LIMITS OF FIRM SIZE

Literature Survey and Hypotheses Based on Transaction Cost Economics

A working paper submitted in partial fulfilment of the requirements for the degree of Doctor of Business Administration

by

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CONTENTS

1. INTRODUCTION

Are there limits to the size of firms? This paper tries to shed light on this question by taking a transaction cost economics (TCE) perspective. It reviews the core arguments put forward by the leading authorities on TCE, verifies these arguments by looking at other sources, and summarises the findings in a TCE-based "limits of firm size" model. The conclusion is that there are significant disadvantages of size, but that they have never been quantified coherently. The collective evidence indicates that the number of employees that can be effectively managed in a firm sets the size limits. This number has been remarkably stable over the years even though the overall size of the economy and the size of companies measured by value-added or assets has increased.

The paper starts by framing the issue with a perspective on size, proceeds with a review of the TCE perspective on limits of firm size, verifies this perspective against other sources, and finally pulls together the findings in an empirically testable framework.

2. PERSPECTIVE ON SIZE

This chapter explains what the dilemma is, defines size, and describes the trends in size.

2.1 THE DILEMMA

Knight (1964, 286–287) observed that the "diminishing returns to management is a subject often referred to in economic literature, but in regard to which there is a dearth of scientific discussion." Since then, many authorities have referred to the potential of size disadvantages, but there appear to be no systematic studies of the issue, at least not in a holistic fashion. The basic dilemma is, on the one hand, that if there are no disadvantages of size, then there are no limits to firm growth. We would observe an inexorable concentration of industries and economies until there is only one firm left. George Stigler (1974, 8) puts it: "If size were a great advantage, the smaller companies would soon lose the unequal race and disappear." This is not happening. On the other hand, if there is an optimum size in an industry, then we would expect increased fragmentation as the general economy grows. This is not happening either. Robert Lucas (1978, 509) observes that "most changes in product demand are met by changes in firm size, not by entry or exit of firms." The

dilemma is that the size distribution of firms is remarkable stable over time in number of employees and as a share of the total economy.

2.2 DEFINITION OF SIZE

Before looking at the trends in size it is important to define size. This includes establishing the boundary of the firm and identifying measurement metrics.

2.2.1 Firm Boundary

There are four basic definitions of what a firm is (Kimberley 1976). The first, based on Coase (1937, 388) and Arrow (1964), holds that the boundary of the firm is where the internal planning mechanism is superseded by the price mechanism. Based on this definition, a self-contained (profit centre) division of a company is a firm. However, it is not clear that the parent company is a firm since the company's divisions by definition trade among each other through market-based transfer prices. The second definition is that ownership sets a firm's boundaries. This definition is clearly the one used by most observers, except academics. A problem is that employees can hardly be part of the firm with this definition. A more serious problem is that a holding company with no control over the operating units will be considered a firm. Still, this

definition is usually equivalent to Coase's definition since there are few, if any, companies where the divisions are totally self contained.[1] The third definition is the firm as network. For example McDonald's is considerable larger than the ownership definition says, since it also consists of a network of thousands of franchisees. The final definition is the firm defined by its sphere of influence. This includes first and second tier suppliers, alliance partners, etc. Toyota is a good example. Toyota employees around 110,000 people directly, but its sphere of influence is around 1 million.

This paper uses the second definition since it is practical and it relates closely to Coase's definition. Thus, a firm is a corporation.

2.2.2 Measures

Most business press rankings of size are by revenue. However, this measure is fairly useless since it says nothing about the underlying activity. When using this definition, four of the world's five largest companies are Japanese trading houses, but they have almost no vertical integration. The best measure of size is value added, i.e. the sum of factor inputs (or revenue less purchased goods). This metric gives a precise

[1] Especially for functional and multidivisional firms according to Williamson (1985). See also Chapter 3.

measure of activity, but is usually not available by company. Another good measure is number of employees. We will see that the number of employees seems to be the (indirect) constraint to firm size. Furthermore, it is widely available. Finally, assets can define size. As with revenue, this may not reflect underlying activity, but for industrial companies this is not a major issue. Assets by firm are usually available back to the 1890s and are therefore a practical measure for time series in longitudinal studies.

Thus, the best measure of size is value added, but for practical reasons number of employees and assets can be used. The definitions are summarised in the table below.

Table 1. Definition of the Firm and Firm Size

DEFINITION OF THE FIRM AND FIRM SIZE				
	Profit Centre	**Ownership**	**Network**	**Influence**
Revenue				
Value-added				
Employees				
Assets				

2.3 TRENDS

The U.S. economy is used as the basis for analysis since it is the largest and most competitive economy in the world, and there are ample statistics available. Within this economy, the paper focuses on the industrial sector.[2]

It is clear that large firms play a substantial role in the U.S. economy. The Fortune 500 companies control close to 50 per cent of corporate assets and employ more than ten million people. Their sphere of influence (see above) is perhaps 40 million employees out of a total workforce of 110 million. Contrary to popular belief, however, the large companies' importance is not increasing, and has not done so in many years. Several studies demonstrate that firm size is remarkable stable in number of employees and as a share of the economy. This is true when looking at industry sectors and at absolute size of large firms

2.3.1 Industry Sector Concentration

Aggregate industry concentration[3] has changed little since the early parts of this century. Nutter (1951) studied the concentration trend between 1899 and 1939 and finds no signs of increased aggregate concentration

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[2] Alternative approaches would be to look at the global industrial sector or the total U.S. private sector, or both. Statistics on the global industrial sector are not yet reliable, and the non-industrial sector is often still highly regulated.

[3] Although there have been significant swings within sectors.

under this time period (pp. 21, 33), mainly because new, fragmented, industries emerged while older ones consolidated. Bain finds the same trend between 1931 and 1963 (1968), but with less variability between sectors. Scherer and Ross (1990, 84) use a modified Nutter methodology and show that aggregate concentration has increased slightly from 35 per cent in 1947 to 37 per cent in 1982.

2.3.2 Absolute Size

Bain (1968, 87) shows that the assets controlled by the largest 200 nonfinancial companies in 1933 was around 57 per cent of total nonfinancial assets.[4] He then estimates that in 1962 the 300 largest nonfinancial companies accounted for 55 per cent of nonfinancial assets. With this author's estimate of the assets tied up by the 100 firms at the tail, the top 200 companies accounted for around 50 per cent of nonfinancial assets in 1962. Data from 1994 show the same ratio to be around 40 per cent.

Adelman (1978) observed a similar pattern when he studied the 117 largest industrial firms between 1931 and 1960. He finds that concentration was

[4] A similar study by Berle and Means (1991) has been widely discredited.

the same at the beginning and at the end of the period (45 per cent). He concludes that "overall concentration in the largest manufacturing firms has remained quite stable over a period of 30 years, from 1931 to 1960." This author did the same analysis for 1994 and found the equivalent number to be 45 per cent in 1994.

Bock (1978, 83) studied the share of value added to total value added of the largest industrial firms between 1947 and 1972. There was a large increase between 1947 and 1954 and a slight increase up till 1963. Between 1963 and 1972 there was no increase. Scherer and Ross (1990, 62) confirm the lack of increase up till the end of the 1980s.

In summary, industry concentration has changed little from the early part of the century and large firm size has kept pace with the overall growth of the industrial part of the economy since the 1960s (but declined in relation to the total U.S. corporate sector and the world corporate sector). If disadvantages of size do not exist then this outcome is unlikely.

3. TRANSACTION COST ECONOMICS AND THE EXPLANATION OF LIMITS OF FIRM SIZE

Transaction cost theory aims to explain the boundary of the firm; what is made internally and what is bought and sold in the marketplace. As firms internalise transactions, bureaucratic disadvantages of size such as communications failure, managerial isolation from reality, employee alienation, and misalignment of incentives set in. Thus, a firm will reach a size where the benefit of the last internalised transaction is offset by the bureaucratic disadvantages. A number of conditions offset these disadvantages. First, under conditions of high asset specificity, high uncertainty, or high frequency of transactions, it will be advantageous to internalise transactions. Second, firms can mitigate the disadvantages by organising appropriately. Third, firms do not aim to minimise transaction costs in isolation from production costs. Thus, to the extent that scale economies exist this has to be included in a model of firm size limits. This chapter expands on this logic and ends with a TCE-based hypothesis of limits of size.

3.1 TCE AND THE LIMITS OF FIRM SIZE

Three pieces of work within TCE are relevant to the argument. Ronald Coase's original article "The Nature of the Firm" (1937) establishes the basic framework. Chapter 7 ("Limits of Vertical Integration and Firm

Size") in Oliver Williamson's book *Markets and Hierarchies* (1975) identifies the nature of limits of size. Chapter 6 ("The Limits of Firms: Incentive and Bureaucratic Features")[5] in Williamson's book *The Economic Institutions of Capitalism* (Williamson 1985) expands on this theme and explains why the limits exist.

3.1.1 Coase's Basic Framework

Coase's famous paper on transaction costs (1937) is the foundation of the New Institutional Economics branch of industrial organisation. Coase asked the fundamental questions "Why is there any organisation?" (p. 388) and "Why is not all production carried on by one big firm?" (p. 394). His answer was that there are transaction costs that determine what is done in the market, with price as the regulating mechanism, and what is done inside the firm, with bureaucracy as the regulator. Coase pointed out that "the distinguishing mark of the firm is the supersession of the price mechanism." Within this framework, all transactions carry a cost, either an external market transaction cost or an internal bureaucratic transaction cost. "The limit to the size of the firm...[is reached] when the costs of organising additional transactions within the firm [exceed] the costs of carrying out the same transactions through the market" (Coase 1993).

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[5] Published earlier in a less developed form (Williamson 1984).

According to Coase the most important market transaction costs are the cost of determining the price of a product or service, the cost of negotiating and creating the contract, and the cost of information failure. The most important internal transaction costs are associated with the administrative cost of determining what, when, and how to produce, the cost of resource misallocation, since planning will never be perfect, and the cost of de-motivation, since motivation is lower in large organisations. In any given industry the relative magnitude of market and internal transaction costs will determine what is done where.

Coase has thus created a theoretical framework that potentially explains why firms have limits to size. However, this is only true if there are decreasing returns to the entrepreneur function. Later work by Williamson theorises that this is the case.

3.1.2 Williamson's Limits of Firm Size Model

"Why can't a large firm do everything that a collection of small firms can do and more?" (Williamson 1984, 736). Williamson argues that the incentive structure of a firm has to be different from the market. Even if a firm tries to emulate the high-powered incentives of the market there will be unavoidable side effects, and the cost for setting up the incentives is non-trivial. Thus, the combination of small firms into a large firm will

never have the same operating characteristics as if they are independent in the market.

3.1.2.1 Nature of Limits

Williamson (1975) argues that the limits to firm size are bureaucratic in origin and thus can be explained by TCE. He identifies four main categories of size disadvantages: communication distortion due to bounded rationality, bureaucratic insularity, atmospheric consequences due to specialisation, and incentive limits of the employment relation.

Communication distortion due to bounded rationality. Since a manager is boundedly rational it is impossible to expand a firm without adding hierarchical layers. As information is passed between layers it is necessarily distorted. This reduces the ability of high level managers to make decisions based on facts and leads to declining return to the entrepreneurial function. In an earlier article (1967), Williamson finds that even under static conditions (without uncertainty) there will be a control-loss phenomenon. He develops a mathematical model to demonstrate that control-loss is of critical importance to limitations of firm size and that there is no need to assume rising factor costs to explain the limits.

Bureaucratic insularity. Williamson (1975) argues that as firms increase in size the senior managers are less accountable to the lower ranks of the organisation (p. 127) and to the shareholders (p. 142). They thus become insulated and will, given opportunism, strive to maximise their personal benefits rather than the corporate goal function (profits). This argument is similar to agency theory (Jensen and Meckling 1976; 1989) which argues that corporate management will tend to overemphasise size over profitability and will keep excess cash flow within the firm rather than distribute it to a more efficient capital market. The consequences are that large firms tend to more easily accept organisational slack and resources are misallocated. If this is correct we will, for example, expect to see wider diversification of large firms, as well as lower profits.

Atmospheric consequences due to specialisation. As firms expand there will be increased specialisation, but also less moral involvement of the employees according to Williamson. The decline in moral involvement is due to the difficulty for the employee to understand the purpose of activities as well as the small contribution each employee makes to the totality. Thus, alienation is more likely to occur in large firms.

Incentive limits of the employment relation. Firms can not compensate their employees perfectly due to a number of limitations according to Williamson. First, large bonus payments may threaten senior managers.

Second, performance related bonuses might affect the employment contract so that less than optimal behaviour is encouraged. The outcome is that large firms tend to pay based on tenure and position rather than on merit. This is especially important in product and process development where the large firms are at a disadvantage to smaller enterprises.

Williamson's four categories are similar to what Coase described in 1937. Coase talked about the determination (or planning) cost, the resource misallocation cost, and the demotivation cost. Williamson's first and second category corresponds broadly to the determination cost, the third category to the demotivation cost, and the fourth category to the resource misallocation cost. Williamson's categories are, however, more detailed and allow for easier operationalisation.

3.1.2.2 Outcomes

There are a number of consequences of these four disadvantages of size according to Williamson.[6]

[6] Again, Williamson's descriptions are confusing. They are found throughout the chapters referenced, in-between theory and examples, and at various levels of the section hierarchies. The outcomes discussed here are this author's attempt to make Williamson's descriptions more explicit.

- Large companies will tend to procure internally when facing a make or buy decision (1975, 119–120).

- They will have excessive compliance procedures and compliance related jobs will proliferate. Thus, policing costs such as audits will be excessive (Williamson 1975, 120–121).

- There is a tendency for projects to persist even though they are clear failures (1975, 121–122).

- There will be conscious manipulation of information to further individual or sub-unit goals (1975, 122–124).

- Asset utilisation will be lower since high-powered market incentives do not exist (1985, 137–138).

- Transfer prices will not reflect reality and cost determination will suffer (1985, 138–140).

- Research and development productivity will be lower (1985, 141–144).

- The organisation will suboptimise by trying to manage the unmanageable, by forgiving mistakes, and by politicising decisions (Williamson 1985, 148–152)

The following links seem reasonable between the limiting factors and the outcomes.

Table 2. Links between Limiting Factors and Consequences

LINKS BETWEEN LIMITING FACTORS AND CONSEQUENCES				
	Factors			
Consequences	**Communication Distortion**	**Bureaucratic Insularity**	**Atmospheric Consequences**	**Incentive Limits**
Internal procurement		Strong	Moderate	Strong
Excessive compliance procedures	Strong	Strong	Strong	Strong
Project persistence		Strong	Strong	Moderate
Conscious manipulation of information	Strong	Strong		
Low asset utilisation	Strong		Strong	
Poor internal costing	Strong			Strong
Low R&D productivity	Strong	Moderate	Strong	Strong
Dysfunctional management decisions	Moderate	Strong	Strong	

All these outcomes indicate that a large firm should have lower profits than a smaller firm, with the same product and market mix, should. The question is how much lower and at what size the negative effects set in.

3.2 OFFSETTING INFLUENCES ON THE LIMITS OF FIRM SIZE

While the categories discussed in the previous section theoretically impose limits to firm size, there are offsetting influences that tend to mitigate the

disadvantages of size. Each of these influences is central to TCE and thus the argument continues to be confined to this theory. To test the validity of the disadvantages of size, it is necessary to take these offsetting influences into account.

3.2.1 Vertical Integration

There is a vast literature on vertical integration applications of TCE and the purpose here is not to review this at length. The theoretical argument is summarised in Williamson (1975, 43–67). Mahoney (1989; 1992) provides rich overviews of theoretical and empirical work. Under the conditions of bounded rationality (Simon [1947] 1976) and opportunism (Williamson 1993), Williamson shows that three factors play a fundamental role in determining the degree of vertical integration: *asset specificity, uncertainty*, and *frequency of transactions*.

With high asset specificity, market transactions become expensive. By asset specificity is meant physical assets, human assets, site, or dedicated assets (1975, 55), which have a specific usage and cannot easily be transferred to another use. Opportunistic behaviour can be expected if the asset is part of a market transaction under this condition. An example is if a supplier invests in specific tooling equipment dedicated to one customer. Over time, the customer will be able to put pressure on the vendor since

the vendor has no alternative use for its investment. The vendor will be willing to accept a price down to the variable cost of production to cover some fixed cost. By owning the asset the incentive to "cheat" disappears and the cost of creating safeguard contracts disappears.

High uncertainty such as business cycle volatility or technological uncertainty will lead to more bureaucratic transactions since it will be difficult, and prohibitively expensive, to create contracts which cover all possible outcomes. Thus, with higher uncertainty firms tend to internalise activities. Finally, if the transactions are frequent there is once again a tendency to manage the transaction through bureaucracy since the repetitive contracting cost will be higher than the bureaucratic cost.

It is not entirely clear if the asset specificity, uncertainty, and frequency factors only apply to vertical (forward and backward) integration. Williamson sometimes uses them in connection with geographic reach and product breadth to shed light on the total integration problem.

3.2.2 Organisational Form

Williamson (1975, 117) also recognises that the disadvantages of size can be reduced by organising appropriately. Based on Chandler's (1962; 1980) pioneering work on the evolution of the American corporation,

Williamson argues that the multidivisional (M) form of organisation lowers the internal transaction cost compared to the unitary[7] (U) form. Thus, large firms organised according to the M-form should, *ceteris paribus*, be more profitable than U-form firms should.

3.2.3 Production Costs

Transaction costs alone do not explain if transactions are carried out in the market or internally in the firm. Douglass North, the 1994 Nobel Prize winner in economics, has pointed out that firms try to minimise total cost, not only transaction costs (e.g. North 1994). In addition to transaction costs, a firm has production costs (or transformation costs in North's terminology). If scale economies in production costs exist they will increase the average size of a company, all other things equal. Riordan and Williamson (Riordan and Williamson 1985) in fact made an attempt to combine production and transaction costs under the condition of asset specificity. In sum, these three factors offset the disadvantages of size according to TCE.

[7] Often referred to as functional organisation by other authorities, including Chandler.

3.3 A TCE HYPOTHESIS OF FIRM SIZE LIMITS

The hypothesis based on the above review is as follows. The profitability of a firm depends on two counteracting forces. Four size-related dysfunctions set the firm's limits to size. If these sources of limits are in effect, then (all other things equal) the larger firm will have lower profitability than the smaller firm. On the other hand, there are offsetting factors. First, when the vertical integration factors (asset specificity, uncertainty, or frequency of transaction) are important, then the firm will tend to internalise more transactions and be larger than otherwise. Also, the profitability will be higher of the more integrated firm. Second, a firm that uses the M-form will be more profitable than a U-form company will, or it can be larger with the same profitability. Third, if there are production scale economies, then this will give higher profits to the larger firm. The table below summarises these hypotheses.

Table 3. TCE-Based "Limits of Firm Size" Framework

TCE-BASED "LIMITS OF FIRM SIZE" FRAMEWORK							
	Limits To Firm Size				**Moderators**		
Profitability	**Communications Distortion**	**Bureaucratic Insularity**	**Atmospheric Consequences**	**Incentive Limits**	**Vertical Integration Conditions**	**Organisation Form**	**Scale in Production Costs**
High	Low	Low	Low	Low	High	M-form	High
Low	High	High	High	High	Low	U-form	Low

4. VALIDATION OF MODEL

This chapter aims to validate the 'limits to size' model developed above and to modify or complement it if other factors are found. In general, no one has done dedicated research on the disadvantages of size. This is somewhat surprising since many authorities mention the analysis of limits to firm size as critical to our understanding of the modern economy. Fortunately though, there are fragments of evidence in much of the relevant literature. The composite picture of these fragments broadly support the model developed in the previous chapter.

4.1 LIMITS OF SIZE

The general literature relating to the limits of firm size does not, for obvious reasons, follow Williamson's categorisation. Thus, this section will review the evidence by general topic and by author. At the end the arguments are summarised and related back to the 'limits to size' model.

4.1.1 Sociological Perspectives

Child (1973) and Pugh et al. (1968), among others, show that size leads to bureaucracy. Thus, large firms are usually highly bureaucratised through formalisation, and to the extent that there are disadvantages of

bureaucracy, these apply to the 'limits to size' model. Williamson (1996) makes a similar point when he says, "almost surely, the added costs of bureaucracy are responsible for limitations in firm size."

Blau and Meyer (1987) articulates the disadvantages of bureaucracy in chapter 7 of their book. They identify three dysfunctions of bureaucracy: 1) excessive rigidity, 2) conservatism and resistance to change, and 3) perpetuation of social-class differences. Of these, the first one is relevant here (conservatism is essentially a subcategory of rigidity). Excessive rigidity appears as organisations formalise work practices through bureaucratic procedures. Problems are solved by adding structure and the firm reaches a point where the added structure costs more than the problem solved: the "problem—organisation—problem—more organisation" spiral of bureaucratic growth (p. 147). They show that external factors, such as increased volume of tasks, have little to do with increased bureaucracy. In the end, the added policies and procedures stifle flexibility.

Crozier (1964) also emphasises rigidity as the most important dysfunction of bureaucracy. In fact, he views the bureaucratic organisational model as inherently inefficient, especially under conditions of uncertainty. A key implication is that management will be increasingly insulated from reality while lower levels of the organisation will experience alienation.

Stinchcombe (1965) demonstrates that a result of this rigidity is that companies tend to maintain the organisation form it had when it was created.

Pondy (1969) studied the administrative intensity in different industries and the causes for variations. He found a positive correlation between size of administration and firm size when he included a measure of ownership-management separation. This is in line with Williamson's notion of bureaucratic insularity which argues that management will be more shielded from reality the larger the organisation is and the more distant the owners are.

4.1.2 Information Processing Perspectives

A few studies within the "firm as information processor" school of thought relate to disadvantages of size. Arrow (1974) finds that employees in large organisations tend to be highly specialised. Thus, there is an increasing need for coordination through communication. Since information flows carry a cost, organisations will code (through formal or informal rules) the information available. The coding brings the benefit of economising on cost, but it also leads to information loss and rigidity (p. 55). The implications are 1) that the longer the hierarchy, the more

information loss or distortion; and 2) the older the firm is, the higher the rigidity.

Simon ([1947] 1976) makes a similar point. Based on his famous concept of bounded rationality—"human behavior is *intendedly* rational, but only *limited* so" (p. xxviii)—Simon finds that information degrades as communications lines are extended. The central problem is not how to organise to produce efficiently, but how to organise to make decisions (p. 292). Geanakoplos and Milgrom (1991) add to this perspective by noting that there are inevitable delays of signals in an organisation, and the longer the hierarchy, the more the delays.

McAfee and McMillan (1995) specifically study the problem of control-loss as a reason for organisational diseconomies of scale. They argue that people in organisations exploit information asymmetries to their advantage (opportunism). Dispersion of knowledge within the organisation combined with individualised incentives make conflict of interest and subgoal pursuit inevitable. They find, among other things, that efficiency will fall as the hierarchy lengthens, and that long hierarchies are not viable in competitive industries (p. 401).

Finally, Qian (1994), with a logic similar to McAfee and McMillan's, finds that large hierarchies will result in low effort levels among the employees.

The employees will not have complete information about their role in the enterprise and thus suffer from demotivation. Moreover, there will be a need to monitor effort, leading to further demotivation.

4.1.3 Agency Theory

Monsen and Downs[8] (1965) argue that very large firms will not strive for profit maximisation. They find that such firms need to build "bureaucratic management structures to cope with their administrative problems. But such structures inevitably introduce certain conflicts of interest between men in different positions within them. These conflicts arise because the goals of middle and lower management are different from those of top management. The introduction of these additional goals into the firm's decision-making process also leads to systematic deviations from profit-maximising behavior."(p. 222). They furthermore find that the motives of managers are different from the motives of owners. Managers maximise personal income, owners maximise profits. It is impossible for owners of large companies to control the behaviour of managers and consequently, profit maximisation does not obtain. The outcome is what Williamson labels bureaucratic insularity.

[8] Monsen and Downs preceded agency theory by at least seven years. Yet their logic is remarkably prescient and similar to Jensen's arguments.

Michael Jensen has deepened and extended these arguments over the last 20 years (e.g. Jensen and Meckling 1976; Jensen 1986, 1988, 1989, 1990). He defines agency cost as the sum of the monitoring expenditures by the principal, the bonding expenditures by the agent, and the residual loss. The magnitude of agency costs depends on a number of factors, including the transparency of the firm's activities and the market for managerial talent. Jensen does not, contrary to Monsen and Downs, explicitly state that agency costs increase with the size of the firm. Jensen does demonstrate that managers will emphasise size over profitability: "Managers have incentives to cause their firms to grow beyond optimal size. Growth increases managers' power by increasing the resources under their control. It is also associated with increases in managers' compensation." (Jensen 1986, 323). He demonstrates the point by looking at the profitability of diversified companies and notes that they are less profitable than focused companies.

4.1.4 Employment Studies

A number of authorities argue that job satisfaction is lower in large organisations and large work establishments. Evidence of this is that employees in large companies are paid significantly more than are employees in small companies. This difference is argued to be

compensation for a less satisfying work environment. Three studies warrant mention here. Scherer (1976) is representative of the extensive work done at the establishment level. In a review of the literature, and his own original research, he concludes that worker satisfaction is 30 per cent lower in large establishments[9] than in small establishments (p. 109), while compensation is more than 15 per cent higher for equivalent job descriptions (p. 119). He concludes that since establishment size is correlated to firm size the effect of alienation is possibly significant.

Brown, Hamilton, and Medoff (1990) find that large firms pay a wage premium of 10–15 per cent over small firms when adjustments have been made for other effects such as unionisation and skill levels (p. 42). However, they do not conclude that this differential is necessarily related to alienation. Regardless of the cause though, it appears that large firms pay a substantial wage premium over smaller firms.

Rasmusen and Zenger (1990) find that span-of-control problems make it increasingly costly to extend incentive contracts to employees (p. 69). Thus, large firms favour fixed-wage contracts more related to tenure than performance and make extensive use of monitoring to control productivity. Smaller firms link pay and performance closely (p. 80). As a result, the larger firms have a fairly narrow spread of salaries and do not

[9] More than 500 employees.

attract top talent, while smaller firms employ both superior talent and low-quality individuals and reward them correspondingly. Their data strongly support these conclusions, especially in functions with indivisibilities in work (e.g. R&D). The closer match between performance and pay in the small firm puts the large firm at a disadvantage, in line with Williamson's source of disadvantages of size.

4.1.5 R&D Productivity

Cooper surprised many business leaders in 1964 with his article "R&D is More Efficient in Small Companies." He argues, based on 25 interviews, that small companies have three to ten times higher productivity in development than large companies. The key reasons are that small companies: Are able to hire better people since they can offer better (more tailored) incentives ("big firms tend to provide a haven for the mediocre in search of anonymity"). Engineers in small companies have a better attitude towards cost. And, the internal communication and coordination is more effective. These reasons match three of Williamson's four sources perfectly: communications distortions, atmospheric consequences, and incentive limits.

Later work has confirmed Cooper's anecdotal evidence both theoretically and empirically. Arrow (1983) demonstrates that large firms will invest

suboptimally in development because of information loss, and that small firms will have a particular advantage in novel areas of research. Schmookler (1972) finds that large firms (more than 5000 employees) trail small firms in the number of patented inventions, the percentage of patented inventions used commercially, and the number of significant inventions (p. 39). Yet, they spend more than twice the resources per patent (p. 37). Schmookler finds four reasons for the lower effectiveness and efficiency of large firms in R&D: A better understanding of the problem to solved, greater cost consciousness, a more hospitable atmosphere for creative contributions, and superior quality of technical personnel (p. 45). Thus, Schmookler confirms and quantifies Cooper's initial anecdotal evidence.

Zenger (1989; 1994) studied employment contracts in R&D in high technology. He finds that organisational diseconomies of scale overwhelm technological economies of scale in R&D. His statistical analysis of Silicon Valley companies shows that small firms attract better talent than large firms, that they induce more effort from the employees, and that compensation is more tied to performance (p. 725).

Finally, the leading anti-bigness ideologues make similar observations based on anecdotes. Peters (1992) supports the notion that R&D is less effective in large organisations. He argues that large companies are

massively overstaffed in development and that there is little correlation between size of R&D budget and output. He offers several case examples as evidence. Brock (1987) argues that bigness retards technological advance since large companies are overly risk averse.

4.1.6 "Big Is bad" Perspectives

Tom Peters, who since the early 80s has crusaded against big business, has put forward his own, experience-based, view on the disadvantages of size in several books and articles. His views are summarised in "Rethinking Scale" (1992). Peters believes that decentralisation is necessary in large companies, and that they are far from as decentralised as they can be. Otherwise they will not be adaptable enough to respond to changes in the marketplace: "If big is so damn good, then why is almost everyone big working overtime to emulate small?" Moreover, Peters argues that any company is well advised to reduce vertical integration although he does not offer evidence for why this is true. Overall, Peters finds that successful firms need to mimic the market as much as possible, while the classical firm creates bureaucratic distortions that will lead to lower profitability and growth. These ideas are in line with Williamson's description of firm limits, except perhaps the notion that companies should always reduce vertical integration.

Schumacher (1989) identifies the lack of motivation in large organisations as the key disadvantage of size: "for a large organisation, with its bureaucracies, its remote and impersonal controls, its many abstract rules and regulations, and above all the relative incomprehensibility that stems from its very size, motivation is the central problem."

4.1.7 Reconciliation with the 'Limits to Size' Model

The above observations on disadvantages of size do not map perfectly to Williamson's four sources of disadvantages. Some are akin to his sources, others to his outcomes. By using a methodology similar to the one in section 2.1.2.2, where sources and outcomes are linked, it is possible to match the observations to the sources. A question is if rigidity should be introduced as a fifth source of size disadvantages. It is classified here as most closely associated with atmospheric consequences and communications distortions.

Table 4. Sources of Limits of Firm Size

SOURCES OF LIMITS OF FIRM SIZE				
Communications Distortion	**Bureaucratic Insularity**	**Atmospheric Consequences**	**Incentive Limits**	**Other**
Arrow (1974): Specialisation leads to poor communication Arrow (1983): Information loss in R&D Blau and Meyer (1987): Excessive rigidity Cooper (1964): R&D coordination Crozier (1964): Rigidity Geanakoplos and Milgrom (1991): Information signal delays McAfee and McMillan (1995): Lower efficiency Simon ([1947] 1976): Processing bottlenecks	Brock (1987): Risk aversion Jensen (1986): Firms larger than optimum Monsen and Downs (1965): Different owner/manager objectives Pondy (1969): Increase in administration Schmookler (1972): Understanding market needs in R&D Stinchcombe (1965): Perpetuation of organisation form	Arrow (1974): Rigidity to change Blau and Meyer (1987): Excessive rigidity Cooper (1964): R&D cost control Crozier (1964): Alienation Scherer (1976): Low job satisfaction in large firms Schmookler (1972): R&D cost consciousness; Climate for innovation Schumacher (1989): Motivation Qian (1994): Monitoring costs/inadequate effort levels	Blau and Meyer (1987): Excessive rigidity Cooper (1964): R&D incentives Crozier (1964): Rigidity Peters (1992): Low productivity in R&D Rasmusen and Zenger (1990): Employment contracts Schmookler (1972): Quality of R&D employees Zenger (1989, 1994): Employment contract disincentives in R&D	Brown, Hamilton, and Medoff (1990): Unexplained wage differential

4.2 OFFSETS

The review of literature relating to the offsets show that they are valid and their influence varies.

4.2.1 Vertical Integration

There is an extensive literature on vertical integration based on TCE or other theories. Indeed, vertical integration has been called the paradigm problem of TCE. Mahoney (1989; 1992) and Shelanski and Klein (1995) provide excellent summaries. There are two issues relevant here:

- Do asset specificity, uncertainty, and frequency explain vertical integration?

- Does Williamson's framework extend to integration in general?

Asset specificity has repeatedly been found to be the most important determinant of vertical integration. A number of empirical studies confirm this (e.g. Masten 1984; Masten, Meehan, and Snyder 1989, 1991; Monteverde and Teece 1982; Joskow, 1993; Klier, 1993; Krickx 1988). Uncertainty and frequency are less important. First, they only contribute to vertical integration in conjunction with asset specificity. Second, the empirical evidence shows only weak explanatory power in regression analyses. Walker and Weber's (1984; 1987) results are typical. They find that volume uncertainty has some impact and that technological uncertainty has no impact. Frequency of transaction has unfortunately not been studied explicitly, perhaps because it is not independent from the various types of asset specificity. Piecemeal evidence from other studies

suggests that it is less important than uncertainty when asset specificity is included in the analysis.

The answer to the second question appears to be yes. Asset specificity influences integration from a reach, breadth, and depth point of view. Teece (1976) shows that the multinational company will not exist if it was not for the moral hazard resulting from the combination of asset specificity and opportunism. Without, for example, human asset specificity a firm can just as easily license its technology to a firm in another country and reap the benefits of development. Tsokhas (1986) illustrates this in a case study of the Australian mining industry. Other studies have shown that market diversity (just as product diversity below) reduce profitability (Ward 1976; Bane and Neubauer 1981).

A number of studies of product breadth show that asset specificity plays a major role in explaining the success and failure of diversification. Rumelt (1974) finds a strong correlation between profitability and if a company draws on common core skills or resources. In two studies of the Fortune 500 he shows that focused companies will have three to four percentage points higher return on capital than highly diversified firms. Subsequent studies "have merely extended or marginally modified Rumelt's (1974) original findings." (Ramanujam and Varadarajan 1989).

The inescapable conclusion is that asset specificity plays a major role in explaining integration in general, not only vertical integration.

4.2.2 Organisational Form

Alfred Chandler has in a long series of studies (Chandler 1962; 1977; 1982; 1990; 1992; Chandler and Daems 1980) demonstrates that large corporations have evolved from functional structures to multidivisional structures as they grow in size and scope of activities. He argues that the functional form is not able to achieve the coordination necessary to be successful in the marketplace, while functional scale economies are too small to make up for this deficiency. Thus, as companies became more diverse they adapt the multidivisional form pioneered by du Pont and General Motors.

Fligstein (1985) shows that the multidivisional form's penetration increased from 2 per cent of large companies,[10] to 75 per cent between 1919 and 1979. By using a logit model he estimates that the spread of the multidivisional form is mainly due to the increase of multiproduct strategies, much in line with Chandler's argument. Armour and Teece (1978) quantify the difference in profits between functional and

[10] The 131 (120) largest manufacturing companies by assets in 1919 (1979).

multidivisional form companies in the petrochemical sector and summarise: "We find strong support for the M-form hypothesis. In the 1955–1968 period the multidivisional (M-form) structure significantly influenced (at better than the 99-per cent level) the rate of return on stockholders' equity, raising it on average by about two percentage points...realized by the average functional form firm."

Teece (1981) extended Armour's and his work by studying 18 manufacturing industries and two retail industries using a matched pair methodology. He found that the multidivisional form outperformed the functional form by on average 2.37 percentage points (p. 188). He concludes, "the M-form innovation has been shown to display a statistically significant impact on firm performance." He thus supports Williamson's view that organisational structure matters and can alleviate size disadvantages.

4.2.3 Production Scale Economies

An important consideration is whether production scale economies offset diseconomies of scale.

4.2.3.1 Structure–Conduct–Performance

Since the 1950s there has been extensive research into the nature and magnitude of scale economies in production costs, much of it emanating from the "structure–conduct–performance" school of thought. This work has been eminently articulated in a number of books and there is no reason to repeat the argument here, except for in a brief summary. In general, the research shows that scale economies do not play a major role in explaining firm size.

Joe Bain pioneered the research in the 1950s and subsequently revolutionised the study of industry and company behaviour with his book *Industrial Organization* (1968). Relevant to this discussion is chapter 6 ("The Rationale of Concentration—Efficiency and Other Considerations") which reviews the scale economies argument. Bain divides the analysis into plant and firm level analyses. At the plant level, scale economies are exploited by specialising the work force and management, and by using dedicated machinery. For each plant there is a minimum optimal scale. Beyond this scale there are few additional scale economies to be exploited. Bain finds that in a study of 20 industries, only two showed significant scale economies: "in a preponderance of cases, plant scale curves tend to be at least moderately flat (and sometimes very flat)...in the bulk of cases, then, the relative flatness of plant scale curves virtually diminishes the

importance of plant scale economies" (pp. 192–193). He found scant evidence at the plant level for benefits of firm size.

At the firm level, Bain's study shows that scale economies are derived from large-scale management, large-scale distribution, and purchasing power.[11] He then notes that these firm level scale economies are elusive, if they exist at all. His research indicates that "where economies of the multiplant firm are encountered, they are ordinarily quite slight in magnitude...the unit costs...are typically only 1 or 2 per cent below those of a firm with one plant of minimum optimal scale." Of the 20 industries studied, Bain was able to quantify firm level scale economies for twelve. Of these twelve industries, none exhibited even moderate scale effects (p. 195).

Bain (1978) later summarises his argument that scale economies do not explain firm size: "It is not true that existing degrees of concentration are adequately explained simply as the result of adjustments to attain maximum efficiency in production and distribution...Industries probably tend to be "more than concentrated than necessary" for efficiency—and the larger firms bigger than necessary" (p. 94).

[11] Bain does not mention R&D and marketing, possibly because these factors were less important in the early 1950s.

Scherer and Ross (1990) give a modern overview of the scale economies debate in chapter 4 of their book. They make the point that it is difficult to make simple conclusions about the relation between size and returns. In general they find that scale economies in production costs are exhausted at a surprisingly small firm[12] size. In a study of twelve industries it was found that market concentration could not be explained by minimum efficient scale considerations. The largest companies in the 12 industries were between two and ten times larger than scale economies necessitated. Scherer and Ross argue that to the extent there are scale economies for large companies in an industry, they derive from economies in overhead costs, fixed costs in tangible assets, R&D, and marketing.

While scale economies appear to be a smaller offset than most casual observers believe, it still appears wise to incorporate Douglass North's suggestion that firms economise on total cost, not transaction costs alone.

4.2.3.2 Stochastic Evolution

A number of theoretical studies (Simon and Bonini 1958; Ijiri and Simon 1964; Lucas 1978; Nelson and Winter 1982) have demonstrated that large firms will evolve, regardless of scale economies, for the simple reason that there will be winners and losers over time. The losers will disappear and

[12] They make the same argument at the product and plant level.

the winners will grow at differential rates depending on the length of win periods. Based on this logic, firms are large because they are winners, not because they realise scale economies. With realistic assumptions about industry growth rates, variance in firm profitability, etc., simulations have created firm size distributions similar to observed distributions. As Ijiri and Simon (p. 78) put it: "the observed distributions are radically different from those we would expect from explanations based on static cost curves...there appear to be no existing models other than the stochastic ones that make specific predictions of the shapes of the distribution."

4.2.3.3 "Big Is Bad" Perspectives on Scale

Finally, Peters (1992) argues that scale economies do not exist any more (if they ever existed): "technology and brainware's dominance is taking the scale out of everything." Adams and Brock (1986), in case studies of the steel industry, automotive industry and conglomerates, find no evidence that size leads to production scale economies at the firm level. They claim that it is "the quintessential myth of America's corporate culture that industrial giantism is the handmaiden of economic efficiency" (p. xiii).

4.2.4 Financial Synergies

A potential fourth offset discussed by Williamson (1986) is that large companies have efficient internal capital markets and thus they realise financial synergies. Bhide (1990) refutes this line of reasoning and shows that the improvement in efficiency of external capital markets help explain the trend away from diversification. Comment and Jarrell (1995) reach the same conclusion based on an exhaustive statistical analysis.

4.2.5 Summary

Below is a summary of the support found in the literature for the offsetting factors.

Table 5. Potential Moderators of Diseconomies of Scale

POTENTIAL MODERATORS OF DISECONOMIES OF SCALE			
Vertical Integration	**Organisation Form**	**Production Scale Economies**	**Other**
Monteverde and Teece (1982) et al.: Asset specificity strong influence Peters (1992): Vertical integration is bad Rumelt (1974): Product diversity Teece (1976): Asset specificity influences geographic reach Walker and Weber (1984, 1987): Volume uncertainty weak factor Ward (1976): Market diversity	Armour and Teece (1978): M-form increases ROE Chandler (e.g. 1962): M-form alleviates co-ordination and control problems Fligstein (1985): Multiproduct co-ordination favours M-form Peters (1992): Decentralisation is critical	Adams and Brock (1986): No firm scale economies Bain (1968): Scale economies do not explain firm size Peters (1992): Scale economies do not exist Ijiri and Simon (1964) et al.: Size distribution is stochastic Scherer and Ross (1990): Small scale economies (R&D, marketing, overhead, tangible assets)	Ijiri and Simon (1964) et al.: Winners become large Bhide (1990): Internal capital markets not efficient Comment and Jarrell (1995): Financial synergies not relevant

5. MODIFIED HYPOTHESIS

It is clear, based on the previous chapter, that the TCE model of limits of firm size is fairly robust. All the sources reviewed fit within Williamson's implicit[13] schema and there does not seem to be any reason to change or complement these factors. The offsets are also validated and asset specificity emerges as the most important driver of both vertical and general integration. It may be argued that the "winner" condition should be included among the offset. The argument is that large firms, especially the ones that are growing, are better management and will thus generate returns despite the disadvantages of size. The treatment here though is to leave it as an exogenous category since it does not fit into the TCE logic except as an illustration of the lack of scale economies.

The literature did show that the sources of disadvantages are more important in certain contexts. Atmospheric consequences and incentive limits are especially severe in R&D intensive industries. Also, communication distortions are most common in diverse companies and in unpredictable industries.

The verification also allowed a first cut assessment of the magnitude of effects and at what size of company the effects have an impact. The

[13] Implicit in the sense that Williamson did not put his sources into a coherent framework.

magnitude of effects is a qualitative assessment of the survey samples' collective judgement on each source of disadvantages. The "size impact" parameter roughly indicates at what size (number of employees) the effect sets in. For example, the incentive advantage in R&D for small firms appears to strong for firms with less than 500 employees according to the literature. Large and medium sized companies do not seem to differ. The estimate is highly imprecise.

The table below summarises the modified hypothesis.

Table 6. Extended TCE-Based "Limits of Firm Size" Framework

EXTENDED TCE-BASED "LIMITS OF FIRM SIZE" FRAMEWORK							
	Sources of Limits of Firm Size				**Moderators**		
Profitability	**Communi-cations Distortion**	**Bureau-cratic Insula-rity**	**Atmos-pheric Conse-quences**	**Incentive Limits**	**Integration Conditions**	**Organi-sational Form**	**Scale in Production Costs**
High	Low	Low	Low	Low	High	M-form	High
Low	High	High	High	High	Low	U-form	Low
Magnitude	Strong	Moderate	Moderate	Moderate in general; Strong in R&D	Asset specificity strong; Uncertainty weak; Frequency negligible	Strong	Weak
Impact size:[14] Small (<1000) Medium Large (>10,000)	 Strong Strong Strong	 Weak Moderate Strong	 Weak Moderate Strong	 Strong Weak Weak	 Strong Strong Strong	 Weak Moderate Strong	 Strong Moderate Weak
Context	Diverse firms; Unpredicta-bility	Managem ent/ board relation	R&D intensive	R&D intensive		Diverse firms	Tangible assets; R&D; Marketing

[14] The "impact size" estimate roughly indicates at what size (number of employees) the effect sets in. For example, the incentive advantage in R&D for small firms appears to strong for firms with less than 500 employees according to the literature. Large and medium sized companies do not seem to differ.

This model can be used to test if the TCE explanation of limits to firm size is valid. The literature survey shows that the sources of disadvantages and the offsets are relevant. The key question is if the effects are large enough to make a difference. Only an empirical analysis where the model is operationalised can answer this.

6. CONCLUSION

This paper has tried to shed light on the disadvantages of size problem by taking a strict transaction cost economics perspective. It uses Coase's and Williamson's implicit ideas and creates a model for explaining the limits of the firm. This model has been verified through an extensive review of the economics, sociology, and business administration literature relating directly or indirectly to the topic. The conclusion is that the TCE explanation of disadvantages of size is valid, but empirical research is required to determine the magnitude of impact.

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