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Employer Strategies for Recruitment and Screening: High-Performance Systems or Diminishing Returns?

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Keywords
recruitment, screening, worker performance

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We study the effects of recruitment and screening methods on worker performance. If high-performance recruitment and screening systems exist, bundles of recruitment and screening methods would produce synergistic effects, increasing worker performance by more than the sum of the individual effects. An alternative hypothesis is one of diminishing returns, according to which adding a second method to an existing one produces a positive, but diminishing, effect on performance. Both hypotheses are definitively rejected by the data.

INTRODUCTION

There is now a well-developed literature on high-performance work systems (Applebaum & Batt 1994; Cappelli & Neumark 2001; Ichniowski et al. 1996, 1997; Milkovich & Boudreau 1997; Pfeffer 2002; White et al. 2003). The question asked in these studies is, what human resource management practices and forms of organizing work, when used together, improve organizational outcomes the most?

Central to the high-performance workplace systems literature is the notion of synergies. Two performance-enhancing variables may be said to have synergistic effects when the impact of one variable on performance depends positively on the usage of the other. Thus, when high-performance systems are operative, the data must exhibit positive main effects for the two explanatory variables and also a positive interaction effect (in some disciplines, the term "moderating effect" is used in place of "interaction effect.") for the two taken together. Many studies have looked for synergistic effects of such workplace practices as self-managing work teams, participatory work practices, modular production systems, flexible job definitions, problem-solving groups, gain-sharing type compensation plans, and extensive labor-management communication. The performance variables in these studies include such workplace outcomes as productivity, sales revenue, costs, downtime, and defect rate. The results are quite mixed: interaction effects sometimes have the correct sign, sometimes are statistically insignificant, and sometimes have the wrong sign. In addition to the studies cited in the previous paragraph, the interested reader is referred to the works of Arthur (1994), Batt (1999), Delery & Doty (1996), MacDuffie (1995), Snell & Dean (1992), Wright et al. (1995), and the references cited therein.

The present paper looks at an earlier stage in the performance chain, namely, at the recruitment and screening strategies adopted by firms when they hire workers. We begin by proposing a theoretical mechanism based on economic theory to explain the nature of synergies in worker selection methods. The central idea is that when recruitment and screening methods are viewed as abstract mechanisms for generating information about a population of potential applicants, and when such information sources are mutually reinforcing, a profit-maximizing firm can bundle them together to better align the incentives of potential job applicants with the goals of the firm. We develop the theoretical foundation with the aid of an illustrative example.

Although there have been many empirical studies of the effects of various recruitment and screening methods on job outcomes (e.g., Bishop 1993; DeVaro 2005; Holzer 1987, 1996; Rynes 1991), only the study by DeVaro & Fields (2005) has included interactions of recruitment and screening methods in a model of worker performance. The focus of that study, however, was not on testing for the presence of high-performance systems, and the authors did not offer a theoretical rationale for synergies in recruitment and screening methods. In the present study, we ask whether certain recruitment and screening practices, when used together, generate higher-performing workers than would have been expected from the sum of the individual effects. We term this the "high-performance recruitment and screening hypothesis." In the absence of high-performance recruitment and screening systems, an alternative hypothesis is one of diminishing returns among recruitment and screening methods. That is, even if the combination of two methods does not produce a synergistic effect on performance, it might still produce a "more positive" main effect than does the more important of the two effects taken alone.

THEORETICAL FOUNDATION

A theoretical foundation for synergies in employee selection methods derives from economic theory, in particular the behavioral assumption that economic agents seek to maximize some objective, be it profits in the case of firms or utility in the case of workers. In this section we aim to clarify the mechanism by which this behavioral theory could create synergies in employee selection methods. An illustrative example makes this mechanism transparent.

Consider two selection methods an employer might use to hire a worker: requiring a sample of work and conducting a personal interview. The employer could use either method individually or both simultaneously. Basing a hiring decision solely on a sample of work, such as a writing sample, would very likely be a costly mistake. Unless ownership is easily verifiable, weak job applicants are likely to behave strategically and submit work samples that are only partially theirs or perhaps someone else's entirely. Similarly, basing the hiring decision solely on a personal interview is not likely to be very informative in many cases. The job applicant might be a fast talker, but under the time constraints of the typical personal interview the employer may well not be able to gauge whether the worker is qualified. In summary, the personal interview used alone is likely to be only modestly informative in many cases, and the work sample used alone could potentially yield such bad information that it would be preferable not to do it at all.

Next, consider the combination of the two methods, a selection bundle that includes both a required work sample and a personal interview. Now the personal interview can be

more focused, centering on the submitted work sample and quickly resolving any questions about its authorship. Perhaps more importantly, strategic-minded workers will no longer see an advantage in submitting a high-quality work sample authored by someone else, since they know they will be caught (and very likely humiliated) in the personal interview. Thus, the lower-qualified applicants do not bother applying, raising the quality of the applicant pool and lowering selection costs for the employer. Because the two selection methods are mutually reinforcing, the work sample becomes an effective screen only when it is combined with a personal interview. Similarly, a personal interview is of limited value unless it is preceded by a required work sample.

There is clearly a synergistic effect of combining the two methods. Used individually, neither method is particularly informative; indeed, it is quite possible that the sum of their individual effects produces a negative outcome for the firm. But used together as a bundle, their combined effect is positive, exhibiting a synergy. It is worth emphasizing that the synergistic effect of the selection methods in this example arises because of the behavioral assumptions of optimization on the part of both workers and firms. The combination of the two mutually reinforcing methods changes the incentives facing potential job applicants, dissuading the lower-quality ones from applying, thereby aligning the incentives of the workers with the goals of the firm.

This illustrative example pertains to screening methods used to select from an existing pool of applicants, as opposed to recruitment methods, which are used to generate such a pool. Since our paper concerns both recruitment and screening systems, it might appear that we lose some generality by illustrating the synergistic mechanism via an example that only uses screening methods. In fact this is not so. Although recruitment and screening methods serve

different functions, in the sense that recruitment methods are used to generate a pool of applicants and screening methods are used to select from this pool, we argue that this distinction is somewhat artificial.

Viewed abstractly, the employer's hiring problem is to draw workers from the population of potential applicants in a way that maximizes profit for the firm. In a world with perfect information this would be a simple task. But in fact the employer has only very limited information about the population of potential applicants and, furthermore, this population is constantly changing. Recruitment and screening methods can both be viewed as mechanisms at the employer's disposal for collecting information about this population. Whether this information is collected by attracting a sample of the population via recruitment methods, or by subsequent close scrutiny of the resulting applicant pool via screening methods, is immaterial. The employer is merely collecting the information that ultimately leads to a hiring decision. Viewed in this way, recruitment and screening methods are simply information-generating devices and, as such, we can view them symmetrically. The synergy illustrated in the previous example pertained to two screening methods, but we could have easily chosen two recruitment methods or one recruitment method and one screening method to illustrate mutually reinforcing information-generating devices.

Although there is a strong theoretical argument in favor of synergies in selection methods, the behavioral theory is also permissive of nonsynergistic effects. In some cases the information gleaned from two selection methods might be useful but not mutually reinforcing. One example concerns information sets that contain some overlap. If two selection methods are both informative but contain some overlap, then we can expect their combined effect to be less than the sum of their individual effects. This notion has been formalized in economic

theory by the concept of diminishing returns. Even when two information sets are mutually reinforcing, suggesting a synergy, if they are also significantly overlapping then a diminishing returns effect could dominate the synergy. The resolution of this tension must lie in empirical analysis.

HYPOTHESES

The first step in analyzing whether high-performance recruitment and screening systems exist is to ask whether recruitment and screening methods are in fact chosen in bundles or systems. By a bundle, we mean a set of recruitment and screening methods that tend to be used together. Simply observing that employers tend to use multiple recruitment and screening methods cannot establish the existence of recruitment and screening bundles. The use of multiple methods does not by itself suggest anything systematic in the choice of recruitment and screening methods. Rather, the question is whether certain recruitment and screening methods tend to be used along with certain other ones. Accordingly, our first hypothesis is as follows.

> *Hypothesis 1: There are bundles of recruitment and screening methods that tend to be used together.*

The next question to ask is whether individual recruitment and screening methods can be shown to be associated with higher worker performance. The notion that there exist recruitment and screening methods that, if used individually, will raise worker performance is the second of our testable hypotheses.

> *Hypothesis 2: Some recruitment and screening methods raise worker performance when used individually.*

If employers tend to combine certain recruitment and screening methods together into bundles and if some individual recruitment and screening methods are found to raise performance, the next question is whether these bundles are chosen in such a way as to produce high-performance. A high-performance recruitment and screening system is defined as a bundle of methods that interact so as to produce a synergistic positive effect on performance, so that the effect of the bundle on performance is greater than the sum of the individual effects on performance. This leads to our next testable hypothesis: that high-performance recruitment and screening systems do in fact exist.

Hypothesis 3: There are high-performance recruitment and screening systems.

One alternative to high-performance recruitment and screening systems would be recruitment and screening systems that produce positive effects but not the synergistic ones that we label "high performance." That is, even if the combination of two methods does not produce a synergistic positive effect on performance, it might still produce a "more positive" main effect than does the more important variable taken alone. We shall say that two methods combined produce diminishing returns when the return to using the two methods together lies between the larger of the two main effects and the sum of the two main effects – for example, when variable X_1 has a main effect of 3 performance points, variable X_2 has a main effect of 6 performance points, and variables X_1 and X_2 together have a main effect greater than 6 but less than 9 performance points. This leads us to our fourth testable hypothesis.

Hypothesis 4. In cases where the effects of recruitment and screening bundles on performance cannot be said to be synergistic, the relationship is characterized by diminishing returns.

Finally, it is possible that successful recruitment and screening methods differ by skill level. That is, the payoffs to methods that are used to recruit and screen high-skilled workers are different from the payoffs to low-skilled workers and that certain combinations of methods may produce high-performance outcomes for one occupational group but not the other. Accordingly, we separate out workers in highly-skilled occupations from those in less-skilled ones and hypothesize:

> *Hypothesis 5. Particular combinations of methods may result in high-performance outcomes for one occupational group but not the other.*

METHODS

Sample

Our sample for the empirical testing of these hypotheses is taken from the Multi-City Study of Urban Inequality (MCSUI); for more information about the data, see Holzer (1996). The MCSUI is a cross-sectional employer telephone survey collected between 1992 and 1995. There are 3510 observations in the data and the sampling universe consists of four metropolitan areas: Atlanta, Boston, Detroit, and Los Angeles. The survey respondent was the owner in 14.5% of the cases, the manager or supervisor in 42%, a personnel department official in 31.5%, and someone else in 12%.

Two thirds of the cases come from a probability sample stratified by establishment size (25%: 1-19 employees; 50%: 20-99 employees; 25%: 100 or more employees), drawn from regional employment directories provided by Survey Sampling, Inc. (SSI), primarily based on local telephone directories. The remaining third was drawn from the current or most recent employer reported by respondents in the corresponding MCSUI household survey. Screening

identified a respondent who actually carried out hiring for the relevant position, and the survey instrument took 30-45 minutes to administer on the telephone, with an overall response rate of 67%. Sampling weights were constructed to correct for the complexities of the sampling scheme and weighted observations are a representative sample of firms, such as would occur if a random sample of employed people were drawn from each city.

A substantial fraction of survey questions ask about the most recently hired worker, and these questions form the basis for our empirical analysis. The key variables for our analysis include this worker's employer-reported subjective performance rating, the recruitment and screening methods that were used in hiring this worker, and various firm characteristics.

Measures

Our analysis requires measures of worker performance, the recruitment and screening methods that were used in hiring, and characteristics of the firm. We report descriptive statistics for the means and standard deviations for all of these variables in Table 1. The definitions of these variables are as follows.

Performance. Our measure of the dependent variable, $PERF_j$, is the employer-reported answer to the following question about the most recently hired worker in firm j: "On a scale of zero to one hundred, where fifty is average and one hundred is the best score, how would you rate this employee's performance in this job?" We use $PERF_j$ as a proxy for the performance of all of the workers who were hired by firm j in a particular time interval. There are 2791 firms for which the dependent variable PERF is reported. As seen in Table 1, the mean value of performance is 78, with a standard deviation of 22.5.

Recruitment Methods. For each of ten individual recruitment methods, the employer is asked which one or ones were used in the campaign to hire the most recent worker. The ten methods include posting help-wanted signs, running newspaper advertisements, accepting "walk-ins," and soliciting referrals from various sources including current employees, the state employment agency, private employment or temporary agencies, community employment agencies, school placement officers, unions, and friends.

As seen in Table 1, the most popular individual recruiting method is soliciting referrals from current employees, used by 82.2 percent of employers. The fact that the sum of the means across all methods is much greater than one indicates a large degree of overlap in the methods chosen; that is, the vast majority of employers report using multiple methods. In fact, the mean and median numbers of recruitment methods used are about four.

Screening Methods. There are seven screening methods observed in the data. For five of these methods, the employer is asked how frequently the particular method is used when hiring into this type of position (that is, the type held by the most recently hired worker). The possible responses are “Always”, “Sometimes”, or “Never”. These five screening methods include requiring a written application, requiring an interview, checking references, checking educational credentials, and checking criminal record. For two additional screening methods, the employer is not asked about frequency. The employer is merely asked whether these methods are used when hiring into positions of this type, with a “Yes” or “No” response. These screening methods include requiring a performance test and requiring a sample of work. Whereas the recruitment questions pertain specifically to the campaign to hire the most recently hired worker, the screening questions pertain to campaigns for workers “of this type.” So if an employer reports that criminal record checks are “sometimes” performed when hiring into positions of this type, we cannot establish whether a criminal record check was performed for the most recently hired worker. Since we can only be certain that criminal record check was performed for this worker when the employer reports that this method is “always” used, we recoded the first five methods to equal one if the particular screening method is always used, and zero otherwise. We do not recode the other two screening variables, since these do not ask about frequency.

Table 1 reveals that the most popular screening method is requiring an interview, used by 87.8% of employers. As was the case with recruitment methods, use of multiple screening methods is common.

Firm Characteristics. We incorporate a number of firm characteristics as control variables in our analysis. These include firm size, number of sites of operation, the fraction of workers covered by collective bargaining agreements, and dummy variables for whether the firm is for-profit, whether it is a franchise, whether it has any temporary workers, and whether it has any contract workers. In addition, we use the following industry indicators: agriculture, forestry, and fishing; mining; construction; transportation; wholesale trade; retail trade; finance; services; and public administration.

Insert Table 1 about here

Analytical Methods

Our first hypothesis is that there exist bundles of recruitment and screening methods that tend to be used together. The most straightforward test of this hypothesis is to consider all possible correlations of recruitment methods with recruitment methods, screening methods with screening methods, and recruitment methods with screening methods. A correlation matrix thus provides our answer to Hypothesis 1. Positive and statistically significant correlations imply that certain combinations of methods are systematically chosen together, supporting the existence of recruitment and screening bundles.

Our remaining hypotheses concern the determinants of worker performance. We test these hypotheses using a cross-sectional multiple regression structure, in which the performance of the most recently hired worker is expressed as a function of the ten individual recruitment methods, the seven individual screening methods, and controls for firm characteristics.

An interactive specification is crucial for our analysis since both the synergies and diminishing returns hypotheses suggest that recruitment and screening strategies affect worker performance nonlinearly. In particular, the synergies hypothesis implies positive main effects and interaction effects, while the diminishing returns hypothesis implies positive main effects with a negative interaction effect within a certain range of magnitudes. Testing either of these hypotheses requires an interactive specification. Given the relatively small sample size and the large number of individual recruitment and screening methods, we are able to consider only two-way interactions. Therefore, the performance equation we estimate can be expressed as follows:

$$PERF = a + \sum_r b_r REC_r + \sum_s c_s SCRN_s + \sum_r \sum_{r'<r} d_{rr'} REC_r \times REC_{r'} + \sum_s \sum_{s'<s} e_{ss'} SCRN_s \times SCRN_{s'} + \sum_r \sum_s f_{rs} REC_r \times SCRN_s + \sum_i g_i F_i + \varepsilon. \quad (1)$$

Here, PERF denotes worker performance, REC denotes recruitment methods, SCRN denotes screening methods, and F denotes firm controls. The equation includes 10 main recruitment method effects, 7 main screening method effects, 45 two-way interactions among recruitment methods, 21 two-way interactions among screening methods, 70 two-way interactions between recruitment and screening methods, and 15 controls for firm characteristics and industry effects.

The performance regression provides the basis for empirically testing Hypothesis 2, which asks whether in fact there are recruitment and screening methods that, if used individually, raise worker performance. To answer this question, for each method we consider the partial derivative of performance with respect to the individual method. Since the performance equation (1) is nonlinear in the variables, the relevant derivative is not simply the

regression coefficient on the method in question. Rather, the derivative is a function of all of the other recruitment and screening methods, so the effect of using a particular recruitment or screening method on performance depends on the values of all of the other methods. The question then arises of where the derivative should be evaluated, since different points of evaluation could imply very different effects on performance. Our method is to evaluate the derivative at the mean values for all of the recruitment and screening methods.

We propose three possible tests of Hypothesis 3. A commonly used approach in studies involving a multitude of human resource policies is to reduce dimensionality by aggregating the individual methods, either based on theoretical considerations or on statistical considerations such as principal components analysis; see, for example, Huselid (1995) and MacDuffie (1995). This approach is standard in the high-performance systems literature. In our context of selection methods, this would involve constructing both a recruitment index and a screening index, regressing worker performance on these two indexes and their interaction, and checking for a statistically significant and positive interaction effect. This would be a very stringent test for high-performance systems, possibly obscuring a multitude of synergistic effects that might exist between pairs of individual recruitment and screening methods.

A less stringent test of Hypothesis 3 involves estimating the performance equation (1), allowing the selection methods to enter individually rather than as aggregate indexes. This test requires comparing the main effects of two individual methods to their interaction effect. The notion of a "main effect" must be very carefully defined in the context of an interactive performance equation like (1). Main effects are defined with respect to a pair of individual methods, such as recruitment and screening methods X_1 and X_2. Let $\partial PERF/\partial X_1$ and $\partial PERF/\partial X_2$ denote the main effects for these recruitment methods, and let d_{12} denote the

coefficient on the interaction term $X_1 \times X_2$. The partial derivative $\partial PERF/\partial X_1$ represents the effect of Method 1 on worker performance. But this effect is a function of all of the other recruitment and screening methods, and the question arises as to where to evaluate the derivative. We evaluate this derivative at the actual chosen values for all recruitment and screening methods except for X_2, which is evaluated at zero. Similarly, the main effect of X_2 on performance is defined as the partial derivative $\partial PERF/\partial X_2$ evaluated at zero for X_1 and at the chosen values for all of the other methods. Intuitively, the two main effects can be thought of as the effect of each method in a pair when it is used in the absence of the other method in the pair.

Having carefully defined our notion of "main effect", we can now state our criterion for our second and less stringent test of Hypothesis 3. Two recruitment and screening methods display a synergy if the interaction effect is positive and statistically significant when both of the main effects are positive. That says that using both methods together raises performance by more than the sum of the two performance effects when the methods are used individually. Our criterion for synergistic effects therefore requires that the following three conditions be met:

Stringent Synergies Condition 1. $\partial PERF/\partial X_1$ is positive.

Stringent Synergies Condition 2. $\partial PERF/\partial X_2$ is positive.

Stringent Synergies Condition 3. d_{12} is positive and statistically significant at the 10% level.

This test is less stringent than the test involving aggregate indexes, since it allows for synergistic effects between particular selection methods to be discovered if they in fact exist. However, the test requires that both main effects be positive. It is possible to conceive of methods that, when used alone, produce no benefit or are perhaps even more damaging than not

using the method at all, yet are profitable for the firm when combined with other methods. For example, recruiting by posting help wanted signs without any efforts to screen applicants could likely produce negative outcomes for the firm. But posting help wanted signs is a very fast and cheap recruitment method that, if combined with careful screening, could likely produce positive outcomes for the firm. This corresponds to a weaker notion of "synergy" that is not captured by our second proposed test of Hypothesis 3. We therefore propose the criterion for our least stringent test of Hypothesis 3. Synergistic effects require that the following three conditions be met:

Less-Stringent Synergies Condition 1. d_{12} is positive and statistically significant at the 10% level.

Less-Stringent Synergies Condition 2. $\partial PERF/\partial X_1 + \partial PERF/\partial X_2 + d_{12}$ is positive.

These conditions say that the total effect on performance of using both selection methods simultaneously must be positive, even if one or perhaps both of their individual effects are negative.

Although we report the results of all three tests of Hypothesis 3, we believe for a number of reasons that the first test is too stringent and not as good as the other two. First, there is no strong theoretical basis for grouping the recruitment and screening methods into aggregates. Second, such aggregation could obscure potential synergistic effects, if they exist, in pairs of particular methods. This could lead to a Type I error, or a rejection of the high-performance systems hypothesis when in fact it holds true for some selection methods. Third, our preference for working with individual methods, as opposed to aggregate indexes, derives from the basic questions a business manager would want answered. A manager would want to know which particular bundles of individual methods produce synergistic effects on

performance, not which pairs of principal components indexes have a positive interaction effect.

When two methods do not produce a synergistic effect, Hypothesis 4 states that their effect may be described by diminishing returns. An empirical test for the presence of diminishing returns in recruitment and screening strategies must be carefully defined. Diminishing returns states that the return to using two methods is less than the sum of their two individual effects but is still larger than the larger of their two individual effects. For example, if Method X_1 raises performance by 3 points and Method X_2 raises performance by 6 points, then Methods X_1 and X_2 together raise performance by between 6 and 9 points.

For each pair of recruitment and screening methods, our test for diminishing returns relies on comparing two main effects from the performance regression and their interaction effect. For example, consider the bundle consisting of the pair X_1 and X_2 from (1). Our criterion for diminishing returns requires that the following four conditions be met:

Diminishing Returns Condition 1. $\partial PERF/\partial X_1$ is positive.

Diminishing Returns Condition 2. $\partial PERF/\partial X_2$ is positive.

Diminishing Returns Condition 3. d_{12} is negative and statistically significant at the 10% level.

Diminishing Returns Condition 4. The larger of $\partial PERF/\partial X_1$ and $\partial PERF/\partial X_2$ is less than $(\partial PERF/\partial X_1 + \partial PERF/\partial X_2 + d_{12})$.

Finally, Hypothesis 5 states that particular combinations of methods may result in high-performance outcomes for one occupational group but not the other. We test this hypothesis by dividing the full sample into two occupational sub-samples and repeating the preceding tests.

RESULTS

The correlation matrix of all seventeen recruitment and screening methods is presented in Table 2. A large number of pairs of methods are found to have positive and statistically significant correlations at the five percent level in all three panels of the table: the recruitment-recruitment correlations, the screening-screening correlations, and the recruitment-screening correlations. There are only a small number of statistically significant negative correlations, and all but two of these are in the recruitment-screening panel. This provides strong support for Hypothesis 1, that recruitment and screening methods tend to be used together in bundles.

Insert Table 2 about here

We then estimated the performance regression (1) using ordinary least squares, computed the partial derivative of performance with respect to each of the recruitment and screening methods, evaluating this derivative at the means of all of the methods, and calculated standard errors using bootstrapping with 1,000 replications. These results are reported in Table 3. The results indicate that some recruitment and screening methods individually raise performance, providing evidence in support of Hypothesis 2. However, none of these positive effects is estimated very precisely. Only one of the screening methods achieves statistical significance at conventional levels. Nevertheless, the point estimates reflect our best estimate of the effect of an individual method on performance, and we find that a number of recruitment methods (help wanted advertising, current employee referrals, private employment agency referrals, and referrals from schools) and a number of screening methods (requiring interviews, checking references, checking educational credentials, checking criminal record, and requiring work samples) raise performance. The point estimates, therefore, provide evidence in support of Hypothesis 2.

Insert Table 3 about here

We come now to our three tests of the high-performance or synergies Hypothesis 3. The first and most stringent test involves constructing indexes for recruitment and screening on the basis of statistical, as opposed to theoretical, considerations. Table 4 reports the results of a principal components analysis of the ten recruitment methods and the seven screening methods. For both recruitment and screening we present all principal components, their cumulative share, and the scoring coefficients associated with the first principal component. We have argued that there is no strong theoretical basis on which to aggregate the individual methods into indexes, and Table 4 confirms that there is no strong statistical basis for aggregation either. Both for recruitment and screening, the first principal component accounts for less than a quarter of the total variation. Furthermore, the cumulative shares indicate that for neither recruitment nor screening would a small subset of principal components account for most of the variation. We conclude that we lack both a theoretical and a statistical basis for reducing the dimensionality of the problem. Nevertheless, if one were to proceed with the most stringent test of Hypothesis 3, on the basis of indexes constructed from the first principal components of recruitment and screening, *RECPC* and *SCRNPC*, the following regression would result with standard errors in parentheses:

$$\begin{matrix} PERF = 78.251 - 0.933(RECPC) + 1.009(SCRNPC) + 0.168(RECPC \times SCRNPC) \\ \qquad\quad (0.467) \quad (0.319) \qquad\quad (0.334) \qquad\quad (0.203) \end{matrix}$$

The interaction effect in this regression is positive but is far from statistically significant at conventional levels. If this stringent test of the high-performance systems hypothesis were to be believed, it would herald a strong rejection of the hypothesis.

Insert Table 4 about here

The results of our two less stringent tests of Hypothesis 3 are reported in Table 5, displaying main effects and interaction effects for all pairs of recruitment and screening methods for which the interaction effect is statistically significant at the ten percent level. We restrict our attention to these pairs since they are the only ones for which we could potentially identify either a synergy or a case of diminishing returns. In fact, Hypothesis 3 is definitively rejected by the data using our second test criterion. There is not a single case of two positive main effects and a positive and statistically significant interaction effect. This is a strong rejection of the idea of high-performance recruitment and screening systems. Our least stringent test of Hypothesis 3 reveals only weak support for high-performance systems. Of all pairs of methods that exhibit a statistically significant interaction, only three satisfy the conditions for our least stringent test of Hypothesis 3. These pairs are: recruitment through union referral and state employment agencies, screening through requiring work samples and personal interviews, and recruiting through newspaper advertising and screening by checking the applicant's criminal record. We conclude that the collective evidence in favor of Hypothesis 3 is extremely weak. Only the least stringent of our three proposed tests identifies any synergies at all, and even that test identifies only three.

Hypothesis 4 -- that recruitment and screening bundles that are not synergistic are characterized by diminishing returns -- is also strongly rejected by the data, as seen in Table 5.

There is not a single pair of recruitment and screening methods for which our four criteria for defining diminishing returns are met. Thus, neither synergistic high-performance recruitment and screening systems nor diminishing returns appears in the full sample.

Insert Table 5 about here

Our final hypothesis concerns occupational differences. While the full sample spans all worker types and skill levels, it is likely that successful recruitment and screening strategies differ by skill level. That is, the payoffs to the methods that are used to recruit and screen high-skilled workers may be different from the payoffs for low-skilled workers. If this is so, then the performance regression (equation 1) could give weak results if estimated on the full sample. This may be why we found no evidence of high-performance recruitment and screening systems in our data. If there are high-performance systems for hiring low-skilled workers but these differ from those that exist for hiring high-skilled workers, then if both types of workers are pooled, the regression results could obscure the existence of different types of high-performance systems.

The same argument applies to tests of the hypothesis of diminishing returns. The combinations of recruitment and screening methods that exhibit diminishing returns for workers in low-skilled occupations might differ dramatically from those that exhibit diminishing returns for those in high-skilled occupations, so that no such effect is discernible in the cross section. Therefore, Hypotheses 3 and 4 cannot be convincingly rejected by the data unless the patterns observed in Table 5 also hold in sub-samples disaggregated by occupation.

To test this conjecture, which is our Hypothesis 5, we created two occupational sub-samples and re-estimated the performance regression on each. The MCSUI data include a question asking the employer about the type of job into which the most recently hired worker

was hired. Responses were coded according to the 1980 Standard Occupational Classification, from the two to four digit level. We categorized each observation into four occupational groups, in roughly descending level of skill:

Occupation 1: Administrative, engineering, scientific, teaching, and related occupations, including creative artists,

Occupation 2: Technical, clerical, sales, and related occupations; precision production, craft and repair,

Occupation 3: Service occupations, including military occupations,

Occupation 4: Operators, fabricators, laborers; farming, forestry, fishing, and hunting occupations.

Given the large number of independent variables in the performance equation (1) and the relatively small number of observations in the four sub-samples, we combined occupations 1 and 2 into a "high-skilled" occupational sub-sample and occupations 3 and 4 into a "low-skilled" occupational sub-sample. Table 6 reports the results for high-skilled occupations and Table 7 reports the results for low-skilled occupations. These tables produce the same results as Table 5, which pertained to the full sample. Tables 6 and 7 reveal that Hypothesis 3 -- that high-performance systems exist in recruitment and screening -- is strongly rejected. In no case is a positive and statistically significant interaction effect accompanied by two positive main effects. Thus, the pattern observed in the full sample persists in both of the occupational sub-samples. Tables 6 and 7 also reveal that Hypothesis 4 -- that recruitment and screening bundles that are not characterized as high-performance systems can be said to exhibit positive but diminishing returns -- is strongly rejected. In no case do we observe two positive main effects and a positive total effect that exceeds the larger of the two main effects in magnitude.

Insert Table 6 about here

Insert Table 7 about here

DISCUSSION AND CONCLUSIONS

Our starting point was the hypothesis that high-performance recruitment and screening systems, or synergies, exist whereby the combination of two recruitment and screening methods increases worker performance by more than the sum of their individual effects. We find no evidence of such synergies. In considering all two-way interactions, in most cases the combination of two methods increases performance by less than the two methods used individually. In some cases the combination actually decreases performance even though the individual methods increase performance when used alone.

In this context of recruitment and screening, we have extended the previous literature on high-performance systems by considering the possibility of diminishing returns, whereby the simultaneous use of two methods has a dampened (but still positive) effect on performance, relative to the sum of their individual effects. This hypothesis is also rejected by our data because the magnitude of the negative interaction term is always large enough to render the total effect of the bundle on worker performance smaller than one or both of the main effects.

Another potential explanation for our findings is that the payoffs vary depending on applicant quality or skill level. To explore this possibility, we divided the data into high-skilled and low-skilled occupational sub-samples and repeated the analysis. We found that, as expected, the recruitment and screening methods that affect performance differ between occupational groups. That is, the combinations of methods that appear in the first two columns

of Table 6, for high-skilled occupations, differ from those of Table 7 (low-skilled occupations). Nevertheless, our tests of Hypotheses 3 and 4 yielded identical results in the occupational sub-samples that were found in the full sample. We therefore conclude that the rejection of these hypotheses in our main set of results is not simply an artifact of the omission of occupational skill level from our analysis. In short, we find strong evidence against both the hypotheses of high-performance systems and of diminishing returns.

If recruitment and screening bundles do not create synergistic high-performance systems, and if they are not characterized by positive but diminishing returns, then how can they be understood? A clear and consistent pattern emerges from the data. As revealed in Table 5, it is usually the case that a statistically significant interaction effect is of the opposite sign as the main effects, and that it is large in magnitude. That is, two positive main effects are typically accompanied by a negative interaction effect, and this interaction effect is large enough so that the recruitment and screening bundle cannot be described by diminishing returns. In other words, adding another method to an existing method actually reduces the total effect on performance. This pattern of an interaction effect differing in sign from the main effects is also upheld in both occupational sub-samples, as seen in Tables 6 and 7.

It is tempting to conclude from this analysis that bundling of recruitment and screening methods does not pay. This would be too strong. In fact, our results indicate only that bundling does not pay in terms of raising worker performance. Why then do employers use multiple recruitment and screening methods? It may be to achieve objectives other than worker performance, such as hiring speed. Although we cannot explore this possibility using our data, we view it as a plausible explanation for our findings and believe that an extension of our analysis to incorporate data on the quantities of workers hired in recruitment campaigns would

be a promising direction for future research. It is possible that when the analysis accounts for multiple employer objectives, bundles of recruitment and screening methods might be high-performing systems or exhibit diminishing returns in dimensions other than performance.

We see this paper as an important first step in the direction of testing for high-performance systems and diminishing returns in recruitment and screening, but further research is required before conclusions regarding high-performance recruitment and screening systems can be drawn with any confidence. Our work establishes some initial findings and charts out a course for future research on hiring systems, in what was until now completely uncharted terrain.

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TABLE 1

Descriptive Statistics

	Mean	*Standard Deviation*
Performance	78.27	22.35
Recruitment Methods:		
Help wanted	0.26	0.77
Newspaper advertisements	0.49	0.83
Walk-ins	0.66	0.82
Current employees	0.82	0.59
State employment agency	0.35	0.82
Private employment agency	0.22	0.72
Community employment agency	0.28	0.80
School referrals	0.40	0.86
Union referrals	0.07	0.37
Friends	0.38	0.84
Screening Methods:		
Application	0.82	0.56
Interview	0.88	0.48
Reference check	0.76	0.56
Education check	0.38	0.80
Criminal record check	0.32	0.70
Test	0.31	0.76
Work sample	0.21	0.65

Firm Characteristics:		
For profit	0.76	0.82
Franchise	0.06	0.33
Number of Sites	60.43	439.83
Size1	655.92	13470.85
Union	17.26	58.21
Temps	0.36	0.85
Contracts	0.30	0.73
Agriculture, Forestry, Fishing	0.00	0.01
Mining	0.01	0.16
Transportation	0.06	0.43
Wholesale Trade	0.08	0.58
Retail Trade	0.15	0.51
Finances	0.07	0.34
Services	0.40	0.85
Public Administration	0.01	0.15

TABLE 2

Correlation Matrix of Recruitment and Screening Methods[a]

	Recruitment Method										*Screening Method*						
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
Recruitment Method																	
Help Wanted Signs	1.00																
Newspaper Ads	0.09*	1.00															
Walk-ins	0.11*	0.23*	1.00														
Current Employees	0.03*	0.09*	0.16*	1.00													
State Employment Agencies	0.30*	0.20*	0.24*	0.24*	1.00												
Private Employment Agencies	0.05	0.10	-0.05	0.17*	0.38*	1.00											
Community Employment Agencies	0.19*	0.09*	0.20*	0.26*	0.51*	0.35*	1.00										
School Referrals	0.23*	0.11*	0.19*	0.22*	0.38*	0.25*	0.45*	1.00									

Union Referrals	-0.03	-0.04	0.13*	0.08*	0.10*	0.13*	0.20*	0.04*	1.00									
Friends	0.05	-0.11	-0.36	-0.11	-0.09	-0.02	-0.09	0.06*	-0.07	1.00								
Screening Method																		
Application	0.10*	0.09*	0.02*	0.07*	0.15*	0.11*	0.22*	0.22*	-0.04	0.13	1.00							
Interview	0.05	-0.05	-0.12	-0.03	-0.15*	0.02	0.07	0.07	0.03	0.01	0.16*	1.00						
Reference Check	0.05*	0.10*	-0.18*	0.06*	0.04	0.13	0.19*	0.20*	0.02	0.14	0.18*	0.13*	1.00					
Education Check	0.01	0.02	-0.25*	-0.08	0.04	0.14	0.03	0.26*	-0.00	0.38*	0.17*	0.16*	0.30*	1.00				
Criminal Record Check	-0.08	-0.03	0.16*	0.11*	-0.08*	0.02	0.07*	0.13*	0.14*	-0.14	0.09*	-0.02	0.04*	0.024*	1.00			
Test	-0.07	0.12*	0.06	0.05	-0.00*	0.15*	-0.09*	-0.10	0.12	-0.16	0.03*	-0.05	-0.12	-0.10	0.23*	1.00		
Work Sample	-0.15	-0.19	-0.16*	-0.10	-0.15	-0.15	-0.16	0.00	0.16	0.26*	-0.09*	0.06	0.04	0.15*	-0.11	-0.02*	1.00	

** $p < .05$*

[a]1. Help Wanted Signs 2. Newspaper Advertisements 3. Walk-ins 4. Current Employees 5. State Employment Agencies 6. Private Employment Agencies 7. Community Employment Agencies 8. School Referrals 9. Union Referrals 10. Friends 11. Application 12. Interview 13. Reference Check 14. Education Check 15. Criminal Record Check 16. Test 17. Work Sample

TABLE 3

Effects of Recruitment, Screening, and Firm Characteristics on Performance[a,b,c]

	Estimate	*Standard Error*
Recruitment Method		
Help wanted adv.	0.19	1.08
Newspaper adv.	-1.36	0.84
Walk-ins	-4.06**	1.00
Current employees	0.59	1.40
State employment agency	-0.20	4.93
Private employment agency	1.09	1.04
Community employment agency	-2.90**	1.22
School referral	1.09	0.94
Union referral	-2.16	2.23
Friends	-0.29	0.88
Screening Method		
Application	-2.28*	1.24
Interview	0.71	1.32
Reference check	1.48	1.16
Education check	1.25	0.98
Criminal record check	1.61*	0.97
Test	-1.06	0.93
Work sample	1.33	1.24

Firm Characteristics		
For Profit	-3.24**	1.19
Franchise	-1.63	1.50
Number of sites	0.00	0.00
Size1	0.00	0.00
Union	0.001	0.01
Temps	-1.64**	0.81
Contract	-0.87	0.90
Agriculture, forestry, fishing	-7.86	8.34
Mining	1.27	4.37
Transportation	0.02	1.93
Wholesale trade	0.40	1.46
Retail trade	2.45**	1.14
Finance	-3.07*	1.73
Services	1.13	1.07
Public administration	-7.18**	3.51
Constant	86.55**	3.31

* $p < .10$

** $p < .05$

[a] Recruitment method effects are the average change in performance with respect to an individual recruitment method. Standard errors are bootstrapped with 1000 replications.

[b] Screening method effects are the difference in performance varying a particular screening method, holding other screening methods constant. That is, we compute the performance level

of the most recently hired worker when a screening method is used and subtract from it the performance level when that particular method is not used. Other recruitment and screening methods entering the performance equation are evaluated at their means, and standard errors are bootstrapped with 1000 replications.

[c] Firm characteristic effects are the firm control coefficients, $g_{i,}$ from estimating equation (1).

TABLE 4

Principal Components Analysis of Recruitment and Screening Methods

Component	*Eigenvalue*	*Proportion*	*Cumulative Proportion*	*Scoring Coefficients of First Principal Component*
Recruitment Methods				
1	2.37	0.24	0.24	0.27
2	1.21	0.12	0.36	0.22
3	1.03	0.10	0.46	0.31
4	0.94	0.09	0.56	0.29
5	0.91	0.09	0.65	0.44
6	0.83	0.08	0.73	0.26
7	0.80	0.08	0.81	0.48
8	0.71	0.07	0.88	0.39
9	0.70	0.07	0.95	0.23
10	0.49	0.05	1.00	0.11
Screening Methods				
1	1.64	0.24	0.24	0.32
2	1.17	0.17	0.40	0.22
3	1.05	0.15	0.55	0.48
4	0.96	0.14	0.69	0.53
5	0.77	0.11	0.80	0.52
6	0.74	0.11	0.91	0.27
7	0.67	0.10	1.00	0.03

TABLE 5

Statistically Significant Interactions and Their Main Effects: Full Sample[a,b]

X1 Variable	*X2 Variable*	$\partial PERF/\partial X1$	$\partial PERF/\partial X2$	*Interaction* (d_{12})
Recruitment Interactions				
Help Wanted Signs	Private Employment Agency	1.32 (1.19)	2.84 (1.20)**	-5.98 (2.43)**
Newspaper	Current Employees	-4.46 (2.07)**	-1.34 (1.65)	3.38 (2.05)*
Walk-ins	State Employment Agency	-5.84 (1.27)**	-2.38 (1.93)	3.64 (2.05)*
Walk-ins	Private Employment Agency	-5.34 (1.04)**	-1.34 (1.80)	4.19 (2.04)**
State Employment Agency	School	1.36 (1.30)	3.25 (1.18)**	-4.55 (1.92)**
State Employment Agency	Union	-0.07 (1.06)	-3.68 (2.73)	5.83 (3.01)*
Private Employment Agency	Union	1.72 (1.07)	-0.30 (2.20)	-7.42 (3.75)**
Screening Interactions				
Application	Work Sample	-3.09 (0.08)**	-1.23 (0.11)**	3.17 (1.88)*
Interview	Work Sample	0.38	-2.38	5.00

		(0.06)**	(0.11)**	(2.28)**
Cross Interactions				
Private Employment Agency	Application	4.63 (2.43)*	-1.58 (0.09)**	-3.95 (2.36)*
Community Employment Agency	Interview	2.70 (3.52)	2.63 (0.11)**	-6.64 (3.11)**
Friends	Interview	3.40 (2.42)	2.27 (0.13)**	-3.90 (2.22)*
Newspaper	Criminal Record Check	-2.42 (1.00)**	0.22 (0.10)**	2.88 (1.71)*
Friends	Criminal Record Check	1.37 (1.11)	2.85 (0.09)**	-3.51 (1.84)*
Help Wanted Signs	Test	1.35 (1.30)	-0.29 (0.11)**	-3.92 (2.02)*
Current Employees	Test	-0.65 (1.59)	-4.09 (0.11)**	3.45 (2.09)*
Current Employees	Work Sample	1.72 (1.51)	6.88 (0.09)**	-6.67 (2.06)**

** $p < .10$*

*** $p < .05$*

[a] Standard Errors are in parentheses.

[b] Standard errors for derivatives with respect to recruitment methods are bootstrapped with 1000 replications.

TABLE 6

Statistically Significant Interactions and Their Main Effects: High-Skilled Sample[a,b]

X1 Variable	*X2 Variable*	*∂PERF/∂X1*	*∂PERF/∂X2*	*Interaction* (d_{12})
Recruitment Method Interactions				
Help Wanted	Newspaper Advertisements	-1.79 (7.58)	-2.94 (4.35)	4.54 (2.16)**
Help Wanted	Walk-ins	2.85 (7.58)	-3.69 (4.26)	-3.92 (2.33)*
Help Wanted	Private Employment Agency	2.07 (7.58)	2.74 (6.10)	-7.04 (2.93)**
Newspaper Advertisements	Current Employees	-5.74 (4.35)	-2.94 (4.66)	4.51 (2.33)*
Walk-ins	Private Employment Agency	-5.72 (4.26)	-2.64 (6.10)	6.56 (2.33)**
Walk-ins	Friends	-3.16 (4.26)	2.26 (4.54)	-3.24 (1.97)*
Screening Method Interactions				
Interview	Reference Check	-2.07 (0.25)**	-5.24 (0.21)**	4.19 (2.47)*
Criminal Record Check	Test	0.23 (0.14)	-2.01 (0.19)**	4.34 (2.24)*

Recruitment/Screening Interactions				
Walk-ins	Interview	-9.56 (4.26)**	-2.58 (0.22)**	6.09 (2.82)**
Current Employees	Interview	-5.84 (4.66)	-3.37 (0.24)**	5.66 (3.42)*
Community Employment Agency	Interview	3.87 (8.13)	2.98 (0.24)**	-6.95 (3.96)*
Union Referrals	Interview	-10.81 (11.31)	0.72 (0.23)**	8.48 (4.78)*
Friends	Interview	5.25 (4.54)	3.64 (0.21)**	-6.34 (2.49)**
Private Employment Agency	Education Check	-0.48 (6.10)	0.62 (0.14)**	4.39 (2.56)*
Help Wanted Advertisements	Test	1.88 (7.58)	0.45 (0.20)**	-4.63 (2.28)**
Newspaper Advertisements	Test	-3.31 (4.35)	-2.76 (0.21)**	4.26 (1.99)**
School Referrals	Test.	0.20 (5.22)	-2.10 (0.22)**	3.59 (2.15)*
Union Referrals	Test	-5.36 (11.31)	-1.25 (0.19)**	9.31 (4.86)*
Newspaper Advertisements	Work Sample	-1.27 (4.35)	3.18 (0.13)**	-3.54 (1.82)*

Current Employees	Work Sample	0.38 (4.66)	5.00 (0.12)**	-4.36 (2.26)*

* $p < .10$

** $p < .05$

[a] Standard Errors are in parentheses.

[b] Standard errors for derivatives with respect to recruitment methods are bootstrapped with 1000 replications.

TABLE 7

Statistically Significant Interactions and Their Main Effects: Low-Skilled Sample[a,b]

X1 Variable	*X2 Variable*	*∂PERF/∂X1*	*∂PERF/∂X2*	*Interaction (d_{12})*
Recruitment Method Interactions				
Help Wanted	Community Employment Agency	-0.96 (15.74)	-0.45 (18.41)	-6.93 (4.19)*
Help Wanted	School Referrals	-5.09 (15.74)	1.47 (16.14)	9.86 (3.52) **
Newspaper Advertisements	Private Employment Agency	-0.57 (12.21)	3.74 (15.50)	-10.51 (3.75) **
Newspaper Advertisements	Community Employment Agency	-2.98 (12.21)	-5.21 (18.41)	6.34 (3.55)*
Newspaper Advertisements	Union Referrals	-1.13 (12.21)	-1.44 (33.82)	-12.23 (4.47) **
Walk-ins	Private Employment Agency	1.74 (11.42)	6.09 (15.41)	-9.32 (4.32) **
Current Employees	Private Employment Agency	-4.00 (12.28)	-13.77 (15.41	15.35 (5.66) **
State Employment Agency	School Referrals	2.21 (11.31)	6.68 (16.14)	-6.67 (3.46)*
Private Employment	School Referrals	2.70	5.11	-9.41

Agency		(15.41)	(16.14)	(4.55) **
Community Employment Agency	Friends	-0.24 (18.41)	2.55 (11.47)	-6.60 (3.35)**
Union Referrals	Friends	-8.74 (33.82)	0.72 (11.47)	7.83 (4.38)*
Screening Method Interactions				
Interview	Reference Check	7.27 (0.48)**	13.48 (0.35)**	-12.52 (4.32)**
Interview	Test	-5.06 (0.50)**	-10.76 (0.35)**	10.90 (4.53)**
Interview	Work Sample	-4.06 (0.46)**	-8.61 (0.41)**	11.45 (5.21)**
Reference Check	Criminal Record Check	5.96 (0.35)**	6.93 (0.36)**	-8.92 (3.91)**
Reference Check	Work Sample	2.02 (0.35)**	-4.48 (0.44)**	8.06 (4.28)*
Criminal Record Check	Test	4.40 (0.34)**	1.90 (0.33)**	-11.17 (3.60)**
Recruitment/Screening Interactions				
State Employment Agency	Application	11.93 (11.31)	4.08 (0.31)**	-13.63 (4.14)*
Walk-ins	Interview	8.20 (11.42)	5.37 (0.51)**	-8.86 (5.13)**

State Employment Agency	Interview	-6.86 (11.31)	-5.17 (0.56)**	8.99 (4.08)**
Community Employment Agency	Interview	14.60 (18.41)	4.35 (0.49)**	-19.76 (5.28)**
State Employment Agency	Reference Check	-5.83 (11.31)	-0.90 (0.38)**	9.59 (3.44)**
Community Employment Agency	Reference Check	3.28 (18.41)	5.48 (0.40)**	-8.30 (3.96)**
State Employment Agency	Criminal Record Check	2.72 (11.31)	3.88 (0.36)**	-7.64 (3.42)**
Private Employment Agency	Criminal Record Check	-3.71 (15.50)	-1.71 (0.44)**	13.53 (4.23)**
Community Employment Agency	Criminal Record Check	-0.29 (18.41)	2.82 (0.37)**	-7.21 (4.17)*
Union Referrals	Criminal Record Check	-9.88 (33.82)	-0.26 (0.37)	11.95 (5.45)**
Private Employment Agency	Test	-2.35 (15.50)	-3.10 (0.46)**	7.62 (3.72)**
Community Employment Agency	Test	1.04 (18.41)	1.66 (0.33)**	-11.64 (4.53)**
Walk-ins	Work Sample	-1.27 (11.42)	-4.91 (0.45)**	7.64 (3.78)**
Current Employees	Work Sample	2.29	16.86	-18.77

		(12.28)	(0.42)**	(5.11)*
Community Employment Agency	Work Sample	-0.73 (18.41)	3.26 (0.44)**	-7.51 (4.50)*
School Referrals	Work Sample	1.58 (16.14)	-3.08 (0.46)**	11.16 (4.09)**
Union Referrals	Work Sample	-2.02 (33.82)	2.77 (0.40)**	-20.53 (7.80)**

* *p < .10*

** *p < .05*

[a] Standard Errors are in parentheses.

[b] Standard errors for derivatives with respect to recruitment methods are bootstrapped with 1000 replications.