

Scarce Human Capital in Managerial Labor Markets

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Strategic human capital scholars are increasingly recognizing the importance of human capital scarcity for explaining individual and firm outcomes. This article focuses on scarce human capital in the top manager labor market—and in particular, patterns in which top managers and firms form employment relationships. This examination redirects strategic human capital scholarship in three important ways. First, the findings point to the importance of specifying an omission from prior human capital scholarship: the relationship between human capital and the firm's resource base (e.g., potential complementarities). Second, the article illustrates the need to simultaneously consider both human capital scarcity and complementarities, and reinforces that scarce human capital can indeed be general human capital. Finally, the theory explains how complementarities fundamentally alter value creation and appropriation dynamics. Specifically, complementarities facilitate the matching of the best managers and firms with the most productive resources, increase the size of the pie (financial proceeds) from the employment relationship, and can enhance the manager's bargaining power in the division of these proceeds.

Keywords: *resource-based theory; strategic factor markets; human capital; microeconomic analysis of panel data; cross-sectional times series design; positive assortative matching*

Acknowledgments: The authors would like to thank Ben Campbell, Russ Coff, Tyson Mackey, seminar participants at the University of Wisconsin, and participants at the Strategic Management Society's Strategic Human Capital Conference at the University of Utah for their helpful comments on earlier versions of this article. The constructive critiques of associate editor Tom Moliterno and two anonymous reviewers are also much appreciated.

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Strategic human capital scholarship questions deeply held assumptions about human capital and its implications for firms and individuals (Coff & Kryscynski, 2011). Most of this work has focused on firm-specific human capital. For example, some work questions the extent to which the firm performance benefits previously associated with firm-specific human capital exist (e.g., Campbell, Coff, & Kryscynski, 2012; Lazear, 2009) and suggests a continued focus on firm-specific human capital may be misplaced (e.g., Ployhart & Moliterno, 2011).

As a result, and consistent with resource-based logic, some scholars (Campbell, Coff, et al., 2012; Chadwick, 2013; Kryscynski, 2013; Molloy, Ployhart, & Barney, 2013) are turning their attention to scarce and valuable human capital (hereafter, for ease of exposition, *scarce human capital*), or knowledge, skills, and abilities persistently in short supply relative to firm demand (Barney, 1986; Rosen, 1983). For example, psychology-based theory now explains the conditions in which scarce human capital can emerge within a firm—even when the individual employees themselves do not have scarce human capital (Ployhart & Moliterno, 2011). Of course, firms can also acquire scarce human capital through labor markets (e.g., Chadwick, 2013).

One occupational group of great interest to scholars and practitioners alike is top managers, or firms' most senior executives. Top managers with scarce human capital are those who manage firms most effectively (Castanias & Helfat, 1991, 2001; Holcomb, Holmes, & Connelly, 2009). This capability might come from any number of human capital attributes, such as a manager's unrivaled ability to motivate employees, process complex information, or allocate organizational resources (Finkelstein, Hambrick, & Cannella, 2009). Whatever the specific knowledge, skills, or abilities, top managers with scarce human capital can substantially influence firm performance (Bertrand & Schoar, 2003; Mackey, 2008). Despite the importance of this scarce human capital and evidence that most firms attempt to secure this human capital through labor markets (e.g., Bonet, Cappelli, & Hamori, 2013), the managerial labor market is underresearched (Finkelstein et al., 2009), leaving central strategic human capital questions unaddressed.

This article addresses this void by developing and testing theory—an economic matching model—regarding patterns in the employment relationships top managers and firms form. The model identifies central mechanisms underlying matching—mechanisms that guide the “right” human capital to the “right” firms and explain differences in top manager compensation. To broadly foreshadow our approach and findings, we appeal to the theoretical matching models used in labor economics and empirically model the compensation and mobility of over 1,000 top managers of S&P 1500 firms. The empirical model identifies managers whose compensation is persistently different than what their human capital proxies (such as years of education and experience) would predict. The model partitions these compensation differences into portions associated with scarce human capital and firm attributes (e.g., Abowd, Kramarz, Perez-Durante, & Schmutte, 2012). Our results indicate managers with scarce human capital are more likely to form employment relationships with resource-rich firms than other firms.

On its surface, this finding may seem trivial and perhaps even obvious: the “best” managers go with the firms with the “best” resources. Yet to interpret the findings in this way would be to miss a theoretical insight with substantial implications. Simply put, this article points to an omitted variable in prior human capital scholarship: the relationship between focal human

capital and a firm's resources. Our findings support a complementary relationship between managerial human capital and firm resources (i.e., the combination of the resources results in more value than what the resources can create separately). A complementary relationship between human capital and a firm's resources fundamentally differs from other labor markets in which resources such as technology can substitute for scarce human capital (e.g., Abowd et al., 2012; Abowd, Kramarz, & Margolis, 1999; M. J. Andrews, Gill, Schank, & Upward, 2008; Mendes, Van Den Berg, & Lindeboom, 2010). Thus our findings point to the need for strategic human capital scholarship to specify if human capital is used as a complementary resource, is substituted with other resources, or has no relationship with other resources. This article redirects strategic human capital scholarship in this, and at least two other ways, a description of which follows.

Second, this article extends other strategic human capital scholarship (Campbell, Coff, et al., 2012; Chadwick, 2013; Morris, Alvarez, Barney, & Molloy, 2013a, 2013b; Ployhart & Moliterno, 2011), by demonstrating the importance of human capital scarcity for gaining human capital advantages. This focus on scarcity differs from classic human capital work (e.g., Becker, 1964) in which human capital advantage comes from individuals being "stuck" at a firm due to investments in firm-specific human capital. In this classic view, individuals' firm-specific investments are most highly valued by their present employer, making it unlikely individuals can secure lucrative offers from alternative employers and bid up their wages with their current employer (Campbell, Coff, et al., 2012). This paradigm shift—from *firm-specific human capital and immobile individuals* to *scarce human capital and complementarities with firm resources*—is accomplished by shifting the unit of theory and analysis and its theoretical framing. The framing here is individuals and firms nested within labor markets and the unit of theory and analysis is the combination of an individual with scarce human capital and potential complementarities with the firm's resource base. This fundamentally differs from extant scholarship that frames individuals within firms (rather than labor markets) and uses aggregates of human capital (e.g., a firm's workforce) as standalone resources as the unit of theory and analysis.

Third, this article also has important implications for understanding the creation and appropriation of value associated with scarce human capital. Specifically, the theory presented in this article explains how complementarities between scarce human capital and a firm's resource base are mechanisms that (a) underlie the matching of individuals with scarce human capital and resource-rich firms, (b) yield a larger economic "pie" to be divided between the firm and top manager, and (c) enhance the manager's bargaining power, making it so that these individuals appropriate some—but not all—of the value the complementary resource combination yields. Such a world in which human capital is scarce and complementarities exist between such capital and a firm's resource base, referred to as positive assortative matching in labor economics, is now described.

Scarce Human Capital and Labor Market Matching

Human capital is an individual's embodied knowledge, skills, abilities and other characteristics (KSAOs) that firms can put to productive use (Molloy & Ployhart, 2012).¹ Human capital that is scarce (a) is persistently in short supply relative to demand and (b) has a use value higher than replacement costs (Campbell, Coff, et al., 2012; Chadwick, 2013). The

scarce human capital may be either general or context-specific (more applicable in some contexts than others; Morris et al., 2013a; Ployhart & Moliterno, 2011). Scarce human capital may also be either innate or developed, and its short supply may be either inherent or artificially created. Consider for example geniuses. Here, the short supply comes from the distribution of innate intelligence across populations; simply put, there are not many geniuses. In contrast, consider the ability to practice medicine. This human capital is developed over time and, in some countries, policy makers cap the supply of licenses, which creates an artificial short supply.

Because we are interested in developing and testing theory regarding patterns in the employment relationships top managers and firms form, we are naturally interested in scarce human capital that is recognized in labor markets. Such human capital is generally valued across firms; yet, as this and other recent works indicate, such human capital can still underlie competitive advantage (Chadwick, 2013; Morris et al., 2013a, 2013b). In addition, individuals possessing scarce human capital can be identified empirically through labor market indicators such as wage contrasts for similarly situated individuals as, according to economic logic, market wages reflect human capital quality (Abowd et al., 1999). This empirical methodology developed within labor economics disaggregates compensation into components reflecting portions due to (a) human capital that is not scarce, (b) human capital that is scarce, and (c) firm differences (Abowd et al., 2012; M. J. Andrews et al., 2008; Tervio, 2008).

Consistent with economic logic, the specific KSAO(s) that are scarce are not specified in the model because to identify a particular KSAO, say high intelligence or conscientiousness, as a source of human capital advantage would create a “rule for riches” firms would try to follow (Barney, 2001; Mosakowski, 1998; Rumelt, Schendel, & Teece, 1991). In following the rule, the firms would bid up wages for individuals with the particular KSAO to the point that individuals possessing the human capital, and not the employing firm, would capture the proceeds associated with the human capital (Barney, 1986). In addition, human capital, just like any resource, is context dependent and will create competitive advantage only embedded in the right context (Barney, 1991).

Matching Theory

Matching theory (e.g., Diamond, 1982; Mortensen, 2005; Pissarides, 1985) is used in economics to understand the dynamics of search in the labor market. Specifically, matching models can predict which individuals will work at which firms, the mechanisms explaining these matches, and why some individuals earn more than others. Many features and assumptions underlie matching models, some of which are implicit to economic logic. Explaining all the features, assumptions, and extensions of matching models in detail is beyond the scope of this article; thus, only those aspects of matching models we appeal to in our theorizing follow. For more detail on the features of matching models, refer to Rogerson, Shimer, and Wright (2005), Shimer (2005), Abowd et al. (2012), and other articles referenced in this section.

Two assumptions are crucial to our model. First, and consistent with management’s strategic factor market theory (e.g., Adegbesan, 2009; Barney, 1986) and recent work in labor economics, our model assumes that both managers and firms are heterogeneous (e.g., Mortensen & Pissarides, 1999; Shimer & Smith, 2000). Simply put, some managers possess

human capital that is scarcer than other managers' human capital—and some firms have more productive resources than other firms. The important implication of this assumption is that of heterogeneous match potential: Each possible permutation of individuals and firms has differing competitive potential (i.e., the firm performance for firms and compensation for managers differs with each match).

Second, based on prior theoretical and empirical work pertaining to top managers, scarce managerial human capital and firm productive capital are assumed to be complements in production (e.g., Falato, Li, & Milbourn, 2011; Gabaix & Landier, 2008; Tervio, 2008). When resources that are complements in production are used together, the value-creation potential of the resources is amplified (Mankiw, 2008). Simply put, a multiplicative relationship exists between complementary resources: They are worth more together than separate. Examples of complementary resources include hot dogs and hot dog buns, DVD players and DVDs, printers and ink cartridges, computer hardware and software, boots and shoelaces, and pencils and erasers. Managers and the firm's resource base can be complementary because the value of resources comes not from the resources alone (Penrose, 1959) but from manager's decisions about how to use (i.e., combine) firm resources to formulate and implement firm strategies (K. R. Andrews, 1987; Barney, 1986; Wernerfelt, 1984). Decisions about how to combine resources are of course subjective, and a central part of the managerial task is exploiting available discretion in these decisions (Hambrick & Finkelstein, 1987). Managers with scarce human capital are more capable of effectively using resources to extract value than managers without this human capital.

Because individuals and firms are assumed to be heterogeneous (Adegbesan, 2009; Barney, 1986), the potential complementary relationships are also heterogeneous and the yield of the various manager–firm matches will vary. Whereas human capital scarcity is defined, in this article, relative to the availability of comparable human capital in the labor market, complementary relationships between human capital and firm resources are defined relative to each firm. In short, this means that managers with scarce human capital command higher wage rates in the labor market as many firms are interested in acquiring their scarce human capital, but that managers can also increase their pay further through bargaining with the firm if they can create value at the firm that other managers cannot. The implications of this heterogeneity in complementary relationships for matching and value creation—and ultimately bargaining power and managerial pay—are now further explained.

Complementarities: Implications for Matching and Value Creation

When resources exchanged in a factor market have a complementary relationship to the purchaser's resources, predictable matching patterns will emerge (cf. Becker, 1973). Simply put, and as explained below, the “best” managers (i.e., those managers with the scarcest human capital) will be employed by the “best” firms (i.e., those firms with the richest resource base/highest potential productivity; Abowd et al., 2012; Mortensen, 2005).

Given the economic assumptions that firms want to maximize firm performance and individuals seek to maximize their compensation, all firms will want to hire the best manager possible and all managers will want to work for the best firm possible because this maximizes outcomes for firms and managers. Firms with the most to gain from potential complementarities (i.e., firms with the most productive resources) generated by the

combination of the scarce human capital and the firm's resource base will be willing to pay the most to acquire this human capital (Rosen, 1990). In other words, firms with the largest potential increase in firm performance (increase in size of the pie to be distributed) will be willing and have the means to pay managers more than firms with less to gain. In turn, given that managers seek to maximize compensation, these firms will have their pick of the best managers—and the best managers will have their pick of the firms with the best resources.

Such a pattern where the best firms and managers form employment relationships is called positive assortative matching (Abowd et al., 2012; Becker, 1973; Sattinger, 1993; Shimer, 2005; Stiglitz, 1975). The complementarities between firm resources and managerial skill are the mechanism driving this matching and have important implications for bargaining power and managerial pay as well.

Complementarities: Implications for Bargaining Power and Managerial Pay

Interestingly, complementarities not only influence the matching process and the value created from the match but also influence the bargaining power of the manager and firm regarding how the value associated with the manager's human capital will be divided between the parties (Coff, 1999). Consistent with Morris et al. (2013a, 2013b), the examples below illustrate how the outcome of value appropriation negotiations depends on whether complementarities between managers' human capital and the firm's resources are uniquely valuable (Barney, 1988).

Suppose the complementarities between a particular firm and its top manager, Mr. Smith, generate \$100 million in revenue; however, the firm could replace this manager with a handful of other managers who could generate similar value, say \$99 million. In such a case, Mr. Smith would have essentially no bargaining power because it is relatively easy for the firm to replace him and realize essentially the same value with another manager. However, if the complementarities between Mr. Smith's human capital and the firm's resources were more unique, such that the firm could not easily hire another individual and enjoy the same complementarities (and thereby the same value creation), then Mr. Smith would be in a much more favorable bargaining position relative to the prior scenario. It is certainly plausible that individuals in situations like Mr. Smith could appropriate enough firm value to make it appear as though the firm does not enjoy a competitive advantage (cf. Coff, 1999). However, a pattern of positive assortative matching among managers and firms would suggest that this is not a zero-sum game in which highly skilled individuals appropriate all of the value they create. Rather, the managers and the firms will share the gains from their match (Campbell, Ganco, Franco, & Agarwal, 2012).

Complementarities above and beyond what the next best manager can generate are a manager's value added (cf. Brandenburger & Stuart, 1996). The more value added, the higher the manager's bargaining power, and the more compensation the manager can walk away with. A manager's value added (and in turn bargaining power and compensation) is highest when his or her skills are effectively matched to a firm's productive resources (i.e., when the "right" human capital finds the "right" firm). If the complementarities can be gained with many managers, the focal manager can be relatively easily replaced, and the firm will have more bargaining power than the manager.

In sum, complementarities are powerful mechanisms in labor markets, especially when individuals and firms are heterogeneous (Adegbesan, 2009). Specifically, when complementarities exist, managers with scarce human capital (a) have opportunities to work at resource-rich firms in which they can create more value than if they were to work at firms with fewer productive resources, (b) can generate firm value that other managers cannot, and (c) can appropriate the difference between their added value and what the next best managers can yield. When this pattern of matching and outcomes emerges in labor markets, it is what labor economists call positive assortative matching. Of course, whether this type of matching and accompanying pattern of results occurs in the top manager labor market is an empirical question. Thus,

Hypothesis: Scarce human capital and the firm's resource base will be positively associated, reflective of complementarities, a phenomenon called positive assortative matching.

Method

Data and Sample

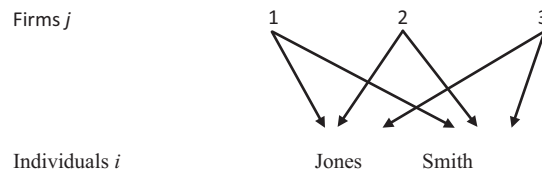
To test the hypothesis, a setting is necessary in which (a) accurate compensation data are available over time (i.e., not subject to socially desirable responding), (b) compensation is referenced to prevailing market wages, (c) detailed historical career information is readily available for constructing human capital measures, and (d) adequate variation exists to disentangle factors influencing compensation. The U.S. labor market for top managers of S&P 1500 firms meets these conditions. First, publicly available top manager compensation information is extracted from SEC filings and corporate annual reports. Because the falsification of SEC filings, unlike self-reports, is subject to criminal prosecution, this information is more likely to be accurate than self-reported data. Second, numerous empirical works demonstrate that top manager (e.g., executive and CEO) compensation contracts are anchored to prevailing market wages (Bizjak, Lemmon, & Naveen, 2008; Bizjak, Lemmon, & Nguyen, 2011; Ezzamel & Watson, 1998; Miller, 1995; Porac, Wade, & Pollock, 1999). Third, historical career information is readily available for top managers through sources such as corporate annual reports and private databases. Finally, the sample tracks top manager mobility and compensation between 1992 and 2006, creating a web of data linking each manager with other managers who have worked at the same companies, providing the necessary variation to test the hypothesis.

Specifically, the data set includes 1,123 top managers employed in 626 different firms and spans from 1992 to 2006, for a final sample of 7,174 individual-firm-year observations. Unique identifiers are included for each manager (available from ExecuComp database) and firm (available from Compustat's Industrial File). These identifiers link all focal managers to their employing firms over time—and also to other managers who have worked at these same employers, at the same time, before, or after the focal manager. The managers and firms are *crossed* rather than *nested*.

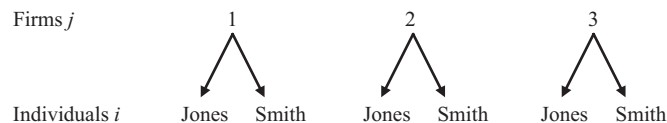
Because data in human resources—organizational behavior (HR-OB) studies are typically nested, we clarify the difference between crossed and nested. Figure 1 pertains to two individuals (Jones and Smith) employed at three firms over time. With the crossed factors illustrated at the top of Figure 1, each individual is recognized as the “same person” as he or she moves across the three employers. Moreover, Jones and Smith can be linked with other individuals who work at these same employers—even if Jones and Smith and those other

Figure 1
Difference in Crossed and Nested Factors

Crossed Factors: Estimation Considers Two Individuals i in Three Firms j



Nested Factors: Estimation Considers Six Individuals i in Three Firms j



individuals did not simultaneously work at an employer. In contrast, the nesting at the bottom of Figure 1 does not allow for this tracking of individuals over time or creation of a web of data. As illustrated, the two individuals working at three firms would statistically be treated as six different individuals, which does not suffice for this article's purposes. In short, because the sample is constructed with crossed factors, the estimation can take into account information from the managers' time at each employer in the data set and what firms paid other top managers across time, yielding unbiased estimates of market rates for human capital and other compensation determinants.²

Measures

We measure top managers' pay with two different variables, which allows for comparing results with different pay measures as is common in compensation studies. *Total cash pay* is the log of salary plus bonus; *total pay* is the log of the sum of salary, bonus, other annual compensation (such as perquisites, tax reimbursements, etc.), the total value of restricted stock grants, the total value of stock options granted using Black–Scholes,³ long-term incentive payouts, and all other total compensation (such as signing bonuses, 401k contributions, debt forgiveness, and life insurance premiums). Pay information was drawn from the ExecuComp database, which summarizes compensation information in SEC filings.

Turning to human capital proxies, prior research and compensation surveys indicate that prior job, firm, and industry experiences are important in predicting compensation. As such, variables in the analysis include current *firm experience* (employment tenure), *position experience* (experience in current job at present employer (and if applicable, prior employers)),⁴ and *prior industry experience* (time employed in present employer's industry prior to joining present employer). Industries were categorized using the first two digits of SIC codes as

classified in the Compustat Industrial File. These variables are measured in years and, like the education variables below, were drawn from Marquis Who's Who in Corporate Executives database. These human capital proxies capture information about the manager's entire professional career—not just the 1992 to 2006 time frame of the data set.

Given the substantial signaling value of MBAs from Tier 1 (top 10) or Tier 2 programs (ranked from 11 to 25) versus all other MBA degrees (Kingston & Clawson, 1990), dummy variables capture if managers have MBAs and, if so, from which tier. Tiers are based on 2006 *U.S. News and World Report* rankings. The respective variable names are *MBA degree Tier 1*, *MBA degree Tier 2*, and *MBA degree*.

We control for several characteristics that will likely affect compensation rates: *CEO status*, *director status*, *company founder*, and *female status*. These data come from the Marquis Who's Who database. Other individual and firm differences are captured in the *person and firm effects* that are central to the following model explanation.

Model and Analysis

In this section, we explain the model and analysis used to test the hypothesis. The methodological approach used in the assortative matching literature is quite different from conventions within HR-OB and to some extent macro-management research. Thus, the model is explained first as it would be for economists and then made accessible to scholars who are not economists. Next we explain how the hypothesis is tested using the model. Finally, the particulars of the analysis are discussed.

Economic interpretation. Equation 1 takes a data set such as our sample with crossed managers and firms (factors) and regresses total pay on a set of theoretically relevant human capital factors and controls using a two-way error components model with crossed person and firm effects. The equation is as follows,

$$y_{it} = \mu_y + (x_{it} - \mu_x)\beta + \mu_i\eta + \theta_i + \psi_j + \varepsilon_{it} \quad (1)$$

for $i = 1, \dots, N$ top managers, and $j = 1, \dots, J$ firms where y_{it} represents the logarithm of annual compensation for top manager i in time t , μ_y is the grand mean of y_{it} , x_{it} is a vector of observed (i.e., codified), time-varying top manager characteristics (i.e., *firm experience*, *position experience*, *prior industry experience*), μ_x is the grand mean of x_{it} , μ_i is a vector of time-invariant observed top manager characteristics and controls (i.e., *MBA degree Tier 1*, *MBA degree Tier 2*, *MBA degree*, *CEO status*, *director status*, *company founder*, and *gender*), θ_i is a random effect parameter capturing persistent unidentified top manager characteristics, and ψ_j is a random effect parameter capturing firm effects on compensation and is often interpreted as a proxy for underlying differences in the resources of the firm.⁵

Multidisciplinary interpretation. The essential logic behind Equation 1 is that pay is a function of who you are (human capital) and where you work (employer characteristics), as represented in Equation 2.

$$\text{Compensation} = f(\text{who you are, where you work}) \quad (2)$$

Consistent with the economic tradition, *who you are* is assessed with an array of human capital proxies, such as years of education and job experience. The purpose of the proxies is to capture the individual's background; the proxies are not precise measures of one's actual knowledge, skills, or abilities. Relevant human capital proxies for this study are industry, company, functional experience, whether the person has an MBA and, if so, from what tier, and so forth.

More recent labor economic compensation models recognize that human capital proxies do not capture all critical variation in human capital. A person effect is included in the estimation to capture persistent differences among individuals that are not captured in the human capital proxies (cf. Abowd et al., 1999). Labor economists interpret the person effect as identifying highly skilled individuals with attributes that are valuable (i.e., in high demand) and are not commonly held by individuals in that particular labor market. Thus, as indicated in Equation 3, "who you are" is captured with an array of human capital proxies and a person effect.

$$\text{Who you are} = f(\text{human capital proxies, person effect}) \quad (3)$$

Simply put, *who you are* captures both the human capital that is not scarce and that which is scarce as referenced in the theory section. The human capital proxies are used to estimate compensation associated with human capital that is not scarce. The person effect is used to estimate compensation associated with human capital that is scarce. Simply stated, those managers for whom the model identifies scarce human capital premiums command higher pay in the labor market than their peers with similar education and experience. Of course, only some individuals in a labor market have scarce human capital and earn an associated compensation premium.⁶ This premium "travels with" managers as they move among firms, suggesting these managers bring productivity gains to firms beyond that of colleagues with similar human capital proxies. It is assumed that this premium, because it persists over time and across firms, is not an error; in the economic view, market-based premiums like the positive person effect persist only for those who can command it, as underperforming managers face ex post settling up in future compensation contracts (Fama, 1980).

More recent labor economic compensation models also recognize the role of employer characteristics in explaining compensation variation. Thus, the model includes a firm effect to capture such between-firm differences in how firms compensate managers (Equation 4). The firm effect identifies cross-sectional differences in firms' preferences—and willingness to pay "above market"—for managerial capital and is often viewed as a proxy for underlying differences in the resources of the firm (Abowd et al., 1999). This premium is particular to an employing firm and therefore does not "travel" with the manager.

$$\text{Where you work} = f(\text{firm effect}) \quad (4)$$

Taken together, the logic behind Equation 1 is that compensation is a function of who you are (human capital proxies, person effect) and where you work (firm effect), as shown in Equation 5.

$$\text{Compensation} = f(\text{human capital proxies, person effect, firm effect}) \quad (5)$$

Importantly, the person effect and firm effect represent two separate adjustments to the expected compensation a manager earns. Thus, if a manager with scarce human capital (positive person effect) works at a firm that pays more than other firms (positive firm effect), this manager essentially earns two premiums above what his or her human capital proxies would predict, one premium for the manager's scarce human capital and the other for where he or she works. To avoid potential confusion, we clarify that the components the model empirically disaggregates are not aligned with compensation elements HR-OB scholars and practitioners might examine in salary surveys, such as base pay, bonuses, or stock grants, for example.

The test. Consistent with the labor economics literature, the hypothesis is tested by examining the correlation between the person and firm effects. A positive and significant correlation indicates that individuals with scarce human capital are matching with firms with rich resource bases, or, in other words, positive assortative matching is occurring. Thus a positive, significant correlation between the person and firm effects supports that complementarities (a) underlie the matching of individuals with scarce human capital and resource-rich firms, (b) yield more economic proceeds to be divided between the firm and top manager, and (c) enhance the manager's bargaining power in appropriating some, but not all, of these proceeds.

Analysis. The person and firm effects are estimated with random effect assumptions and all other variables with fixed effect assumptions.⁷ This simultaneous modeling of random and fixed effects has been made possible by innovations in panel data methodology referred to as mixed effects or a two-way error component model with cross random effects (cf. Rabe-Hesketh & Skrondal, 2005). Mixed effect approaches do not require assuming that the random effect parameters are uncorrelated with the explanatory variables (Abowd, Creecy, & McKinney, 2005), which is important as person and firm effects are likely correlated with the regression coefficients. The following results were modeled using the *xtmixed* command in Stata Version 10.

Results

Descriptive statistics for the variables included in Equation 1 are presented in Table 1.

Results from the estimation of Equation 1 are presented in Table 2. Model 1 uses total pay as the dependent variable, and Model 2 cash pay. Results for both models are comparable, suggesting the findings are consistent between measures of compensation. Results are also consistent with theories of human capital (Becker, 1964). For example, as expected, top managers with more nonscarce general human capital, such as education and experience, earn higher compensation than do managers with less.

To test the hypothesis, the relevant statistics are the correlations between the person and firm effects, which are listed in Table 2 beneath the effects' standard deviations.⁸ The results

Table 1
Descriptive Statistics

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
1. Total compensation (ln)	14.30	1.16	1.00											
2. Total cash compensation (ln)	13.53	0.96	.64	1.00										
3. Firm experience (yrs)	14.65	11.79	.04	.10	1.00									
4. Prior industry experience (yrs)	2.05	5.47	.07	.05	-.19	1.00								
5. Position experience (yrs)	8.84	8.24	.07	.09	.50	-.01	1.00							
6. CEO status	0.28	0.45	.32	.24	.18	.09	.29	1.00						
7. Director status	0.45	0.50	.31	.24	.29	.05	.34	.62	1.00					
8. Company founder status	0.03	0.18	.03	.02	.12	-.04	.22	.14	.16	1.00				
9. Female status	0.05	0.22	-.06	-.05	-.06	-.03	-.05	-.06	-.12	-.03	1.00			
10. Education (MBA degree)	0.24	0.43	.09	.06	-.05	.06	-.08	.00	-.05	-.09	-.02	1.00		
11. Education (MBA degree Tier 1)	0.12	0.32	.09	.08	-.03	.07	-.02	.03	.01	-.05	-.02	.65	1.00	
12. Education (MBA degree Tier 2)	0.03	0.16	.03	.05	.01	.00	-.02	.01	-.02	-.03	-.04	.30	-.06	1.00

Table 2
Two-Way Error Components Estimates of Wage Equation

	Model 1, DV: Total Pay	Model 2, DV: Cash Pay
	Estimate (<i>SE</i>)	Estimate (<i>SE</i>)
Firm experience (yrs)	0.031*** (0.002)	0.012*** (0.002)
Prior industry experience (yrs)	0.027*** (0.005)	0.011*** (0.003)
Position tenure (yrs)	0.008*** (0.003)	0.006*** (0.002)
Education (MBA degree)	-0.006 (0.083)	-0.115** (0.059)
Education (MBA degree from Tier 1 school)	0.081 (0.105)	0.122 (0.075)
Education (MBA degree from Tier 2 school)	-0.214 (0.164)	0.062 (0.118)
CEO status	0.472*** (0.034)	0.287*** (0.031)
Director status	0.515*** (0.036)	0.243*** (0.031)
Company founder status	-0.379*** (0.109)	-0.110 (0.090)
Female status	-0.328*** (0.103)	-0.123* (0.074)
Random effect parameters (estimates of <i>SD</i>)		
Person effect	0.55	0.35
Firm effect	0.89	0.53
Correlation (person, firm effects)	.39***	.43***
Observations	7,174	7,174
Number of top managers	1,123	1,123
Number of firms	626	626
Restricted log likelihood	-9,283	-8,597

* $p < .1$.** $p < .01$.*** $p < .001$.

confirm the hypothesis—the correlations between these two effects are positive and statistically significant ($r = .39$ and $r = .43$ for Models 1 and 2, respectively; $p < .001$). These correlations are consistent with a medium effect size (correlation ranging between .30 and .49 using Cohen's, 1988, standards). This means that the compensation attributed to person effects and firm effects is positively associated; managers with more human capital tend to “go with” firms with more resources. Thus, the data support the hypothesis that this managerial labor market is characterized by positive assortative matching.

Simply put, the positive, significant correlation between the person and firm effects suggests that managers with scarce human capital (indicated by the person effect) are employed by firms with the most productive resources (indicated by the firm effect). Based on economic theory, this matching of individuals with scarce human capital and resource-rich firms is driven by the complementarities between the manager and the firm. These complementarities also create a larger economic “pie” to be divided between the firm and top manager. These managers with scarce human capital earn higher compensation than their peers without this scarce human capital because the market rewards such capital (the positive person effect compensation premium) but also because the complementarities with the firm enhance their bargaining power such that they earn a second premium (the positive firm effect compensation premium). This is not a zero-sum game, however, as these managers appropriate some—but not all—of the value the complementary combination yields.

Of course, the correlation merely reports a tendency; certainly cases exist in which managers with scarce human capital are not employed by highly productive firms. The preponderance of the evidence, however, suggests that matches between managers with scarce human capital and firms with more productive resources occur more often than not.

These findings must be interpreted relative to the empirical literature and alternative explanations. Empirical work within labor economics does not find strong support for positive assortative matching (Abowd et al., 2012). Some work demonstrates a small negative correlation between person and firm effects (e.g., Abowd et al., 1999), while other work shows evidence of a positive correlation (e.g., Abowd, Lengermann, & McKinney, 2003; Iranzo, Schivardi, & Tosetti, 2008; Woodcock, 2008). However, most empirical work within labor economics testing these predictions analyzes data sets of workers in broad labor markets, such as a country's full labor market. There is some reason to expect those labor markets to exhibit different matching patterns from the managerial labor market. Recent work suggests that positive assortative matching may be concentrated at the higher end of the distribution of the labor market (i.e., skilled occupations commanding top salaries; Bagger, Vejlin, & Sørensen, 2012) and in the CEO labor market in particular (Tervio, 2008).

Discussion

This article examined scarce human capital and complementarities with firm resources. We found support for complementarities in the top manager labor market (a) acting as mechanisms facilitating matches between individuals with scarce human capital and resource-rich firms, (b) increasing the economic proceeds to be divided between the firm and top manager, and (c) enhancing managers' bargaining power/ability to appropriate the value associated

with their human capital. In this section, we outline the contributions this article makes, opportunities for future research, and the limitations of this study.

Contributions

This article makes many contributions. For convenience, the following contributions are grouped into those that (a) respond to calls for strategic human capital scholarship and paradigm shifts, (b) are applicable to all human capital scholarship, and (c) pertain to managerial compensation scholarship.

Broadly, this article addresses several calls to redirect strategic human capital scholarship. First, the article responds to calls to incorporate logic and methods of labor economics to offer a different perspective of human capital advantages (Molloy & Ployhart, 2012). Second, the article contextualizes human capital in its labor market context, which has been relatively overlooked in respect to organizational perspectives (Campbell, Coff, et al., 2012; Molloy et al., 2013). Finally, the article sheds much-needed light on mechanisms linking human capital, value creation, and value capture (Coff, 2012). These contributions position this article to complement Ployhart and Moliterno's (2011) theory regarding scarce human capital within organizations. Whereas Ployhart and Moliterno's focus is scarce human capital developing (emerging) from an individual's human capital within organizations through HR-OB mechanisms, this article's focus is scarce human capital that is acquired by firms in labor markets. Together, this article and that of Ployhart and Moliterno provide important theoretical direction for strategic human capital scholarship.

The article also explicates important steps scholars can take to advance human capital scholarship. First, scholars need to specify a previously omitted variable: the relationship between human capital and the firm's resource base (which could be complements, substitutes, or unrelated). Second, and along related lines, scholars examining scarce human capital need to simultaneously examine the implications of scarcity *and* complementarities with firm resources. And as other scholars have suggested (Morris et al., 2013a, 2013b), the theory and findings of this article give credence to the idea that general human capital of an individual can indeed be scarce. Finally, scholars need to apply this article to examine how complementarities fundamentally alter value creation and appropriation dynamics (e.g., increasing the financial proceeds for managers and firms to divide, enhancing the manager's bargaining power in compensation negotiations, etc.; cf. Morris et al., 2013a, 2013b).

This article also makes important contributions to scholarship on managerial compensation. To date, a link between human capital and executive compensation has eluded scholars. Finkelstein et al. (2009) explain,

The work on human capital [to explain executive compensation] has not yet produced a robust set of results. While it may be that certain human capital is advantageous in reaching the top echelons of a firm or in being selected as an outsider to run a company, theory has been . . . less clear on how this translates more directly into higher pay. In some ways, this is surprising, because at an intuitive level it is perfectly evident that some executives are paid more than others in part due to differences in skill sets. The problem may be the occasional disconnect between the primary research idea being investigated and the relative lack of sophistication in effectively testing that idea. (pp. 307-308)

Specifically, this article fulfills calls (Devers, Cannella, Reilly, & Yoder, 2007; Finkelstein et al., 2009) to theoretically link human capital, executive pay, and other relevant labor market influences. Moreover, the article demonstrates the productivity interconnectedness of individuals and firms, which has implications for assessing the marginal product of managers (Tervio, 2008). The approach we use can also be applied to other labor markets to link human capital and compensation. Like the prior contributions, this contribution points to important future research.

Future Research

The article opens many important opportunities for theoretical and empirical scholarship on topics as far ranging as scholarship about complements, substitutes, value appropriation, outliers, industry differences, and diverse (or underrepresented) groups.

Complements, substitutes, and value appropriation. A promising and important theoretical need is articulating the value creation and appropriation implications of various types of relationships between forms of capital. For example, in the complementary relationships between human capital and the firm's productive capital in this article, the value of the human capital is amplified and the managers are in a better position to appropriate value because of the complementarities. Future research could explore important boundary conditions for when human capital is a complement to other forms of capital. In addition, theory is needed for when human capital is a substitute for firm productive capital and what the value appropriation implications are of these scenarios. In some situations substitution will lower bargaining power (e.g., when technology deskills remaining jobs), but in other situations it could potentially raise it, as when technology increases the skills that remaining jobs require (such as when mechanization creates the need for statistical process control skills).

Of course, another important opportunity is examining other labor markets, be they geographical or occupational markets, for evidence of positive assortative matching. Scholars have anticipated positive assortative matching in other markets, but to date strong evidence has eluded scholars (e.g., Abowd et al., 2012; M. J. Andrews et al., 2008; Gruetter & Lalive, 2004; Sørensen & Vejlín, 2012).

Along related lines, an important area for research is whether potential complementarities are actually realized. This work could assess if some complementarities are easier to realize than others, and if meaningful distinctions exist, create a typology of realization categories to guide future research. An interesting consideration here is whether the ease of realization varies with the prevalence of the human capital. For example, it could be that complementarities involving human capital that is not scarce are easier to realize than complementarities involving scarce human capital. Then, scholars can define and test conditions in which complementarities are most likely to be realized. Of course, if scholars find a typology of realization categories is warranted, such conditions may vary by category. Scholarship on realization of complementarities not only is interesting and important from a theoretical perspective but also can make managerial prescriptions regarding human capital that are more useful.

Outliers. Theorizing and further empirical work on the outliers in this and related studies could yield important insights into human-capital-based advantages. For example, although we find that overall the managerial labor market can be characterized by positive assortative matching, this is of course a general tendency. Certainly cases exist in which managers with scarce human capital are not employed in highly productive firms in which they share complementarities. Thus, examination of “outliers” could be fruitful for further understanding of managing scarce human capital, specifically understanding what attracts some managers with scarce human capital to firms that are not highly productive. As emerging theory suggests, do these firms offer nonpecuniary benefits that these managers value more than traditional compensation (cf. Kryscynski, 2013), or are there noncompensation preferences that are driving these employment decisions, such as family obligations that impose geographic restrictions? Likewise, when highly productive firms hire managers without scarce human capital, is this an intentional choice for certain positions less critical to a firm’s strategy? These situations may be reflective of a substitution relationship between human capital and firm productive resources.

Industry differences. Similarly, future work could construct hypotheses regarding between-industry differences in the person and firm effect correlations. Some industries, or some positions within some industries, are likely to not require or reward managers with scarce human capital. This could be the case if top managerial positions in some industries require less executive discretion than others. Thus, this work on labor market matching could lead to identification of important boundary conditions about the feasibility of human-capital-based advantages. It may be that some assumptions about human capital advantage need to be rethought. Of course, competitive advantages based on other firm resources are possible even when human-capital-based advantages are not. Even if prevailing theory still stands, explication of boundary conditions is an important contribution to strategic management and HR-OB scholarship.

Diversity. As firms seek to increase the participation of groups previously underrepresented among top managers, such as females and racial minorities, an important area of research is if membership in an underrepresented group has compensation implications—and if members of underrepresented groups have equal opportunities to work at highly productive firms. Historically, economists have found that racial minorities, for example, are underpaid relative to their peers. Does this continue to be the case in the top manager market? Or does the increased demand for the short supply of underrepresented top managers have the opposite effect and lead to members of underrepresented groups earning more than other managers?

A preliminary finding from this study, consistent with other work (e.g., Blau & Kahn, 2000) is that compensation differences between males and females are statistically significant, with men earning more than women. Our approach extends prior work by allowing decomposition of the wage gap into portions associated with human capital and employers. The preliminary analyses for the top manager labor market (see Table 3) show that men appear to have more commonly held human capital (e.g., education and experience) than their female counterparts, which results in a wage gap. Two factors reducing this gap are the

Table 3
Determinants of Male and Female Top Manager Total Pay

		Raw Compensation Gap	Average Human Capital Proxies	Average Firm Effect	Average Person Effect
	Observations	(SD)	(SD)	(SD)	(SD)
Male top managers	4,886	-0.22 (1.08)	0.08 (0.50)	-0.21 (0.66)	-0.06 (0.34)
Female top managers	296	-0.42 (1.15)	-0.48 (0.29)	0.06 (0.58)	0.00 (0.30)
Male–female difference		0.20***	0.56***	-0.27***	-0.06***

*** $p < .001$.

increased likelihood that women have scarce human capital (i.e., higher average person effects) and work for more productive firms (i.e., have higher average firm effects) than do men. Sample sizes of female top managers are obviously small, and statistical inference from the techniques used in this article should be cautiously interpreted. These results are preliminary and require more systematic study but do point to provocative and important research for any labor market studied by strategic human capital scholars.

Limitations

Like all studies, this study has limitations, which also present research opportunities. For example, since our sample includes individuals who are heavily incentivized (compared to nonmanagerial employees), it is possible that the person effect could include some managerial skill plus some “effort.” If so this may cause some difficulty with the interpretation of the person effect. Labor economists view effort as adjustable capital whereas they view managerial skill/ability as fixed capital. Typically, matching models define the surplus of the match net of the cost of all adjustable inputs. However, in the case of effort, this is a type of adjustable capital that is embedded in the individual managers and therefore may become a confounding factor in the estimation. That said, the extant literature suggests that the variation in the effort exerted by top managers is minimal and does not substantially affect the interpretation of the person effect (cf. Tervio, 2008). However, a unique feature of human capital is that as an embodied resource, its ownership and use cannot be separated (Chadwick, 2013). This differs from other resources such as, for example, a machine or technology, for which the owner decides how it is deployed. Simply put, these other resources cannot regulate or withhold their effort. Examining this issue is an important area for theory development that will have meaningful implications not only for studies such as this on top managers, but also for all research examining relationships between human capital and performance. Some scholars have begun to address this issue (Molloy & Cooper, 2012), but more intensive examination is required.

Another possible limitation concerns other mechanisms that potentially drive the positive correlation between person and firm effects. For example, firms in an extremely competitive environment that need to be highly productive may opt to pay efficiency

wages to attract highly skilled managers and/or curb monitoring costs. Such firms may be those in a technology race with substantial gains for being the first to market (i.e., first mover advantage). If the sample comprises many such firms, this could also lead to our findings of positive assortative matching. In a different vein, a Dutch study shows that the correlation is not stationary over time and appears to be driven by voluntary movement from the most skilled workers moving from one highly productive firm to another (Bagger et al., 2012). Frequent movement between firms could certainly be occurring within the top manager labor market. Future research that examines this in more detail and explores the moderating factors of this change in the correlation over time would be valuable.

Last, it is possible that the correlation between person and firm effects could be a statistical artifact resulting from a scenario in which it is difficult to disentangle person and firm effects. However, we do not anticipate this as a problem in the current data, as the connectivity between the managers and firms creates sufficient mobility to disentangle person and firm effects. Clearly, with more and better data (i.e., more mobility in the sample), the model could yield even more accurate results.

Conclusion

Human capital scholarship in management is undergoing nothing short of a renaissance, challenging scholars and managers alike to rethink “what we know” about human capital and competitive advantage. This article contributes to this scholarship by examining which top managers and firms form employment relationships and what compensation is paid. Our findings open important avenues for research and practice. Indeed, it is our hope that this article, along with other emerging strategic human capital scholarship, shifts research from an almost exclusive focus on firm specificity to a focus on scarcity and facilitates cross- and multidisciplinary research. Such scholarship is necessary to understand the complexities underlying individuals’ career mobility and relationships between human capital and firm performance.

Appendix

Overview of Panel Data and Two-Way Error Components Models With Crossed Random Effects

The empirical methodology of this article relies on sampling and estimation techniques less common in the human resources–organizational behavior (HR-OB) literature. Given that strategic human capital scholarship spans both strategic management and HR-OB, it is important for the empirical work to be accessible to both sets of scholars.

The “Data and Sample” section of the article references an unbalanced panel data set. The data set includes 1,123 top managers—including 401 CEOs—employed in 626 different firms and spans from 1992 to 2006. Since a manager is observed in multiple years, and in some instances in multiple firms, but not *every* year in the data set (an “unbalanced” panel), the final sample is 7,174 individual-firm-year observations.

Statisticians and econometrics use the term “panel” to refer to data that are both cross-sectional and times series. Panel data have the general form of $\chi_{it}, i = 1, \dots, N, t = 1, \dots, T$, where

i is the individual (cross-sectional) dimension and t is the time dimension. Simply stated, data for each top manager in the sample are recorded in a separate row for each year the manager is in the data set. For each available year of the data set (1992-2006), a row contains the manager's annual compensation (taken from Compustat's ExecuComp database) and human capital (taken from Marquis Who's Who in Corporate Executives biographical file) data—and identifiers for the employing firm and industry (taken from Compustat's Industrial File).

One substantial benefit of this type of data construction is the rich variations captured. For example, a top manager may have made different investments in human capital as of 2006 than earlier in his or her career (say, the first year of our sampling period, 1992, before the manager earned an MBA in 1996). Moreover, top managers will likely earn different compensation in different years; all of these changes are captured. It is also critical to note that the human capital data (taken from Marquis Who's Who in Corporate Executives biographical file) actually capture a top manager's entire professional career—even prior to 1992 when the compensation data begins. Thus, for a given top manager in the data set in 1992, the compensation data for that row of the panel will represent compensation earned in 1992 but the human capital data will represent human capital investments from the beginning of his or her career up to 1992.

In both the "Measures" and the "Model and Analysis" sections, reference is made to fixed and random effects in the modeling. Some confusion has been noted about the use of these terms between econometrics and psychometrics (cf. Molloy, Ployhart, & Wright, 2011). Modeling data with fixed effects assumptions means that a given variable is assumed to have the same effect on the dependent variable, common across all observations (in this case, individuals and firms). In other words, if *prior industry experience* is modeled with fixed effects assumptions, then it is assumed that prior industry experience affects the dependent variable (i.e., compensation) in the same way for every individual in the data set—thus, one coefficient for the relationship between prior industry experience and compensation is sufficient for the entire sample (i.e., the regression coefficient is the same for each person). In contrast, modeling data with random effects assumptions means that a given variable is assumed to have a different effect on the dependent variable for each individual in the sample. In other words, it is assumed that there is a distribution of effects instead of one coefficient. So using the prior example about the relationship between prior industry experience and compensation, this variable, if modeled with random effects assumptions, would be presumed to have a different effect for every individual in the data set; thus the entire distribution of effects would be estimated (instead of one coefficient for the entire data set).

As noted in the article, the person and firm effects are estimated with random effect assumptions and all other variables with fixed effect assumptions using the technique of mixed effects, or two-way error components modeling with crossed random effects. As indicated in Figure 1, the crossed random effects are the person and firm effects. Their crossing allows the estimation procedure to "track" individuals as they move across firms, which is vital for decomposing compensation into its human capital and employer determinants. This decomposition would not be possible using nested effects, because as indicated in Figure 1, when individuals move between firms, the estimation procedure would consider the individuals as different subjects.

Notes

1. For ease of exposition, the terms *human capital* and *skills* are used interchangeably in the rest of this article and the term *scarce human capital* refers to scarce and valuable human capital.
2. Crossed factors are particularly important for empirical estimations of managerial labor market dynamics because the sample naturally incorporates compensation information about industry peers and any "settling up" occurring for the manager (cf. Fama, 1980; Spence, 2002; Wowak, Hambrick, & Henderson, 2011). This is consistent with research suggesting that, at least to some degree, top manager pay is influenced by industry peer groups (e.g., Bizjak, Lemmon, & Naveen, 2008; Bizjak, Lemmon, & Nguyen, 2011; Porac, Wade, & Pollock, 1999) and that managers with poor track records suffer diminished employment prospects, receive lower pay, and hold lower positions (Cannella, Fraser, & Lee, 1995; Gilson, 1989; Semadeni, Cannella, Fraser, & Lee, 2008).
3. Compensation is calculated for option grants instead of exercised options because the timing for exercising options is arbitrarily determined by the executive whereas the timing of option grants is determined contractually between the executive and the firm.
4. For example, if an individual were a CEO of a prior and his or her current employer, all of this time in the CEO position would be included in the position experience variable.
5. As shown in Equation 1, variables are centered at their means prior to the estimation. Centering variables in this manner allows for interpretation of the effect on expected compensation when the other explanatory variables are set to their means, instead of zero. This approach eases interpretation as it allows relative comparisons to be made.
6. Labor economists use the term *high-wage worker* for these individuals.
7. See the appendix for additional information about modeling with fixed and random effect assumptions.
8. The estimates of the person and firm effect parameters are not reported in Table 2 since these effects are estimated for every individual and firm in the sample.

References

- Abowd, J. M., Creecy, R., & McKinney, K. 2005. *Who you are versus where you work: Using a mixed-effects model to decompose wages*. Working paper, Cornell University School of Industrial and Labor Relations.
- Abowd, J. M., Kramarz, F., & Margolis, D. 1999. High wage workers and high-wage firms. *Econometrica*, 67: 251-333.
- Abowd, J. M., Kramarz, F., Perez-Durante, S., & Schmutte, I. M. 2012. *A formal test of assortative matching in labor markets*. Working paper, Cornell University School of Industrial and Labor Relations.
- Abowd, J. M., Lengermann, P., & McKinney, K. L. 2003. *The measurement of human capital in the U.S. economy*. Technical report no. TP-2002-09, LEHD, U.S. Census Bureau, Washington, DC.
- Adegbesan, J. A. 2009. On the origins of competitive advantage: Strategic factor markets and heterogeneous resource complementarity. *Academy of Management Review*, 34: 463-475.
- Andrews, K. R. 1987. *The concept of corporate strategy* (3rd ed.). Homewood, IL: Irwin.
- Andrews, M. J., Gill, L., Schank, T., & Upward, R. 2008. High wage workers and low wage firms: Negative assortative matching or limited mobility bias? *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 171: 673-697.
- Bagger, J., Vejlin, R., & Sørensen, K. L. 2012. *Wage sorting trends*. [ftp://ftp.econ.au.dk/afn/wp/12/wp12_17.pdf](http://ftp.econ.au.dk/afn/wp/12/wp12_17.pdf).
- Barney, J. B. 1986. Strategic factor markets: Expectations, luck and business strategy. *Management Science*, 32: 1231-1241.
- Barney, J. B. 1988. Returns to bidding firms in mergers and acquisitions: Reconsidering the relatedness hypothesis. *Strategic Management Journal*, 9(S1):71-78.
- Barney, J. B. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17: 99-120.
- Barney, J. B. 2001. Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, 27: 643-650.
- Becker, G. S. 1964. *Human capital: A theoretical and empirical analysis, with special reference to education*. Chicago: University of Chicago Press.
- Becker, G. S. 1973. A theory of marriage: Part 1. *Journal of Political Economy*, 81: 813-846.
- Bertrand, M., & Schoar, A. 2003. Managing with style: The effect of managers on firm policies. *Quarterly Journal of Economics*, 118: 1169-208.

- Bizjak, J., Lemmon, M., & Naveen, L. 2008. Does the use of peer groups contribute to higher pay and less efficient compensation? *Journal of Financial Economics*, 90: 158-168.
- Bizjak, J., Lemmon, M., & Nguyen, T. 2011. Are all CEOs above average? An empirical analysis of compensation peer groups and pay design. *Journal of Financial Economics*, 100: 538-555.
- Blau, F., & Kahn, L. 2000. *Gender differences in pay*. Working paper no. 7732, National Bureau of Economic Research, Cambridge, MA.
- Bonet, R., Cappelli, P., & Hamori, M. 2013. Labor market intermediaries and the new paradigm for human resources. *Academy of Management Annals*, 7: 339-390.
- Brandenburger, A. M., & Stuart, H. W. 1996. Value-based business strategy. *Journal of Economics & Management Strategy*, 5: 5-24.
- Campbell, B., Coff, R., & Kryscynski, D. 2012. Re-thinking competitive advantage from human capital: How the concept of firm-specificity has led strategy theorists astray. *Academy of Management Review*, 37: 376-395.
- Campbell, B. A., Ganco, M., Franco, A. M., & Agarwal, R. 2012. Who leaves, where to, and why worry? Employee mobility, entrepreneurship and effects on source firm performance. *Strategic Management Journal*, 33: 65-87.
- Cannella, A. A., Fraser, D. R., & Lee, D. S. 1995. Firm failure and managerial labor markets: Evidence from Texas banking. *Journal of Financial Economics*, 38: 185-210.
- Castanias, R. P., & Helfat, C. E. 1991. Managerial resources and rents. *Journal of Management*, 17: 155-171.
- Castanias, R. P., & Helfat, C. E. 2001. The managerial rents model: Theory and empirical analysis. *Journal of Management*, 27: 661-678.
- Chadwick, C. 2013. *Beyond firm-specific human capital: Labor market imperfections, human capital scarcity, and the competitive advantage of firms*. Working paper, University of Kansas, Lawrence.
- Coff, R. W. 1999. When competitive advantage doesn't lead to performance: The resource-based view and stakeholder bargaining power. *Organization Science*, 10: 119-133.
- Coff, R. W. 2012. Strategic human capital paradoxes. *Strategic Human Capital Interest Group Fall Newsletter*, 3: 9-10.
- Coff, R. W., & Kryscynski, D. 2011. Drilling for micro-foundations of human capital-based advantages. *Journal of Management*, 37: 1299-1315.
- Cohen, J. 1988. *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Devers, C. E., Cannella, A. A., Reilly, G. P., & Yoder, M. E. 2007. Executive compensation: A multidisciplinary review of recent developments. *Journal of Management*, 33: 1016-1072.
- Diamond, P. A. 1982. Aggregate demand management in search equilibrium. *Journal of Political Economy*, 90: 881-94.
- Ezzamel, M., & Watson, R. 1998. Market comparison earnings and the bidding-up of executive cash compensation: Evidence from the United Kingdom. *Academy of Management Journal*, 41: 221-231.
- Falato, A., Li, D., & Milbourn, T. 2011. *To each according to his ability? CEO pay and the market for CEOs*. Working paper, Washington University in St. Louis.
- Fama, E. G. 1980. Agency problems and the theory of the firm. *Journal of Political Economy*, 88: 280-307.
- Finkelstein, S., Hambrick, D. C., & Cannella, A. 2009. *Strategic leadership: Theory and research on executives, top management teams, and boards*. Oxford, UK: Oxford University Press.
- Gabaix, X., & Landier, A. 2008. Why has CEO pay increased so much? *Quarterly Journal of Economics*, 123: 49-100.
- Gilson, S. C. 1989. Management turnover and financial distress. *Journal of Financial Economics*, 25: 241-262.
- Gruetter, M., & Lalive, R. 2004. *Job mobility and industry wage differentials evidence from matched employer employee data*. Royal Economic Society annual conference paper no. 140, Royal Economic Society, St. Andrews, UK.
- Hambrick, D. C., & Finkelstein, S. 1987. Managerial discretion: A bridge between polar views of organizational outcomes. *Research in Organizational Behavior*, 9: 369-406.
- Holcomb, T. R., Holmes, R. M., & Connelly, B. 2009. Making the most of what you've got: Managerial ability as a source of resource value creation. *Strategic Management Journal*, 30: 457-485.
- Iranzo, S., Schivardi, F., & Tosetti, E. 2008. Skill dispersion and firm productivity: An analysis with matched employer-employee data. *Journal of Labor Economics*, 26: 247-285.
- Kingston, P. W., & Clawson, J. G. 1990. Getting on the fast track: Recruitment at an elite business school. In P. W. Kingston & L. S. Lewis (Eds.), *High status track: Studies of elite schools and stratification*: 231-254. Albany: State University of New York Press.

- Kruscynski, D. 2013. *The other side of the coin: Firm-specific inducements and human capital-based competitive advantages*. Working paper, Marriott School of Business, Brigham Young University, Provo, UT.
- Lazear, E. P. 2009. Firm-specific human capital: A skill-weights approach. *Journal of Political Economy*, 117: 914-940.
- Mackey, A. 2008. The effect of CEOs on firm performance. *Strategic Management Journal*, 29: 1357-1367.
- Mankiw, G. 2008. *Principles of economics*. Mason, OH: Cengage Learning.
- Mendes, R., Van Den Berg, G. J., & Lindeboom, M. 2010. An empirical assessment of assortative matching in the labor market. *Labour Economics*, 17: 919-929.
- Miller, D. J. 1995. CEO salary increases may be rational after all: Referents and contracts in CEO pay. *Academy of Management Journal*, 38: 1361-1385.
- Molloy, J. C., & Cooper, J. T. 2012. *Interactions between human capital, motivation, and commitment*. Presentation at the Strategic Management Society special conference on Strategic Human Capital, Columbus, OH.
- Molloy, J. C., & Ployhart, R. E. 2012. Construct clarity: Multidisciplinary considerations and an illustration using human capital. *Human Resource Management Review*, 22: 152-156.
- Molloy, J. C., Ployhart, R. E., & Barney, J. B. 2013. *A theory of general human capital and firm performance*. Working paper, University of Bath, Bath, UK.
- Molloy, J. C., Ployhart, R. E., & Wright, P. M. 2011. The myth of "the" micro-macro divide: Bridging disciplinary and system-level divides. *Journal of Management*, 37: 581-609.
- Morris, S., Alvarez, S., Barney, J., & Molloy, J. 2013a. *Dancing with the stars: Dynamic value appropriation and pareto-optimal contracting*. Working paper, Marriott School of Business, Brigham Young University, Provo, UT.
- Morris, S., Alvarez, S., Barney, J., & Molloy, J. 2013b. *Firm-specific human capital as a signal of general value: Revisiting assumptions about human capital and how it is managed*. Working paper, Marriott School of Business, Brigham Young University, Provo, UT.
- Mortensen, D. T. 2005. *Wage dispersion: Why are similar workers paid differently?* Cambridge, MA: MIT Press.
- Mortensen, D. T., & Pissarides, C. A. 1999. New developments in models of search in the labor market. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (1st ed.), vol. 3: 2567-2627. Amsterdam: Elsevier.
- Mosakowski, E. 1998. Managerial prescriptions under the resource-based view of strategy: The example of motivational techniques. *Strategic Management Journal*, 19: 1169-1182.
- Penrose, E. 1959. *The theory of the growth of the firm*. New York: John Wiley.
- Pissarides, C. A. 1985. Short-run equilibrium dynamics of unemployment vacancies and real wages. *American Economic Review*, 75: 676-690.
- Ployhart, R. E., & Moliterno, T. P. 2011. Emergence of the human capital resource: A multilevel model. *Academy of Management Review*, 36: 127-150.
- Porac, J. F., Wade, J. B., & Pollock, T. G. 1999. Industry categories and the politics of the comparable firm in CEO compensation. *Administrative Science Quarterly*, 44: 112-144.
- Rabe-Hesketh, S., & Skrondal, A. 2005. *Multilevel and longitudinal modeling using Stata*. College Station, TX: Stata Press.
- Rogerson, R., Shimer, R., & Wright, R. 2005. Search-theoretic models of the labor market: A survey. *Journal of Economic Literature*, 43: 959-988.
- Rosen, S. 1983. Specialization and human capital. *Journal of Labor Economics*, 1: 43-49.
- Rosen, S. 1990. *Contracts and the market for executives*. Working paper no. 3542, National Bureau of Economic Research, Cambridge, MA.
- Rumelt, R. P., Schendel, D., & Teece, D. J. 1991. Strategic management and economics. *Strategic Management Journal*, 12(S2): 5-29.
- Sattinger, M. 1993. Assignment models of the distribution of earnings. *Journal of Economic Literature*, 31: 831-880.
- Semadeni, M., Cannella, A. A., Fraser, D. R., & Lee, D. S. 2008. Fight or flight: Managing stigma in executive careers. *Strategic Management Journal*, 29: 555-567.
- Shimer, R. 2005. The assignment of workers to jobs in an economy with coordination frictions. *Journal of Political Economy*, 113: 996-1025.
- Shimer, R., & Smith, L. 2000. Assortative matching and search. *Econometrica*, 68: 343-370.
- Sørensen, K. L., & Vejlin, R. 2012. *Return to experience and initial wage level: Do low wage workers catch up?* Economics working papers, School of Economics and Management, University of Aarhus.

- Spence, M. 2002. Signaling in retrospect and the informational structure of markets. *American Economic Review*, 92: 434-459.
- Stiglitz, J. E. 1975. The theory of "screening," education, and the distribution of income. *American Economic Review*, 65: 283-300.
- Tervio, M. 2008. The difference that CEOs make: An assignment model approach. *American Economic Review*, 98: 642-668.
- Wernerfelt, B. 1984. A resource-based view of the firm. *Strategic Management Journal*, 5: 171-180.
- Woodcock, S. D. 2008. Wage differentials in the presence of unobserved worker, firm, and match heterogeneity. *Labour Economics*, 15: 771-793.
- Wowak, A. J., Hambrick, D. C., & Henderson, A. D. 2011. Do CEOs encounter within-tenure settling up? A multi-period perspective on executive pay and dismissal. *Academy of Management Journal*, 54: 719-739.