HR Practices and Firm Performance:

What Matters and Who Does It?

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Abstract

We examine the impact of human resource practices on firm performance. The analysis uses data from an economy-wide survey to determine whether firms that adopt certain individual HR practices, or that adopt a suite of practices, perform better than their rivals. We find that adoption of a suite of high performance practices (and adoption of specific practices pertaining to staff training and performance pay) impacts positively on firm outcomes. The strength of the relationships differ by firm size and age, having their strongest impact on small and large firms; curiously they do not appear relevant for mid-sized firms. The nature of firms that adopt high performance practices varies strongly according to size, age and sector.

Executive Summary

We examine whether firms that adopt certain human resource (HR) practices perform more successfully than do other firms. The HR practices on which we concentrate include provision of staff training, measurement of employee satisfaction and adoption of performance pay. We also examine whether adoption of a bundle of 'high performance' HR practices improves firm performance.

The analysis uses data from an economy-wide survey, Statistics New Zealand's 2001 Business Practices Survey (BPS). The BPS is a survey of approximately 3,000 New Zealand firms, being a representative sample (having an 82% response rate) of all New Zealand firms with at least six full-time equivalent staff. It contains questions on a comprehensive range of employee practices, and also contains measures of firm performance. We are able to use these questions, plus other questions from the survey, to test whether adoption of certain employee practices has a causal impact on firm success. We examine also the types of firm that adopt certain employee practices.

Our results indicate that firms which adopt a suite of high performance HR practices experience a lift in their profitability, productivity and market share relative to their rivals. Two individual HR practices appear particularly important: performance pay for most or all employees, and firm-specific (innovation-related) employee training.

There are systematic differences in the types of firms that adopt high performance HR practices. Younger firms, large firms, and high-tech services firms are most likely to adopt high performance HR systems. Small, old (i.e. long-established) agriculture and manufacturing firms are least likely to adopt such systems.

We discuss reasons why management in many firms fails to adopt high performance practices. One reason is that high performance HR systems are more likely to have an impact on firm performance in some industries than in others. A low-tech firm with fixed coefficient technology operating in an undifferentiated commodity market may find little advantage in adopting potentially costly HR practices that neither improve productivity nor quality. Conversely, a firm operating in a market in which individual

flair drives both quality and output may find that choice of HR practices is central to performance. This explanation is consistent with our findings regarding sectoral adoption of the identified HR practices.

A second explanation is that idiosyncratic ability of managers is important. Our statistical work indicates that underlying management characteristics and capabilities help explain whether firms adopt modern HR practices or not. Consistent with these findings, old firms have a tendency to have poorer HR practices. Managers in some of these firms may be habituated in "old school" practices that are no longer appropriate in a technological setting in which employees expect to be treated as self-reliant contributors to the firm.

Smaller firms also tend not to adopt high performance HR practices, possibly because they may not have the breadth of expertise to draw on in designing high performance systems.

Our results are relevant to understanding the impact of HR practices on firm performance. They indicate that adoption of a suite of high performance HR practices (plus performance pay and employee training) impacts on three different measures of firm performance. This finding, derived from a large sample that is representative of an entire economy, provides evidence that human resource practices really do matter.

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HR Practices and Firm Performance: What Matters and Who Does It?

1   Introduction

We test whether firms that adopt certain human resource (HR) practices, such as performance pay, perform more successfully than do other firms. Recent international findings also point to the importance of a bundle of HR practices in promoting productivity (Ichniowski and Shaw, 2003). We add to this research by utilising a new and unique large-scale database: Statistics New Zealand's 2001 *Business Practices Survey* (BPS). The BPS is a survey of approximately 3,000 New Zealand firms, being a representative sample (having an 82% response rate) of all New Zealand firms with at least six full-time equivalent staff (FTEs) (Statistics New Zealand, 2002).

The BPS contained questions on a comprehensive range of employee practices; it also contains measures of firm performance. The survey's wide, representative coverage makes it an excellent source to shed new light on the importance of human resource policies for firm success. Fabling and Grimes (2006) use multivariate probit analysis to determine associations between a range of business practices and self-reported measures of firm success. This paper extends those results by examining whether adoption of certain employee practices have a causal impact on firm success. We examine also the types of firm that adopt certain employee practices.

Section 2 reviews recent international studies that find a link between human resource practices and firms' outcomes providing hypotheses to test with the New Zealand data. Section 3 briefly describes the data. Section 4 sets out our methodology and tests the impact of employee practices on firm success. We find evidence that adoption of a suite of modern employee practices, along with adoption of certain specific practices (relating to employee training, measurement of employee satisfaction, and performance pay), impact on firm success. In section 5 we isolate the key characteristics of firms that adopt these employee practices. Section 6 summarises our results.

2   HR Practices & Firm Performance: International Evidence

Evidence suggests that adoption of new capital equipment and upgrading in human capital are important components of United States productivity behaviour since the mid-1990s (Abowd *et al*, 2001; Nickell and Nicolitsas, 2000). Black and Lynch (2004, 2001, 1996) find that adoption of individual high performance work practices have also had a material impact on productivity outcomes. To determine these impacts, they estimate a fixed effects model utilising two separate surveys of workplace practices and firm results. Use of firm fixed effects, however, does not cater fully for potential endogeneity of practice choices. Black and Lynch note the difficulty of choosing appropriate instruments (that are both correlated with the choice of workplace practices and are orthogonal to productivity shocks) that would enable instrumental variables estimation of the impact of workplace practices.

The importance of utilising a suite of employee practices, rather than Black and Lynch's focus on individual workplace practices, has been emphasised in a number of studies (Milgrom and Roberts, 1995; Ichniowski *et al*,1997; Kandel and Lazear, 1992; Kruse *et al*, 2003). In a variant of these findings, Therrien and Leonard (2003) find, using Canadian data, that establishments with coherent HR systems and establishments with highly dedicated (but more narrowly focused) HR systems have the highest probability of being at the top end of the innovation spectrum. Ichniowski and Shaw (2003) discuss reasons

underpinning complementarities between implementation of incentive schemes and more general HR innovations. These include the importance of avoiding free-rider behaviour on the part of some employees (in group incentive schemes) and encouraging individuals to expand their horizons to problem-solving across the firm.[1] In the latter case, employees are expected to "multi-task", so employee management and incentive systems need to be more complex relative to systems in traditionally managed firms (Holmstrom and Milgrom, 1994).

Existing studies also indicate the importance of differentiating the impact of workplace practices on firm *productivity* from firm *profitability*. Freeman and Lazear (1995) demonstrate that adoption of certain practices can increase total firm rents through increased productivity (see also Teece *et al*, 1997; Spanos and Lioukas, 2001). However, the split of these rents between owners and employees is affected by the nature of the practices that are adopted (Lazear, 2000). Another form of rent sharing occurs when both the employee and the firm receive a direct benefit from adoption of a particular practice. Employee training is an example where employees gain greater skills that they can utilise both at the firm and potentially elsewhere, while the firm benefits from increased productivity, particularly in the case of firm-specific training (Becker, 1962; Milgrom and Roberts, 1990 and 1995; Addison and Belfield, 2004; Gerfin, 2004; Munasinghe and O'Flaherty, 2005). Several studies find that provision of employee training contributes to productivity. For instance, Dearden *et al* (2000) analyse a panel of industries finding that training contributes positively to firm productivity. The estimated effect is much stronger when training is treated as an endogenous variable than when it is treated as exogenous. The latter result indicates that training is likely to be endogenous, with higher productivity contributing negatively to training.[2]

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[1] The experimental economics literature (e.g. Fehr and Gachter, 2000 and 2002) suggests that introduction of performance pay without the introduction of other high performance HR practices (that are viewed as "friendly" by employees) may result in negative outcomes for the firm if the pay scheme's introduction is interpreted by employees as a reduction in trust between the firm and workers.

[2] One may conjecture, for instance, that initial low productivity induces some firms to increase training so as to provide a productivity boost.

On the basis of these studies' findings, we test the following hypotheses:[3]

1. That adoption of a suite of "high performance" employee practices has beneficial effects on firm performance.
2. That adoption of performance pay has beneficial effects on firm performance.
3. That adoption of employee training systems has beneficial impacts on firm performance.

In addition, we test whether other surveyed individual employee practices have beneficial effects on firm performance. We determine the impact of individual practices both in the presence of, and separate from, the adoption of a suite of "high performance" practices.

3   Data

All our data are from New Zealand's 2001 *Business Practices Survey* (BPS) conducted by Statistics New Zealand, the country's official statistical agency (Statistics New Zealand, 2002; Knuckey and Johnston, 2002; Fabling and Grimes, 2006). The survey included a wide range of business practices and firm characteristics. Being an official survey, its coverage was comprehensive (3,378 surveyed firms), its response rate excellent (82% response rate with 96% of respondents answering 90% or more of the questions); and its sampling approach meticulous.[4] Questions in the survey were designed to test for the presence of "high performance" work practices posited by strategic management and economic literature (Knuckey and Johnston, 2002). The questions were either qualitative, or quantitative offering response ranges. We use both types of question in our empirical analysis, and test each category of response separately rather than use a restrictive representation of the responses (such as a Likert scale).

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[3] Each hypothesis is stated as the alternative hypothesis (relative to the null of no effect). In each case, the impact is tested after controlling for a range of other firm practices and characteristics. We measure firm performance using measures of relative profitability and relative productivity (in keeping with several cited studies) and by change in market share.
[4] The target population was all private sector firms with at least six FTEs drawn from a sampling frame of all New Zealand enterprises; the sampling design employed two-way stratification by sector and employment size; enterprises were weighted to make the sample representative of the underlying population of firms. We use weighted responses in all our analysis.

The questions contained under the category of "employee practices" in the survey are as follows:[5]

- Does this business systematically measure employee satisfaction?
- Are formal performance employee reviews used within this business (consistent methods that are recognised and regularly used)?
- How many employees are on "pay for performance" schemes (e.g. productivity based incentives, gain sharing, bonuses, etc)?
- In the last 12 months please estimate what proportion of this business's pre-tax payroll was related to employee education and training?
- Over the last 12 months please estimate the proportion of employees in this business who participated in in-house training?
- Over the last 12 months please estimate the proportion of employees in this business who participated in external training?
- Over the last 12 months please estimate the proportion of employees in this business who participated in job rotation/exchanges?
- Does this business have processes in place to manage health and safety (e.g. a training program, provision of information for employees)?

Using factor analysis, we take the first factor calculated across this list of practices as our measure of the suite of employee practices potentially relevant to firm performance. We denote this measure as SF_{EP} where the EP relates to "employee practices" and the SF refers to the "special factor", being the factor derived solely from employee practice questions. (In subsequent analysis we differentiate this factor from general factors, GF_j, j=1,.., n, derived from more general management practices and firm characteristics.)

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[5] See www.med.govt.nz/irdev/ind_dev/firm-foundations/firm-foundations.pdf for the full questionnaire (Appendix F, Knuckey and Johnston, 2002).

The BPS also surveys Business Results. Each firm is asked to record against a qualitative 3-point scale (plus "don't know") their firm's situation for three performance measures (our dependent variables):

- profitability relative to major competitors (denoted P^f);
- productivity relative to major competitors (P^d); and
- market share relative to three years' prior (P^m).[6]

We divide the responses to each of the business result questions into binary outcomes, grouping together the neutral and unfavourable responses as one outcome and the favourable responses as the other outcome for each variable. We undertake probit analysis on these data. Fabling and Grimes (2006) describes the reasons for grouping the responses into binary outcomes, rather than using all three response categories. The key reason is to compensate for potential respondent bias since (in each category) few respondents answered that their firm was doing relatively poorly.

In testing associations between business practices and firm performance, Fabling and Grimes (2006) found that ordered probit estimation gave the same signs on each variable as did the binary probit estimates, but the latter had preferred statistical properties (in keeping with prior expectations). That study also used an out-of-sample group to test whether the in-sample estimates had out-of-sample predictive power. For each of the performance measures, the in-sample results had strong out-of-sample predictive power, indicating that the performance measures do reflect underlying performance of the surveyed firms.[7] This out-of-sample test is particularly important since the performance measures are self-reported. For these self-reported measures to have validity in the face of measurement issues raised by Bertrand and Mullainathan (2001), it was imperative that our estimated (in-sample) relationships determining high from low performance could also distinguish performance out-of-sample.

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[6] For profitability and productivity, choices are "lower", "on a par", "higher"; for market share, choices are "decreased", "stayed the same", "increased". We refer to the three performance measures collectively as P^i (i=f,d,m).

[7] The out-of-sample group responded "don't know" to the performance question; our maintained hypothesis was that the performance of firms in this group was consistent with performance of firms within the lower of the binary categories.

The survey data yield 2,147 observations for the P^f equation, 2,191 observations for P^d, and 2,529 observations for P^m (observations vary across the P^i since in each case we drop firms that answered "don't know"). For each performance measure, each of the binary result categories contains at least one-third of the observations. Our analysis seeks to determine whether choice of employee practices places an individual firm in the upper portion or lower portion of all firms for each performance measure.

4   Causal Impact of Employee Practices

4.1   Methodology

Fabling and Grimes (2006) identified three employee practices that were associated with at least one of our binary measures of firm performance, P^i, at the 5% significance level.[8] The three practices are:

- Firm measures employee satisfaction at least bi-annually (ESAT);
- Firm has performance pay for many or all staff (EPAY); and
- Firm invests in employee training related to the introduction of new or significantly improved products, services or processes (ETRN).[9]

Each of ESAT, EPAY and ETRN is a binary variable. The second and third of these practices correspond closely to practices found significant in studies reviewed in section 2. The first practice is likely to be a characteristic of general "high performance" employee practices. Reflecting this observation, the correlation coefficient between ESAT and SF_{EP} is 0.49.[10]

The choice of certain employee practices may be affected by P^i, and so be endogenous. For this reason, the associative results cannot be taken to imply

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[8] Each had a positive coefficient. In addition, a job rotation variable was significant at the 4.4% level but its significance was not robust when subjected to a series of tests, and so is not considered separately here.

[9] The three practices correspond to survey questions 0501, 0503 and 0923 respectively. In the case of ETRN, the training is related to an innovation within the firm so we interpret this practice as firm-specific training. This contrasts with the more general employee training variables contained within the "Employee Practices" section of the survey.

[10] The correlation between SF_{EP} and each of EPAY and ETRN is 0.39 and 0.43 respectively.

that adoption of these practices necessarily has a causal impact on firm success. We examine whether a causal link from each of these practices to each P^i measure holds. In addition, we examine whether a causal link holds from the adoption of the suite of employee practices (SF_{EP}) to each P^i, and we examine whether the individual practices have an impact on each P^i over and above the impact of the suite of employee practices. Our approach uses a two-stage probit regression, controlling for other firm practices and characteristics, and instrumenting potentially endogenous variables. We use a range of instruments, plus a variant of the estimation technique, to test robustness of the results.

We test the impact of each of the employee practice variables after controlling for the impact of general management practices and firm characteristics. We divide the almost 200 questions in the BPS into those that we judge to be exogenous with respect to each P^i, and those that may be endogenous. The practices considered exogenous are listed in the Appendix. These practices reflect underlying firm characteristics (e.g. sector) or what we judge to be properties of the underlying management capability or "idiosyncratic ability of managers" of the firm (Teece *et al*, 1997; Haltiwanger *et al*, 1999 and 2000). We consider this idiosyncratic ability is a characteristic that is not influenced by firm performance. This consideration rests on an *a priori* judgement that is not ultimately testable, so we are careful to test the robustness of our results across a range of instruments and also test over-identifying restrictions.

The form of the single stage equation (before instrumenting) for any employee practice variable, E^k, is shown in (1), for each P^i:

$$P^i = f_i(GF_1, \ldots, GF_n, E^k, u_i) \tag{1}$$

where f_i reflects the probit specification corresponding to P^i; $GF_1, \ldots, GF_n$ are n general factors formed from the variables listed in the Appendix (n is chosen according to the number of general factors estimated to be significant at the 5% level in the respective equation); and u_i is the error term with standard properties. Within this specification, for an employee practice to have a

significant effect on firm performance, it must have an effect over and above any generalised impact it already has (or is correlated with) through the general management practices proxied by the GF's. Accordingly, lack of significance of an E^k does not necessarily imply that that practice is irrelevant to firm performance. Conversely, a significant result means that the impact of the practice on firm performance stands out in a test that may be biased against it, especially where the practice is correlated with general "high performance" management practices.

By assumption, each of the GF_j is independent of u_i in each equation; however, for some k, E^k may not be independent of one or more u_i. In this case, the probit estimates from (1) will be biased and inconsistent. Where a particular E^k is not considered exogenous, we instrument that employee practice with one or more variables considered exogenous.[11] The prospective instrument(s), Z, must fulfil the standard instrument requirements:

(i) $Cov (Z, u_i) = 0$;

(ii) $Cov (Z, E^k) \neq 0$.

We maintain (i) if Z is listed in the Appendix. We implement (ii) by requiring that Z be significant at the 5% level in an equation in which E^k is regressed on Z and a constant. We also require Z to be significant in the P^i equation when included while E^k is excluded; these latter tests reduce the potential for weak instrument problems. Finally, we limit the number of instruments so as to minimise bias in the estimates (Angrist and Kreuger, 2001).

Four instruments meet the criteria across the three equations. They are:[12]

- firm has formal planning process (0201);
- non-sales staff visit major customers (0302);
- firm systematically measures employee satisfaction (0501);

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[11] Each of the GF_j variables is considered exogenous, but they cannot be used as the sole instruments since each is also included in (1).

[12] The number refers to the BPS question number used to identify the instrument henceforth.

- books, journals, shows, conferences are used as sources for innovation ideas (0934).

Intuitively, each of 0201 and 0501 (when answered in the affirmative) is a basic characteristic of "good management" practice, and hence fits well with our concept of exogenous management capability. The remaining two instruments are more idiosyncratic. Three of these instruments (0201, 0302, 0501) meet all three tests for P^f, two instruments (0302, 0501) meet all three tests for P^d and two instruments (0201, 0934) meet all three tests for P^m. At least one of 0201 and 0501 appears as an instrument for each of the P^is. The fact that we have more than one instrument for each P^i, means we can test over-identifying restrictions for each equation. We do so using the over-identification test of Stock and Watson (2003). One of the instruments, 0501, is also one of our E^k variables (ESAT). Where ESAT is included as an explanatory variable, we treat it as exogenous.

Our two-stage process entails first regressing the relevant E^k variable on the instrument(s), then including the explained portion of E^k ($\hat{E}^k$) in (1) in place of E^k. In the cases of the two binary endogenous explanatory variables (EPAY and ETRN), $\hat{E}^k$ takes on the predicted probability rather than the predicted binary outcome, to retain the maximum information from the first stage regression. Angrist and Kreuger (2001) recommend a slightly different approach, estimating the first stage regression using linear regression (even in the presence of binary variables) and using the estimates from this stage as the instrumented variables in the second (probit) stage. As a robustness check, we estimate each of our preferred equations using this approach.

We obtain multiple estimates of $\hat{E}^k$ using alternative instruments in the first stage regression. In each case (other than for ESAT) we estimate the first stage regression using as instruments:

- each of the appropriate instruments individually;
- each of the appropriate instruments individually plus the GF's included in the equation;

- all the appropriate instruments, excluding the GF's;
- all the appropriate instruments, including the GF's.

We present the results using each approach, and check whether the results are sensitive to our instrument choice. We also present the single stage (no instrument) results.

Tables 1-3 present the results for P^f, P^d and P^m respectively. In each case, the explanatory variables are listed horizontally; instruments are listed vertically. Each column refers to tests on a specific employee practice (or suite of practices). Subsequently, we examine interactions between the employee practice variables and SF_{EP}.

The first line presents the results of the single stage probit regression (no instruments); the figure in each cell is the p-value corresponding to the explanatory variable (against the null hypothesis of zero effect). In subsequent lines, the figure in each cell is the p-value corresponding to the instrumented explanatory variable using the listed instruments. Each equation also includes general factors (GFs) to control for broad management practices and firm characteristics as specified in (1), but their significance is not reported for clarity. A shaded cell corresponds to the specification that has the greatest explanatory power (lowest p-value for the equation F-statistic) for that variable. We choose this equation as our preferred specification for that explanatory variable. In almost all cases the preferred specification uses all eligible instruments excluding the GF's.

We indicate where our instruments are inappropriate in terms of the requirements laid out above (denoted II),[13] and also note where the use of a set of instruments yields a result with an *a priori* "wrong sign" (denoted WS). In interpreting our results, we look for consistency in results across different

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[13] The finding of inappropriate instruments arises where the instruments have no (jointly) significant impact on the explanatory variable.

instrument sets and across the three performance metrics.[14] We perform robustness tests on each of our preferred equations. These tests are presented in the lower block in each table. The first robustness test re-estimates the equation using the Angrist and Kreuger specification described earlier. Second, we split the sample first by size, and then by age to examine whether the results are consistent across firms of different types.[15] We also discuss tests of over-identifying restrictions for each equation.

4.2 Results

In the single stage (no instruments) regression, the suite of employee practices, SF_{EP}, is of marginal significance in the relative profitability equation (p=5.8%) but is significant at the 1% level for each of relative productivity and market share. Once instrumented, it is significant at the 5% level in all cases. This finding is consistent with cited results concerning the importance of generalised HR practices.

Performance pay, when entered without instrumenting, is significant at 5% for each of the performance measures. When instrumented, it retains its significance in each case for the P^f and P^d measures. It loses its significance in the P^m equation when 0201 is not used as an instrument, but otherwise is significant in that equation also. Employee training is not significant at the 5% level in the single stage regression for either P^f or P^d, although it is significant for P^m. Once instrumented, it is consistently significant for P^m at the 5% level and also for P^d and P^f at 10%. Measuring employee satisfaction is significant for P^f and P^d but not for P^m.

The robustness checks indicate that the results are consistent whether we estimate the first stage by probit or by linear regression. All over-identification

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[14] We do not interpret a characteristic as having a causal impact on firm success if it exhibits only sporadic "significant" instrumented results, or swaps signs with different instruments. This is not common in the current study; instances of II and WS occur more frequently in some related studies (e.g. Fabling and Grimes, 2004). This suggests that the HR results are more stable than is the case for other business practices.

[15] Firm age is divided into three groups: young (<2 years old), middle-aged (2-10 years old), and old (>10 years old). Firm size is divided into three groups based on the number of FTEs: small (6-20 FTEs), medium (20-50 FTEs) and large (more than 50 FTEs).

tests are passed at the 5% level other than one test that is significant at the 4.6% level. Together, the over-identification test results and those using the Angrist and Kreuger methodology indicate that our instruments are acceptable and that the equations are robust to different estimation approaches.

When we split the samples by size and by age, some consistent patterns emerge. Adoption of performance pay is always significant for small firms and is significant in two of the three cases for large firms. However, it is never significant (at even 10%) for medium sized firms (20-50 employees). It is never significant for young firms (less than 2 years old) but is consistently significant (in one case at the 7.9% level) for firms older than two years. Each of employee satisfaction measurement, employee training and the suite of employee practices exhibits very similar patterns.

The finding that adoption of high performance employee practices does not affect the success of younger firms is not surprising. Many of these firms are still at the start-up stage and their success most probably reflects the entrepreneur's own characteristics. The importance of employee practices for firms older than two years appears robust. However a quandary arises with the size-related results, particularly those for medium sized firms (20-50 employees). We have further broken down this category by the three age categories. When we do so, none of the practices (including SF_{EP}) is significant for any of the performance measures for medium sized firms in any of the age categories.

A key finding in prior papers is that individual employment practices are not as important for firm performance as adoption of a suite of high performance practices. The estimates in Tables 1-3 do not address this issue explicitly since each of the individual practices and the index of practices is entered separately.[16] We examine this issue more closely by re-estimating (1), using an interaction term between the suite of practices and an individual practice, $SF_{EP}*E^k$, in place of E^k (or SF_{EP}). In no case does the interaction term

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[16] More general management practices are controlled for through the GF's.

increase the overall explanatory power for the P^i relative to the better of the equations incorporating just E^k or SF_{EP}.

Another way that we have investigated this issue is to enter either SF_{EP} or $SF_{EP}*E^k$, as separate terms in the equation containing E^k. The specifications are shown as (2) and (3):

$$P^i = f_i(GF_1, \ldots, GF_n, \ E^k, \ SF_{EP}, \ u_i) \tag{2}$$

$$P^i = f_i(GF_1, \ldots, GF_n, \ E^k, \ SF_{EP}*E^k, \ u_i) \tag{3}$$

In (2), we test whether the individual practice term has a significant impact on firm performance *in addition to* the adoption of a suite of employee practices (and vice versa). In (3), we test whether adoption of a suite of practices *amplifies* the impact on firm performance of the adoption of each individual practice.

In each case, E^k and SF_{EP} are *jointly* significant at 5% in specification (2). Similarly, in each case, E^k and $SF_{EP}*E^k$ are *jointly* significant at 5% in specification (3). Where E^k corresponds to employee training, neither the individual practice variable nor the suite (or interaction) variable is significantly different from zero at 5% in either specification for any of the performance measures. Similarly, where E^k corresponds to performance pay, neither the individual practice variable nor the suite (or interaction) variable is significantly different from zero at 5% for either profitability or productivity.[17] These results reflect the moderate degree of multicollinearity between SF_{EP} and each of EPAY and ETRN. This collinearity makes it difficult to pinpoint whether it is the suite of practices, or the individual practice, or the interaction between the two, that is primarily determining the joint significance of the variables. Where E^k corresponds to measuring employee satisfaction, SF_{EP} is in each case significant in specification (2) and $SF_{EP}*E^k$ is in each case significant in specification (3). The individual practice is not significantly different from zero

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[17] For market share, SF_{EP} is significant (but EPAY is not) in specification (2), while each of $SF_{EP}*E^k$ and EPAY is significant in specification (3).

for profitability or market share (although it is significant in each specification for productivity).

Together, the results indicate that measurement of employee satisfaction (ESAT) does not outperform the suite of employee practices, and may be best thought of as an integral component of a suite of high performance HR practices. The evidence is less clear-cut in relation to performance pay and employee training. Both appear to have explanatory power over each performance measure, and generally more so than does the suite of practices. However the data cannot distinguish whether either the suite of practices or the two individual practices have explanatory power over and above the influence of the other. At a minimum, the results suggest that each of the practices is an important component of a suite of high performance HR practices. In turn, these practices have significant ability to distinguish high performing firms from low performing firms across three different performance measures.

5   Employee Practices and Firm Characteristics

Ichniowski and Shaw (2003) report that innovative employee practices occur most in greenfields and reconstituted sites, while traditional systems are most common in brownfields sites. Consistent with the latter feature, firms that face large transactions costs in shifting systems may become stuck with more traditional HR approaches. The nature of the industry itself may also be important; firms are more likely to adopt innovative HR systems where there is greater potential for workers to work "smarter" rather than just harder (e.g. in industries that produce high-quality or highly complex products or that employ complex equipment for which labour is a complement). Thus uptake of new HR systems may be sector as well as age-specific.

In Canada, Leckie *et al* (2001) find that variable pay usage increases with firm size but then drops off sharply for firms with over 500 employees. This drop-off is consistent with the brownfields effect reported by Ichniowski and Shaw. Further, Leckie *et al* report that firms in industries facing rapid technological

change and stiff competition are most likely to adopt performance pay. Separately, Leckie *et al* find that larger establishments tend to support more employee training than do smaller establishments, and training is most prevalent in industries considered to be high-tech. In New Zealand, Gobbi (1998) found that employee training was most prevalent in the services sector; by occupation, it was most prevalent amongst workers in skilled occupations.

Here, we examine typical traits of firms that adopt "high performance" employment practices. We concentrate on SF_{EP} as our measure of employment practices given the results in the previous section. Before doing so, however, we note that only 5.8% of firms adopt all three of the individual HR practices that we have examined, while 33.8% of firms adopt none of them. Individually, 36.6% measure employee satisfaction at least bi-annually, 17.5% have performance pay for many or all staff, and 46.0% invest in innovation-related employee training. These figures indicate a wide disparity in adoption of high performance employee practices across firms.

We regress SF_{EP} on three types of firm demographic variables distinguishing between three sizes,[18] five ages,[19] and fourteen sectors.[20] We omit one of each category from the equation; the results indicate the propensity to adopt high performance HR practices relative to a small, old, agricultural firm. Firms with each of these characteristics generally have the "worst" HR practices across each category. The results are presented in (4):

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[18] The sizes correspond to: small, 6-19 FTEs; medium, 20-49 FTEs; and large, ≥50 FTEs; medium and large are shortened to MED and LGE respectively.

[19] The ages correspond to: start-up, <1 year since establishment; very young, 1-2 years; young, 2-5 years; middle aged, 5-10 years; and old, ≥10 years; the first four categories are shortened to STR, VYNG, YNG and MID respectively.

[20] Agriculture, fishing, forestry (AFF); mining (MIN); manufacturing (MAN); construction (CON); wholesale trade (WHT); retail trade (RET); accommodation, cafes, restaurants (ACR); transport & storage (T&S); communications (COM); finance & insurance (F&I); property & business services (P&B); education (EDU); health & community services (H&C); film, radio & television (FRT).

SF_{EP} = 0.309*MED +0.418*LGE -0.146*STR +0.398*VYNG +0.227*YNG +0.118*MID
      [0.000]   [0.000]   [0.459]   [0.001]   [0.016]   [0.162]

      +0.217*MIN +0.059*MAN +0.264*CON +0.160*WHT +0.129*RET +0.099*ACR
        [0.189]   [0.482]   [0.073]   [0.100]   [0.371]   [0.395]

      +0.239*T&S +0.405*COM +0.723*F&I +0.433*P&B +0.838*EDU +0.639*HCS
        [0.037]   [0.008]   [0.000]   [0.000]   [0.000]   [0.000]

      +0.010*FRT -0.363   (4)
        [0.945]   [0.000]

R^2 = 0.107

p-values in brackets

SF_{EP} mean = -0.03;

SF_{EP} std.dev.= 0.83

The results in (4) are consistent with results cited above. Practices improve with firm size: large firms have greater high performance HR practices than do medium sized firms (the difference between the two is significant at 1%), which in turn have better HR practices than do small firms (significant at 1%). Other than start-up firms, firms of all ages up to 10 years perform better than do old firms (although the difference is not significant at 5% for middle-aged firms), consistent with the brownfields results in the cited literature.

By sector, there is no statistically significant difference (at 5%) in HR practices between agricultural firms and those in mining, manufacturing, construction and "low-tech" services (WHT, RET, ACR). However HR practices for all other services sectors (excluding FRT[21]) are highly differentiated from the low-HR sectors. In these "high-tech" services sectors, firms are much more likely to adopt high performance HR practices.

The differences in HR practices between different types of firm is illustrated in Figure 1. We plot the kernel density for SF_{EP} for all firms, and also for small, old, agricultural and manufacturing firms (grouped together), and for medium-sized and large, very young and young, high-tech services firms[22] (grouped

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[21] There is only a small sample for FRT, so little weight should be placed on this result.
[22] I.e. firms in T&S, COM, F&I, P&B, EDU and HCS.

together). The rightward shift in the distribution of the latter relative to the former (and to the total) is readily apparent.

6   Conclusions

Our finding that younger firms, large firms, and high-tech services firms are most likely to adopt high performance HR systems fits with our findings that high-performance HR systems impact positively on firm performance. Our results indicate that firms that adopt a suite of high performance HR practices experience a lift in their profitability and productivity and in their market share relative to their rivals. Two individual HR practices appear particularly important: performance pay for most or all employees, and firm-specific (innovation-related) employee training.

In the face of these findings – which are consistent with recent findings in other countries – why does management in many firms fail to adopt high performance practices? Two potential explanations arise from our work.

First, high performance HR systems are more likely to have an impact on firm performance in some industries than in others. A low-tech firm with fixed coefficient technology operating in an undifferentiated commodity market may find little advantage in adopting potentially costly, HR practices that neither improve productivity nor quality. Conversely, a firm operating in a market in which individual flair drives both quality and output may find that choice of HR practices is central to performance.

Second, idiosyncratic ability of managers appears to be highly important. Old firms (which tend to have poorer HR practices) may be reliant on managers habituated in "old school" practices that are no longer appropriate in a technological economy and/or in a world in which employees expect to be treated as self-reliant contributors to the firm.

Smaller firms tend not to adopt high performance HR practices. One explanation is that they may not have the breadth of expertise to draw on in designing high performance systems. An alternative explanation is that the benefits of adopting such practices may not be as large for these firms as for larger firms. However, this explanation is not supported by our econometric results which indicate that small firms consistently benefit from adoption of high performance HR practices.

As well as firm size and age, idiosyncratic management capability appears important. In all our estimates, the instrumented practices have greater explanatory power than do the raw variables. Our choice of instruments is designed to isolate the portion of the individual HR practice or suite of practices that can be attributed to underlying management capability. In each case, our instruments are significant explanators of the practice. For instance, we can "explain" the adoption of performance pay (at a statistically significant level) by whether or not the firm has a formal planning process, and we consider it reasonable to maintain that the latter reflects underlying management capabilities within the firm. (A firm that does not plan formally for the future is, intuitively, likely to have poor overall management capabilities.) The fact that the instrumented component of each practice has significant ability to explain firm outcomes indicates that management capability is indeed important in determining relative performance across firms.

The data that we have used is a single snapshot of practices and performance, albeit across a large, representative sample of firms. Future linking of the data to dynamic measures of firm performance should enable us to test whether these idiosyncratic management factors are able to explain the subsequent financial performance and survivorship of firms.

Even without these dynamically linked data, our results are highly relevant to studying the impact of HR practices on firm performance. In earlier work, we demonstrated that a number of management practices – particularly HR and innovation related practices – are strongly associated with firm profitability, productivity and market share. The current paper extends this work to test

whether these associative results stand once we control for a broad range of firm characteristics and management practices (our 'general factors') and once we instrument HR practices with variables that reflect underlying management capability. The results indicate strongly that adoption of a suite of high performance HR practices (plus performance pay and employee training) impacts on three different measures of firm performance. This finding, derived from a large sample that is representative of an entire economy, provides evidence that human resource practices really do matter.

References

Abowd, John, John Haltiwanger, Julia Lane & Kristin Sandusky (2001) "Within and Between Firm Changes in Human Capital, Technology, and Productivity", Research Report, Washington DC: Urban Institute

Addison, John & Clive Belfield (2004) "Unions, Training, and Firm Performance: Evidence from the British Workplace Employee Relations Survey", IZA Discussion Paper No. 1264, Bonn

Angrist, Joshua & Alan Krueger (2001) "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments", *Journal of Economic Perspectives*, 15(4), 69-86

Becker, Gary (1962) "Investment in Human Capital: A Theoretical Analysis", *Journal of Political Economy* 70, 9-49

Bertrand, M. & S. Mullainathan (2001) "Do People Mean What They Say? Implications for Subjective Survey Data", *American Economic Review* (Papers and Proceedings), 91(2), 67-72

Black, Sandra & Lisa Lynch (1996) "Human Capital Investments and Productivity", *American Economic Review* 86(2), 263-267

Black, Sandra & Lisa Lynch (2001) "How to Compete: The Impact of Workplace Practices and Information Technology on Productivity", *Review of Economics and Statistics* 83(3), 434-445

Black, Sandra & Lisa Lynch (2004) "What's Driving the New Economy?: The Benefits of Workplace Innovation", *Economic Journal* 114(493), F97-F116

Dearden, Lorraine, Howard Reed & John van Reenan (2000) "Who Gains when Workers Train? Training and Corporate Productivity in a Panel of British Industries", Working Paper 00/04, Institute for Fiscal Studies, London

Fabling, Richard & Arthur Grimes (2004) "Three Secrets of Firm Success: Innovation, Innovation, Innovation", Wellington: Ministry of Economic Development

Fabling, Richard & Arthur Grimes (2006) "Practice Makes Profit: Business Practices and Firm Success", *Small Business Economics*, forthcoming

Fehr, Ernst & Simon Gachter (2000) "Fairness and Retaliation: The Economics of Reciprocity", *Journal of Economic Perspectives* 14(3), 159-181

Fehr, Ernst & Simon Gachter (2002) "Do Incentive Contracts Undermine Voluntary Cooperation?", Institute for Empirical Research in Economics, University of Zurich, Working Paper No. 34

Freeman, Richard & Edward Lazear (1995) "An Economic Analysis of Works Councils" in J. Rogers & W. Streek (eds.) *Works Councils*, 27-52, Chicago: University of Chicago Press

Gerfin, Michael (2004) "Work Related Training and Wages: An Empirical Analysis for Male Workers in Switzerland", IZA Discussion Paper No. 1078, Bonn

Gobbi, Maria (1998) "Participation in Post-Compulsory Education and Training in New Zealand", *Labour Market Bulletin*, 1998: 1&2, 108-126

Haltiwanger, John, Julia Lane and James Speltzer (1999) "Productivity Differences Across Employers: The Roles of Employer Size, Age, and Human Capital", *American Economic Review*, 89(2), 94-98

Haltiwanger, John, Julia Lane and James Speltzer (2000) *Wages, Productivity, and the Dynamic Interaction of Businesses and Workers*, NBER Working Paper No. 7994, Cambridge Mass: NBER

Holmstrom, Bengt & Paul Milgrom (1994) "The Firm as an Incentive System", *American Economic Review* 84, 972-991

Ichniowski, Casey & Kathryn Shaw (2003) "Beyond Incentive Pay: Insiders' Estimates of the Value of Complementary Human Resource Management Practices", *Journal of Economic Perspectives* 17(1), 155-178

Ichniowski, Casey, Kathryn Shaw & Giovanna Prennushi (1997) "The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines", *American Economic Review* 87(3), June, 291-313

Kandel, Eugene & Edward Lazear (1992) "Peer Pressure and Partnerships", *Journal of Political Economy* 100, 801-817

Knuckey, Stephen & Hayden Johnston (2002) *Firm Foundations: A Study of New Zealand Business Practices and Performance*, Wellington: Ministry of Economic Development

Kruse, Douglas, Richard Freeman, Joseph Blasi, Robert Buchele, Adria Scharf, Loren Rodgers & Chris Mackin (2003) "Motivating Employee-Owners in ESOP Firms: Human Resource Policies and Company Performance", NBER Working Paper 10177, Cambridge, Mass.

Lazear, Edward (2000) "Performance Pay and Productivity", *American Economic Review* 90(5), December, 1346-1361

Leckie, Norm, Andre Leonard, Julie Turcotte & David Wallace (2001) *Employer and Employee Perspectives on Human Resource Practices*, The Evolving Workplace Series No. 71-584-MIE No.1, Statistics Canada

Milgrom, Paul & John Roberts (1990) "The Economics of Modern Manufacturing: Technology, Strategy, and Organizations", *American Economic Review* 80, 511-528

Milgrom, Paul & John Roberts (1995) "Complementarities and Fit: Strategy, Structure, and Organizational Change in Manufacturing", *Journal of Accounting and Economics* 19, 179-208

Munasinghe, L. and B. O'Flaherty (2005) "Specific Training Sometimes Cuts Wages and Always Cuts Turnover", *Journal of Labor Economics* 23(2), 213-233

Nickell, S. & D. Nicolitsas (2000) "Human Capital, Investment and Innovation: What are the Connections?" In R. Barrell, G. Mason & M. O'Mahony (eds) *Productivity, Innovation and Economic Performance*, Cambridge: Cambridge University Press

Spanos, Y.E. & S. Lioukas (2001) "An Examination into the Causal Logic of Rent Generation: Contrasting Porter's Competitive Strategy Framework and the Resource-Based Perspective", *Strategic Management Journal*, 22, 907-934

Statistics New Zealand (2002) "Business Practices Survey: Technical Report", Wellington

Stock, J. & M. Watson (2003) *Introduction to Econometrics*, Boston: Addison-Wesley

Teece, D.J., G. Pisano & A. Shuen (1997) "Dynamic Capabilities and Strategic Management", *Strategic Management Journal,* 18(7), 509-533

Therrien, Pierre & Andre Leonard (2003) *Empowering Employees: A Route to Innovation*, The Evolving Workplace Series No. 71-584-MIE No.8, Statistics Canada

Table 1: Relative Profitability

Instruments	Employee practices p-values			
	ESAT	EPAY	ETRN	SF$_{EP}$
None	0.031	0.002	0.171	0.058
q0201		0.026	0.026	0.026
q0302		0.019	0.019	0.019
q0501		0.031	0.031	0.031
q0201 & GFs		0.009	0.058	0.026
q0302 & GFs		0.006	0.054	0.019
q0501 & GFs		0.012	0.091	0.031
q0201,q0302 & q0501		0.000	0.000	0.001
q0201,q0302,q0501 & GFs		0.000	0.000	0.002
Full equation F-statistic [p-value]	2.8E-04	5.9E-07	1.9E-07	1.6E-06
Linear regression (Stage 1)		0.000	0.000	0.001
Subsample: small FTE	0.051	0.003	0.001	0.003
medium FTE	0.589	0.178	0.146	0.222
large FTE	0.042	0.023	0.025	0.017
<2yr old	0.916	0.702	0.747	0.812
2-10yr old	0.864	0.079	0.063	0.165
>10yr old	0.009	0.001	0.000	0.001

Notes: Exogenous general factors (GFs) also included in final regression but not reported. Full equation F-statistic [p-value] refers to shaded (best) equation. Numbers in table are p-values for the listed variable using alternative instrument sets; ESAT is assumed exogenous and so is not instrumented. A cell marked `II` indicates that conditions for instrument suitability were not met; a cell marked `WS` indicates wrong sign on the estimated coefficient compared with theoretical priors. Instrument numbers indicate survey question (see text). Equation with the highest explanatory power is shaded; the lower box contains robustness checks performed on this specification.

Table 2: Relative Productivity

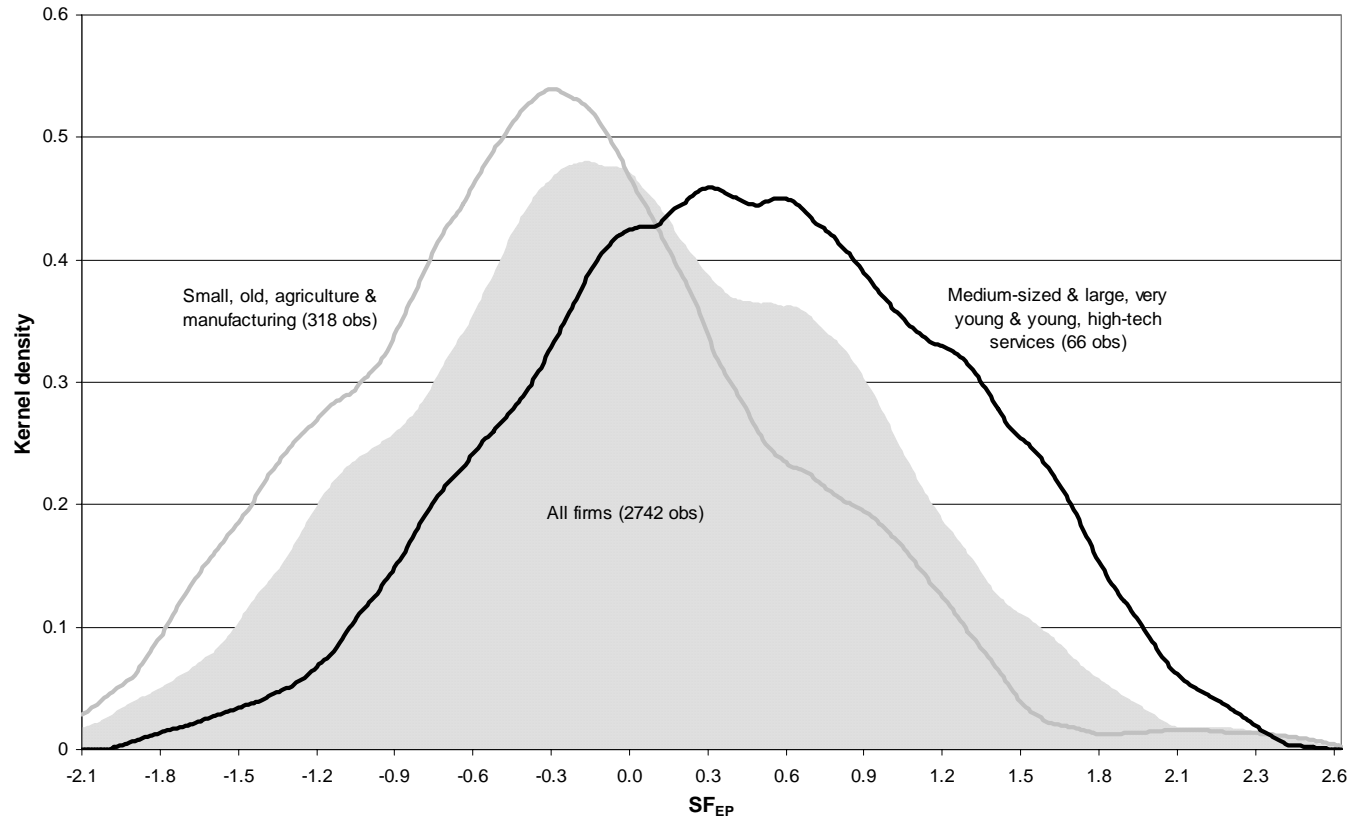| Instruments	Employee practices p-values			
	ESAT	EPAY	ETRN	SF_{EP}
None	0.003	0.013	0.072	0.010
q0302		0.012	0.012	0.012
q0501		0.003	0.003	0.003
q0302 & GF1		0.020	0.083	0.012
q0501 & GF1		0.007	0.012	0.003
q0302 & q0501		0.000	0.000	0.000
q0302,q0501 & GF1		0.000	0.001	0.001
Full equation F-statistic [p-value]	6.9E-05	1.1E-05	6.4E-06	1.3E-05
Linear regression (Stage 1)		0.000	0.000	0.006
Subsample: small FTE	0.008	0.002	0.001	0.002
medium FTE	0.616	0.114	0.099	0.266
large FTE	0.007	0.005	0.003	0.002
<2yr old	0.120	0.120	0.065	0.067
2-10yr old	0.068	0.011	0.008	0.018
>10yr old	0.067	0.030	0.026	0.032

Notes: Exogenous general factor (GF) also included in final regression but not reported. Full equation F-statistic [p-value] refers to shaded (best) equation. Numbers in table are p-values for the listed variable using alternative instrument sets; ESAT is assumed exogenous and so is not instrumented. A cell marked II indicates that conditions for instrument suitability were not met; a cell marked WS indicates wrong sign on the estimated coefficient compared with theoretical priors. Instrument numbers indicate survey question (see text). Equation with the highest explanatory power is shaded; the lower box contains robustness checks performed on this specification.

Table 3: Market Share

Instruments	Employee practices p-values			
	ESAT	EPAY	ETRN	SF_{EP}
None	0.477	0.031	0.029	0.007
q0201		0.005	0.005	0.005
q0934		II	0.017	0.017
q0201 & GFs		0.021	0.005	0.005
q0934 & GFs		WS	0.010	0.017
q0201 & q0934		0.016	0.000	0.000
q0201,q0934 & GFs		0.015	0.002	0.000
Full equation F-statistic [p-value]	4.5E-05	1.8E-07	1.3E-07	5.2E-08

	ESAT	EPAY	ETRN	SF_{EP}
Linear regression (Stage 1)		0.006	0.000	0.000
Subsample: small FTE	0.526	0.025	0.001	0.001
medium FTE	0.829	0.187	0.188	0.204
large FTE	0.151	0.676	WS	WS
<2yr old	0.066	WS	WS	WS
2-10yr old	0.332	0.036	0.000	0.000
>10yr old	0.336	0.030	0.078	0.025

Notes: Exogenous general factors (GFs) also included in final regression but not reported. Full equation F-statistic [p-value] refers to shaded (best) equation. Numbers in table are p-values for the listed variable using alternative instrument sets; ESAT is assumed exogenous and so is not instrumented. A cell marked II indicates that conditions for instrument suitability were not met; a cell marked WS indicates wrong sign on the estimated coefficient compared with theoretical priors. Instrument numbers indicate survey question (see text). Equation with the highest explanatory power is shaded; the lower box contains robustness checks performed on this specification.

Figure 1: Distribution of High Performance Practices

Notes: Distributions are produced using Epanechnikov kernel density estimates with bandwidths of approximately 0.15, 0.22 & 0.30 for the all firm, agriculture/manufacturing, and high-tech services groupings respectively. Unweighted sub-sample sizes are indicated in brackets (densities, however, are weighted to reflect the underlying population of firms). "Small, old, agriculture & manufacturing firms" are 6-19 FTEs, established for 10 or more years, in AFF or MAN industries. "Medium-sized & large, very young & young, high-tech services" are 20 or more FTEs, established for 1 to 5 years, in T&S, COM, F&I, P&B, EDU or HCS industries (footnote 26 describes these industry codes).

Appendix: Exogenous Variables

The following variables are considered exogenous with respect to P^f, P^d and P^m, being sector-specific or indicative of underlying management capability. For each question, the survey number is entered together with some explanatory words.

Strategy

0103   Flexibility used as a type of strategy
0104   Delivery used as a type of strategy
0113   Someone focuses on achieving business goals

Leadership & Planning

0201   Business has formal planning process
0202   Business incorporates customer requirements in its planning
0203   Business incorporates supplier requirements in its planning
0205   Business has a vision statement
0206   Business promotes a set of company values

Customer Focus

0301   Business has procedures to deal with customer complaints
0302   Non-sales staff visit major customers
0303   Business measures customer satisfaction
0304   Business works with customers on product development

Supplier Focus

0401   Business has systems to measure input quality
0402   Business works with key suppliers to improve processes
0403   Non-managerial authority to contact suppliers regarding problems

Employee Practices

ESAT   Business systematically measures employee satisfaction
0502   Employee performance reviews are used

Quality & Process

0601   Non-mgmt employees encouraged to suggest process improvements

Information & Benchmarking

0703   Business compares performance with firms in same industry
0704   Business compares performance with firms in different industry
0705   Business compares performance with firms located domestically
0706   Business compares performance with firms located overseas

Information & Benchmarking

0708   Competitor comparisons made regarding financial measures
0709   Competitor comparisons made regarding cost measures
0710   Competitor comparisons made regarding operational measures
0711   Competitor comparisons made regarding quality measures
0712   Competitor comparisons made regarding innovation measures
0713   Competitor comparisons made regarding human resource measures
0715   Performance assessment using financial measures
0716   Performance assessment using cost measures
0717   Performance assessment using operational measures
0718   Performance assessment using quality measures
0719   Performance assessment using innovation measures
0720   Performance assessment using human resource measures

Innovation

0928   Source of ideas: competitors
0919   Source of ideas: NZ owners
0930   Source of ideas: overseas owners
0931   Source of ideas: industry associations
0932   Source of ideas: other research institutes
0933   Source of ideas: universities or polytechnics
0934   Source of ideas: books, journals, shows, conferences
0935   Source of ideas: banks, accountants, consultants
0936   Source of ideas: Trade NZ
0937   Source of ideas: Technology NZ
0938   Source of ideas: Industry NZ
0939   Source of ideas: Government departments

Demographics

Sector (two digit ANZSIC dummies)