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ASSET STOCK ACCUMULATION AND SUSTAINABILITY OF COMPETITIVE ADVANTAGE*

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Given incomplete factor markets, appropriate time paths of flow variables must be chosen to build required stocks of assets. That is, critical resources are accumulated rather than acquired in "strategic factor markets" (Barney 1986). Sustainability of a firm's asset position hinges on how easily assets can be substituted or imitated. Imitability is linked to the characteristics of the asset accumulation process: time compression diseconomies, asset mass efficiencies, inter-connectedness, asset erosion and causal ambiguity.
(COMPETITIVE ADVANTAGE; RESOURCE ACCUMULATION; IMITATION)

Recently, a number of scholars have expressed the concern that much of the strategy literature focuses too narrowly on privileged product market positions as a basis for competitive advantage and above-normal returns (*e.g.*, Gabel 1984; Wernerfelt 1984; Barney 1986). The fact that resource bundles need to be deployed to achieve or protect such privileged product market positions is often overlooked. This creates both analytical and managerial problems. The analytical problem stems from the fact that if a privileged product market position is achieved or protected by the deployment of scarce assets, it is necessary to account for the *opportunity cost* of those assets. Unless the opportunity cost of those scarce assets is properly accounted for, measured returns of product market activities will be inflated. The managerial problem stems from the fact that hidden cross-subsidization, in turn, distorts performance appraisal and capital allocation decisions. In addition, managers often fail to recognize that a bundle of assets, rather than the particular product market combination chosen for its deployment, lies at the heart of their firm's competitive position. In such cases, inadequate attention is given to protecting these assets from being imitated, bid away to competitors, or rendered valueless as a result of substitution by other assets.

A recent statement reflecting this critique is presented by Barney (1986). To help analyze the cost of implementing product market strategies, Barney introduces the concept of a "strategic factor market" defined as "a market where the resources necessary to implement a strategy are acquired" (p. 1231). For example, the market for market share is cited as a relevant strategic factor market for implementing a cost leadership strategy. Barney then argues that in the absence of imperfections in strategic factor markets, buyers will not be able to extract superior economic performance from any factor, since the cost of acquiring strategic resources will approximately equal the economic value of those resources once they are used to implement product market strategies. Firms may, however, have different expectations about the future value of a strategic asset. In that case, strategic factor markets are "imperfectly competitive" (p. 1231). According to Barney, firms may obtain above normal returns only when they have superior information, when they are lucky, or both.[1] It is argued that all other apparent sources of either quasi-rents or market power ultimately boil down to either superior information or luck. The managerial implication drawn is that firms should focus their analysis mainly on their "unique" skills and resources rather than on the competitive environment.

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[1] Barney's work is one of several contributions emphasizing this point. See, *e.g.*, Alchian (1950), Mancke (1974), Rumelt (1984); for a different view, see, *e.g.*, Caves, Gale and Porter (1977).

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The purpose of this paper is threefold: (1) to discuss some of the limitations inherent in the concept of "strategic factor markets", (2) to put forward a complementary framework based on the notion of asset stock accumulation, and (3) to develop guidelines for assessing the sustainability of a firm's competitive advantage.

Incomplete vs. Imperfect Factor Markets

While Barney focuses on market "imperfections", the central question whether all required assets to implement a given strategy are actually traded is not examined. Instead, it is assumed that all required assets can be bought and sold. Granted, many inputs required to implement a strategy may be acquired in corresponding factor markets, and in those cases, the concept proposed by Barney is indeed useful to evaluate the opportunity cost of deploying those assets in product markets. Yet, it is not clear that *all* resources are actually bought and sold. In fact, some of the very examples suggested by Barney cast serious doubt on the universal validity of this assumption. The example of corporate reputations (Barney 1986, p. 1232) is a case in point. Are reputations for quality, for "toughness" (readiness to retaliate) and so on, really bought in "the market for corporate reputations"? Can a business school perceived as a teaching institution purchase a reputation for research excellence in a market for "research institute reputations"? Can a scholar buy his or her reputation for quality work in a strategic factor market?

The implementation of a strategy may require assets which are nonappropriable. Nonappropriability may stem from various sources, such as the absence of well-defined property rights, or "bookkeeping feasibility" problems (see, *e.g.*, Meade 1952; Bator 1958). Clearly, markets for such assets do not exist. Loyalty of one's dealers or the trust of one's customers cannot be bought. Dealer loyalty must be cultivated, and customers' trust must be earned through a history of honest dealings. As Arrow (1974, p. 23) points out: "Unfortunately, [trust] is not a commodity which can be bought very easily. If you have to buy it, you already have some doubts about what you've bought. Trust and similar values, loyalty or truth telling, are examples of what the economist would call "externalities". They are goods, they are commodities; they have real, practical economic value; [· · ·] But they are not commodities for which trade on the open market is technically possible or even meaningful".

In addition, the successful implementation of a strategy often requires highly firm-specific assets, as opposed to undifferentiated inputs. Firms may, of course, acquire imperfect substitutes for the desired strategic input factor(s) and adapt them, at a cost, to the specific use it intends. For example, firms do not employ "generic labor", but people endowed with firm-specific skills and values. "Generic labor" is rented in the market; firm-specific skills, knowledge and values are accumulated through on the job learning and training. In sum, as Williamson (1979) points out, the idiosyncratic nature of firm-specific assets precludes their tradeability on open markets. Being nontradeable, the firm-specific component is *accumulated* internally.

Under the assumption of complete factor markets, competitors can replicate any asset bundle, and dispose of it at will, merely by purchasing and selling the required components at going market prices. So firms may as well realize the value of their asset bundles through the relevant factor markets instead of deploying them in product markets. Clearly, the assumption that factor markets are complete may not be pushed too far. As Caves (1980, p. 65) pointed out several years ago, "at least some [factors] are simply not traded on open markets that permit capitalizing their differential qualities into their contract prices. Thus rents that the firm can earn are not entirely passed along to the unique fixed factors responsible for them".

In sum, firms deploy both tradeable and nontradeable assets. Many inputs required for the implementation of a firm's product market strategy may be bought and sold in

corresponding factor markets. The concept proposed by Barney is indeed useful to evaluate the opportunity cost of deploying these assets. However, the deployment of such assets does not entail a sustainable competitive advantage, precisely because they are freely tradeable. Factor markets, however, are not complete. Some factors are simply not traded on open markets. Thus, a complementary framework is required to gauge the sustainability of the stream of quasi rents generated through the deployment of nontradeable assets. The remainder of our paper proposes such a framework, based on the notion of accumulation of asset stocks.[2]

Accumulation of Asset Stocks

When an asset is nontradeable, the option to realize its value in a factor market is not available. In order to tap its rent earning potential, the owner of such an asset has to deploy it in product markets where, owing to the factor's nontradeability, it may remain in fixed supply.[3] Conversely, a firm which does not own a nontradeable asset which it requires for the implementation of its product market strategy is constrained to "building" this asset.

For example, a reputation for quality may be built (rather than bought) by following a consistent set of production, quality control etc. policies over some period of time. Similarly, a reputation for "toughness" (readiness to retaliate) is established through a history of aggressive behavior, and so on. The same goes for factors such as firm-specific human capital, dealer loyalty, R&D capability (as opposed to a specific technology), etc. The common element in all of these cases is that the strategic asset is the cumulative result of adhering to a set of consistent policies over a period of time. Put differently, strategic asset *stocks* are *accumulated* by choosing appropriate time paths of *flows* over a period of time.[4]

The fundamental distinction between stocks and flows may be illustrated by the "bathtub" metaphor: at any moment in time, the stock of water is indicated by the level of water in the tub; it is the cumulative result of flows of water into the tub (through the tap) and out of it (through a leak). In the example of R&D, the amount of water in the tub represents the stock of know-how at a particular moment in time, whereas current R&D spending is represented by the water flowing in through the tap; the fact that know-how depreciates over time is represented by the flow of water leaking through the hole in the tub. A crucial point illustrated by the bathtub metaphor is that *while flows can be adjusted instantaneously, stocks cannot.* It takes a consistent pattern of resource flows to accumulate a desired change in strategic asset stocks.

It follows that a key dimension of strategy formulation may be identified as the task of making appropriate choices about strategic expenditures (advertising spending, R&D outlays, etc.) with a view to accumulating required resources and skills (brand loyalty,

[2] Of course, Barney's fundamental argument about competition for resources may be extended in a straightforward manner from competition in factor markets to competition in resource accumulation. Thus, our paper should not be read as a prescription for creating competitive advantage. Indeed, it appears logically impossible to formulate a set of rules to systematically create competitive advantage. This issue has been dealt with elsewhere (Barney 1988), and is not the focus of the present paper, which addresses the issue of sustainability of competitive advantage.

[3] At least for some time. Nontradeability is a necessary, but not a sufficient condition; see below.

[4] The fundamental notion that strategic expenditures should be viewed as investments in (intangible) asset stocks goes back at least 25 years. In a classic paper on advertising, Telser (1961, p. 197) pointed out that ". . . consumers tend to forget brands and continuous advertising is needed to maintain a given rate of sales. Thus, advertising expenditures can be viewed as a capital good that depreciates over time and needs maintenance and repair." Similarly, "The annual research and development expenditures of a firm are considered to be investments which add to a firm's stock of knowledge. This stock of knowledge is depreciating over time so that the contribution of older R&D investiments becomes less valuable as time passes" (Hall, Griliches and Hausman 1986, p. 265).

technological expertise, etc.). In other words, appropriate time paths of relevant flow variables must be chosen to build required asset stocks. *Critical* or *strategic* asset stocks are those assets which are *nontradeable*, and as will be argued below, *nonimitable* and *nonsubstitutable*.

Sustainability of Privileged Asset Positions

Sustainability of a firm's privileged asset position hinges on how easily it can be replicated. If certain assets cannot be bought in factor markets, rivals may either attempt to *imitate* them by accumulating similar asset stocks of their own or they may try to *substitute* them by other assets.

Imitation of Asset Stocks

Whether imitation of a particular asset stock will be time consuming, costly, or both depends on the relative ease with which rival firms are able to accumulate a similar asset stock of their own. That is, imitability of an asset stock is related to the characteristics of the process by which it may be accumulated. In general, the following characteristics can be identified: *time compression diseconomies*, *asset mass efficiencies*, *interconnectedness of asset stocks*, *asset erosion*, and *causal embiguity*.[5]

Time Compression Diseconomies. The importance of time compression diseconomies for sustaining competitive advantage is perhaps best illustrated by the following dialogue between a British Lord and his American visitor:

> "How come you got such a gorgeous lawn?" "Well, the quality of the soil is, I dare say, of the utmost importance." "No problem." "Furthermore, one does need the finest quality seed and fertilizers". "Big deal". "Of course, daily watering and weekly moving are jolly important". "No sweat, jest leave it to me!". "That's it." "No kidding?!" "Oh, absolutely. There is nothing to it, old boy; just keep it up for five centuries".

In addition, the irresistible Thorstein Veblen would have commented, genuine blue-blooded nobility such as his Lordship's can only be produced through several generations of careful breeding. Clearly, both examples illustrate the importance of time compression diseconomies as a source of early-mover advantages.

Conceptually, time compression diseconomies and the notion of "strictly convex adjustment costs" in the theory of capital investment to which they are related express the same fundamental mechanism: the "law of diminishing returns" when one input, *viz.* time, is held constant. For example, MBA students may not accumulate the same stock of knowledge in a one-year program as in a two-year program, even if all inputs other than time are doubled. In the case of R&D, the presence of time compression diseconomies implies that maintaining a given rate of R&D spending over a particular time interval produces a larger increment to the stock of R&D know-how than maintaining twice this rate of R&D spending over half the time interval. Empirically, this does indeed seem to be the case (see, *e.g.*, Scherer 1967; Mansfield 1968).[6] "Crash" R&D programs, for example, are typically less effective than programs where annual R&D outlays are lower but spread out over a proportionally longer period of time.

Asset Mass Efficiencies. Sustainability will be enhanced to the extent that adding increments to an existing asset stock is facilitated by possessing high levels of that stock. The underlying notion is that "success breeds success": historical success translates into favorable initial asset stock positions which in turn facilitate further asset accumulation.

[5] Note that it is not implied here that all asset accumulation processes exhibit the properties described below. In fact, many do not. It is suggested only that imitability in any particular case is determined by the extent to which asset accumulation processes exhibit these properties.

[6] The assumption of time compression diseconomies is also very common in recent theoretical work on R&D. See, *e.g.*, Reinganum (1982).

For example, firms who already have an important stock of R&D know-how are often in a better position to make further breakthroughs and add to their existing stock of knowledge than firms who have low initial levels of know-how. Similarly, a firm's cumulative sales base may be an important determinant of its current sales. This will be the case when "word of mouth" increases product awareness, when "bandwagon effects" influence buying behavior, or when the value of a product or a service increases with the size of the "network" of adopters (as, *e.g.*, in the market for personal computers, markets for franchises, automobile dealer networks, etc.).

The competitive implication is clear: when asset mass efficiencies are important, building asset stocks starting from low initial levels may be difficult. Difficulties in "catching up" may be greater still when the asset accumulation process exhibits discontinuities, *i.e.* when critical mass is required. Setting up a dealer network in a new geographic area is a case in point: one of the toughest problems may to establish a beachhead.

Interconnectedness of Asset Stocks. Accumulating increments in an existing stock may depend not just on the level of that stock, but also on the level of *other* stocks. For example, to the extent that new product and process developments find their origin in customer requests or suggestions (Von Hippel 1978), it may be harder to develop technological know-how for firms who do not have an extensive service network. Here, the difficulty of building one stock is related, not to the initial level of that stock, but to the low initial level of another stock which is its complement.

Asset Erosion. As is the case with physical plant and equipment, all asset stocks "decay" in the absence of adequate "maintenance" expenditures. R&D know-how depreciates over time because of technological obsolescence; brand awareness erodes because the consumer population is not stationary (existing consumers leave the market, while new consumers enter), consumers forget, etc. The characteristics of the decay process have several managerial implications. There is an important relation between an asset's "half life" and strategic entry deterrence. To *credibly* deter entry, firms must be *committed* to punitive post entry behavior. Thus, output and advertising policies are not, in general, credible vehicles for entry deterrence, whereas capacity and brand loyalty are. The reason is that the former, pertaining to flow variables, could be adjusted at will should entry occur,[7] whereas the latter, being stock variables cannot. In general, only variables that have the nature of a stock, as opposed to a flow, can carry a credible threat, and the more so, the slower the stock is decaying over time. If the stock is decaying rapidly over time, a credible threat is harder to establish (see, *e.g.*, Eaton and Lipsey 1980).

More generally, higher decay rates weaken the inherent asymmetry between firms having important asset stocks and those having lower asset stock levels. Yet, it is important to note that a firm's dominant position may be sustainable even though its underlying asset base is subject to rapid decay, provided it faces lower "maintenance" costs. This may be the case when a firm enjoys greater efficiency in asset accumulation due to asset mass efficiencies and/or asset interconnectedness. Conversely, the presence of time compression diseconomies in addition to rapid asset erosion makes it extremely hard to sustain asset stock level asymmetries.

Causal Ambiguity. So far, we have implicitly assumed that the process of accumulation of asset stocks in both deterministic and continuous. These may be reasonable simplifications for some industries, but not for others. In the pharmaceutical industry, for example, the process is better described as stochastic and discontinuous. The underlying process can perhaps be described as a "jackpot model". Firms sink R&D flows in projects with highly uncertain outcomes, and only few firms actually "hit the jackpot" by bringing out highly successful products. The stocks *vs.* flows framework discussed earlier can easily

[7] Firms may, however, *contractually commit* themselves to a given output level; in this case contract length becomes critical. See Aghion and Bolton (1987).

be accommodated to deal with such industries. In fact, the levels of the firm's stocks will determine each firm's probability of success, *i.e.* different firms try their fortunes on different slot machines, the odds of each machine being set by the levels of that firm's relevant asset stocks.

The stochastic nature of the accumulation process may stem from our inability to *identify* some of the relevant variables as well as our inability to *control* them. Indeed, for some asset stocks it may be impossible to fully specify which factors play a role in their accumulation process, even for firms who already own those stocks (Nelson and Winter 1982). Clearly, imitation of those stocks by other firms becomes next to impossible. Causal ambiguity about the process of asset stock accumulation is captured by the notion of "uncertain imitability" (Lippman and Rumelt 1982), suggesting that sustained performance differences may be found even in perfectly competitive industry settings.

Summarizing, the degree of imitability of a particular asset is determined by the interplay of a number of basic properties which may or may not characterize that asset's accumulation process: *asset mass efficiencies* (the initial level of an asset stock significantly influences the pace of its further accumulation), *time compression diseconomies* (decreasing returns to the fixed factor time), *interconnectedness* (the pace of an asset's accumulation is influenced by the level of other asset stocks), *asset erosion*, and *causal ambiguity* about the accumulation process.

Substitution of Asset Stocks

Even when, for reasons outlined above, imitation is not a major threat, asset stocks may still be vulnerable to *substitution* by *different* asset stocks. The fundamental danger lies in the fact that successful substitution threatens to render the original asset stocks obsolete, typically because they no longer create value to the buyer. The strategy followed by Canon to upset Xerox's dominant position in the low to medium volume copier market provides a good example. Capitalizing on its stock of R&D, Canon was able to "design service out of the product", thereby substituting superior product design for Xerox's extensive service network. As a result of the substitution process, Xerox's service network became partly obsolete, as the value it created for the buyer had sharply diminished.

Conclusion

As Barney (1986) correctly points out, firms need to be analyzed from the resource side as well as from the product side: if a privileged product market position is achieved or protected by the deployment of scarce assets, it is necessary to account for the *opportunity cost* of those assets.

Many inputs required to implement a strategy may be acquired in corresponding input markets. In those cases, market prices are indeed useful to evaluate the opportunity cost of deploying those assets in product markets. However, the deployment of such assets does not entail a sustainable competitive advantage, precisely because they are freely tradeable. Factor markets, however, are not complete. Some factors are simply not traded on open markets. Thus, a complementary framework is required to gauge the sustainability of the stream of quasi rents generated through the deployment of nontradeable assets. The proposed framework is based on the notion of *asset stock accumulation.*

The rent earning potential of a nontradeable asset may be tapped by deploying it to product markets. Conversely, nontradeability is required to ensure that the asset, once deployed in a given product market, remains in fixed supply. Competitors who need an asset which is nontradeable are constrained to "building" it. Asset stocks are "built" or *accumulated* through a consistent time pattern of expenditures or flows.

Sustainability of a firm's asset position hinges on how easily it can be replicated. If

certain assets cannot be bought in factor markets, rivals may either attempt to *imitate* them, by accumulating similar asset stocks of their own, or they may try to *substitute* them by other assets. Imitability depends on the extent to which asset accumulation processes exhibit the following properties: time compression diseconomies, asset mass efficiencies, interconnectedness, asset erosion, and causal ambiguity. Substitution threatens to render the original asset stocks obsolete, because they no longer create value to the buyer. In short, asset stocks are *strategic* to the extent that they are *nontradeable*, *nonimitable* and *nonsubstitutable*.

Within the framework presented in this paper, a firm's current *strategy* involves choosing *optimal time paths of flows*, whereas its *competitive position* and hence its potential profitability is determined by the level of its *stocks*. Strategic flows enter the current profit equation only in a "trivial" fashion, *viz.* on the expenditure side.[8] It follows that attempts to explain performance differences among firms on the basis of current strategic expenditures only are pointless and likely to lead to conflicting results. Thus, the framework has important implications for empirical strategy-performance research. A central objective has been to explain differences in firm performance. That this endeavor has not led to unequivocal results is well known (see, *e.g.*, McGee and Thomas 1986). In our opinion, this is due to a large extent to the lack of attention paid to variable selection in terms of the fundamental distinction between strategic stocks and flows. Research on the performance implications of strategic group membership also illustrates the same basic problem. While some studies found performance differences among strategic groups, others did not find such evidence (see Cool and Schendel 1987 for an overview). Although other factors may contribute to this phenomenon, clearly the failure to distinguish between strategic flow and strategic stock variables to identify strategic groups precludes unequivocal results. It is hoped that this paper will prove useful to further empirical research by suggesting a theoretical framework for variable selection.

[8] See, *e.g.*, Arrow and Nerlove (1962), where, in contrast to the earlier Dorfman and Steiner (1954) model, current advertising does not directly enter the firm's demand function, but only indirectly through the accumulated stock of "goodwill"; the flow of current advertising outlays enters the current profit equation only as a cost.

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ASSET STOCKS AND SUSTAINED COMPETITIVE ADVANTAGE: A COMMENT

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In their paper, Dierickx and Cool suggest that the strategic factor markets model developed in Barney (1986a) cannot be applied in the analysis of sustained competitive advantages due to asset stocks accumulated over time. In this comment, it is shown that the discussion of asset stocks extends and complements, rather than limits, the strategic factor markets model. This is done by analyzing how the strategic factor markets model can be used to examine the cost of accumulating asset stocks over long periods of time, and how these costs will compare to the value of strategies that are implemented exploiting these asset stocks.
(COMPETITIVE ADVANTAGE; RESOURCE ACCUMULATION; IMITATION)

In their analysis of sources of sustained competitive advantage, Dierickx and Cool argue that the concept of strategic factor markets developed in Barney (1986a), though helpful in understanding the conditions under which certain strategies will generate sustained competitive advantages for firms, is limited in its application. The main limitation cited by Dierickx and Cool is that not all the assets firms use to implement strategies can be bought and sold in strategic factor markets. When strategic assets cannot be traded, due perhaps to their "nonappropriability" or their highly "firm specific" character, Dierickx and Cool argue that strategic factor market arguments do not apply, and that a model that distinguishes between strategic "stocks and flows" is necessary in order to understand sources of sustained competitive advantage.

The purpose of this reply is to suggest that the "tradeability" question that is apparently

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