

STRATEGIC RESOURCES AND PERFORMANCE: A META-ANALYSIS[†]

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Resource-based theory (RBT) has emerged as a key perspective guiding inquiry into the determinants of organizational performance. Since the early 1990s, numerous studies have examined RBT's assertion that the extent to which organizations possess strategic resources is positively related to performance. Although many studies appear to support this assertion, there is no consensus regarding how strongly strategic resources relate to performance. To help resolve this issue, we meta-analyze 125 studies of RBT that collectively encompass over 29,000 organizations. Our conservative estimate is that the effect size of the strategic resources–performance relationship is $\bar{r}_c = 0.22$. Moderator tests suggest that the resources–performance link is stronger (1) when resources meet the criteria laid out in RBT and (2) for those performance measures that are not affected by potential value appropriation. When resources meet RBT's criteria and when performance measures are not affected by potential appropriation, the strength of the relationship grows to $\bar{r}_c = 0.29$. This suggests that the identification, development, and distribution of value from strategic resources should be a primary consideration for scholars, managers, and shareholders. Copyright © 2008 John Wiley & Sons, Ltd.

INTRODUCTION

Understanding why some organizations outperform others is a central goal of strategic management research. Over the last two decades, resource-

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based theory (RBT) has emerged as a very popular theoretical perspective for explaining performance (Newbert, 2007). Indeed, the *Web of Science*, an academic database provided online by Thomson Scientific, reveals that Wernerfelt's (1984) early RBT article has attracted over 1,200 citations, and Barney's (1991) article has been cited over 2,000 times. RBT's popularity appears to be growing. In 2000 and 2001, these two articles received 403 citations combined. In 2005 and 2006, the number increased to 735—an 83 percent increase over 2000 and 2001, and 23 percent of their total citations since publication.

Scholars historically have used ‘resources’ as a general term to refer to inputs into organizational processes, but within RBT, ‘strategic resources’ are the focus (Amit and Schoemaker, 1993; Barney, 1991). A strategic resource meets certain criteria—it is valuable, such that it reduces costs or increases value to customers, rare enough that competitors do not use the same resource to compete away the value, and difficult to imitate or substitute, which keeps competitors from gaining parity (Barney, 1991). Resources identified in the literature as potentially strategic include, for example, reputation, patents, and unique knowledge (Barney and Arikan, 2001).

Barney (1991) suggested that resources are leveraged to create competitive advantages, which in turn confer performance advantages.¹ Perhaps because competitive advantage is difficult to measure, a series of studies have sought to link strategic resources and performance. Scholars such as Coff (1999) and Collis and Montgomery (1995) have cautioned however that there is not a ‘neat’ connection between such resources and performance. Instead, strategic resources explain performance only to the extent that organizations capture the economic value that they create (Barney and Clark, 2007). According to Coff (1999), key stakeholders, such as owners, top managers, and employees, compete to capture this economic value. If stakeholders other than owners capture the value, then some of the benefits generated by strategic resources will not be revealed in some performance measures (e.g., accounting returns). Whether value is captured by owners, and thus is reflected in performance measures, has become known as the appropriability condition within RBT (Collis and Montgomery, 1995).²

Because a sizeable body of RBT-based inquiry into the strategic resources-performance relationship has developed, researchers have begun to

take stock of the cumulative results. Perhaps the two most prominent assessments are Barney and Arikan (2001) and Newbert (2007). Both suggest that strategic resources matter, but they disagree regarding how much. Barney and Arikan (2001: 170) conclude that ‘overall, results are consistent with resource-based expectations.’ No statistics were calculated to support this contention; it is their qualitative assessment of the literature. In Newbert’s case (2007: 121), he concludes that RBT ‘has received only modest support overall.’ His approach calculated the percentage of significance tests supporting the notion that strategic resources shape performance. This approach is subject to important limitations, including not accounting for statistical artifacts (e.g., sampling error), not providing an estimate of how much resources influence performance, and not indicating how much of the economic value created by resources is captured by owners.

Meta-analysis, a technique that statistically aggregates empirical findings to discern whether relationships exist and provides estimates of their size, can add value beyond Barney and Arikan (2001) and Newbert (2007) in at least two important ways. First, because meta-analysis takes into account statistical artifacts (such as sampling error) that other approaches to assessing a research stream are ill equipped to handle, meta-analysis offers a more accurate assessment of a relationship (Hunter and Schmidt, 1990). The accuracy of the assessment of RBT is, we believe, a crucial issue. Over a decade ago, Godfrey and Hill asserted that ‘ultimately [RBT] will stand or fall not on the basis if whether its key constructs can be verified, but upon whether its predictions correspond to reality observed for populations of firms’ (Godfrey and Hill, 1995: 530, emphasis in original). More generally, a theory that stands up to the empirical evidence warrants attention from practitioners, deserves a prominent place in university curricula, and justifies researchers’ interest in discovering limitations and contingencies surrounding central predictions. Meta-analysis is the best way available to discern whether RBT has met the challenge offered by Godfrey and Hill (1995) and thereby warrants the attention it currently receives (cf. Hunter and Schmidt, 1990). Second, whereas direct observation of value appropriation by stakeholder groups is difficult to detect in an individual study, meta-analysis allows for an indirect test of the appropriability condition.

¹ It is important to draw a clear distinction between competitive advantage and performance advantage. A competitive advantage is a necessary but not sufficient condition for a performance advantage. Within RBT, competitive advantages are defined in terms of ‘value creating strategies’ (Barney, 1991: 102). Yet, value creation necessarily includes customers’ willingness to pay, which makes value creation difficult to measure directly. As an anonymous reviewer insightfully pointed out, by examining the resources-performance link, we are only able to test an imprecise expression of the actual RBT model (i.e., one that does not include competitive advantage). This implies that our findings may underestimate the strength of support for the model.

² We thank an anonymous reviewer for highlighting this issue.

Specifically, meta-analytic estimates can provide preliminary evidence regarding the extent to which the economic value created by strategic resources is differentially revealed in performance measures that are affected by appropriation by nonowners versus those that are not affected by such appropriation.

Because of its advantages, meta-analysis has become increasingly popular within strategic management inquiry. Some meta-analyses have assessed the cumulative evidence involving narrowly defined theoretical constructs, such as composition of board of directors (Dalton *et al.*, 1998), number of directors (Dalton *et al.*, 1999), and post-acquisition performance (King *et al.*, 2003). Meta-analysis is well suited for examining narrow constructs because the measurement of such constructs tends to be fairly consistent across studies. This makes aggregating their results and drawing conclusions fairly simple.

However, meta-analysis can also be valuable for assessing broader constructs such as 'strategic resources.' It has added significant value to our understanding of broadly defined constructs such as generic strategies (Campbell-Hunt, 2000), innovation (Damanpour, 1991), organizational configurations (Ketchen *et al.*, 1997), and corporate social responsibility (Orlitzky, Schmidt, and Rynes, 2003). Such studies clarify the degree to which a theory that uses broadly defined constructs has received support. Geyskens, Steenkamp, and Kumar's (2006) meta-analysis of over 100 different asset specificity measures, for example, takes an important step toward assessing the predictive efficacy of transaction cost theory. Meta-analysis can also test predictions that are not easily tested in a single study, and can identify previously unknown factors that help explain the wide variety of findings that often arise in research streams centered on broad constructs. An example is Combs *et al.*'s (2006) meta-analytic test of theory about the bundling of high performance work practices, which was not amenable to testing within a single study. They also identified a previously unexamined contextual factor—i.e., the rigidity of the environment—that raises important research questions. Overall, meta-analysis appears to be useful for assessing relationships involving both narrow and broad constructs.

Given (1) the importance of understanding performance differences within strategic management inquiry, (2) the popularity of RBT, and (3) the

opinion that the theory will 'stand or fall' based upon whether its predictions conform to reality, we believe that applying meta-analysis to assess the extent to which strategic resources relate to performance is both timely and warranted. Accordingly, we meta-analyzed 125 RBT studies involving 127 samples. Our study makes three contributions. First, we provide a rigorously derived estimate of how much resources influence performance. Second, we examine how much stronger the strategic resources-performance relationship is when studies investigate resources that more closely meet Barney's (1991) criteria. Third, we offer preliminary evidence regarding how much the resources-performance link differs when performance measures reflect or do not reflect potential appropriation. Our discussion section builds on these contributions to map out directions for richer theorizing about and studies of RBT.

THEORETICAL BACKGROUND AND HYPOTHESES

The genesis of the idea that a firm's strategic resources are important is found in Penrose (1959). She defined a firm as a collection of productive resources and described how current resource stocks, along with the opportunities to deploy them, limit the direction and speed of future growth. Resource-based logic began to gain traction in the strategy field when Wernerfelt (1984) similarly asserted that firms can be viewed as collections of resources, and suggested that resources enable effective product market strategies. Barney (1986, 1991) and others (Amit and Shoemaker, 1993; Collis and Montgomery, 1995; Peteraf, 1993) later developed specific criteria for 'strategic' resources that allow firms to cultivate strategies that help generate and sustain competitive advantages.

RBT assumes that resources are heterogeneously distributed among organizations and that many resources are not perfectly imitable or substitutable (Barney, 1991). Resource heterogeneity is a condition wherein organizations possess different bundles of resources (Peteraf, 1993). Imperfect imitability is a condition wherein resources are isolated from imitation (Barney, 1991). Imperfect substitutability implies that other resources are not available to craft and implement strategies as effectively or efficiently (Barney, 1991).

For some resources, certain characteristics such as their social complexity, the causal ambiguity surrounding how they work, or the unique historical conditions under which they were accumulated make it difficult for competitors to obtain the same, or substitute, resources (Dierckx and Cool, 1989; Lippman and Rumelt, 1982). To the extent that such isolating mechanisms are present, heterogeneity remains an enduring condition despite competitors' efforts to replicate strategic resources (Rumelt, 1984).

Because of resource heterogeneity, some organizations possess more strategic resources than others. Because strategic resources generate economic value, an organization that possesses them can develop competitive advantages, and because strategic resources cannot be easily replicated, resources-based advantages can be sustained over time (Hoopes, Madsen, and Walker, 2003). Thus, organizations with strategic resources should have sustained competitive advantages over competitors that lack such resources (Barney, 1991).

Perhaps because competitive advantages are difficult to measure (Ketchen, Hult, and Slater, 2007), many researchers have sought to empirically link strategic resources and performance (Barney and Arikan, 2001). The assumption is that if strategic resources and performance are related, then a competitive advantage must exist. Within many studies, the term *competitive advantage* is almost synonymous with performance in the sense that competitive advantage is 'generally used to describe the relative performance of rivals in a given (product) market environment' (Peteraf and Barney, 2003: 313). Consequently, across the body of RBT studies, the extent to which organizations possess strategic resources should relate positively to their performance. Thus, we expect:

Hypothesis 1: Possession of resources identified by researchers as strategic is positively related to organizational performance.

When studies tap resources that meet RBT criteria, the resources-performance relationship should be stronger than when resources do not meet the criteria. According to Barney (1991), strategic resources are valuable, rare, and difficult to imitate or substitute. Practically speaking, value and imitability matter most because resources that are difficult to imitate are rare by definition (Hoopes *et al.*, 2003) and substitution is a form of imitation

(Barney, 1995). When resources are valuable, they generate at least a temporary competitive advantage by reducing costs or commanding premium prices. When resources are difficult to imitate, the advantage is sustainable because competitors face obstacles obtaining competitive parity. Conversely, resources that do not add value should not show systematic performance effects, and the effects of valuable resources that are easily imitated should dissipate quickly.

Although many of the measures used in extant RBT research depict resources that appear to meet Barney's criteria, others do not. For example, some studies have used research and development spending divided by sales (research and development [R&D] intensity) as a strategic resource measure. R&D intensity appears to be a distant proxy for an organization's underlying R&D resources because investment levels say little about the quality of the outputs from those investments (Rouse and Daelenbach, 1999). Investment levels are also easy to copy.

A key tenet of RBT is that only resources meeting specific criteria generate advantages (Barney, 1991). Consequently, studies that use measures that depict resources that fail to meet RBT's criteria should show smaller effects than studies that use resource measures that meet the criteria (Barney, 1995). Separating resource-performance relationships according to whether the resource measures depict resources that conform versus those that do not conform to the theory's standards is important because including the latter would make support for the theory appear weak, whether or not it actually is (cf. Newbert, 2007). Accordingly, we predict that:

Hypothesis 2: Measures of resources that meet RBT criteria have a stronger positive relationship with organizational performance than measures that do not meet the criteria.

Studies building on pioneering RBT work established the general prediction that possessing strategic resources enhances organizational performance. However, subsequent theoretical developments leveraged Dierckx and Cool's (1989) ideas to suggest that not all of the economic value created by strategic resources is captured by owners (Amit and Shoemaker, 1993; Collis and Montgomery, 1995; Peteraf, 1993). Instead, there is competition for the economic value—some might

be captured by owners while some might be captured by other stakeholders such as top managers and employees (Coff, 1999). According to Coff, 'performance is an outcome of a two-stage game' (Coff, 1999: 120). Economic value is generated from strategic resources in the first stage, but it must be appropriated in the second. When stakeholders are powerful, they may successfully extract above-market prices for their contributions to the organization. In this way, stakeholders other than an organization's owners can appropriate some (or all) of the economic value generated by resources (Coff, 1999).

Empirically observing the appropriation of economic value in a single study is difficult. Doing so would require researchers to somehow ascertain the difference between the total value generated and the value captured by owners (see Coff and Lee, 2003, and Moliterno and Wiersema, 2007 for clever attempts to surmount this hurdle). Meta-analysis, however, allows us to learn about the extent to which concern about appropriability is empirically supported, by permitting an indirect test based on alternative performance measures. Researchers have used a variety of measures to depict performance. Some of these measures are recorded after stakeholders have had the opportunity to appropriate economic value. For example, accounting returns and stock prices are set after stakeholders have had the opportunity to try to extract above-market prices for their contributions (Coff, 1999; Coff and Lee, 2003).³ Other performance measures appear to reflect outcomes *before* potential appropriation occurs. For example, market share reflects an organization's percentage of total sales in a market. While this measure shows the amount of sales generated, it does not reveal how much of the economic value that results from these sales is appropriated from owners by other stakeholders.

Building on these ideas, when performance measures are taken before the potential appropriation of economic value, the link between strategic resources and performance should be relatively strong. In contrast, the link should be weaker for those measures of performance that are set after potential appropriation. Stated formally:

Hypothesis 3: The strategic resources-performance relationship is stronger when performance measures are unaffected by potential appropriation than when measures are affected by potential appropriation.

METHOD

Sample and coding

Our objective was to collect the population of articles that offer data on the performance implications of one or more resources that the study's authors argued were strategic, and that reported the statistics required for conducting a meta-analysis (usually correlation coefficients). We began by conducting a keyword search of ABI Inform, Business Source Premier, and JSTOR using the keywords 'resource,' 'resource-based,' and 'performance.' We used 1991 as the starting date for the search because that was the year of Barney's (1991) landmark article and the year when RBT came into widespread use (Barney and Mackey, 2005). We also checked the reference sections of RBT reviews to find additional studies. Our search yielded 125 usable studies with 127 samples, over half of which appear in either the *Strategic Management Journal* (42 studies) or the *Academy of Management Journal* (28 studies). The studies were coded independently by two of our article's authors. They agreed on 92 percent of initial codes, and discrepancies were resolved via discussion. Table 1 lists the studies and how they were coded. Collectively, the studies encompassed 29,561 organizations.

To code for Hypothesis 1, we recorded the reported correlation between measures of strategic resources and organizational performance. We used the study as our unit of analysis in testing this hypothesis. Thus, if a study reported effects between multiple strategic resources and performance measures, the correlations were averaged to yield a single estimate for that study (Hunter and Schmidt, 1990). Our coding approach for Hypothesis 1 relied on authors and the reviewers and editors who vetted the authors' work in the review process to judge whether a measure met the standards laid out in RBT.

To code for Hypothesis 2, we actively assessed whether resource measures appeared to meet the criteria described in RBT. We used Barney's

³ A key way top managers appropriate excess economic value is by trading their companies' stocks. Thus, the effects of prior managerial appropriation (through insider trading) is already factored into observable share prices.

Table 1. Studies used in the meta-analysis^{a,b,c}

Strategic Management Journal (42)	Academy of Management Journal (28)
Ahuja and Katila, 2004	* (A)
Bansal, 2005	
Bergh, 1995	
Brush and Artz, 1999	*
Capron, 1999	*
Carmeli and Tishler, 2004	*
Carow, Heron, and Saxton, 2004	
Chadwick, Hunter, and Walston, 2004	* (AN)
Cho and Pucik, 2005	* (AN)
Combs and Ketchen, 1999	*
DeCarolis and Deeds, 1999	*
Douglas and Ryman, 2003	*
Ethiraj, Kale, Krishnan, and Singh, 2005	*
Garg, Walters, and Priem, 2003	
Geringer, Tallman, and Olsen, 2000	
Hatch and Dyer, 2004	
Hillman and Keim, 2001	*
Hult and Ketchen, 2001	*
Kor, 2006	*
Kor and Leblebici, 2005	
Kor and Mahoney, 2005	
Lee and Miller, 1999	*
Lee, Lee, and Pennings, 2001	*
Miller, 2004	*
Miller, 2006	*
Mishina, Pollock, and Porac, 2004	
Moliterno and Wiersema, 2007	*
Morrow, Sirmon, Hitt, and Holcomb, 2007	*
Nixon, Hitt, Lee, and Jeong, 2004	
Park and Luo, 2001	*
Powell and Dent-Micallef, 1997	
Powell, 1992	*
Powell, 1995	*
Roberts and Dowling, 2002	
Robins and Wiersema, 1995	
Skaggs and Youndt, 2004	*
Spanos and Lioukas, 2001	*
Tanriverdi and Venkatraman, 2005	*
Tippins and Sohi, 2003	*
Wiklund and Shepherd, 2003	*
Zahra and Nielsen, 2002	*
Zajac, Kraatz, and Bresser, 2000	
	Other journals (55)
	Bae, Chen, Wan, Lawler, and Walumbwa, 2003
	Batjargal, 2005
	Bergh, 2001
	Carmeli, 2004
	Challis, Samson, and Lawson, 2002
	Chan, 2005
	Chan, Shaffer, and Snape, 2004
	Chandler and Hanks, 1994
	DeCarolis, 2003
	Deephouse, 2000
	Dhanaraj and Beamish, 2003
	Droge, Claycomb, and Germain, 2003
	Edelman, Brush, and Manolova, 2005
	Fey, Bjorkman, and Pavlovskaya, 2000
	Flamholtz and Kannan-Narasimhan, 2005
	Guerrero & Barraud-Didier, 2004
	Guest, Michie, Conway, and Sheehan, 2003
	Harel and Tzafrir, 1999
	Hayton, 2003
	Hooley, Greenley, Cadogan, and Fahy, 2005
	Hulland, Wade, and Antia, 2007
	Irwin, Hoffman, and Lamont, 1998

Table 1. (Continued)

Other journals (continued)	
Judge and Douglas, 1998	24
Keller, 2004	13
Lambe, Spekman, and Hunt, 2002	* 30
Lee and Grewal, 2004	* (A) 25
Lopez, 2003	* (A) 16
Luneborg and Nielsen, 2003	* (N) 7
Luo, Griffith, Liu, and Shi, 2005	* (AN) 21
Manev, Gyohev, and Manolova, 2005	* (A) 11
Menguc, Auh, and Shih, 2007	* (A) 17
Menguc and Barker, 2005	* 6
Menguc and Ozanne, 2005	* (AN) 17
Michalisin, Karau, and Tangpong, 2004	8
O'Shaughnessy, Gedajlovic, and Reinmoeller, 2007	1
Park, Mitsuhashi, Fey, and Bjorkman, 2003	* 12
Patterson, West, and Wall, 2004	* (A) 28
Peng and York, 2001	* (AN) 20
Phua, 2006	* (A) 3
Prahinski and Benton, 2004	* (N) 27
Richard, McMillan, Chadwick, and Dwyer, 2003	8
Rothaermel and Thursby, 2005	* (N) 32
Schlemmer and Webb, 2006	* 5
Sher and Yang, 2005	34
Short, Palmer, and Ketchen, 2002	9
Slotegraaf, Moorman, and Inman, 2003	* 26
Song, DiBenedetto, and Mason, 2007	* (A) 30
Thompson and Heron, 2005	* 12
Wang and Ang, 2004	* 29
Wang, Lo, and Yang, 2004	* 19
Wright, Gardner, Moynihan, and Allen, 2005	* (AN) 31
Wright, McCormick, Sherman, and McMahan, 1999	* 12
Yeoh, 2004	* (AN) 15
Yip, Biscarri, and Monti, 2000	* (N) 21
Zou, Fang, and Zhao, 2003	* (A) 21

^a * Indicates that the study contained at least one resource measure that met RBT's criteria (Hypothesis 2). For Hypothesis 3, we coded whether studies contained performance measures that were affected by appropriability (A) and/or were not affected by appropriability (N) in the parentheses.

^b Numbers after parentheses correspond to the following 'Other' journals: (1) *Asia Pacific Journal of Management* (2) *British Journal of Industrial Relations* (3) *Construction Management and Economics* (4) *Decision Sciences* (5) *Electronic Markets* (6) *European Journal of Marketing* (7) *European Management Journal* (8) *Group and Organization Management* (9) *Health Care Management Review* (10) *Human Resource Management* (11) *International Journal of Entrepreneurship and Innovation Management* (12) *International Journal of Human Resource Management* (13) *International Journal of Innovation Management* (14) *International Journal of Production Research* (15) *International Marketing Review* (16) *Irish Journal of Management* (17) *Journal of Business Research* (18) *Journal of Business Venturing* (19) *Journal of Engineering and Technology Management* (20) *Journal of International Business Studies* (21) *Journal of International Marketing* (22) *Journal of Management* (23) *Journal of Management Information Systems* (24) *Journal of Management Studies* (25) *Journal of Marketing* (26) *Journal of Marketing Research* (27) *Journal of Operations Management* (28) *Journal of Organizational Behavior* (29) *Journal of Small Business Management* (30) *Journal of the Academy of Marketing Science* (31) *Personnel Psychology* (32) *Research Policy* (33) *Scandinavian Journal of Management* (34) *Technovation*.

^c Corrections have been made to this table after initial online publication.

(1991) claim that resources must be valuable, rare, difficult to imitate, and difficult to substitute as the basis for categorizing measures. We started with inimitability by coding each measure used in every study according to whether the measure depicted a resource that is protected by at least one of the three main isolating mechanisms researchers have argued protect a resource from imitation: unique historical conditions, causal ambiguity, and social complexity.

Measures deemed as depicting unique historical conditions include property-based resources that could be protected via law such as patents, copyrights, or trademarks. We also included measures depicting resources subject to time compression diseconomies (Dierckx and Cool, 1989). For example, one of Cho and Pucik's (2005) resource measures was a *Fortune* magazine quality rating that was compiled from surveys of

CEOs, executives, and financial analysts. Because organizations' quality reputations often take years to establish, we considered such measures subject to time compression diseconomies, whereas measures such as annual marketing expenditures were not.

A measure was coded as causally ambiguous if it depicted the presence of tacit knowledge, capabilities, or bundles of routines. Thus, in the case of R&D intensity, it was coded as imitable because it depicts easy-to-copy expenditure levels. In contrast, survey measures asking about technological skills and ability (Park and Luo, 2001), were coded as depicting an underlying tacit knowledge base or capability. For routines, we considered a single easily identified practice or routine to be imitable, whereas bundles of such practices interact in potentially complex ways and thus are less so. For example, a single high performance work

practice (such as using incentive compensation) can be imitated, but a bundle of such practices interacts in ways that may not be easily copied (Combs *et al.*, 2006).

Finally, because social complexity implies interactions among individuals, we coded measures depicting the presence of human or social capital as socially complex. Measures of culture were also considered socially complex. Overall, 69 percent of the measures we examined were judged to be protected by isolating mechanisms.

The next step was to go through those measures that were coded as difficult to imitate and consider whether each also should be coded as potentially valuable. Our basic approach was to accept the value claim made by authors and approved by reviewers and editors unless there was good theoretical reasoning or empirical evidence that undermined the claim that a resource was valuable. For example, measures of resources pertaining to the natural environment were not coded as valuable based on meta-analytic evidence from Orlitzky *et al.* (2003) suggesting that such resources do not, at present, justify their costs. Similarly, top management and CEO tenure was not coded as valuable based on theory and evidence that firm-specific experience has an inverted U-shaped relationship with performance (Henderson, Miller, and Hambrick, 2006). This step led us to consider an additional 6 percent of the measures as not meeting the RBT criteria, leaving 63 percent judged to be protected by isolating mechanisms and potentially valuable.

Prior literature suggests that the screening approaches listed above are sufficient, thus we did not perform additional screens based on rareness and substitutability. Regarding rareness, Hoopes *et al.* (2003) argue that if a resource is difficult to imitate, it is rare by definition. Regarding nonsubstitutability, Barney (1995) asserts that substitution is best viewed as a form of imitation. Thus, by assessing inimitability, we also deal with rareness and nonsubstitutability. In the end, our coding created two groups: measures that appear to meet RBT criteria (63% of the total measures) and measures not meeting the criteria (37%).

For Hypothesis 3 (and our *post hoc* robustness tests discussed below), we included only strategic resources-performance effects wherein the resource measure was coded for Hypothesis 2 as meeting RBT's criteria. We then categorized performance measures according to whether

they were potentially affected by appropriability. Because appropriation occurs after economic value is created but before financial statements are recorded, any measures of accounting returns (e.g., return on assets, return on sales) were considered to be potentially affected by appropriability.⁴ Evidence that top managers appropriate value via insider trading suggests that share prices depict economic value only after appropriation (Coff and Lee, 2003). Thus, we also considered stock measures subject to appropriability. Measures such as sales growth and market share, in contrast, were not considered to be affected by appropriation. We excluded effects where the performance measure combined metrics that are and are not potentially affected by appropriability (e.g., a survey measure asking respondents to compare their organization's productivity, accounting returns, and revenues to that of competitors—Powell, 1995).

Meta-analytic procedures

Effect size estimates were calculated as the mean of the sample size weighted correlations (\bar{r}) from the studies. This estimate offers more accuracy than estimates obtained from any one study because positive and negative sampling errors cancel out each other (Hunter and Schmidt, 1990). After sampling error, measurement error has the largest impact on findings. Most RBT studies do not report reliability coefficients for every measure, making it impossible to correct each study individually for measurement error. Thus, the mean of the available reliabilities was used to correct \bar{r} according to: $\bar{r}_c = \frac{\bar{r}}{\sqrt{\bar{r}_{xx}}\sqrt{\bar{r}_{yy}}}$ (Hunter and Schmidt, 1990).

Confidence intervals were constructed around each \bar{r} to facilitate hypothesis testing (Whitener, 1990).⁵ Because our predictions were directional, we used one-tailed tests. The main effect described

⁴ As Dierickx and Cool (1989: 1504) indicate, the relationship between resources and accounting returns can also be influenced by 'hidden cross-subsidization' across units within a firm. In examining the resources-performance link, we cannot distinguish empirically between appropriation and cross-subsidization. We appreciate an anonymous reviewer calling this to our attention.

⁵ The width of the confidence interval is determined by whether the amount of unexplained variance is larger than expected by chance, which can be tested by: $\chi^2_{K-1} = \frac{T}{(1-\bar{r}^2)^2} s^2_{\bar{r}}$, where K is the number of study effects, T is the total sample size, and $s^2_{\bar{r}}$ is the observed variance of \bar{r} . In this study, all χ^2_{K-1} were significant, so confidence intervals were calculated based on

by Hypothesis 1 was tested by whether confidence intervals for \bar{r} included zero. The moderator hypotheses (2 and 3) were tested by grouping effects according to the moderator of interest, calculating \bar{r} for each group, and testing for differences (Hunter and Schmidt, 1990). We used this same approach to conduct *post hoc* robustness tests, except that we used two-tailed tests because we were not offering predictions that one side of the moderator would have stronger effects than the other (e.g., large versus small firms).

RESULTS

Table 2 reports the results of the hypotheses tests. Hypothesis 1, which predicted that strategic resources are positively related to performance, was supported with $\bar{r} = 0.17$ ($p < 0.01$). After correcting for measurement error, the estimate is $\bar{r}_c = 0.22$. Hypothesis 2 predicted that the relationship between resources and performance would be stronger for measures of resources that meet RBT's criteria; this hypothesis received support with $\bar{r} = 0.20$ ($\bar{r}_c = 0.26$) for measures that meet the criteria versus $\bar{r} = 0.09$ ($\bar{r}_c = 0.12$) for measures that do not ($p < 0.01$). Hypothesis 3, which predicted that the strategic resources-performance relationship is stronger when researchers use measures that are unaffected by potential appropriation, received modest support with $\bar{r} = 0.23$ ($\bar{r}_c = 0.29$) versus 0.16 ($\bar{r}_c = 0.21$; $p < 0.10$).

Post hoc robustness tests

Some possible moderators seemed potentially important, but lacked the strong theoretical underpinnings needed to offer hypotheses. To explore these factors, we conducted *post hoc* robustness tests. First, because RBT describes several types of resources that can be considered 'strategic,' we disaggregated resources into smaller groupings according to value chain function (Porter, 1985) and according to Grant's (1991) groupings of human, tangible, and intangible resources.⁶ Our aggregation at the value chain function level combines similar and related but not identical

the standard error of the total effect size variance, i.e., $\sqrt{\sigma_r^2/K}$ (Whitener, 1990).

⁶ We thank two anonymous reviewers for recommending that we disaggregate resources into smaller groupings.

measures. The effects by function are marketing ($\bar{r}_c = 0.42$), logistics ($\bar{r}_c = 0.29$), R&D ($\bar{r}_c = 0.27$), human resources ($\bar{r}_c = 0.26$), operations ($\bar{r}_c = 0.38$), and firm infrastructure ($\bar{r}_c = 0.24$). All are significantly related to performance at $p < 0.01$. The only significant difference among these effects is between marketing and firm infrastructure resources at $p < 0.10$. Using Grant's (1991) groupings produced $\bar{r}_c = 0.30$, 0.08, and 0.24 for human, tangible, and intangible resources, respectively. All are significantly related to performance, and the human and intangible resource effects are significantly larger than the effect for tangible resources ($p < 0.01$).

Next, we examined whether industry sector, level of diversification, or firm size moderates the strategic resources-performance relationship. We found no significant differences; the effects were: (1) industry sector (manufacturing versus service firms, $\bar{r}_c = 0.27$ vs. 0.19, ns), (2) diversified versus undiversified firms ($\bar{r}_c = 0.18$ versus 0.24, ns), and (3) firm size (*Fortune* 1,000 firms versus others, $\bar{r}_c = 0.28$ versus 0.25, ns). Drawing on Ray, Barney, and Muhanna (2004), we investigated whether effects differed based on whether a performance measure was an operational-level (e.g., customer satisfaction) or an organization-level (e.g., return on assets) measure. There was no significant difference ($\bar{r}_c = 0.31$ versus 0.24; ns). We investigated whether time of publication moderated the relationship. Effects were stronger for studies published from 2001 and later than for studies published from 1991 to 2000 ($\bar{r}_c = 0.29$ versus 0.19; $p < 0.01$). Finally, to ensure that moderator groupings did not overlap, we conducted point-biserial correlations. The only significant correlation between groupings was for firm size and diversified versus undiversified firms (0.81; $p < 0.01$). This correlation could be expected given that diversified firms are involved in more businesses than undiversified firms and, by their nature, are typically larger.

DISCUSSION

Our study's results should be viewed in light of at least one caveat. A critique of RBT is that possible intervening steps between strategic resources and performance remain largely unexplored (Ketchen *et al.*, 2007; Sirmon, Hitt and

Table 2. Meta-analytic results

Hypothesis	N	K ^a	\bar{F}	\bar{F}_c	σ_e^2	σ_r^2	Residual variance	Percent artificial variance	99% Confidence interval ^b	95% Confidence interval ^b	90% Confidence interval ^b	p value
1 All resources	29561	127	0.17	0.22	0.00	0.02	0.01	23.91%	0.14:0.20	0.15:0.19	0.16:0.19	<0.01
2 Do not meet RBT criteria	11680	48	0.09	0.12	0.00	0.04	0.03	11.06%	0.03:0.16	0.05:0.14	0.06:0.13	<0.01
Meet RBT criteria	17333	89	0.20	0.26	0.00	0.02	0.01	28.27%	0.17:0.24	0.18:0.23	0.19:0.22	
3 Performance measures affected by appropriation	11570	55	0.16	0.21	0.00	0.02	0.01	27.70%	0.12:0.20	0.13:0.19	0.14:0.19	<0.10
Not affected by appropriation	5590	28	0.23	0.29	0.00	0.01	0.01	34.84%	0.17:0.28	0.19:0.26	0.20:0.26	

^a The sum of Ks (i.e., studies) for moderator tests differs from the overall K (i.e., 127) because some studies report effects on both sides of the moderator. Also, Hypothesis 3 was tested using only effects based on measures coded as meeting RBT criteria.

^b Confidence intervals are based on \bar{F} (see Whittier, 1990). They are partially determined by the amount of residual variance after removing sampling error variance. Based on χ^2 tests, we assume residual variance is heterogeneous.

Ireland, 2007). Indeed, because RBT is still evolving (Barney and Mackey, 2005), few of the studies we examined investigate the processes through which strategic resources yield performance gains. Our primary focus was the bivariate relationship between resources and performance that has been the subject of frequent investigation. Despite this limitation, our study offers an important contribution by closing the gap between *what we know* and *what we need to know* about RBT's ability to address a core issue in the strategic management field: why some organizations outperform others.

More specifically, based on data from over 29,000 firms contained within 125 studies, our results show that, on average, resources identified by researchers as strategic are related to performance at $\bar{F}_c = 0.22$. This means that 22 percent of the utility available from predicting performance differences across organizations is provided by strategic resources. Stated differently, we can consider two firms, one of which has a one standard deviation advantage in its strategic resources over the other. Our results suggest that on average the performance of the former firm would exceed that of the latter by 0.22 of a standard deviation. Collins and Clark (2003), for example, reported a mean of 0.33 with a standard deviation of 0.71 for high technology startups' sales growth. In this sample, an organization with a one standard deviation advantage in resource network building practices (i.e., training and rewards for top managers to build relationships) would enjoy, on average, 48.6 percent sales growth versus 33 percent for the average competitor; a 47 percent difference. This does not mean that strategic resources are a lever for improving performance whereby amassing additional resources automatically enhances outcomes directly and without any ceiling. However, we can conclude that significant benefits can result from possessing more strategic resources than competitors.

Having an accurate assessment of the evidence regarding a theory's central predictions is critical because of the implications for managerial practice and future inquiry. Godfrey and Hill (1995: 530) contended over a decade ago with respect to RBT that it will 'stand or fall' on the basis of whether its predictions correspond to reality. A recent review based on counts of significance tests concluded that RBT 'has received only modest support overall' (Newbert, 2007: 121). Such a finding raises

important questions. Should managers invest heavily in guidance grounded in a theoretical perspective that has only modest support? Should such a theory be taught in business schools? Should researchers' time and limited journal space be directed toward more promising theoretical views? However, by using a more rigorous approach to statistically aggregate results, our findings offer a different answer to Godfrey and Hill's (1995) challenge. We find that, at present, RBT's expectation that resources and performance are related has strong support, and that the level of support can be enhanced or weakened by important moderating factors. The sizeable link between resources and performance leads to the conclusion that RBT is managerially relevant and worthy of researchers' attention.

The results for our second hypothesis indicate that resource measures that meet RBT's criteria are more strongly related to performance than measures that do not meet the criteria. When criteria are met, we estimate that the overall effect of strategic resources on performance is $\bar{r}_c = 0.26$. This effect is 117 percent larger than for resources that do not meet RBT's criteria ($\bar{r}_c = 0.12$). This is an important finding given recent concerns about construct measurement in strategy research (Boyd, Gove, and Hitt, 2005). More broadly, the finding highlights the need for researchers to take extra care when selecting measures. Empirical tests are weakened considerably when measures fail to depict constructs (strategic resources in this case) that conform to the theory's central insights (Hunter and Schmidt, 1990). As the strategic management field in general and the RBT literature in particular move forward, we would do well to avoid a long running criticism of our colleagues in economics:

Econometric theory is like an exquisitely balanced French recipe, spelling out precisely with how many turns to mix the sauce, how many carats of spice to add, and for how many milliseconds to bake the mixture at exactly 474 degrees of temperature. But when the statistical cook turns to raw materials, he finds that hearts of cactus fruit are unavailable, so he substitutes chunks of cantaloupe; where the recipe calls for vermicelli he uses shredded wheat; and he substitutes green garment dye for curry, ping-pong balls for turtle's eggs, and, for Chalifougnac vintage 1883, a can of turpentine (Valavanis, 1959: 83).

To avoid this kind of slippage in our methodological 'recipes,' one goal of future research should be to converge on specific, carefully validated measures for any strategic resource under examination. This will help scholars clearly define which resources are most valuable without fear that construct measurement problems are distorting the results, and thus, enable stronger tests of RBT.

Our third finding is that the resources-performance link is relatively stronger when researchers use performance measures that are unaffected by potential appropriation. Theory suggests that appropriation should affect RBT relationships (Coff, 1999), but evidence of actual appropriation has been limited to investigations of insider trading (e.g., Coff and Lee, 2003) and professional baseball teams (Moliterno and Wiersema, 2007). Meta-analysis offers an indirect way to examine whether appropriation reduces the impact of strategic resources over a broad set of organizations. Our results indicate that, on average, effects are about 38 percent larger for performance measures that are unaffected by appropriation (0.29 versus 0.21).

Issues involving the measurement of resources and performance may have led these findings to underestimate the true relationships. In terms of resources, we attempted to tap into historical conditions, causal ambiguity, and social complexity in order to capture the imperfect imitability condition. Such characteristics can also affect resource mobility, tie the resources to the firm, and make it more likely that the opportunity costs of the resources are lowered so that value can be captured more readily. In terms of performance, measures such as market share and sales growth may mitigate the appropriation problem, but they may underestimate the value created if it has taken place largely on the cost side and is not reflected in price. To the extent that these issues were embedded in our data, the findings for Hypothesis 3 may not reflect the full magnitude of the difference between the two sets of performance measures.⁷

The results for Hypothesis 3 offer preliminary evidence that appropriation is systematically affecting RBT research, and suggests that future researchers need to take stock of its potential impact. One approach would be to purposively design studies to include two types of performance

⁷ We appreciate an anonymous reviewer highlighting these issues.

measures—those potentially affected by appropriation and those not affected by it—and then assess the differences in the findings between the two. Our results also suggest that systematic efforts to investigate who appropriates economic value, the amount of appropriation, and factors that shape the amount of appropriation appear warranted.

The finding that the resources-performance link is relatively stronger when researchers use performance measures that are unaffected by potential appropriation may be instructive with respect to a central tenet of RBT: that strategic resources create competitive advantage (Barney, 1991). As noted above, competitive advantage is difficult to measure, and its direct assessment is seldom attempted. According to RBT, strategic resources deliver competitive advantages that might or might not be reflected in performance. To the extent that value appropriation intervenes between competitive advantage and performance, our findings regarding appropriation-free outcomes may move us closer to testing RBT's actual prediction.

The results related to the *post hoc* robustness tests shed some light into the state of the literature. Strategic resources in each of the value chain functions as well as human, tangible, and intangible resources relate positively to performance, suggesting the merit of cultivating numerous types of resources (Barney, 1986). Our *post hoc* results showing no significant differences across manufacturing versus service firms, diversified versus undiversified firms, and large versus small firms imply that the performance implications of strategic resources are important and relatively constant across a wide variety of contexts. The lack of differences for operational-level versus organizational-level performance measures implies that, despite concern that firm-level performance is overaggregated (Ray et al., 2004), this issue, at present, does not appear to be hampering RBT research. Lastly, the finding that strategic resource-performance effects are stronger in newer studies suggests that researchers are making strides over time toward better understanding the types of resources that shape performance (Barney and Mackey, 2005).

The major advantages of meta-analysis are that it offers a much more accurate estimate of the level of support for a theory than other methods for assessing a research stream, and that it can test theory that is difficult to assess through

other means, as is the case with the appropriability condition. In addition, however, the process of conducting meta-analyses often points the meta-analyst toward important follow-on questions for future inquiry (Combs et al., 2006). For us, those questions include: (1) Are certain strategic resources superior to others? (2) How do strategic resources interact with each other? (3) What are the specific environmental contingencies affecting resource value? and (4) How do strategic choices interact with resource value? Beyond broad generalizations, such as the expectation that knowledge underpins all strategic resources (e.g., Grant, 1996), theory is yet to be developed to aid predictions about the relative superiority of, or interactions among, particular strategic resources. We took a small step in this direction by separating effects by value chain function and by Grant's (1991) resource groupings in our *post hoc* robustness tests, but there is much to be done in this area. Theory and some evidence is emerging regarding the interaction of strategic resources with the environment (Adner and Zemsky, 2006) and strategic choices (Sirmon et al., 2007), but again, much work remains before theory can map out the many contingencies that potentially affect a specific resource's value. By clarifying evidence regarding long-standing and difficult-to-test theory, we hope our efforts will free researchers to develop theory and tests to answer these follow-on questions.

Finally, juxtaposing the results of our meta-analysis with the results of others raises interesting possibilities. When compared to other meta-analyses, our overall best case effect of strategic resources on performance ($\bar{r}_c = 0.29$) is far stronger than the effect of board composition (0.03; Dalton et al., 1998) and similar to that of configuration membership (0.28; Ketchen et al., 1997). As meta-analysis is increasingly used to assess sources of performance differences among organizations, future inquiry might benefit from considering how competing sources interact. For example, what is the relationship between the effects found here and those found for organizational configurations? These effects originate from different levels of analysis: the individual firm versus groups of firms. Are these effects additive as some recent evidence suggests (i.e., Short et al., 2007), or do they capture some of the same variance? In an example of possible overlap, resource

commitment measures often used to define configurations (e.g., Cool and Schendel, 1988) might capture some of the same variance as strategic resource measures. One approach to answering such questions would be to use the effects found in studies from overlapping research streams as inputs into structural equation models aimed at tying various performance antecedents together in one nomological network (Viswesvaran and Ones, 1995).

CONCLUSION

Resource-based theory has become one of the most influential perspectives guiding strategic management research. In contrast to a recent review that concluded that RBT has 'received only modest support overall' (Newbert, 2007: 121), our findings show that support is quite robust. Indeed, our results demonstrate that, while RBT is still evolving as a theory, its empirical base of over 29,000 organizations offers strong support for the assertion that organizations' performance is enhanced to the extent that they possess strategic resources. Overall, our results are consistent with resource-based expectations, and show that RBT has, to use Godfrey and Hill's (1995) language, stood, and stood strong. Nevertheless, as we look to the future, theory building about and empirical inquiry into the processes through which strategic resources lead to high performance, how value is appropriated, and how resources interact with the environment and strategy is essential. This will allow RBT to fully develop as a theory, and to offer more precise managerial prescriptions. Our hope is that after the next 125 RBT studies are published, a meta-analysis conducted at that point will be able to clearly define the key contingencies surrounding the performance effects of strategic resources.

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