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Impact of Growth Opportunities and Competition on Firm-Level Capability Development Trade-offs

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How should managers prioritize among production, product development, branding, internationalization, and other capabilities and resources? This question is central to the resource-based view, and the answer depends not only on the direct returns on investment in each capability but also on the trade-offs in using those returns for future growth or survival in a competitive market. Through simulation experiments, this study examines firm-level capability development trade-offs in the context of a firm's market-level competition and growth. It is found that investing in operational capabilities (which enhance short-term performance) *gains priority* over investing in long-term dynamic capabilities *when the operational capability investment strengthens the reinforcing loop* between performance, investment flow, and capability development. Such operational capability investment provides growth opportunities and competitive advantage. Moreover, in strategic competition, firms anticipating rivals' focus on short-term growth need to further ignore dynamic (long-term) capability building in order to survive. Testable propositions are offered as to how trade-offs between short-term and long-term investments depend on different firm and industry characteristics. The results may explain why short-term-focused firm behavior persists in firms even in the absence of discounting, short-term managerial incentives, decision biases, or learning failures.

Key words: resource-based view; capability; dynamics; simulation; competition; firm performance
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1. Introduction

Understanding how firms allocate their investment among different types of capabilities they can choose to develop is central to the resource-based view of strategy. Consider the dilemma faced by Mike, the CEO of a small software start-up, Alpha.[1] Mike needed to allocate a limited budget between hiring developers to add new features to Alpha's product (coding capability) and acquiring advanced testing and software development tools (development capability). Mike knew that the latter investment had a higher return: it would lead to better and faster coding in the future, more so than the long-term benefits of a similar investment in coding capability. Yet in the short run, the investment in Alpha's coding capability was attractive for two reasons. First, Mike hoped that it would speed up the growth in revenue, which could finance future investments in both capabilities. Second, he was afraid of falling behind his competitors in a market that rewarded first movers. In the end, Mike decided to invest in the coding capability. But was this decision an example of managerial myopia (Levinthal and March 1993) in light of the lower expected net present value of this investment? Or was it a smart move? What can this episode tell us about the expected focus of Internet software start-ups on their development capability? Should a different capability investment pattern be expected if Alpha's product were under development in a larger firm or if economies of scale were not important in this market?

More generally, firms' survival and growth depend on their investment in operational capabilities such as production, as well as in dynamic capabilities such as research and development. These capabilities pay off with different delays; consequently, allocating a limited investment flow among them leads to intertemporal trade-offs, which are at the heart of executives' challenges (Grant 2002). Because the costs and benefits of allocating organizational investment among different capabilities affect firms' performance and survival in competition, that allocation is intricately linked with market-level forces. Focusing on the investment allocation between operational and dynamic capabilities, this paper asks the following questions: (1) What fraction of the investment should go to operational versus dynamic capabilities? (2) How does this fraction depend on a firm's growth opportunities? (3) How does this fraction depend on competitive forces in a market? And finally, (4) how do firm characteristics (e.g., initial capability endowments) and market features (e.g., economies of scale) change the value of different capabilities?

2. Dynamics of Capability Development in Organizations

The resource-based view (RBV) in strategy maintains that performance heterogeneity across firms is largely the result of heterogeneity in their capabilities and resources (Barney 1991, Peteraf 1993). Capability is defined as a group of routines that provides a firm with the option of producing specific outputs or changing other routines (Nelson and Winter 1982, Winter 2000). Literature distinguishes between two types of capabilities (Eisenhardt and Martin 2000, Teece et al. 1997). *Operational* (also called ordinary or zero-level) capabilities are "those that permit a firm to 'make a living' in the short term," and *dynamic* (i.e., higher-level) ones are "those that operate to extend, modify or create ordinary capabilities" (Winter 2003, p. 991). Production, sales, and customer service are examples of operational capabilities; product development, forming alliances, and acquisition qualify as dynamic ones.[2]

Capabilities change over time; hence, their accumulation and depletion processes are central to a firm's performance (Dierickx and Cool 1989, Henderson 1994, Penrose 1959). Whereas operational capabilities directly contribute to performance (i.e., "permit a firm to make a living"), dynamic capabilities only impact the "rate of change" of operational capabilities (Collis 1994). For example, production (an operational capability) directly contributes to the bottom line, whereas product development (a dynamic capability) helps a firm build a more profitable product portfolio and thus seeks to make future investments in *production* more fruitful (i.e., influences the rate of increase in production capability). Similar relationships exist between customer service, sales, and design (operational capabilities) and process improvement, product acquisition, and knowledge creation routines (dynamic capabilities).

Capability development requires investment of organizational resources such as money, labor, and technology to develop and fine-tune more efficient routines (Helfat and Peteraf 2003, Winter 2003). With limited investment resources, firms must decide how to allocate those resources among alternative capabilities. Such allocation decisions are among the most common strategic challenges a business manager faces (Grant 2002). Investment choices must be made among green technologies, internationalization, marketing, production, and many other capabilities and resources.

Understanding the trade-offs between developing different types of capabilities is important for advancing theory and enhancing practice. In reviewing the state of capability research, Hoopes and Madsen (2008) identified the relationship between zero-order and first-order capabilities as an important open question. Understanding this relationship helps explain differential patterns of capability investment across different firms and industries. From a practical standpoint, such an understanding can help managers analyze, quantify, and make operational allocation decisions among different capabilities.

Research efforts to date have not examined the dynamics of investment trade-offs between operational and dynamic capabilities, yet the literature on organizational capabilities provides the building blocks for investigating these trade-offs. Specifically, the dynamics associated with building a single capability (Helfat 2000) have been clarified through studies that provide a theoretical framework for a capability life cycle (Helfat and Peteraf 2003) and investigate the role of managerial cognition (Tripsas and Gavetti 2000) and situational effects (Ahuja and Katila 2004) in capability evolution. These studies have shown that capabilities increase through explicit and implicit investments that enable exploration of alternative options and learning by doing. Capabilities erode through forgetting, architectural change in production systems, or technological shifts. Chance and managerial cognition both play a role in these evolutionary processes. These findings inform the capability modeling approach described in this paper.

A few studies address the normative question of optimal investment in capabilities. Specifically, because of market pressures, optimal production and pricing strategies will depend on learning curves in developing a new capability (Cabral and Riordan 1994, Fine 1986, Ghemawat and Spence 1985, Spence 1981). More recently, Pacheco-de-Almeida and Zemsky (2007) showed that resource development timing interacts with time-compression diseconomies to determine optimum investment policies for two competing firms. Building on the insights from this literature, this paper explicitly models the competitive pressures so as to study the intrafirm capability development trade-offs.

Other research has analyzed the trade-offs a firm faces in developing long-term versus short-term capabilities.[3] Management bias toward allocating limited resources among capabilities that pay off in the short term has been recognized (Laverty 1996). For example, reactive maintenance is chosen over preventive maintenance (Sterman 2000), process improvement is ignored in favor of meeting production goals (Repenning and Sterman 2002), and emergency health care gets more attention than preventive medicine (Homer and Hirsch 2006). Theoretical explanations for these observations include discounting of future rewards (Loewenstein and Prelec 1992), managerial incentive problems (Levinthal and March 1993), stock market pressures (Bushee 1998), and learning biases (Rahmandad 2008, Sterman 1989). The current paper analyzes how growth opportunities and competitive pressures influence "short-termism."

Finally, a related trade-off between exploration and exploitation has been a central theme in studying organizational learning (Gupta et al. 2006, March 1991). Exploiting current competencies and fine-tuning known alternatives can enhance performance with little risk, yet these activities divert attention from the exploration of uncertain but potentially more promising markets, technologies, and strategies. As capabilities are increasingly fine-tuned through exploitation, firms find fewer reasons to explore unknown territories. As a result, capabilities turn to sources of rigidity (Leonard-Barton 1992), which can trap organizations in their adaptive trajectories (Levitt and March 1988). The current analysis of investment trade-offs between operational and dynamic capabilities brings the endogenous capability accumulation processes and market competition to the center of exploration–exploitation research.

Two features distinguish the contributions of this paper. First, prior studies have not addressed the impact of endogenous changes in the investment flow available for capability development. However, investment flow is "endogenous"; i.e., it depends on the market performance of the firm, which in turn is dependent on the firm's capabilities (Penrose 1959). Such endogeneity can be consequential. In Alpha's example, the company could benefit from investing significantly in process improvement capability. However, that investment might be better applied to the fast-payoff coding capability because this alternative allows the firm to grow quickly and expand the resources available for further investment. Considering the endogeneity of investment flow refocuses analyses on nonequilibrium growth and decline dynamics and, given the added complexity, calls for the use of simulation models. Second, the impact of competitive pressures on the viability of long-term capabilities is considered. Under competitive pressures, survival may depend on developing short-term capabilities. Even though large investments in long-term capabilities may promise high downstream rewards, a firm may not be able to sustain the required investments in the face of an eroding market share.

Here, a firm is modeled as a bundle of two capabilities, and the trade-offs in allocating an investment flow between these capabilities are investigated. The reinforcing feedback loop connecting capability development, performance, and investment favors capabilities with an early payoff. Competitive pressures further strengthen this preference. Firms that lag in developing short-term capabilities will lose market share and may fall into a deadly spiral of diminishing revenue, reduced investment flow, and declining capability. Therefore, acting strategically, firms may have to ignore long-term capabilities. Detailed analysis provides testable propositions regarding heterogeneous capability investment patterns across different markets and firm structures.

3. Trade-offs in the Development of Operational and Dynamic Capabilities in a Firm

Consider an electronics manufacturer for which production, characterized by effective and efficient production processes, is the operational capability that defines performance. This capability erodes over time as facilities depreciate, technologies go out of date, and margins shrink with the introduction of competitors' products. In response, the firm can invest in production capability by building new facilities. Yet not all facilities are equal—the profitability of a new facility depends on the profit margins of the products produced in it. Therefore investment in new facilities increases operational capability to the extent that the firm is able to design high-margin new products to be produced in these new facilities; i.e., it depends on the product development capability.

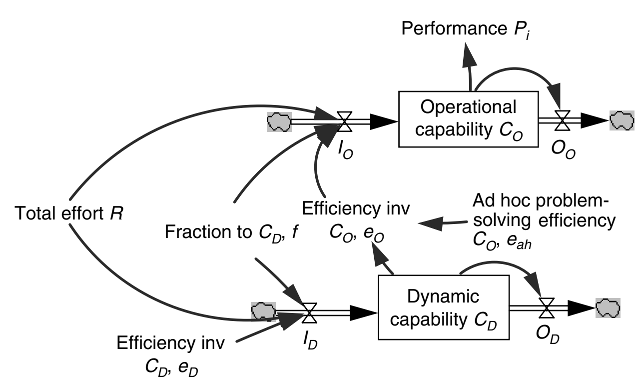
Following Winter (2003), operational capability $(C_O(t))$[4] is set to generate the firm's performance $(\Pi(t))$, defined as its continuous-time profit stream. Without loss of generality, one additional unit of operational capability is assumed to create one unit of profit. That is, the variable costs of production and maintenance of the capability are embedded in the level of capability. In the example above, operational capability not only captures the web of machinery and workers but also their productivity in producing profitable products. Fixed production costs (c), operating costs of dynamic capabilities ($C_D(t)$ with a unit cost of c_D), and costs of investment in dynamic and operational capabilities ($R(t)$) reduce the profit (Equation (1)). To focus on mechanisms unique to this research, a discount rate of zero is used.[5] A firm's performance is thus given by

$$\Pi(t) = C_O(t) - R(t) - C_D(t)c_D - c. \qquad (1)$$

Organizational capabilities and resources are "stocks" of routines and assets that change only through accumulation and depletion processes, i.e., flows (DeCarolis and Deeds 1999, Dierickx and Cool 1989, Henderson 1994). Collis (1994) and Winter (2003) have specified how stock and flow relationships regulate different levels of capabilities. Following their conceptualization, two stocks, $C_O(t)$ and $C_D(t)$, represent the operational and dynamic capabilities, respectively, each with an inflow ($I(t)$) and an outflow ($O(t)$) regulating the stock's speed of change (Equations (2) and (3)). Figure 1 provides an overview of the model of a firm where rectangles represent the capability stocks and capability flows are represented as valves.

$$\frac{dC_O(t)}{dt} = I_O(t) - O_O(t), \qquad (2)$$

Figure 1 Overview of Single-Firm Model



$$\frac{dC_D(t)}{dt} = I_D(t) - O_D(t). \quad (3)$$

A capability's outflow captures its erosion process. Although research has focused more on capability creation, erosion is an inevitable part of the capability life cycle (Helfat and Peteraf 2003). Organizational assets depreciate, skills are outdated or lost as a result of turnover, market demand shifts (Eisenhardt and Martin 2000), and competition catches up by imitation or innovation—all of which diminish the value of specific capabilities. As a capability's stock increases, more routines and assets are subject to erosion, competitive imitation, and substitution (Equations (4) and (5)).

$$O_O(t) = \frac{C_O(t)}{d_O}, \quad (4)$$

$$O_D(t) = \frac{C_D(t)}{d_D}. \quad (5)$$

The parameters d_O and d_D represent the average life of a capability and depend on market dynamism, barriers to entry, capability imitability, and turnover. Similar formulations are used commonly, from modeling erosion of software development capability (Rahmandad and Weiss 2009) to the depreciation of physical assets using the double declining balance method (Bragg 2002).

Capabilities increase through their inflows (Dierickx and Cool 1989). These include diverse activities such as investing in hard assets, assimilating factors of production, training individuals, and giving workers time to develop effective processes. Organizational investment flow ($R(t)$; e.g., employee time and money) is divided between operational ($R_O(t)$) and dynamic ($R_D(t)$) capabilities. The amount of investment differs from the resulting capability accumulation because of variations in investment efficiency (Pacheco-de-Almeida and Zemsky 2007). For example, two firms may invest the same amount to build a new production facility (i.e., the same $R_O(t)$), yet one may end up with higher capability (and thus, performance) because it invested in an assembly line that produces a more profitable product. Therefore, the efficiencies of investment in the capabilities (e_O and e_D) are considered separately from investments:

$$I_O(t) = e_O R_O(t), \quad (6)$$

$$I_D(t) = e_D R_D(t). \quad (7)$$

The critical decision for a firm's manager is how to allocate investment flow between operational and dynamic capabilities. A fraction f of total investment is allocated to dynamic capabilities, leaving the rest to be invested in operational capabilities (Equations (8) and (9)). Here, f is assumed constant:

$$R_O(t) = (1 - f)R(t), \quad (8)$$

$$R_D(t) = fR(t). \quad (9)$$

As Winter (2003. p. 992) put it, "Dynamic capabilities govern the rate of change of ordinary capabilities." Other researchers have also conceptualized dynamic capabilities to operate on the rate of change of operational capabilities (Collis 1994, Helfat et al. 2007). For example, a strong product development capability would increase the efficiency of the electronics manufacturer's investments in production. Leveraging the better products designed by the product development capability makes investments in new plants and equipment more profitable than in the absence of strong product development. As another example, consider the replication and transfer capability of McDonald's. Using this dynamic capability, McDonald's locates and establishes new stores effectively. Although investment in building a new store is required, the efficiency of that investment depends on the replication and transfer capability that determines both the fit in terms of location and the smooth replication of tried-and-true operations in the new store.

Gains in efficiency as a result of dynamic capabilities are affected by decreasing returns because routine formation is slow, and there are limits to the speed with which physical assets can be installed and human capital can be developed. For example, doubling the size of a product development organization is unlikely to make new products twice as profitable. Moreover, dynamic capabilities are not a necessary requirement for developing operational capabilities. Operational capabilities can also be built through ad hoc problem solving (Winter 2003), which includes nonroutine organizational activities to address a problem. For example, a firm can license a new product design rather than develop it in house. We assume that such ad hoc problem-solving processes have an efficiency of e_{ah} in developing new operational capabilities and require no additional costs because the firm does not divert any specific investment toward developing those problem-solving processes. In developing operational capabilities, the firm selects between utilizing dynamic capabilities or ad hoc problem solving, whichever is more efficient:

$$e_O(t) = \text{Max}(e_{ah}, g(C_D(t))), \quad \text{where} \quad g(0) = 0,\ g'(\cdot) \geq 0, \text{ and } g''(\cdot) \leq 0. \quad (10)$$

Function $g(\cdot)$ represents the efficiency of producing operational capabilities through the application of dynamic ones. Without dynamic capability, that efficiency is zero ($g(0) = 0$). An increase in the dynamic capability does not decrease the efficiency of using this capability ($g'(\cdot) \geq 0$), yet diminishing returns on dynamic capabilities prevail ($g''(\cdot) \leq 0$). Higher-level dynamic capabilities (e.g., capability of transforming product development capability) are not considered;

thus, e_D is assumed to be constant. Alternative formulations for connecting dynamic and operational capabilities are explored in §3.4.

This simple representation of capability development mechanisms is first used to analyze organizational performance dynamics when a constant investment flow is allocated between operational and dynamic capabilities (§3.1). Then the link between organizational performance and the available investment flow is addressed to show the resulting shift in a firm's best allocation policy (§3.2). Next, competition among firms is considered (§3.3). Two extremes of competitive structures are analyzed, where uniform competition (§3.3.1) represents firms following a predetermined allocation policy (f) and strategic competition (§3.3.2) represents firms that rationally take into account the reactions of their competitors in determining their allocation policy. The robustness of results to alternative formulations is discussed in §3.4. Section 4 addresses the impact of alternative industry and firm characteristics on the preceding dynamics and develops testable propositions. Contributions to understanding organizational resource allocation and strategy are discussed in §5.

3.1. Capability Development Trade-offs with Constant Investment Flow

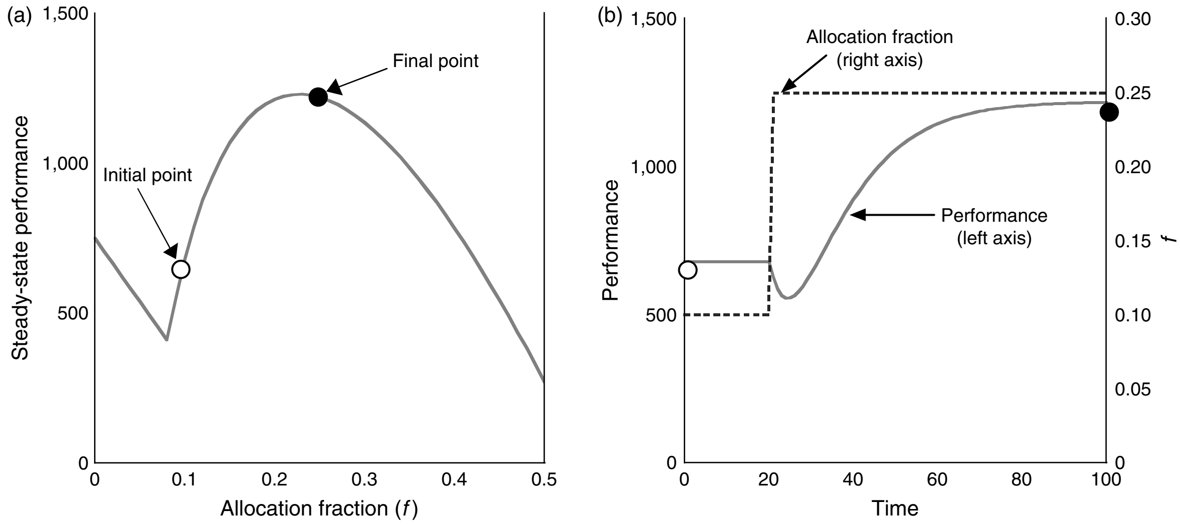
By controlling the fraction of investment in dynamic capability (allocation fraction f), managers can balance direct investment in operational capability with expected efficiency improvements that result from investments in dynamic capability. The steady-state value of performance, Π_{eq}, as a function of f, provides a starting point for analysis. It can be shown that in steady state with any parameter setting, one of two conditions occurs. (See S1 of the electronic companion, available at http://orgsci.journal.informs.org/, for details.) Either there is a global performance peak at $f = 0$ or two performance peaks exist, one of which is a local peak at $f = 0$ and the other the global peak with $f > 0$. Intuitively, an increase in f in the neighborhood of $f = 0$ always reduces performance. Such a shift diverts investment from productive operational capability with no benefit because ad hoc problem solving dominates for small values of dynamic capability (see Equation (10)). Thus either a global peak or a local peak always exists at $f = 0$. Only one other peak may be observed when increased dynamic capability could be worth the investment, where building operational capabilities through the $g(\cdot)$ function is superior to ad hoc problem solving. Given the shape of $g(\cdot)$, only one nonzero performance peak is possible over f. Where the overall optimum is at $f = 0$, the best strategy is to allocate all the investment to operational capabilities. This is an easy managerial decision because factors such as discounting, managerial incentives, and learning traps only reinforce the focus on operational capabilities. The second case is more interesting, because a modest investment in dynamic capabilities maximizes steady-state performance, and thus the firm needs to balance investment between operational and dynamic capabilities. Figure 2(a) shows such a firm's steady-state performance as a function of f. The remaining analyses in this paper address this second case. Table 1 provides the parameter values used in the simulations reported in the paper.[6]

In Figure 2(a) some investment in dynamic capability is optimal, yet making no such investment ($f = 0$) is locally stable. Investment in dynamic capabilities should be sufficient to enable the firm to outperform the alternative ad hoc solution. If those investments are not large enough, resources that otherwise would have extended operational capabilities are wasted. Therefore, incremental increases in investment in dynamic capabilities will *reduce* performance at low levels of the allocation fraction. This simple mechanism explains why organizations that invest very little in dynamic capabilities have a hard time recovering from this equilibrium condition (Repenning et al. 2001), because incremental experimentation discourages focusing on dynamic capabilities.

Another challenge associated with increasing dynamic capabilities is the time delay involved in seeing the results. Investment in operational capability pays off relatively quickly through the accumulation of revenue-generating routines. Investment in dynamic capability takes longer to pay off because it takes time to increase the dynamic capability stock, which only then increases the efficiency of operational capability investments. Therefore, changing allocation fraction f in favor of dynamic capabilities would entail a short-term decline in performance because resources are taken away from direct investment in quick-payoff operational capabilities, before gains in dynamic capabilities can improve performance. Figure 2(b) shows an example of a firm switching from the inefficient policy of $f = 0.1$ to the more efficient policy of $f = 0.25$ at time 20. The firm's performance declines initially because investment shifts away from operational capability. Only later, when the resulting increase in the dynamic capability compensates for that loss, does performance gradually improve. Such "worse-before-better" dynamics lead to learning traps, where managers learn to focus on short-term capabilities at the expense of valuable long-term capabilities (e.g., Repenning 2001, Repenning and Sterman 2002).

Another interesting result is that, in this model, market dynamism (captured in lower levels of capability life time, d_O and d_D) does not require more investment in dynamic capabilities. Of course, in more dynamic markets, faster erosion of operational capabilities requires faster rebuilding of these capabilities. Rebuilding, however, can be pursued through additional investment in operational capabilities (direct increase) or additional investment in dynamic capabilities (indirect increase).

Figure 2 (a) Steady-State Performance as a Function of the Fraction of Investment Allocated to Dynamic Capability Development (*f*); (b) Performance Over Time for a Firm Changing Its Allocation Policy



Thus more dynamic markets do not necessarily increase the priority of investment in dynamic capabilities. Moreover, if market dynamism also erodes dynamic capabilities faster, then it actually *reduces* the priority of dynamic capabilities in favor of ad hoc problem solving. This may seem to conflict with previous research that has highlighted the dynamism of the market as a primary reason for increased investment in dynamic capabilities (Eisenhardt and Martin 2000, Teece et al. 1997). However, these studies do not distinguish between ad hoc problem solving and dynamic capabilities. In fact, the resolution of this apparent contradiction may lie in Eisenhardt and Martin's (2000, p. 1105) observation that "in moderately dynamic markets, dynamic capabilities resemble the traditional conception of routines.... In contrast, in high-velocity markets, they are simple, highly experiential and fragile processes with unpredictable outcomes." In other words, more dynamic markets may call for more fragile processes that are better categorized as ad hoc problem solving. The distinction is important, however, because dynamic capabilities require separate investment and nurturing, whereas ad hoc problem solving does not.

3.2. Capability Development with Endogenous Investment Flow

Financial resources, assets, and manpower available for investment in capabilities largely depend on the organization's performance. In fact, the relationship between performance and available investment flow is at the heart of firms' growth (Penrose 1959). For example, profits from a previous quarter can dictate how many maintenance personnel, design engineers, or production and process improvement personnel will be available for capability building. In the absence of capital markets, this relationship between performance and investment is direct—only a fraction of the firm's net revenue is available for investment. A weaker relationship exists in organizational units where past performance is used to establish future budgets. In contrast, investments in different organizational resources and capabilities such as sales force, brand name, and product development contribute to increased performance and profitability. Profits, in turn, feed future capability investment, completing different reinforcing loops that fuel a firm's growth (Sterman 2000).

These dynamics are included by capturing the impact of performance on investment flow into capabilities.

Table 1 Model Parameters Used in the Reported Simulations

Parameter	Value	Units	Parameter	Value	Units
R	1,000	\$/Month	b	0.79	Fraction
c_D	5	\$/Capability/Month	$C_{O\,\text{init}}$	3,520	\$/Month
c	2,000	\$/Month	$C_{D\,\text{init}}$	50	Capability
d_O	10	Month	c_{ON}	7,500	\$/Month
d_D	10	Month	ω	0.5	Scalar
e_D	0.01	Capability/\$	υ	0.5	Scalar
e_{ah}	0.0375	1/Month	r_N	3,000	\$
$g(x)$	$0.18 \times \ln(\text{Max}(x, 1))$[a]				

[a]For robustness to extreme conditions, in the simulations, Max(x, 1) was used so that $g(x)$ always remains positive.

The resulting capability levels determine performance, closing the "growth" feedback loop(s). A fixed fraction (b) of the organization's net revenue is assumed to be invested in capabilities. A constant fraction provides a simple and common formulation (Lilien et al. 1992):

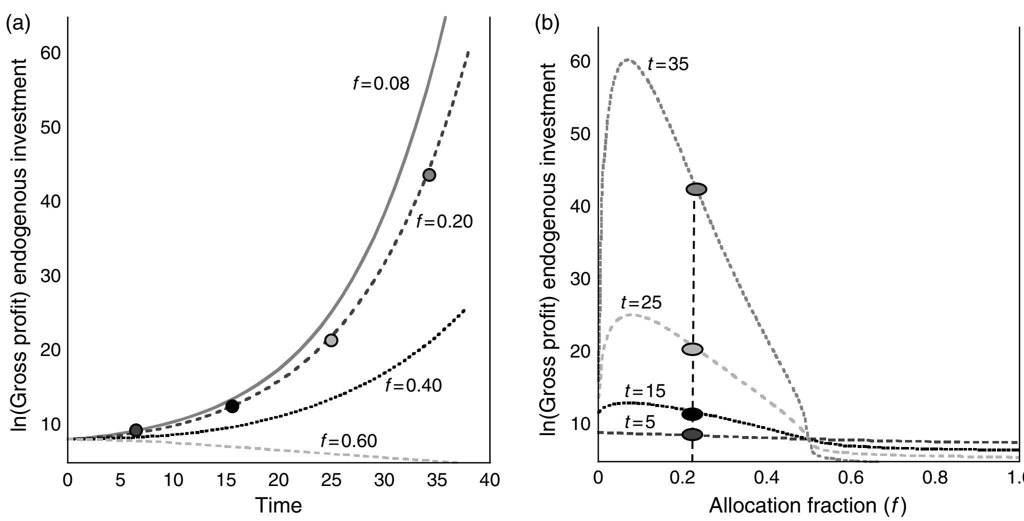
$$R(t) = (C_O(t) - C_D(t)c_D - c)b. \tag{11}$$

The new formulation does not include market saturation effects that slow growth. The firm can, for example, continuously grow by investing in its production and product development capabilities, where the former contributes to the performance and growth directly and the latter contributes by increasing the profitability of new product lines. Real markets are limited in size, yet this simple formulation isolates the impact of growth opportunities on capability development trade-offs.

Figure 3 reports the results of experiments using this formulation. Given an unlimited market, the organization can grow quickly and reach high profit levels; therefore, performance is charted on a logarithmic scale. Panel a shows the performance over time for four firms using $f = 0.08$, 0.20, 0.40, and 0.60. The "growth loop" dominates the dynamics, where profit leads to increased investment flow, which in turn increases investment in both dynamic and operational capabilities. Operational capability grows even faster because of both the growing investments it receives and the growing efficiency of those investments caused by increasing dynamic capabilities. Panel b reports the performance of firms with different allocation policies ($0 \leq f \leq 1$) at times 5, 15, 25, and 35 to capture, in a single graph, the dynamics of firms with different f values. (Note that in Figure 3(b), the unit of measure in the x axis is in allocation fractions, not time.) Firms' initial capabilities are identical, so performance differences are due to allocation policies. Initial capabilities, as well as parameter b (Equation (11)), are selected such that a firm with $f = 0.5$ is at equilibrium. All firms with $f < 0.5$ will grow. Allocation fractions above 0.5 will cause a decline in performance because the reinvestment in operational capability cannot offset erosion for higher fractions. Along with faster growth and decline rates, two qualitative differences emerge, compared to the constant investment flow. First, the performance peak shifts to the left toward policies with higher fractions of investment in operational capabilities. Second, the local performance peak at $f = 0$ no longer exists.

Organizational performance is a function of operational capability (Equation (1)). It depends on the two factors that dynamically change the level of this capability—investments in the capability and the efficiency of those investments. Additional investment in the dynamic capability increases performance by improving the efficiency of operational capability investments. In contrast, direct investment in operational capability not only increases the performance but also adds to the pace of growth in the investment flow. The short-term-focused policy of shifting investment toward operational capability also provides the opportunity for quick growth not available through applying the "long-term" policy. The increased investment flow as a result of performance growth benefits both operational and dynamic capabilities in the long run. In fact, the best policy shifts from $f = 0.23$ to allocating only about one-third of this fraction ($f = 0.08$) to dynamic capabilities. Although the exact extent of the shift depends on the parameters used, the qualitative results are quite general. When the investment flow depends on performance, investment in dynamic capabilities is less attractive because that payoff comes with a delay.

Figure 3 Performance with Endogenous Investment



Note. (a) Over time with $f = (0.08, 0.2, 0.4, 0.6)$, and (b) over the allocation fraction; corresponding points on the two graphs are shown for $f = 0.2$.

Endogenous investment flow also removes the performance peak at $f = 0$. Under a constant investment flow, ad hoc problem-solving processes can outperform dynamic capabilities because the achievable level of dynamic capability is limited by the total available investment flow. For small allocation fractions, dynamic capability does not contribute to the efficiency of developing operational capability and only wastes the allocated investment. However, when the *growth loop* is active and dominates (here, $f < 0.5$), available investment will continue to grow, and eventually dynamic capability will replace ad hoc problem solving. In this setting, over the long run, the $f = 0$ allocation policy will be dominated by policies that require some investment in the dynamic capability.

In contrast to Figure 1(b), the worse-before-better dynamics are rarely observed in the endogenous investment setting. Instead, most short-term declines in performance trigger a death spiral of reduced investment flow, lower capability, and declining performance. In essence, sacrificing performance takes an additional toll by not creating enough future investment in capabilities. Under these conditions, managers might decide to slow down their short-term growth in order to build their dynamic capabilities for faster long-term growth. However, they are well advised not to completely sacrifice growth in favor of building dynamic capabilities. Such a sacrifice rarely pays off because a short-term decline in performance often leads to lower investment flow, capabilities, and the overall decline of the firm.

3.3. Capability Development Under Competition

Competition often poses the toughest challenges to managers. The real-world benchmark is not an isolated firm's performance or growth potential but rather whether the firm can survive and excel amid competition.[7] Capability development is therefore best understood when survival and future performance impose conflicting demands on the managers. Lenox and his colleagues (2006, 2007) show the importance of considering the interdependency among internal firm components and the external competitive dynamics in explaining industry dynamics. This paper extends their work by analyzing trade-offs between operational and dynamic capabilities under competition.

The competition between N identical firms is modeled in a market with constant demand. Equations (2) to (10) remain unchanged while all variables are assigned an index (j) identifying the jth firm in the market. Equations (12) and (13) describe the market aggregation and competition processes. Firm j's operational capability determines its *potential output* (P_j).[8] Real sales, however, are determined by the allocation of total demand among the firms. If total market size is bigger than the sum of the potential outputs of all the firms, then each firm sells all of its potential output ($S_j = P_j$). Otherwise, each firm's market share is proportional to the firm's potential output. Market size (m) is constant and equals the sum of initial potential outputs of all firms combined. Stated formally,

$$P_j = C_{O,j}, \tag{12}$$

$$S_j = \mathrm{Min}\left(P_j, mP_j \Big/ \sum_{i=1}^{i=N} P_j\right); \quad m = \sum_{i=1}^{i=N} P_{\mathrm{Initial},\, i}, \tag{13}$$

$$R_j = (S_j - c - C_D c_D)b, \tag{14}$$

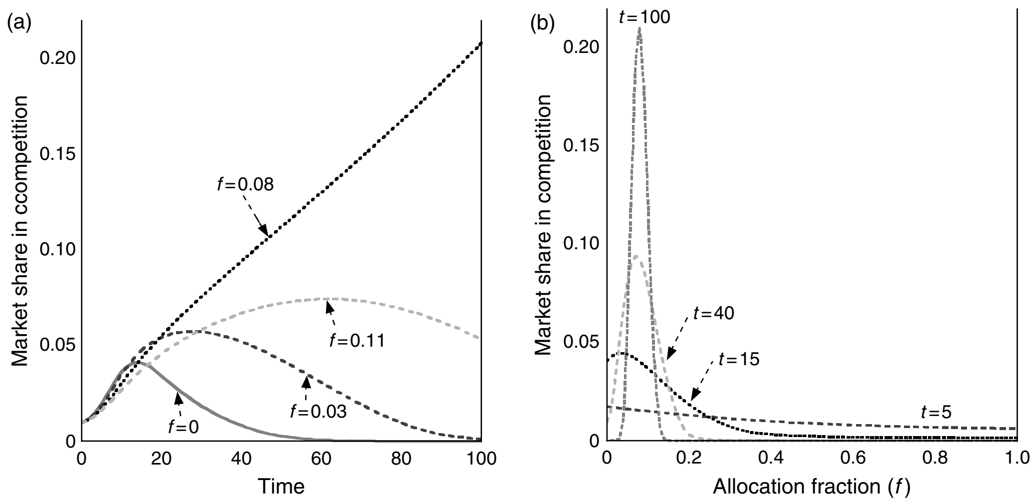
$$\Pi_j = (S_j - c - C_D c_D)(1 - b). \tag{15}$$

Equations (14) and (15) replace Equations (11) and (1), respectively.[9] Controlled experiments feature N identical firms, the market starts from equilibrium, and every firm is endowed with the same capabilities, $C_{O\,\mathrm{init}}$ and $C_{D\,\mathrm{init}}$ (calculated by putting in equilibrium a firm with $f_{\mathrm{initial}} = 0.5$). At time 0, each firm switches to a different allocation policy, and the simulations trace the market share gains and losses of each firm. Two conditions to select allocation fraction f are analyzed—uniform competition and strategic competition. Uniform competition assumes managers follow some predetermined decision rule (Cyert and March 1963), whereas strategic competition assumes rational firms that optimally pick their allocation fraction while considering the best their competitors can do (Saloner 1991). This design therefore explores a wide range of assumptions on firms' rationality.

3.3.1. Uniform Competition. In the uniform competition, the market shares of N firms are compared, with each switching to a constant policy of $f_j = j/100$ ($j = [0, 1, \ldots, 100]$, $N = 101$, so that both extreme strategies of $f = 0$ and $f = 1$ are covered) at time 0, independent of what other firms do. Figure 4(a) shows the market share over time for the four competing firms with allocation fractions of $f = 0$, 0.03, 0.08, and 0.11. The firm that focuses primarily on operational capability, $f = 0$, grows most quickly in early stages, whereas the other competitors in this neighborhood also gain market share. After a few months, however, firms who have invested modestly in dynamic capabilities start to see the benefits and gradually increase market share over those using very low allocation fractions. As fewer competitors remain in the market, firms compete head-to-head, and the firm with the strongest growth potential at the time wins in the market. A firm's growth potential at any point in time depends both on the firm's policy (f) and its dynamic capability level. Those with higher accumulated dynamic capability can grow faster.

Figure 4(b) shows the market share for all the competitors at selected points in time. The optimum allocation policy significantly shifts from the constant investment case (from 23% to 8%). Firms that can achieve the fastest growth rates take market share away

Figure 4 Market Share for Different Firms in Uniform Competition



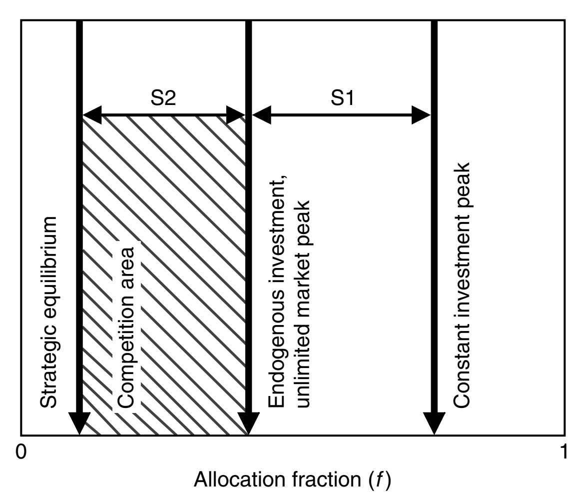
Notes. (a) Over time. (b) Over allocation fractions.

from the slow-growing firms. The dominant strategy is similar to the one with unlimited market (§3.2) because in both cases the fastest-growing firm takes away market share from others. However, this result hinges on the large number of firms with inefficient policies (such as firms with ($f > 0.5$); that allows firms with notable long-term investment ($f \approx 0.08$) to build enough dynamic capability early on, before entering a head-to-head competition with more short-term-focused competitors ($f \approx 0$). If fewer firms are in competition, or more firms pick a short-term policy (rather than a uniform distribution), the winning strategy shifts to lower levels of f. Here, as in the unlimited market case, worse-before-better dynamics are rare. A sacrifice of short-term sales leads to lower investment flow and reduced capabilities, permanently hurting the firm.

3.3.2. Strategic Competition. Competition further favors short-term policies when firms strategically choose their allocation policy. Rational firms consider how other firms in the market act, and they select their own allocation fraction accordingly. The half of the firms choosing the highest investment in dynamic capabilities have the slowest *initial* growth potential and therefore lose in competition. Knowing this, the firms entering the market want to strategically choose allocation policies that are at, or below, the median firm's allocation fraction. Intuitively, the Nash equilibrium is for every firm to select the minimum value of its allocation fraction because being above the median firm leads to loss, and the only way for everybody to be equal or below median is for everybody to select the minimum. Simulation experiments confirm that $f = 0$ is a game-theoretic equilibrium for competition among 10 firms in this market (see S2 of the electronic companion for details). Therefore, the strategic selection of an allocation policy leads the firms to allocate all their investment to short-term, operational capabilities and to ignore dynamic capabilities all together.

3.3.3. Summary of Impact of Endogenous Growth Opportunities and Competition. Figure 5 reports the shifts in the optimum allocation policy as a result of growth opportunities and competitive pressures. Three potential peaks (optimum allocation fractions) are identified. Farthest to the right, where the highest investment in dynamic capabilities occurs, is the peak associated with a single firm allocating a constant investment stream between operational and dynamic capabilities. A business unit with a fixed budget is an example of this condition. The peak shifts to the left (i.e., requiring less investment in dynamic capabilities) for a small business that finances its growth from its own profit. The amount of this shift, S1, depends on how fast the firm can grow. For example, an Internet start-up with significant growth opportunities is more likely to focus on its

Figure 5 Summary of Shifts in the Best Allocation Policy as a Result of Growth Opportunities and Competition



coding capability because it leads to more rapid growth in profits than investing in development tools and processes. A second shift, S2, in optimum policy occurs when the firm faces a competitive market. Competition further rewards those firms with the fastest short-term growth, thus discouraging investment in long-term capabilities. The extent of this shift depends on the market's competitive landscape. Although competing against firms with limited foresight (such as in the uniform competition setting; see §3.3.1) encourages somewhat higher investment in dynamic capabilities, competition among rational firms drives such investments down, potentially to zero. Depending on the strength of the competition and the degree of rationality of the firms involved, different allocation policies can dominate within the "Competition area" in Figure 5.

3.4. Robustness of Results

Extensive sensitivity analysis was conducted on both the parameters and the structural assumptions of the model. In general, the results are robust to parameter values as long as the peak performance with constant investment is achieved at some $f \neq 0$ and some firms are profitable. Besides analyzing parameter sensitivity, the base case analysis (§§3.1–3.3) was repeated under six different formulations. These included alternative views on the relationship between dynamic and operational capabilities (e.g., making the impact of ad hoc problem solving and dynamic capability additive rather than using only the more efficient one), changes in the firm characteristics (using dynamic capability to drive the productivity of operational capabilities), changes in the production function (using the Cobb–Douglas function), inclusion of a buffer between sales and investment to capture delays in organizational decision making and the generation and depletion of organizational slack, and assessment of competition in unsaturated markets. Overall, the robustness tests are consistent with the basic results with only mild variations observed. Specifically, buffering investment in capability from firm performance, e.g., through providing a larger pool of slack resources, makes the long-term capabilities more viable. This happens because the buffer reduces the gain of the reinforcing loop between Performance → Investment → Capabilities → Performance, which regulates the shifts in optimum allocation. Also, unsaturated markets provide a window of opportunity for competitors to invest in dynamic capabilities without losing sales, thus leading strategic competition equilibrium to include some investment in dynamic capabilities. Detailed results for this set of analyses are reported in S3 of the electronic companion.

4. Implications for Capability Development Across Different Markets and Organizations

The preceding analysis established three fundamental processes that regulate the trade-offs between operational and dynamic capabilities. First, delays in building a capability create opportunity costs of foregoing growth and expansion of investment flow. Therefore, firms would rather invest in short-term operational capabilities when opportunities for faster growth are available. Second, under zero-sum competition, firms need to grow or sustain their market share in order to survive. Short-term growth, however, requires a shift in policy toward investments with faster turnaround. Finally, rational firms foresee their competitors taking on more short-term focused policies. Desiring to grow faster than the average competitor, all firms thus converge to investing little in dynamic capabilities. This section explores how economies of scale, time-compression diseconomies, and heterogeneity of initial capability endowments affect these dynamics.

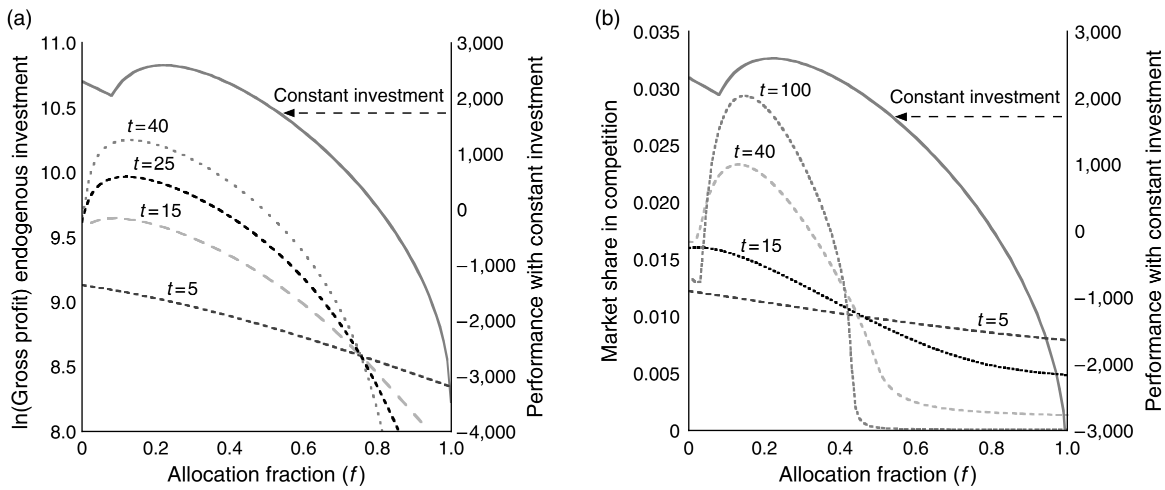
4.1. Impact of Economies of Scale on Balancing Capability Investments

Reinforcing growth loops depend directly on a firm's economies of scale—how much a firm's profit-generating potential changes because of an increase in its size (here, capability levels). In the base case, the firm is characterized with increasing returns to scale, where doubling investment flow both doubles the investment in operational capability and increases, through $g(\cdot)$, the efficiency of those investments. As a result, the overall output more than doubles. The increasing returns to scale in the base case benefit larger firms and provide incentives for growth, thus tipping the balance in favor of short-term capabilities. We may expect greater preference for long-term capabilities where firms face decreasing returns. To explore this hypothesis, Equation (12) is replaced by Equation (16):

$$P_j = (C_{O,j}/c_{ON})^{\omega} c_{ON}. \quad (16)$$

Here, c_{ON} is the normal value of operational capability at which the potential output of this model equates to the base case. This parameter enables these experiments to be directly compared with the previous ones, but it has no qualitative effect on the results. Parameter ω captures the returns to scale for operational capabilities. Simulations reported here use $\omega = 0.5$, which reflects strong decreasing returns to scale. The results are reported in Figure 6. Decreasing returns to scale reduce the viability of bigger firms and thus create limits to growth. These limits to growth reduce the relative value of short-term focus. Figure 6(a) shows that maximum endogenous growth is achieved at $f = 0.13$ when competition does not exist, compared with $f = 0.08$ in the

Figure 6 Impact of Decreasing Returns to Scale



Notes. (a) Endogenous investment. (b) Uniform competition.

base case, whereas optimum allocation under constant investment flow is still $f = 0.22$. Figure 6(b) shows that under uniform competition, the winning firm allocates $f = 0.15$ of its investment to dynamic capability, which is higher than the base case. Despite the lower value of growth opportunities under strong diseconomies of scale, the strategic equilibrium remains at $f = 0$.

4.2. Time-Compression Diseconomies and Capability Development Trade-offs

Rapid investment in many capabilities may be inefficient. The more quickly a firm invests, the greater the unit costs of capability development may be. The increasing costs can result from the complexity of building the capabilities and the interactions among the different components that constitute a capability (Mansfield 1968). Such time-compression diseconomies can complicate capability development (Dierickx and Cool 1989). To analyze the impact of time-compression diseconomies on capability development dynamics, Equations (6) and (7), respectively, are changed to

$$I_O = (1 - f)(R/r_N)^{v} r_N e_O, \tag{17}$$

$$I_D = f(R/r_N)^{v} r_N e_D, \quad 0 \le v \le 1. \tag{18}$$

This formulation is consistent with the literature (Pacheco-de-Almeida and Zemsky 2007) and uses v to specify the extent of the time-compression diseconomies. Parameter r_N is the normal level of investment flow and makes the numerical results directly comparable to the base case without any qualitative impact on the findings. The results are reported in Figure 7.

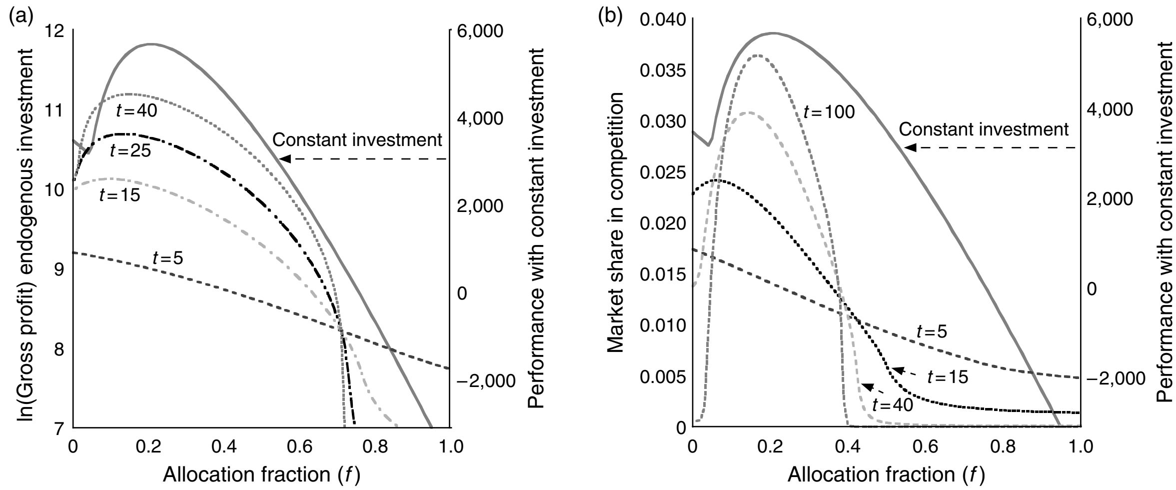
Time-compression diseconomies reduce the value of extreme investment policies because high investment levels waste resources. Moreover, in the endogenous case, the firm's growth slows and then ceases as the investment grows larger. The efficiency of investment is reduced until the marginal cost of investment equals the marginal return on capability growth. Therefore, whereas the constant investment flow peak is close to the base case at $f = 0.21$, endogenous investment and uniform competition cases favor allocation policies at $f = 0.15$ and $f = 0.17$, respectively, significantly higher than the base case (see Figure 7). Interestingly, the strategic competition equilibrium shifts much closer to uniform competition at $f = 0.10$.

Two mechanisms explain these shifts. First, focusing solely on operational capability is now very costly because of the additional waste in one-sided investment policies. Moreover, the strong growth opportunities that rewarded a focus on short-term investments in the base case are weakened when firms cannot grow as rapidly. Both factors lead to the viability of investment in dynamic capabilities when engaged in strategic competition. Therefore one may propose that growth opportunities and competition are less important when evaluating capabilities with significant time-compression diseconomies, such as internationalization and alliance formation.

4.3. Heterogeneous Capability Endowment

Luck and history can endow firms with different initial capability levels, and these initial capability levels can affect future investment strategy. For example, soon after launching Alpha, Mike learned that he was competing against another start-up that was supported by a major software company and thus benefited from higher initial levels of process capabilities. The impact of heterogeneous resources is analyzed using Monte Carlo simulations of firms competing with different initial capability levels. For each firm, initial capabilities are randomly picked from a uniform distribution between zero and twice the base case initial capability levels; other equations remain intact.

Figure 7 Impact of Time-Compression Diseconomies

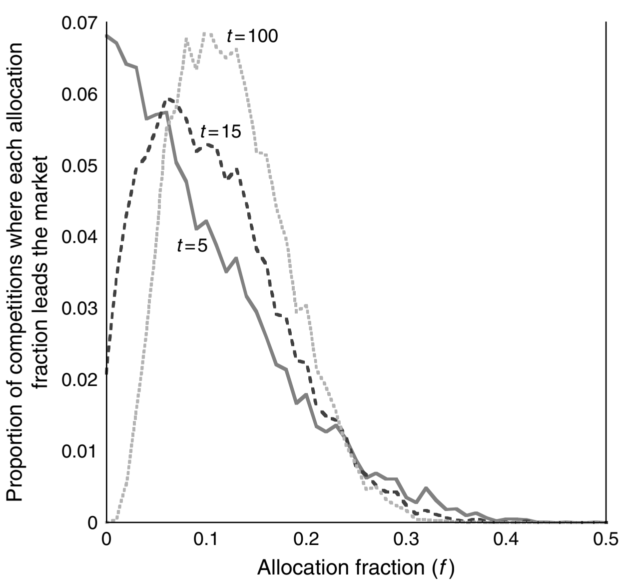


Note. (a) Endogenous investment; (b) uniform competition.

Figure 8 shows the proportion with which firms with different allocation policies are ahead of other players in the market (in terms of sales). Results are reported for 10,000 simulated markets, each with 101 competing firms under the uniform competition condition (§3.3.1) and at three different points in time. The overall patterns are similar to the base case results: initially, short-term policies are more likely to succeed, but as competition progresses, more investment in long-term capabilities starts to pay off. As in the base case, the maximum success rate is achieved at $f = 0.08$.

On the other hand, as the tails of the distributions reveal, initial resource endowment can enable a firm with a nonefficient allocation strategy to win in the competition. Two factors of capability endowment and allocation policy interact in a subtle way to determine success in the presence of initial capability heterogeneity. First, the capability endowment of each firm strongly influences the initial growth potential of that firm. The other determinant of growth potential is the allocation policy, which is controlled by each firm independently. The pattern of growth resulting from these two factors influences the evolving capability position of the firm. Increasing returns enable firms that initially grow rather quickly to gain a significant advantage over their competitors. In some cases, this advantage can compensate for a firm's otherwise inefficient allocation policy. As a result, a firm with an investment policy as high as $f = 0.34$ can dominate the long-term competition. In other words, the impact of initial endowments does not erode over time. As firms grow, they benefit from increasing returns. A firm with a suboptimal investment policy can reach a size threshold beyond which it becomes more efficient than small firms that implement more efficient allocation strategies (e.g., $f = 0.08$).

Figure 8 Impact of Heterogeneous Capability Endowment



Note. Proportion of 10,000 simulations in which each allocation fraction has led the market, in terms of sales, for three different points in the timeline of competition.

These dynamics are possible only in markets with increasing returns. Over the long run, markets with decreasing returns always shift to favor the firm with the most efficient allocation policy. Without increasing returns, the impact of initial capability endowments erodes as time passes, and the allocation policy soon becomes the sole factor in determining gains in market share. Therefore, a fundamental interaction between returns to scale and initial capability endowment exists: initial capability endowments matter most when markets are dominated by increasing returns. Otherwise, the allocation policy is the main factor determining the best performers in the market.

4.4. Generating Propositions Based on Simulation Experiments

This analysis of firms in growing and competitive markets shows that the delays between investment in dynamic capabilities and performance can reduce the value of these capabilities compared with operational ones. This could encourage a shift in the organizational investment toward more short-term-focused policies. How does this analysis inform the relative value of dynamic capabilities across different markets? In what types of markets do we expect product development to be more important, and where will ad hoc problem solving replace it? Which firm characteristics increase the value of alliance formation as a dynamic capability? Which markets most value replication and transfer routines? Table 2 summarizes the propositions that build on the experiments above to address these and similar questions.

Section 3.1 discussed how market dynamism, by eroding dynamic capabilities faster, potentially increases the attractiveness of ad hoc problem solving (P1). Section 3.2 presents results that suggest that in markets with strong growth opportunities, such as new electronic media, successful firms are more likely to invest in expanding their operational capabilities and rely more heavily on ad hoc problem solving rather than on structured dynamic capabilities (P2). Strategic competition further increases firms' focus on short-term investments (P3; see §4.3). Economies of scale exacerbate this effect of competition (P4), whereas time-compression diseconomies and unsaturated markets limit the shift of focus toward operational capabilities in strategic competition (P5). Based on the analysis in §3.4, buffering investment flow from revenue will increase the viability of dynamic capabilities (P6). Experiments with heterogeneous firms suggest an interaction effect between economies of scale and initial capability endowment. Specifically, in markets with increasing returns to scale, heterogeneous capability endowments allow diverse strategies to succeed because of path dependencies in capability accumulation. In markets with decreasing returns, competition is expected to have a stronger homogenizing impact on capability development patterns among firms (P7).

Table 2 Summary of Propositions Generated from Simulation Experiments

	Market and firm characteristics	Impact on capability investment
P1	Market dynamism	Favors ad hoc problem solving relative to dynamic capability.
P2	Growth opportunities in the market	Increase the relative value of operational capabilities because of a growth feedback loop; however, unsaturated markets also reduce the impact of strategic competition.
P3	Market competitiveness	Reduces the relative value of dynamic capabilities in favor of ad hoc problem solving.
P4	Decreasing returns to scale	Increase the relative value of dynamic capabilities.
P5	Time-compression diseconomies	Increase the relative value of dynamic capabilities.
P6	Resource buffer between sales and investment	Increases the viability of dynamic capabilities.
P7	Heterogeneity in initial capability endowment	Introduces path dependence in what policy can win, if markets are dominated by increasing returns. Markets with decreasing returns always favor efficient policies.

5. Discussion and Conclusions

Both critics and proponents of the resource-based view (Barney 2001, Priem and Butler 2001) agree that RBV will benefit from integrating the analysis of internal resources and capabilities with the analysis of external competitive dynamics (e.g., see Lenox et al. 2006, 2007). Moreover, formalizing definitions and incorporating a temporal dimension into resource-based studies are critical to moving RBV to the next stage (Pacheco-de-Almeida and Zemsky 2007). This study addresses these challenges by formally modeling how growth opportunities and competition dynamically affect the trade-offs in the development of different organizational capabilities.

From explicitly modeling capability evolution at the firm level and how that evolution interacts with competitive pressures at the market level, new theoretical insights emerge. First, many have observed that firms underinvest in capabilities and resources with delayed payoff (e.g., Hendricks and Singhal 2001, Homer and Hirsch 2006, Repenning and Sterman 2002). Economic short-termism describes firms' tendency to focus on short-term initiatives at the expense of long-term ones (Laverty 1996, Marginson and McAulay 2008). Proposed explanations for short-termism include heavy discounting because of executives' incentives (Levinthal and March 1993), stock market pressures (Bushee 1998), individual and organizational learning biases (Rahmandad 2008, Sterman 1989), and exploration–exploitation trade-offs (Levitt and March 1988, March 1991). The present analysis complements these explanations by showing that what is considered short-termism with constant investment flow may be a reasonable investment plan when opportunities for growth or competitive pressures are considered. This may explain why large-scale studies have had mixed results in finding widespread economic short-termism at the market level (e.g., Bizjak et al. 1993, Holden and Lundstrum 2009).

When do the mechanisms identified in this paper better explain the perceived short-termism, and when might discounting, learning biases, and managerial incentives provide a better explanation? Only future empirical work can settle such questions. Yet one can speculate that in highly competitive markets, in the absence of efficient capital markets, when increasing returns are present, and in competition among smaller firms that lack a resource buffer, the impacts of mechanisms discussed here are more salient, and hence they shift the efficient policy away from investing in dynamic capabilities. Interestingly, such a shift may misleadingly signal the presence of managerial myopia to outside observers.

More practically, current measures for comparing investment returns, such as net present value (NPV), do not consider the opportunity for reinvesting the returns from short-term investments to fuel the firm's growth so as to provide, in turn, capital for more investments. Similarly, NPV does not include the costs of shrinking market share, which reduces future investment flow while firms wait for long-term initiatives to pay off. This study shows that both these considerations could be crucial and calls for a more nuanced method for measuring intertemporal trade-offs that captures the value of growth opportunities and the competitive pressures.

Second, this study provides another reason why competition may not always favor the organization with the highest performance potential. Previous research has shown that diversity of performance dimensions increases the importance of social and institutional factors in determining organizational survival (Anderson and Tushman 1990). Moreover, slack can buffer organizations from temporary performance shortfalls caused by their poor policies (Barnett et al. 1994, Levinthal 1991). Furthermore, path dependencies resulting from reinforcing dynamics in organizations (Arthur 1989) may randomly favor inefficient configurations (Barnett and Burgelman 1996). Finally, competition favors learning strategies that provide more stable patterns of behavior, even at the expense of expected performance (Levinthal and Posen 2007). The present study shows how growth opportunities and competition can lead to the dominance of short-term investment policies in the market, eliminating firms that have higher long-term performance potential.

Third, the present results expand on the predictions in the RBV literature by providing new testable propositions regarding variations in capability investment across different firms and markets. Previous literature has considered these variations to be largely rooted in the technological and institutional structure of different markets (Ahuja and Katila 2004), and therefore few generalizations are made beyond predicting a positive link between market dynamism and the importance of dynamic capabilities (Eisenhardt and Martin 2000). By explicitly distinguishing ad hoc problem solving from dynamic capabilities, the present analysis suggests that market dynamism may actually *disfavor* dynamic capability development relative to ad hoc problem solving. It is also proposed that dynamic capabilities receive higher shares of investment, where decreasing returns or time-compression diseconomies exist and when capability investments are buffered from performance. On the other hand, market competitiveness is proposed to increase the value of operational capabilities. In summary, addressing an underexplored area in the literature (Hoopes and Madsen 2008), this study calls for empirical research that assesses new theoretical propositions.

A similar analysis can be extended to the outsourcing question (Espino-Rodriguez and Padron-Robaina 2006). Just as the dynamics of endogenous growth and competition change the cost-benefit calculations used to assess alternative capability investments, they also influence the comparison between internally developed and externally acquired resources. For example, the faster a resource can be put into action, the stronger the reinforcing loop between resource acquisition, performance gains, and increase in investment for future resource growth would be.

Fourth, an extension of these results to alternative firm and market characteristics reveals avenues through which firms can invest in long-term capabilities without losing in the competition. Although the basic results are robust to several assumptions about firm characteristics, time-compression diseconomies in capability development favor long-term policies by reducing the efficiency of policies that focus on quick growth through one-sided investment. Similarly, a buffer between performance and investment can reduce the impact of the dynamics discussed and can promote investment in long-term capabilities even in the presence of strong competition. This fact favors diversifying incumbent firms that compete with start-ups. It also adds to the advantages of firms with access to capital markets. Firms without such access must finance their growth directly from their own profit, thus strengthening the link between performance and investment flow. Moreover, growing markets provide firms with an opportunity to invest in long-term capabilities without being penalized by the loss of sales to more myopic competitors. Therefore, the growth phase of a market provides an opportunity for building dynamic capabilities. This window of opportunity closes once the market is saturated, and the competition becomes a zero-sum game. Interestingly, new players in the initial growth phase of the market often lack a resource buffer and are under extreme pressure to meet demand, thus reducing their ability to invest in dynamic capabilities. Therefore, a delicate balance exists between the risk of ignoring dynamic capabilities to foster initial growth and the risk of losing the window of opportunity for developing dynamic capabilities in the initial market growth phase.

Initial resource endowment interacts with these dynamics. Specifically, in markets that feature economies of scale, a firm with especially strong initial capability endowment can dominate rival firms even if they adopt optimal managerial policies (§4.3). In other words, both luck (e.g., initial resource endowment) and managerial insight (e.g., investment policy) have a share in determining winners and losers. This is in line with the RBV literature that finds both luck and managerial foresight as relevant determinants of performance heterogeneity (Denrell et al. 2003, Tripsas and Gavetti 2000). Moreover, consistent with the previous research on path dependency, we find that the persistent role of luck depends on the existence of increasing returns (Arthur 1989).

Path dependency is created because in the presence of increasing returns, investing in long-term capabilities, by increasing these capabilities, enhances the viability of further investment in these capabilities. In contrast, once a firm is in a poor capability position, market forces leave the firm with few options other than to further ignore long-term capabilities. In fact, if a firm has accumulated sufficient capabilities and resources during the growth phase of the market, it is in a position to benefit from further investments in long-term capabilities when the market matures. Therefore, during the growth phase of a market, firms may face a critical dilemma. Although they can benefit from faster short-term growth by investing mainly in operational capabilities, this decision may rob them of the opportunity to gain superior performance through higher investment in dynamic capabilities once the market matures. Small early differences in decisions regarding dynamic capabilities can lead, over the long term, to large differences in the repertoire of feasible strategies available to the firm.

Finally, this analysis raises new questions regarding the viability of dynamic capabilities. Assuming that a firm acts rationally and faces a mature market dominated by reinforcing feedback, ad hoc problem solving may prove more valuable than the acquisition of dynamic capabilities. The rationality assumption may be debated, but the impact of competition on shifting allocation policy is robust and more significant under increasing returns. Empirical analysis can test the proposition that firms in markets dominated by reinforcing feedback are less amenable to investment in dynamic capabilities. Also, conditions in these markets that favor the development of dynamic capabilities require further study.

Several limitations of this study provide opportunities for future research. The formulations used for firm performance are all simple and deterministic. The allocation fraction and the fraction of profits invested in capabilities are assumed constant over time, even though they are dynamic in the real world. Multidimensional capability spaces (Levinthal 2000) and stochasticity of performance are excluded, although these can lead to convergence to alternative peaks on rugged payoff landscapes (Levinthal 1997) and introduce capability traps (Levitt and March 1988). Firms are assumed to keep expanding their capability base even if the market is saturated. Moreover, the impact of capital markets on generating the investment flow for the firm is not considered. Weakening the relationship between firm performance and investment flow, capital markets can move the performance peak toward the exogenous resource case. Furthermore, ad hoc problem solving can lead to the creation of dynamic capabilities (Szulanski 2000), but this interaction is not considered.

The formulations here assume a homogenous demand base for a commodity product where players are not distinguished by quality or other factors. Niche markets and product differentiation based on heterogeneous customer tastes may affect the results. Growth in one niche market can underwrite capability development for the next market segment. Therefore, firms can pace their capability development strategy according to the opportunities available in successive markets. Similarly, firms are assumed to be active in a single market, but larger firms are often active in multiple markets, which allows them to use the gains from one market to buffer their capability development activities from competition in another market. Despite these limitations, this analysis contributes to a more nuanced understanding of the difficult choices managers face in balancing their investment among different capabilities. A focus on short-term investments does not necessarily signal myopia, but it may be required for faster growth or survival in competition.

6. Electronic Companion

An electronic companion to this paper is available as part of the online version that can be found at http://orgsci.journal.informs.org/.

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Endnotes

[1]This example is based on the author's interviews in a real case; names have been changed to protect privacy.

[2]It is important to distinguish instances of acquisition and alliance formation from the "acquisition capability" and "alliance formation capability." The former are single acts; the latter are sets of routines that make those acts more productive in increasing the operational capabilities of the firm.

[3]The current analysis compares two points (investments in operational and dynamic capabilities) on the continuum of short-term to long-term initiatives. Therefore the terms short-term/long-term investments are interchangeably used with investments in operational/dynamic capability.

[4]Capital letters are used for variables that vary over time, and lowercase letters are used for constants.
[5]Including discounting does not change any of the general conclusions but has some impact on numerical results.
[6]Models are built in the Vensim™ software and are all available in the electronic companion (see S4).
[7]Firms do not enter or exit the market in the following simulations; the term "survive" identifies firms with noticeable sales.
[8]For readability of equations hereafter, the time index (t) is dropped.
[9]A more detailed formulation can specify market clearing price and market share levels for profit-maximizing firms, but the basic insights remain unchanged because bigger firms get a higher market share in such a competition, similar to the results of the simpler formulations here.

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