



The effect of transaction costs, payment terms and power on the level of raw materials inventories

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ABSTRACT

This paper proposes and tests an explanation for the level of raw materials inventories based on transaction cost economics theory and the role of power in a supply chain. According to this explanation, raw materials inventories are larger the higher a company's transaction costs and the lower its storage-related production and management costs. Factors that affect these costs are the company's vulnerability to opportunism, whether the input becomes more or less costly to store and manage as it moves through the supply chain, payment terms and the company's power in relation to its supplier. This explanation for the level of raw materials inventories was tested on a large sample of customer industries matched to their main supplier industries. Consistent with this theory, the empirical results show that companies hold larger raw materials inventories the more money their suppliers spend on research and development and the less important the customers are to their suppliers. These results are important because they indicate companies must consider a wider range of factors than previously thought necessary when establishing inventory policy.

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1. Introduction

The United States Census Bureau (2010) reported that U.S. companies held \$1.36 trillion of inventories at the end of June 2010. This is a large investment that also is apparent in the manufacturing industries studied in this paper. Fig. 1 shows the distribution of total inventories as a percent of cost of goods sold held by companies in the sample industries over a 10-year period. Nearly two-thirds (62.23%) of the observations were of inventory levels between 10 and 30% of cost of goods sold. The average value of this ratio in the sample was 20.34% which corresponds to a days'-cost-in-inventory of approximately 74 days.² Looked at another way, about 60% (59.89%) of the observations in the sample were for inventory levels of more than 10% of total assets.

Large investments in inventory like these persist even though we have more than 25 years of experience with just-in-time (JIT) and other innovations in manufacturing and information technology. One explanation for the persistence of inventories is that even the wide-spread use of JIT cannot completely eliminate

some of them; it can only shift them elsewhere in the supply chain.

This paper proposes and tests an explanation for the level of one component of a company's inventory, raw materials, by recognizing that this inventory could be held by its supplier as finished goods. A company that substitutes its own raw materials inventory for part or all of its supplier's finished goods inventory can be considered to have partially backward vertically integrated into its supplier's business. Transaction cost economics (TCE) theory is widely used to examine full vertical integration which is why it is used here to examine partial vertical integration via storage.³

Using TCE theory to examine the level of raw materials inventory makes several contributions to inventory theory and practice. At the theoretical level, the paper places inventory policy in a broad economic context that it shares with other strategic decisions such as vertical integration. This makes it easier to recognize that the decision to store inputs is one of many adaptations to the costs of contracting with external suppliers. Placing inventory policy in this context also expands the explanations for the levels of core and precautionary inventories beyond order costs and demand and replacement lead-time uncertainty to include protection from supplier opportunism. This provides an explanation for

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² Days'-cost-in-inventory equals total inventory as a percent of cost of goods sold multiplied by 365.

³ See Rindfleisch and Heide (1997) and Shelanski and Klein (1995) for comprehensive reviews of the TCE literature.

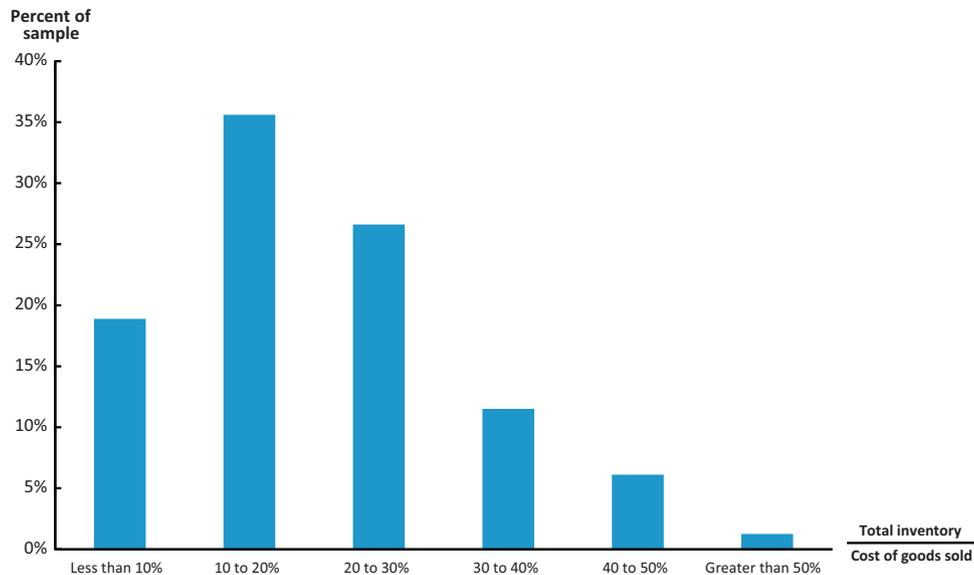


Fig. 1. Total inventory levels of sample manufacturing firms.

higher inventory levels than would be predicted by theories that omit this factor. Finally, the paper provides a theoretical explanation for JIT as an extreme outcome within the transactions cost context for inventory policy.

This explanation for the level of raw materials inventories was tested on a large sample of customer industries matched to their main supplier industries. The results of these tests contribute to inventory practice at the policy level. These contributions include providing evidence that companies hold larger raw materials inventories when they buy specialized parts from a limited number of suppliers that are more important to them than they are to the suppliers. There also is practical significance to the finding that a supplier's payment terms have two effects. The first effect is a reduction in opportunity costs when an account payable is created which increases the demand for inventory. The second effect is a reduction in transaction costs when an account payable is held hostage to the supplier's performance which reduces the demand for inventory. The latter effect was not widely recognized or documented before. Taken together, all the empirical results demonstrate that when establishing raw materials inventory policy, companies must consider a broader range of factors than previously thought necessary.

Finally, the paper makes an important methodological contribution to the study of supply chains by developing a new measure of power based on how important a customer and supplier are to each other. This new measure of power is an objective measure based on the volume of trade between the parties which contrasts sharply with previous measures that were based on surveys. The measure was highly effective in all the empirical tests, demonstrating its practical significance.

The remainder of this paper is organized as follows. Section 2 briefly reviews TCE theory as well as some of the results of using that theory to explain vertical integration. Section 2 also reviews more recent papers that provided an impetus for this paper by recommending that TCE theory be applied to supply chain management. Section 3 develops the explanation for the level of raw materials inventory as a function of the customer's transaction costs and storage-related production and management costs, the supplier's payment terms and the customer's power. Section 4 presents the results of empirical tests of this explanation for the level of raw materials inventory while section 5 provides concluding remarks.

2. Related work

TCE theory recognizes that companies incur production and governance costs whether they make or buy the parts and services they need. Production costs are the costs of the inputs themselves while governance costs are the costs of negotiating, implementing and revising the contracts under which the company obtains its inputs. Coase (1937) distinguished between the governance costs of contracting with external firms and the company's own employees by calling them transaction and management costs, respectively. Williamson (1981) argued that asset specificity affects both production and governance costs. Suppliers may have lower production costs than their customers due to economies of scale and scope but their advantage is smaller with specialized products that provide fewer opportunities to pool customers' demand. He also claimed that transaction costs are lower than management costs for general purpose products but that this advantage disappears with specialized ones for which there are few substitutes. Williamson predicted that companies vertically integrate and produce their own inputs when a high degree of asset specificity causes the transaction, production and management costs of external supply to be higher than the production and management costs of internal supply.

There have been other suggestions for dealing with the potential problems of external supply but on close examination, they also involve vertical integration. Kraljic (1983) associated supply risk with the complexity of the supply market and the relative strength of the customer and its supplier. He argued that customers purchasing high-value specialized materials from strong suppliers face a high level of supply risk and proposed that they produce their own inputs or hold larger inventories to manage this risk (Exhibit V, page 115). Fisher (1997) suggested that different types of products require different types of supply chains. He claimed that functional goods require physically efficient processes that minimize the cost of supplying predictable demand by limiting internal production capacity and inventories while innovative goods require market-responsive processes that permit effective reactions to unpredictable demand via buffer production capacity and stocks of parts or finished goods (Table, page 108). In the language of TCE, Kraljic's (1983) specialized materials and Fisher's (1997) innovative products have high asset-specificity and the supply chains they proposed for them are more vertically integrated

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