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Understanding the M-form Hypothesis

Matthew J. Holian

Abstract

This lecture describes the M-form Hypothesis (due to Chandler, 1962 and Williamson, 1975), with a mathematical model and examples.

Author Notes: I began this work while participating in EITM V at the University of Michigan. I thank Massimo Morelli, James Dearden, and an anonymous referee for valuable comments, and my Fall 2009 Economic Decision Making class at San Jose State University for useful feedback on the lecture and accompanying slides.

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Introduction

The theory of the firm deserves to play a prominent role in both the undergraduate and graduate industrial organization curriculum, both because of the vast amount of attention that has been paid to this area over the last four decades, as well as its practical relevance for strategy and antitrust. This lecture briefly presents some background on the theory of the firm in general, and the M-form Hypothesis in particular. The M-form Hypothesis is an important theory of firm structure, developed by Chandler (1962) and Williamson (1975). A mathematical model, discussion section and accompanying lecture slides illustrate the concepts necessary to understand the M-form Hypothesis.

The Theory of the Firm and the M-form Hypothesis

Broadly speaking, the theory of the firm can be broken into two sections, theory of firm boundaries (or scope) and theories of firm hierarchies (or structure.) An example of a boundary question is the outsourcing problem. Ronald Coase (1937) thought about this in terms of vertical integration—when should some input be produced by a firm versus produced for a firm by a contractor. However, once an organization exists, another question arises. Especially for large organizations, attention must be paid to the structure of the hierarchy. Slides three and four in the accompanying notes depict the difference between scope and structure.

To gain a greater appreciation for what economists mean when they refer to scope and structure, consider the case of General Motors (GM). With regard to scope, a classic story in the industrial organization literature involves GM's acquisition of its body supplier in 1926; see Church and Ware (2000, pp. 78-79) for background. The essence of the problem is that GM and Fisher Body wrote a long term contract to induce parties to make relationship specific investments. This created an opportunity for Fisher Body to hold up GM, and so eventually GM found it worthwhile to acquire Fisher Body, rather than be held up by them.

Moving to structure, the example of General Motors can again be illustrative.[1] Maskin et al. (2000, p. 360) compare the historical structures of GM,

[1] Although this is an old example, the GM case has become s a classic in the literature. More recently, information technology-induced reductions in transaction costs have increased the extent of outsourcing. With respect to firm structure, IT innovations enhance vertical communication (up and down the hierarchy) facilitating centralization, as well as lateral communication (between lower units), facilitating decentralization. The recent empirical research appears to support the hypothesis that the reduction in the cost of IT makes organizations more likely to decentralize, but the evidence is far from conclusive (Chang, 2007).

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a multidivisional firm (or M-form organization) and Ford, who had a unidivisional firm (or U-form organization):

> A classic example of the U-form was the Ford Motor Company before the Second World War. In those days, Ford was organized into a number of functionally specialized departments: production, sales, purchasing, and so on. In other words, the various departments carried out complementary tasks; none was independent of the others. By contrast, General Motors under Alfred Sloan became the prototypical M-form; GM comprised (and still comprises) a collection of fairly self-contained divisions, e.g. Chevrolet, Pontiac, and Oldsmobile.

One question theories of firm structure aim to explain is when will a firm take on an M-form or U-form. M-forms are multidivisional firms whose divisions sell related products, whereas U-forms have one (unitary) division. Williamson (1975, chapter eight) provides a taxonomy of three main forms of corporate structures: U-forms, M-forms and H-forms (or holding companies). Corporations can be U-forms – "one organization," made up of a collection of different functions, no one of which can conduct business separately. M-forms are collections of many different *related* U-form organizations. H-forms are collections of many different *unrelated* U-form organizations. Slides five and six in the accompanying lecture notes can be used to illustrate this point. As this taxonomy makes clear, it is not quite right to say that all multidivisional firms correspond to M-forms, as both H-forms and M-forms are multidivisional. They differ in whether or not their businesses are related.

When will firms adopt these various forms? Williamson (1975) argues that large organizations would need to take on a divisionalized structure as the scale of the business expanded. However, when the various divisions are unrelated, there may often be more value in spinning off the divisions as independently-owned firms, and so the only large firms that will survive will be M-forms. Barney and Ouchi (1986) put it as follows:

> "…corporate managers must strike a careful balance in an M-form. On the one hand, they must encourage competition between divisions for capital and recognition. On the other hand, they must encourage cooperation in those areas where synergies exist between divisions in order to obtain higher overall levels of performance. M-forms that are able to strike this balance will outperform both large U-forms and all H-forms. This, in a nutshell, is Williamson's M-form Hypothesis."

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The remainder of this lecture will be concerned with describing and modeling the costs and benefits of divisionalization. We do not stress the role of interdivisional competition; this has been discussed in Tirole (1988, pp. 47-48) and Maskin et al. (2000). Rather, we aim to stress the role of synergies and bounded rationality.

While the U-form organization allows for economies of scale, an advantage over M-form organizations, a major cost of the U-form comes in the form of "control loss" (Williamson, 1975, p. 133). Executives of H-forms may benefit from superior knowledge about divisional performance, but the managers of H-forms cannot know that much more than equity traders about all the diverse businesses they operate, face transaction costs associated with liquidating businesses greater than to that of equity investors, and because the businesses in an H-form are unrelated, there are no chances to exploit synergies.

On the other hand, in M-form organizations, there are many chances to exploit synergies between the related businesses. Also, Williamson suggests two main channels whereby the M-form organization mitigates control loss problems: "...the M-form organization... served both to economize on bounded rationality and attenuate opportunism." (1975, p. 137) Attenuating opportunism has been the focus of much of the literature on incentives. This lecture emphasizes bounded rationality.[2]

Understanding either branch of the theory of the firm—scope or structure—involves becoming familiar with terminology and concepts that are sometimes rather foreign to students. Luckily, a student interested in pursuing theories of firm scope can consult a large number of good reviews. My advice would be to begin with Gibbons (2005); although much of this survey will be beyond the reach of students, a good deal of it is accessible. A student interested in pursuing theories of firm structure, however, will find a demonstration in what follows.

Local and Global Knowledge

In the introduction to his 1975 book, Williamson cites Hayek (1945) as an important antecedent to his own work. According to Williamson (1975, pp. 4-5) Hayek (1945), who wrote about comparative economic systems, was concerned with demonstrating that:

> Much of the knowledge required to make efficient economic decisions cannot be expressed as statistical aggregates but is highly idiosyncratic in nature: “Practically every individual has some advantage over all others in that he possesses unique information

[2] Yet another account of the M-form Hypothesis can be found in Qian et al. (2006).

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> of which beneficial use might be made, but of which use can be made only if the decisions depending on it are left to him or are made with his active cooperation. We need to remember…how valuable an asset in all walks of life is knowledge of people, of local conditions, and of special circumstances" (1945, pp. 521-522.

The notion of "local" knowledge has become important throughout economics, as well as strategic management and other applied fields. However, students need to appreciate that not all useful knowledge should be thought of as local. In the business literature, for example, Koch Industries CEO Charles Koch describes the limits of local knowledge (2007, pp. 132-133):

> Proximity to a problem or process does not determine who is in the best position to make a decision...Those with local knowledge are often in a better position to solve the problem at hand...but universally decentralized decision-making has its own problems. Some decisions, if made at the local level, can be unprofitable because a broader perspective is required.

Another way to phrase this is to say that there is a tension between optimally using local knowledge and what below we term "global knowledge".[3] Having global knowledge means knowing something about how the different parts of the organization fit together. It is often those at the top that will have global knowledge, but not always. The tradeoff between the use of local and global knowledge is an important determinant of the optimal form of organization.

The insight that there is a tradeoff between using local and global knowledge is complimentary to the incentive-based account of the M-form Hypothesis. In the incentive-based account, the benefit to decentralization is ability to use benchmarking when providing performance incentives, whereas the benefit of centralization is economies of scale. These incentive and production aspects are important considerations in the cost and benefit calculus of firm structure. The model presented below provides a complementary set of tradeoffs for students to consider. Together, the incentive, production and knowledge-based concepts combine to offer a comprehensive view of the delegation problem.[4]

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[3] It should be noted that the term "global knowledge" is used here differently than in much of the management and strategy literature, where it is used to refer to knowledge spillovers in a national, or economy-wide setting. Here, global knowledge means knowledge of the spillovers that affect the productive opportunities of the firm.

[4] See Holian (2008) for an attempt to develop a model that integrates these three sets of forces.

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Modeling Decision Making and Firm Structure

This section uses a modified version of the model from Besley and Coase (2003) as an aid in demonstrating the M-form Hypothesis.[5] The firm sells products in two regions, (alternatively, one can think of the regions as differentiated product lines) indexed by $i \in \{1,2\}$. The firm has two decisions to make (g_1, g_2) where g_i is the investment in region i which can come in a variety of forms; we focus on the example of advertising for concreteness, though R&D is another interpretation. To produce one unit of g_i requires p dollars. The revenue function for region i is given by

$$R_i(g) = x + \lambda_i[\log g_i + k \log g_{-i}]$$

where x is revenue that accrues to the firm regardless of investment,[6] and g_{-i} refers to the level of investment in region $-i$. The parameter λ_i represents the effectiveness of investment in the region (in the advertising example, if λ_i is high, the firm will in general find that it is worthwhile to invest in more advertising.) The revenue function is increasing in the size of the investment in the other region whenever $k > 0$. That is, there are externalities, and the extent of spillovers is measured by k. For example, region i may benefit from advertising done in region $-i$ through commercials that raise overall demand for the goods sold by the firm.

The large firm also has a strategic decision to make regarding structure (denoted Ω, for organization.)[7] It has two options. First, it can form regional (or product-based) divisions, which produce and market the products; we call this a divisionalized organization, and denote this as $\Omega = D$. Or, it can produce and market the products for both regions in one division. We will call this a unitary organization, and denote this by $\Omega = U$.

Profit does not depend on structure directly, but structure influences the firm's ability to make investment decisions. When $\Omega = U$, we assume $g_i = g_{-i}$. That is, the organization must choose the same investment level for both entities. This assumption reflects the fact that managing the operations of the enterprise is "….too complex…for a small number of top officers to handle…" (Chandler, 1962, p. 383) A centralized decision maker has difficulty differentiating between appropriate levels in each entity, because her attention is divided between both

[5] Although their model builds on Oates' (1972) model of a federal system of government, we reinterpret it as a model of firm structure. Glazer (2002) and Gibbons (2005) also reinterpret a public choice model in a theory of the firm context.

[6] This is produced by the manufacturing and sales functions which are not modeled here.

[7] The adjective "large" refers to the fact that the organization is subject to bounded rationality constraints.

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divisions, and perhaps more importantly because the executive is engaged in strategic planning; hence the choice of a "one size fits all" policy can be viewed as arising due to bounded rationality.[8]

When $\Omega = D$, then each division is assumed to choose its investment level independently, but is only knowledgeable about the effect of investment in its own division. By focusing only on her region, a regional division manager is able to select the right investment level for her own division, but the decision will appear near-sighted from the standpoint of the firm as a whole.

To summarize, bounded rationality affects both decentralized and centralized decision making. In a centralized setting, bounded rationality manifests itself in a one-size fits all policy. In a decentralized setting, bounded rationality manifests itself as a lack of awareness of synergies. We ignore other issues, such as operations risk, coordination across units, etc.[9]

This setup can be used to illustrate the role of bounded rationality in organizational structure. As a benchmark case, first consider overall firm profits when it chooses investment levels (g_1, g_2) subject to the cost of investment p, but no bounded rationality constraints:

$$\pi(g_1, g_2) = 2x + (\lambda_1 + \lambda_2 k)\log g_1 + (\lambda_2 + \lambda_1 k)\log g_2 - p(g_1 + g_2)$$

It is readily checked that the profit maximizing investment levels, which maximize g_1 and g_2 are given by row (a) in Table 1 below. Executives in a small firm may be able to achieve these optimal investment levels, but large firms will be subject to the bounded rationality constraints mentioned above. In particular, when $\Omega = D$, divisions act as though the value of k is zero, and choose levels of g_i to maximize

$$\pi_i(g_i) = x + \lambda_i[\log g_i + k \log g_{-i}] - pg_i$$

and the outcome is given by row (b) in Table 1. When $\Omega = U$, a uniform investment level g that maximizes overall profit is chosen (by assumption). The firm maximizes:

$$\pi(g) = 2x + (\lambda_1 + \lambda_2)(1 + k)\log g - 2pg$$

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[8] In this corporate context it may seem strange that managers know the optimal average level but cannot assign a specific optimal level to each division. However, it would be stranger if the manager knew the optimal level in each division.

[9] The assumption here is that divisional managers are not aware of spillovers (they believe $k = 0$), and therefore there is no strategic interaction between the divisional managers. They attribute any spillover revenue to x. If managers were aware of k, and played an infinitely repeated game, they could coordinate on the efficient level of investment, given sufficient patience. See Koppel (2005) for a related model (but with a non-additively separable objective function) in a repeated setting.

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Solving this problem yields the investment levels shown in row (c) in Table 1. Here the organization maximizes total overall profit, with the constraint that $g_1 = g_2 = g$.

Compared to the benchmark case (a) that maximizes overall profit, the investment level when $\Omega = U$ is too high in one division and too low in the other unless $\lambda_1 = \lambda_2$. When $\Omega = D$, the investment level is too low compared to the benchmark case for both divisions whenever $k > 0$. When the firm is not able to maximize joint profits due to bounded rationality, it must compare the firm's profit under each form of structure; given a configuration of parameter values, this is now straightforward.

The model above yields the following central insight: *A unitary structure is preferred when the effectiveness of investment in both divisions is similar (the businesses are not complex) and/or the spillovers are large (the business are highly related), and a divisionalized structure is preferred when the effectiveness of investment in the divisions are dissimilar (the businesses are operationally complex) and/or the spillovers are small.*

Having described the costs and benefits of divisionalization, we are now in a position to characterize the performance of H-form, M-form and U-form organizations. H-form organizations are divisionalized, unrelated organizations. If $k = 0$, then the divisionalized form coincides with the optimal form, and we would call such an organization an H-form. Given identical effectiveness parameters (the $\lambda's$) and investment levels (the $g's$), M-form organizations will clearly outperform all H-form organizations, because of the presence of spillovers ($k > 0$) in the former, but not in the latter.

If $k > 0$, then firms may optimize by taking on the unitary structure, which enables internalizing inter-divisional externalities. However, if the $\lambda's$ differ greatly, a divisionalized structure may still outperform a unitary structure, as the M-form allows for the use of local knowledge. One telling of the M-form Hypothesis, then, is simply that local knowledge is usually more important than global knowledge, and so M-form structures will usually outperform U-form structures (and will always outperform H-form structures, due to their lack of spillover benefits.) However, and although we did not model this, if strategic decisions, such as the choice of structure itself, become more difficult in U-form organizations, as Williamson (1975) and others argue, then the case for taking on an M-form over U-form structure is even more compelling.

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Table 1. Investment levels under three regimes

The Benchmark Case	$(g_1, g_2) = (\frac{(\lambda_1 + \lambda_2 k)}{p}, \frac{(\lambda_2 + \lambda_1 k)}{p})$	(a)
Divisionalization	$(g_1, g_2) = (\frac{\lambda_1}{p}, \frac{\lambda_2}{p})$	(b)
The Unitary Form	$(g_1, g_2) = (\frac{(\lambda_1 + \lambda_2 k) + (\lambda_2 + \lambda_1 k)}{2p}, \frac{(\lambda_2 + \lambda_1 k) + (\lambda_1 + \lambda_2 k)}{2p})$	(c)

Discussion

An interesting question is, how large does an organization need to be before it might benefit from divisionalized form? Daniel Spulber (2007, p. 237) provides a modern example that suggests the answer might be, not very. Wal-Mart takes advantage of externalities (spillovers) arising through impulse purchases; this example can be used to illustrate the notion of control loss and spillovers to which we refer:

> The combination of a department store and a supermarket offered customers the convenience of one-stop shopping, an advantage over specialized department stores and over standard supermarkets. Wal-Mart's supercenter format took advantage of impulse purchasing and in-store promotions. A customer of the department store or the supermarket might be induced to make an unanticipated purchase from the other side of the supercenter.

If one division of the store advertises, the other may receive a benefit in the form of a spillover. These spillovers are underprovided for in the decentralized case; to illustrate, imagine that for some reason customers who buy pomegranates also make many impulse purchases. Then, if the manager of Wal-Mart's grocery division can attract these types of customers, say through holding a sale on

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pomegranates, the other department (e.g. clothing or hardware) will benefit from increased sales. However, the grocery manager may not be aware of this potential externality, as he has only local, not global knowledge. Although there is under provision in the decentralized case, there is no free-riding. Here, under provision results from bounded rationality, not opportunism.

The fact that Wal-Mart emphasizes a "store within a store" structure suggests that the benefits of local knowledge may be substantial. The fact that some Wal-Mart stores are not that large suggests that carefully balancing local and global knowledge is likely to be relevant in design tasks of all sizes.

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