CHAPTER NINE

Why Do Firms Tend to Become Different?

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Introduction

A central lesson to emerge since the early 1980s of research in management is that a firm's strategy has to be rooted in its unique properties. Unless a firm is already different, it is hard to prescribe a path to sustainable above-average profits. This makes management theory look simultaneously good and bad. The good part is that firms, in fact, *are different* from each other. So the theory is relevant. The bad part is that we have a very poor understanding of how and why firms *become different* (Rumelt et al. 1991; Nelson, 1991: Helfat, 2000).

One explanation is that a firm will want to differentiate from an identical competitor in order to reduce competition. However, this does not explain who gets the more attractive position, or what prevents other firms from entering and driving down profits. Another class of stories, which include evolutionary economics (Nelson and Winter, 1982), population ecology (Hannon and Freeman, 1989), and various other uses of genetic analogies, is that firms are different because bounded rationality prevents them from becoming identical. Some management theorists look at this as unsatisfactory, because we believe that management matters in the sense that firms try to, and generally succeed in, doing the right things.

The present chapter presents a theory that combines elements of competitive differentiation with some bounded rationality. The argument is one in which competitive pressures cause a small deviation from rationality to snowball into a major deviation in the growth path of the firm. In two steps, the argument is that: (1) An initial error produces, in the firm's resource stock, a change that hurts in the execution of the current strategy, but helps in the execution of another strategy. (2) This puts the firm at a competitive disadvantage that it can escape by changing its strategy. The overall argument is consistent with D'Aunno, et al.'s (2000) view that both institutional and market forces contribute to organizational change. The idea that a missed step in the resource development process can have long-term consequences has some similarity with Cohen and Levinthal's claim that "lack of investment in an area of expertise early on may foreclose the future development of a technical capability in the area" (1990: 128).

Another feature of the proposed theory is that it operates on an essential function of the firm; the reporting of information to management. This links it to a theory of the firm, ensures that it applies to all firms, and fits well with informal accounts suggesting that most differences between firms are organizational, having to do with what groups of employees do and do well. We do not mean to imply that the mechanism proposed here is the only source of firm heterogeneity. Other explanations, such as the existence of past irreversible investments in physical assets (Sutton, 1991; Ghemawat, 1991), no doubt play a role in several cases.

Most of the chapter will be devoted to what we will call the "reporting error" version of the argument. The premise is that employees can report only a minor fraction of the available information to management, and that management's information constitutes a resources. So a reporting error will cause a slight misfit between a firm's resources and its product-market strategy. More importantly, a reporting error will put the firm at a competitive disadvantage relative to competitors who have not suffered such setbacks. So the firm finds itself with incentives to tweak its strategy away from competition and in the direction of its resources. Over time, this firm would acquire more resources to support the new strategy. The next time it suffers a reporting error, it would therefore not be an option to revert to the original strategy. Competition forces the firm further and further away and it becomes increasingly different from its original competitors. If many employees report a lot of information per period over a large number of periods, the chances of such bifurcating errors could be large.

Example

Because the preceding may seem a bit abstract and far-fetched, we will now offer a fictional and simplified, but still more specific example.

Consider two providers of executive education, who initially follow identical product-market strategies. In order for the firms to keep the content of their courses up to date, their employees collect information from students and instructors. Suppose now that an employee meets a customer, who is interested in more quantitative course content than the majority of the market. If this customer is particularly convincing, the employee may submit a report that gives "too much" detail about the type of quantitative course content customers want, and too little detail about what other customers want. One could now tell a reasonable story about management itself being misled by this report. However, assume that management understands that the report does not cover the wants of representative customers. Even so, compared to competition, management knows less about what non-quantitative course content is desired, but more about the quantitative content. So it is not unreasonable to predict that the firm will offer a slightly more quantitative course than its competitor.

This product differentiation leads to a decline in competition and the beginnings of market segmentation. To be really effective in its niche, the firm has to learn more about the market for quantitative courses, and perhaps differentiate its offerings more sharply from those of the competitor. When the next error occurs, the only attractive changes in the strategy will take the firm even further away from competition. So over time, it will collect different information, build up different resources, and offer a different product.

Plan of the chapter

In the next section, we develop the intuition behind the "reporting error" version of the argument in more detail. In order to convince skeptics that the argument is logically consistent, we then present a formal economic model of the process. To make clear that the reporting error story is just an example, albeit an important one, we end the chapter by describing several other cases in which errors can produce heterogeneity.

Intuition

In this section, we will go through several steps to make the argument at an intuitive level.

The Informational Implications of Specialization

It is not necessary to argue that modern society is characterized by a lot of division of labor. This is the *raison d'être* of all economies. We want to make the more rarely argued point that specialization of task implies specialization of information (Simon, 1976: 238; Polanyi, 1962). Agents learn about their environments, and as they perform different tasks, they learn different things. An R&D manager will tend to learn more about his area than somebody else's and a sales person will generally be the local expert on her district. Two trading partners, who may or may not be in the same firm, will tend to learn different things about the environment. So while specialization of task obviously implies a need for coordination, it also endows agents with heterogeneous information. Management can coordinate better if more of this information is taken into account, and the values of different pieces of information depend on the direction of coordination, that is the product-market strategy.

The above is just a new way of saying what we already know; that there is a relationship between organizational design and strategy. Every product-market strategy creates different demands for different pieces of information, and implies an ideal set of reporting rules. Similarly, a particular set of reporting rules provides management with a specific subset of the feasible information. The current and accumulated information available to management is in turn a resource that supports a specific strategy better than others. *We can therefore think of strategies and reporting rules as pairs. If one changes, so should the other.*

When do we have firms?

The need for ongoing adaptation to changes in the environment takes center stage in the adjustment-cost theory of the firm (Wernerfelt, 1997). The theory relies on the costs of adapting a trading relationship to new circumstances. (1) If the need for adaptation arises very infrequently, the players may negotiate changes on an as-needed basis. A house renovation is an example of this type of arrangement. (2) If the number of possible changes is very small, the players can refer to an ex ante agreed upon price, and change without any extra negotiation. This is, for example, what happens if you decide to ask for extra services at the hairdresser. (3) If frequent and diverse changes are needed, the above solutions do not work well, but a hierarchical relationship, or a firm, may. That is, in exchange for an average payment and the right to quit, one player may agree to let the other decide on the changes. The relationship between a manager and a secretary is an example of this.

The theory then implies that firms are used when diverse, high-frequency adjustments are needed: exactly when large amounts of new information have to reach management. So upward reporting of information is an essential property of firms. As evidence of the importance of communication, recall that *it is common to define someone's place in a firm by "who they report to,"* rather than by their productive role.

Fortunately, the firm often gives employees good incentives to communicate. While agents in an arm's length relationship may withhold information from each other in order to protect their bargaining positions, the upfront negotiation in the firm implies that there is less reason to withhold information there (Wernerfelt, 2001). Consistent with this, empirical studies have shown that there is more communication within, than between, firms (Tushman, 1978; Simester and Knez, 2002). Conversely, Monteverde (1995) demonstrated that activities demanding more cross-functional communication are more likely to be performed inside the firm.

What information gets reported to management?

If all information could be reported to management, they could in theory coordinate the team perfectly. However, this is not possible. Nor is it possible for management to tell employees exactly what information to report. On the assumption that information can be put into classes, the best management can do is to formulate rules asking for reports on certain classes of information. As noted above, management wants the rules to result in information that supports execution of its product-market strategy. Once the rules are formulated, individual employees have to decide how to apply them.

Both formulation and application of reporting rules are very complex tasks because only a tiny fraction of the employees' information can be reported to, and used by, management. Furthermore, the reporting choices are made under highly imperfect information. Management has to base its requests on judgements about what classes of information will prove important, and employees have to make guesses about whether trends are merely local or of broader importance. So while it is possible that management and employees can find the ex ante optimal set of reporting decisions, it is not unreasonable to predict occasional mistakes.

Why do different firms choose to focus on different information?

As noted above, we could also phrase this question as "why do firms have different resources?" or "why do firms pursue different strategies?" While there undoubtedly are many reasons for this, we want to think of ex ante identical firms that diverge because of seemingly innocuous errors in the reporting of information. In order to minimize the role of bounded rationality in the argument, we will assume that only one player errs, and that the error is short-lived. For simplicity, this can be thought of as a single error in a discrete time setting.

It is likely that most reporting errors have relatively minor impacts on firm performance. However, because one piece of information often aids in the interpretation or use of another, a missing report tends to reduce the value of other, correctly reported, information. This complementarity works both within and between time periods. For example, a missed report on an object ("the state of x_1 at time t") may make a another report on a related topic ("the state of x_2 at time t") or a later report on the same object ("the state of x_1 at time t+1") less valuable. In this way, an error can cause more widespread damage.

There are two forces through which such damage can cause a firm to change its strategy and reporting rules. There is a resource effect and a competitive effect. First, based on the mistaken report and the damage, the firm has (ever so little) additional information and "expertise" in a new area, but fewer than expected resources in the old product-market area. Using resource-based logic, it may thus make sense to build on the expertise and tweak the strategy towards the new resources. Second, because competitors now have relatively more expertise in the original product-market area, they can be expected to exploit their newfound advantages and amplify the differences. This makes the new area even more attractive because the firm can avoid competition from similar, but stronger, rivals.

If the new area suggested by the reporting error is sufficiently attractive, the two above effects may cause the firm to change its strategy and hence its future reporting practices. Over time, the attractiveness of the original strategy will decrease as the novel expertise accumulates. The next time it suffers a reporting error, it would therefore not be an option to revert to the original strategy. Competition forces the firm further and further away and it becomes increasingly different from its original competitors. In this way, a small deviation from the optimal reporting path can lead to a much larger deviation over time. So a population of homogeneous firms, with a small proclivity to make reporting errors, can over time develop quite different kinds of expertise, and thus become heterogeneous.

Model

In this section, we will formalize the above intuition in a mathematical model. This is done for the skeptics.

Modeling philosophy

The modeling follows the "low fat" philosophy that is very common in economics, but less so in the strategy field. The idea is to keep the model as simple as possible, such that the reader can readily identify the conditions that are sufficient for the results. This means that many realistic factors are omitted because they are not necessary.

In the present setting, this is most dramatically seen in the modeling of employees' local environments and the set of feasible messages. The idea is that these environments are so rich that only a coarse sketch of their information content can be reported to the central manager. This is modeled by assuming that reports are limited to just one, out of many possible, dimensions in each period. As a result, we get a very simple, but obviously not realistic, picture of the relative magnitudes.

Some of the simplifying assumptions are not completely innocuous. A good example of this is the parameter values. We choose to look at an error that leads the firm to an inferior, but acceptable, strategy. Many other parameter values will not yield divergence. However, because the models are so stylized, we are not really interested in showing when one does and doesn't get divergence – just that some errors can make it happen.

We will first look at a case in which each firm has only one employee, and then go on to the more complicated case with more employees.

The local environments

We assume initially that each firm has one employee, who learns about developments in a large number of areas. New information arrives in each area in each period. So an employee receives a large number of sequences, each of which contains information about trends in different aspects of consumer tastes or technologies. For simplicity, we assume that there is a one-to-one correspondence between sequences and strategies, in the sense that each sequence helps a firm keep a specific strategy in sync with the times. Bearing in mind that the firms initially pursue the same strategy, we assume that this strategy requires that the sequence $x(t)$, x(t+1), x(t+2), etc. gets reported to management. To put a label on the first reporting mistake, we use y() to represent a specific different sequence. In any given period, x(t) and y(t) are i.i.d. draws from a zero-mean distribution with variance σ^2. Being exceedingly abstract, we will say that a firm can execute the product-market strategy X perfectly in period t by setting the control variable $Dx(t)=2x(t-1)+x(t-2)$. Similarly, a firm can perfectly execute the Y strategy in period t if it sets $Dy(t)=2y(t-1)+y(t-2)$. This formulation captures the ideas, (1) that information has value beyond the current period, (2) that the value of different pieces of information depends on the firm's strategy, and (3) that strategy and reporting rules go together.

Organizational processes

Each firm has one manager, who in each period formulates and implements the product-market strategy that the firm will follow. The manager and the employee cannot be the same person, making it necessary that the latter report to the former. However, in each period, the employee can inform the manager of only one sequence. This captures, in a very crude way, the idea that the employee is unable to report everything he knows about his local environment.

To keep the model simple, and to clarify the impact of the bound on communication, we assume that a firm can not execute more than one product-market strategy in any given period, and that it cannot reliably get information on one strategy while executing another.

Competition

We look at two identical firms, *a* and *b*, and imagine that they compete on quantity. We use $Q_{xa}(t)$ to denote firm *a*'s period *t* sales if it follows the product-market strategy *X*, while $Q_{ya}(t)$ is its sales if it follows the *Y* strategy. Similarly, $Q_{xb}(t)$ and $Q_{yb}(t)$ are firm *b*'s period *t* sales with these two alternative strategies. We will use $D_{xa}(t)$ and $D_{ya}(t)$, respectively, to denote how firm *a* executes whatever strategy it chooses in period *t*. Analogously, if firm *b* follows the *X* strategy in period *t*, $D_{xb}(t)$ describes its execution, while if it chooses strategy *Y*, $D_{yb}(t)$ is its period *t* execution. We assume that firm *a*'s price with the *X* strategy is given by

$$P_{xa}(t) = \mu_x - [D_{xa}(t) - 2x(t-1) - x(t-2)]^2 - v[Q_{xa}(t) + Q_{xb}(t)], \tag{1}$$

where μ and v are positive. This formulation captures three reasonable premises, each of which is essential for the argument.

1 There is more demand for the firm's products if the strategy reflects the state of the environment. This is here modeled as $2x(t-1)+x(t-2)$.
2 There is less competition between firms using different strategies. This is modeled as an extreme case in which firms using the *X* strategy are completely unaffected by anything done by firms following the *Y* strategy.
3 Competition leads to lower prices.

Reflecting the assumption that the firms initially are identical, firm *b*'s price with the *X* strategy is determined symmetrically by

$$Pxb(t) = \mu_x - [D_{xb}(t) - 2x(t-1) - x(t-2)]^2 - v[Q_{xa}(t) + Q_{xb}(t)]. \tag{2}$$

Of course, if a firm does not follow the *X* strategy, its Qx is zero, and the other firm is a monopolist.

In parallel to the above, we assume that the prices for the *Y* strategy are

$$P_{ya}(t) = \mu_y - [D_{ya}(t) - 2y(t-1) - y(t-2)]^2 - v[Q_{ya}(t) + Q_{yb}(t)], \text{ and} \tag{3}$$
$$P_{yb}(t) = \mu_y - [D_{yb}(t) - 2y(t-1) - y(t-2)]^2 - v[Q_{ya}(t) + Q_{yb}(t)], \tag{4}$$

We will denote the unit costs of firms following the *X* and *Y* strategies by c_x and c_y, respectively. So the attractiveness of the two strategies differ only by $\mu_x - \mu_y$ and $c_y - c_x$.

Equilibrium when both firms follow the X strategy

We first look at the case in which both firms use the *X* strategy, and both managers are perfectly informed about the $x()$ sequence, such that they can set $D_{xa}(t) = 2x(t-1) + x(t-2)$ and $D_{xb}(t) = 2x(t-1) + x(t-2)$. In this scenario, firm *a* will select $Q_{xa}(t)$ to maximize the expected value of its profits. Dropping time arguments and assuming that unit costs are c_x, firm *a*'s profits are $[P_{xa} - c_x]Q_{xa}$. Firm *b* will aim to maximize the expectation of $[P_{xb} - c_x]Q_{xb}$. We assume that the firms do not observe each other's executions (the D's) before selecting quantities. Using that $D_{xa} = 2x(t-1) + x(t-2)$ and $D_{xb} = 2x(t-1) + x(t-2)$, the first order conditions are

$$\mu_x - c_x - vQ_{xb}^* - 2\,vQ_{xa}^* = 0, \text{ and} \tag{5}$$
$$\mu_x - c_x - vQ_{xa}^* - 2\,vQ_{xb}^* = 0. \tag{6}$$

In equilibrium, $Q_{xa}^* = Q_{xb}^* = [\mu_x - c_x]/3\,v$, and bôth firms make profits of

$$(\mu_x - c_x - v2[\mu_x - c_x]/3\,v)\ \mu_x - c_y/3v = [\mu_x - c_x]^2/9\,v \tag{7}$$

per period.

One firms follows the Υ strategy

By reasoning identical to that used above (or really just by relabeling), we see that if both firms follow the Υ strategy, they will each make per period profits of $[\mu_y - c_y]2/9\,v$. We will assume that $\mu_x - c_x > \mu_y - c_y$, the X strategy is more attractive than the Υ strategy. So if both firms use in the Υ strategy, they will earn less than if they both use the X strategy.

However, it is possible than a firm could do better by being a "monopolist" in the Υ strategy than by competing with the X strategy. To check this, we note that firm a, if it pursues the Υ strategy while firm b pursues the X strategy, would maximize the expectation of $[P_{ya} - c_y]Q_{ya}$. If its manager is perfectly informed about the $y()$ sequence, she can set $D_{ya} = 2y(t-1) + y(t-2)$, and the first order condition is

$$[\mu_y - c_y] - 2\,vQ_{ya}^* = 0. \tag{8}$$

This gives profits of

$$(\mu_y - c_y - v[\mu_y - c_y]/2\,v)\ [\mu_y - c_y]/2\,v = [\mu_y - c_y]^2/4\,v. \tag{9}$$

Comparison with (7), the "duopoly" profits from the X strategy, we see that the firm makes higher profits in the former scenario if

$$[\mu_y - c_y] < 2[\mu_x - c_x]/3. \tag{10}$$

In the following, we will be looking at cases in which (10) holds. Without this assumption, the firms would prefer to become heterogeneous simply in order to avoid competition. Since we are trying to evaluate a different explanation for the same phenomenon, we will want to neutralize the purely competitive argument. So between perfect information scenarios, we assume that both firms would prefer to follow the X strategy, in spite of the fact that they have to compete with each other.

A reporting error

Let us therefore start with a situation in which both firms follow the X strategy and intend to keep their managers perfectly informed about the $x()$ sequence. Suppose now that an error occurs in firm a at time $t - 1$, such that the manager receives $y(t - 1)$ instead of $x(t - 1)$. Should the firm switch to the Y strategy in period t and thereafter?

If firm a switches to the Y strategy, its manager does not know $y(t - 2)$, so she has to set $D_{ya}(t) = 2y(t - 1) + Ey(t - 2) = 2y(t - 1)$, and

$$E\,[D_{ya}(t) - 2y(t - 1) - y(t - 2)]^2 = \sigma^2. \tag{11}$$

The ignorance leads to an inferior execution, and lower demand as modeled in (3). On the other hand, if firm a decides to stay with the X strategy, the manager does not know $x(t - 1)$ and has to set $D_{xa}(t) = 2Ex(t - 1) + x(t - 2) = x(t - 2)$, and

$$E\,[D_{xa}(t) - 2x(t - 1) - x(t - 2)]^2 = 4\sigma^2. \tag{12}$$

So in period t alone, firm a's resources, the knowledge of $x(t - 2)$ and $y(t - 1)$, are a better fit for the X strategy, because more recent information is more valuable. However, two additional factors favor a switch. First, there is a competitive effect: while firm a has no competitor if it switches to the Y strategy, firm b will exploit a's weakness if it stays with the X strategy. Second, there is a resource effect: while $x(t-2)$ will cease to be of value in period $t + 1$, $y(t - 1)$ will favor the Y strategy for one more period.

To see the implications of these effects, we first assume that firm a stays with the X strategy. Since firm b does not observe the execution $D_{xa}(t)$ before setting its quantity, we make the conservative assumption that it will not know that firm a's manager did not learn $x(t - 1)$. We will furthermore assume that firm b competes as if the probability of such a mistake is very, very low. For simplicity, we set it to zero. So $Q_{xb}^*(t) = [\mu_x - c_x]/3\,v$, and the first order condition for $Q_{xa}^*(t)$ will be

$$\mu_x - c_x - 4\sigma^2 - vQ_{xb}^*(t) - 2\,vQ_{xa}^*(t) = 0 \tag{13}$$

In equilibrium,

$$Q_{xa}^*(t) = [\mu_x - c_x]/3v - 2\,\sigma^2/v, \text{ and} \tag{14}$$

firm a's profits in period t are therefore

$$[\mu_x - c_x - 4\sigma^2 - (2\mu_x - 2c_x - 6\sigma^2)/3]\,[\mu_x - c_x - 6\sigma^2]/3\,v = [\mu_x - c_x - 6\sigma^2]^2/9\,v \tag{15}$$

If on the other hand firm a switches to the Y strategy, we can use (8) to see that its quantity in period t will be

$$Q_{ya}^*(t) = (\mu_y - c_y - \sigma^2)/2\,v, \tag{16}$$

While profits in period t are

$$[\mu_y - c_y - \sigma^2]^2/4\,v. \tag{17}$$

Comparing (17) and (19), we see that the presence of the competitor using the X strategy makes the ignorance more costly there. Firm b is able to exploit its competitive advantage.

The final difference between firm a's situation in the two strategies is that the information $y(t-1)$ will be valuable also in period $t + l$, while $x(t-2)$ will not. So if firm a switches to the Υ strategy and its manager receives $y(t)$, (9) tells us that it earns a profit of $[\mu_y - c_y]^2/4\,v$ in period $t + 1$. If it stays with the X strategy and its manager receives $x(t)$, firm b will know, from observing the inferior execution $D_{xa}(t) = x(t-2)$, that firm a's manager did not receive $x(t-1)$. So while firm b's first order condition is (6), a's first order condition in period $t + 1$ is

$$\mu_x - c_x - \sigma^2 - vQ_{xb}{}^*(t + 1) - 2\,vQ_{xa}{}^*(t + 1)> = 0, \tag{18}$$

and in equilibrium

$$Q_{xa}{}^*(t + 1) = (\mu_x - c_x - 2\,\sigma^2)/3\,v, \text{ and} \tag{19}$$
$$Q_{xb}{}^*(t + 1) = (\mu_x - c_x + \sigma^2)/3\,v. \tag{20}$$

Firm a's profits in period $t + 1$ are therefore

$$[\mu_x - c_x - \sigma^2 - (2\mu_x - 2c_x - \sigma^2)/3]\;[\mu_x - c_x - 2\sigma^2\,]/3v = [\mu_x - c_x - 2\sigma^2]^2/9v. \tag{21}$$

So the two reasons why a reporting error makes the Υ strategy more attractive to firm a, are that its resources are a better fit in periods t and $t+1$, and that it becomes competitively disadvantaged if it stays with the X strategy.

To look at the combined implications of this, we assume that firm a discounts future profits by the factor $\delta<1$ per period. The net present value of switching to the Υ strategy is

$$[\mu_y - c_y - \sigma^2]^2/4\,v + \delta[\mu_y - c_y]^2/4v + [\delta^2/1-\delta][\mu_y - c_y]^2/4v, \tag{22}$$

while the net present value of staying with the X strategy is

$$[\mu_x - c_x - 6\sigma^2]^2/9v + \delta[\mu_x - c_x - 2\sigma^2]^2/9v + [\delta^2/1-\delta][\mu_x - c_x]^2/9v. \tag{23}$$

Comparing, we see that (22) may be larger than (23) even if $[\mu_y - c_y] < 2[\mu_x - c_x]/3$. For example, if $\mu_x - c_x = 31$, $\mu_y - c_y = 20$, $v = 1$, $\sigma^2 = 5$, and $\delta = 1/2$, then the value of (22) is 56.25+50+50=156.25, while (23) is 1/9+441/18+961/18=702/9=78. So this example shows that *a single reporting error may cause a firm to permanently switch from the ex ante more attractive X strategy to the Υ strategy.*

If the firm later suffers another reporting error, say getting $z(T)$ instead of $y(T)$, it may well be that $[\mu_z - c_z]$ is too small to justify a further change in strategy. However, it seems reasonable to expect that some later errors will be sufficiently attractive to produce further changes in the firm's strategy. While we have not described the "distances" between X, Y, and other strategies, it seems reasonable to conjecture that the differentiation process explained above will result in increasing differences.

Extension: several employees

The above result was driven by two forces: the fact that the mistaken report has value in periods t and $t+1$, and the fact that the error puts the firm at a competitive disadvantage if it presses on with the original strategy. In the case where several employees report correctly, the first factor works against bifurcation, but the second may still make it the optimal response. In addition, the presence of more employees increases the potential for errors. We will now change the model to look at this.

We assume that each firm has n employees, each of whom observes a different aspect of the x and y sequences. Specifically, employee $i = 1, 2, \ldots, n$, observes $x_i(t)$ and $y_i(t)$, but can only report on one of these. We assume that the reports are complementary in the sense that a manager only knows $x(t)$ if all the firm's salesmen report on their $x_i(t)$'s, and similarly only knows $y(t)$ if all the firm's salesmen report on their $y_i(t)$'s.

Suppose now that the firms are competing on the basis of the X strategies, but that one of firm a's employees erroneously report $y_i(t-1)$. If the firm stays with the X strategy, its period t profits in periods t, $t+1$, and $t+2$ are given by (15), (21), and (7). So the net present value is again that expressed in (23). If the firm switches to the Y strategy, its period t profits will be

$$[\mu_y - c_y - 4\sigma^2]^2/4v, \tag{24}$$

while its profits in periods $t+1$ and $t+2$ are those in (17) and (9). Consequently, the net present value is

$$[\mu_y - c_y - 4\sigma^2]^2/4v + \delta[\mu_y - c_y - \sigma^2]^2/4v + [\delta^2/1-\delta][\mu_y - c_y]^2/4v \tag{25}$$

Using the same numerical example as before, the value of (25) is 0+28.125+50 = 78.125. Recalling that the value of (23) is 78, we see that the firm also in this case should switch to the Y strategy. As illustrated by this example, *the chance that an individual reporting error will cause the firm to change is smaller when there are more employees. On the other hand, we would expect more errors in firms with more employees.*

Broader Versions

We have chosen to lead with the "reporting error" version of the argument, because reporting is an essential activity in firms, and because it is easy to formalize. However, the theory should apply to a much wider set of activities inside firms. The purpose of the present section is to go through several other examples of the story. The key aspect in all of these examples is that *an error produces, in the firm's resource stock, a change that hurts in the execution of the current strategy, but helps in the execution of another strategy.* Once understood, the point is rather simple, so we will very briefly describe possible results of several accidental deviations from intended actions.

Incorrect time allocation
If an R&D employee or a salesperson spends what is ex ante "too much" time on a lead, it may hurt the execution of the current strategy in terms of costs and timeliness. However, the allocation may ex post yield valuable information (discovering aspertame).

Too low quality
If an employee does "too bad" a job on some aspect of a product or service, it will hurt the firm's reputation in its current market, but perhaps suggest future designs that could be targeted at different segments.

Too high quality
In the opposite case, where the employee does a job that is "too good," current costs will increase, but the error may reveal information that can be used to enhance the quality of future offerings.

Components that do not fit
Suppose that an employee, by mistake, produces a component that does not fit with those produced by his colleagues. This will hurt the firm's ability to deliver on time in the original market, and at the same time gives it some production experience that could be used to make different designs.

Summary

We have tried to offer a new explanation for the existence of persistent differences between firms. The basic idea is that a minor error can snowball into a major deviation. Compared to other explanations of the same phenomenon, the theory has the pleasant property that a very small amount of bounded rationality, followed by perfectly rational behavior and competitive pressure, can produce the effect. Two further attractive properties of the explanation are that (i) it is rooted in essential properties of the firm and therefore applies to all firms, and (ii) that it is based on a theory of the firm, and thus relates the RBV to a broader body of theory.

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