Commitment, Firm and Industry Effects in Strategic Divisionalization

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Abstract

We modify the canonical two-stage game of strategic divisionalization by adding an initial stage to allow firms to credibly commit to whether they will create additional divisions or not. This generates a unique equilibrium prediction consistent with the key stylised fact that often only one of the mother firms alone creates independent divisions. Examples include GM versus Ford for national markets and many cases of franchising in local markets (e.g., Walmart vs Target, McDonald's vs Burger King). A key implication for organization theory is that the adoption of the M versus the U-form is part of a strategic whole necessarily involving all competitors, rather than just intra-firm managerial and informational considerations as in the classical theory. The differences between the predictions of the latter and of the present approach are highlighted.

Key words: M-form vs U-form, organizational form, strategic organizational heterogeneity, organizational preemption, franchising.

1 Introduction

In business strategy and organization theory on the one hand, and in industrial organization on the other hand, divisionalization refers to one of the most important long run strategic decisions of a firm. For the former fields, this issue came to the fore early on with important work contrasting the pros and cons of the U-form (unitary or single-divisional firm) and the M-form (multi-divisional firm) by Chandler (1962, 1990) and Williamson (1975).[1] This early work argued with great insight that a number of different factors, such as the nature of managerial hierarchies and contracts, the management of informational flows, the size of the firm, and notions of economies of scale and scope, give rise to the complex trade-offs that determine the final decision of the firm on this key long-term commitment. This pioneering work found formalized expression with significant delay upon the emergence of modern incentive theory in economics (e.g., Maskin, Qian, & Xu, 2000).[2] More recently, this issue has received much renewed attention in the study of multiunit-multimarket (MUMM) organizations: See Greve and Baum (2001 and references therein) and Puranam (2018). MUMM organizations differ from the classical M-form in their greater degree of coordination amongst units and strategic relatedness of activities, e.g., for units of service chains.

On the other hand, industrial organization economists have to some extent ignored intra-firm organizational aspects,[3] and focused instead on the market share and other industry-level effects: Even with induced self-competition or cannibalization effects, the incentive to divisionalize is to increase the mother firm's overall market share and its total profit by creating additional competing units. In short, divisionalization is simply seen as the converse operation to a horizontal merger or acquisition (see Faulí-Oller & Sandonis, 2018, for a thorough survey). The formal study of divisionalization and franchising in a game-theoretic framework traces back to Schwartz and Thompson (1986), who justified a firm's creation of multiple divisions as an entry deterrence tool to forestall potential entry and

[1]We shall not distinguish between the M-form and the H-form (holding company) and instead view both as the organizational form of running autonomous divisions that operate independently of, and compete with, each other and with all other firms' divisions in the same market.

[2]As noted by several authors, including Maskin et al. (2000), the complex trade-offs that underpin the optimal organization of a firm are similar to their analogs in a planned economy, e.g., the Soviet Union or China. Likewise, one might add historically large empires, and the most obvious examples of an M-form in this context are the West and East-Roman empires first formed in 285 AD out of a unitary empire, and then re-formed again for good in 395 AD (upon a lapse back to a U-form for some decades in between).

[3]As noted by Rumelt, Shandel, and Teece (1991), this is a general trend among industrial economists, although an exception to this is precisely one strand of the franchising literature.

maintain monopoly status. The dominant model for strategic divisionalization is a two-stage game wherein firms choose the number of divisions in the first stage and then let all the divisions thus created compete in Cournot fashion in a homogeneous-good industry in the second stage. Assuming costless divisionalization and linear demand and production costs, Corchon (1991) and Polasky (1992) showed that each firm would create an infinite number of divisions, thus giving rise to perfect competition and zero profit at equilibrium.

However, although many firms do divisionalize, nothing akin to perfect competition (or infinite divisionalization) has ever been observed as a result in the real world. Following Corchon (1991) and Polasky (1992), efforts were made to theoretically explain why those firms that do divisionalize create only relatively few divisions in the equilibrium of a divisionalization game. Introducing a unit cost of creating each additional division, Baye, Crocker, and Ju (1996) derived a unique equilibrium with finitely many divisions, thus circumventing the self-defeating perfect competition trap. Other features of interest in this contest that relax the perfect competition outcome are product differentiation and inter-firm substitutability (Yuan, 1999; Ziss, 1998).

In terms of strategic divisionalization at the global level, a classical example is General Motors, with its multiple independent divisions, Chevrolet, Buick, Pontiac, GMC, and Oldsmobile. Established as a holding company, General Motors lets the General Manager of each division take full control of all activities and operations within the division (Schwartz & Thompson, 1986). More broadly, in a comprehensive study of the patterns of firm entry, growth, and exit in four-digit U.S. manufacturing industries, Dunne, Roberts, and Samuelson (1988) report that "Multiplant firms, on average, own 3.59 plants and produce in 2.64 different four-digit industries, while single-plant firms produce in 1.14 industries." Multi-plant in the latter study refers to MUMM firms, as reported by Greve and Baum (2001).

The standard divisionalization model has also been used to shed light on the problem of franchising (Baye et al., 1996) by restaurant chains, retail mega-stores, electronics, office supplies, hairdresser salons, tax services, etc...[4] A key issue in the adaptation of this model to retail chains is the relevant geographical market definition. For instance, in their empirical study of fast-food hamburger markets, Igami and Yang (2016) define relevant markets to be small neighborhoods (each with a 0.5-mile radius) within large cities, but also checked

[4]Consistent with the nature of the present model of divisionalization, we follow past literature in industrial organization in not distinguishing between franchises and company-owned outlets, a subject of quite some interest in the management literature (e.g., Kalnins, 2004).

robustness via lower (0.25-mile radius) and higher (1-mile radius) distance thresholds.[5] In contrast, Blevins, Khwaja, and Yang (2018) consider city-sized fast-food markets.[6] There are other similar examples including hotels, furniture stores, office supplies, hairdresser salons, tax services, etc.

Despite a sizable literature in industrial organization, intra-firm divisionalization as one of the key strategies in the complex process of endogenous determination of market structure has remained less than fully understood. A key observation, not covered in the extant literature, is that in some global markets, some firms, often a single one, do divisionalize while others do not. A prototypical example is the automobile industry. While GM created several non-luxury divisions early on, Ford and Chrysler eschewed divisionalization.

Several retail chain industries exhibit similar patterns. Schuetz (2015) found a proclivity of "Big Box" retail chains to locate their new stores near in-sector competitors (thus oligopoly follows), while among all mother chain firms, about half of the new stores are co-located near existing stores of the same mother firm, the other half being the chain's only store within the geographical area (possibly because a competitor has preempted a large market share in the area). The macro statistics for Target vs Wal-Mart seem to match the regional location tendency.[7] In a recent empirical work by Ellickson, Houghton, and Timmins (2013), Wal-Mart has nearly twice as many stores as Target in their dataset. Similar patterns also emerge in fast food and gas station franchising, among other retail sectors. McDonald's is often observed to feature a multiple of the number of stores than other hamburger chains in local markets (see e.g., Table 1 in Igami & Yang, 2016).[8] In US gasoline retail, Shell has around 14,000 stations versus 7,200 for British Petroleum. While the evidence here is not clear-cut due to the local relevant (case-specific) market definition alluded to earlier, the numbers are quite suggestive at the aggregate level.

In addition to the factors identified by classical organization theory (Chandler, 1962),

[5] They justify this choice by writing "because this sphere of competition is the most relevant according to the store-development officers of the hamburger chains, and Thomadsen's (2005) empirical analysis further supports its validity."

[6] Another issue with fast-food and other chains is the widely recognized success of offering a fully uniform product across all the outlets (see e.g., Thomadsen, 2005). This feature does not square well with our postulated demand system. Instead, ignoring location specifics, the goods of different divisions of the same firm ought to be viewed as homogeneous between them, but differentiated with respect to those of the other firm (as in Yuan, 1999). For the sake of brevity, the study of such a model is beyond the scope of this paper.

[7] As of 2020, Wal-Mart has 4,756 stores in North America compared to 1,848 Target stores (all such data comes from the companies' annual reports, unless otherwise stated).

[8] In macro, as of 2019, there were 13,837 McDonald's versus 7,257 Burger King stores in North America. The analogous numbers in China were 3,383 and 1,299 (according to Burger King's largest Asian and Turkish franchisee TFI).

historical, regional and local factors, and different geographical preferences no doubt contribute to the choice of organizational form (Ellickson et al., 2013; Jia, 2008). However, there does seem to be a fairly common pattern for one firm to divisionalize while rivals do not, and in the case of franchising in local markets, for one firm to create a multiple of a rival's number of divisions. Some caveats to the validity of this stylized fact will be discussed at the end of Section 3.

This key stylized fact brings up a natural question that forms the main focus of the present paper: Can the basic two-stage game model of strategic divisionalization be amended in plausible ways so as to yield equilibrium outcomes consistent with this key stylised fact and with the absence of perfect competition?[9] The main purpose of this paper is to settle this question in the affirmative by proposing to simply add product differentiation on the demand side and an initial period to the basic two-stage game, at which each firm credibly announces and commits to a decision on whether it will divisionalize or not. Thus, the proposed setting looks at the role of commitment in the modified divisionalization game, and as such fits with a long-standing approach in business strategy (Ghemawat, 1991) and industrial organization (Shapiro, 1989).

We offer two versions of this three-stage game, both with the commonly used linear inverse demand and production costs. In the first model, with two initial mother firms and no divisionalization costs, we show that, in any pure strategy subgame perfect equilibrium, one firm will create multiple divisions and the other firm will not divisionalize. This conclusion is then extended to any number of mother firms, a case that requires invoking Pareto dominance as an equilibrium refinement criterion. While the modification of the basic model is certainly both elementary and plausible, the resulting change in the predictions of the model is quite drastic. The perfect competition trap is avoided and the afore-mentioned stylised fact neatly predicted, along with the afore-mentioned quantitative evidence in multiple markets (Ford vs GM, Wal-Mart vs Target, McDonald's vs Burger King, Shell vs BP, ...).

Importantly, our main result implies fundamentally different organizational structures for two ex ante identical competing firms: M-form for one and U-form for the other. Since this strategic outcome eludes any explanation based only on factors internal to the firm, we shall think of it below as part of the industry effect. This terminology is motivated by the view expressed in business strategy that industrial organization takes the industry as the most

[9] With unit costs of divisionalization added to the basic two-stage game, Baye et al. (1996) got rid of perfect competition, but did not fit the stylized fact at hand.

common unit of analysis while management strategy focuses instead on firm-internal effects (Rumelt et al., 1991). Recall that, in classical organization theory, the decision between the U-form and the M-form is usually posited to depend on firm-specific characteristics (Chandler, 1962; Williamson, 1975). This paper proposes a new dimension of strategic interdependence across firms for this key decision. Finally, this result also connects this paper to the broader economics literature on symmetry-breaking in various economic and political settings (e.g., Acemoglu, Robinson, & Verdier, 2017).

In the second part of the model, the aim is to bring together and contrast the aforementioned basic insights from classical organization theory and the result from the present model in the simplest meaningful setting. To this end, an asymmetry in fixed costs of divisionalization is introduced parametrically across firms. The idea behind this feature is that, in line with organization theory, a firm with a natural stand-alone proclivity for a U-form would have relatively high fixed costs while the M-form would be associated with low fixed costs.[10] Adding the industry effect, or the strategic interaction reflected by the same three-stage game, will then allow for both types of effects to interact and yield a more complete, yet still simple, theory for the strategic determination of organizational forms.

The main result of the second part of the paper is that, except when both fixed costs are too large for an M-form, one and only one firm will elect to divisionalize, with the other firm remaining with the U-form. Thus, both firms electing the M-form is still ruled out, and the analysis neatly captures the inter-related roles of firm-internal and industry effects in determining the final outcomes.

The remainder of this paper is organized as follows. Section 2 presents the standard duopoly divisionalization game and our new three-period version with commitment. Section 3 generalizes to the n-firm case. Section 4 integrates the insights of classical organization theory with the present model with fixed costs. Section 5 concludes.

2 The two-firm model

This section deals with the formal aspects of the basic model. We begin with a brief description of the characteristics of the M-form and a summary of the extant basic two-stage model of strategic divisionalization in industrial organization. To this end, attention is initially

[10] This black-box cost structure is justified in some detail later on via studies that explicitly analyze the incentives and counter-incentives for divisionalization, in particular Zhou (2013).

restricted to the two-firm case for simplicity. The three-period divisionalization game with commitment is then described and analyzed.

For a succinct description of the salient features of the M-form that are particularly relevant to our approach, one may cite either Chandler (1977), Williamson (1975), or more recently Arrow (1993) who wrote "Coordinating activities themselves are costly; not only do they directly involve the use of resources (managerial and supporting personnel, associated equipment, space, and communication channels), but they also impose costs upon decision making at lower levels by creating delays and requiring additional communication costs. They are undertaken because the costs of coordination are exceeded by the benefits... A large firm is organized into profit centers, each of which operates as virtually a separate firm. Transactions between them are market transactions, and payments between them are made at current market prices or (if no suitable market exists) at transfer prices mimicking market prices. Presumably the opportunities for direct (as opposed to market oriented) coordination of activities have been exhausted within the profit centers. What distinguishes the large firm, however, from a collection of smaller firms is that many resource-allocation decisions are still made at a central level, particularly capital formation. A profit center is responsible for its own decisions on current flows, but in general it cannot make its own investment decisions, except possibly for very trivial ones. Indeed, it is surprising how often decisions on investment require the approval of the Board of Directors, while decisions of at least equal importance relating to pricing and production are decentralized to much lower levels."

In line with this description, the simple model of an M-form firm in this paper will thus treat each division as an independent entity as far as the product market decision (output) is concerned, but leave the key prior long-run decision of the organizational structure (M-form vs U-form) to the mother firm (or center). As such, forming divisions here corresponds equally well to the M-form and the H-form (Williamson, 1975), since the synergies that distinguish the two forms are not of direct relevance. Both of these forms call for running autonomous divisions that compete with each other, as well as with all other firms' divisions in the market. Another, more recent, organizational form that the present model applies to is the so-called multiunit-multimarket (MUMM) organizations. While quite similar to the M-form, these differ in their greater degree of strategic relatedness of activities and coordination of units, though this is less pronounced for the manufacture of multiple related products than for service units (Greve & Baum, 2001).

2.1 The basic two-period divisionalization model with product differentiation

As in the literature on divisionalization (e.g., Ziss, 1998), consider an industry with two initial firms, each of which may create independent divisions, each selling a variant of the same basic product (e.g., automobiles). These divisions will engage in Cournot competition with all other firms' divisions and with the same firm's other divisions. In line with the general theory of product differentiation, each division is postulated to supply a single differentiated good, or a horizontally differentiated variety of the same basic product (e.g., automobiles). This reflects the common view that one justification behind the process of divisionalization is the creation and management of differentiated products.[11]

The demand system for these varieties is specified by the multi-dimensional linear inverse demand

$$P_{ij}\left(q_{ij}, q_{i,-j}, Q_{-i}\right) = a - bq_{ij} - \theta q_{i,-j} - \theta Q_{-i} \tag{1}$$

where q_{ij} denotes the output of the j^{th} division of Firm i, $q_{i,-j}$ denotes the total output of all other divisions of Firm i, and Q_{-i} denotes the total output of all the divisions of all firms other than Firm i. Here $i = 1, 2$ and $j = 1, 2, .., d_i$, where d_i is the number of divisions created by Firm i. The substitution parameter θ represents the extent of substitution effect for the differentiated products. Thus the products of other divisions, whether created by the same firm or by other firms, are treated as symmetric substitutes to one division's own product.[12] As usual for differentiated-product demand systems, the condition that $0 < \theta < b$ is needed to capture that the effect of own output on own price exceeds any cross effect. If $\theta \to b$, products become homogeneous (or perfect substitutes) across all divisions of all firms. If $\theta \to 0$, products are unrelated, and each division acts as a monopolist in supplying its single variety of the product in an independent market.

This simple and tractable demand system, probably the most widely used in industrial organization and business strategy (see Choné & Linnemer, 2020, for a comprehensive survey), goes back all the way to Shubik (1959). For more recent advances, see Singh and Vives (1984) and Amir, Erickson, and Jin (2017). One frequently cited behavioral justification for

[11] While this partial rationalization of the divisionalization process is quite commonly accepted starting with the pioneers of organization theory, a more nuanced view is offered by Zhou and Wan (2017a, 2017b).

[12] Such specification differs from Ziss (1998) and Yuan (1999) which assume products are homogeneous within a firm and differentiated across firms, i.e., $P_{ij}\left(q_{ij}, q_{i,-j}, Q_{-i}\right) = a - bq_{ij} - bq_{i,-j} - \theta Q_{-i}$, giving rise to different results in our model. For a justification of our modeling in terms of treating divisions, created by the same firm as well as by the rival firm, as selling substitutes rather than homogeneous goods, see Ren, Hu, and Cui (2019). The latter employed the linear demand system in a novel way to investigate post-rival-exit endogenous product differentiation with prices fixed due to price-matching guarantees.

the linear structure is that (boundedly-rational) managers often perceive general demand functions only as a (first-order) linear approximation.

With the linear demand, and assuming that each division incurs the same marginal cost $c \geq 0$ for producing a unit of each variety, the divisional profit function for Firm i's j^{th} division is

$$\pi_{ij}(q_{ij}, q_{i,-j}, Q_{-i}) = q_{ij}(a - bq_{ij} - \theta q_{i,-j} - \theta Q_{-i}) - cq_{ij}. \tag{2}$$

Consider the following two-stage game (G_0) involving two symmetric mother firms (the n-firm version will be considered in a later section).

Game G_0.

Stage 1: Each firm chooses the number of autonomous divisions it will create.

Stage 2: Each division competes in outputs with all other divisions to maximize own profit.

This basic two-stage game of strategic divisionalization is the same as described in Corchon (1991) and Polasky (1992), except for the extension to product differentiation. The main goal is to show that this two-stage game has a unique subgame-perfect equilibrium wherein both firms choose to divisionalize repeatedly, leading to perfect competition and thus zero profit for each firm.

Suppose Firm i chooses to create d_i divisions, $i = 1, 2$, and let d_{-i} denote the number of divisions created by the other firm. In line with the theory of divisionalization, each division is treated as a single decision unit and all of them compete in a symmetric Cournot oligopoly.

The model may be seen in light of the theory of strategic delegation or strategic choice of managerial incentives wherein each mother firm hires an independent manager to run each division, whose contract specifies a fixed proportion of the division's profit as compensation, unlike Sklivas (1987) and Fershtman and Judd (1987) where contracts also include some weight on a non-profit objective such as market share.[13] Since the manager's preferences are then perfectly aligned with the unit's, we simply posit the unit's profit maximization as its objective. Then (mother) Firm i's payoff is the sum of the profits generated by all of its divisions, i.e., $\Pi_i = \sum_j \pi_{ij}$.

The game is solved by backwards induction. Stage 2 features a symmetric Cournot oligopoly with differentiated products and substitution parameter θ, among $d_1 + d_2$ independent decision units. In equilibrium, the per-division output and profit are solved to

[13]Though somewhat related, the question of strategic choice of vertical structure for a manufacturer-retailer channel involves a sequential pricing structure that is not part of the present set-up (see Moorthy, 1988).

be:[14]

$$q_{ij} = \frac{a-c}{2b-\theta+\theta(d_i+d_{-i})} \text{ and } \pi_{ij} = b\Big(\frac{a-c}{2b-\theta+\theta(d_i+d_{-i})}\Big)^2. \tag{3}$$

At Stage 1, Firm i chooses d_i to maximize its total profit $\Pi_i = \sum_j \pi_{ij} = d_i\pi_{ij}$:[15]

$$\max_{d_i} \frac{d_i b(a-c)^2}{\big(2b-\theta+\theta(d_i+d_{-i})\big)^2}. \tag{4}$$

The first-order condition of (4) yields Firm i's reaction curve in divisionalization choice as

$$d_i^*(d_{-i}) = d_{-i} + \frac{2b-\theta}{\theta}. \tag{5}$$

Since $b > \theta > 0$, one clearly has $\frac{2b-\theta}{\theta} > 1$. Hence, each firm's optimal reaction calls for creating at least one more division than the rival firm does. With two mother firms, we have the two reaction curves as $d_1^*(d_2) = d_2 + \frac{2b-\theta}{\theta}$ and $d_2^*(d_1) = d_1 + \frac{2b-\theta}{\theta}$. The unique equilibrium outcome, as the intersection of these two reaction curves with unitary slope, is thus $d_1^* = d_2^* = \infty$. Therefore, perfect competition is the equilibrium outcome, along with zero profit for each firm.[16]

In the special case $\theta = b$, the products are homogeneous and the same perfectly competitive outcome obtains. This indeed corresponds to the model proposed by Corchon (1991) and Polasky (1992) who derived the same conclusion. This suggests that, though widely believed to relax competition in general, in this context, product differentiation yields the same qualitative outcome as homogeneous goods.

Although the basic model appears adequate, its main prediction is at odds with business reality since perfect competition is virtually never observed in the real world. Thus, following this early work, efforts were made to modify the model to rationalize the absence of perfect competition, including the inclusion of variable costs of divisionalization (Baye et al., 1996) and inter-firm substitutability (Yuan, 1999; Ziss, 1998).

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[14] See Appendix S1 for the derivations of Eq. (3), (4) and (5).

[15] Here, q_{ij} and π_{ij} depends on the total number of divisions $(d_i + d_{-i})$ in the industry and are thus symmetric across divisions and firms. Firm i's profit is d_i times per-division profit π_{ij}.

[16] Using standard myopic Cournot dynamics yields a simple process via which the number of total divisions will increase without bound. Indeed, with each firm best-responding at each stage by creating $\frac{2b-\theta}{\theta}$ more divisions than its rival, the resulting number of firms keeps growing without bound.

2.2 The three-period divisionalization game with commitment

In this paper, we start with the premise that an ideal basic model ought to yield qualitatively realistic predictions independently of the inclusion, and the level, of the two realistic ingredients listed above. In other words, while the predictions could vary quantitatively as divisionalization costs or product differentiation are varied, the nature of the prediction ought to remain similar in a qualitative sense. We now propose a modified model that satisfies the afore-mentioned criterion.

While retaining the basic ingredients of the industry above, the crucial feature to add to the basic game is a pre-stage or initial stage at which each firm announces, and credibly commits to, whether it plans to divisionalize (action Y for "Yes") or not (action N for "No"), as a binary decision. We will show that adding such an announcement stage suffices to eliminate the perfectly competitive outcome, and to give rise to an outcome that closely fits the stylised fact described in some detail in the Introduction, regarding the automobile industry, as well as fast food and other retail chain industries.

Formally, we consider the following three-stage game.

Game G_1.

Stage 1: Each firm announces and commits to whether (Y) or not (N) it will divisionalize.
Stage 2: Any firm that has announced Y chooses a number of divisions. Any firm that has announced N remains with one division.
Stage 3: All divisions in the industry compete in Cournot fashion (with differentiated products).

The extra stage of the game squares well with all the attending legal, administrative and organizational steps that a mother firm needs to undertake in order to actually implement a divisionalization decision. In particular, it readily fulfills the usual requirements for a credible commitment as applied to multi-stage games (Schelling, 1980). For the firm decides to divisionalize, such a decision would be very costly to reverse in view of the afore-mentioned preparation steps for divisionalization.[17] The commitment from the firm who decides not to divisionalize is also credible, since it should be well aware of the perfect competition trap resulting from both firms divisionalizing.

[17] A more realistic viewpoint is to think of the preparation steps as being associated with some fixed costs. The main results are robust to fixed costs, while we eschew adding fixed costs at this point for a succinct presentation of the model's main idea. It will be added to the model in Section 4 to address another main finding of this paper.

As before, tacit in the description of the game is the fact that each created division is delegated to an independent manager whose contract aims at maximizing own divisional profit, in full Cournot competition with all other divisions, from the same mother firm as well as from the other firm. The model described here clearly distinguishes between a U-form firm (one having chosen N, and thus having a single division) and an M-form firm (one having chosen Y, and thus two or more divisions), but not between the latter and the H-form.[18]

Despite having three stages, the game at hand may be analyzed in very elementary manner to find its subgame-perfect Nash equilibrium (SPE). To use backward induction, first observe that there are four different subgames starting after Stage 1, corresponding to:

(i) both firms choosing not to divisionalize, i.e (N, N),

(ii) both firms choosing to divisionalize, i.e (Y, Y), and

(iii)-(iv) two configurations with one firm choosing to divisionalize and the other not to, i.e (Y, N) and (N, Y).

In Subgame (i), the firms are committed to choosing 1 division each at Stage 2 (i.e., $d_1 = d_2 = 1$) and engaging in Cournot competition at Stage 3. By Eq. (3), the equilibrium profits for two firms are $\Pi_i = \frac{b(a-c)^2}{(2b+\theta)^2}, \quad i = 1, 2$.

In Subgame (ii), each firm's reaction curve at Stage 2 is to choose $\frac{2b-\theta}{\theta}$ plus the rival's number of divisions as described in Eq. (5). Hence the equilibrium outcome is for each to choose infinitely many divisions. Perfect competition follows with zero profit to both firms.

In Subgames (iii)-(iv), let us analyze, say, the case (Y, N), the other case being similar. Since Firm 2 is committed to choosing one division at Stage 2 (i.e. not divisionalize further), Firm 1 will choose $d_1^*(1) = 1 + \frac{2b-\theta}{\theta} = \frac{2b}{\theta}$ divisions. Since $b > \theta > 0$, we have $\frac{2b}{\theta} > 2$, hence Firm 2 will create at least 2 divisions. In Eq. (3) the per-division payoff π_{ij} depends on the sum of the divisions created by both firms. Thus we have $\pi_{ij} = \frac{b(a-c)^2}{\left(2b-\theta+\theta(1+1+\frac{2b-\theta}{\theta})\right)^2} = \frac{(a-c)^2}{16b}$. Since Firm 1 creates $\frac{2b}{\theta}$ divisions and Firm 2 remains with one division, the payoffs to the two firms are

$$\Pi_1 = (1 + \frac{2b-\theta}{\theta})\pi_{ij} = \frac{(a-c)^2}{8\theta} \text{ and } \Pi_2 = \pi_{ij} = \frac{(a-c)^2}{16b}.$$

[18]Our model reflects precisely the H-form due to the complete independence of divisions of the same H-form firm (Williamson, 1975). The distinctions between the H and the M form have to do with coordinated functions shared between the divisions of the latter, including R&D, information flows, ... Our simple model does not include such factors, though they are added in a stylized manner in Section 4.

Folding back to the first stage of the game, we have the 2×2 matrix game in Table 1.

[Insert Table 1 Here.]

This matrix game represents an anti-coordination game. There are two pure-strategy Nash equilibria: (Y, N) and (N, Y). The SPEs call for one firm to divisionalize and for the other to remain as a single-division firm (proofs in Appendix S2).

Proposition 1 *There are two subgame-perfect equilibria of G_1. In either equilibrium, one firm announces Y (Yes) at Stage 1 and creates $\frac{2b}{\theta}$ divisions at Stage 2, whereas the other firm announces N (No) at Stage 1 and remains with one division at Stage 2.*

Adding a commitment period to the basic game is thus sufficient to engender our two desired conclusions. With product differentiation $(\theta > 0)$, the resulting oligopoly is distinct from perfect competition, and it suggestively delivers the stylised facts reported in the Introduction. At equilibrium, one firm chooses the M-form with at least two divisions and the other firm remains unitary or retains its U-form. For instance, in the automobile industry, GM has several independent non-luxury divisions while Ford is single-division. As a further note of interest in the actual historical development of the automobile industry in the U.S., GM's divisionalization may be viewed as costless since the separate divisions had an independent existence as such before being bought by GM as a holding company (e.g., Sloan, 1990). This and other similar cases where M-forms arose out of separate acquisitions make the no-fixed-cost case relevant in the real world.

In the franchising application, taking appropriate local geographic areas as the relevant markets, Wal-mart seems to be the firm opening multiple supercenters in local markets, in some areas outnumbering Target supercenters by more than three times (Graff, 2006). McDonald's and Burger King are often observed in a higher than two-to-one ratio in local markets (Igami & Yang, 2016). A similar remark applies to gas station chains. For some important details on this evidence, the reader is referred to the Introduction section.

Naturally, the specific ratio of $\frac{2b}{\theta}$ to one provides a link between the level of product differentiation and the extent of divisionalization by a single firm in the industry. In particular, in the special case of homogeneous products (or $\theta = b$), the ratio is 2 to 1. The number of divisions clearly increases as θ decreases, i.e., as products become more and more differentiated.[19] In addition, the incentive to divisionalize increases with produce differentiation

[19]In the limiting case of independent products, obtained as $\theta \to 0$, the divisionalizing firm creates infinitely many divisions, which is to be expected since each division would then act as a monopolist in its own market. This is an idealization as independent products are an unrealistic prospect.

(since $\Pi_1 = (a-c)^2/8\theta$ increases as θ decreases) whereas the incentive to remain a U-form firm is independent of product differentiation (since $\Pi_2 = (a-c)^2/16b$ does not depend on θ).

The key aspect of this Proposition that is robust to the level of product differentiation is the qualitative conclusion that only one mother firm engages in divisionalization in industries where such strategic activity takes place (more on this point below). In this respect, it is worth recalling that, with a per-unit cost in creating divisions that produce homogeneous goods instead of our commitment assumption, the equilibrium outcome is symmetric, with each firm creating a finite number of divisions (Baye et al., 1996). However, while the cost structure of the latter study (and the extant literature) got rid of the perfect competition outcome, it did not generate the stylized fact of a single firm engaging in divisionalization. Some important caveats to this stylized fact are discussed in the next section.

Another important implication of our main conclusion is on organization theory. Recall that in classical organization theory (Chandler, 1962, 1990; Williamson, 1975), the key decision of whether to adopt the M-form or the U-form is reached via a firm-specific comparative evaluation of the pros and cons of each of the forms, in terms of the ease of managerial control, better information processing, the need to exploit economies of scale and scope, etc. In other words, the decision is based entirely on within-firm optimization, taking into account the nature of the industry and other exogenous factors.[20] In contrast, our simple equilibrium analysis suggests that the organizational structures espoused by companies operating in the same industry are intimately connected to each other, and form a strategically coherent whole. Thus, for instance, confronted with the key strategic choice of an organizational form, Ford adopted the U-form in part because GM had chosen the M-form, and vice versa. This key choice could not be made in isolation by a firm operating in an oligopolistic industry as a simple matter of internal design and optimization. In other words, the two decisions are not only guided by intra-firm organizational trade-offs, such as managing information flows, multi-level managerial incentives, among other internal factors, but also constitute mutual best responses in an overall industry-level strategic environment. The underlying mechanism could thus be termed endogenous strategic organizational heterogeneity of competing firms. Often referred to as symmetry-breaking, similar mechanisms for endogenous heterogeneity

[20] Maskin et al. (2000) developed a formal model where contractual incentives in the form of yardstick competition between divisions play a key role, thus providing an incentive-based account of Williamson's (1975) M-form Hypothesis.

of ex ante identical entities have emerged in a wide variety of economic settings.[21]

Our main result is also relevant to the general dichotomy between the fields of industrial organization and business strategy.[22] While the former is often seen as stressing industry effects and disregarding the internal organization of the firm, the latter tends to take the opposite perspective (see e.g., Rumelt et al., 1991). The present analysis proposes a simple modification of a typical model in industrial organization, thus a priori stressing industry effects, yet delivers a conclusion that has direct bearing on the internal organization of the firm, and thus clear relevance to business strategy and organization theory. Is the present result to be seen as an alternative to the classical intra-firm analysis of organizational structure by Chandler and Williamson? Not really. Rather, the present result brings to the fore an additional factor hitherto ignored in the literature, which is intimately tied to product market competition, and thus part of industry factors. By postulating ex ante identical firms, the present result appears stronger since organizational heterogeneity emerges even when all the firm-specific trade-offs identified by organization theorists as definitely relevant are the same across the two firms. This discussion, along with the effects of initial asymmetry between the two firms, will be taken up again in the next two sections.

A final remark concerns the effect of this pattern of divisionalization on subsequent market structure. As suggested by Hadfield (1991), franchising can serve as a spatial preemption tool to deter entry. Our analysis provides another perspective on preemption that is more limited in scope. In the unique equilibrium (up to the identity of the players) of the three-stage game at hand, the unilateral creation of multiple divisions does not quite aim at deterring entry and thus preserving a monopoly, but rather at undermining competitors' incentive to divisionalize (or franchise) in the market. In other words, the preemption preserves an asymmetric oligopolistic advantage by preventing other firms from creating more divisions than just themselves. For instance, GM acquired Buick, Cadillac and Chevrolet by 1918 while its competitor Ford essentially kept its U-form. GM has been able to keep a larger market share ever since, despite recent set-backs.[23]

While the duopoly case captures the main message of this paper neatly and unambigu-

[21] Among others, Acemoglu et al. (2017) deals with endogenously distinct national economic systems, Matsuyama (2004) with inequality of nations, Hermalin (1994) with managerial contracts, and Amir, Garcia, and Knauff (2010) with different settings in industrial organization, including R&D competition.

[22] As a remark, recall that both fields share the common perception that strategic commitment is a key ingredient for understanding corporate strategy in many different aspects (see e.g., Rumelt et al., 1991; Shapiro, 1989). The present analysis may be seen as reflecting one more setting where commitment is a critical assumption of the model which leads to the key stylised fact about divisionalization.

[23] For the source, see U.S. Vehicle Sales Market Share by Company, 1961-2016 on Knoema.com.

ously, it is clearly desirable to extend the analysis to the n-firm case. We show next that while the essential conclusion goes through, the analysis requires an economically plausible equilibrium selection argument.

3 The n-firm model

In this section, we analyze the n-firm version of the three-stage game, with $n \geq 2$. In the n-firm game, one firm alone committing to divisionalization is still a SPE, but some other SPEs with more firms divisionalizing emerge as well. To retain our conclusion that only a single firm divisionalizes as an equilibrium outcome, we need to use an intuitive, economically meaningful selection tool, namely Pareto dominance, as a plausible way to rule out those equilibria where multiple firms choose to divisionalize. Indeed, as the two-firm case suggests, multiple firms divisionalizing will lead to perfect competition, thus zero profits for all firms in the industry, which is clearly Pareto dominated by the single-firm divisionalizing equilibrium, wherein all firms maintain a strictly positive profit.

Consider a game, G_n, the n-firm version of game G_1 with the same three stages. We claim that the equilibrium configuration of G_n consists of n_y firms announcing Y and the rest announcing N, for all $n_y = 1, 3, .., n$. In other words, the only outcomes not eligible for equilibrium involve exactly two firms choosing Y.

Lemma 1 *Consider a n-firm game G_n analogous to G_1, $n \geq 2$. In any equilibrium, there are n_y firms choosing to divisionalize while the others choosing not to, for $n_y = 1, 3, 4, 5, ..., n$.*

A detailed proof of the Lemma are provided in Appendix S3. The Lemma predicts a large set of equilibria, with any number of firms divisionalizing except the case where exactly two firms divisionalize (i.e., $n_y = 2$). Indeed, two firms announcing Y can never happen in equilibrium because either of these two firms will be better off by deviating from Y to N. Since firms' best responses are the same as Eq.(5), $d_i^*(d_{-i}) = d_{-i} + \frac{2b-\theta}{\theta}$, that is, every divisionalizing firm wants to create more divisions than the total rivals' divisions, the equilibrium can have finitely many divisions only if there is one firm divisionalizing (so it can outnumber all other firms' divisions). Otherwise, multiple firms engaging in divisionalization will lead to the perfect competition trap. For this reason, two firms divisionalizing can never be part of an equilibrium in our setting, because by unilaterally deviating from Y to N, a firm strictly increases its profit from zero to positive.

However, $n_y = 3$ also constitutes an equilibrium, because a unilateral deviation of one firm from Y to N (resulting in $n_y = 2$) would not change the zero-profit outcome. Analogously, $n_y > 3$ are all eligible equilibrium configurations (that cannot be upset by a single firm deviating).

A natural question arises then, as to whether this equilibrium multiplicity is a robust property of the n-firm model. It turns out not to be the case. It is clear from the foregoing discussion that for all $n_y \geq 3$ equilibria, infinitely many divisions will be created, and all firms in the industry, divisionalizing or not, end up earning zero profit. However, if $n_y = 1$, all other firms remain with 1 division while the divisionalizing firm creates $(n-1) + \frac{2b-\theta}{\theta}$ divisions, thus yielding finitely many divisions in the equilibrium. Perfect competition is avoided and all firms maintain positive profits, though of course the divisionalizing firm earns more than the others do due to its higher market share. Hence, all firms are better off in the equilibrium $n_y = 1$ or, in other words, this equilibrium (strictly) Pareto dominates all other equilibria in which multiple firms divisionalize. It follows that any outcome with $n_y \geq 3$ is unlikely to materialize in the real-world since all firms strictly prefer the equilibrium $n_y = 1$. Using this simple selection tool, the conclusion with only one firm divisionalizing in the equilibrium is re-established in the n-firm case. The result is summarized in the next Proposition.

Proposition 2 *In the n-firm game G_n, $n_y = 1$, i.e., one firm divisionalizing, strictly Pareto dominates any other equilibria wherein $n_y \geq 3$.*

In conclusion, the multiple equilibria arising in the n-firm case are not robust to the selection criterion of Pareto dominance. Therefore, the main conclusion that the divisionalization game yields a single multi-divisional firm competing in a strategic manner with (any number of) single-division firms essentially extends to any initial market structure. This gives the main result so far a desirable robustness property, conditional on the validity of Pareto selection.

On the other hand, as a very important caveat to the present theory, one cannot quite claim a near-universal conclusion of a single firm creating divisions in an industry as an unequivocal implication of the present analysis. One reason for this is that Pareto dominance does not necessarily possess unconditional validity in reality, as it fails for instance to be fully predictive in some experimental settings (such as the class of coordination games in Van Huyck, Battalio, & Beil, 1990, among others). More importantly, even if one accepts

Pareto dominance as a selection criterion, the direct implication of a single M-form has to be recognized as narrower in practice: It is only valid for firms that enter an industry at approximately the same time, so the specific timing of the present model applies directly. If instead, a new firm enters an already established industry, it may decide to do so as an M-form, even though a prior M-form is already present. The reason is that the latter might not respond with further divisionalizing due to the fixed cost of doing so (and potential inertia), thus putting an end to the multiple reactions that would lead to perfect competition (according to the reaction curve (5)). Anticipating such passive reaction, the new entrant would then feel safe entering as an M-form (with the right finite number of divisions once and for all).

As a final remark, there is an extensive older literature providing empirical evidence that is consistent with our implied theoretical result that M-form firms tend to be more profitable than U-form firms. A key study among several others is Teece (1981), who concludes that large multi-product firms that adopted a multi-divisional form tend to perform better than those with a unitary form. There is more recent indirect evidence: investigating the parenting advantage, Feldman (2021) finds that comparable utilities that were owned by regulated holding companies have lower return on assets than utilities that were owned by exempt holding companies.

4 Inter-firm asymmetry via fixed costs of divisionalization

This section is motivated by two separate questions that will be considered together. The first relates the the fact that, in the three-stage game G_1, SPE calls for one firm to divisionalize and for the other firm not to do so, but could not pin down any role assignment to the two firms due to their full symmetry.[24] It is thus natural to ask which equilibrium will prevail if some small inter-firm heterogeneity is introduced in a meaningful way. Such initial asymmetry between firms and its evolution are also a common concern of business strategy (see e.g., Rumelt et al., 1991).[25]

[24] Instead, other factors such as opportunistic preemption, managerial ability, limited inertia and superior information could be relevant in selecting which firm is more likely to be the one selecting multiple divisions. However, such factors are outside the scope of this paper.

[25] Though, it is worth stressing here that the key result of endogenous heterogeneity in organizational form as given in Section 2 is strengthened by the assumption that the two firms are ex ante identical.

For the second motivation, recall that the market share preemption effect (as reflected in the three-stage game G_1) introduced in this paper is meant as one of the key mechanisms that could impact the organizational choice of an oligopolistic firm, on top of the usual intra-firm factors such as managerial structure, economies of scale and scope, etc., whose relevance is well known since Chandler (1962) and Williamson (1975).

A question of substantial interest is to investigate how these two sets of factors might interact to produce a final strategic decision by a duopolist to adopt the M-form or the U-form. In other words, the idea is to bring together industry-level and firm-level considerations in one integrated yet simple strategic analysis to bear on this key question.[26] This section provides a highly stylized treatment of this question, in the spirit of the simple formal analysis in the rest of the paper.

4.1 Organization theory: The firm-internal effect

This subsection provides a complete analysis of the firm-internal effect in the simplest possible formal setting. To precisely capture the firm-internal effect here, we assume that Firm i must pay a fixed cost $f_i > 0$ to engage in (any level of) divisionalization, with this fixed cost being firm-specific and directly tied to the intra-firm factors that ought to govern the divisionalization choice of the firm according to classical organization theory. Specifically, a firm whose internal factors favor the adoption of the M-form is postulated to have low fixed costs of creating divisions, while the opposite holds true for a firm with an internal proclivity for the U-form. These costs may be thought of as net fixed costs in the sense that creating divisions may entail gross costs[27] but also may deliver some benefits, and the difference between the two, assumed strictly positive, is what matters here. The size of the fixed cost of divisionalization is thus an aggregate inverse measure of the firm's internal propensity to divisionalize. This reduced-form is possibly the simplest meaningful way to introduce cost-related heterogeneity into our simple model while relating this feature directly to the intra-firm characteristics in organization theory.

One instructive way to open the black box and conceptualize the internal factors involved in this reduced-form is to invoke recent work in organization theory. Using team and mod-

[26]As such, this question may be seen as a natural step in the program of cooperation between business strategy and industrial organization outlined in Rumelt et al. (1991).

[27]For example, creating divisions thus changing the firm's organizational form involves organizational costs such as influence costs (Milgrom, 1988), coordination costs such as ensuring managers' incentive compatibility in line with their divisional-profit-maximizing contracts, etc.

ularity theories, Zhou (2013) posits that a firm's degree of divisionalization is predicated on both the extents of complexity of, and interdependence among, tasks and of their decomposability.[28] In this view, organizational hierarchy serves to mitigate the tension between complexity and decomposability by facilitating a higher degree of divisionalization. Zhou (2013) conducts empirical tests on U.S. equipment manufacturers and confirms that the propensity for divisionalization increases with task complexity, but decreases as task systems become less decomposable. This study suggests that the fixed cost for divisionalization decreases with task complexity, but increases as task systems become less decomposable.[29] Capturing all this underlying structure via a simple fixed cost is admittedly an over-simplification, but one that accords well with the main goal of the present paper: To shed light on the role of the pre-emption (for market share) motive for divisionalization.[30]

To keep the analysis as parsimonious as possible, the firm-internal effects will be captured by a simple threshold fixed cost that makes a firm indifferent between the U-form and the M-form, denoted by f^*. In other words, in the perspective of organization theory alone, *the U-form is optimal for a firm if its fixed cost is higher than* f^* *while the M-form is optimal if its fixed cost is lower than* f^*. This is a precise, though reduced-form, summary of the detailed insights of Chandler (1962), Williamson (1975) and Zhou (2013), which is quite convenient for our purposes.

An alternative and insightful interpretation of this individual cost minimization undertaken by the firm is to embed the associated divisionalization decision in the context of a specific market structure. If the firm were a monopolist in an industry, then its optimal divisionalization decision would clearly be captured by the same threshold f^* and be identical to the aforementioned one. A similar remark would apply to a firm in a perfectly competitive industry. What these two polar market structures share is the absence of any strategic interaction on the part of firms, which of course is the purview of oligopolistic industries. Although this interpretation of the firm-internal effect tied to non-strategic market structures is counter-factual (as this paper does not deal with those industries as such), it will be insightful when contrasting the firm-internal and the strategic effects on divisionalization below to keep in mind their respective natural industry environments.

[28]A task system is highly decomposable when its tasks can be divided into discrete subsystems whose interdependencies are dense within each subsystem but sparse across them.

[29]Another recent study of the interplay between a firm's coordination costs, synergies and diversification choices that may shed some light on opening the black box of our simple fixed cost structure is Zhou (2011).

[30]For a recent comprehensive study of organization theory, the notion of tasks, hierarchies, and other concepts, the reader is referred to Puranam (2018).

4.2 The strategic or industry effect

This subsection provides a complete analysis of the strategic effect and its comparison with the firm-internal effect. For the sake of a simpler presentation, we restrict attention once more to duopoly in this section. We consider a modified version of game G_1, G_1', with the only modification being that, if a firm chooses to divisionalize, it must incur a fixed cost $f_i > 0$, $i = 1, 2$, in order to implement this decision.

In addition to being realistic, this fixed cost will allow a direct connection to the analysis of the firm-internal effect. For interpretation purposes, we shall think about the strategic determination of organizational form as given by the solution of the game G_1' as the combination of the classical firm-internal effect and the preemption effect.

Specifically, once a firm decides at Stage 1 that it will divisionalize, it needs to take all the attending legal, administrative and organizational steps to implement the decision of divisionalization and those steps are associated with a fixed cost f_i. Once undertaken, the cost is to be viewed as sunk at the start of Stage 2, so firms' play is exactly the same as game G_1 in the four subgames. Therefore, firms' payoffs shown below in Table 2, are the same as in Table 1, except for the need to subtract the fixed cost for divisionalizing firms. To establish ex ante asymmetry between the two firms and to facilitate the discussion below contrasting the firm-internal and industry effects, assume without loss of generality that $f_1 < f_2$.

[Insert Table 2 Here.]

The inclusion of fixed costs does not change the main idea behind the equilibrium analysis, except, quite intuitively, a firm that would have originally selected Y in the absence of divisionalization costs may refrain from doing so if its divisionalization cost is too high. Therefore, the game G_1' may have different Nash equilibria from game G_1 for sufficiently high fixed costs, by standard comparison of firms' payoffs in the divisionalization game. Let us define $\tilde{f}$ as:

$$\tilde{f} \triangleq \frac{(a-c)^2(2b-\theta)^2}{8\theta(2b+\theta)^2}.$$

As may be seen from the analysis in Appendix S5, $\tilde{f}$ is the cost threshold that makes a firm indifferent between choosing N or Y when the rival chooses N. In other words, when facing a U-form rival, a firm will divisionalize if and only if its fixed cost is below the threshold $\tilde{f}$. One would expect the latter to be relatively high as it reflects the main insight from Section 2, namely that a sole divisionalizer in a duopolistic industry will end up with a major increase in market share.

The next result gives the Nash equilibria of the modified game G_1' for all possible values of f_1, f_2 and $\tilde{f}$.

Proposition 3 *Assuming without loss of generality that $f_1 < f_2$, the set of Nash equilibria of the modified game G_1' is as follows.*

(a) If $f_1 < \tilde{f} < f_2$, the game G_1' has a unique equilibrium (Y, N).

(b) If $f_1 < f_2 < \tilde{f}$, the game G_1' has two equilibria, (N, Y) and (Y, N).

(c) If $\tilde{f} < f_1 < f_2$, the game G_1' has a unique equilibrium (N, N).

The formal proof of this Proposition is included in Appendix S5. For a complete understanding of this result, we discuss the implications of each case separately for different ranges of f_1 and f_2. In so doing, we refer to firm-internal effects as the optimal organizational structures implied by the threshold fixed cost f^* (as in Subsection 4.1), and to the strategic (or industry) effects as those implied by the threshold fixed cost $\tilde{f}$ in the context of Proposition 3.

A key assumption we shall use when contrasting the two effects in the sequel is that

$$f^* < \tilde{f}, \tag{6}$$

so that any firm that chooses to divisionalize as a monopolist (due only to firm-internal considerations) will also divisionalize as a duopolist *facing a U-form firm*, but not vice versa. This is obviously a direct implication of the analysis of this paper, as such a duopolist would have an incentive to form divisions as a way to preempt a larger market share in the product market, above and beyond its own internal organizational incentives.

We are now ready for a case-by-case discussion of Proposition 3. For each case (a)-(c), we first paraphrase the content of Proposition 3 and then contrast the implications of the Proposition and the incentives to divisionalize from classical organization theory (as given in Subsection 4.1).

Case (a): When $f_1 < \tilde{f} < f_2$, Firm 2's divisionalization cost is high, leading to N being a dominant strategy for Firm 2. Firm 1's cost is low, implying that it will best respond to N by Y. Therefore, game G_1' has a unique equilibrium: (Y, N). This is a priori the most interesting outcome for this game. In this case, divisionalization ensures that Firm 1 earns a higher profit than Firm 2 (details may be seen in Appendix S5). Relative to the original game G_1 in Section 2, it may be said that the heterogeneous divisionalization costs naturally select the unique equilibrium wherein the more efficient firm is the one that divisionalizes and thereby ends up earning the higher profit. This unique equilibrium reflects a sense of social efficiency that the other equilibrium of the original game G_1 does not satisfy.

We now bring in the firm-internal conclusions for a case-by-case comparison with Proposition 3(a), depending on the relative sizes of the fixed costs f_1 and $f_2, \tilde{f}$ and f^* subject to the natural restriction (6).

(i) If f^* is such that $f_1 < f^* < \tilde{f} < f_2$, the firm-internal effect alone (as in Subsection 4.1) would call for Firm 1 with low fixed cost to choose the M-form or Y (since $f_1 < f^*$), but for Firm 2 to go for the U-form or N (since $f^* < f_2$). Since (Y, N) is also the unique prediction of Proposition 3 for this parameter constellation, the two approaches are in full agreement in this subcase.

(ii) If $f^* < f_1 < \tilde{f} < f_2$, the firm-internal effect would call for both firms to choose the U-form or (N, N) since $f^* < f_1, f_2$ instead of Proposition 3's equilibrium outcome (Y, N). Thus, for this subcase, the firm-internal effects and Proposition 3 lead to the same prediction for Firm 2 but to conflicting conclusions for Firm 1. Indeed, due to the preemption effect, Firm 1 chooses to divisionalize to reap the benefits of higher market share, even though its own firm-internal calculus would have dictated remaining a single-division firm. Put differently, were Firm 1 a monopolist, it would have chosen not to divisionalize, but as a duopolist facing an U-form rival, Firm 1 chooses to become an M-form firm to ensure a higher overall market share in the industry.

Case (b): When $f_1 < f_2 < \tilde{f}$, the best response to N is Y and to Y is N for both firms. It follows that the game G_1' is an anti-coordination game with two equilibria (N, Y) and (Y, N), just like game G_1 in Section 2. In other words, as both firms' fixed costs are relatively small here, the inclusion of such costs does not change the equilibria of game G_1.[31] Since Firm 1 is assumed to be more efficient at undertaking divisionalization, the equilibrium (Y, N) is socially preferable to the equilibrium (N, Y).

In light of (6), there are three separate subcases here.

(i) If $f_1 < f_2 < f^* < \tilde{f}$, the firm-internal effect alone would clearly lead to the outcome (Y, Y), or both firms divisionalizing. Hence, comparing with the game prediction (N, Y) and (Y, N), the firm-internal effects lead to conflicting predictions for the firm choosing N. The

[31] There are candidate equilibrium selection tools that might be used in this case to select a unique outcome, such as risk dominance. However, this issue is beyond the scope of the present paper.

overall strategic effect forces the latter firm to forego cost-effective divisionalization to avoid unraveling towards perfect competition and zero profit.

(ii) If $f_1 < f^* < f_2 < \tilde{f}$, then the internal effect alone would lead to the outcome (Y, N), thus fully agreeing with the equilibrium (Y, N), but perfectly contradicting the Proposition for the other equilibrium (N, Y). In other words, for the latter equilibrium, the strategic effect here would make both firms take decisions that are contrary to their own firm-internal effects.

(iii) If $f^* < f_1 < f_2 < \tilde{f}$, then the internal effect alone leads to the outcome (N, N). Thus the two separate effects are in agreement for the firm choosing N, but in conflict for the firm choosing Y. This is the classic message of the paper at work in the sense that one firm must divisionalize to capture extra market share, even if individual cost minimization or classical organization theory would dictate otherwise.

Case (c): When $\tilde{f} < f_1 < f_2$, N is then a dominant strategy for both firms in game G_1'. Hence, equilibrium (N, N) follows. The simple content of this case is the intuitive fact that, if firms' divisionalization costs are too high, no firm would choose to divisionalize (despite the lure of increased market share).

In Case (c), in light of (6), the only possible position for f^* must be such that $f^* < \tilde{f} < f_1 < f_2$. Therefore, both firms possess a natural proclivity for the U-form in terms of the firms' own internal effects, and these effects alone would lead to the same prediction, (N, N), as implied by Proposition 3. The strategic effect and the firm-internal effect are thus in full agreement for this high-cost case.

The three possible cases of this Proposition and their subcases neatly encapsulate the extent of discrepancy between an analysis of organizational form based solely on within-firm characteristics and a more inclusive view integrating the latter with the broader industry context in a strategic setting. The comparison ranges from full agreement to total conflict, depending on the relative cost configuration. In a nutshell, the strategic effect induces one firm to choose divisionalization to secure higher market share in the product market and the other firm to forsake divisionalization in order to avoid a spiral towards perfect competition, even when the firms' own firm-internal calculus would have dictated the opposite decisions. Put differently, the optimal decision on divisionalization that a firm would elect as a monopolist need not coincide with the strategic decision the same firm reaches in a duopolistic market. This analysis of the divisionalization decision within a duopoly may then be termed the strategic view of the determination of organizational form by firms within their industrial imperfectly competitive context.

All in all, this Proposition is in line with the key stylized fact that, amongst firms choosing organisation forms around the same time period, only one firm may elect the M-form (and none when the net costs of doing so are prohibitive). At the same time, it reflects a diversity of possible outcomes, wherein the firm-internal and the industry effects may be in full or partial agreement, as well as in full conflict. Therefore, relative to the analysis of Section 2 where firm-internal effects were absent, this section offers an interesting synthesis of the determinants of divisionalization that integrates the classical view from organization theory and the new perspective developed in this paper, namely that industry or competition effects, coupled with realistic commitment, lead to the natural game used in industrial organization to study strategic divisionalization to give rise to equilibria that are consistent with the stylized fact put forward earlier.

5 Conclusion

This paper has proposed to modify the canonical model for strategic divisionalization by adding an initial stage to the standard two-stage game to allow firms to credibly commit to whether they will create additional divisions or not. Such a simple revision suffices to eliminate the perfectly competitive outcome and generate a unique equilibrium prediction that is consistent with the key stylised fact that, in industries with divisionalized firms, often only one of the mother firms alone creates independent divisions while the others do not. At a global industry level, the prototypical example is GM vs Ford. At the level of local markets (franchising), this stylised fact receives clear support at least at the aggregate level for different types of industries. While the analysis of duopoly is both elementary and transparent, the extension to oligopoly requires a plausible equilibrium selection argument based on Pareto efficiency.

The model has a novel and powerful implication for organization theory, in capturing what may be seen as endogenous strategic organizational heterogeneity of competing firms. This reflects the novel idea that, under imperfect competition, a firm's optimal organizational form cannot be decided only on the basis of internal characteristics to the firm. Rather, all the decisions of the firms in the same industry are strategically entertwined and thus form a coherent whole.

This multi-divisional firm gains an edge over its rivals by securing a higher overall market share. This advantage that accrues to a single mother firm reflects a benefit that may be seen as a novel advantage of commitment, in line with similar effects in political science (Schelling, 1980), economics (Shapiro, 1989), and strategic management (Ghemawat, 1991).

The issue of organizational choice is central to both organization theory and to business strategy, and also quite relevant to industrial organization (see e.g., Rumelt et al., 1991). An important aspect of the present paper is that, by linking the choice of an M or a U-form for a firm to the (initial) market structure in the industry, it naturally brings together these three fields. While the former two have tended to address the adoption of the M-form or the U-form for a given firm only in terms of its own internal characteristics, such as size, managerial structure and contracts, economies of scale and scope, information processing, etc. (Chandler, 1962, 1990; Williamson, 1975), the game-theoretic approach taken in this paper addresses it in terms that also integrate industry or strategic effects for oligopolistic competition. The latter effect induces one firm to elect the M-form to secure higher market share in the product market and the other firm to keep its U-form so as to avoid a process of unraveling towards perfect competition, even when the firms' own firm-internal approach would have dictated the opposite decision for one or both firms.[32] An ancillary implication of this mechanism is that of organizational heterogeneity: Within the same industry, M-form and U-form firms would be expected to co-exist.

In both cases, the formal models used in the paper are highly stylized and reflect minimal complexity to address these issues in a parsimonious manner. Our elementary equilibrium analysis suggests that the organizational forms adopted by firms within the same oligopolistic industry cannot be analyzed in isolation. Instead, they are part of a strategically coherent whole, and not a simple matter of firm-specific internal design and optimization. The predictions of the present view substantially diverge from those of classical organization theory, and reflect a tendency for organizational heterogeneity of strategically competing firms.

We close with a final word recognizing some limitations of the present analysis. Franchising, though appealing to firms that wish to expand their market shares, is not always viable or successful. Factors such as a good operating routine (Scott & Spell, 1998), local expertise (Combs & Ketchen, 2003), services such as financial support from the franchisor to the franchisees (Shane, Shankar, & Aravindakshan, 2006), and avoidance of encroachment on existing franchisees at the local level (Kalnins, 2004) are crucial to successful franchising.

[32]In contrast, for a monopoly or a perfectly competitive firm, the predictions of the firm-internal effect alone would carry through.

Our model suggests that firms with sufficient local knowledge, reliable capital source, and a proper operating routine design, should start franchising as soon as possible to deter potential entrants or existing rivals from franchising further in the relevant area. By focusing on the preemption motive in the strategic struggle for market share by divisionalizing firms and limiting divisionalization costs to a fixed cost, this paper has disregarded some aspects of the functioning of M-form and in particular MUMM firms that may be important in some industry contexts, including in particular the coordination and central planning aspect exercised by the mother firm over its constituent divisions. Another key aspect of MUMM firms not addressed here is that, by operating in mutiple markets, the scope for tacit collusion may be enhanced via increased scope for retaliation and foreknowledge of this may motivate firms in favor of this organizational form in the first place (this is the so-called mutual forbearance theory, Greve & Baum, 2001).

Nonetheless, this paper may pave the way for further research on the incentives for divisionalization and on the comparative performance of M-form and U-form firms. Some promising avenues to further explore are the strategic dimension of organization theory with inter-dependence between the demand and cost sides[33]; the scope and effects of forming R&D alliances (Runge, Schwens, & Schulz, 2021); the possible interaction between mutual forbearance and market share preemption; the effects of increased competition on M-form firms (e.g., for hotel chains, see Chang & Sokol, 2021); and an in-depth look at vertical relationships such as the corporate parenting advantage (Feldman, 2021) or the role of organizational distance (Belenzon, Hashai, & Patacconi, 2019). Finally, the implication of intra-industry organizational heterogeneity would be an interesting hypothesis for further study and empirical testing.

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[33] In a study of coordination and organization design problems for firms that pursue variety as main product strategy (with a soft drink bottling firm as main case), Zhou and Wan (2017b) show that product variety magnifies the tension between scale economies in production and scope economies in distribution, leading to worse performance.

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Appendix

S0. Tables

Note: The payoff pairs represent (Firm 1's payoff, Firm 2's payoff).

Firm 1 \ Firm 2	Y	N
Y	$0, 0$	$\frac{(a-c)^2}{8\theta}, \frac{(a-c)^2}{16b}$
N	$\frac{(a-c)^2}{16b}, \frac{(a-c)^2}{8\theta}$	$\frac{b(a-c)^2}{(2b+\theta)^2}, \frac{b(a-c)^2}{(2b+\theta)^2}$

TABLE 1 Payoffs in the Announcement Stage of Game G_1

Firm 1 \ Firm 2	Y	N
Y	$-f_1, -f_2$	$\frac{(a-c)^2}{8\theta} - f_1,\ \frac{(a-c)^2}{16b}$
N	$\frac{(a-c)^2}{16b},\ \frac{(a-c)^2}{8\theta} - f_2$	$\frac{b(a-c)^2}{(2b+\theta)^2},\ \frac{b(a-c)^2}{(2b+\theta)^2}$

TABLE 2 Payoffs in the Announcement Stage of Game G_1'

S1. Derivations of Eq. (3), (4) and (5)

We will prove Eq. (3), (4) and (5) in the general n-firm case. The following proofs can be directly applied to $n = 2$.

At Stage 3, given d_i divisions of Firm i, d_{-i} divisions of other firms, the profit function for the j^{th} division of Firm i is $\pi_{ij} = (a - bq_{ij} - \theta q_{i,-j} - \theta Q_{-i})q_{ij} - cq_{ij}$. The manager of the j^{th} division of Firm i maximizes profits by choosing q_{ij}, and the FOC is

$$a - c - 2bq_{ij} - \theta q_{i,-j} - \theta Q_{-i} = 0. \tag{7}$$

Let $Q_i = \sum_j q_{ij}$ denote the total output of Firm i, and $Q = \sum_{i=1}^{n} Q_i$ the industry output. Notice each division of Firm i has the same FOC described in Eq. (7), thus such divisions are symmetric, and $q_{ij} = \frac{Q_i}{d_i}$. Substitute $q_{ij} = \frac{Q_i}{d_i}$, $q_{i,-j} = \frac{Q_i}{d_i}(d_i - 1)$ and $Q_{-i} = Q - Q_i$ in Eq. (7) to obtain

$$Q_i = \frac{d_i}{2b - \theta}(a - c - \theta Q). \tag{8}$$

Sum up Eq. (8) for all i and then substitute $Q = \sum_{i=1}^{n} Q_i$ to obtain $Q = \frac{a-c-\theta Q}{2b-\theta} \sum_{k=1}^{n} d_k$. Re-arranging the above expression yields that the third stage solution for industry output denoted by $Q(\mathbf{d})$ where $\mathbf{d} = (d_1, ..., d_n)$, is given by

$$Q(\mathbf{d}) = \frac{(a - c)\sum_{k=1}^{n} d_k}{2b - \theta + \theta \sum_{k=1}^{n} d_k}. \tag{9}$$

Substituting Eq. (9) into Eq. (8) yields that the third stage solution for Firm i's output is

$$Q_i = \frac{(a - c)d_i}{2b - \theta + \theta \sum_{k=1}^{n} d_k}. \tag{10}$$

Thus the third stage solution for the output of the j^{th} division of Firm i is $q_{ij} = \frac{Q_i(\mathbf{d})}{d_i}$ as given in Eq. (3). Profits of the j^{th} division of Firm i is $\pi_{ij} = (a - c - bq_{ij} - \theta q_{i,-j} - \theta Q_{-i})q_{ij}$. Notice from Eq. (7), we have $a - c - bq_{ij} - \theta q_{i,-j} - \theta Q_{-i} = bq_{ij}$. Thus $\pi_{ij} = bq_{ij}^2$, and substituting q_{ij} gives the expression given in Eq. (3). Also notice all divisions of Firm i (in fact, all divisions across firms) are symmetric and have the same q_{ij} and π_{ij}.

Next, Firm i maximizes its total profit $\Pi_i = \frac{bd_i(a-c)^2}{\left(2b-\theta+\theta(d_i+d_{-i})\right)^2}$. The FOC of this problem is $\frac{b(a-c)^2(2b-\theta-\theta d_i+\theta d_{-i})}{(2b-\theta+\theta d_i+\theta d_{-i}))^3} = 0$, that is, $2b - \theta - \theta d_i + \theta d_{-i} = 0$. Re-arranging FOC gives Eq. (5).

Q.E.D.

S2. Proof of Proposition 1

We have shown in the context that firms' payoffs follow Table 1. Now let us derive the Nash Equilibrium by looking at the best response of, say, Firm 1 in this symmetric matrix game.

If Firm 2 chooses Y, obviously Firm 1's best response is N because $\frac{(a-c)^2}{16b} > 0$. If Firm 2 chooses N, Firm 1 gets $\frac{(a-c)^2}{8\theta}$ by choosing Y and gets $\frac{b(a-c)^2}{(2b+\theta)^2}$ by choosing N. Note $\frac{(a-c)^2}{8\theta} - \frac{b(a-c)^2}{(2b+\theta)^2} = \frac{(a-c)^2(2b-\theta)^2}{8\theta(2b+\theta)^2} > 0$ always holds. So Firm 1's best response to N is Y.

Since the game is symmetric, and the best responses are N to Y and Y to N, there are two Nash Equilibria, (Y, N) and (N, Y).

Q.E.D.

S3. Proof of Lemma 1

We have proved in Appendix S1 that, for all divisionalizing firms, their best responses in terms of how many divisions to create is $d_i^*(d_{-i}) = d_{-i} + \frac{2b-\theta}{\theta}$, where d_{-i} is the total number of divisions created by other firms.

Let us first derive each firm's profit when no firm chooses to divisionalize, i.e., $n_y = 0$. Then $d_1 = d_2 = ... = d_n = 1$ and $\sum_i d_i = n$. By Eq. (3), $\pi_{ij} = \frac{b(a-c)^2}{(2b+(n-1)\theta)^2}$. Since each firm only has one division, $\Pi_i = \pi_{ij}$ for all i.

Next, let us derive each firm's profit when there is one firm divisionalizing, i.e., $n_y = 1$. Without loss of generality (w.l.o.g), assume Firm 1 chooses Y and others choose N at Stage 1. Then other firms commit to maintaining one division at Stage 2 (i.e., $d_2 = d_3 = ... = d_n = 1$) whereas Firm 1 creates $d_1 = (n-1) + \frac{2b-\theta}{\theta}$ divisions. The per-division profit for all firms is given by Eq. (3) with $\sum_i d_i = 2(n-1) + \frac{2b-\theta}{\theta}$, so $\pi_{ij} = \frac{b(a-c)^2}{(4b+2(n-2)\theta)^2}$. Therefore, Firm 1's profit is $\Pi_1 = d_1\pi_{ij} = \frac{b(a-c)^2}{4\theta(2b+(n-2)\theta)}$, and other firms' profits are $\Pi_k = \pi_{ij} = \frac{b(a-c)^2}{(4b+2(n-2)\theta)^2}$ for all $k \geq 2$. Note that each firm is able to keep positive profits when there is only one firm divisionalizing.

Lastly, assume two or more firms choose Y, i.e., $n_y \geq 2$. With the above reaction curve, it is easily seen that the unique solution (intersection of the reactions curves) is for each of the divisionalizing firms to choose $d_i = \infty$. Then $\sum_i d_i = \infty$. By Eq. (3) all firms will earn zero profit.

Now let us show that $n_y = 1$ (w.l.o.g., Firm 1 choosing Y) belongs in the equilibrium set. Firm 1 does not want to deviate to N because its current profit $\frac{b(a-c)^2}{4\theta(2b+(n-2)\theta)}$ is greater than $\frac{b(a-c)^2}{(2b+(n-1)\theta)^2}$, the profit it earns after the deviation (i.e., $n_y = 0$), since $\frac{b(a-c)^2}{4\theta(2b+(n-2)\theta)} - \frac{b(a-c)^2}{(2b+(n-1)\theta)^2} = \frac{b(a-c)^2(2b+(n-3)\theta)^2}{4\theta(2b+(n-2)\theta)(2b+(n-1)\theta)^2} \geq 0$. On the other hand, other firms do not want to deviate to Y, because their current profit $\frac{b(a-c)^2}{(4b+2(n-2)\theta)^2}$ is greater than 0, the profit they would earn after the deviation (i.e., $n_y \geq 2$).

$n_y = 0$ is not an equilibrium, because one firm wants to deviate to Y (resulting in $n_y = 1$) and to earn $\frac{b(a-c)^2}{4\theta(2b+(n-2)\theta)}$ instead of $\frac{b(a-c)^2}{(2b+(n-1)\theta)^2}$. $n_y = 2$ is not an equilibrium, because one of the divisionalizing firms would want to deviate to N (resulting in $n_y = 1$) to earn $\frac{b(a-c)^2}{(4b+2(n-2)\theta)^2}$ instead of 0. However, $n_y \geq 3$ is an equilibrium because no matter which firm unilaterally deviates, the resulting equilibrium still has $n_y \geq 2$ and the zero-profit outcome cannot be altered.

Therefore, all $n_y = 1, 3, 4, ..., n$ are part of the Nash Equilibrium set of the divisionalization game. Q.E.D.

S4. Proof of Proposition 2

The proof for Pareto dominance is straightforward and already indicated in the context.

S5. Proof of Proposition 3

The modified two-firm game introduces an asymmetric fixed cost associated with divisionalization, resulting in a slight modification of Table 1, as shown in Table 2. Notice the inclusion of f_i does not change each firm's best response to Y, which is still N because $\frac{(a-c)^2}{16b} > -f_i$ for both firms. As for the best response to N, take Firm 1 as an example. The choice of Y gives Firm 1 profits $\frac{(a-c)^2}{8\theta} - f_1$, compared to the profits $\frac{b(a-c)^2}{(2b+\theta)^2}$ given by the choice of N. Therefore, Firm 1's best response to N is Y if $\frac{(a-c)^2}{8\theta} - f_1 - \frac{b(a-c)^2}{(2b+\theta)^2} > 0$, or $f_1 < \frac{(a-c)^2(2b-\theta)^2}{8\theta(2b+\theta)^2} = \tilde{f}$. If otherwise $f_1 > \tilde{f}$, Firm 1's best response to N is N. Given the symmetry of two firms' payoffs, Firm 2's best response to N is Y if $f_2 < \tilde{f}$, and is N if $f_2 > \tilde{f}$. Lastly, notice that if $f_i > \tilde{f}$, N becomes a dominant strategy for Firm i.

Now let us turn to finding the Nash Equilibrium. If $f_1 > \tilde{f}$, since $f_1 < f_2$, both firms have a dominant strategy N, thus (N, N) is the unique equilibrium. If $f_1 < \tilde{f}$, there are two cases. When $f_2 > \tilde{f}$, Firm 2's dominant strategy is N, and Firm 1's best response to N is Y, so (Y, N) is the unique equilibrium. When $f_2 < \tilde{f}$, for both firms the best response to Y is N and the best response to N is Y, giving rise to two equilibria, (Y, N) and (N, Y).

Last, notice that in the equilibrium (Y, N), Firm 1's profit is $\frac{(a-c)^2}{8\theta} - f_1$ and Firm 2's profit is $\frac{(a-c)^2}{16b}$. Since $\frac{(a-c)^2}{8\theta} - f_1 - \frac{(a-c)^2}{16b} > \frac{(a-c)^2}{8\theta} - \tilde{f} - \frac{(a-c)^2}{16b} = \frac{(a-c)^2(2b-\theta)(6b+\theta)}{16b(2b+\theta)^2} > 0$, Firm 1 earns a higher profit than Firm 2 in this scenario. Q.E.D.