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Economic Order Quantity and the value of the firm: perpetuities in a world without leverage cost

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EXECUTIVE SUMMARY

Deciding on the lot size when buying from a supplier is important because it may affect the value of the entire firm. Several authors in the Supply Chain Management (SCM) world have come up with formulas to calculate the order quantity, so that the total cost of the firm is minimized. This optimum quantity is usually referred to as the Economic Order Quantity (EOQ). In contrast, financial researchers have also developed methods to calculate (and eventually maximize) the value of a firm, which is what really matters to shareholders. Unfortunately, minimizing cost is not the same as maximizing value, and SCM specialists do not always use these financial tools.

In this thesis, we show how some of these tools should be used to derive the order quantity optimally in a simple world. This simple world consists of a firm facing constant and deterministic demand for one product served by a single supplier. There is no leverage cost (the perceived value of the firm is not reduced for stakeholders due to financial distress or bankruptcy) and flows are perpetual. The market is perfect.

The criterion we use is not, as one could expect, to minimize the total cost of the firm, but to maximize the value of the firm for its shareholders. Besides, as an unprecedented assumption, we define the firm's cost of capital as partially endogenous to operations.

During our analysis, we derived a modified EOQ formula. We assessed how different this EOQ is from the classic one and conducted a sensitivity analysis for the difference. We also generalized the classic EOQ by including a parameter that depends on how debt is repaid to the bank. Under the assumptions made, we found that:

- The cost of capital (a key component of the holding inventory cost) to be used in the EOQ formula should *not* be the usual weighted average capital cost, but the cost of capital of the unleveraged firm.

- The EOQ should actually be lower than in the classic model.

- The EOQ dos not depend on the cost of the debt nor the leverage of the firm.

We then analyzed the implications of postponement of payments to a supplier on both the value of the firm and the EOQ. We derived an expression for the increase in value of the firm using both discrete and continuous discount techniques. We learnt that:

- The value of the firm increases more than current discount techniques suggest because of the lower risk that shareholders perceive.

- The EOQ does not change if the firm is valued using discrete discount techniques.

The implications of the conclusions of this thesis are that, under reasonable assumptions, managers should:

- Consider the impact of risk change for shareholders when making operational decisions due to the change in leverage.

- Reduce order quantities to suppliers by a significant amount.

The economic impact of this reduction is usually unimportant, due to the recognized low sensitivity of both the total costs and the equity cost of capital with regard to the order quantity. However, for some companies in specific industries (showing high financial leverage, high business risk, and thin net margins) the impact can be significant.