3. Empirical Evidence on Transaction Cost Theory

Outline

- Transaction Cost Economics (TCE)
- Evidence regarding transaction cost theory
- The business management approach to outsourcing
- Evidence from the business management literature
- Implications for the Air Force

Outline

Next, we describe statistical tests of the predictions made by transaction cost theory regarding the relationship between governance structures and the characteristics of transactions. The empirical evidence related to outsourcing includes analysis of the “make vs. buy” decision, contract design, temporal specificity, and reputation effects. In general, the evidence is consistent with the predictions of transaction cost theory.
Empirical Evidence Is Consistent with the Predictions of TCE

- Statistical tests of TCE relate governance structures to characteristics of transactions
  - Asset specificity, uncertainty, complexity
- Based on “survivor analysis”
  - Inefficient governance structures are weeded out by competitive pressures
  - Remaining structures should be efficient
- Since the Air Force doesn’t face the same kind of competitive pressure, it can learn from the experience of private firms

Empirical Evidence Is Consistent with the Predictions of TCE

The empirical literature on TCE tests the proposition that the efficient governance structure is a function of the properties of the transaction in question, such as asset specificity, uncertainty, complexity, and frequency. The governance structure can be a binary decision variable, such as “make” or “buy,” or a continuous variable, such as contract duration. The characteristics of the transactions are difficult to measure, and are often based on surveys or interviews of industry managers. For example, measures of asset specificity include engineering or research and development (R&D) expenditure on components (as measures of physical specificity), worker-specific knowledge, physical proximity of contracting firms, and contract quantities (as a proxy for dedicated assets).

Statistical tests of TCE are based on “survivor analysis,” i.e., the proposition that inefficient governance structures will be weeded out over time by competitive pressure. Organizations that choose the wrong governance structures for transactions will have higher costs for a given level of output than organizations that choose efficient governance structures, and will eventually be driven out of
the market. Managers can learn from the success or failure of other organizations and adapt governance structures accordingly. Therefore, the active governance structures observed by researchers should be efficient, assuming that the economy is close to a steady-state equilibrium.\footnote{As we discuss in greater detail in Section 5 below, the empirical business management literature suggests that survivor analysis may not always reveal the most efficient industry structure. In particular, the vertical integration decisions of the U.S. automobile industry analyzed by Monteverde and Teece [1982a] and [1982b] and Masten, Meehan, and Snyder [1989] may have been a local optimum, but they were not a global optimum in comparison with the integration decisions made by the Japanese automobile industry. Even within the U.S. automobile industry, there is a great deal of variation in the degree of vertical integration, which in 1980 ranged from 30-35 percent of value added at Chrysler to 50 percent at Ford and 60-70 percent at General Motors. See Helper [1991b].}

Government entities (such as the Air Force) do not face the same types of competitive pressures that private industry does, although recent budget pressures may serve as a substitute to some extent. This lack of competitive pressure suggests that the Air Force may have chosen non-optimal governance structures for some transactions, and could learn from the experience of the private sector. For example, if the Air Force uses organic provision when contractor provision could increase the value of performance net of total production and governance costs, then outsourcing could correct some of these problems.
Asset Specificity Makes Outsourcing More Difficult

- Vertical integration may be more efficient when transactions involve
  - Asset specificity
  - Uncertainty
  - Thin markets

- Outsourcing can still be feasible if buyer owns transaction-specific assets
  - Government ownership of facilities and tooling can reduce potential for opportunism

Asset Specificity Makes Outsourcing More Difficult

Statistical tests of the “make vs. buy” decision find that vertical integration is positively associated with site specificity (particularly when transportation costs are high), physical asset specificity, and human capital or “know-how” specific to the transaction. Uncertainty about demand does not increase integration by itself, but has an interactive effect with transaction-specific assets and with thin markets (small numbers of buyers and/or sellers). However, outsourcing may still be feasible if ownership of transaction-specific assets by the buyer can mitigate the potential for opportunism.

One group of empirical results in this area is based on mine/refinery (or electricity generator) relationships, where the need to tailor the plant to the quality of the ore and high transportation costs create asset specificity. For example, Joskow [1985] found that mine-mouth electricity generators were six times more likely to own the associated coal mine than non-mine-mouth plants. Aluminum refiners typically own their own bauxite mines because of high transportation costs and the specificity of refineries to ores, but tin refining is less likely to be vertically integrated because of lower transportation costs and the
ability of refineries to handle ores from different mines. (See Stuckey [1983] and Hennart [1988].)

Vertical integration decisions have also been studied extensively in the automobile industry. Klein, Crawford, and Alchian [1978] and Klein [1988] discuss General Motors’ (GM’s) 1926 decision to acquire Fisher Body. Factors that influenced the integration decision included the need for transaction-specific investments in stamping presses and dies after the transition from wooden bodies to closed metal bodies, friction over the price of sales exceeding the quantities covered in the contract, and the refusal of Fisher to locate its facilities closer to GM.

Monteverde and Teece [1982a] collected data on internal and external procurement of automobile components by GM and Ford. They found that component production was more likely to be vertically integrated if the component required a greater amount of design engineering, which served as a proxy for human capital specificity. Masten, Meehan, and Snyder [1989], using an independent sample of 118 automobile components procured by the Big Three, looked at the importance of physical-asset and site specificity in addition to engineering intensity. Although they found that engineering intensity was a significant determinant of vertical integration, physical and site specificity were not. The authors argued that buyer ownership of transaction-specific physical assets may be sufficient to reduce opportunism, whereas human capital assets are more difficult to monitor outside the firm.

This argument has been demonstrated by Monteverde and Teece [1982b], who found that automobile manufacturers were more likely to retain title to tooling used by suppliers the more specialized and expensive it was. Similar evidence was found in rail freight contracting (see Palay [1984]), where shippers rather than carriers owned more-specialized rail cars and internal racks to secure specific parts. Masten [1984] also found that the government retained title to specialized tooling and test equipment in the aerospace industry except in a few cases that involved proprietary technology or equipment with a high alternative-use value or short useful life.
Contracts Can Be Tailored to Fit the Characteristics of Transactions

To induce the contracting parties to make transaction-specific investments, the buyer/seller relationship must last long enough to realize a positive return on the investment. The ability to engage in opportunistic behavior can be reduced by long-term contracts that limit the parties’ ability to renegotiate. As expected, the empirical literature on contract duration finds that contract length increases with greater site specificity, physical asset specificity, and the value of dedicated assets. However, if circumstances are changing rapidly, long-term contracts that reduce opportunities for renegotiation may lock the parties into an agreement that is no longer appropriate. Thus, these studies also find that contract length decreases with greater uncertainty, because of the increased need to adapt to changing conditions.

Joskow [1987] examined the relationship between contract duration and asset specificity using evidence from long-term contracts between U.S. coal mines and electric utilities. He found that coal contracts in the West, where coal is of variable quality and mines are large and geographically dispersed, are 11 years longer on average than in the East, where a large number of small mines produce
coal of relatively uniform quality. Contracts with mine-mouth plants are 12 years longer on average, and contract length increases by 13 years for each additional million tons of coal contracted for delivery (which reflects the size of the investment in transaction-specific assets).\(^2\)

Crocker and Masten [1988] addressed the effects of uncertainty on contract duration using data on long-term natural gas contracts. They found that price regulation of natural gas reduced the ability of the contracting parties to adapt long-term contracts to reflect changing circumstances, and reduced contract length by an average of 14 years. Uncertainty caused by the 1973 Arab oil embargo further reduced contract length by three years.

Other contract features include “take-or-pay” provisions or other penalties for refusing to buy, to protect the seller’s investment. For example, Goldberg and Erickson [1987] examined long-term contracts between petroleum coke refiners and their customers. Because of high storage costs, a buyer’s failure to take delivery can disrupt operations at the refinery and impose costs on the seller. Furthermore, high transportation costs encourage customers to locate near suppliers and limit the possibility for sales to alternative customers. As a result, contracts tend to be long-term, with minimum purchase requirements and substantial financial penalties for non-removal by buyers. Many contracts also provided for price flexibility by using indices tied to the price of crude oil or allowing negotiation within minimum and maximum prices.

Masten and Crocker [1985] interpret take-or-pay provisions (requiring minimum payments even if delivery is not accepted) in natural gas contracts as damages for breach of contract by the buyer. Breach of contract is efficient if the buyer gains more than the seller loses, which will be the case if the minimum payment compensates the seller for the difference between the contract price and its next-best sale opportunity. The authors found that the size of take-or-pay requirements were negatively correlated with the number of pipelines serving the field (reflecting alternative sales opportunities), and positively correlated with the number of sellers in the field (which reduces the value of retaining gas in the ground for future sales, since the sellers are drawing on a common pool of gas).

Price adjustment provisions can facilitate the use of long-term contracts by mitigating the effects of price uncertainty. Although fixed-price contracts are

\(^2\)The sample of 205 contracts accounted for more than 30 percent of contract coal deliveries in 1979. Contracts ranged in length from one to 50 years. Approximately 17 percent of contracts covered 5 years or less, 12 percent covered 6-10 years, 37 percent covered 11-20 years, 17 percent covered 21-30 years, and 17 percent covered more than 30 years.
easier to administer and are associated with better pre-contract information and less opportunism, Goldberg [1985] argued that they can result in an excessive pre-contract search for information about future prices and costs, and in poor performance and post-agreement jockeying to force a renegotiation if they are used in circumstances where prices are uncertain. There are also trade-offs involved with the choice of price adjustment mechanisms, which can be based on market price indices or allow for some degree of renegotiation. Less formulaic price adjustment mechanisms are more flexible, but they also allow for greater opportunism during renegotiation.

Joskow [1988] and [1990] examined how well price adjustment mechanisms related to production costs in long-term coal contracts reflect market prices over time. He found that these mechanisms worked well in the 1970s, but diverged from the 1980s market price of coal, which fell while production costs continued to rise. However, relatively few of these contracts were renegotiated, possibly because of threat of legal sanctions. There may also have been less competitive pressure for regulated or local-government-owned electric utilities to minimize costs.

However, in many cases, there is no relevant market price or index that can serve as a guideline for price adjustment mechanisms. Crocker and Masten’s [1991] study of natural gas contracts found a trade-off between very precise agreements that constrain opportunism and loose agreements that permit adjustment to changing economic circumstances. More-flexible price renegotiation was associated with longer contract duration and greater price uncertainty, as well as larger minimum payment provisions. This suggests that quantity guarantees are a substitute for stricter price adjustment mechanisms.

There is also evidence that the Air Force has tailored price adjustment mechanisms to reflect transaction costs. Crocker and Reynolds [1993] analyzed jet engine contracts for the F-15 and F-16 with Pratt and Whitney and General Electric over the period from 1970 to 1991. Price adjustment mechanisms varied from firm fixed price (no adjustment) through formulaic adjustment mechanisms to incentive contracts allowing relatively open-ended renegotiation. They found that more-open-ended contracts were associated with greater uncertainty about costs or technology, longer contract duration, and lower potential for contractor opportunism (as measured by the contractor’s litigation history and the presence of alternative suppliers). The authors concluded that the degree of contract completeness is an optimizing decision by the parties that reflects a trade-off between ex ante contract design costs and ex post potential for opportunism.
Timing and Reputation Can Influence Outsourcing Decisions

- If timing is crucial, vertical integration may allow more flexible and responsive scheduling
  - Temporal specificity may be an issue in meeting surge requirements

- Reputation effects are important for both buyers and sellers
  - Using reputation in source selection can reduce opportunism by sellers
  - Opportunism by buyers can drive potential sellers away

Timing and Reputation Can Influence Outsourcing Decisions

Even when asset specificity is not a strong factor, the importance of timing in deliveries or in the use of assets can be associated with more integrated governance structures. Thus, temporal specificity may be an important issue for Air Force activities that have a role in meeting surge requirements. For example, Masten, Meehan, and Snyder’s [1991] study of subcontracting practices in naval construction found that the probability of integration increased with the importance of scheduling the component in construction. This occurs because interruptions at an early stage in the construction process can disrupt all subsequent operations, giving subcontractors an incentive to delay in order to elicit price concessions.

Pirrong [1994] found that in ocean shipping, spot markets, medium- and long-term contracts and vertical integration are all used, depending upon the difficulty of arranging alternative shipping services for the commodity at short notice. The duration of shipping contracts and the incidence of vertical integration were positively correlated with the thinness of the market and the need for specialized ships in bulk shipping markets for 14 different commodities.
In some circumstances, the reputation of buyers and sellers can be an enforcement mechanism for informal, or not legally enforceable, agreements. Short-term gains from opportunism can be offset by long-term losses from a damaged reputation in the industry community if other buyers and sellers then refuse to deal with a party who has a reputation for breaking agreements. Reputation effects can be important for both buyers and sellers in cases where either has the potential to engage in opportunistic behavior. In particular, government entities must commit not to expropriate assets from contractors or regulated firms, to get them to invest in transaction-specific assets.

For example, Wilson’s [1980] study of the New England fresh fish market and Acheson’s [1985] study of the Maine lobster market found that reputation in the local market is an important enforcement mechanism to support long-term, informal relationships. Given a price for a catch, buyers or sellers could act opportunistically by sorting out high-quality or low-quality fish. To ensure quality, the parties would incur monitoring costs that would lower the total value of the relationship to both parties. Reputation-based agreements avoided these additional costs, and were supported by interdependencies arising from the sharing of scarce resources, such as market information, fuel, and bait.

Grandy [1989] studied the effect of opportunistic behavior by 19th century railroad regulators in New Jersey. He found that railroads were willing to make large, specialized investments only when they were protected by “special corporation charters” that limited state actions against them. Levy and Spiller’s [1994] international comparison of telecommunications regulation showed that private investment is forthcoming only when regulators can commit not to pursue arbitrary administrative actions that expropriate the value of assets. In either case, if regulators were not able to commit not to set arbitrarily low prices, regulated firms were unwilling to make infrastructure investments because they might not be able to recover the value of their investments.

Thus, on the whole the results of the empirical literature on transaction cost economics are consistent with the theoretical predictions. Higher degrees of asset specificity are associated with greater vertical integration, longer-term contracts, and other contract clauses that help adjust to changing circumstances and protect transaction-specific assets. New insights, such as the importance of temporal specificity and the reputations of buyers and sellers, also emerge from the empirical literature.