Corporate Finance, Module 10: “Positive net present values”

Homework Assignment

(The attached PDF file has better formatting.)

{This homework assignment leads you through the reasoning for projecting future prices and economic rents. The numeric solutions are shown; you must derive the results.}

- A steel manufacturing has the opportunity to buy an automated plant for $35 million that will produce *500,000 tons* a year. This firm is the first in its industry to automate.
- Its existing plant produces *1 million tons* a year. It cost $80 million 5 years ago, and it could be sold as a warehouse for $30 million at any time.

We find the net present value of the automated plant and the present value of the existing plant. To find net present values, we use three stages of analysis:

- In the earliest modules, we use the expected cash flows in each year.
- In other modules, we use the expected revenue and expenses in each year.
- We now complete the scenario by assuming an efficient and competitive market.

The first two stages assume the analyst knows the future revenues and cash inflows. But this often ignores market efficiency or competitive markets. If a project has a positive net present value, other firms enter and drive down the price of the product or service. Unless the firm has a competitive advantage, the net present value may be an illusion.

All new steel plants have a zero net present value unless the firm has a competitive advantage. The production costs per ton of steel for the old and new plants are

	Old Plant	*New Plant*
Raw Materials and Energy	15	17
Labor	10	3
Other Direct Costs	5	5
Total Direct Costs	30	25

The *current price* of steel is $38 per ton. The new plant will not affect the market price, since this steel maker is too small to affect the market price. Once all firms switch to the more efficient plants, the market price will change so that no firm earns economic profits.

In this homework assignment, the firm is the first to automate, so it earns economic rents until others automate. It will take two years for other firms to automate.

We look also at the present value of the old plant. Building the old plant for $80 million would be a zero NPV investment if the market price stays at $38 a ton. (This exercise assumes that costs and market demand have not changed since the old plant was built.) Since the market price will fall when other firms automate, building the old plant now for $80 million would be a negative NPV investment.

But the old plant is already built; the $80 million is a sunk cost. The present value of the old plant is the profits it earns as long as it is used plus the present value of its sale price. (The sale is for a warehouse; it is not sold to produce steel.)

For simplicity, this problem ignores taxes and depreciation. Both the old and new plants are assumed to continue in perpetuity without loss of nominal dollar value. We cover taxes and depreciation in other modules of this course.

Other steel makers are also automating, but they need two years to built new plants. The other new plants are identical to the plant which this steel maker wants to buy. (In practice, since buying this plant is a positive NPV investment, the seller would ask for a higher price in a perfectly competitive market. We assume that this steel maker is getting a good deal from the seller.)

When other companies complete their modernization programs in two years, the price of steel will fall to the competitive price (the costs plus the opportunity cost of the steel plant).

The cost of capital is 10% per annum. Ignore income taxes for this problem.

Part A: What is the initial capital outlay for the new (automated) plant per annual ton of steel? (The cost of the plant is $35 million, and the annual production is 500,000 tons.)

Part B: What is the break-even price *per ton of steel* to give a *zero NPV* for the new plant? (This is the initial capital outlay per ton of steel times the opportunity cost of capital plus the material, energy, expenses, and labor per ton of steel in the new plant. If the initial investment is $10 per annual unit, the opportunity cost of capital is 10% per annum, and the variable costs are $1 per unit, the break-even price is $2 per unit. Work out the break-even price for steel from the variable costs, the initial outlay, and the cost of capital.)

Part C: The current price is $38 per ton of steel, and the price will not fall to the competitive price with automated plants for two years. The new plant does not depreciate; its worth remains $35 million, so the difference between $38 and the competitive price is the economic rent. In two years, the market price falls to the competitive price and the plant has no more economic rent. (It still has value, but its value is exactly its opportunity cost of capital.) Explain why the rent is $6 a year per ton of steel for two years.

Part D: What is the net present value of this economic rent? (Use the 10% opportunity cost of capital.) Explain why the rent is $5,206,612.

The steel maker must decide whether to close down the old plant and sell it. It will sell the plant if the opportunity cost of the old plant exceeds its profit per ton of steel.

Part E: What is the opportunity cost of the old plant? (This is the opportunity cost of capital times its potential sale price, not the opportunity cost of capital time the original purchase price. The original purchase price is a sunk cost.)

Part F: What are the costs per ton of steel for the *old plant*? (Listed in the table.)

Part G: Does the present market price of $38 per ton of steel exceed the sum of the costs per ton of steel plus the opportunity cost of the old plant per ton of steel? (It does; show this. Use the *sale price* of the old plant, not the original purchase price. The potential sale price is the opportunity cost, not the original purchase price, which is a sunk cost.) Brealey and Myers emphasize this difference. The average firm (with no competitive advantage) is reluctant to enter a market; but once it has spent the sunk costs of entry, it will stay even if the original decision to enter was not wise. Actuaries speak of this as the costs of exit or as ransom paid to exit a state. Brealey and Myers say that if the insurer has already spent the sunk costs of entering a state, it may be rational to stay even in poor times.

Part H: The old plant will be sold if the competitive price per ton of steel falls below the break-even price. This will happen when the industry automates and everyone is using new plants. What is the break-even price per ton of steel for the old plant?

Part I: By how much does this break-even price exceed the competitive price using automated plants? (Show that this is $1 per ton of steel.)

Part J: What is the present value of the old plant? (This is the present value of its use over the next two years, until it is sold, plus the present value of its sale price in two years. We don't subtract the opportunity cost of capital, so the profit is the current market price of $38 per ton minus the costs of $30 per ton. We don't subtract the opportunity cost of capital of the $30 million resale-value plant because we are *comparing* the present value of the plant with its sale price.)

Show that this present value is $38,677,686. The implication is that it is rational to continue producing with the old plant (as well as the new plant) for the next two years, and then to sell the old plant as a warehouse.