	8729	(10333)
-4%	2518	12304	(9786)
-2%	6639	15878	(9240)
0%	10760	19453	(8693)
2%	14881	23027	(8147)
4%	19002	26602	(7600)
6%	23123	30176	(7054)
8%	27244	33751	(6507)
10%	31365	37325	(5961)
12%	35486	40900	(5414)
14%	39607	44475	(4868)
16%	43728	48049	(4321)
18%	47849	51624	(3775)
20%	51970	55198	(3228)

Table A.3
Sensitivity Analysis - Impacts of Changes in Cost Overrun factor to Financial NPVs

<u>Cost Overrun Factor</u>	<u>Fin. NPV (W/ Proj)</u>	<u>Fin. NPV (W/O Proj)</u>	<u>Fin. NPV (Increm.)</u>
0.995	10976	19518	(8542)
1.000	10760	19453	(8693)
1.005	10543	19388	(8844)
1.010	10327	19323	(8996)
1.015	10111	19258	(9147)
1.020	9894	19193	(9298)
1.025	9678	19128	(9450)
1.030	9462	19062	(9601)
1.035	9245	18997	(9752)
1.040	9029	18932	(9903)
1.045	8813	18867	(10055)
1.050	8596	18802	(10206)
1.055	8380	18737	(10357)
1.060	8164	18672	(10509)
1.065	7947	18607	(10660)
1.070	7731	18542	(10811)
1.075	7515	18477	(10962)
1.080	7298	18412	(11114)
1.085	7082	18347	(11265)
1.090	6866	18282	(11416)

Table A.4
Sensitivity Analysis - Impacts of Changes in Operating Costs to Financial NPVs

<u>Annual % Increase in Operating Costs</u>	<u>Fin. NPV (W/ Proj)</u>	<u>Fin. NPV (W/O Proj)</u>	<u>Fin. NPV (Incr.)</u>
-0.50%	11410	19872	(8462)
0.00%	10760	19453	(8693)
0.50%	10109	19033	(8924)
1.00%	9459	18614	(9155)
1.50%	8808	18195	(9386)
2.00%	8158	17775	(9617)
2.50%	7508	17356	(9848)
3.00%	6857	16937	(10079)
3.50%	6207	16517	(10310)
4.00%	5557	16098	(10541)
4.50%	4906	15678	(10772)
5.00%	4256	15259	(11003)
5.50%	3605	14840	(11234)
6.00%	2955	14420	(11465)
6.50%	2305	14001	(11696)
7.00%	1654	13582	(11927)
7.50%	1004	13162	(12158)
8.00%	354	12743	(12389)
8.50%	(297)	12324	(12620)
9.00%	(947)	11904	(12851)
9.50%	(1598)	11485	(13082)
10.00%	(2248)	11065	(13313)
10.50%	(2898)	10646	(13544)
11.00%	(3549)	10227	(13775)
11.50%	(4199)	9807	(14006)
12.00%	(4849)	9388	(14237)

Table A.5**Phillipine Inflation Rates, 1976-1990**

Year	Inflation Rate, %
1976	9.7
1977	9.4
1978	7.2
1979	17.5
1980	18.2
1981	13.1
1982	10.2
1983	10.0
1984	50.3
1985	23.1
1986	0.8
1987	3.8
1988	8.8
1989	10.6
1990	12.7

Frequency Distribution

Range, %	Frequency
1- 5	2
5-10	5
10-15	4
15-20	2
20 & above	2

Source: National Statistics Coordination Board, Philippine Statistical Yearbook 1991