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Diversification and Focus: A Bayesian Application of the Resource-Based View

Abstract

We propose a new application of the resource-based view (RBV) that is more consistent with Penrose's (1959) original framework. We use that framework to study the relationship between diversification and refocusing strategies and economic performance. We propose that the RBV may be enhanced by the explicit recognition of Penrose's two classes of resources, administrative and productive resources. This distinction suggests a focus on the administrative decisions of managers, including the multiple decisions associated with diversification and refocusing strategies, which lead to economic performance. Second, we argue that RBV theory is a theory about extraordinary performers or outliers, not averages. Therefore, the statistical methods used in applying the theory should account for the difference between individual firms, rather than relying on means across firms, which statistically neutralize firm differences. We introduce a novel Bayesian Hierarchical method to examine actions taken by new CEOs and the resulting effects on economic performance over time. The unique feature of this Bayesian method is it allows us to make meaningful probability statements about the diversification and refocusing strategies of individual firms.

JEL-Classification: C11, L22, M00.

Keywords: Bayesian Analysis; Diversification; Leadership; Performance; Resource-Based View.

1 Introduction

Edith Penrose's book, *The Theory of the Growth of the Firm* (1959), is widely considered to be the resource-based view's (RBV) seminal work. Although the fundamental logic of the RBV has been derived from Penrose's book, the primary purpose of her book is somewhat different she is writing about how firms grow. The issues of diversification and, conversely, focus, are fundamental to the theory she elaborates in *The Theory of the Growth of the Firm.* Penrose believes that firms expand based on both internal and external inducements. However, although external inducements, such as new inventions, change's in consumer's tastes, and growing demand for particular products, are potentially powerful, they are only

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available to what she calls "qualified" firms, those firms with the special resource complement that can either provide them with unique advantages or, at least, negate disadvantages (1959, 86). Principally, Penrose describes a theory about internal inducements to firm growth, resource-based reasons for why firms expand through diversification and contract through refocusing.

Although applications of the RBV are expanding (Hansen/Perry/Reese (2004)), the RBV is primarily used as a means of determining the conditions under which resources offer competitive advantage. This use implies a mostly "static" view of resources and resource bundles. One recent development in RBV theory is the shift to a more "dynamic" process view of resources and the services they create (e.g., Nordstrom/Malm/Linnerz/Sanders (2004)). These more dynamic, process-based applications of the RBV draw on many of the dynamics of growth originally described by Penrose (1959), and hold the potential for informing theory about how firms grow and contract, diversify, and refocus.

Penrose also explains why some firms do better than others. Her insights have been carried forward in the theoretical developments of the RBV (Barney (1991); Collis/Montgomery, (1995)), but not in empirical tests of the theory (Hansen/Perry/Reese (2004)). Thus, another important consideration is alignment between RBV theory and empirical methods. Clearly, the RBV is a theory of outliers, those firms that are different enough from other firms that competitive advantage accrues to these outlier firms. A good empirical approach would thus be one that allows for a focus on truly firm-specific phenomena.

2 Two Classes of Resources

Early on in the development of her theory, Penrose (1959) is careful to distinguish between productive resources and the "administrative decisions" that govern the use of resources. Penrose's framework implies two classes of resources: "productive" resources and "administrative" resources that exercise discretion over the use of productive resources.

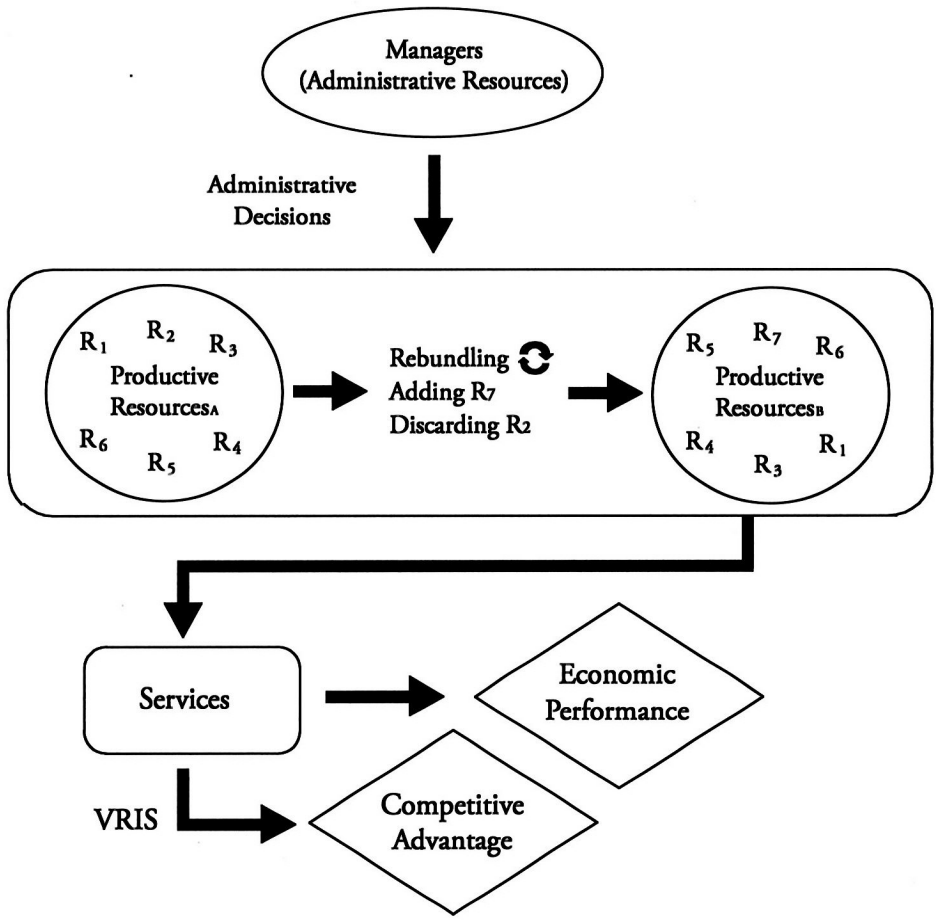
Penrose also discusses a firm's "subjective productive opportunity," which refers to what the firm "thinks it can accomplish," given its resources (1959, 41). Some firms are "qualified" to take advantage of opportunities, while others are not. This view is consistent with views expressed by Barney (1986) on factor markets and Alchian and Demsetz (1972) about knowledge of the "relative productive performances" of resources. These views lead us to conclude that what a firm does with its resources is at least as important as the resources it possesses. The subtle, yet profound, implication is that firms with homogeneously distributed resources can realize competitive advantage.

Black & Decker was a "qualified" buyer when it acquired Pentair's tools unit in July 2004 (Archibald (2004)). Pentair had announced in February 2004 that it intended to sell its tools unit, citing pricing pressures, narrow margins, and a desire to focus on its more lucrative water technologies businesses. Black & Decker, already the world's biggest power tool company, was uniquely poised to gain the most from acquiring Pentair's tools businesses, including brands such as Porter-Cable, Delta, Devilbiss, Oldham Saw and Flex. Nolan Archibald, Black & Decker's CEO, called the acqui-

sition a "good fit," and one analyst likened the fit to a jigsaw puzzle. Pentair was strong in the industrial and construction channel, where Black & Decker was weaker. There was practically no market overlap. Black & Decker had relatively low market share in table saws, sanders, and routers, where Pentair focused. Moreover, the addition of Pentair's brands to Black & Decker's arsenal would add supplier power when bargaining with big-box retailers. Although another firm might have successfully acquired Pentair's tool units, there are many reasons to conclude that Black & Decker, given its pre-existing administrative and productive resources, was positioned to extract the greatest return from Pentair's resources.

This example demonstrates that a firm can gain tremendous leverage through administrative decisions to acquire and then effectively redirect and re-bundle resources. Again, what a firm is able to do with its resources is at least as important as the resources themselves.

Figure 1: RBV Logic Flow



Modeling the RBV to account for the administrative decisions that convert resources to services helps greatly with its application (see *figure 1*). These administrative decisions may consist of rebundling the existing resources of the firm; adding new resources; discarding resources; redirecting resources; or more likely some combination of the four. It is important to assume all levels of resource aggregation in this model, from something as simple and distinct as individual knowledge to factors as complex and intertwined as a complete business unit. However, the focus of our study is the more complex resource bundles associated with diversification and refocusing strategies. Services are generated as a result of administrative decisions that arrange the firm's resources in a particular way. The services thus generated may result in competitive advantage and possibly superior economic performance if the services meet the criteria of the VRIS Model (Barney (1991)). Barney's model suggests that if a resource is valuable (V), rare (R), costly to imitate (I), and non-substitutable (S), then the resource can be a source of competitive advantage.

Conceivably, we could measure all the elements of the framework depicted in *figure 1* either directly or through some proxy. However, such measurement would contain confounding effects (Powell (2001)). More importantly, such measurement of each element of the model might be unnecessary. The pivotal point in the model displayed in *figure 1* is the administrative decisions that lead to services, and ultimately to economic performance. The general firm-level question suggested by this application of the RBV is, "What are the effects of administrative decisions on the economic performance of firms?" We can address this question by using measures of administrative decisions and economic performance. This approach is appropriate in a framework where the focus is on **how** a firm bundles its resources as opposed to which resources a firm possesses.

3 A Bayesian Method and the RBV[1]

Although there has been considerable empirical research using RBV reasoning, the congruency between the theory and the methods used deserves a closer look. Several studies examine the relationship between resources and/or capabilities possessed by a firm and the economic performance of the firm (Bergh (1998); Hult/Ketchen (2001); Maijoor/van Witteloostuijn (1996); Miller/Shamsie (1996); Perry-Smith/Blum (2000)). Most of the empirical studies are based on traditional (classical) statistical approaches, generally a form of regression analysis. These studies typically focus on whether there is a statistically significant association between a resource and/or capability and economic performance.

A statistically significant, positive association between a resource and performance in a study using regression analysis indicates that, on average, the more of that resource a firm possesses, the more positive the economic performance of that firm. Such a result provides evidence that a relationship exists between a resource and performance, and it informs us about the confidence we can have in the rela-

1 The description of Bayesian methods in this paper is similar to that in an earlier paper (see A Bayesian Operationalization of the Resource-Based View, Mark H. Hansen, Lee T. Perry and C. Shane Reese, Strategic Management Journal, 25: 1279-1295. Copyright ©2004 John Wiley & Sons, Ltd. Reproduced with permission).

tionship existing across repeated samples (Cohen/Cohen (1983)). However, no comment can be made as to a specific probability that such a relationship exists in a given firm.

There are other important issues to be considered in terms of the congruency between such results and RBV theory. First, the results are based on averages across the sample. A regression approach is not intended to focus on the effects of specific firms. In fact, if a researcher finds that an observation (firm) is influential and can demonstrate that the observation is an outlier, then the observation could justifiably be removed from the analysis. This practice seems to be incongruent with RBV logic. Furthermore, some studies use random and fixed effects models to control for the 'firm effect' in panel data (Johnston/DiNardo (1997)) to ensure that the lack of independence among variables and observations due to a firm's repeated appearance in the sample does not bias results. Although these random and fixed effects might be used to examine individual firms, the interpretation of results would be subject to the same limitations of regression analysis. To determine how widely held the resource is among firms in the sample, additional analysis, including graphing, could identify influential observations (Cohen/Cohen (1983)). Without such additional analysis there is no way of knowing if an association is the result of a widely held resource, or if the resource is held by only a very few firms that are able to achieve extraordinary economic performance because of the resource. However, we do not know of any study in which this type of additional analysis has been done.

In addition, a positive association between a resource and performance says nothing about superior economic performance or competitive advantage. Such a finding does suggest that firms without that resource may be at a disadvantage, but one cannot conclude that possessing that resource confers a competitive advantage. The limitations of traditional statistical approaches lead to the conclusion that there is an important lack of congruency between RBV theory and regression-type analysis.

As suggested by Rumelt: "...strategy analysis must be situational. Just as there is no algorithm for creating wealth, strategic prescriptions that apply to broad classes of firms can only aid in avoiding mistakes, not in attaining advantage." (1984, 569). Congruency between RBV theory and an empirical method requires a process that can isolate the effects of individual firms and allow for meaningful interpretation of firm-level results. We propose a Bayesian approach because it allows such an examination of firm-specific phenomena.

3.1 The Bayesian Approach

Bayesian methods are ideal for examining the types of issues inherent in the RBV, and particularly for those raised in this paper. Berry (1996) provides a helpful overview of basic concepts in Bayesian methods. In this study, we characterize the Bayesian class of methods by the use of sources of data external to the data of immediate interest. This external information is often called prior information, and it is usually captured in terms of a probability distribution based on such things as previous studies, expert opinion, and historical information. The Bayes' Theorem that we use here asserts that

$$Pr(A \mid B) = \frac{Pr(B \mid A)\,Pr(A)}{Pr(B)} \quad (1)$$

where A represents the unknown parameter (vector), and B represents the data. The formula shows that the probability of observing unknown parameters conditional on the observed data is proportional to the probability of the data conditional on the unknown parameters, $Pr(B \mid A)$, (more commonly known as the likelihood function) multiplied by the prior probability of the unknown parameters, $Pr(A)$, which represents the prior information referred to earlier.

In Bayesian hierarchical models, the central idea is that each observation (or group of observations) is allowed to have a separate parameter or distribution. In our study, we assume that the parameter of each firm comes from a population of such parameters. The primary distinction between Bayesian hierarchical models and classical alternatives (such as regression models, including random and fixed effects models (Cohen/Cohen (1983); Haveman (1993); Johnston/DiNardo (1997)) are that Bayesian hierarchical models provide complete distributional estimation, instead of point and/or interval estimates; Bayesian hierarchical models allow for predictive inference, while classical procedures allow only estimation and inference to observed firms, i.e., they are not predictive; and Bayesian hierarchical models allow decision makers to make probability statements about decisions on a firm basis with the inclusion of uncertainty, while classical procedures do not allow such statements (Berry (1996)).

For example, a study of the effect of resource X on market returns using a classical approach such as regression analysis would yield point (beta) and interval estimates. Suppose the model resulted in a beta of 0.5 and a standard deviation of one for resource X, meaning that a one-unit increase in resource X is associated with a 0.5% increase in market returns. This result can be appropriately interpreted to mean that with a 95% confidence interval the association of resource X with market returns lies somewhere in the range of 0.5 plus or minus two standard deviations. In other words, a one unit increase of resource X could be associated with a change in market returns of anywhere between -1.5% and 2.5%. No inference can be made as to whether a change of 0.5% is more or less likely than a change of -1.5%, 2.5%, or any value in between. The interval for any subsequent sample would be different, and there would be no way of knowing how different. A Bayesian model using the same data would yield a probability distribution that would indicate the actual probability of a given percentage change. Thus, the Bayesian model allows full probabilistic predictive inference.

A key element of this Bayesian method is the notion of a "borrowing of strength" across observations made possible by the fact that the parameters come from the same distribution (Carlin/Louis (1996)). In addition to giving a better estimation of individual (or firm) specific parameters, the distribution of parameters provides a predictive capability that is often desirable in management problems. For example, this method allows for specific probability statements as to the effects of one or more constructs (variables) on other constructs. In other words, the probability that a particular action will affect an outcome can be known. Such interpretation is not possible with a classical approach.

3.2 Data Collection

The phenomena of interest in this paper are administrative decisions and the resulting economic performance of firms. We study firms that have recently appointed new CEOs. We choose this context because it is a setting in which a new leader (administrative resource) inherits a set of productive resources. Newly appointed CEOs have the opportunity and challenge to do nothing, or very little, to the resource base of the firm; rebundle the existing resource base of the firm; or change the resource base of the firm through acquisition, divestiture, etc. Although all CEOs have these same opportunities and challenges to varying degrees throughout their tenure, new CEOs face an immediate challenge, perhaps even a mandate, to adjust the bundling of the firm's productive resources. Therefore, the first several years of a CEO's tenure are likely to be a period during which the CEO more actively manages a firm's productive resources. In fact, ongoing data collection indicates that the rate of administrative decisions declines in subsequent years of a CEO's tenure.

Our decision to examine the first several years of a CEO's tenure is motivated primarily by a desire to capture a very active period of productive resource management. This decision was not motivated by any expectation that the outcomes of new CEO's decisions would be any different from the outcomes of more seasoned CEO's decisions. That is an empirical question that we intend to examine in a later paper.

We collected data on 195 Fortune 500 firms that changed CEO's during the period 1980-1996. Using the Wall Street Journal Index, we gathered data concerning major administrative decisions, including buying or selling business units, financial restructuring, organizational restructuring (shuttering divisions, consolidating divisions, etc.), layoffs, hiring, key personnel changes, and alliance formation. Assistants gathered and cross-checked these data to ensure that announcements were accurately and consistently categorized. One of the co-authors then reviewed these categorizations. Financial performance data were gathered from Compustat for each firm. These data were gathered for the year preceding the new CEO's appointment and for the first three years of each new CEO's tenure.

3.3 Bayesian Hierarchical Model

We use a Bayesian hierarchical linear model (Broemeling (1985)) to examine the effects of administrative decisions, firms, and industries on economic performance. We model two types of performance, an accounting measure (net income/sales) and a market measure (stock market return, including dividends). Here, both response variables are continuous and a normal hierarchical model is reasonable. We express the performance parameter as a function of both the firm (where each firm has its own effect) and the industry, and the administrative decisions made, such as selling or buying units, personnel actions, etc. Our model is:

$$performance = firm(industry) + industry + year + \sum_{j=1}^{10} \beta_j \, action_j \qquad (2)$$

where we allow each industry and each firm to have its own effects, which makes our model a Bayesian hierarchical model). This model allows for individual firm

contribution as well as industry average contribution (four digit SIC's) in addition to the action-based contributions to the economic performance of the firm.

We perform all computation using Markov Chain Monte Carlo methods as reviewed in Gilks, Richardson, and Spiegelhalter (1996). The priors we use in these calculations have little, if any, effect on the results for two reasons. First, prior distributions were assumed to be relatively flat, which has the effect of ensuring that the influence of the prior distributions on the posterior distributions will be minimal (Berry (1996)). Second, due to the reasonably large sample size, the effect of prior distributions was minimal.

We also analyze several choices for prior distributions and find they have little effect on the resulting posterior distributions. Thus, although priors are necessary to perform the calculations, the priors that we choose have a minimal influence on the results of the analysis. Posterior predictive checks of the model (analogous to residual analysis) presented in Gelman et al. (1995) indicated a good fit.

4 Results and Discussion

Although the focus of interest is at the firm level, the Bayesian hierarchical model we use here can also provide information about average effects across the sample. *Table 1* indicates the probability that each of the administrative decisions (actions) we measure will affect accounting measures of economic performance and market measures of economic performance. The probabilities in *table 1* give no indication of the size of effect.

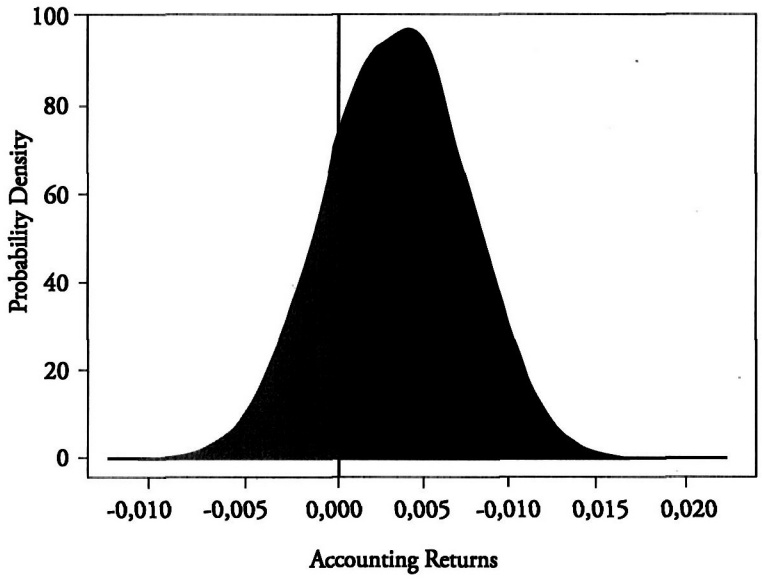
Table 1: Probabilities of Effects of Actions on Performance

Actions	Accounting Returns	Market Returns
Buying Units	0.8111	0.9671
Selling Units	0.5584	0.0791
Org. Restructuring	0.9274	0.4781
Alliances	0.4571	0.0519
Hiring	0.5867	0.8848
New Markets	0.4646	0.5983
Financial Restructuring	0.0516*	0.9828
Personnel Changes	0.1169	0.0032
Layoffs	0.3082	0.4341
New Products	0.7434	0.9687

* values below 0.5 indicate a probability of a negative effect, thus, 0.0516 indicates a strong probability (1 - 0.0516 = 0.9484) of a negative effect.

One of the advantages of the Bayesian approach is that much of the information generated by the analysis can be graphically represented as posterior distributions. These graphical representations contain much more information than would a single metric. We note that in *table 1*, the probability is 0.8111 that buying business units will have a positive effect on accounting measures of performance. The graph in *figure 2* shows how that probability is distributed.

Figure 2: Effect of Buying Units on Accounting Returns



The peak of the curve appears to be centered over approximately 0.005, indicating that the most likely effect on accounting returns of buying a business unit is an increase in performance of about one-half of one percent. There is a small area under the curve that lies to the left of zero, representing the 0.1889 probability that the effect of buying a business unit is negative. We note that these results do not represent a confidence interval, nor are they significant because they have passed a *p*-value threshold. These results are the actual probabilities based on the data in this sample.

The probabilities reported in *table 1* can answer a variety of questions about which actions, on average, are likely to lead to which outcomes. Such results may serve as a useful point of departure in theory building that focuses on the pathway from resources to economic performance. These results may also overturn some of our previously held convictions concerning the effects of certain actions on economic performance (Hansen/Perry/Reese (2004)).

Figures 3 and *4* show the probability distributions for the effects of each action on accounting returns and market returns, respectively. The *dark-shaded* area to the right of zero under the curve represents the probability that the effect on performance is positive. The *light-shaded* area to the left of zero indicates the probability of a negative effect.

Graphs in which the ***dark- and light-shaded*** areas are roughly equal indicate that the probability of a positive or a negative effect is roughly equal. We note that this result is different from saying that there is no effect. For example, in ***figure 3***, the probability distributions for both selling units and hiring indicate that the probability of a positive versus negative effect is roughly equal. However, the shape of the distribution for selling units indicates that the effect is almost certain to lie between -1% and 1%, while the shape of the distribution for hiring indicates that the effect is spread from -3% to 3%. These graphs convey a large amount of information in a simple, straightforward manner.

Figure 3: Probability Distribution of Effect on Accounting Returns

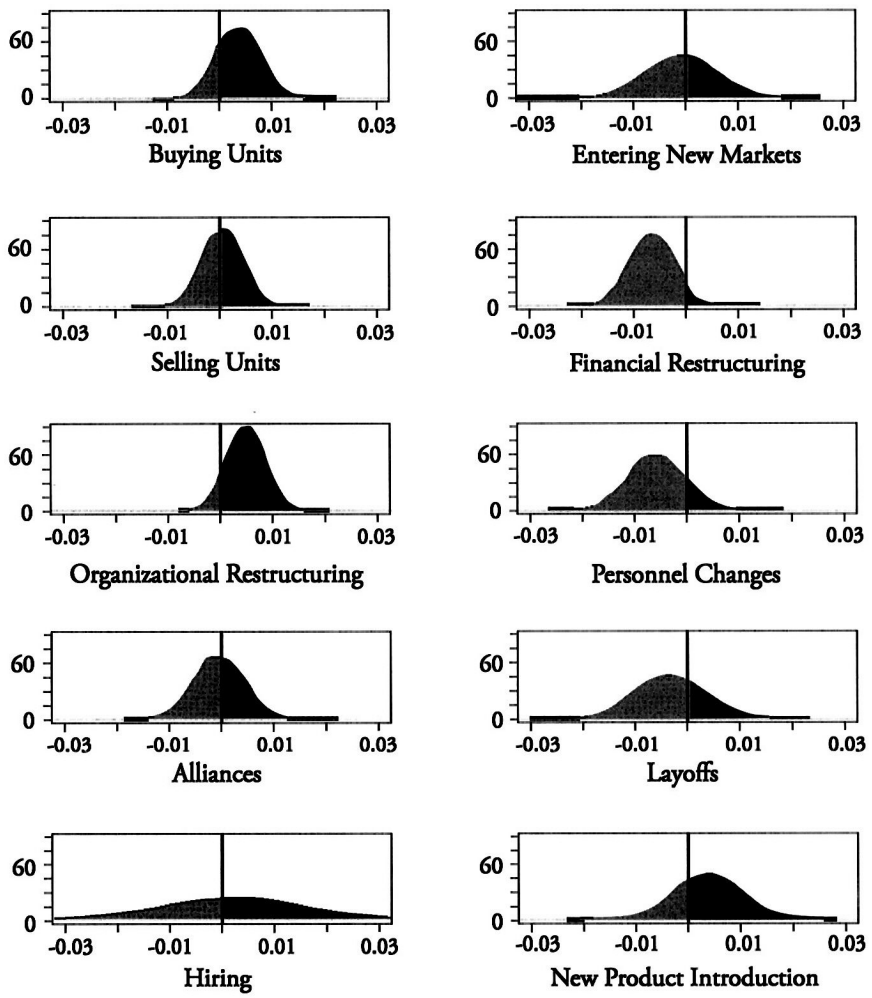
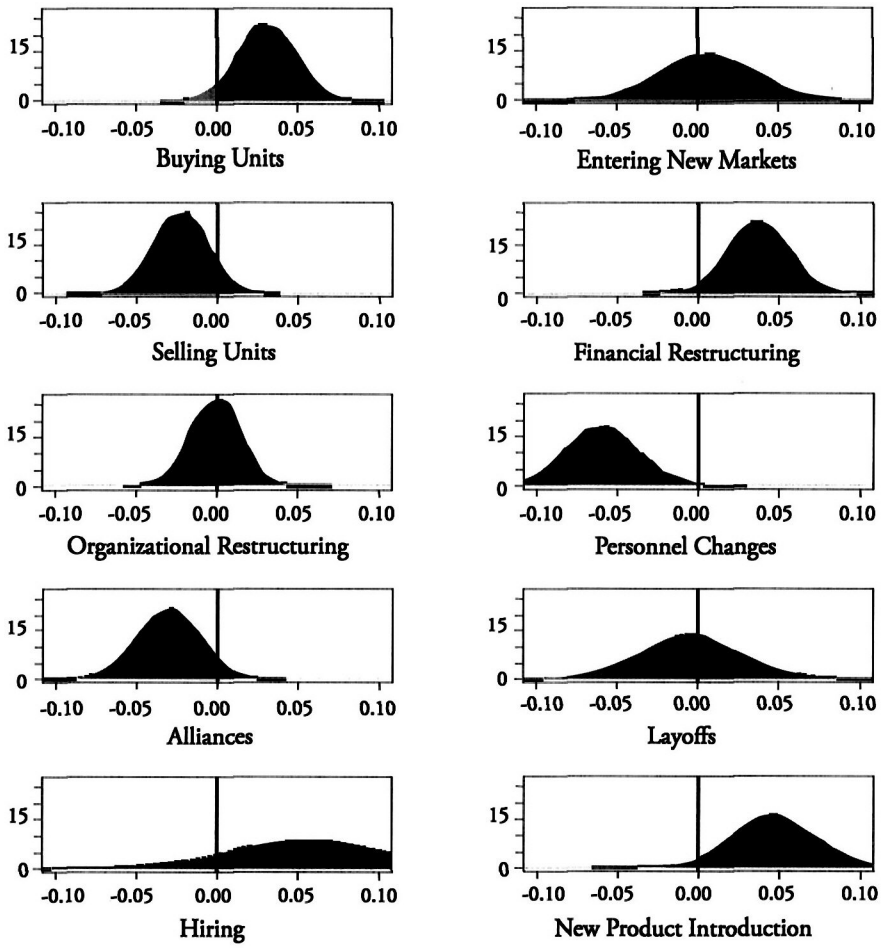


Figure 4: Probability Distribution of Effect on Market Returns



0.01 = 1%

The results reported in *table 1* and *figures 2, 3,* and *4* are similar in nature to other empirical RBV work in that they reflect the average effect of the various administrative decisions. However, these results are fundamentally different in terms of their interpretation. Results from a classical approach would be correctly interpreted to mean that if the sample were repeated infinitely, the results would include the correct parameters 99% of the time assuming a *p*-value of 0.01. A problem with classical approaches is that there is no way to know, with a specific sample, if the results are part of the 99% that is correct or the one percent that is incorrect. Thus, classical approaches allow us to say nothing about probabilities. On the other hand, the Bayesian results reported here are, in fact, probability statements. The

unique value of this Bayesian approach is not the ability to predict average effects across firms; it is the ability to generate probabilities for individual firms and specific industries.

4.1 Diversification and Focus

An interesting analysis that can be performed with our current data set and this Bayesian approach is to ask "What if?" questions about a set of actions a firm may be considering. To answer such questions, we construct a refocusing scenario and a diversification scenario. The refocusing scenario consists of selling two business units, one organizational restructuring, one key personnel change, and one layoff. The diversification scenario includes buying two business units, one financial restructuring, one key personnel change, one hiring, and one alliance. We can calculate the probability distributions for the effects of these scenarios on the market performance of individual firms, taking into account the relevant firm effect and industry effect.

Figure 5 shows the effects of the two scenarios on Micron. The distribution of the firm effect for Micron is centered over 63% before being combined with the scenarios, indicating a considerable competitive advantage. The diversification scenario moves the distribution to the right, indicating an improvement in the effect for Micron of about nine percent. The refocusing scenario moves the distribution to the left by about eight percent. Thus, for Micron there is a difference in effect of about 17% between the two scenarios.

Again, the point is not to demonstrate that one strategy is generally better than another. Rather, the point of the analysis is to show that this Bayesian approach can be used to see which strategy is likely to produce the most favorable results for a specific firm.

Figure 5: Market Performance Effect of Scenarios on Micron

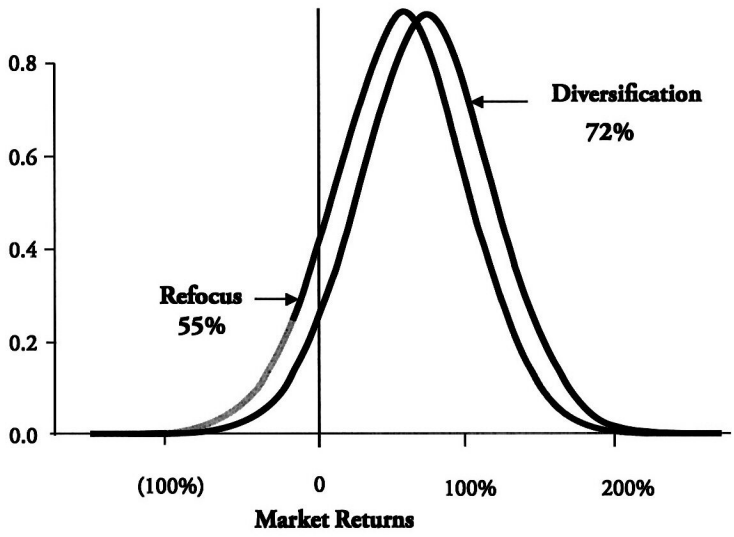
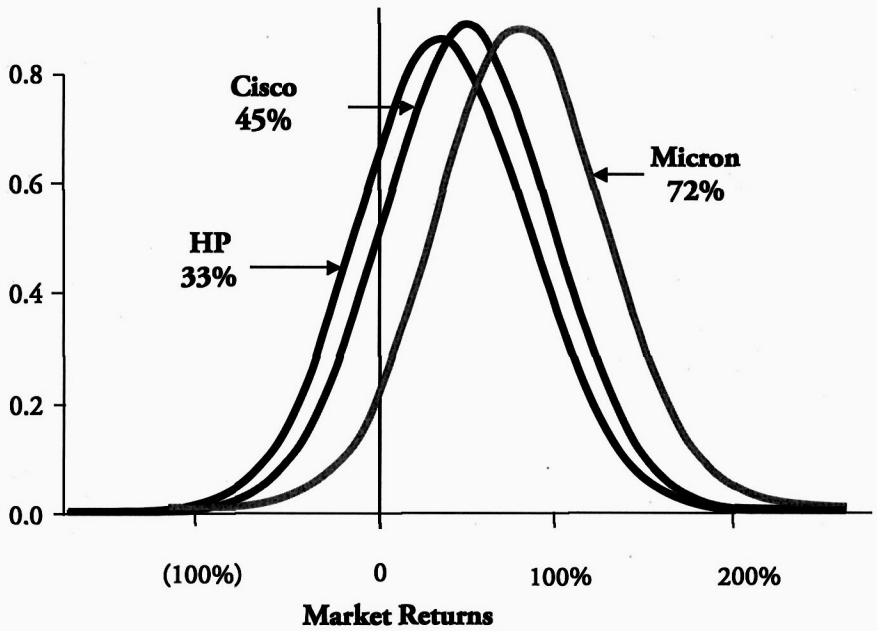


Figure 6 shows the effects of the diversification strategy on three different firms: Micron, Cisco, and Hewlett-Packard (HP). Each of these three firms had unique firm effects before being combined with the effects of the diversification scenario. Combining the firm effects with the diversification scenario resulted in the three distributions.

Figure 6: Effect of Diversification Scenario



4.2 *Limitations*

Perhaps the greatest limitation of our study is the liability of newness. This study is an effort to demonstrate that there is a reasonable alternative to the way scholars have thought about and applied the RBV. We suspect that some scholars may resist the notion that a picture, a posterior distribution, can actually convey enough information to be meaningful in a research or practical setting. We suspect that some researchers will resist the notion of using prior information to establish prior distributions. Our hope is that more work can be done that will, in time, prove convincing to skeptics.

Measures of discretion we use in this study are admittedly coarse-grained, given that administrative decisions and the impact of those decisions may vary greatly across firms. However, the Bayesian approach we use here assumes that each firm has its own distribution of parameters. Therefore, we treat the effect of an action with specific regard to the firm that took the action. Thus, our approach captures and accounts for the fact that a diversification or focus strategy has different significance to different firms. More fine-grained measures would allow researchers to study more specific details of administrative decisions.

Generalizing our results to a population of firms should be addressed in a somewhat different manner when we use a Bayesian approach. Strictly speaking, these results are for the firms in this sample only. These results say nothing about what we would expect from another sample of firms, as would be the case in a classical approach. It would be inappropriate to generalize the relationship between one of the actions examined in this study and economic performance to some larger population. However, on an individual basis, the results obtained for a given firm can be generalized to other firms if the other firms are "exchangeable" (Berry (1996)), meaning that the other firms are mostly similar to the firm in this sample. However, this begs the question, "How similar is 'mostly' similar?" There is no test for determining if another firm is similar enough and it remains a question of judgment. Having stated the limitation, we note the congruency between appropriate generalization and the RBV. The rareness notion inherent in the RBV would be violated if a relationship could be appropriately generalized to a larger population.

5 Conclusion

We have suggested a modification in the conceptualization of the RBV and its empirical application. We have shown how these modifications can improve our understanding of diversification and focus.

Specifically, this study calls for an explicit recognition of Penrose's (1959) distinction between resources and the services those resources can produce. We also call for a recognition of her two classes of resources: administrative resources and productive resources. These distinctions allow us to explain how firms with seemingly homogeneous productive resources can achieve competitive advantage. Furthermore, these distinctions imply that what a firm does with its resources may be just as important as what resources the firm possesses.

This study also suggests that the RBV can be empirically applied using a Bayesian hierarchical method to study diversification and focus. We have argued that such a Bayesian method is more congruent with the RBV than traditional statistical approaches. The main point of congruency is that this Bayesian method allows us to meaningfully interpret results for individual firms and the actions taken by those firms. We show how individual firms differ in the effect of diversification on economic performance.

The modifications to the RBV and the application of Bayesian methods suggested in this paper have implications for scholars and practicing managers. Hopefully scholars will use the suggested modifications to develop better explanations of competitive advantage. We are particularly interested in further examination of the relationship between administrative resources and productive resources.

We also hope that the resources-services distinction and the administrative resources-productive resources distinction will provide a useful framework for managers to think about their roles in firms. Although technically complex to calculate, the results provided by the Bayesian approach suggested here are intuitively appealing and easily applied to managerial decision making.

We are confident that the study and practice of strategic management, particularly diversification, can be advanced as scholars and managers adopt the suggestions made in this paper. The congruency between the RBV as a theory and the empirical application of the theory can be improved by recognizing the distinction between resources and services and by using a Bayesian approach to apply the theory empirically. As this congruency improves, the RBV will become even more practical as a management tool.

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