Commitment, Firm and Industry Effects in Strategic Divisionalization

Rabah Amir*, Jingwen Tian†

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 equilibrium predictions consistent with the key stylised fact that often a limited number of the mother firms create independent divisions in an industry while others do not. Examples include GM versus Ford for national markets and many cases of franchising in local markets (e.g., 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 received theory.

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

*Department of Economics, the University of Iowa, Iowa City, IA, USA (e-mail: *rabah-amir@uiowa.edu*).
†Department of Economics, the University of Iowa, Iowa City, IA, USA (e-mail: *gin-tian@uiowa.edu*).

1 Introduction

In business strategy and organization theory on one hand, and in industrial organization on the other, divisionalization refers to one of the most important long-run strategic decisions of a firm, namely, the mother firm may create multiple divisions which not only have a large degree of autonomy over the lower-level operating decisions (e.g., pricing and output) but also operate in a way that compete with each other as well as with other firms or their divisions in the same market. Thus the concept of multidivisional firms is closely related to M-form organizations, and single-division firms to U-form organizations studied in business strategy (Chandler, 1962, 1990), with an emphasis on divisional autonomy. Probably the most well-known example in this context is General Motors. Initially established as a holding company, GM rapidly acquired or created multiple divisions that evolved into famous brands known today as Chevrolet, Buick, Pontiac, GMC, Oldsmobile, etc., while implementing internal policies that encouraged divisional autonomy.[1] Another example akin to divisionalization is franchising. Franchised stores located in close proximity are often operated by different managers and engage in competition with each other in the same geographical market,[2] a phenomenon commonly referred to as encroachment (Kalnins, 2004).

Researchers in organization theory and industrial organization approach the divisionalization problem from distinct perspectives. In organization theory, structural choices are typically evaluated against internal factors such as coordination, information flow, managerial capacity, and incentive controls, while organizations are viewed as complex hierarchical systems interacting unilaterally with an abstract, largely non-competitive environment that continually provides information or tasks and necessitates ongoing adaptation (Dessein and Santos, 2006; Alonso et al., 2008; Bolton and Dewatripont, 1994; Patacconi, 2009). In con-

[1]The long-time president, chairman and CEO of General Motors, Alfred Sloan, was a devoted follower of the tradition of divisional autonomy. He advocated within the firm that while the top executives would serve only in an advisory capacity to the divisions, the operating decisions would remain "absolutely" in the hands of the division managers (see *pp.50-87* in Freeland, 2001). Despite ongoing debate among top management regarding the extent of decentralization within the firm, divisional interdependence largely remained confined to policy decisions, such as those related to engineering and design.

[2]In our context, a franchised outlet is equivalent to a company-owned outlet if (i) both types of outlets possess autonomy over key operational decisions (such as pricing and output), which are made in competition with other outlets (if any) of the same mother firm in the same geographical market, and (ii) the mother firm owns a share (if not all) of the outlet's profits, which rules out fixed-fee payment contracts.

trast, industrial organization tends to treat firms as "black boxes," simplifying their internal complexity and focusing on their external strategic interactions in a competitive setting. Each perspective offers valuable insights, underscoring the importance of both internal characteristics of the firm and competitive dynamics within the market in shaping the firm's organizational structure choices. Nevertheless, works that synthesize these two strands of literature are particularly rare (an exception being strategic delegation, see Literature Review). This paper seeks to provide a meaningful synthesis of the two perspectives in analyzing the firm's divisionalization decision. In addition to the various internal trade-offs and environmental factors highlighted in business strategy and organization theory, we introduce a new dimension of trade-off from an industrial organization perspective: a market-level trade-off between intensified competition and market share growth.

Even with induced self-competition or cannibalization effects (the *competition effect*), the incentive to divisionalize is to increase the mother firm's overall market share and its total profit by creating additional competing units (the *business-stealing effect*). In this regard, divisionalization is simply seen as the converse operation to a horizontal merger or acquisition.[3] This trade-off forms the fundamental logic of many significant works on strategic divisionalization in the industrial organization literature. Schwartz and Thompson (1986) show that divisionalization can be used as an entry deterrence tool for the incumbent to forestall potential entry and maintain monopoly status. In an oligopoly market, Corchon (1991) and Polasky (1992) conclude that costless divisionalization inevitably leads to excess divisionalization and perfect competition as the unique equilibrium outcome. This self-defeating perfect competition trap may be circumvented if creating divisions is costly (Baye et al., 1996), or if products are horizontally differentiated (Yuan, 1999; Ziss, 1998).

This paper is particularly motivated by a key observation that has been somewhat overlooked in the existing literature: In some global markets, some firms—often a single one—divisionalize while others do not. For instance, while GM expanded into multiple divisions early on, its long-time U.S. rival, Ford, opted to maintain a more centralized form.[4] Indeed,

[3] A merger among multiple firms often implicitly seeks to reduce competition; however, it may also result in a decreased market share relative to the total market share of the firms prior to the merger. See Faulí-Oller and Sandonis (2018) for a thorough survey on horizontal mergers.

[4] Ford also owns several subsidiaries such as Mercury, Lincoln, and Troller. However, Mercury was discontinued in 2010, while Lincoln (luxury car) and Troller (off-road vehicle) do not compete with Ford's regular

the continued coexistence of multiunit and single-unit organizations creates difficulty for the simplest kinds of forbearance and learning theories (Greve and Baum, 2001). In the context of franchising, McDonald's not only has more franchised units than Burger King in the local markets (Igami and Yang, 2016) but also maintains stricter control over franchisee ownership, allowing only 1-2 units per franchisee, whereas Burger King tends to have larger franchisees owning more than 10 stores (Kalnins and Lafontaine, 2004). As a result, McDonald's stores may be said to operate in a more competitive and divisionalized manner compared to those of Burger King. One plausible explanation for the observed variation in the degree of divisionalization between the companies is their inherent organizational differences, for instance, in capacity, efficiency, and goals. However, can two *ex ante* identical firms adopt different organizational structures due to factors beyond their internal characteristics, such as purely strategic considerations?

Drawing upon the industrial organization literature, this paper settles this question in the affirmative. We amend the basic two-stage game model of strategic divisionalization widely used in the industrial organization literature in a plausible way to yield equilibrium outcomes that are more general and consistent with the stylized facts. In the basic two-stage game, firms choose the number of divisions in the first stage, followed by Cournot competition among the thus-created divisions in the second stage. Such a model predicts either all or none of the firms will divisionalize in the equilibrium (see e.g., Baye et al., 1996), failing to account for the key observation mentioned earlier. We add an initial stage to the two-stage game wherein each firm credibly announces and commits to whether it will divisionalize in the following stages, thus shedding light on strategic commitment which fits with a long-standing approach in business strategy (Ghemawat, 1991) and industrial organization (Shapiro, 1989).

In the first model with strictly positive fixed and variable divisionalization costs, we show that in an industry of ex-ante identical firms, the number of divisionalized (M-form) firms in the Nash equilibrium are endogenously determined by the magnitude of the fixed costs, for which threshold conditions are derived. In the second model where the variable cost is

product lines in the same market. Moreover, no evidence suggests that Ford promotes divisional autonomy among its subsidiaries in the same manner as GM.

zero, i.e., if creating additional divisions is costless once a lump sum is paid upfront (such as through acquisition), then the unique equilibrium outcome entails one firm divisionalizing as long as the fixed costs are too not large for an M-form (otherwise no firm divisionalizes), which fits the stylized fact of GM versus Ford, with some caveats that will be discussed.

Insights from business strategy and organization theory are integrated into the game setup in a simple but meaningful way through the exogenous divisionalization cost. We assume that 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. That is, the divisionalization cost is directly tied to the intra-firm factors that ought to govern the divisionalization choice of the firm according to classical organization theory. Such internal factors, for instance, that support the adoption of the M-form structure may include the need for adaptation to local conditions (Dessein and Santos, 2006; Alonso et al., 2008), high returns from specialized knowledge (Patacconi, 2009; Garicano, 2000), streamlined inter-divisional communication (Bolton and Dewatripont, 1994), or effective incentive mechanisms to regulate managerial actions (Friebel and Raith, 2010; Hart and Holmstrom, 2010). On top of these firm-internal effects, 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.

Importantly, our main result implies fundamentally different organizational structures for ex-ante identical competing firms. 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 common view in business strategy that industrial organization takes the industry as the most common unit of analysis while management strategy focuses instead on firm-internal effects (Rumelt et al., 1991). Lastly, in the third model, we provide a complete comparison between the current model and the classical organization theory in an asymmetric duopoly context, encapsulating the possible discrepancy between the two theories, ranging from full agreement to full conflict.

The remainder of this paper is organized as follows: Section 2 provides a brief literature review on related works in business strategy and organization theory. Section 3 introduces the model setup, establishes connections with classical organization theory, and presents the general three-stage game with strictly positive fixed and variable costs, which are symmetric across firms. Section 4 explores two extensions: a symmetric model without variable divisionalization costs and an asymmetric duopoly model, the latter enabling a comprehensive comparison with the classical organization theory. Finally, Section 5 concludes.

2 Literature Review

Drawing upon strategic divisionalization from industrial organization, this paper connects with at least three additional strands of literature: the classical business strategy literature on strategy and structure, the organizational economics literature, and the strategic delegation literature. In business strategy, 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). These early works 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.[5] In general, variations in organizational structures are attributed to the pursuit of organizational effectiveness, which emphasizes the alignment between structure and various "imperatives" (e.g., environment, technology, strategy, as noted in the survey of Keats and O'Neill, 2005).

More recently, the organizational economics literature examines the various organizational trade-offs involved in a firm's choice of structure and level of decentralization, such as coordination vs. adaptation, specialization vs. communication, efficiency vs. incentives, etc. For instance, coordination is enhanced by centralization, where the headquarter manager makes decisions for all divisions, while adaptation to local conditions is better supported by decentralization, where the division managers communicate with each other horizontally and then make their decisions in a decentralized manner. The optimal structure choice

[5] 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).

may be mediated by the quality difference between vertical and horizontal communication in a hierarchical structure (Alonso et al., 2008). There exists a general trade-off between specialization, which enhances the adaptation to local conditions, and coordination, which stresses communication among units (Dessein and Santos, 2006). Whether an organization is viewed as an information processor (Bolton and Dewatripont, 1994; Patacconi, 2009) or a knowledge-based hierarchy (Garicano, 2000), efficiency gains arise from labor being highly specialized and divided across various divisions. However, this also leads to increased communication costs and potential information loss. Despite the efficiency gains, decentralization is also linked to various incentive issues, such as eliciting truthful communication (Friebel and Raith, 2010), preventing shading or the incentive to harm other parties (Hart and Holmstrom, 2010), and protecting the source of organizational rents (Rajan and Zingales, 2001). A centralized structure (or U-form) is favored when certain incentive issues become particularly significant. Rivkin and Siggelkow (2003) synthesize several of the aforementioned organizational elements and identify the conditions under which a centralized hierarchy (U-form) is more efficient than decentralization (M-form).

A related concept to divisionalization or M-form is "multi-unit multi-market (MUMM) firms," mostly in the form of conglomerates. MUMM organizations differ from the M-form in their greater degree of strategic relatedness of activities and coordination of units (Greve and Baum, 2001), facilitated by organizational learning by doing, innovation diffusion, and mutual aid with co-locations.[6] That is, MUMM may be said to consist of highly efficient M-forms that operate in different markets.[7] However, the multi-market aspect of MUMM falls beyond the scope of this paper, which is confined to a single market. Disregarding the multi-market aspect, a key factor in identifying whether an MUMM or M-form firm fits with the contexts of this paper is assessing whether the divisions operate with a certain level of autonomy and compete with each other in the same market.[8] This can be implemented, for

[6]Evidence from the co-location patterns of hotel chains and their pricing behaviors suggests that co-location may not be primarily intended to implement price controls through collusion in an anti-competitive manner, but rather to facilitate other forms of mutual aid and coordination (Kalnins and Chung, 2001).

[7]Efficiency gain from strategic relatedness and coordination of units may be crucial for the success of new industry entrants. Studying different types of producers, Dunne et al. (1989) show that single-plant producers (U-form) have the highest initial failure rates (and the failure rates persist as the producer ages), followed by the new multiplant producers (M-form), and finally the diversifying multiplant producers (MUMM).

[8]This criterion excludes major conglomerates from our framework, such as General Electric, which oper-

instance, by basing managerial compensation solely on the performance of their respective divisions. The last point is related to the third strand of literature on strategic delegation.

Strategic delegation is essentially an organizational design problem addressing key issues such as manager selection, incentive control, the allocation of decision rights, etc. (Sengul et al., 2012). Similar to strategic divisionalization, industrial and strategic factors are regarded as key elements in the delegation problem (e.g., Fershtman and Judd, 1987; Sklivas, 1987; Vickers, 1985). However, the two problems diverge fundamentally in their focus. Strategic divisionalization centers on the organization's endogenous choice of structure, while circumventing the incentive control issue by assuming full alignment between the manager's incentive and the firm's performance (or in this paper, the division's performance). In contrast, the delegation problem treats the organization's divisional structure as exogenous, emphasizing the potential strategic gains from proper designs of managerial incentives.

3 The Model

The dominant model for strategic divisionalization in industrial organization is a two-stage game wherein firms choose the number of divisions in the first stage and let all the divisions thus created compete in Cournot fashion in the second stage. In a homogeneous goods industry, Corchon (1991) shows that the two-stage game has a unique equilibrium in which each firm creates infinitely many divisions in the first stage, resulting in perfect competition in the second stage. Subsequent studies suggest that the spiral toward perfect competition can be avoided by introducing variable divisionalization costs (Baye et al., 1996) or product differentiation (Yuan, 1999; Ziss, 1998). However, these studies do not fully explain the observed variation in firms' divisionalization choices in real markets (e.g., GM vs. Ford).

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 (Y or "Yes") or not (N or "No"). Formally, we consider the following three-stage divisionalization game:

Game G_1.

ates multiple inter-market subsidiaries, including GE Aerospace, GE Digital, GE Power, etc., but does not have intra-market competing units (to our best knowledge).

Stage 1: Each firm announces and commits to whether it will divisionalize (Y) or not (N), and pays a fixed divisionalization cost $f > 0$ upon choosing Y.
Stage 2: Any firm that has announced Y (M-form) chooses the number of divisions to create and pays the variable cost $\delta > 0$ for each additional division created. Any firm that has announced N remains with one division (U-form).
Stage 3: The division managers compete in Cournot fashion (with profit maximization of their respective divisions as their goals).

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 a firm that decides to divisionalize, reversing such a decision after the public announcement would be highly costly given the potential damage to the firm's reputation and credibility. Moreover, the fixed costs associated with the preparatory steps are also unrecoverable.

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... 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... 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 (despite MUMM often operating in multiple markets), these differ in their greater degree of strategic relatedness of activities and coordination of units (Greve and Baum, 2001). Thus, MUMM with multiple units competing in the same market may be viewed as a highly efficient M-form, characterized by low divisionalization costs.

To avoid potential incentive issues highlighted in the delegation literature (Fershtman and Judd, 1987), we assume that the manager's incentives are fully aligned with divisional performance, which holds when the manager's compensation is entirely based on the division's profit and remains independent of the performance of other divisions. Such an assumption enables us to concentrate solely on the strategic divisionalization aspect of the overall organization design problem. Next, we begin by establishing the connection with organization theory before proceeding to solve the game. Thoughout the paper, we refer to the mother firm as the "firm" and to its subdivisions as "divisions."

3.1 The connection with organization theory

The firms' organizational characteristics are highly abstracted in the competitive market framework, except for the idiosyncratic fixed divisionalization cost f. This cost is assumed to be symmetric (and firms are assumed to be identical) for the purposes of the current analysis, though the symmetry will be relaxed in subsequent extensions. In line with organization theory, we assume that 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.

That is, the divisionalization cost is speculated to encapsulate all (quantifiable) internal organizational factors that prevent a firm from adopting the M-form. Drawing upon the organizational economics literature (Dessein and Santos, 2006; Patacconi, 2009; Bolton and Dewatripont, 1994; Garicano, 2000; Friebel and Raith, 2010; Hart and Holmstrom, 2010; Rajan and Zingales, 2001), the associated costs may include communication costs or information loss incurred when divisions coordinate on non-operational decisions (policy implementation, information sharing, or mutual aid), as well as losses resulting from incentive-related issues (including managerial shading, untruthful reporting, or the appropriation of organizational rents). These organizational costs should be considered in relation to the benefits of implementing the M-form, including the necessity to adapt to local conditions, the establishment of effective replicable routines,[9] and high returns to specialized labor, in order to inform the firm's divisionalization decision from an organizational viewpoint.[10]

For simplicity, we assume throughout the paper that the benefits accruing to each firm from divisionalization are the same, which can be achieved by appropriately scaling the divisionalization costs. Consequently, there should exist a threshold $\bar{f}$ such that it is optimal for a firm with divisionalization costs below $\bar{f}$ to adopt a multidivisional (M-form) structure, considering all organizational internal and non-competitive environmental factors. Conversely, it is optimal for a firm with costs above $\bar{f}$ to adopt a unitary (U-form) structure.

Postulate 1. *Assume f encapsulates all the organizational internal and non-competitive environmental factors that ought to govern the firm's divisionalization decision. By classical organization theory, a firm adopts M-form if $f < \bar{f}$ and adopts U-form if $f > \bar{f}$.*

Without considering industry competitive dynamics and strategic factors, firms with similar internal characteristics and facing comparable local conditions tend to adopt the same organizational structure—either the M-form when the costs of divisionalization are relatively low compared to the benefits, or the U-form when the opposite benefit-cost relationship pre-

[9]However, multiunit organizations also face increased variations in competitive environments, which poses a risk when transferring established routines across these differing contexts (Greve and Baum, 2001). Consequently, transferring well-established routines may prove detrimental to local markets characterized by distinct environmental conditions (Ingram and Baum, 1997) in some scenarios.

[10]Divisionalization also involves a variable cost with the creation of each additional division. However, the magnitude of these variable costs is more likely to influence the firm's decision regarding the degree of divisionalization—specifically, how many divisions to create—rather than determining the fundamental choice between the U-form and M-form. The distinct roles of fixed and variable costs in shaping the firm's structural decisions align with the solution of the game, as outlined in the next subsection.

vails. Implicit in this Postulate is the assumption that a firm's structural choice is independent of the decisions made by other firms. In the following subsection, we demonstrate that, by incorporating the industry-level trade-offs associated with creating additional divisions, a firm's choice between the U-form and M-form becomes part of a strategic whole involving all competitors, rather than just intra-firm managerial and informational considerations.

3.2 An n-firm oligopoly with fixed and variable divisionalization costs

In this subsection, we solve the Nash equilibrium of Game G_1 given earlier, with strictly positive fixed and variable divisionalization costs. Consider an industry with n firms. Firms can create divisions at a fixed cost of f and a variable cost of δ for each additional division created. Each division sells a product that is differentiated from the products of all other divisions, whether created by the same mother firm or by rival firms. This reflects the common view that one of the justifications behind the process of divisionalization is the creation and management of differentiated products.

The demand faced by Firm i's j^{th} division is specified by the linear inverse demand

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

where q_{ij} denotes the output of the division, $q_{i,-j}$ the total output of other divisions of Firm i, and Q_{-i} the total output of other firms' divisions in the market. As usual for differentiated-product demand systems, the condition $0 < \theta < b$ is needed to capture that the effect of a division's output on its own price exceeds any cross effect. If $\theta \to b$, products become homogeneous across all divisions. If $\theta \to 0$, products become independent and each division acts as a monopolist in supplying its single variety of the product. For simplicity, we do not distinguish between the degree of product differentiation between divisions of the same firm and those of different mother firms.[11] This simple and tractable demand system, going back

[11] Our assumption regarding substitution effects differs from that of Ziss (1998) and Yuan (1999). They assume that products are homogeneous within a firm but differentiated across firms, i.e., $P_{ij}\left(q_{ij}, q_{i,-j}, Q_{-i}\right) = a - bq_{ij} - bq_{i,-j} - \theta Q_{-i}$. In contrast, we assume that products are differentiated even within a firm, across its various divisions. This assumption is more relevant in certain markets. For instance, in the automobile industry, Buick and Chevrolet, both divisions of GM, produce and sell differentiated cars similarly to how Buick and Ford do, albeit perhaps to a slightly lesser extent.

all the way to Shubik (1959), is probably the most widely used in industrial organization and business strategy.[12] One frequently cited plausible justification for the linear structure is that boundedly-rational managers often perceive demand functions only as a first-order linear approximation (for a compelling justification, see Cohen et al., 2021).

Assume constant marginal cost of production, $c \geq 0$, for all firms and no fixed production cost, then the profit of Firm i's j^{th} division is

$$\pi_{ij}(q_{ij}, q_{i,-j}, Q_{-i}) = q_{ij}(a - bq_{ij} - \theta q_{i,-j} - \theta Q_{-i}) - cq_{ij}. \tag{1}$$

The division manager is incentivized to choose the level of output that maximizes divisional profits. While there may be higher-level coordination (e.g., R&D or advertising investment, policy implementation,...) within the firm across its divisions, the output decision for each division is not centralized but under the full control of the divisional manager.

Firm i's profit is the sum of all divisional profits minus total divisionalization cost:

$$\Pi_i = \sum_{j=1}^{d_i} \pi_{ij} - \delta(d_i - 1) - f. \tag{2}$$

We solve Game G_1 by backward induction. Let d_i denote the number of divisions owned by Firm i, and d_{-i} the number of divisions owned by the rival firms. At Stage 3, $d_i + d_{-i}$ divisions compete in the market by choosing quantities. Cournot competition in a differentiated-goods market with $d_i + d_{-i}$ competing entities gives rise to the third-stage equilibrium output and profit of each division (see Appendix A1 for calculation details):

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

At Stage 2, each firm that chose Y at Stage 1, decides on the number of divisions in order to maximize profit, while firms having committed to N remain with one division. Supposing

[12] See Choné and Linnemer (2020) for a comprehensive survey. For micro-economic foundations, see Singh and Vives (1984) and Amir et al. (2017).

Firm i has chosen Y, in light of Eq. (2), it needs to solve

$$\max_{d_i} \; d_i \frac{b(a-c)^2}{\left(2b-\theta+\theta(d_i+d_{-i})\right)^2} - \delta(d_i-1) - f. \tag{4}$$

The trade-off associated with creating additional divisions, even without considering the cost of divisionalization, is neatly captured in the first term of Eq. (4): on one hand, the divisional profit π_{ij} decreases with d_i due to the *competition effect*; on the other hand, Firm i increases d_i to multiply its divisional profits, ultimately enabling it to secure a larger market share, known as the *business-stealing effect*. Solving the first-order condition of Eq.(4) yields:

$$b(a-c)^2\left(2b-\theta-\theta d_i+\theta d_{-i}\right) = \delta\left(2b-\theta+\theta d_i+\theta d_{-i}\right)^3. \tag{5}$$

Firm i's reaction curve $d_i^*(d_{-i})$, i.e., the firm's optimal number of divisions in response to d_{-i} divisions created by its rivals, is implicitly defined by Eq. (5). The latter admits no closed-form solution as long as the variable cost is strictly positive, i.e., $\delta > 0$.

At Stage 1, each firm chooses and commits to whether it will divisionalize (Y) or not (N). Assume that n_y firms have chosen Y while the remaining firms have chosen N, $n_y = 0, 1, ..., n$. The set of potential equilibria may be quite large, possibly containing asymmetric ones. To simplify, we focus on the partial symmetric equilibrium, where each Y-firm chooses the same number of divisions at Stage 2, denoted by d_y, while each N-firm remains with a single division. Then for any Y-firm, say Firm i, $d_{-i} = (n_y-1)d_y + (n-n_y)$, and Eq. (5) becomes:

$$b(a-c)^2\left(2b+\theta(n-1-n_y)+\theta(n_y-2)d_y\right) = \delta\left(2b+\theta(n-1-n_y)+\theta n_y d_y\right)^3. \tag{6}$$

In Appendix A2, we show that Eq. (6) admits a root $d_y > 1$ for any n_y as long as the variable cost δ is sufficiently small. For instance, consider the simple example of a duopoly, where both firms have chosen Y at Stage 1, i.e., $n = n_y = 2$, then Eq. (6) can be written as $b(a-c)^2(2b-\theta) = \delta(2b-\theta+2\theta d_y)^3$. It follows that $d_y > 1$ if and only if $\delta < \frac{b(a-c)^2(2b-\theta)}{2b+\theta}$.

Let π_y denote the profit of a Y-firm (divisionalized firm), π_n the profit of a N-firm (single-division firm), and write all variables as functions of n_y (i.e., $q(n_y)$, $d_y(n_y)$, $\pi_y(n_y)$, $\pi_n(n_y)$...), which is yet to be solved at Stage 1. Substituting $n_y d_y(n_y) + (n-n_y)$ for $(d_i + d_{-i})$ in Eq.

(3) gives rise to the equilibrium output of each division at Stage 3

$$q(n_y) = \frac{a-c}{2b + \theta n_y d_y(n_y) + \theta(n - n_y - 1)}. \tag{7}$$

At stage 2, the profits of Y-firm and N-firm are, respectively

$$\pi_y(n_y) = b d_y(n_y)\big(q(n_y)\big)^2 - \delta(d_y(n_y) - 1) - f \quad \text{and} \quad \pi_n(n_y) = b\big(q(n_y)\big)^2. \tag{8}$$

The calculation details are contained in Appendix A1. Both π_n and π_y can be verified to be positive for sufficiently small f, so the solution is well-defined.[13]

Lastly, for n_y firms choosing Y to be a Nash equilibrium, by definition, the following two conditions need to be satisfied: the Y-firm does not want to deviate to choosing N, or $\pi_y(n_y) \geq \pi_n(n_y - 1)$, and the N-firm does not want to deviate to choosing Y, or $\pi_n(n_y) \geq \pi_y(n_y + 1)$. By Eq. (8), these two conditions can be respectively rewritten as

$$f \leq F(n_y) \quad \text{and} \quad f \geq F(n_y + 1)$$

where $F(\cdot)$ is defined as

$$F(n_y) := b\big(\big(q(n_y)\big)^2 - \big(q(n_y - 1)\big)^2\big) + \big(b\big(q(n_y)\big)^2 - \delta\big)(d_y(n_y) - 1).$$

Thus, the conditions for the Y-firm and the N-firm define an upper and lower bound, respectively, on the fixed cost. This discussion leads to the central result of the paper.

Proposition 1. *In Game G_1, for any $f > 0$ there always exists a Nash equilibrium and it is such that*

(a) if $F(n_y + 1) \leq f \leq F(n_y)$ where $1 \leq n_y \leq n - 1$, n_y firms choose the M-form and all the others opt for the U-form.

(b) if $f \leq F(n)$, all n firms choose the M-form.

(c) if $f \geq F(1)$, no firm chooses the M-form.

[13] Consider $\pi_y(n_y)$ in Eq. (8). Write $bd_y q^2 - \delta(d_y - 1)$ as $bq^2 + (bq^2 - \delta)(d_y - 1)$, and by Eq. (7), $bq^2 = b(\frac{a-c}{2b+\theta n_y d_y + \theta(n-n_y-1)})^2$. By Eq. (6), it follows that $bq^2 = \delta\frac{2b+\theta n_y d_y+\theta(n-n_y-1)}{2b+\theta(n_y-2)d_y+\theta(n-n_y-1)}$ and $bq^2 - \delta = \delta\frac{2\theta d_y}{2b+\theta(n_y-2)d_y+\theta(n-n_y-1)} > 0$. Hence $bd_y q^2 - \delta(d_y - 1) > 0$, and $\pi_y > 0$ as long as f is sufficiently small.

The key message of Proposition 1 is that not just the divisionalization decision of a single firm (as implied by Postulate 1), but the number of firms choosing to divisionalize in the Nash equilibrium is determined by the magnitude of the fixed cost f. Meanwhile, the variable cost δ, as indicated by Eq. (6), determines the number of divisions those firms will create. Since the equilibrium values of the variables are implicitly determined by the first-order conditions of the second and third-stage subgames, as shown in Eq. (6) and Eq. (7), a direct analysis of the function $F(n_y)$ is not feasible. In the simulation, we find that $F(n_y)$ is generally a monotonically decreasing function (except for extremely small values of δ). In this case, $F(1), F(2), \ldots, F(n)$ partition the real line into $(n+1)$ intervals, and thus there exists a unique equilibrium for any f. In particular, n_y is a decreasing step function of f (as shown in Figure 1), which implies that in line with organization theory, in industries where firms have a natural proclivity toward the M-form, more firms will choose to divisionalize in the Nash equilibrium.[14]

Therefore, the adoption of the M versus the U-form is part of a strategic whole necessarily involving all firms in the market. When more rival firms opt for divisionalization, competition intensifies due to the rivals' creation of autonomous divisions, diminishing the market share gains from divisionalization for the focal firm. In this case, it may be optimal for the focal firm to adopt the U-form if the fixed costs of divisionalization are not sufficiently low. This phenomenon can be described as the industry effects of divisionalization, driven by market competition and interacting with the internal effects within the firm, as captured by the divisionalization costs. Note that the model is a generalization of Baye et al. (1996). Their model only considers the case of variable divisionalization costs (i.e., $f = 0$) and homogeneous goods (i.e., $\theta = b$), which corresponds to case (b) in the Proposition. The following example provides a numerical illustration of the Proposition.

Example 1. *Assume there are three firms ($n = 3$) and creating a division incurs a variable cost of $\delta = 3$. The j^{th} division faces an inverse demand function $P_{ij} = 20 - 2q_{ij} - q_{i,-j} - Q_{-i}$ and a marginal production cost of $c = 2$. As a benchmark, a monopolist in this market would*

[14] If the sequence $F(1), F(2), ...F(n)$ is not monotonically decreasing, then depending on the specific values, certain n_y's may fail to constitute an equilibrium because the interval between the upper and lower bounds becomes ill-defined. Conversely, multiple equilibria may arise for some f if these intervals overlap. Since these cases rarely happen in the simulation, we restrict our attention in the main text to the case where $F(1), F(2), ...F(n)$ is monotonically decreasing.

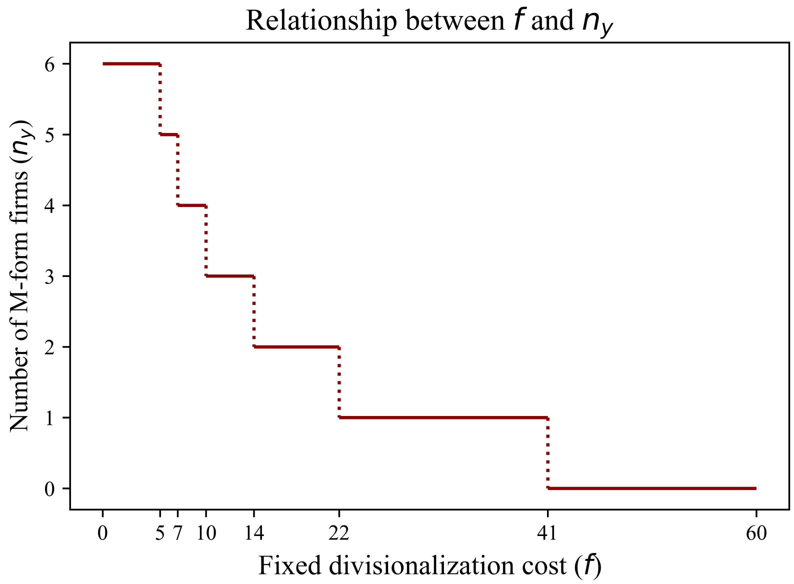

Figure 1: Illustration of Proposition 1

Note: The figure depicts the equilibrium number of M-form firms given that $P_{ij} = 50 - 2q_{ij} - Q_{-i}$, $n = 6$, $c = 2$, $\delta = 10$, when f falls in each interval divided by $F(n_y)$, $n_y = 1, ..., n$. Here, $F(n_y)$ is solved to be $F(1) = 41.2, F(2) = 21.9, F(3) = 14, F(4) = 9.6, F(5) = 6.9, F(6) = 5.3$.

have a profit of $\frac{(a-c)^2}{4b} = 40.5$. *To solve the game, let us consider the firms' profits gross of* f*, i.e., before paying the fixed divisionalization cost, in four possible scenarios,* $n_y = 0, 1, 2, 3$.

(a) In the case where no firm divisionalizes, i.e., $n_y = 0$*, by Eq. (7), we can solve each firm's profit in the standard Cournot game to be* $\pi_{n0} = 18$.

(b) If $n_y = 1$*, by Eq. (6) and Eq. (7), the* Y*-firm will create* $d_y = 2.8$ *divisions, resulting in a total profit of* $\pi_{y1} = 24.4$*, while each of the two* N*-firms earns a profit of* $\pi_{n1} = 10.6$.

(c) If $n_y = 2$*, similar calculation leads to each of the two* Y*-firms creating* $d_y = 2.7$ *divisions, yielding a firm profit of* $\pi_{y2} = 14.4$*, while the remaining* N*-firm earns* $\pi_{n2} = 7.1$.

(d) Finally, if $n_y = 3$*, a similar calculation leads to each* Y*-firm creating* $d_y = 2.5$ *divisions, with a firm profit of* $\pi_{y3} = 10$.

Therefore, each scenario with $n_y = 0, 1, 2, 3$ *may be a Nash equilibrium depending on the interval in which* f *falls, which may be found by checking the incentive condition of each firm, i.e.,* Y*-firm does not want to deviate to choosing* N *in which case* n_y *decreases by 1, and* N*-firm does not want to deviate to choosing* Y *in which case* n_y *increases by 1. The unique Nash equilibrium of the game is then* *(i)* $n_y = 0$ *if* $f > \pi_{y1} - \pi_{n0} = 6.4$*;*

(ii) $n_y = 1$ *if* $3.8 = \pi_{y2} - \pi_{n1} < f < \pi_{y1} - \pi_{n0} = 6.4$*;*

(iii) $n_y = 2$ *if* $2.9 = \pi_{y3} - \pi_{n2} < f < \pi_{y2} - \pi_{n1} = 3.8$*, and*

(iv) $n_y = 3$ *if* $f < \pi_{y3} - \pi_{n2} = 2.9$*.*

Even after paying the fixed cost, a Y-firm earns higher profits than an N-firm in the equilibrium. For instance, combining (b) and (ii), a Y-firm earns a net profit of no less than $24.4 - 6.4$*, which is greater than the N-firm's profit of 10.6. This holds true as long as the total number of divisions,* $D = n_y d_y + n - n_y$*, implicitly defined by Eq.* (6)*, increases with* n_y *(which is typically observed in simulations). In this case, the single-division profit* π_{ij}*, or equivalently the N-firm's profit* $\pi_n(n_y)$*, decreases with D by Eq.* (3)*, and thus* $\pi_n(n_y)$ *decreases with* n_y*. It follows that* $\pi_y(n_y) - f > \pi_n(n_y - 1) > \pi_n(n_y)$*.*

Recall that in classical organization theory, 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 adapt to local conditions, etc. In other words, the decision is based mostly on within-firm optimization, taking into account the nature of the industry and other exogenous factors. 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. 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 of ex-ante identical entities have emerged in a wide variety of economic settings.[15]

Our main result is also relevant to the general dichotomy between the fields of industrial organization and business strategy on the issue of a firm's organizational structure choice.[16] While the former is often seen as stressing industry-level effects and downplaying the internal

[15] 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 et al. (2010) with different settings in industrial organization, including R&D competition.

[16] 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, such as strategic delegation (see e.g., Shapiro, 1989; Rumelt et al., 1991; Fershtman and Judd, 1987). 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.

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 a 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 as in Chandler (1962) and Williamson (1975) and other organizational economics literature? Not really. Rather, the present result brings to the fore an additional factor hitherto understated in the aforementioned 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 firms. This discussion, along with the effects of initial asymmetry between the firms, will be taken up again in the Extension (in the analysis of an asymmetric duopoly).

The proposed endogenous organizational heterogeneity of competing firms, as the key insight of the current model, may account for the stylized facts observed in real markets. GM and Ford entered the automobile industry around the same time in the early 1900s; while GM quickly acquired Buick, Oldsmobile, and Cadillac, Ford concentrated on establishing its own brand identity. This initial divergence in the companies' divisionalization decisions has its historical roots.[17] However, over the course of a century, the two firms appear to have maintained their initial strategies: GM continued to operate with competitive, highly autonomous divisions, while Ford reinforced its brand identity with the recently announced "One Ford" plan. In light of the model, it may no longer be profitable for Ford to adopt such a strategy, especially as GM had already implemented divisionalization. A comparable argument can be made regarding fast-food chains, such as McDonald's and Burger King, as mentioned in the Introduction. The varying degrees of franchising in local markets may have arisen endogenously, with one firm preempting others by being the first to grant multiple franchises in a given area.

[17] The founder of GM initially had a background in horse-drawn vehicle manufacturing and formed the GM Company primarily as a holding company, whereas Ford was already an established automobile manufacturer at that time. This explains GM's early attempts at divisionalization, particularly through acquisitions.

4 Extensions

This section examines two extensions of the general model discussed earlier. The first extension addresses the scenario in which the variable divisionalization cost is zero, enabling a comparison with classical two-stage industrial organization models. This comparison emphasizes the impact of strategic commitment through the inclusion of an initial announcement stage. The second model features an asymmetric duopoly, characterized by their differing internal proclivities towards the M-form, which are represented by the two firms' different fixed divisionalization costs. We compare this model with the classical organization theory in a reduced form, as elaborated in some detail in subsection 3.1, demonstrating that the two theories can exhibit full agreement, partial agreement, or full conflict in predicting a firm's structural choice.

4.1 An n-firm oligopoly with fixed divisionalization cost

The classical two-stage model adopted in the industrial organization literature often assumes zero variable divisionalization costs (see, e.g., Corchon, 1991; Yuan, 1999) to maintain the model's tractability. This is seen when we set $\delta = 0$, which allows the first-order condition in Eq. (6) to yield closed-form solutions. It is important to note that $\delta = 0$ is not a special case of the general model, as Proposition 1 requires δ to be strictly positive. When divisionalization becomes costless, the primary distinction between our model and the classical industrial organization model is the inclusion of the initial stage, where firms announce and credibly commit to their divisionalization decision. This addition is argued below to lead to a Nash equilibrium that provides a more accurate account of the firms' behavior observed in real markets.

Consider Game G_1, but with $\delta = 0$ at Stage 2. Setting $\delta = 0$ in Eq. (5), Firm i's reaction curve is solved to be

$$d_i^*(d_{-i}) = d_{-i} + \frac{2b - \theta}{\theta}. \tag{9}$$

That is, each firm wants to create $\frac{2b-\theta}{\theta}$ more divisions than the total number of divisions created by its rival firms. When the products are homogeneous, i.e., $b = \theta$, we get the classical argument that each firm wants to create one more division compared to those established by other firms, as discussed in Corchon (1991).

Back to Stage 1, a key observation is that if *more than one* firm chooses Y (i.e., $n_y \geq 2$), each having the reaction curve defined by Eq. (9), then the unique solution to the system of reaction curves is for each firm to create infinitely many divisions, i.e., $d_i = d_{-i} = \infty$, resulting in perfect competition at Stage 3. However, this cannot be a Nash equilibrium because the divisionalized firm has a net profit of $-f$, yet it can increase its profit to non-negative values by choosing not to divisionalize or N. To see this, note that an N-firm earns the profit of a single division. In the case where $n_y = 2$, after one firm deviates to choosing N, the number of divisionalized firms becomes one, and that firm will create $d_i^* = n-1+\frac{2b-\theta}{\theta}$ divisions. With finitely many divisions created, strictly positive profits are ensured for each division (thus each N-firm) at Stage 3. In the case where $n_y \geq 3$, after one firm deviates to choosing N, there are still two or more firms choosing Y, which results in the creation of infinitely many divisions by Eq. (9), leading each division (thus each N-firm) to earn zero profit at Stage 3. In either case, a divisionalized firm does not want to remain divisionalized with strictly negative profits of $-f$.

If no more than one firm divisionalizes (i.e., $n_y = 0$ or 1), finitely many divisions are created at Stage 2, allowing each division to earn strictly positive profit at Stage 3. Whether $n_y = 0$ or 1 constitutes a Nash equilibrium then depends on the fixed cost f. This leads us to Proposition 2, the proof of which is included in Appendix A3.

Proposition 2. *In Game G_1 with $f > 0$ and $\delta = 0$, let $\tilde{f} = \frac{b(a-c)^2(2b+(n-3)\theta)^2}{4\theta(2b+(n-2)\theta)(2b+(n-1)\theta)^2}$. The unique equilibrium is:*

(a) $n_y = 1$ if $f < \tilde{f}$;

(b) $n_y = 0$ if $f > \tilde{f}$.

In the subgame starting at Stage 2, i.e., without the initial announcement stage, no firm commits to remaining with one division, thus the reaction curve defined by Eq. (9) for each firm necessarily leads to infinitely many divisions created at Stage 2, resulting in perfect competition at Stage 3, even with the product differentiation specified in the model (i.e., $\theta < b$, as opposed to homogeneous goods studied in Corchon, 1991, where $\theta = b$).

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 Corchon's (1991) basic two-stage model neatly explains firms' incentives to divisionalize, its main prediction is at odds with business reality, as perfect competition is virtually never observed in the real world. However, by adding the initial announcement stage, we show that perfect competition never arises as an equilibrium outcome, even in the case where $f = 0$.[18] Moreover, without variable divisionalization costs, more than one firm choosing Y, i.e., $n_y \geq 2$, no longer constitutes a feasible equilibrium outcome, which fits the case of GM vs. Ford. As a note in the actual historical development of the U.S. automobile industry, GM's divisionalization may be viewed as free of variable costs since the separate divisions had an independent existence as such before being bought by GM as a holding company.

On the other hand, as an 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 establishing divisions generally incurs variable costs. More importantly, even if one accepts the variable divisionalization cost as nearly zero, 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. 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).

4.2 An asymmetric duopoly with fixed divisionalization cost

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

[18] This requires an additional step of equilibrium selection by Pareto Dominance. It is easily verified that all perfectly competitive outcomes are Pareto dominated by the equilibria where $n_y = 0, 1$, in which all firms maintain positive profits. The proof is available from the authors upon request.

pay a fixed cost $f_i > 0$ to engage in (any level of) divisionalization and no variable cost (i.e., $\delta = 0$), 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 (e.g., the internal trade-offs between division coordination vs. local adaptation, labor specialization vs. communication, efficiency vs. incentive control, etc), as discussed in some detail in Subsection 3.1. 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. 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.

To keep the analysis as parsimonious as possible, the firm-internal effects are captured by the simple threshold fixed cost, denoted by $\bar{f}$, which makes a firm indifferent between the U-form and the M-form, as demonstrated in Postulate 1. 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 $\bar{f}$ while the M-form is optimal if its fixed cost is lower than $\bar{f}$. This is a precise, though reduced-form, summary of the detailed insights of earlier literature on business strategy and organization theory (Chandler, 1962; Williamson, 1975; Dessein and Santos, 2006; Alonso et al., 2008; Bolton and Dewatripont, 1994; Garicano, 2000; Rivkin and Siggelkow, 2003).

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 $\bar{f}$ 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.

Recall that the fixed divisionalization cost is sunk at Stage 1, so the subgame starting from Stage 2 is identical to the one studied in Subsection 4.1. Thus, Firm i's reaction curve is still defined by Eq. (9). At Stage 2, there are four possible subgames: (Y, Y), (Y, N), (N, Y), and (N, N). According to Eq. (9), in the subgame of (Y, Y), both firms will create infinitely many divisions (i.e., $d_1 = d_2 = \infty$), leading to perfect competition at Stage 3. In the subgame of (Y, N), Firm 2 will maintain one division (i.e., $d_2 = 1$), while Firm 1 will best respond by creating $\frac{2b}{\theta}$ divisions (i.e., $d_1 = \frac{2b}{\theta}$). The situation is reversed in the case of (N, Y). In the subgame of (N, N), both firms will maintain one division (i.e., $d_1 = d_2 = 1$). Substituting the specific values of d_1 and d_2 in Eq. (3) yields the per-division profit π_{ij} at Stage 3, then $d_i\pi_{ij}$ represents Firm i's profit before paying the fixed cost. At Stage 1, the fixed cost is subtracted, and the payoffs for the two firms can be summarized in Table 1.

[Insert Table 1 Here.]

By standard comparison of payoffs, when Firm j chooses Y, Firm i's best response is always N since $\frac{(a-c)^2}{16b} > -f_i$, the latter being Firm i's payoff if it chooses Y. But when Firm j chooses N, Firm i's best response is Y if the benefits of divisionalization through market share gains surpass the divisionalization fixed cost, i.e., $\frac{(a-c)^2}{8\theta} - f_i > \frac{b(a-c)^2}{(2b+\theta)^2}$, or $f_i < \tilde{f}$, where

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

while Firm i's best response is N if $f_i > \tilde{f}$. Here, $\tilde{f}$ is identical to the one defined in Proposition 2 when $n = 2$. Therefore, $\tilde{f}$ 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 $\tilde{f}$. This interpretation stands in direct contrast to the threshold $\bar{f}$ in Postulate 1, which involves only a firm's internal and non-competitive environmental factors and represents the fixed cost that makes a firm indifferent between the U-form and the M-form *regardless of the rival's structure choice*, and is thus non-strategic.

In a nutshell, if $f_i > \tilde{f}$, Firm i always chooses N regardless of its rival's action—in this case, N is a dominant strategy for Firm i. Conversely, if $f_i < \tilde{f}$, Firm i's best response to Y is N, and to N is Y. Without loss of generality, let us assume $f_2 > f_1$, i.e., Firm 1 is more efficient in divisionalization. We have just proved the next result.

Proposition 3. *Consider the duopoly game where $\delta = 0$ and $f_2 > f_1 > 0$.*

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

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

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

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 $\bar{f}$ (as in Postulate 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

$$\bar{f} < \tilde{f} \tag{10}$$

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.

In fact, it can be shown that in any equilibrium where one firm chooses Y while the other chooses N, i.e., cases (a) and (b) in Proposition 3, the M-form firm always earns a higher profit than the U-form firm.[19] The next Proposition summarizes this result. The proof can be found in Appendix A4.

Proposition 4. *In any equilibrium where one firm divisionalizes while the other does not, the M-form firm always earns a higher profit than the U-form firm.*

Due to space limit, we restrict attention to three most interesting scenarios to illustrate the possible discrepancy between the classical organization theory and the proposed model, ranging from full agreement, partial agreement, to full conflict. A complete discussion of all subcases can be found in Appendix A5.

[19] Empirical evidence also suggests that General Motors has maintained a longstanding lead in market share among U.S. automobile manufacturers, particularly outpacing its longtime rival Ford (see e.g., Figure 2 in Hiraide and Chakraborty, 2012).

Case (a) in Proposition 3 is a priori the most interesting case for this game, as it specifies the role assignment that is missing in Propositions 1 and 2, particularly regarding which firm should divisionalize in equilibrium. With $f_1 < \tilde{f} < f_2$, Firm 2's high fixed cost makes N its dominant strategy, while Firm 1's low fixed cost implies that Y is the best response, so the game has a unique equilibrium, (Y, N). It can be verified that the divisionalizing firm, Firm 1, earns a higher profit than Firm 2. Thus, it can be said that the heterogeneous divisionalization costs naturally select the equilibrium in which the more efficient firm (Firm 1) divisionalizes, thereby ending up with the higher profit.

Case (a) may be in full or partial agreement with Postulate 1. If $f_1 < \bar{f} < \tilde{f} < f_2$, organization theory suggests that Firm 1 should divisionalize (since $f_1 < \bar{f}$) while Firm 2 should not divisionalize (since $\bar{f} < f_2$). Since (Y, N) is also the unique prediction of Proposition 3 within this parameter range, the two theories are in full agreement. However, if $\bar{f} < f_1 < \tilde{f} < f_2$, organization theory would indicate that both firms should not divisionalize, leading to the outcome (N, N). In this scenario, the two theories align in their predictions for Firm 2 but conflict in their predictions for Firm 1. One possible interpretation of this conflict is that it may stem from the business-stealing effect as part of the industry effects. 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.

The two theories can also be in full conflict, which may be seen from a subcase of Case (b). Since both fixed costs are below $\tilde{f}$, $f_1 < f_2 < \tilde{f}$, according to earlier analysis, for both firms, the best response to N is Y, and the best response to Y is N. Thus, the game is an anti-coordination game with two equilibria, (N, Y) and (Y, N). Here, (Y, N) is the more efficient equilibrium from a social point of view, as Firm 1 has the lower fixed cost. On the other hand, the less efficient Nash equilibrium, (N, Y), may lead to full conflict between the two theories. Indeed, if $\bar{f}$ is located such that $f_1 < \bar{f} < f_2 < \tilde{f}$, then (Y, N) is predicted by Postulate 1 instead of (N, Y): The industry effect here makes both firms take a structure that is contrary to their own firm-internal effects! This is because by adopting an M-form, Firm 2's market-share gain outweighs its internal inefficiency associated with divisionalization, and confronted with an M-form rival thus intensified competition, Firm 1 loses its internal efficiency associated with divisionalization, thereby choosing to remain as a U-form.

The three possible cases of this Proposition 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 strategic effect at work 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 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 organization 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 Subsection 4.1 where firm-internal effects were not explicitly examined, 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 equilibrium predictions that are consistent with the key stylised fact that, in industries with divisionalized firms, often only a limited number of the mother firms create independent divisions while the others do not.

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 and the non-competitive environmental dynamics. 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 predictions of the present view substantially diverge from those of classical organization theory, reflecting a tendency for organizational heterogeneity of strategically competing firms.

We close with a final word recognizing some limitations of the present analysis. By focusing on the preemption motive in the strategic struggle for market share by divisionalizing firms and encapsulating the firm-internal factors in a reduced-form 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, as illustrated in the mutual forbearance theory (Greve and 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;[20] the scope and effects of forming

[20] 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 (2017) show that product variety magnifies the tension between scale economies in production and scope economies in distribution, leading to

R&D alliances (Runge et al., 2021); the possible interaction between mutual forbearance and market share preemption; the effects of increased competition on M-form firms; and an in-depth look at vertical relationships such as the corporate parenting advantage (Feldman, 2021) or the role of organizational distance (Belenzon et al., 2019). Finally, the implication of intra-industry organizational heterogeneity would be an interesting hypothesis for further study and empirical testing.

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Appendix

A0. Tables

Note: The pair of payoffs in a cell stands for (Firm 1's payoff, Firm 2's payoff).

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 1 Payoffs in Stage 1 of Game G_1

A1. Derivation of Eq. (3).

At Stage 3, given d_i divisions created by Firm i and d_{-i} divisions created by 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

$$a - c - 2bq_{ij} - \theta q_{i,-j} - \theta Q_{-i} = 0. \tag{11}$$

Let $Q_i = \sum\limits_{j=1}^{d_i} q_{ij}$ denote the total output of Firm i, and $Q = \sum\limits_{i=1}^{n} Q_i$ the industry output. For the symmetric solution, let $q_{ij} = \frac{Q_i}{d_i}$, $q_{i,-j} = \frac{Q_i}{d_i}(d_i - 1)$ and $Q_{-i} = Q - Q_i$ in Eq. (11) to obtain

$$Q_i = \frac{d_i}{2b - \theta}(a - c - \theta Q). \tag{12}$$

Sum up Eq. (12) for all i's to obtain $Q = \frac{a-c-\theta Q}{2b-\theta} \sum\limits_{k=1}^{n} d_k$. Re-arranging this expression yields the third stage solution for industry output, denoted by $Q(\mathbf{d})$, where $\mathbf{d} = (d_1, ..., d_n)$,

$$Q(\mathbf{d}) = \frac{(a - c)\sum_{k=1}^{n} d_k}{2b - \theta + \theta \sum_{k=1}^{n} d_k}. \tag{13}$$

Substituting Eq. (13) for Q in Eq. (12) yields the third-stage output of Firm i

$$Q_i = \frac{(a - c)d_i}{2b - \theta + \theta \sum_{k=1}^{n} d_k}. \tag{14}$$

Thus the third-stage output of the j^{th} division of Firm i is $q_{ij} = \frac{Q_i(\mathbf{d})}{d_i}$, which corresponds to the output's expression given in Eq. (3). The profit 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. (11), we have $a - c - bq_{ij} - \theta q_{i,-j} - \theta Q_{-i} = bq_{ij}$, giving rise to $\pi_{ij} = bq_{ij}^2$, corresponding to the profit's expression given in Eq. (3). Lastly, note that since all divisions in the third-stage product market are symmetric, the divisional output and profit are all denoted by q_{ij} and π_{ij}.

A2. Existence of solution to Eq. (6)

We want to prove that for sufficiently small $\delta > 0$, there always exists a solution $d_y > 1$ to Eq. (6). As the root of the cubic function (6) does not allow for a closed-form expression for d_y, we shall use an intermediate value argument. First notice that for strictly positive δ, the left-hand side of Eq. (6) is a linear function of d_y, which increases at a much slower rate than the right-hand side of Eq. (6), the latter being a cubic function of d_y. (Indeed, the LHS even decreases in d_y when $n_y = 1$.) Second, notice that when $d_y = 0$, the LHS is strictly positive as $b(a-c)^2\,(2b + \theta(n-1-n_y)) \geq b(a-c)^2\,(2b-\theta) > 0$, but the RHS can be arbitrarily close to 0 for sufficiently small δ, as δ is the coefficient of the cubic function. Hence, for $\delta > 0$ sufficiently small, the RHS must be smaller than the LHS at $d_y = 0$. But since the RHS increases faster in d_y than the LHS, they will eventually cross at some $d_y > 1$. Therefore, a root $d_y > 1$ to Eq. (6) always exists for sufficiently small δ.

A3. Proof of Proposition 2

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

Now let us consider the case when $n_y = 1$. Without loss of generality, assume Firm 1 chooses Y and other firms choose N at Stage 1. Then at Stage 2, $d_2 = d_3 = ... = d_n = 1$, and by Eq. (9), $d_1 = (n-1) + \frac{2b-\theta}{\theta}$. Substituting $\sum\limits_{i=1}^{n} d_i = 2(n-1) + \frac{2b-\theta}{\theta}$ in Eq. (3), we get the divisional profit $\pi_{ij} = \frac{b(a-c)^2}{(4b+2(n-2)\theta)^2}$. Therefore, Firm 1's profit is $\Pi_1 = d_1\pi_{ij} - f = \frac{b(a-c)^2}{4\theta(2b+(n-2)\theta)} - f$, and its rival firm's profit is $\Pi_k = \pi_{ij} = \frac{b(a-c)^2}{(4b+2(n-2)\theta)^2}$, $k \geq 2$. Note that all firms have positive profits if f is sufficiently small.

Lastly, assume two or more firms have chosen Y, i.e., $n_y \geq 2$. Since each divisionalizing firm wants to create $\frac{2b-\theta}{\theta}$ more divisions than the divisions created by all other firms combined, the only possible solution is $d_i = \infty$ for all divisionalizing firms. Then $\sum\limits_{i=1}^{n} d_i = \infty$. By Eq. (3), this scenario resembles perfect competition and all divisions earn zero profit. Hence, firms choosing N earn zero profit, while firms chosing Y earn a profit of $-f$.

It follows that $n_y \geq 2$ can never be a Nash equilibrium, because by deviating from Y to

N, the divisionalizing firm can increase its profit from $-f$ to either 0 (when $n_y \geq 3$, thus $n_y - 1 \geq 2$) or $\frac{b(a-c)^2}{(4b+2(n-2)\theta)^2}$ (when $n_y = 2$, thus $n_y - 1 = 1$). On the other hand, $n_y = 1$ is the Nash equilibrium if for the divisionalizing firm, deviating to N to earn the single-division firm's profit in the case of $n_y = 0$ is not profitable: $\frac{b(a-c)^2}{4\theta(2b+(n-2)\theta)} - f > \frac{b(a-c)^2}{(2b+(n-1)\theta)^2}$, or $f < \frac{b(a-c)^2(2b+(n-3)\theta)^2}{4\theta(2b+(n-2)\theta)(2b+(n-1)\theta)^2}$. Otherwise, $n_y = 0$ is the Nash equilibrium. Q.E.D.

A4. Proof of Proposition 4

Without loss of generality, consider the equilibrium (Y, N), wherein Firm 1 divisionalizes and Firm 2 does not. According to Table 1, Firm 1's profit is $\frac{(a-c)^2}{8\theta} - f_1$, whereas 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's profit is higher than Firm 2's. It can be shown symmetrically that Firm 2's profit is higher than Firm 1's in the equilibrium (N, Y). Q.E.D.

A5. A complete comparison between Postulate 1 and Proposition 3

In the main text, we have discussed Case (a) and a subcase of Case (b) where $\bar{f} < f_1 < \tilde{f} < f_2$. Now we present a complete comparison for other subcases of Case (b) and Case (c) in Proposition 3. In light of Eq. (10), there are two more possible subcases of Case (b).

(i) If $f_1 < f_2 < \bar{f} < \tilde{f}$, 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 overall strategic effect forces the latter firm to forego cost-effective divisionalization to avoid unraveling towards perfect competition and zero profit.

(ii) If $\bar{f} < f_1 < f_2 < \tilde{f}$, 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.

In Case (c), $\tilde{f} < f_1 < f_2$, N is then a dominant strategy for both firms. 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 light of Eq. (10), the only possible position for $\bar{f}$ must be such that $\bar{f} < \tilde{f} < f_1 < f_2$. 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.