The Impact of Acquisitions on Firm Performance. Evidence from private & closely held companies

Carmine Gioia [1]
Department of International Economics and Management, Copenhagen Business School, Howitzvej 60 2000 Copenhagen F, Denmark

Abstract

The general purpose of this paper is to investigate the effects of ownership change on the performance of small-medium and privately held companies. The research is conducted on a single European country, Denmark, in the period from 1991 to 1999. We test the matching theory of ownership change presented by Lichtenberg and Siegel (1992) and find empirical support on the hypothesis that changes in ownership via acquisition *can be a mechanism to correct for lapses in efficiency.* Acquisition targets are characterized by a low level of factor productivity at the time prior to the acquisition compared to non acquired companies, and to their industry median. Acquired firms benefit from the change of ownership and improve their productivity and financial performance in the post acquisition period. Among surviving firms acquisition have a positive effect on sales and employment growth, suggesting an increase in the scale and efficiency of the firm. Selectivity bias and endogeneity have been taken into account during the estimation.

JEL Classification: G34

Keywords: Mergers; acquisitions; takeovers; productivity; ownership change

[1] Tel.: + 45 38 15 25 08 Fax: +45 38152500 email: cg.int@cbs.dk

1 Introduction

Economists have widely studied the causes and effects of mergers and acquisitions[2], and have utilized various set of measurement to assess a company's performance (e.g., Jensen and Ruback 1983, Jensen 1988, Ravenscraft and Scherer 1988, Frank and Harris, 1989 Lichtenberg and Siegel 1992 McGuckin and Nguyen 1995, 2001, Andrade et. al, 2001, Gugler et al, 2003). We stand today with a general agreement that the mergers and acquisitions create shareholder value, with the largest part of the gain going to the acquired company (e.g., Andrade et al., 2001). This paper adds to the previous literature with evidence from Denmark, a country characterized by small and medium size companies. A large majority of firms are limited family owned companies (eg. Lausten, 2002), with high concentrated ownership, and with relatively few firms listed at the Copenhagen Stock Exchange. Therefore, some of the theories of managerial discipline of takeovers might not be applicable to explain the causes and effect of takeovers. This aspect might only be a characteristic of large firms where there is a clear separation between owner and managers, or where shareholders have less direct control on the company management. Still, the theoretical argument presented and empirically supported by Lichtenberg and Siegel (1992), that an acquisition and indeed the ownership change of a company is a mechanism to correct for lapses in efficiency, can be an interesting aspect to treat in this study, and indeed can be of substantial interest to company owners, managers, and government agencies for policy purposes. Jensen (1988) summarizing previous evidence on causes and effect of takeovers, states that *'takeover gains do not come from creation of monopoly power'* and that *merger and acquisition*

[2] The words Merger and Acquisitions are used interchangeably.

activity has not increased industrial concentration. Indeed management operating in price competitive industries will have to focus mainly on efficiency gains from takeover than to the possibility of exercising market power by increasing prices above marginal cost. Given antitrust regulations and the presence of competition authorities, monopoly rents might indeed be difficult to be achieved by mergers and acquisitions. In this paper we investigate the general hypothesis on the effects of an acquisition on firms' performance. Performance is mainly defined as total factor productivity and return on assets. On a sample of surviving firms we also test the effect of acquisitions on sales and employment growth. The research is conducted on a sample of Danish firms being acquired in the period from 1991 to 1996 and observed until 1999. The paper benefits from the previous work of Lichtenberg and Siegel (1992) and McGuckin and Nguyen (1995). We test the *matching theory of ownership change* presented by Lichtenberg and Siegel (1992). The results indicate that firm with low level of productivity relative to the non targets and to their industry median, are more likely to being acquired. Firms subject to an acquisition are associated with improvement in their productivity performance. The evidence suggests that acquisitions *can be a mechanism to correct for lapses in efficiency*. The hypothesis is also supported empirically when performance is defined as of return on assets and sales growth. The results hold also when the industry-adjusted measurement is used as benchmark. One characteristic of this study is that is mainly based on a large sample firms including small and medium size companies, and one novelty is that it attempts to correct for sample self selection and endogeneity.

The paper is organized as follows. Section 2 introduces the literature review; section 3 discusses the main hypothesis, presents the empirical model and discusses the results and section 4 concludes.

2 Literature Review

According to Andrade and Stafford (1999) merger activities can be decomposed in two fundamental roles 'expansion' and 'contraction'. At the industry level the immediate effect of mergers is a reallocation of existing assets. Clearly this reallocation can occur in the context of and industry wide expansion, as firms may attempt to increase their size and scale in order to afford large capital investments in response to good growth prospects. However, it is also clear that to the extent that mergers within an industry allow firms to remove duplicate functions and rationalize operations, they often result in an overall decrease in the industry's asset base therefore they represent industry contraction. Furthermore, the clustering of mergers by industry suggests that mergers are often a response to an industry shock. Jensen (1993) argues that most merger activity since the mid 1970s has been caused by technological and supply shocks, which resulted in excess productive capacity in many industries. Mitchell and Mulherin (1996) document that some of the takeover activity during the 1980s could be explained by industries reacting to deregulation, increased foreign competition, financial innovations, and oil price shocks.

Bruner (2001) summarizes the evidence of 130 studies from 1971 to 2001, concluding that target shareholders earn positive market returns, bidder earn zero adjusted returns, and bidder and targets combined earn positive adjusted returns. In the field of M&As research applying event study methodologies, based on a sample of 4000 mergers in U.S.

during 1973-1998, a recent study from Andrade Mitchell and Stafford (2001) concludes that merger created value for the stockholders of the combined firms, with the majority of gains accruing to the stockholders of the target. The authors find that as in the 1980s, also mergers clustered by industries in the 1990s and that deregulation played a major role in explaining their causes. In Denmark, Jacobsen and Voetmann (2000) using data for companies listed on the Copenhagen Stock Exchange from 1993 to 1997, find that for a long time horizon of three years, the acquiring firms under perform the market by 9.4%, while after three years the long run abnormal returns turn to be not statistically different from zero. Agrawal, Jaffe and Gershon (1992) examine 937 mergers and 227 tender offers in the US over the period 1955 to 1987. The authors find that for a five year period after the completion of the merger the cumulative average abnormal return is –10.16% with non-conglomerate mergers underperforming the conglomerate mergers. For a sub-sample only in the period from 1975-1979, the post merger performance is actually positive. From accounting data, Ravenscraft and Scherer (1988) use US data from 1957-77. The authors find that the profitability of acquired firms declined relative to their pre-merger level of profitability. The exception with positive returns was found only for mergers of equals and under the pooling of interest accounting method. Healy et al. (1992) examine the post acquisition performance of the 50 largest companies in US between 1979-1984[3]. They find that for high overlapping businesses there is a significant improvement of 5.1% in industry adjusted post merger performance (mainly due to the improvement in asset turnover, see Healy et al. Page 153). Switzer (1999) uses a sample

[3] They use cash flow as a measure of a firm's economic performance deflated by the market value of assets. Their cash flow measure does not include the effect of taxes, interest expenses, goodwill and depreciation, therefore netting out the effect of financing and accounting procedure for the merger. The authors compare the post-merger performance of the combined unit to their pre-merger performance. Given industry variability, their performance measurement is calculated as a median industry-adjusted return for each firm for the five years before and after the merger.

of 324 US's acquisitions from 1967-1987. Targets and bidders in period prior and after the acquisition are found to outperform their industry peers (median). The finding show that there is a positive and significant difference between post-acquisition and pre-acquisition performance for the combined entities, measured as the difference between the five year median post acquisition cash flow return, and the five-year median pre-acquisition cash flow return. Frank and Harris (1989) use a large sample of 1800 UK takeovers over a 30 years period from 1955 to 1985 and find that shareholders of target firms benefit from the merger. Jensen and Ruback (1983) conclude that targets of successful tender offers and mergers increased the value of their shareholders in the period before the 1980s. Bühner (1990) finds cumulative abnormal losses to shareholders of acquiring firms on a sample of the 500 largest German's firms during the period from 1973 to 1985 and having their core business in the manufacturing sector. Gugler et. al, (2003) investigate the effects of mergers on an international level, during the past 15 years. The authors conclude that on the five years post merger, merged firms increase market power on average, as is found and increase profitability but a reduction in sales. However, for a sub-sample of small firms that merge the authors observe an increase in both profitability and sales due to the increase in efficiency caused by to economies of scale and scope. Still for the sub-sample of large firms, the effect is more in line with the market power hypothesis. In the field of productivity studies, McGuckin and Nguyen (1995) find evidence that the net change in productivity is positive for the acquired plants, negative for the acquiring and zero when considered as a whole unit. Lichtenberg and Siegel (1992) find positive change in productivity for large acquired properties in the manufacturing sector. Schoar (2001) finds that newly acquired plants experience a

significant increase of their total factor productivity, while the incumbent plants experience a productivity decline. When acquired and acquirers are combined in the analysis the net effect is negative. Schoar (2001) defines the negative effect on the incumbent plants as a 'new toy effect' given the shift of focus from the management of the incumbent plant on the newly acquired one.

McGuckin and Nguyen (2003) find interesting results on the impact of change in ownership on labor. The authors find that in the period from 1977 to 1987 both wages and employment increase due to ownership change. However, the authors also report that for the plants in the top 10^{th} percentile of the size distribution, ownership change did not cause a growth in wages, with 76% of workers incurring lower growth rates than for workers of plants that did not change ownership. Still, the wages remain above the average for the workers of the acquiring firms.

3 Theory formulation and hypothesis testing

3.1.1 Testing 'The Matching Theory of Ownership Change'

Lichtenberg and Siegel (1992a) consider ownership change as a *mechanism for correcting lapses of efficiency.* They base their theory on the matching theory of job turnover developed from Jovanovic (1979) where ''workers and employers'' engage in a matching process evaluating the quality of the match. Lichtenberg and Siegel (1992a) consider ''plants and parents (owner)'' as two entities that constantly engage in a matching process as the worker and the employer in Jovanovic (1979). Plants with low level of productivity relative to the average level in their industry will be perceived by the parent as a non optimal match therefore motivating the decision of the parent (owner) to

transfer its control to an other owner by selling the plant. According to both Lichtenberg and Siegel (1992) and in McGuckin and Nguyen (1995), this reasoning gives two main implications: (1) low level of productivity interpreted as a poor match between the parent and the plant will cause ownership change, and (2) ownership change will result in an increase in the level of productivity. Lichtenberg and Siegel (1992) based their study on a sample of 20,493 manufacturing plants over the period 1974-1980 from the U.S. Bureau of the Longitudinal Research Database (LRD). They found that 21% of their sample experienced at least one ownership change and tested the hypothesis that plants with low productivity were most likely to be subjected to ownership changes. They estimated a probit regression model and found that there was a highly significant inverse relationship between initial productivity and subsequent plant turnover. Lichtenberg and Siegel (1992) compute the productivity residuals based on the estimation of a Cobb-Douglas production function estimated separately by industry using annual data for 1974-80. The plants' productivity growth is, on average, 0.5 percent higher for plants that have been involved in an ownership change. From their analysis, one can also observe that this improvement is not experienced in the year immediately after the take-over. McGuckin and Nguyen (1995) conduct an empirical work on an unbalanced panel of 28,407 plants from the Longitudinal Research Database during 1977-1987. They present the following evidence: first, plants with above average productivity are the most likely to experience ownership change; second, after the ownership change the transferred plants shows improvement on their productivity 5-9 years after being acquired; third when the plants have a size above 250 employees or more they are more likely to buy plants with low initial level of productivity. Their findings, in line with Matsusaka (1993a) and in part in

contrast with Lichtenberg and Siegel (1992) implying that the ''matching theory of ownership change'', cannot be used to explain why ownership change occurs when all plants of all sizes are taken into account into the estimation. Based on these findings, McGuckin and Nguyen (1995) argues that ownership change during 1977-1987 in the manufacturing industry was driven by the expected gain from synergies between the acquired plant and its buyer, and therefore supporting the economic theory on managerial-synergy of acquisitions. On the other hand when their model is tested on a sub-sample of large and surviving plants their finding are in line with Lichtenberg and Siegel (1992).

3.1.2 Performance Measurement

A number of previous studies on M&As have been characterized by the use of stock price performance and event study methodology. For the majority of the available data we do not possess information on share price, since a lot of firms are small and medium sized and not listed on the stock exchange. Limiting the study to stock price performance and event study methodology would therefore only give evidence for a few firms. Other studies have focused on accounting based measures such as return on assets and profitability. In this study, we will employ total factor productivity, return on assets and sales growth as performance measurements. We will also briefly study the effects of acquisition on employment in a sample of surviving firms. This is mainly to compare with our reference study of McGuckin and Nguyen (1995)[4].

[4] McGuckin and Nguyen (1995) define productivity as *the best known measure of firm efficiency*.

3.1.3 Total Factor Productivity Measurement

McGuckin and Nguyen (1993) explain that factor productivity can be specified with a gross output model or a value added model (sales – cost of materials). The authors suggest that for highly aggregate level of analysis such a manufacturing sector, or the economy as a whole, value added measurement is preferable. Assuming that output of one industry can be purchased and used as input by another industry the use of value added will avoid double counting problems. On the other hand, if one assumes little intraindustry or intracompany trade, then gross output is the appropriate measure to use (see McGuckin and Nguyen (1993, 1995). Lichtenberg and Siegel (1992) define output in current dollar as total value of shipments adjusted for change in finished goods and work-in process inventories. Schoar (2001) uses plant sales plus changes in value of inventories for finished goods and work-in-process as a proxy for output. McGuckin and Nguyen (1995) use both value of shipment and value added in their productivity analysis. They found that both measure lead to the same qualitative results. Therefore we will follow the general methodology and use gross output defined as value of sales as proxy for output quantity. Still this result could be biased. As argued by Schoar (2001 page 6) if product markets are imperfectly competitive then growth in total factor productivity might also include the effect of mark-up on prices, and our measure of efficiency might not represent the true efficiency of the firm. Our measure of gross output might suffer from the intraindustry and intracompany trade and therefore value added might be the more appropriate measure to use.

3.1.4 The Empirical Model

Based on the general arguments of the TFP methodology, the empirical model is specified by the use of a standard Cobb-Douglas production function:

$$lnY_{it} = a_i + b_1 \ln L_{it} + b_2 \ln K_{it} + m_{it} \qquad (1)$$

(ln = natural logarithm)

where Y_{it}, is the firm *i*th total sales at time *t* deflated by a 3 – digit industry specific price deflator and is a proxy variables for actual quantities, L_{it}, is the number of employees in firm, K_{it}, is the sum of firm capital stock, deflated by an aggregate capital goods price index, and m_{it} is the error term and a_i is the time invariant firm specific intercept, that varies across firms but remains constant for the specific firm overtime. a_i captures the unobservable effects specific to each production unit (see Maddala 1987), that are assumed to not have a distribution and are treated as fixed and estimable. Assuming the existence of a firm-specific intercept (a_i) and not including it into the regression model could cause heterogeneity bias and generate some inconsistent estimates of the parameters in the OLS regression (see Nielsen & Gaddy, 2002). The sum of the two components $\mu_{it} + a_i$ estimates the logarithm of the firm *i*th productivity (see Maddala 1987, Dilling Hansen et al 2001, Nielsen & Gaddy 2002).

--Insert table 1 here--

3.1.5 Logit Estimation

One starting intuition before testing for improvement in productivity is that we might expect that firms with low initial productivity are more likely to become an acquisition

target (see Lichtenberg and Siegel 1992). In order to test this hypothesis we estimate the following logit regression:

$$L_{ti} = ln(P_{it} / 1- P_{it}) = a + b_1 TFP_{i92} + b_2 lnY_{i92} + \gamma_i \sum D_{industry} \qquad (2)$$

Where our dependent variable is categorical and take values of 1 if a firm has been a target in the period from 1993 to 1996 and 0 if not. TFP_{92} is the total factor productivity of firm *i* in year 1992, *Y* is the firm *i* total revenues in year 1992, and *D* are industry dummies. The model is also estimated by using industry-adjusted measurement where, for the specific firm, TFP is measured as its distance from the industry median. Table 2 shows our results for the two models. For comparisons the specification of Model 1 and 2 are similar to those of McGuckin and Nguyen, (1995) that use productivity (labor productivity) and size (log of total employees) as explanatory variables in a linear and nonlinear specification.

--Insert Table 2A here --

From the above table we can observe that the coefficient sign of TFP is negative in all four models implying that the log odds ratio (or the risk) for a firm of becoming a merger target in the period 1993-1996 increases due to its low initial (1992) level of productivity. These results hold also when firm productivity is compared to its industry median. Firm size is statistically significant and carries a positive sign, implying that larger value of total revenues will result in an increase of the likelihood of becoming a target. The model is also tested with a sample of acquirers and non. The dependent categorical variable assumes a value of 1 if a firm has engaged in an acquisition (acquirer) and 0 otherwise, during the period from 1993 until 1996. The next table shows the results:

--Insert Table 2B here--

The likelihood for a company to engage in any acquisition during the sample period increases if its initial level of productivity is relatively low compared to non-merging ones. These findings are similar to those we observed for the sample of target and non targets. Concluding, we can infer that firms with low level of productivity enter acquisitions as acquirers or targets as a strategy to improve their productivity performance (that is lower compared with those firms who do not engage in merger activities). The evidence is consistent with Gioia's (2003) study on Danish data from 1993-1996. The author finds asset turnover and profit margin inversely related to the likelihood in engaging into an acquisition. Gioia (2003) also controls for other factors like industry sales concentration, market share, minimum efficiency scale, and the general conclusion remains invariant.

3.1.6 Performance over-time

In order to test the difference in performance between firms that engaged in a takeover activity and firms that did not, we use a model that captures the differences in performance for a period going from 3 years before the acquisition to 4 years after. We correct for firms size, year effects and industry level. The empirical model is:

$$Performance_{it} = a + b\boldsymbol{X}_{it} + b\boldsymbol{T}_{it} + b\boldsymbol{A}_{it} + g_i \sum D_{industry} + g_i \sum D_{year} + m_{it} \qquad (3)$$

Where $\boldsymbol{X}$ is a vector for firm and industry characteristics, $\boldsymbol{T}$ is a set of dummy variables for targets (-3 to +4), $\boldsymbol{A}$ is a set of dummy variables for acquirers (-3 to +4) and $\boldsymbol{D}$ are industry and year dummies respectively. Performance is measured in terms of total factor

productivity and return on asset both as firm specific and as distance to its industry median, for firm *i* at time *t* respectively. For the exogenous variables, *Asst* is company's total assets, *Share* is the company's market share in four digit industry, *Index* is the Herfindhal index of sales concentration at the four digit level, *Debtr* is the company debt ratio, *T* and *A* are dummies that refer to targets and acquirers respectively, indicating 'years' before and after the acquisition, and they go from three years before to four years after (i.e. *T_1* = 1 means that firm *i* has been a target and is observed 1 year before the acquisition). *Dindust* are industry dummies, while $D_{90\text{-}99}$ are year dummies. For the models using industry adjusted measures it follows that our performance variables are defined in terms of their distance from the four digit industry average. In case of TFP than one would have DTFP= TFP_{it} – Industry average TFP_{jt}, where the subscript *i, t, and j* represent the company, time (years) and industry respectively (4 digit level). Table 4 shows the complete results from the estimation of our regression. For the non linear specification we add Y^2 and Debtr^2 for optimal size and capital structure. The models are estimated with robust standard errors applying the White Huber correction for heteroskedasticity.

- Insert table 3 here -

Table 3 present six models. In column 1 & 2 we have linear and non linear model for TFP, in column 3 & 4 we have the linear and non linear models for ROA and in column 5 & 6 we have the industry adjusted non liner model for TFP and ROA respectively.

Targets improve their performance compared to non targets in the post acquisition period as it seems that their gap in performance reduces over time. These results hold for the TFP, ROA and industry adjusted models. Acquirers instead seem to have more difficulties to shorten the gap in performance when the latter is measured in terms of TFP

in the linear model. In the non linear model, performance improves already three years after the acquisition and in the industry-adjusted model, improvement can be spotted already one year after. Using ROA, we observe a small but significant decreasing trend (decrease in gap) in the second year after the acquisition, while in the subsequent periods the performance gap could also be zero. Anyway, we might conclude with caution on the ROA and industry adjusted models given the non high degree of explanatory power in the regressions. Common to all models we observe that at time T or T1 companies have generally more difficulties and have a decrease in performance compared to the non merging companies. This could be due to the high cost or reorganization and to the deployment of firm resources in the organizational and implementation phase of the acquisition. There could be other explanations for the above findings. One interpretation could be that acquirers might need a longer time period of observation (Lichtenberg 1992, used 9 years) in order to adjust their operations and benefit from the acquisition. Some acquisition might also be small compared to the size of the acquirer and therefore have low or non impact in their performance. On the other hand there could be a margin of error in the ability of management from the side of the acquirer, to make a merger or acquisition work and indeed some mergers will never result in an increase of a firm's performance. We also performed some F-test on the significance of each individual parameter within the industry adjusted regression (e.g., Maddala 1992, Wooldridge, 2003) . Productivity differential at t_3 is statistically significantly different from t_2(p-0.07), t2(p-0.04), t3(p-0.03) and t4(p-0.09); t_0 is significantly different than t2(p-0.08), t3(0.07); t1 is significantly different from t2(p-0.002), t3(0.002) and t4(p-0.06). For the acquirers, a_2 is statistically significant different from a_1(p-0.01), a_0(p-0.04); a_1 is

significant different from a4(p-0.006); a_0 significantly different from a4(p-0.004); a1 is significantly different from a4(p-0.01); a2 is significantly different from a4(p-0.018) and a3 is significantly different from a4(p-0.017).

3.1.7 Long term performance change

In this section we collapse the pre and post acquisition years in 2 period units and allows our time frame to be extended from -6 years to 8 years after the acquisition. We compare acquired companies to the non acquired ones in the pre and post acquisition period and use industry adjusted measures of performance including a benchmark measure to assess firm relative performance to its industry median. We try to control for other factors that economic theory might suggest to affect performance, and we construct our regression model with a set of explanatory variables based on firm and industry level. Performance is defined with two general measurements: total factor productivity and return on assets. In this study we only focus on targets and non targets. We use two sets of three equations. In the first three we use TFP as dependent variables and we test the models on overall period, pre-acquisition period and post acquisition period. In the second set we substitute ROA with TFP. We restate our general hypothesis: Do targets improve their performance in the post acquisition period? If targets are below industry median performers in the pre acquisition period, are they able in post-acquisition to reduce the gap in performance relative to their industry median, compared to the non acquired companies?

The explicit empirical estimation becomes:

$$DTFP_{it} = \alpha + \beta_1 Share_{it} + \beta_2 Debtr_{it} + \beta_3 Debtrsq + \beta_4 Indexh_{it} + \beta_5 Y_{it} + \beta_6 Ysq_{it} + \beta_7 Assturn_{it} + \beta_7 PMargin_{it} + \gamma_i \sum Dyears + \mu_{it} \quad (4)$$

$$DROA_{it} = a + \beta_1 Share_{it} + \beta_2 Debtr_{it} + \beta_3 Debtrsq + \beta_4 Indexh_{it} + \beta_4 TFP_{it} + \gamma_i \sum Dyears + \mu_{it} \quad (5)$$

DTFP is gap or difference of a firm's total factor productivity from its industry average or median, D*ROA* is the difference of a firm's return on assets from its industry average or median, *Share* is the company market share, *Debtr* is the company debt/asset ratio, *Index* is the Herfindhal index for sales concentration at 4 digit industry level, *Y* is firm sales revenues, *Assturn* is the asset turnover (sales/assets), *PMargin* profit margin (profit/sales), *D* are years dummies from 1990 to 1999.

The models are estimated with robust standard error, applying the White correction for heteroskedasticity. Heteroskedastic errors could lead to the following two implications (Maddala, 1992 p.209): a) the least square estimators are unbiased but inefficient; b) the estimates of the variances are also biased therefore invalidating the test of significance; this will turn out in underestimating the true variance of the OLS estimator and obtaining shorter confidence intervals then the true ones.

If we assume that there are some unobserved random effects specific to each unit (firm) that are time invariant then as suggested in Maddala (1987) and Greene (2000), the above model should be estimated by the inclusion of random effects. Indeed as already argued

in section 3.1.4 for the fixed effect model of the production functions, the non inclusion of 'unit-specific intercept' that capture omitted time invariant variables (Nielsen & Gaddy, 2002) might determine heterogeneity bias, and might cause the OLS estimation to be different from those that could be estimated on a true model. Therefore adding to the equation (12) a random term v_i the random effect model is estimated by Generalized Least Squares procedure (GLS). This modeling approach allows inclusion of unobserved effect specific to each specific firm (Maddala 1987).

Where $E(v_i) = 0$ $\quad Var(v_i) = \sigma_v^2$ $\quad Cov(v_i\ m_i) = 0$ $\quad Var(v_i + m_i) = \sigma_v^2 + \sigma_u^2 = \sigma^2$

It is assumed that the unit specific component v_i, are uncorrelated with the regressors in the model (Nielsen & Gaddy, 2002).

The following tables show the results of the model with robust standard errors and the model with random effect.

--Insert tables 4, 4A and 5 here--

On both tables in the first column we can observe that the coefficient of target variable is significant and negative. This implies that in the overall period from -6 to 8 years after the acquisition targets perform below their industry median compared to sample of non target firms. These results hold both for productivity and return on asset measurements and are industry adjusted. After controlling for other factor influencing firm performance we can observe that targets performance in term of total factor productivity is on average 13.1% below industry median compared to non targets while in term of return on asset this value is 2.3% for the estimation with robust standard errors. With the random effect estimation the values are 22% and 3% respectively.

Turning to pre and post acquisition performance, the estimation with robust standard errors targets productivity is 16.5% below their industry median compared to non targets,

in the pre acquisition period, as in the post-acquisition period, the gap is reduced to 8.5%. For the ROA measure we observe instead 2.36% and 2.1% respectively. The latter is not statistically significant different form zero with a 95% confidence interval between, -5.08% and 0.84%. Here the difference is much narrower and not significant.

In the random effect estimation pre acquisition performance of targets is 32% below industry median compared to non targets and decreases to 14.5% in the post acquisition period. While the ROA measure are 2.5% and 3.4%. We tested for difference in structural change across time (Wooldridge, 2003) in the coefficients for the post and pre acquisition period. We define a dummy variable, *p* equal to 1 for the post acquisition period and equal to 0 for the pre-acquisition period, and then interact the new variable, *p* with all other explanatory variables. The results, corrected for heteroskedasticity, are showed in table 4A. We can observe that the two models differ across the two periods. The Wald test for joint significance of the period dummy and the interacted variables is statistically significant. The heteroskedastic-robust Wald statistic has a chi2(10) equal to 104.8 with a p-value<0.0000,(e.g., Wooldridge, 2003)[5]. However not all the parameters differ across time. The interaction terms on the variables debt ratio, Herfindahl index, profit margin, asset turnover, and the dummy for targets are statistically significant from zero, implying that there is difference in those coefficients across the two periods. For our variable of interest, the target dummy, we observe that the improvement in productivity in the post acquisition period is estimated to be approx 7.9% and significant at the 5%. Summing up our finding based on the robust standard error models and random effect models we can conclude that in term of productivity, the performance of targets improves

[5] This value has been computed by multiplying the numerator degrees of freedom with the F value (Gould W. 1999) Chi-squared is the limiting distribution of the F as the denominator degrees of freedom goes to infinity.

in the post acquisition period compared to the non targets. The results are less robust in the ROA specification for the robust standard errors and the random effects models[6].

3.1.8 TFP Growth of Surviving Firms

To further examine the effects of acquisition on surviving firms' performance, we follow the work of Lichtenberg and Siegel (1992) and McGuckin and Nguyen (1995).

In the following model we sample only surviving firms for which data is available in 1991 and 1996. The intuition is that for the companies acquired between 1991 and 1996 we should witness an higher performance growth compared to the non acquired. Since those are the companies which survive one should expect substantial improvement in their productivity. We add to this analysis sales and labor growth as dependent variables expressed in equation 18 and 19. Equation 19 is estimated in order to compare our results to a previous study of McGuckin, Nguyen and Rezneck (1995). Ownership change via an acquisition involving change in control of the firm might have an impact on labor. Still as explained by McGuckin et al. (1995) there is no clear theoretical link between 'labor market outcomes and ownership change'. Productivity growth could be caused by efficiencies that lead to growth, and therefore to upsizing of the firm. However, as argued

[6]Generally random effect models are seen as preserving more information in the data and the GLS transformation is more efficient when the random effect model is satisfied (Nielsen and Gaddy, 2002). Maddala (1987) suggests that random effect models are better when we want to make inference about the population from which the data comes from. Maddala (1987) also comments that 'as the ***v*** measure the firm specific effect that one is ignorant about in the same way ***u*** measures effects of cross section unit in the specific period ***t*** that we are ignorant about'. Then if we treat u as random there should be no reason why ***v*** should not be treated as random. Breusch and Pagan (1980) propose a specification test for the random effect model. The test is based in testing if the individual components do not exist and therefore one can use the OLS method for the estimation (Maddala 1987). The test is based on the null hypothesis that the variance of the error component is zero versus the alternative hypothesis that is not. Our test is significant (Prob>chi2 = 0.000) therefore we cannot reject the random effect model as a correct specification.

by McGuckin et al. (1995), synergies might also lead to cuts in employment in the acquired firms. Therefore, following the above arguments, one could expect both downsizing and upsizing following an acquisition.

The following are the empirical models:

$$lnTFP_{i96} - lnTFP_{i91} = a + b_1 ln\ Y_{i91} + b_2 T_{i91-96} + b_3 TFP_{i91} + b_{12} ln\ Y_{i91} * T_{i91-96} + b_{13} ln\ Y_{i91} * TFP_{i91} + m_{it} \quad (6)$$

$$ROA_{i96} - ROA_{i91} = a + b_1 ln\ Y_{i91} + b_2 T_{i91-96} + b_3 TFP_{i91} + b_{12} ln\ Y_{i91} * T_{i91-96} + b_{13} ln\ Y_{i91} * TFP_{i91} + m_{it} \quad (7)$$

$$lnY_{i96} - lnY_{i91} = a + b_1 lnL_{i91} + b_2 T_{i91-96} + b_3 TFP_{i91} + b_{12} lnL_{i91} * T_{i91-96} + b_{13} lnL_{i91} * TFP_{i91} + m_{it} \quad (8)$$

$$lnL_{i96} - lnL_{i91} = a + b_1 lnL_{i91} + b_2 T_{i91-96} + b_{12} lnL_{i91} * T_{i91-96} + m_{it} \quad (9)$$

On the left-hand side we have the changes in: total factor productivity, return on assets, sales revenues, and employment for each firm expressed as the difference from their value in 1996 and in 1991. The explanatory variables are: ln Y_{it} natural log of revenues, T_{it}, a dummy variable, equal to 1 if firm i in time t, has been a target, and 0 otherwise and TPF_i for initial total factor productivity as in year 1991, L_i is the log of employees. The remaining variables represent the interaction effects. The general specification in eq. 1 is similar to the one used by McGuckin and Nguyen (1995) that uses instead labor productivity growth as dependent variable (1987-1977) and correct for firm size using log of employment (1977) and initial (1977) labor productivity. We test three other models

including in eq. 1, 2, 3 and 4 a set of control variables such as company debt, market share, sales concentration index asset turnover and profit margin. In addition we test industry adjusted models where the dependent variables is defined as the distance to its industry median in the given year. For TFP this will give: DTFP= DTFP96-DTFP91, where DTFP96 and DTFP91 are the differences of TFP of the firm *i* to its industry median. All the above specifications are summarized in the next table where we show our results.

--Insert table 6 here--

We present three sets of tree equations. In model 1, 5, 7 and 10 we use a specification similar to McGuckin et al. (1995) in model 2, 4, 8 and 11 we include other explanatory variables to correct for other effect that might influence performance and in model 3, 6, 9 and 12 we use industry adjusted measures. Ten out of twelve models support the theory that acquisitions improve firm performance. Acquisition targets experienced a higher growth in total factor productivity, return on assets, sales and employment in the period from 1991 to 1996 compared to the sample of non-targets (assuming everything else constant). In model 2, 4, and 8 we can observe that by controlling for other factors that can influence firm performance, the coefficients of the target variable generally decrease in their magnitude and indeed we presume that this set of model might be more theoretically correct in explaining firm performance. The coefficient for the initial (1991) factor productivity is generally negative and significant indicating the negative relationship between productivity growth and initial company's performance. The negative and significant coefficient for the interaction term of *LnY91*Target* implies that the targets' performance growth declined with the increase in size. Larger non acquired companies improve their performance growth at higher rate than the non-targets ones.

We can compute several indicative calculations by the use of the estimate of the coefficients of the target dummy and the interaction effect with the size variables. If we fix Y and L to mean values of 10 and 4 and keeping the remaining variables of the equations constant we obtain the following results for the average growth:

TFP Model 1 (M&G specification): 2.3 – 0.193 * (10) =0.37

TFP Model 2 (Non linear): 1.82 – 0.151 (10) =0.31

TFP Model 3 (Non Linear Ind. adjusted): 0.648 – 0.053 (10) = 0.118 (non significant)

ROA Model 4 (M&G specification): 0.535 – 0.047 * (10) = 0.065

ROA Model 5 (Non linear): 0.507 – 0.045 (10) = 0.057

ROA Model 6 (Non Linear Industry adjusted): 0.508 – 0.045 (10) = 0.058

SALES Model 7 (M&G specification): 0.878 – 0.148 * (4) = 0.286

SALES Model 8 (Non linear): 0.758 – 0.122 (4) = 0.27

SALES Model 9 (Non Linear Ind. adjusted): -0.338 – 0.104 (4) = -0.754 (non significant)

EMP Model 1 (M&G specification): 0.581 – 0.101 * (4) = 0.177

EMP Model 2 (Non linear): 0.584 – 0.102 (4) = 0.176

EMP Model 3 (Non Linear Ind. adjusted): 0.332 – 0.072 (10) = 0.044 (non significant)

For the productivity models we observe that the average productivity between 1991 and 1996 in a typical firm is 37% higher than the non target firm for model 1 (M&G specification). In model 2, where we add other explanatory variables to control for other economic relevant factors, the coefficient is 31% and in the industry-adjusted model, the value is 11.8% but not significant. For the ROA the values are 6.5%, 5.7% and 5.8% respectively. For the sales growth, we observe 28.6% 27% for model 7 and 8

respectively, while in model 9 the value is highly negative but not significant. For the employment growth the values are 17.7% and 17.6% for the first two models while is 4.4% for the industry adjusted model but not statistically significant. McGuckin et al. found a coefficient of 16.2% for their productivity study and 24% for the employment growth models. We also tested the M&G specification against our richer specification (see Table 6, Models: 1&2, 4&5, 7&8 and 10 & 11). We define the M&G specification with fewer parameters as our restricted model and our specification as the unrestricted model and perform a joint hypothesis test (e.g., Wooldridge 2003). In all cases our specification cannot be rejected, as our extra variables are jointly statistically significant. The following are the levels of significance for the respective models: Models 1&2 F(7, 3834)=35.05 Prob>F= 0.0000; models 4&5 F(5, 3786)=40.27 Prob>F= 0.0000; models 7&8 F(7, 3834)= 20.06 Prob > F = 0.0000; models 10&11 F(3, 3873)=7.44 Prob>F=0.0001.

We can conclude from a general perspective that our results are in line with those from Lichtenberg and Siegel (1992), and McGuckin and Nguyen (1995) and on a certain degree to those of Gugler et al. (2003) and are strongly in support the hypothesis of ownership change for improvements in targets' performance. Improvement in performance might be caused by increase in firms' efficiencies leading to sales and employment growth, and as argued in Gugler et al. (2003), caused by economies of scale and scope. In this respect our result are similar to those of Gugler et al. (2003) who find that for small merging firms both sales and profitability increases.

Surviving firms perform better after the acquisition increase productivity, return on assets, their sales value, and hire more workers. Our models with a richer specification in

terms of independent variables perform better compared with the specifications used by Lichtenberg and Siegel (1992) and McGucking and Nguyen (1995). Therefore it can be relevant to control of other factors like market concentration, market share, company debt and profitability, in order to extrapolate the real effect of acquisitions on a firm's performance[7].

3.2 Endogeneity Bias

In this section we discuss the implication of endogeneity bias and self selection, often the characteristics of labor studies. These problems have been discussed and analyzed among economist often on evaluating the benefits of social programs and on their effects on unemployment (e.g., Maddala 1983). The estimation of treatment effects is very close related to the problem of self selection (e.g., Winship and Mare, 1992). Consider equation 10 and 12 as our performance equations, and 11 and 13 as our selection equations. The dichotomous variable T, define the category of the 'treated and not treated' and takes value of 1 if a company has been acquired (has sold) and 0 otherwise (e.g., Maddala 1983, and Greene 1997). The empirical model becomes:

a) Regression / Performance Equation TFP

$$GrowthTFP = a + b_1 \ln Y_{i91} + b_2 T_i + b_3 TFP_{91} + b_{12} \ln Y_{i91} * T_i + b_{13} \ln Y_{i91} * TFP_{i91} + b_{11} Y_{i91}\,\hat{}\,2 + b_4 Share_{i91} + b_5 Debtr_{i91} + b_{55} Debtr\hat{}2_{i91} + b_6 Index_{i91} + b_7 Asst_{i91} + b_8 Promargin_{i91} + \gamma_i \Sigma D_{industry} + m_{it} \quad (10)$$

[7] Still, using only existing firms, we only sample the companies that survived or that where not integrated into the mother company operations. This evidence might only show one side of the story, and therefore our conclusion on the growth models is limited only for those firms who survive in the long run.

b) Selection Equation TFP

$$T = a + b_1 DMY_{i91} + b_2 T_i + b_3 DMTFP_{i91} + b_4 Age_{i91} + b_5 MES_{i91} + b_6 Index_{i91} + b_7 Period + v_{it} \quad (11)$$

c) Performance equation ROA

$$GrowthROA = a + b_1 \ln Y_{i91} + b_2 T_i + b_3 TFP_{91} + b_{12} \ln Y_{i91} * T_i + b_{13} \ln Y_{i91} * TFP_{i91} + b_{11} Y_{i91} \text{^}2 + b_4 Share_{i91} + b_5 Debtr_{i91} + b_{55} YDebtr\text{^}2_{i91} + b_6 Index_{i91} + \gamma_i \sum D_{industry} + m_{it} \quad (12)$$

d) Selection Equation ROA

$$T = a + b_1 DMY_{i91} + b_2 T_i + b_3 DMTFP_{i91} + b_4 Age_{i91} + b_5 MES_{i91} + b_6 Index_{i91} + b_7 Period + v_{it} \quad (13)$$

Where *GrowhtTFP* is the growth in TFP from 1991 to 1996, *Y* is the log of company sales revenues, *Share* is the company market share, *TFP* if the total factor productivity, *Debtr* is the company debt ratio, *Index* is the Herfindhal index for sales concentration, *Asst* is the asset turnover(sales/assets), *Pmargin* is profit margin (profit/sales), *DI* are industry dummies, DM*Y* is the company's gap of its sales revenues for its industry median, *T* is dummy for target or non, D*TFP* is the company distance of its total factor productivity form its industry median *Age* is the log of firms age, *MES* if the minimum efficiency scale, *GrowthROA* is the growth of company return on assets between 1991 and 1996, *Period* is a dummy variable that is equal to 1 if a company has been acquired in period prior to 1993 and zero otherwise[8]. The performance equation includes also interaction effects.

[8] This variable is assumed to only have an impact on the selection equation, but not on the performance equation.

--Insert table 7 here--

The above table shows the result from the MLA. The probit models are generated for the TFP and ROA models and represent the selection equations. Lambda is negative in both models implying that our coefficient in the OLS regression tend to underestimate the treatment effect of takeover on company performance. The estimation in OLS is compared with the estimation via the MLA treatment effect estimation. This is showed in the four performance equations. The corrected coefficients of the target's dummy are larger in magnitude compared to the coefficient in the OLS estimation without the correction. However the Likelihood ratio test (LR) for the ROA model show that the size of bias is negligible since we cannot reject the null hypothesis that the errors of the two models (selection and performance equations) are uncorrelated (Prob > chi2 = 0.1631). Whereas for the TFP model the LR test is in support of rejecting the zero correlation for the two models (Prob > chi2 = 0.0450). If we compare the effect of the corrected models with the non corrected ones and fix Y (ln revenues) at the mean firm size we obtain the following results:

Model TFP corrected: 1.60 – 0.113 (10) = 0.47

Model TFP original: 1.37 – 0.107 (10) = 0.30

Model ROA corrected: 0.684 – 0.052 (10) = 0.164

Model ROA original: 0.542 – 0.048 (10) = 0.062

While productivity and ROA growth in the non-corrected models were estimated to be 30% and 6.2% respectively, in the new estimation taking into account endogeneity and non random selection, we observe much higher values, and indeed 47% and 16.4% respectively for the TFP and ROA models.

4 Conclusion

In sample of small and medium private owned companies, the acquisition targets are characterized by being less efficient. However as theory predicts, acquisition targets show a positive trend in total factor productivity and return on assets, when compared to the control group of non-merging firms and to their industry median. Among surviving companies the general results are also supported by the positive effects of acquisition on sales growth and employment growth. These findings show that 'surviving' firms have been upsizing, increasing the sales revenues and employing more staff.

Our results do not differ from the general findings in the academic literature that identify targets as the 'part' that receive the most benefit from a merger activity. However they differ from the US evidence (e.g., McGuckin and Nguyen 1995, Matsusaka 1993) which identify acquisition targets as efficient and good performing firms.

As acquisition targets are mainly those firms that perform poorly prior to the acquisition compared to the non-targets, the usual econometric estimation tended to underestimate the coefficient of the dummy variable for acquisition effects on firm performance. By taking into account endogeneity and self selection in our data, we found the new corrected coefficients are to be significantly larger in their magnitude. The overall results suggests that acquisition can be a tool to correct for lapses of efficiency (Lichtenberg 1992) for small and medium privately held companies, and contribute further evidence for the *matching theory* of ownership change.

Acknowledgments

The author thanks Steen Thomsen, Tor Eriksson, Erik S. Madsen, Clas Wihlborg, Per Jenster, Bersant Hobdari, Evis Sinani, Andreas Wittmer, Bodil Rasmussen, Hans Kurt Kvist, Reid Gavin, and seminar participants at the EARIE 30th annual meeting in Helsinki, and at the Copenhagen Business School.
The author is grateful to Anna Cristina D'Addio, Mette Ejrnes from the Copenhagen University, and to Stephen Bond, Frank Windmeiier and seminar participants from XIVth EEA Summer Shool 2003 at the IFS CEMMAP in London. The author thanks Daniel O'Boyle Kelly for proof reading the manuscript.
All the remaining errors are solely of the author.

References

Albæk Karsten, 2000. A Note on Self-selection and Labor Supply, Institute of Economics. University of Copenhagen

Andrade Gregor, Mitchell Mark, Stafford Erik, 2001. New Evidence and Perspectives on Mergers. Journal of Economic Perspective, Volume 15, Number 2, pages 103-120

Angrist Joshua D., Krueger Alan B., 1999. Empirical Strategies in Labor Economics, Handbook of Labor Economics, Ch. 23 Volume 3

Azarchs, T., 1995. Bank mergers and economics prove elusive, Standard and Poor's Credit Week, 2 January, pp. 63-66

Bruner Robert F., 2001. Does M&A Pay? A Survey of Evidence for Decision-Maker, WP No. 01-23, Darden, University of Virginia

Dickerson Andrew P., Gibson Heather D. and Tsakalotos Euclid, 2002. Takeover risk and the market for corporate control: the experience of British firms in the 1970s and 1980s. International Journal of Industrial Organization 20 1167-1195

Greene William H., 1981. Sample Selection Bias as a Specification Error: A Comment, Econometrica, Vol. 49, Issue 3, 795-798

Gioia C., 2003. Characteristics and predictability of companies' acquisitions. Evidence from Denmark. WP Copenhagen Business School

Greene William H., 1997. Econometric Analysis, 3rd edition, Prentice Hall

Gujarati D. N., 1995. Basic Econometrics, McGraw-Hill International Editions, 3rd Edition

Gugler Klaus, Mueller C. Dennis, Yurtoglu Burcin B., Zulehner Christine, 2003. The effects of mergers: an international comparison, International Journal of Industrial Organization, 21, 625-653

Hansen M. D., Eriksson T., Madsen E. S., Smith V., 1999. The influence of competition and ownership structure on the performance of Danish manufacturing firms, Working Paper, The Aarhus School of Business Danmark.

Healy Paul M., Palepu Krishna G. Ruback Richard S., 1992. Does corporate performance improve after mergers? Journal of Financial Economics 31 135-175, North Holland

Heckman J.J., 1979. Sample Selection Bias as Specification Error, Econometrica, Volume 47, Issue 1, 153-162

Idson Todd L., Feaster Daniel J., 1990. A Selectivity Model of Employer-Size Wage Differential, Journal of Labor Economics Vol. 8 Issue 1, Part 1, 99-122

Jensen Michael C., 1988. Takeovers: Their Causes and Consequences, Journal of Economic Perspective, Volume 2, Number 1, pages 21-48

Kenny Laurence W, Lee Lung-Fei, Maddala G. S. and Trost R. P., 1979. Returns to College Education: An Investigation of Self-Selection Bias Based on the Project of Talent Data, International Economic Review Vol. 20 Nr. 3

Lausten Mette, 2002. CEO turnover, firm performance and corporate governance: empirical evidence on Danish firms, International Journal of Industrial Organization, 20 391-414

Lichtenberg Frank R., 1992. Corporate Takeovers and Productivity, The MIT Press Cambridge Massachusetts

Maddala G. S., 1983. Limited-Dependent and Qualitative Variables in Econometrics, Cambridge University Press

Maddala G. S., 1987. Limited-Dependent Models Using Panel Data, Journal of Human Resources, Vol. 22, Issue 3, 307-338

Maddala G.S., 1992. Introduction to Econometrics, Prentice Hall

Main Brian G. M., Reilly Barry., 1993. The Employer Size-Wage Gap: Evidence for Britain, Economica 60, 125-142

Martin Stephen, 1993. Industrial Economics: economic analysis and public policy, 2nd ed, Prentice-Hall

Matsusaka John G., 1993. Target Profits and Managerial Discipline During the Conglomerate Merger Wave, Journal of Industrial Economics, Vol. 16 No. 2

Matsusaka John G., 1993. Takeover motives during the conglomerate merger wave, Journal of Economics, Vol. 24 No. 3

McGuckin Robert H. and Nguyen Sang V., 1995. On productivity and plant ownership change: new evidence from the Longitudinal Research Database, Rand Journal of Economics, page 257-276

McGuckin Robert H., Nguyen Sang V. and Arnold P. Reznek, 1998. On measuring the impact of ownership change on labor: evidence from US food-manufacturing plant-lvevel data. In: Haltiwanger, J., Manser, M., Toppel, R. (Eds.). Labor Statistics Measurement. National Bureau of Economic Research, Studies in Income and Wealth, Vol. 60. University of Chicago Press, Chicago and London, pp. 207-246

McGuckin Robert H. and Nguyen Sang V., 2001. The impact of ownership changes: a view from labor markets. International Journal of Industrial Organization, 19 739-762

Mitchell L.M., 1997. Consulting in mergers and acquisitions, Journal of Organisational Change Management Vol.10 No 3 1997

Mitchell L.M. Mulherin J.H., 1996. The Impact of Industry Shocks on Takeovers and Restructuring Activity, Journal of Financial Economics Vol.42 No 2 June 193 - 229

Nielsen Francois, Gaddy Gary, 2000. Pooled Time Series of Cross Sections, University of Chicago, Special Lecture

Palepu Krishna G., 1986. Predicting Takeover Targets, Journal of Accounting and Economics 8 3 – 35 North Holland

Ravenscraft David J., Scherer F.M., 1989. The Profitability of Mergers, Journal of Industrial Organisation, 101-116 North Holland

Rhoades Stephen A., 1997. The efficiency effects of bank mergers: An overview of case studies of nine merges Federal Reserve Board, Washington DC, 274-277

Schoar Antoinette, 2000. Effects of Corporate Diversification on Productivity, MIT Sloan School WP, forthcoming in the Journal of Finance

Switzer Jeannette A., 1996. *Evidence on Real Gains in Corporate Acquisitions,* Journal of Economics and Business 1996, North-Holland

Winship Christoper, Mare Robert D., 1992. *Models for Sample Selection Bias,* Annual Review of Sociology, Vol. 18, 327-350

Wooldridge Jeffrey M., 2002. Econometric Analysis of Cross Section and Panel Data. Cambridge, MA, MIT Press

Wooldridge Jeffrey M., 2003. Introductory Econometrics, 2nd Edition, Thomson

Appendix of tables and figures

Table 1: Regression results TFP model

Variables	Model
Labour	0.523
	(0.000)***
Capital	0.425
	(0.000)***
F – test	24764.22
	(0.000) p value
Adjusted R^2	81.8%
Nr of groups	16825
Obs per groups: min	1
max	10
avg	4.4
Number of Observations	74426

***,**,* = coefficient significant at the 0.01, 0.05 and 0.1 level respectively .

Table 2A: Logit TFP Model

Variables	Model 1 Linear	Model 2 Non linear	Model 3 Linear Industry Adjusted	Model 4 Non Linear Industry Adjusted
Total Factor Productivity 1992	-0.474	-4.822	-0.730	-0.999
	(0.003)***	(0.010) **	(0.000)***	(0.000)***
Log of total revenues	0.571	5.926	0.606	0.902
	(0.003)***	(0.000) ***	(0.000)***	(0.000)***
Industry Dummies	YES	YES		
$TFP92^2$		-0.189		-0.055
		(0.274)		(0.785)
$Rev92^2$		-0.240		-0.131
		(0.000) ***		(0.009) ***
TFP92 * Rev92		0.378		0.218
		(0.026) **		(0.239)
Constant	-10.237	-39.54	-4.42	-4.36
	(0.000)***	(0.000) ***	(0.000)***	(0.000)***
Log likelihood	-545.45	-523.57	-586.90	-582.33
LR Chi^2	141.01	184.78	69.42	78.56
Prob P>chi^2	(0.000)	(0.000)	(0.000)	(0.000)
Pseudo R^2	11.45%	15%	5.58%	6.32%
Obs	8087	8087	8481	8481

***, **,* = significant at the 0.01, 0.05 and 0.1 level respectively

Table 2B: Logit TFP Model Acquiers

Variables	**Model 1 Linear**	**Model 2 Non linear**	**Model Linear Industry Adjusted**	**Model Non L. Industry Adjusted**
Total Factor Productivity 1992	-0.668 (0.000)***	-4375 (0.002 ***	-1.119 (0.000)***	-1.422 (0.000)***
Log of total revenues	0.769 (0.000)***	4.558 (0.000)***	0.941 (0.000)***	1.228 (0.000)***
Industry Dummies	YES	YES		
$TFP92^2$		-0.118 (0.385)		-0.052 (0.776)
$Rev92^2$		-0.162 (0.000)***		-0.088 (0.020)**
TFP92 * Rev92		0.308 (0.011)**		0.186 (0.222)
Constant	-12.13 (0.000)***	-33.89 (0.000)***	-4.65 (0.000)***	-4.71 (0.000)***
Log likelihood	-578.75	-559.58	-585.66	-582.55
LR Chi^2	245.23	283.57	231.48	237.69
Prob P>chi^2	(0.000)	(0.000)	(0.000)	(0.000)
Pseudo R^2	17.48%	20.22%	16.50%	16.94%
Obs	8498	8498	8500	8500

***, **,* = significant at the 0.01, 0.05 and 0.1 level respectively

Table 3:Regression with robust standard errors

Variables	Model 1 Linear TFP	Model 1 Non Linear TFP	Model 2 Linear ROA	Model 2 Non Linear ROA	Model 3 Non Linear Industry Adjusted TFP	Model 4 Non Linear Industry Adjusted ROA
Constant	-2.679	-6.205	0.091	-0.062	-3.019	-0.180
	(0.000)***	(0.000)***	(0.055)*	(0.055)*	(0.000) ***	(0.000)***
Ln Revenues	0.280	0.868	0.002	0.04	0.535	0.051
	(0.000) ***	(0.000) ***	(0.002)***	(0.000) ***	(0.000) ***	(0.000) ***
Share	-0.006	-0.004	0.0001	0.0002	0.0003	0.00022
	(0.006) ***	(0.014)**	(0.203)	(0.041)**	(0.658)	(0.115)
Index	-0.231	-0.269	-0.028	-0.025	-0.103	-0.009
	(0.000) ***	(0.000)***	(0.000)***	(0.000) ***	(0.000) ***	(0.063)*
Debtr	0.156	0.287	-0.08	-0.115	0.234	-0.114
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)	(0.000)***
Mes		0.079		-0.002	-0.082	-0.0037
		(0.000)***		(0.179)	(0.000) ***	(0.004)***
Rev sq		-0.029		-0.002	-0.018	-0.0023
		(0.000)***		(0.000) ***	(0.000) ***	(0.000) ***
Debtr sq		-0.014		0.004	-0.012	0.004
		(0.000)***		(0.000) ***	(0.000) ***	(0.000) ***
T_3	-0.227	-0.223	-0.018	-0.019	-0.233	-0.016
	(0.001) ***	(0.001)***	(0.276)	(0.272)	(0.000) ***	(0.345)
T_2	-0.226	-0.229	-0.048	-0.048	-0.186	-0.044
	(0.000) ***	(0.000)***	(0.000)***	(0.000) ***	(0.001) ***	(0.001)***
T_1	-0.210	-0.224	-0.032	-0.030	-0.183	-0.028
	(0.000) ***	(0.000)***	(0.011)**	(0.017)**	(0.000) ***	(0.022)**
T	-0.278	-0.295	-0.049	-0.050	-0.225	-0.046
	(0.000) ***	(0.000)***	(0.005)***	(0.006)***	(0.000) ***	(0.012)**
T1	-0.270	-0.291	-0.033	-0.032	-0.239	-0.030
	(0.000) ***	(0.000)***	(0.080)*	(0.082)*	(0.000) ***	(0.103)*
T2	-0.198	-0.204	-0.036	-0.036	-0.147	-0.034
	(0.000) ***	(0.000)***	(0.007)***	(0.006) ***	(0.000) ***	(0.011)**
T3	-0.174	-0.183	-0.028	-0.029	-0.127	-0.027
	(0.002) ***	(0.001)***	(0.075)*	(0.065)*	(0.008) ***	(0.088)*
T4	-0.214	-0.211	-0.038	-0.037	-0.146	-0.036
	(0.000) ***	(0.000)***	(0.013)**	(0.015)**	(0.003) ***	(0.018)**
A_3	-0.276	-0.238	-0.026	-0.024	-0.167	-0.025
	(0.004) ***	(0.009)***	(0.402)	(0.437)	(0.007) ***	(0.402)
A_2	-0.325	-0.268	-0.008	-0.007	-0.138	-0.007
	(0.000) ***	(0.000)***	(0.773)	(0.797)	(0.011)**	(0.793)
A_1	-0.390	-0.332	-0.058	-0.057	-0.252	-0.059
	(0.000) ***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
A	-0.397	-0.343	-0.027	-0.026	-0.243	-0.028
	(0.000) ***	(0.000)***	(0.073)*	(0.076)*	(0.000) ***	(0.053)*
A1	-0.400	-0.335	-0.037	-0.035	-0.203	-0.036
	(0.000) ***	(0.000)***	(0.030)**	(0.041)**	(0.000) ***	(0.035)**
A2	-0.414	-0.344	-0.021	-0.019	-0.198	-0.020
	(0.000) ***	(0.000)***	(0.197)	(0.241)	(0.000) ***	(0.207)
A3	-0.400	-0.318	-0.018	-0.015	-0.202	-0.016
	(0.000) ***	(0.000)***	(0.321)	(0.402)	(0.000) ***	(0.365)
A4	-0.349	-0.271	-0.032	-0.028	-0.113	-0.0282
	(0.000) ***	(0.000)***	(0.075)*	(0.129)	(0.000)***	(0.120)
Industry Dummies	YES	YES	YES	YES		
Year Dummies	YES	YES	YES	YES	YES	YES
F –value	148.46	220.07	11.58	20.04	127.59	28.62
Prob > F	(0.000) ***	(0.000)***	(0.000) ***	(0.000) ***	(0.000)***	(0.000) ***
Adjusted R^2	41.2%	44.0%	4.8%	5.9%	24.7%	6.1%
Clusters	16581	16581	16581	16581	16581	16581
Obs	72481	72472	72481	72472	72472	72472

***,**,* coefficient are statistically significant at the 0.01, 0.05, and 0.1 respectively.

Table 4:Regression Model with robust standard errors

Variables	**Model Industry Adjusted TFP All**	**Model Industry Adjusted TFP Pre**	**Model Industry Adjusted TFP Post**	**Model Industry Adjusted ROA All[9]**	**Model Industry Adjusted ROA Pre**	**Model Industry Adjusted ROA Post**
Constant	-3.26	-3.19	-3.16	0.083	0.10	0.08
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Share	0.0008	0.0007	0.004	0.0005	0.0001	0.0006
	(0.521)	(0.408)	(0.672)	(0.802)	(0.595)	(0.558)
Debtr	0.106	0.125	0.071	-0.124	-0.129	-0.119
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Debtrsq	-0.007	-0.006	-0.006	0.005	0.005	0.003
	(0.001)***	(0.001)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Indexh	-0.185	-0.233	-0.10	-0.0143	-0.0134	-0.0147
	(0.000)***	(0.000)***	(0.000)***	(0.001)***	(0.013)**	(0.001)***
TFP				0.0297	0.0295	0.0299
				(0.000)***	(0.000)***	(0.000)***
Y	0.457	0.455	0.427			
	(0.000)***	(0.000)***	(0.000)***			
Ysq	-0.152	-0.150	-0.143			
	(0.000)***	(0.000)***	(0.000)***			
Asset Turn.	0.116	0.092	0.166			
	(0.000)***	(0.000)***	(0.000)***			
Profit	0.073	0.304	0.054			
margin	(0.004)***	(0.004)***	(0.008)***			
Target	-0.131	-0.165	-0.085	-0.0236	-0.0230	-0.021
	(0.000)***	(0.000)***	(0.024)**	(0.014)**	(0.014)**	(0.162)
Year Dummies	YES	YES	YES	YES	YES	YES
F –value	288.63	305.24	182.01	80.39	67.10	39.24
Prob>F	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Adjusted R^2	0.39	0.38	0.45	0.08	0.08	0.07
Obs	63842	35516	28326	63696	35436	28260

***,**,* coefficient are statistically significant at the 0.01, 0.05, and 0.1 respectively.

[9] ROA constrained between -1.5 and 1.5

Table 4 A (p-value in parenthesis)

Variables	**Model** **Industry Adjusted ROA All**	**Model** **Industry Adjusted TFP Pre**
Constant	.0837893 (0.000)***	-3.268 (0.000)***
Share	0.0001 (0.594)	.00074 (0.408)
Debtr	-0.128 (0.000) ***	0.125 (0.000)***
Debtrsq	0.005 (0.000) ***	-0.0062 (0.001)***
Indexh	-.0134 (0.013)**	-0.2332 (0.000)***
TFP	0.0295 (0.000) ***	
Y		0.455 (0.000)***
Ysq		-0.0150 (0.000)***
Asset Turn.		0.0928 (0.000)***
Profit margin		0.303 (0.000)***
Target	-0.0231 (0.039) **	-0.164 (0.000)***
P	-0.0038 (0.601)	0.112 (0.608)
Share x P	-0.0007 (0.492)	0.0029 (0.734)
Debtr x P	0.010 (0.320)	-0.0545 (0.022)**
Debtrsq x P	-0.0018 (0.038)**	-0.00009 (0.960)
Indexh x P	-0.001 (0.874)	0.134 (0.000)***
TFP x P	0.0003 (0.874)	
Y x P		-0.0281 (0.527)
Ysq x P		0.0007 (0.721)
Asset Turn. x P		0.0731 (0.001)***
Profit margin x P		-0.249 (0.000)***
Target x P	-0.0012 (0.941)	0.079 (0.040)**
Year Dummies	YES	YES
F–value	55.90	206.83
Prob>F	(0.000) ***	(0.000)***
Adj. R-squared	0.08	0.4140
Obs	63696	63842

Table 5: Random Effect Model

Variables	**Model Industry Adjusted TFP All**	**Model Industry Adjusted TFP Pre**	**Model Industry Adjusted TFP Post**	**Model Industry Adjusted ROA All**	**Model Industry Adjusted ROA Pre**	**Model Industry Adjusted ROA Post**
Constant	-5.85	-5.66	-5.48	0.114	0.131	0.108
	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***
Share	0.000	0.0005	-0.023	0.0002	0.0002	0.0001
	(0.987)	(0.596)	(0.000) ***	(0.693)	(0.663)	(0.558)
Debtr	0.028	0.052	0.016	-0.171	-0.175	-0.161
	(0.000) ***	(0.000) ***	(0.024) **	(0.000) ***	(0.000) ***	(0.000) ***
Debtrsq	-0.0026	-0.002	-0.002	0.006	0.007	0.005
	(0.001) ***	(0.001) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***
Indexh	-0.084	-0.08	-0.104	-0.007	-0.007	-0.0171
	(0.000) ***	(0.000) ***	(0.000) ***	(0.074) *	(0.166)	(0.007) ***
TFP				0.06	0.05	0.047
				(0.000) ***	(0.000) ***	(0.000) ***
Y	0.871	0.876	0.796			
	(0.000) ***	(0.000) ***	(0.000) ***			
Ysq	-0.030	-0.031	-0.026			
	(0.000) ***	(0.000) ***	(0.000) ***			
Asset Turn.	0.124	0.105	0.156			
	(0.000) ***	(0.000) ***	(0.000) ***			
Profit	0.029	0.233	0.015			
margin	(0.004) ***	(0.004) ***	(0.000) ***			
Target	-0.222	-0.320	-0.145	-0.030	-0.025	-0.034
	(0.000) ***	(0.000) ***	(0.000) ***	(0.001) ***	(0.028)**	(0.001) ***
Year Dummies	YES	YES	YES	YES	YES	YES
Wald Chi2	58319.80	29598.40	31311.89	7316.81	3940.51	2867.92
Prob > chi2	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***
Adjusted R^2	0.36	0.35	0.40	0.08	0.08	0.07
Obs	63842	35516	28326	63696	35436	28260

Table 6: Results Targets and Non

Variables	Model 1 TFP M&G	Model 2 TFP	Model 3 TFP Ind. Adj.	Model 4 ROA Reduced	Model 5 ROA Full	Model 6 ROA Ind. Adj.	Model 7 Sales Reduced	Model 8 Sales Full	Model 9 Sales Ind. Adj.	Model 10 Empl Reduced	Model 11 Empl Full	Model 12 Empl Ind. Adj.
Constant	-0.129	-2.66	-2.50	-0.031	-0.158	-0.116	0.278	0.032	0.032	0.281	0.193	0.105
	(0.008)***	(0.000)***	(0.000)***	(0.144)	(0.184)	(0.318)	(0.000)***	(0.668)	(0.668)	(0.000)***	(0.000)***	(0.017)**
LnY 1991	0.010	0.502	0.464	-0.003	0.016	0.006						
	(0.054)**	(0.000)***	(0.000)***	(0.151)	(0.492)	(0.794)						
Target	2.300	1.820	0.648	0.535	0.507	0.508	0.878	0.758	-0.388	0.581	0.584	0.331
	(0.000)***	(0.000)***	(0.220)	(0.015)**	(0.018)**	(0.016)**	(0.013)**	(0.030)**	(0.429)	(0.018)**	(0.017)**	(0.386)
TFP 91	-0.717	-0.985	-0.974	-0.097	-0.127	-0.124	-0.145	-0.146	-0.295			
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.001)***	(0.001)***	(0.000)***			
Ln Y91* Target	-0.193	-0.151	-0.053	-0.047	-0.045	-0.045						
	(0.000)***	(0.001)***	(0.253)	(0.015)**	(0.018)**	(0.015)**						
TFP91*LnY91	0.053	0.082	0.077	0.008	0.009	0.008						
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.001)***	(0.001)***						
Y^2		-0.024	-0.022		-0.0007	-0.0001						
		(0.000)***	(0.000)***		(0.523)	(0.904)						
L91							-0.042	0.08	0.07	-0.050	-0.048	-0.051
							(0.000)***	(0.024)**	(0.888)	(0.000)***	(0.024)**	(0.000)***
L91^2								-0.016	-0.010			
								(0.000)***	(0.131)			
L91 * Target							-0.148	-0.122	-0.104	-0.101	-0.102	-0.072
							(0.052)**	(0.105)	(0.324)	(0.056)*	(0.053)*	(0.324)
L91 * TFP 91							0.016	0.021	0.024			
							(0.214)	(0.098)***	(0.192)			
Share		0.0003	0.0009		-0.0005	-0.0005		-0.01	-0.01			
		(0.894)	(0.743)		(0.624)	(0.629)		(0.785)	(0.076)*			
Detbr		0.167	0.171		0.076	0.065		0.010	0.140		0.109	0.066
		(0.000)***	(0.000)***		(0.000)***	(0.000)***		(0.877)	(0.114)		(0.000)***	(0.122)
Debtr^2		-0.018	-0.020		0.026	0.028		0.064	0.005		-0.025	0.001
		(0.230)	(0.186)		(0.000)***	(0.000)***		(0.004)**	(0.867)		(0.027)**	(0.507)
Index		0.067	0.044		0.005	0.013		0.07	0.650			
		(0.060)**	(0.220)		(0.769)	(0.769)		(0.187)	(0.000)***			
Asset turnover		-0.025	-0.018					-0.002	0.011		-0.001	
		(0.000)***	(0.006)***					(0.819)	(0.371)		(0.860)	
Margin		-0.220	-0.250					-0.334	-0.310			
		(0.000)***	(0.000)***					(0.000)***	(0.000)***			
Industry Dummies	YES	YES		YES	YES		YES	YES		YES	YES	
R^2	10.3%	15%	14.5%	2%	6%	6%	3%	6%	7%	2.6%	3%	2%
F value	24.41	28.45	55.93	3.66	11.77	25.17	6.69	10.59	25.25	6.52	6.69	8.82
Prob > F	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	3863	3860	3860	3813	3810	3810	3863	3860	3860	3893	3893	3893

Table 7 Growth model (treatment effects and endogeneity correction)

Variables	**Probit model**	**Probit model**
	TFP	ROA
Constant	-2.99	-3.187
	(0.000)***	(0.000)***
DMY91	0.329	0.325
	(0.000)***	(0.000)***
DMTFP91	-0.642	-0.629
	(0.000)***	(0.000)***
Ln age	-0.004	-0.004
	(0.196)	(0.189) [a]
Minimum eff. Scale	-0.036	-0.065
	(0.694)	(0.469)
Herdindhal Index	-0.167	-0.136
	(0.639)	(0.695)
Industry dummies	YES	YES
Dummy If Period < 1993 =1	0.531	0.508
=>1993 = 0	(0.000)***	(0.000)***

Regression Variables	**Performance MLA Regression TFP + IMR**	**Performance OLS Regression TFP**	**Performance MLA Regression ROA + IMR**	**Performance OLS Regression ROA**
Y 91	0.556	0.553	0.018	0.016
	(0.000)***	(0.000)***	(0.472)	(0.517)
TFP 91	-1.023	-1.02	-0.134	-0.132
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Y91 * Target	-0.113	-0.107	-0.052	-0.048
	(0.011)**	(0.018)**	(0.007)***	(0.016)**
TFP 91 * Y91	0.086	0.086	0.010	0.010
	(0.000)***	(0.000)***	(0.001)***	(0.001)***
Y 91 ^2	-0.027	-0.026	-0.0008	-0.0007
	(0.000)***	(0.000)***	(0.489)	(0.557)
SHARE	0.0006	0.0007	-0.0007	-0.0006
	(0.811)	(0.797)	(0.542)	(0.569)
DETBR	0.167	0.167	0.078	0.077
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
DEBTR^2	-0.017	-0.017	0.025	0.026
	(0.246)	(0.250)	(0.000)***	(0.000)***
H-INDEX	0.069	0.067	0.007	0.005
	(0.055)*	(0.065)*	(0.674)	(0.735)
ASS. TURN	-0.032	-0.032		
	(0.000)***	(0.000)***		
PROFIT MARGIN	-0.216	-0.216		
	(0.000)***	(0.000)***		
TARGET	1.60	1.37	0.684	0.542
	(0.002)***	(0.007)***	(0.002)***	(0.015)**
INDSUTRY DUMMIES	YES	YES	YES	YES
Constant	-2.90	-2.89	-0.170	-0.164
	(0.000)***	(0.000)***	(0.185)	(0.202)
Lambda	-0.065		-0.040	
	(0.000)***		(0.000)***	
R-sq		0.16		0.06
F value		28.83		11.73
Prob > F		(0.000)***		(0.000)***
Wald Chi2(7)	731.71		279.32	
Prob > Chi2	(0.000)***		(0.000)***	
Number of Observations	3725	3725	3676	3676
Number of groups				

***= significant at the 0.01 level ** = significant at the 0.05 level * = significant at the 0.1 level

Figure 1

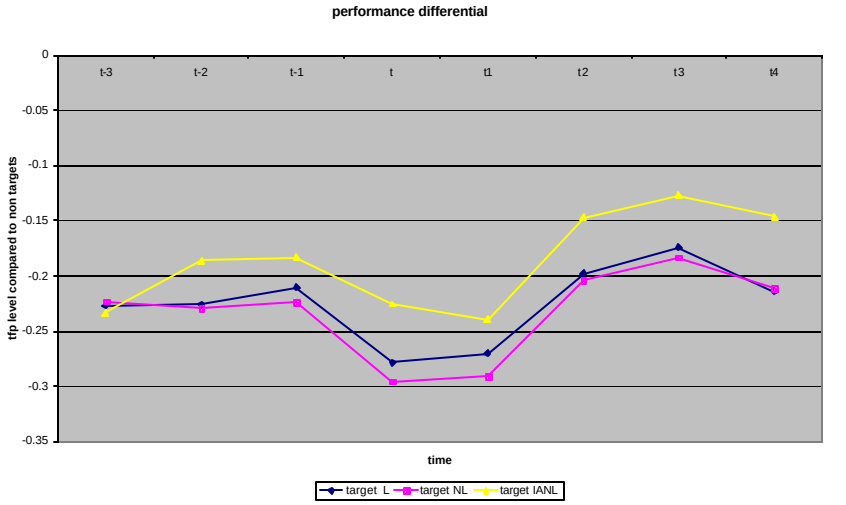

Figure 2