EVOLUTIONARY ECONOMICS, 
ENDOGENOUS GROWTH MODELS, 
AND RESOURCE-ADVANTAGE THEORY

Shelby D. Hunt
Texas Tech University

INTRODUCTION

Over two decades ago, Nelson and Winter [1974] examined the gap between theories of economic growth in the evolutionary and neoclassical traditions. Since their seminal article, evolutionary economics has expanded in numerous directions [Nelson, 1995]. Witt’s [1992] review identifies four of the major directions as: (1) the Schumpeterian stream [e.g., Nelson and Winter, 1982], which focuses on technical progress, innovation, industrial development, business cycles, and growth, (2) the Austrian-subjectivist works [e.g., Hayek, 1978], which emphasize subjective knowledge and competition as a discovery process, (3) the institutionalist stream [e.g., Hodgson, 1993], which focuses on how routinized patterns of behavior and habits of thought affect economic change, and (4) the neo-Darwinian works [e.g., Metcalfe and Saviotti, 1991], which rely on explicit biological analogies to explain change. Though diverse, Witt [1992] argues that a coherent research program is gaining shape in evolutionary economics.

The burgeoning literature on evolutionary economics notwithstanding, no one would dispute that a significant gap still remains between the evolutionary and neoclassical approaches to economics. This article proposes that evolutionary economics can further narrow the gap by developing process theories that provide theoretical foundations for formal models in the neoclassical tradition. I argue that an evolutionary process theory of competition, labeled “resource-advantage” theory and discussed in the institutional economics literature [Hunt, 1997a], can provide a theoretical foundation for formal models of endogenous economic growth. In so doing, the article shows how neoclassical and evolutionary theories—rather than being mutually exclusive—can complement each other.

First, I discuss formal models of endogenous economic growth and show why a process theory of competition with four specific requisites is needed to theoretically ground such models. I then overview resource-advantage theory and show that it has the needed requisites.

Before proceeding, however, a terminological must be addressed. Like Nelson and Winter [1974; 1982], I use “neoclassical tradition” and “neoclassical theory” as summary terms for research that stems from viewing competition as equilibrium-seeking and perfect competition as an ideal competitive form. I do not use these labels to signify all of mainstream economics. Indeed, it is obvious that many mainstream works on competition depart significantly from one or more of the character-
istics of the textbook version of perfect competition. Therefore, though this paper compares resource-advantage theory with perfect competition, the latter is not used as a straw man, but because its foundational premises have been so meticulously articulated that they place the foundations of resource-advantage theory in sharp relief.

FORMAL MODELS OF ECONOMIC GROWTH

Since the works of Romer [1986] and Lucas [1988], most formal models of economic growth have abandoned the view that the capital-labor ratio should be the key endogenous variable. Indeed:

Everyone agrees that a conventional neoclassical model with an exponent of about one-third on capital and about two-thirds on labor cannot fit the cross-country or cross-state data. Everyone agrees that the marginal product of investment cannot be orders of magnitude smaller in rich countries than in poor countries. [Romer, 1994, 10]

Because technological progress accounts for most economic growth, theorists now argue that technological change can no longer be treated as exogenous in growth models. If, however, technological change is endogenous, perfect competition cannot provide the underlying theoretical foundation for growth modeling efforts. Indeed, though his early works retained the assumption of price-taking competition, Romer [1994, 14] notes that “it is obvious in retrospect that endogenous growth theory would have to introduce imperfect competition.” Similarly, Solow's [1994, 48-9] review points out that “no one could ever have intended to deny that technological progress is at least partially endogenous to the economy.” Indeed, he believes that making technological progress endogenous is “probably the most promising aspect of the current third wave of growth theory” and that “the incorporation of monopolistic competition into growth theory is an unambiguously good thing.” Grossman and Helpman concur:

Technological progress often has been treated as an exogenous process in long-run economic analysis. This treatment would be appropriate for studying the growth of modern industrial economies if advances in industrial know-how followed automatically from fundamental scientific discoveries and if basic research was guided mostly by nonmarket forces. ... But neither of these descriptions of the learning process seems in accordance with the available evidence. Scientific advances no doubt facilitate invention. But substantial investments are needed to transform abstract ideas into commercially viable products. ... We take the view that technological progress results from the intentional actions of economic agents responding to perceived profit opportunities. Firms and entrepreneurs devote re-
sources to R&D when they see prospects for reaping returns on their investments. Returns come most often in the form of economic rents in imperfectly competitive product markets. Thus monopoly profits provide the impetus for growth, just as in the Schumpeterian process of "creative destruction." [1991, 334-5]

Four economic facts have stimulated the development of endogenous growth models: (1) economic output has outpaced population growth since the industrial revolution, (2) the growth paths of different countries are not converging to a common level of per capita income, as would be expected if the capital/labor ratio were the key endogenous variable explaining growth, (3) technological progress is the main driver of economic growth, and (4) the innovative ideas that collectively constitute technological progress have most often involved, either at their conception or commercial exploitation (or both), the profit-driven actions of firms. Contrasted with the Solow model’s assumption that technological knowledge is an exogenously provided public good, endogenous growth models make technology grow as a result of specific, profit-driven actions of firms, as three examples illustrate.

Romer’s work [1990; 1993; 1994] highlights the fact that technological knowledge, like labor and capital, is a resource or factor used in the production process. However, technological knowledge and other innovative ideas differ from labor and capital in that they are nonrival goods (i.e., their use by one firm doesn’t preclude their use by others) that are at least partially excludable (i.e., firms possessing knowledge and/or creating ideas can inhibit others from using them). Therefore, the problem confronting the economics of technological knowledge does not involve how such knowledge is allocated, but how it is created and disseminated.

Romer [1994, 17] notes that, if “A” stands for the aggregate amount of an economy’s technology at a point in time, “All models of growth need at least one equation which describes the evolution of something like A(t).” For example, his 1990 model makes A evolve in proportion to the total human capital that firms devote to R&D. This implies that an economy with a larger stock of human capital will not just have greater output but will also experience faster growth. Furthermore, “a subsidy to physical capital accumulation may be a very poor substitute for direct subsidies that increase the incentive to undertake research” [ibid., 99]. Romer stresses that the motivation for investing in R&D must be the expectation of rents, which can only result from the existence of market power, which, in turn, implies abandoning the assumption of marginal cost pricing, both in the short and long run. Therefore, the goal of a long-run, Pareto-optimal, general equilibrium must also be abandoned because “there is no hope that a decentralized equilibrium in which new ideas are discovered will be first-best Pareto optimal” [1993, 74].

As a second example, Stokey’s [1991] model recognizes that increased productivity can result from firms being either more efficient or more effective. Her model has individuals make investments in education in the expectation that higher wages will balance the opportunity cost of later entry to the workforce. In the aggregate, these investments increase the social stock of knowledge, which increases firms’ effective-
ness in producing higher quality goods (where quality has Lancasterian [1966] characteristics). Therefore, "as aggregate human capital grows, output growth consists of dropping lower-quality goods from production and adding higher-quality goods" [ibid., 588]. That is, growth occurs not from additional physical capital enabling firms to produce homogeneous commodities more efficiently, but from human capital enabling firms to produce heterogeneous goods more effectively.

As a third example, Young [1993] develops a hybrid model that integrates models focusing on the inventions resulting from R & D [Romer, 1990; Grossman and Helpman, 1991] with models of "learning by doing" [Arrow, 1962; Lucas, 1988]. It also highlights the role of societal institutions. Specifically, Young's model assumes that (1) developing inventions requires firms to shift resources from current production to R & D, (2) innovators receive infinite-lived patents, (3) production experience generates productivity-enhancing knowledge, but such "learning by doing" is bounded, and (4) productivity-enhancing knowledge spills over into other sectors. The model implies that, rather than reducing growth rates, "rent seeking . . . might, in fact, encourage growth by allowing innovators to reap rewards greater than those that could be achieved under a free-market system" [Young, 1993, 464].

Formal growth models, as a group, imply an endogenous, technological progress, four-stage, theory of economic growth: (1) Certain aspects of the process of monopolistic competition, including the rational expectation of rents, engender innovative ideas at the firm level. (2) These competition-induced innovations, through time, result in both firm and industry-level technological changes. (3) These technological changes, cumulatively, result in increases in total factor productivity for the economy, i.e., technological progress. (4) Thus, competition-induced technological progress, through time, results in economic growth. However, when Romer, Solow, and others advocate incorporating "imperfect competition" or "monopolistic competition" into growth models, they are using these terms generically. That is, they are not urging the adoption of either Robinson's [1934] specific theory of imperfect competition or Chamberlin's [1933] specific theory of monopolistic competition as a theoretical foundation for endogenous growth models. Neither of these theories, as noted by McNulty [1968], views competition as a process wherein innovations result in technological progress.

A theory of competition that could potentially ground endogenous growth models would be, at the minimum, a process-oriented theory with four requisites. First, technology cannot be assumed as freely available to all firms, but must be a resource in the production process that is a nonrival, partially excludable good. Second, innovation must not be exogenous, but must be an outcome of the process of competition. Third, firms should not be price-takers, but must have the rational expectation that rents will be earned from innovations that contribute to their efficiency and/or effectiveness. And fourth, societal institutions, such as the patent system, should be viewed as potentially facilitating or inhibiting competition-induced economic growth. A theory of competition having these four requisites would depart not only from perfect competition but also from all extant theories of monopolistic competition.

As McNulty [1968] pointed out some three decades ago, "the essence of industrialization and economic growth is a changing production function and the development
of new products, techniques, and forms of business organizations" [ibid., 653]. Unfortunately, he notes, there has been no "systematic effort to relate these changes to the concept of competition" [ibid., 654]. Indeed, a "fundamental weakness of the [neo-classical] competitive concept has been its failure to relate to economic growth" [ibid., 652]. For McNulty: "Clearly, the time has come to incorporate into the mainstream of economic theory . . . a concept of competition closer to that occasionally suggested by Adam Smith and strongly advocated by Schumpeter" [ibid., 654, italics in original].

The thesis defended here is that resource-advantage theory has the four requisites for theoretically grounding endogenous growth models. Furthermore, both endogenous growth models and the resource-advantage theory of competition may be considered as a (much belated) response to McNulty's call for a theory that has views of competition closer to those of Smith and Schumpeter and, hence, can relate to economic growth. In so doing, the theory also appears to respond to the recent call of Colander:

The 1930s-50s was a time for formal mathematical economics to export ideas to intuitive economics. In my view, the 1990s is a time for the reverse. More and more top economists are accepting that we have come as far as we can with the static Walrasian general equilibrium model and we need good intuitive economists to guide us to a meaningful Post Walrasian model. [1995, 292]

AN OVERVIEW OF RESOURCE-ADVANTAGE THEORY

Hunt [1997a] explicates an evolutionary theory of competition that he labels the "resource-advantage theory of competition" (hereafter, R-A theory). Its foundations are shown in Table 1 and its structure in Figures 1 and 2. R-A theory, like Chamberlin [1933], acknowledges the heterogeneity of intra-industry tastes and preferences. Also, like Alderson [1965] and Porter [1985], competition is viewed as a process that focuses on marketplace positions of competitive advantage. Like Hayek [1948], firms learn as a result of competition. Like Kaldor [1985], competitive processes are disequilibrating. Like Kirzner [1979], entrepreneurial activity is important. Like Nelson and Winter [1982], competition is evolutionary. Like North [1990], societal institutions are important constraints on firm activities. Like Penrose [1959], resources are heterogeneous. Like Schumpeter [1950], innovation is endogenous. And like Stigler [1961], consumer information is imperfect. Nonetheless, R-A theory is neither the same as the theories developed by the previously cited authors, nor is it simply a composite of their works. Indeed, R-A theory differs in important respects from all extant theories of competition—as a review of its structure attests.

Using Hodgson's [1993] taxonomy, R-A theory is an evolutionary, disequilibrium-provoking, process theory of competition, in which innovation and organizational learning are endogenous, firms and consumers have imperfect information, and in which entrepreneurship, institutions and public policy affect economic performance. Evolutionary theories of competition require units of selection that are (1) relatively durable, i.e., that can exist, at least potentially, through long periods of time, and (2)
TABLE 1
Foundational Propositions of Perfect Competition and Resource-advantage Theory

<table>
<thead>
<tr>
<th></th>
<th>Perfect Competition Theory</th>
<th>Resource-advantage Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Demand is.</td>
<td>heterogeneous across industries, homogeneous within industries and static</td>
</tr>
<tr>
<td></td>
<td></td>
<td>heterogeneous across industries, heterogeneous within industries, and dynamic</td>
</tr>
<tr>
<td>P2</td>
<td>Consumer information is</td>
<td>perfect and costless</td>
</tr>
<tr>
<td></td>
<td></td>
<td>imperfect and costly</td>
</tr>
<tr>
<td>P3</td>
<td>Human motivation is</td>
<td>self-interest maximization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>constrained self-interest seeking</td>
</tr>
<tr>
<td>P4</td>
<td>The firm’s objective is</td>
<td>profit maximization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>superior financial performance</td>
</tr>
<tr>
<td>P5</td>
<td>The firm’s information is</td>
<td>perfect and costless</td>
</tr>
<tr>
<td></td>
<td></td>
<td>imperfect and costly</td>
</tr>
<tr>
<td>P6</td>
<td>The firm’s resources are</td>
<td>capital, labor, and land</td>
</tr>
<tr>
<td></td>
<td></td>
<td>financial, physical, legal, human, organizational, informational, and relational</td>
</tr>
<tr>
<td>P7</td>
<td>Resource characteristics are.</td>
<td>homogeneous and perfectly mobile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>heterogeneous and imperfectly mobile</td>
</tr>
<tr>
<td>P8</td>
<td>The role of management is</td>
<td>to determine quantity and implement production function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to recognize, understand, create, select, implement, and modify strategies</td>
</tr>
<tr>
<td>P9</td>
<td>Competitive dynamics are</td>
<td>equilibrium-seeking, with innovation exogenous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>disequilibrium-provoking, with innovation endogenous</td>
</tr>
</tbody>
</table>

Source: Hunt (1997a)

heritable, i.e., that can be transmitted to successors. For R-A theory, both firms and resources are proposed as the heritable, durable units of selection, with competition for a comparative advantage in resources constituting the selection process.

At its core, R-A theory combines heterogeneous demand theory [Alderson, 1965; Chamberlin, 1933] with the resource-based theory of the firm. The resource-based theory of the firm, which traces to Penrose [1959], Nelson and Winter [1982], and Wernerfelt [1984], parallels, if not undergirds, what Foss [1993] calls the “competence perspective” in evolutionary economics and the “capabilities” approaches of Teece and Pisano [1994] and Langlois and Robertson [1995]. (For recent reviews, see Hunt and Morgan [1995] and Montgomery [1995].) Contrasted with perfect competition, heterogeneous demand theory views intra-industry demand as significantly heterogeneous with respect to consumers’ tastes and preferences. Therefore, viewing products as bundles of Lancasterian [1966] attributes, different market offerings or “bundles” are required for different market segments within the same industry.

Also contrasted with perfect competition, rather than a production function that combines homogeneous, perfectly mobile factors of production, the resource-based
Competition is the disequilibrating, ongoing process that consists of the constant struggle among firms for a comparative advantage in resources that will yield a marketplace position of competitive advantage and, thereby, superior financial performance. Firms learn through competition as a result of feedback from relative financial performance "signaling" relative market position which, in turn, signals relative resources.


view holds that the firm is a combiner of heterogeneous, imperfectly mobile factors, which are labeled “resources.” These heterogeneous, imperfectly mobile resources, when combined with heterogeneous demand, imply significant diversity as to the sizes, scopes, and levels of profitability of firms within the same industry. As diagramed in Figures 1 and 2, R-A theory stresses the importance of (1) market segments, (2) heterogeneous firm resources, (3) a comparative advantage/disadvantage in resources, and (4) marketplace positions of competitive advantage/disadvantage.

In brief, market segments are defined as intra-industry groups of consumers whose tastes and preferences with regard to an industry’s output are relatively homogeneous. Resources are defined as the tangible and intangible entities available to the firm that enable it to produce efficiently and/or effectively a market offering that has value for some marketing segment(s). Just as international trade theory recognizes that nations have heterogeneous, immobile resources, and it focuses on the importance of a comparative advantage in resources to explain the benefits of trade, R-A theory recognizes that many of the resources of firms within the same industry are significantly heterogeneous and relatively immobile. Therefore, analogous to nations, some firms will have a comparative advantage and others a comparative disadvan-
FIGURE 2
Competitive Position Matrix

<table>
<thead>
<tr>
<th>Relative Resource-produced Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
</tr>
<tr>
<td>1. Indeterminate Position</td>
</tr>
<tr>
<td>2. Competitive Advantage</td>
</tr>
<tr>
<td>3. Competitive Advantage</td>
</tr>
<tr>
<td>Party</td>
</tr>
<tr>
<td>4. Competitive Disadvantage</td>
</tr>
<tr>
<td>5. Parity Position</td>
</tr>
<tr>
<td>6. Competitive Disadvantage</td>
</tr>
<tr>
<td>Superior</td>
</tr>
<tr>
<td>7. Competitive Disadvantage</td>
</tr>
<tr>
<td>8. Indeterminate Position</td>
</tr>
</tbody>
</table>

a. Read: The marketplace position of competitive advantage identified as Cell 3 results from the firm, relative to its competitors, having a resource assortment that enables it to produce an offering for some market segment(s) that (a) is perceived to be of superior value and (b) is produced at lower cost.


tage in efficiently and/or effectively producing particular market offerings that have value for particular marketing segments.

Specifically, when firms have a comparative advantage (disadvantage) in resources, they will occupy marketplace positions of competitive advantage (disadvantage), as shown in Figure 1 and further explicated in Figure 2. Marketplace positions of competitive advantage (disadvantage) then result in superior (inferior) financial performance. Therefore, firms compete for a comparative advantage in resources that will yield marketplace positions of competitive advantage for some market segment(s) and, thereby, superior financial performance. As Figure 1 shows, how well competitive processes work is significantly influenced by five environmental factors: the societal resources on which firms draw, the societal institutions that form the “rules of the game” [North, 1990], as stressed by Colander [1995], the actions of competitors, the behavior of consumers, and public policy decisions.

Consistent with its Schumpeterian heritage, R-A theory places great emphasis on innovation, both proactive and reactive. The former is innovation by firms that, although motivated by the expectation of superior financial performance, is not prompted by specific competitive pressures—it is genuinely entrepreneurial in the classic sense of entrepreneur. In contrast, the latter is innovation that is directly
prompted by the learning process of firms' competing for the patronage of market segments. Both proactive and reactive innovation contribute to the dynamism of R-A competition.

As the feedback loops in Figure 1 show, firms learn through competition as a result of the feedback from relative financial performance signaling relative market position, which, in turn, signals relative resources. When firms competing for a market segment learn from their inferior financial performance that they occupy positions of competitive disadvantage (see Figure 2), they attempt to neutralize and/or leapfrog the advantaged firm (or firms) by acquisition and/or innovation. That is, they attempt to acquire the same resource as the advantaged firm(s) and/or they attempt to innovate by imitating the resource, finding an equivalent resource, or finding (creating) a superior resource. Here, “superior” implies that the innovating firm's new resource enables it to surpass the previously advantaged competitor in terms of either relative efficiency, or relative value, or both.

Firms occupying positions of competitive advantage can continue to do so if (1) they continue to reinvest in the resources that produced the competitive advantage and (2) rivals' acquisition and innovation efforts fail. Rivals will fail (or take a long time to succeed) when an advantaged firm's resources are either protected by such societal institutions as patents or the advantage-producing resources are causally ambiguous, socially complex, tacit, or have time compression diseconomies. (These concepts are explicated later in this article.)

*Competition,* then, is viewed as an evolutionary, disequilibrium-provoking process. It consists of the constant struggle among firms for a comparative advantage in resources that will yield a marketplace position of competitive advantage and, thereby, superior financial performance. Once a firm's comparative advantage in resources enables it to achieve superior performance through a position of competitive advantage in some market segment(s), competitors attempt to neutralize and/or leapfrog the advantaged firm through acquisition, imitation, substitution, or major innovation. R-A theory is, therefore, inherently dynamic. Disequilibrium, not equilibrium, is the norm. In the terminology of Hodgson's [1993] taxonomy of evolutionary economic theories, R-A theory is non-consummatory: it has no end-stage, only a never-ending process of change. The implication is that, though market-based economies are *moving,* they are not moving toward some final state, such as a Pareto-optimal general equilibrium.

**GROUNDING ENDOGENOUS GROWTH MODELS**

As discussed, recent developments in formal models of economic growth imply a theory of competition with four requisites. These models, I argue, require an evolutionary, process theory of competition for their theoretical foundations
Technology as a Resource

As to requisite one, because it defines resources as the tangible and intangible entities available to the firm that enable it to produce efficiently and/or effectively a market offering that has value for some market segment(s), R-A theory provides grounds for the view that technologies are nonrival, partially excludable resources. First, if technologies are viewed as distinctive ways for firms to produce value, then a specific technology is a distinctive pattern or "routine" [Nelson and Winter, 1982] that describes the firm's process for combining inputs to produce valued outputs. In R-A terminology, for a firm to possess a specific technology is equivalent to its having a specific organizational competency. Because R-A theory recognizes that technologies or competencies can be replicated by other firms, it acknowledges that they are nonrival goods. As shown in Table 1, R-A theory recognizes organizational competencies as a distinctive kind of higher-order resource, where "higher order" implies a specific assortment of socially complex, interconnected, basic resources. Because competencies both create value and can be deployed by firms in their strategies, competencies are viewed as similar to basic pieces of machinery. Indeed, Prahalad and Hamel [1990, 86] argue that a firm should be viewed as a "portfolio of competencies." R-A theory, in contrast, views the firm as a combiner of heterogeneous, imperfectly mobile resources, of which competencies are but one kind—albeit an important one.

Second, R-A theory provides a rationale for why technologies or competencies are partially excludable. Note that it proposes that a comparative advantage in resources, of which technologies or competencies are prominent, is the manner by which firms achieve marketplace positions of competitive advantage and, thereby, superior financial performance. Therefore, how technologies become partially excludable is simply part of the following more fundamental question: What determines the life-span of the comparative advantage of any advantage-producing resource? Why are some resources less easily replicable, i.e., more easily excludable, than others? Simple resources, such as standard pieces of machinery, can customarily be purchased in the factor markets and, by themselves, are unlikely to produce a comparative advantage with anything beyond a very short life-span. The long life-spans of some advantage-producing resources result from the protection afforded by such societal institutions as patents (as Young's [1993] model assumes) or their long life-spans result from resources that are causally ambiguous, socially complex, tacit, or have time compression diseconomies.

As to causal ambiguity, Figure 1 stresses that competition is a learning process. Relative financial performance signals relative marketplace position, which in turn signals relative resources. Causal ambiguity exists in the signaling process when competitors recognize that consumers in a market segment prefer a rival's offering but either do not know which attributes of the rival's offering result in its being perceived as more valuable [Lippman and Rumelt, 1982; Reed and De Filippi, 1990] or do not know which resources are responsible for producing the valued attributes. Thus, because the life-span of an advantage derived from a causally ambiguous resource
is longer, such resources are more excludable. Therefore, because technologies or competencies have a tendency to be more causally ambiguous, they are more excludable than such resources as machinery [Lippman and Rumelt, 1982].

The life-span of a comparative advantage resulting from socially complex, interconnected resources also has a tendency to be longer [Barney, 1992; Dierickx and Cool, 1989; Nelson and Winter, 1982]. Socially complex, interconnected resources, e.g., a corporate culture stressing innovation, are higher-order resources that have a large number of interrelated components, such as specific human skills, values, beliefs, interpersonal relationships, and physical assets. Because many technologies/competencies are comprised of socially complex, interrelated components, they are more excludable.

Tacit resources are those that encompass skills that are noncodifiable and must be learned by doing [Polanyi, 1967; Nelson and Winter, 1982]. The endogenous growth models of Lucas [1988] and Young [1993] incorporate such “learning by doing” production processes. Because tacit resources cannot, in general, be purchased in the marketplace, the life-span of a comparative advantage based on a tacit resource has a tendency to be longer. Therefore, when the knowledge underlying technologies/competencies is tacit, such tacitness contributes to their excludability.

Some resources exhibit time compression diseconomies, i.e., they take time to accumulate. In general, for example, “maintaining a given rate of R&D spending over a particular time interval produces a larger increment to the stock of R&D knowledge than maintaining twice this rate of R&D spending over half the time interval” [Dierickx and Cool, 1989, 1507]. Because many technologies or competencies exhibit time compression diseconomies, this contributes to their excludability.

**Endogenous Innovation**

The second requisite is that innovation should be an outcome of competition. R-A theory identifies two different kinds of innovative activities: proactive and reactive. The former occurs when, for example, a firm's market research identifies a previously unserved market segment and tailors a market offering for it. A firm is also being proactive when its R&D department develops a market offering and the firm then finds a market segment for it. When proactive innovative activities successfully produce innovations that contribute to efficiency and/or effectiveness, firms will be rewarded by marketplace positions of competitive advantage and, thus, accomplish their goal of superior financial performance.

Reactive innovative activities occur when inferior financial performance signals firms that their comparative disadvantage in resources has resulted in their occupying marketplace positions of competitive disadvantage. Upon so learning, firms react by attempting to acquire their rivals' advantage-producing resource, by imitating it, by finding an equivalent resource for it, or by finding a superior resource. Firms having a comparative disadvantage in resources are motivated to innovate by their desire for superior financial performance, necessity is, indeed, the mother of invention.
Rents

The third requisite is that firms must have the rational expectation of rents to be earned from innovations that contribute to their efficiency and/or effectiveness. R-A theory maintains that firms can expect superior financial performance when they have a comparative advantage in resources that leads to marketplace positions of competitive advantage. That is, as shown in Figure 2, firms can have superior financial performance when their resources, relative to their rivals, enable them to produce market offerings that are perceived by some market segment(s) as (1) being of superior value at parity costs, or (2) having superior value at lower costs, or (3) having parity value at lower costs. In cases one and two firms are able to charge higher than parity prices. In case three they can achieve superior performance at parity prices because of lower costs. Importantly, the expectation of superior financial performance is rational because empirical works reveal large within-industry variance in financial performance. Indeed, using return on investment (ROI) as the measure of financial performance, studies show that “firm effects” account for 46 to 55% of the variance in business-unit ROI and “industry effects” account for only 8 to 10% [Rumelt, 1991; Roquebert, Phillips, and Westfall, 1996].

Institutions

The fourth requisite is that such societal institutions as the patent system should contribute to facilitating or inhibiting competition-induced economic growth. Three examples will illustrate how R-A theory accommodates institutions. First, the institution of a patent system fosters efficiency and/or effectiveness by extending the life-span of the advantage produced by an innovation. Absent an effective patent system, the financial rewards for inventions would often be insufficient for prompting the investment in R&D required for their discovery.

Second, trademarks are considered to be resources. Therefore, the legal protection of trademarks, by protecting the investment that firms have in them, encourages firms to protect this resource by maintaining high quality market offerings. Because R-A theory maintains that consumers have imperfect information and that gathering information is costly (Table 1), trademarks not only help reduce consumer search costs, but also serve as a quality control mechanism for society.

Third, trust as a societal institution is increasingly being viewed as a critical factor for distinguishing highly productive from less productive economies [Harrison, 1992]. As North observes: “The absence of some degree of individual restraint from maximizing behavior would render the political or economic institution nonviable” [1981, 19]. Indeed, for him, the “strong moral and ethical codes of a society are the cement of social stability which makes an economic system viable” [ibid., 47]. Because R-A theory posits that humans, in their roles as consumers, firm-owners, and managers, are constrained in their self-interest seeking by the societal institution of a moral code, trust can exist. Specifically, when people share the same moral code, then trust can exist among people, between people and their firms, and, indeed, among firms themselves [Hunt, 1997b].
CONCLUSION

The gap between the evolutionary and neoclassical traditions in economics remains large, despite the rapid growth in evolutionary theorizing since Nelson and Winter's [1974] seminal article. This article proposes that the gap can be further narrowed if evolutionary economics develops process theories that provide theoretical foundations for existing formal models that have explanatory/predictive power. Applying this criterion to a recently proposed evolutionary theory, I examine whether resource-advantage theory can provide the theoretical foundations for models of endogenous economic growth.

At the minimum, what is needed for a theory of competition to ground endogenous growth models is one that views (1) technology as a nonrival, partially excludable resource in the production process, (2) innovation as endogenous, (3) firms as having the rational expectation of rents to be earned from innovations, and (4) societal institutions as potentially facilitating or inhibiting economic growth. R-A theory is an evolutionary, disequilibrium-provoking, process theory of competition, in which innovation and organizational learning are endogenous and in which entrepreneurship and institutions affect economic performance. It stresses the importance of market segments, heterogeneous firm resources, a comparative advantage (disadvantage) in resources, and marketplace positions of competitive advantage (disadvantage). As such, R-A theory appears to satisfy the minimum criteria for theoretically grounding endogenous growth models.

It is important to stress, as I noted in the introduction, that resource-advantage theory is not proposed as a rival for perfect competition. Rather than being mutually exclusive, the two theories of competition complement each other well. Sometimes, and in some contexts, economic processes are equilibrating; at other times and in other contexts they are not. Sometimes, and in some contexts, endogenous growth occurs, at other times and in other contexts it does not. Indeed, it can be argued that perfect competition is a special case of R-A competition, for each of the foundational propositions of perfect competition is a limiting or special case of R-A competition (see Table 1). The objective of this work is to narrow the gap between the evolutionary and neoclassical approaches to economics by showing how the two can complement each other, it is not to further widen the gap with stark contrasts and talk of rivals.

Finally, R-A theory is, most definitely, a work in progress. Although it appears to have potential for contributing to narrowing the gap between the evolutionary and neoclassical traditions, it requires critical analysis, further theoretical development, formal modeling, simulation modeling, and empirical testing. It is offered for all these purposes.
NOTES

The author thanks the reviewers and editor of this Journal for their helpful comments. The assistance of Robert M. Morgan, Nicolai Foss, Dennis Arnett, and Richard R. Nelson in developing resource-advantage theory is also gratefully acknowledged. Of course, the usual caveats apply.

REFERENCES

Diericks, I. and Cool, K. Asset Stock Accumulation and Sustainability of Competitive Advantage. Management Science, December 1988, 1504-1 1
Hayek, F. A. Individualism and Economic Order. Chicago: The University of Chicago Press, 1948


