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# The Efficiency and Productivity Implications of Corporate Layoffs

Mahendra Raj and Michael Forsyth[1]

ABSTRACT

*This paper examines the impact of corporate layoffs on firm efficiency levels. The methodology used in this paper provides fresh insights into the effects of layoffs on firm and labour-force performance. This paper uses a data envelopment analysis (DEA) approach to provide a benchmark measure for the operating efficiency of restructured companies that have reduced staff numbers and also companies that have found it necessary to downsize due to declining demand for its product. We apply this linear programming technique to both pre- and post-layoff periods. The findings indicate the sample of companies that restructure and incorporate layoffs as part of the process find an increase in efficiency while the opposite is found for firms that find it necessary to cut staff due to declining performance.*

*The study also examines the relation between layoffs and shareholder wealth. The findings show that layoffs attributed to declining demand are related with poor stock market performance in the long-term post-layoff period. The evidence also suggests that firms involved in reorganisation, and subsequently layoffs, perform strongly and are viewed positively by the market over the 2-year post-layoff period.*

## 1. INTRODUCTION

THE ECONOMIC research surrounding corporate layoffs has been quite extensive of late. Many studies have dealt with the impact of the layoff announcement on the stock price of publicly listed companies. There has been less research relating layoffs to subsequent corporate performance. Most studies either use regression techniques or simply individual evaluator measures to interpret efficiency or performance levels. No study to date has employed data envelopment analysis (DEA) to examine the effects of layoffs on firm efficiency levels. We analyse the returns to scale in the pre-layoff period and then test the efficiency in the year after the layoffs to ascertain the effects of this action on corporate performance.

The information effects of layoff announcements may be attributed to the future expectations of the company. Positive information from announcing layoffs would be met with the anticipation of improved post-period performance. The expectation of enhanced cash-flows and profits resulting from this type of corporate action would stem from a firm that is operating well and chooses to restructure voluntarily so as to become more competitive. Jensen's (1993) argu-

ment regarding excess capacity can lead to value creation when human capital can be transferred to other areas of the business that have more prosperous investment opportunities. This would be one instance of restructuring where resources are redeployed as a result of strategic refocusing. This theory would not apply to our declining-demand sample, as there are no opportunities for redeploying the workforce. As Dial and Murphy (1994) state 'few managers have been able to accomplish the necessary resource redirection'. This explanation would tie in with our declining-demand sample, where rather than focusing on overall strategic repositioning that the company could employ, the management simply cut staff numbers to improve profitability. Therefore, we believe that our downsizing sample associated with reduced demand for the company's product portrays unfavourable information about the value of these announcing firms. Therefore, the choice by these firms to reduce the workforce and not to redeploy should naturally lead to a negative reassessment of these firms by the market.

For the period of 1994 to 1996 we assess whether restructured companies become more competitive as compared with companies forced into downsizing its operations. The study also examines the stock returns of companies in the build-up to the layoff announcement and subsequently the stock market performance over a long-term period once the layoffs have taken place.

## 2. Previous research

The evidence surrounding layoffs and their financial impact is limited and conflicting. There have been many studies that have concentrated on the relationship between stock returns and the intricacies of layoffs (Elayan *et al*, 1998; Palmon, Sung and Tang, 1997; Lee 1997). However, while analysing stock returns around the announcement of this type of corporate action is valuable in learning how the market and investors interpret this information, it does not necessarily reflect the impact this will have on firm efficiency. It may be that investors misinterpret the reason behind the layoff and how this will affect the overall value of the firm. In turn, this may mean a decline in the stock price on announcement, even if the decision will be more effective in increasing firm efficiency in the long-term. Therefore, it is important to study the effectiveness of layoffs in the post-period under this framework in terms of both efficiency and market performance.

There are few studies that have focused on the effectiveness of corporate layoffs on firm performance and in particular the levels of firm efficiency. Conyon et al. (2002) use regression models to measure the impact of mergers on labour demand and find that job losses and declines in productivity result from merger activity. They also find that related and hostile takeovers consequently reduce labour demand, but promote efficiency. Elayan, et al (1998) examine layoff effectiveness through proxies for firm and labour force efficiency and base their hypotheses on the characteristics of the layoff. They examine 646 layoff announcements and find a negative reaction to the announcement and find factors such as size of the layoff, industry and reason behind the layoff to affect the market reaction. They also find that return-on-equity (ROE) significantly improves in year's +1 and +2 supporting the hypothesis that corporate layoffs enhance firm efficiency. They also find similar results for the measures of labour force efficiency in the post layoff period.

Some past studies have used accounting performance measures to examine whether the reason behind the layoff is associated with how the firm performs in the future in terms of

profitability and sales measures. Palmon, Sun and Tang (1997) find that efficiency-enhancing firms outperform the declining-demand sample in terms of the profitability measures they use in the year following the announcement. The authors also go on to test for the differences between the samples. However, the authors do note that the average size of the firms within the two samples is different and so limits their ability to draw conclusions with regard to the sales performance measures. This is where the methodology used in this study adds to the existing literature due to the flexibility in recognising differences in production functions between DMUs (decision making units). Furthermore, many studies have used regression techniques to interpret the efficiency levels of the firm. Palmon, Sun and Tang (1997) study the efficiency levels of two samples using regression analysis while controlling for factors such as size and industry. However, DEA provides weights, or coefficients, that are unique to the sample firms being evaluated, whereas regression coefficients apply to a class or group of firms.

## 3. Methodology and data

A sample of layoff announcements by UK firms was obtained from 1994 to 1996. The dates and information content of each layoff announcement was gathered from a news search using McCarthy database, where the announcement places emphasis on actual job losses. These are actual announcements of job losses made by companies due to restructuring or declines in demand. Furthermore, these are companies that are reducing employee numbers due to these two principle motives being studied. Job losses are not estimated from financial statement numbers before and after an event, as these may show the impact of activities such as mergers and spin-offs. These firms are not those announcing the largest job losses, as the focus of this study is of a different nature. The daily share price data and financial ratios were collected from *FT Prices and Sequencer*. Financial ratios were collected from the period 1993 to 1997 in order to analyse pre- and post-layoff performance. Using the reasons cited in each announcement, layoffs are classified into two subsamples. Announcements of layoff decisions due to lack of demand for the firm's products, resulting in financial distress are included in the decreasing-demand sample. Announcements indicating that the company is restructuring to improve efficiency are allocated to the restructuring sample. After excluding firms with incomplete information, the sample consisted of 33 companies, 22 of which made up the declining-demand sample, and 11 made up the restructuring sample.

DEA is used to identify efficient and inefficient firms and how their efficiency levels changed in the post-layoff period. DEA was first introduced by Charnes *et al* (1978) and since then the methodology has been adapted and developed to address performance measurement in many disciplines. It is a non-parametric, flexible technique and makes no assumptions about the form of the production function and estimates an empirical 'best practice frontier' from the individual DMUs (decision making units) inputs/outputs. The analysis is based on input-output configuration and addresses the technical efficiency, reflecting the amount of slack in the way the firms utilise physical, financial and human resources. A frontier based on the best practices of the companies analysed within the samples is identified. DEA then computes a maximal performance measure for each firm relative to the other firms / DMUs within the sample. The DMUs with a value of one lie on the frontier and operate with the best practice, whereas those DMUs not on the frontier have values somewhere between 0 and 1.

Several different mathematical programming DEA models exist in the literature (see Charnes *et al*, 1990, 1994). Basically, the aim of each of these models is to determine which of

n DMUs lie on the *envelopment surface*, or best practice efficiency frontier.

First assume that there are $n$ DMUs to be evaluated. Each utilises varying amounts of $m$ different inputs to produce $s$ different outputs. Specifically, firm $j$ uses amounts $Xj = \{x_{ij}\}$ of inputs $i = 1,...,m$ and produces amounts $Yj = \{y_{rj}\}$ of outputs $r = 1,...,s$. It is assumed that the observed values are positive, so that $x_{ij} > 0$ and $y_{rj} > 0$. The $s \cdot n$ matrix of output measures is denoted by $Y$ and the $m \cdot n$ matrix of input measures is denoted by $X$. The CCR (Charnes-Cooper-Rhodes model) input-oriented DEA model reduces the multiple-input, multiple-output situation for each firm to a scalar measure of efficiency (see Charnes *et al*, 1994). The following model evaluates the relative efficiency of firm $o$ based on the performance of $j$=1,...,$n$ firms in the population, where the $y_{rj}$ and $x_{ij}$ variables in the model represent the observed amounts of the $r^{th}$ output and the $i^{th}$ input, respectively, of the $j^{th}$ DMU.

The DEA approach reduces multiple inputs and outputs to a single virtual input and virtual output and finally to a single summary comparative efficiency score. The development of the efficient frontier recognises the difficulty in the quest for a common set of weights to determine relative efficiency. DEA is distinct in that it recognises that units/firms might value inputs and outputs differently and so adopt different weights. DEA proposes that each unit should be allowed to adopt a set of weights that shows the unit as advantageously as possible when compared to the other units. Therefore, the main aim is to maximise the efficiency of firm $o$, subject to the efficiency of all units within sample being less than, or equal, to one.

$$\max_{u,v}(Eff_o)\frac{\sum_r u_r y_{ro}}{\sum_i v_i x_{io}}$$

subject to:

$$\frac{\sum_r u_r y_{rj}}{\sum_i v_i x_{ij}} \le 1, \quad \text{for } j = 0, 1, ..., n$$

$$\frac{u_r}{\sum_i v_i x_{io}} \ge \varepsilon, \quad \text{for } r = 1, ..., s$$

$$\frac{v_r}{\sum_i v_i x_{io}} \ge \varepsilon, \quad \text{for } i = 1, ..., m$$

The multipliers are the unit weights for each of the outputs and inputs, designated by $u_{io}$ and $v_{io}$, respectively, and are the decision variables in the model. The objective function seeks to maximise the ratio of the total weighted output of firm $o$ divided by its total weighted input.

Each DMU's maximum efficiency score will be less than or equal to 1 by virtue of the constraints. A value of $EFF_o = 1$ represents full efficiency and it follows that firm $o$ operating at 'best practice'. When $EFF_o < 1$, then some level of inefficiency exists.

It is also possible to transform the problem presented above into an ordinary linear programming problem (Charnes et al., 1994). The results of which can be shown as follows:

$$\max_{u,v} \omega_o = \sum_r u_r y_{ro}$$

subject to:

$$\sum_i v_i x_{io} = 1$$

$$\sum_r u_r y_{rj} - \sum_i v_i x_{ij} \leq 0$$

$$u_r \geq \varepsilon$$

$$v_i \geq \varepsilon$$

This can be interpreted as maximising the sum of the weighted outputs (virtual output) for DMU *o* subject to unit virtual input for DMU *o* while maintaining the condition that virtual output cannot exceed virtual input for any DMU.

Standard event-study methodology is employed to measure abnormal returns. The market index model is used and the FTSE Allshare index acts as the benchmark. Lyon *et al* (1999) details robust procedures for calculating long-term abnormal stock performance. To measure abnormal performance, cumulative abnormal returns and buy-and-hold abnormal returns are used. Fama (1998) states that one of the problems with calculating average abnormal returns is that they do not realistically reveal the actual returns gained by the investor, hence one of the reasons for using buy-and-hold returns. Nevertheless, long-term buy-and-hold returns have been criticised for being significantly right-skewed (Kothari and Warner, 1997), although this is not found to be the case for cumulative abnormal returns. One of the advantages of using buy-and-hold returns is that due to compounding, the returns accurately reflect the gains or losses to an investor. However, cumulative abnormal returns avoid skewness problems and so provide additional evidence and provide further support to the concluding comments.

## 4. Model specification

To evaluate firm efficiency, we incorporate the CCR model, which assumes constant returns to scale. This paper tests the efficiency of two groups of DMUs and hypothesises that differences will exist in the efficiency ratings. Banker (1989, 1993) proposes a test statistic to determine whether rating differences are significantly different. He assumes that inefficiency ratings follow an exponential or half-normal distribution with means $1 + \sigma_1$ for group $N_1$ and $1 + \sigma_2$ for group $N_2$. The null hypothesis would be $H_o$: $\sigma_1 = \sigma_2$. The alternative hypothesis is $H_a$: $\sigma_1 > \sigma_2$ if it is believed that group $N_1$ has a lower average efficiency rating than group $N_2$, meaning that group $N_1$ is less efficient than group $N_2$. The test statistic ($TS_e$) is given by:

$$TSe = \left[\sum_{J \varepsilon N_1} (1/h_j - 1)/n_1\right] \Big/ \left[\sum_{J \varepsilon N_2} (1/h_j - 1)/n_2\right]$$

*hj* = The DEA efficiency rating for each firm included in the particular sub-sample.
*n1* = the number of firms included in Group 1 (Declining-Demand sample)
*n2* = the number of firms included in Group 2 (Reorganisation Sample)

*Input/output variables*

Selecting valid input and output variables is fundamental in applying DEA. Firstly, a relationship should exist between inputs and outputs where an increase in inputs can reasonably be expected to increase one or more of the outputs. Another consideration is to choose input/output variables that are used in measures of performance evaluation by management. The inputs used generally represent two of the main fundamental resources required by firms so as to operate. The input variables used in this paper are the total number of employees in the firm and the total assets of the firm. The two outputs represent desired outcomes. The output variables are the firm's turnover and share price abnormal returns.

## 5. Results of the analysis

*Firm efficiency*

We assessed the performance of the 2 samples (layoff$^{dec\text{-}dem}$and and layoff$^{reorg}$) in the year before the layoff announcement and in the year following the layoffs and the results are shown in table 1.

DEA was applied to the each sample in the year before the corporate layoff announcements. Once again, in the post-period the sample is then split in accordance to the motivation behind the corporate layoffs and DEA is applied separately. Table 1 displays the efficiency levels of firms in the pre-period and also details the efficiency of the subsamples in the post-layoff period. The pre-period shows that for the layoffdec-demand sample of 22 companies studied the average efficiency of the sample was 75.34 per cent with 4 of the sample being deemed efficient and the remaining 18 firms operating at inefficient levels. For the 11 companies that made up the layoffreorg. sample the pre-period efficiency levels averaged 82.02 per cent. Judging from the pre-layoff efficiency figures it seems that the firms that reorganised were operating more efficiently than the declining-demand firms were. However, it can still be said that both samples were correct in taking some form of corporate action.

The results suggest that the companies that chose to restructure the company were correct in doing so. The average efficiency in the period after the layoffs was 84.71%, with nearly 46% of the sample operating at full efficiency compared with 27% operating at efficient levels in the pre-layoff period. The efficiency levels for the layoffreorg. sample increased by a small amount in the post-layoff period and ensured the average efficiency level for the sample is relatively high. Therefore, these companies have reorganised themselves while maintaining adequate performance levels and so the companies in this sample have positioned themselves well in the marketplace for the future. As a result, it is expected that the findings from the post-period stock market performance of this sample will be strong.

In contrast, drastic action from management to cut costs in a quick manner does not benefit the firm in the long-term and the firm continues in its performance slide, as shown in Table 1 where it details the efficiency levels of the 22 firms within the layoffdec-demand subsample. The efficiency levels of firms this sample declined in the post-layoff period. The average efficiency level of the layoffdec-demand sample decreases to 70.2 per cent in the post-layoff period, with the majority of the sample (excess of 75 per cent), operating inefficiently.

In effect, the evidence from this study supports prior research that has shown the market to react positively to firms that layoff employees due to restructuring (Palmon, Sun and

**Table 1: Statistics of DEA efficiency levels for sample firms in pre- and post-periods**

| *Company* | *Layoff type* | *Pre-layoff efficiency* | *Post-layoff efficiency* | *Difference* |
|---|---|---|---|---|
| Arjo Wiggins Appleton | Cuts | 0.9138 | 0.7939 | -0.1198 |
| Blue Circle | Cuts | 0.5096 | 0.4809 | -0.0287 |
| Claremont Garments | Cuts | 0.9287 | 0.8381 | -0.0906 |
| Crabtree Electrical Ind. | Cuts | 0.2057 | 0.2498 | 0.0441 |
| Dawson International | Cuts | 0.5169 | 0.4508 | -0.0662 |
| GKN | Cuts | 0.9532 | 0.5824 | -0.3708 |
| Glaxo Wellcome | Cuts | 0.9759 | 0.7215 | -0.2544 |
| Inchcape | Cuts | 0.9363 | 0.9430 | 0.0067 |
| Mersey Docks & Harbour | Cuts | 0.4875 | 0.4077 | -0.0798 |
| Norweb | Cuts | 0.8350 | 1.0000 | 0.1650 |
| Pearson | Cuts | 0.6383 | 0.6594 | 0.0211 |
| Rolls - Royce | Cuts | 0.6438 | 0.6294 | -0.0144 |
| Scottish Power | Cuts | 0.9292 | 0.5923 | -0.3369 |
| Smith Kline Beecham | Cuts | 0.6899 | 0.6673 | -0.0226 |
| Spring Ram | Cuts | 0.7525 | 0.6744 | -0.0781 |
| Tate & Lyle | Cuts | 1.0000 | 1.0000 | 0.0000 |
| Trafalgar House | Cuts | 0.7830 | 1.0000 | 0.2170 |
| Unigate | Cuts | 1.0000 | 0.9213 | -0.0787 |
| Weir Group | Cuts | 0.6066 | 0.6262 | 0.0197 |
| WH Smith | Cuts | 1.0000 | 1.0000 | 0.0000 |
| Willis Corroon | Cuts | 0.2688 | 0.2048 | -0.0641 |
| Yorkshire Electricity | Cuts | 1.0000 | 1.0000 | 0.0000 |
| Babcock Intl | Reorg | 0.9124 | 0.8579 | -0.0545 |
| Sainsburys | Reorg | 0.9829 | 0.8923 | -0.0906 |
| Eastern Group | Reorg | 1.0000 | 1.0000 | 0.0000 |
| Ocean Group | Reorg | 1.0000 | 1.0000 | 0.0000 |
| Safeway | Reorg | 0.8788 | 0.8323 | -0.0465 |
| Tibbet & Britten | Reorg | 0.9398 | 1.0000 | 0.0602 |
| Airtours | Reorg | 1.0000 | 1.0000 | 0.0000 |
| S&N | Reorg | 0.4713 | 0.4548 | -0.0165 |
| United Utilities | Reorg | 0.6812 | 0.6265 | -0.0547 |
| BA | Reorg | 0.5962 | 0.6546 | 0.0583 |
| Anglian Water | Reorg | 0.5593 | 1.0000 | 0.4407 |

| Average efficiency | | *Pre-* | *Post-* |
|---|---|---|---|
| | Cuts | 0.7534 | 0.7020 |
| | Reorg. | 0.8202 | 0.8471 |

*Banker test*

Pre-period: TSe = 1.91**, indicating the efficiency levels between the two samples are significantly different from one another at the 5 per cent level.

Post period: TSe = 2.79***, indicating the efficiency levels between the two samples are significantly different from one another at the 1% level.

Tang, 1997). In addition, the efficiency decreases shown in the post-period from declining demand sample also support the evidence shown from the negative market reaction to firms using this reason as the underlying factor behind the layoffs (Elayan, *et al* 1998; Palmon, Sung and Tang, 1997; Lee 1997).

It is important to test the hypothesis of whether the DEA efficiency ratings of the layoff$^{dec\text{-}demand}$ and layoff$^{reorg.}$ samples differ significantly from one another and to determine if in fact the firms that restructure do operate more efficiently in the post-layoff period. As a means of testing this hypothesis, we use the test statistic proposed by Banker (1989, 1993). The result shows that a significant difference exists between the two sub-samples in both pre- and post-layoff periods (see Table 1.).

The findings from this paper prove that firms which decide to layoff employees as part of a cost-cutting exercise find declines in firm efficiency in the post-layoff period, whereas firms that choose to restructure the company go onto improve firm performance and efficiency. This result is not consistent with the general notion that layoffs improve firm efficiency. Furthermore, this finding does support the hypothesis where the nature of the layoff is a major determinant in how the firm will perform in the future.

## 6. Pre-and-post stock market performance

A number of studies have examined the impact layoff announcements have on shareholder wealth, but most have concentrated in the period around the layoff announcement (Worrell, Davidson and Sharma 1993; Lee 1997; Palmon, Sung and Tang 1997; Raj and Forsyth 1999). However, little research has been done to determine the stock price performance of the firm prior to the layoff announcement and consequently how the firm performs once this form of corporate action has occurred. Palmon *et al.* (1997) find that the reasons cited in the layoff announcement acts as a signal with regard to future performance, however this has not been directly tested.

Table 2 details the cumulative average abnormal returns and also the buy-and-hold returns for the layoff$^{dec\text{-}demand}$ and layoff$^{reorg.}$ samples. Figure 1 illustrates the stock market performance of each of the two layoff samples in the pre-layoff and post-layoff periods. The evidence shows that a period of significant underperformance precedes corporate layoff announcements. This is found for both layoff$^{dec\text{-}demand}$ and layoff$^{reorg}$ samples. As would be expected, the layoff$^{dec\text{-}demand}$ sample has a Cumulative Average Abnormal Returns (CAAR) and Buy-and-Hold Abnormal Returns (BHAR) of -12.86 per cent and -15.67 per cent respectively in the two-year period prior to the layoff announcement. Perhaps more surprising is that the layoff$^{reorg}$ sample also fairs poorly in this period with CAARs and BHARs of -8.47 per cent and -13.73 per cent respectively. These findings are similar to that of Chen *et al.* (2001) where the authors find that the excess returns in the 3-year period before the layoff are -22 per cent, while in the year before the layoff itself, excess returns are -17 per cent. In the post-layoff period, they go on to find that the 3-year buy-and-hold return of 9 per cent is significantly positive and state that layoffs are a necessary step in bringing to an end a long period of abnormally poor stock market performance by the firm. However, the findings of this study differ quite significantly to prior evidence in that the post-period returns are relative to the nature of the layoff announcement. As can be seen from Table 2 and Figure 1 the layoff$^{dec\text{-}demand}$ sample shows a continuation in underperformance. The results show CAARs and BHARs of -28.38 per cent and -25.88 per cent respec-

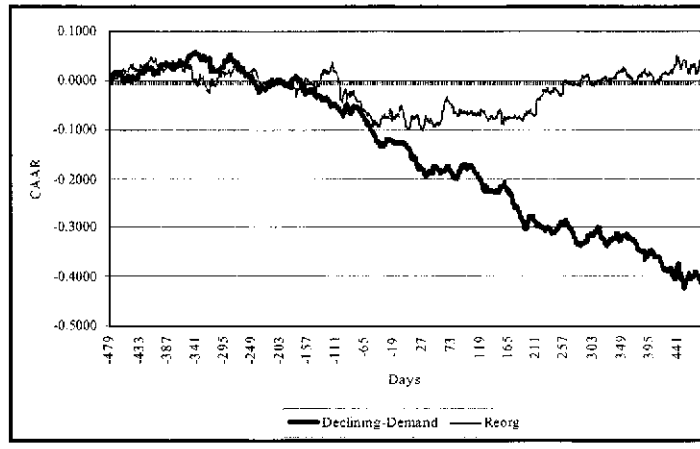
tively in the two-year post-layoff period, supporting the hypothesis of Palmon *et al.* (1997) in that firms for which layoffs are associated with adverse market conditions signal poor performance in the long-run. In contrast to the negative information portrayed within the layoff announcements of the layoff$^{dec\text{-}demand}$ sample, the layoff$^{reorg}$ sample is associated with restructuring and cost-evaluation procedures in order to enhance firm value and to position the firm effectively for the future. The findings of this study support this theory as the CAARs and BHARs in the two-year post-layoff period are found to be significantly positive, at 13.01 per cent and 15.33 per cent respectively. These findings are in line with that of Chen *et al* (2001) and support the reasoning that firms choose to layoff employees as part of an overall restructuring plan to position the company effectively for the future and that this is reflected in their stock market performance.

**Table 2: Summary statistics of stockmarket performance for the sample firms in the pre- and post-sample periods**

| | *Pre-Layoff Period (-2years to ann date)* | | *Post-Layoff Period (ann date to +2years)* | |
|---|---|---|---|---|
| | *CAAR* | *BHAR* | *CAAR* | *BHAR* |
| Layoff$^{dec\text{-}demand}$ Sample | -1286%* | -1567%* | -2838%*** | -2588%*** |
| Layoff$^{reorg}$ Sample | -847% | -1373%** | 1301%* | 1533%** |

*, **, ***, significant at 10%, 5%, and 1% levels respectively

**Figure 1: Long-term stockmarket performance of the sample firms in the pre- and post-periods**



## 7. FINAL REMARKS

This study examines the link between layoffs, firm efficiency and stock market performance. The findings show that layoffs follow a period of stock price underperformance. The post-layoff stock performance depends on the reason behind the layoff. The efficiency levels of the firms before and after the layoffs do not change by a large amount but do however follow the trends of what is seen in the stock market performance. The declining demand sample suffers a decrease in firm efficiency in the period after a layoff. The sample of companies that restructure and therefore layoff employees as part of an overall process increase firm efficiency very slightly but maintain a relatively high level of efficiency. The empirical evidence indicates that the market supports firms that choose to layoff employees as part of a cost-evaluation and restructuring process so as to cope with changing market climates and expectations. However, firms that simply cut staff numbers as part of a cost-cutting exercise are not seen in a positive manner by the market and this is justified by the lower levels of firm efficiency that are displayed by these firms in the post-layoff period. The Banker (1989, 1993) test statistic shows a significant difference does exist in the DEA levels of the two subsamples and so supports this finding.

Overall, the findings of this study suggest that management choose to layoff employees in response to declines in market performance. The eventual performance of a firm following the layoff decision is dependent on whether the firm decides to simply cut staff numbers in order to reduce costs or as a wider restructuring plan in which layoffs are necessary in order to refocus and develop the firm. From the empirical exercise, this study highlights the implications that arise from reducing the human capital of the company under specific circumstances and will benefit the interests of managers, investors and strategists.

## ENDNOTE

1. Aberdeen Business School, Robert Gordon University, Kepplestone Mansion, Viewfield Road, Aberdeen AB15 7AW, United Kingdom, Fax: (44) 01224 263100, e-mail: m.raj@rgu.ac.uk . We thank a referee for useful comments. Remaining errors etc. are our own.

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