International Mergers and Acquisitions and the Market for Lemons.

International Acquisitions and Firm Performance in Denmark 1990-1997[1]

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Paper proposed for presentation at the 28th European International Business Academy Conference
December 8-10, Athens, Greece.

September 10, 2002

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Abstract

We propose that the market for international acquisitions may be subject to a double "lemons problem": because of information asymmetries firms acquired by international buyers tend to be poor performers compared to firms acquired by domestic buyers that again tend to perform worse than firms that are not acquired. We find support for these propositions by comparing international to domestic acquisitions of Danish firms over the period 1990-1997. Foreign firms tend to acquire poorly performing firms measured by return on assets and factor productivity. Moreover, although the relative performance of the internationally acquired firms does improve significantly a couple of years after acquisition, selection-adjusted estimates indicate a negative performance effect of international takeovers. This may be interpreted as an indication of further unidentified adverse selection bias and/or acquirer motives like market and technology access that are traded off for local financial performance.

1.Introduction

Although there is a large literature on international mergers and acquisitions, we still know surprisingly little about the consequences of international acquisitions for the performance of the acquired firms. One important reason for this is that most studies of international acquisitions study the choice of entry mode comparing acquisitions to greenfield investment or non-equity mode like joint ventures (e.g. Caves 1982, Anderson and Gattignon 1986, Benito 1996, Arora and Fosfuri, 2000; Makino and Neupert, 2000; Pan and Tse 2000, Harzing 2001). Other studies have examined the impact of international acquisitions on value creation from the viewpoint of the large, listed companies, which attract more public attention and where value creation can be evaluated by stock price reactions (Seth 1990, Chatterjee et al. 1992). But these studies examine only international mergers and acquisitions and do not include a control group such as domestic acquisitions or firms not involved in acquisitions. Moreover many, if not most, acquisitions are less spectacular bread-and-butter takeovers of smaller, closely held firms that differ considerably from listed firms. A third reason is that there is considerable uncertainty concerning performance measurement of foreign-owned companies. How should performance be measured if subsidiary financial performance is influenced by taxation and overall strategic consideration as much as by local performance.

This paper attempts to break some new ground on these issues and generates some surprising findings. We propose that the liability of foreignness implies information asymmetries and adverse selection effects in the market for acquisitions and that these information asymmetries are magnified for international acquisitions. As a consequence foreign acquirers tend to acquire as disproportionate amount of "lemons" (low quality firms). We test this hypothesis on a comprehensive data set encompassing essentially all firms in a single European country (Denmark)

and an official survey of mergers and acquisitions in the country over the period 1990-1997. In this data we are able to distinguish between foreign and domestic acquirers and so can compare firms subject to foreign acquisition to relevant control groups such as firms subject to domestic acquisition and firms that are not acquired over the period. We are able track alternative performance measures such as asset returns, factor productivity or sales growth both prior to and after acquisition and to control for a number of other factors that influence performance.

We find that foreign firms tend to acquire poorly firms measured by return on assets, factor productivity and other measures. Moreover, although the relative performance of the internationally acquired firms does not improve significantly after acquisition, selection-adjusted estimates indicate a negative effect of international takeovers on the performance of the acquired firms. These results are somewhat at odds with the theoretical literature, which emphasizes performance-enhancing resource transfers between parent companies and subsidiaries. However, we also observe signs of improve in subsidiary performance after the first couple of years and so propose that further unidentified adverse selection effects may be at work. Alternatively, compared to domestic firms foreign acquirers may place more emphasis on the target as a sales channel or source of technology and less emphasis on other aspects of performance.

2. Theory development

According to standard theories of foreign direct investment international acquirers must posses firm specific firm specific competitive advantages to compensate for the liability of foreignness, i.e. a deficit of local information, experience, business relationships and other soft assets compared to

domestic firms enterprise (Caves 1996, Dunning 1981, Hennart 1991). If these advantages are deemed to be sufficiently large, foreign firms will undertake the acquisition. Provided that they behave rationally and aim to maximize maximise profits, the foreign firms will not be systematically disappointed, and foreign acquisitions will create value. Value may be created when parent company resources (competence, specialised production facilities, access to capital markets etc.) are shared with the subsidiary. Or the parent company may gain access to valuable resources in the subsidiary such as proprietary technology or sales channels. The gains may be reflected in higher productivity, improved returns on capital and higher sales growth at the subsidiary level or as higher firm value or return on assets in the parent company.

The established theory therefore tends to view "foreignness" as a cost item, which may reduce acquisition activity, but will not affect the generally positive consequences of those transactions that are carried out. In contrast we propose that the information cost view needs to be amended because information asymmetries have more subtle implications than merely adding to the costs of foreign acquirers. In particular we will propose that a double "market for lemons effect" (Akerlof 1970) is at work in the market for acquisitions: 0) acquired firms will tend to be low-performers compared to non-acquired firms, 1) firms acquired by international buyers will be low performers compared to firms acquired by domestic buyers. In this paper we direct attention at hypothesis 1.

This is the argument. There are large information asymmetries in the market for acquisitions, since e.g. accounting information is imperfect or possibly manipulated, and a number of important factors like quality of management, managerial effort, market trends etc. will only be imperfectly observable to outsiders. In general sellers will be better informed than buyers about these issues. As a result prospective acquirers will be careful and offer relatively low prices, which reflect the risk of

buying low-quality firms. High quality firms will therefore generally prefer not to sell out because they can do better with the existing ownership structure expect in special situations related to credit rationing, succession at death of founder, expectations of synergy and other motives which have been analysed in the motives for mergers literature. The same arguments clearly apply even though the firm is not actually put up for sale. Firms that search for acquisition targets will be more likely to strike a deal with incumbent owners of low quality firms whose opportunity costs of continuing in charge are lower. This conjecture has considerable support in the efficiency view of mergers and acquisitions, which regards mergers and acquisitions as a "civilised alternative to bankruptcy" (Dewey 1961?). Financial distress is certainly one factor, which may force incumbent owners to sell out even if they would prefer to hold on. We do not at this stage have any specific performance measure in mind and will employ alternative measures for empirical testing (return on assets, factor productivity, sales growth).

The liability of foreignness implies that foreign buyers face extra uncertainties regarding the nature the host country business environment, foreign accounting standards, etc. Because of this liability of foreignness prospective domestic buyers will have access to information signals that foreign buyers do not get. A disproportionate share of the high quality firms will therefore be acquired by domestic buyers, although again resources fit, synergies and other factors may make it more attractive to offer some firms to international buyers. We therefore propose the following hypothesis

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Hypothesis 1. Firms acquired by foreign buyers will be underperformers relative to firms that are acquired by domestic buyers.

This hypothesis is not generally appreciated in international business studies and may seem highly controversial to some. For example, Hooley et. al. (1996) propose and strongly support the hypothesis that *"firms with foreign participation.. outperform firms without foreign participation"*. Globerman et al. (1994) find higher labour productivity in foreign-owned firms in Canada, although the difference becomes significant when capital input and industry conditions are taken into account. Davis and Lyons (1991) also find higher labour productivity among foreign firms in the UK compared to domestic counterparts.

However, it is important to realise that the hypothesis does not concern the effects of foreign acquisitions as such, but rather the effect of the selection processes that lead to foreign acquisitions. The acquired firms are likely to be poor performers prior to foreign acquisition, and the effects of the acquisition have to be measured relative to that. Moreover, foreign acquisitions are likely to be self-selected by firms with relatively poor prospects prior to acquisitions and this must also be taken into consideration when estimating the effects of foreign acquisition.

If selection forces so clearly disfavour foreign acquisition, it is worthwhile to consider why international acquisitions take place at all. And why doesn't the market cease to function at all as originally envisioned by Acklerlof (1970)? It seems reasonable to assume that foreign buyers are not fooled, i.e. they form rational expectations given their information sets. One answer is that the standard theories of the multinational enterprise continue to hold. Because of the acquirer's ownership advantages and specific internationalisation benefits between acquired and acquiring firms some prospective acquisitions are more valuable to foreign buyers (Dunning 1981). Another important reason is that value creation by a foreign acquisition may occur both at the parent and

subsidiary level. Foreign buyers may therefore be relatively less concerned with the performance of the acquired subsidiary as such and more concerned with overall benefits related to market access, access to proprietary technology or stability of supply. Studies by Suverkrup and Hushildt (1990), Norburn and Schoenberg (1994) , Chakrabati et al (1994), Hamil and Castledine (1996) and all find market access to be the first or second most important motive for international acquisitions (Gammelgaard 2002).

One qualification is that foreign acquirers may also have access to information (e.g. on technology issues or market potential), which is not known to domestic companies (in fact such information may be part of their ownership advantages) and which may give the foreign aquirers a unique ability to screen acquisition targets. This would then imply that the liability of foreignness needs to be balanced against global information advantages. We propose that these advantages will be industry specific whereas the liabilities are likely to be country specific.

Control variables

Obviously, a large number of factors other than ownership influence firm performance. These include industry and firm specific effects related to market growth, market position, intensity of competition, entry barriers, proprietary knowledge and other firm specific resources. We control for these effects by industry dummies, concentration indices and other control variables.

3. Data and measurement

Our dataset has been constructed from two main sources. First we identified the companies acquired in Denmark in the period 1990-1997 from the publication *Fusioner,* which is an annual report published from the Danish Competition's authority (Konkurrence Rådet). Until 1999 Danish companies were obliged to inform the competition authority if they engaged in any mergers or acquisitions. Second from a Danish private company *Købmandsstandens Oplysningsbureau A/S* we obtained data on firm specific information and other aggregated measures at industry level. The database includes in principle all Danish firms, since unless smaller than 10 employees, Danish companies have the mandatory obligation to deliver their accounting report to the public authorities. This enabled us to construct an unbalanced panel from 1990 to 1999 and observe firms' acquisitions over the period from 1990 to 1997.

Table 1 presents a list of the variables that we use in our study.

// Table 1. //

We employ two different performance measures including sales growth, return on assets and factor productivity. Following earlier work by Licthemberg Siegel (1992) and McGuckin, Nguyen and Reznek (1995) total factor productivity (TFP) is measured as the residuals of a production function which explains variations in output by capital and labour input (total accounting assets, no. of employees). Based on the general TFP methodology, we describe the empirical model by the use of a standard Cobb-Douglas production function:

$\ln Y_{it} = \alpha + \beta_1 \ln L_{it} + \beta_2 \ln K_{it} + \mu_{it}$ (ln = natural logarithm)

where Y_{it}, is the firm ith 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 (approximated by log of total assets (see Koning and Repkin 1997), deflated by an aggregate capital goods price index, and μ_{it} is the error term or disturbance, is equal to the logarithm of the firm ith productivity. The total factor productivity for firm i at time t is obtained by adding to the error term the value of the constant from the regression analysis[3]:

$TFP_{it} = \boldsymbol{a} + \boldsymbol{m}_t$ where $\boldsymbol{m}_t = lnY_{it} - (\boldsymbol{a} + \boldsymbol{b_1}lnL_{it} + \boldsymbol{b_2}lnK_{it})$

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). If one assumes little change in vertical integration (i.e. in the value added/totals sales ratio), gross output is an acceptable measure (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 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 follow the general methodology and use gross output defined as

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[3] Estimation with robust standard errors (White correction for heteroskedasticity).

value of sales as proxy for output quantity, while adding appropriate controls for industry effects, profit margins and other variables.

Background

For background reference table 3 gives some descriptive information on mergers and acquisitions in Denmark 1990-1997.

// Table 2. Mergers and Acquisitions in Denmark 1990-1997 //

Each year some 300-400 Danish firms are acquired of which around 1/5 are acquired by foreign firms. Since foreigners tend to acquire slightly bigger firms than Danish bueyers, the international share of revenue and employment is higher (some 30-40% towards the end of the period). In 1996 a firm acquired by a foreign firm had 196 employees while the firms acquired by domestic buyers had only 73 employees. In term of revenues the figures are respectively 263 millions and 96 millions. In 1997 the international share of total sales rose to 64%, mainly because of the (partial) acquisition of the former telecommunications monopoly, Tele Denmark, by Ameritech from the USA.

The following table show some mean values and correlations in our sample:

// Table 3. Descriptive statistics and correlation matrix //

In term of profit margin and asset turnover, domestic firms seem to show signs of better performance compared with firms acquired by foreign companies. Foreign acquirers seem also to prefer bigger firms, while level of debt to equity ratio seems to be invariant between the samples. These values give us some general indication but in order to test the hypothesis on the characteristics of foreigner acquisition while also taking into account other control variables, we turn to a logistic regression model and treat the analysis in the next section.

4. Results.

Determinants of acquisition

Earlier studies (Carmine 2002a) have already analysed the characteristics of acquired firms compared to non-acquired firms over the period 1990-1997. In this paper we present some simple comparisons of the two groups.

// Table 4. //

Combining pre and post acquisition data we observe that acquired firms do worse than firms that were not acquired in terms of mean profit margin, sales growth, return on assets and changes in

return on assets, and asset turnover and total factor productivity. These results were found to hold in logistic regressions on the likelihood of becoming acquired or merged over the period. In other words, both simple statistics and the more elaborate tests not presented here provide support for the first half of the proposed "double lemons" problem: acquired companies tend to be low performers compared to companies that are not acquired.

Determinants of international acquisition

We start by testing the big picture, i.e. we lump all observations of acquired firms together and examine how economic performance measures influence the likelihood of foreign relative to domestic takeover. We estimate a standard logit regression

$$L_{it1} = ln\,(P_{it}\,/\,(1\text{-}\,P_{it})) = \boldsymbol{a} + \boldsymbol{b}_{it\text{-}n}\boldsymbol{C} + \boldsymbol{m}_{t} \quad (1)$$

Where $(P_{it}/1\text{-}P_{it})$, is the ratio of the probability that a firm (i) will be a foreign acquisition target at time t to the probability that a firm will be a domestic acquisition target (odds ratio). X is a vector containing firms and industry characteristics lagged one year, $\boldsymbol{a}$ and $\boldsymbol{b}$ are parameters to be estimated and $\boldsymbol{m}$ is the error term, In particular we estimate the models

$$L_{it} = ln(P_{it}\,/\,1\text{-}\,P_{it}) = \boldsymbol{a} + \boldsymbol{b}_{1}AGE_{it\text{-}1} + \boldsymbol{b}_{2}TFP_{it\text{-}1} + \boldsymbol{b}_{3}lnASSET_{it\text{-}1} + \boldsymbol{b}_{4}lnASSET\hat{}2_{it\text{-}1} +$$
$$+ \boldsymbol{b}_{5}DEBTR_{it\text{-}1} + \boldsymbol{b}_{6}MES_{it\text{-}1} + \boldsymbol{b}_{7}SHARE_{it\text{-}1}\ \boldsymbol{b}\,X_{\,year} + \boldsymbol{b}Z_{\,indust} + \boldsymbol{m}_{t} \qquad (2)$$

$$L_{ti} = ln(P_{it}\,/\,1\text{-}\,P_{it}) = \boldsymbol{a} + \boldsymbol{b}_{1}ASST_{it\text{-}1} + \boldsymbol{b}_{2}MARGIN_{it\text{-}1} + \boldsymbol{b}_{3}AGE_{it\text{-}1} + \boldsymbol{b}_{4}lnASSET_{it\text{-}1} +$$
$$+\boldsymbol{b}_{5}lnASSET\hat{}2_{it\text{-}1} + \boldsymbol{b}_{6}DEBTR_{it\text{-}1} + \boldsymbol{b}_{7}MES_{it\text{-}1} + \boldsymbol{b}_{8}SHARE_{it\text{-}1}\ \boldsymbol{b}\,X_{\,year} + \boldsymbol{b}Z_{\,indust} + \boldsymbol{m}_{t} \qquad (3)$$

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AGE is the company age at the time of acquisition, *TFP* is the total factor productivity estimated from the Cobb Douglas production function, *lnASSET*, is the natural log of total assets, *MES* is the minimum efficiency scale (approximated by the smallest company's revenue within the 4 digit industry), *DEBTR* is the ratio of debt to total assets, *ASST* is the ratio of sales to total assets and *MARGIN* the ratio of profit to sales, *SHARE* is the firm market share in the 4 digit industry, $\boldsymbol{X}_{year}$ are years dummies, and $\boldsymbol{Z}_{indust}$ are industry dummies.

The following table shows the result from the logit regression for the two models.

// Table 5 //

In both models we observe that the likelihood of a company being acquired by a foreign firm is inversely related to its performance(when compared to the pool of domestic acquired companies). The TFP, and ASSET coefficients show a negative sign and are statistically significant different from zero. The coefficient for firm size (ln Assets) is positive and statistically significant, implying the odds of being purchased by a foreigner acquirer are positively related to its target size. Asset squared is negative as expected specifying for the nonlinear effect in our model. The debt ratio and market share have a negative sign in both models, but are not statistically significant. The Minimum efficiency scale variable, used as a proxy for entry barrier, is positive but only significant in model 1 at the 10% level.

We conclude that foreign companies have a propensity to buy bigger but lower performing targets compared to domestic firms. These findings provide support for hypothesis 1. As indicated in the

theory section, adverse selection because of asymmetry of information could be a explanation if foreign firms do not possess the same level of knowledge of the Danish market as domestic firms do and therefore fail to recognise the bad from the good targets. Moreover, many international acquirers may be pursuing a geographic market expansion and therefore care less about local financial performance or actually prefer to buy a failing firms, which are presumably a relatively cheap way to acquire marketing channels (c.f. the positive impact of sales revenue) or they may plan to transfer know-how to correct for the observed lapses in efficiency.

These results continue to hold when we estimate the models on industry-adjusted measures (i.e. as deviations from 4-digit industry average values) in table 5.1. The better firms perform relative to the industry the less likely they are to be acquired by a foreign relative to a domestic firm. This result provides further support for hypothesis 1. A positive size effect is still observable, which indicates that foreign firms buy big even relative to similar acquisitions by Danish firms.

Pre- and post acquistion performance

We now distinguish between pre and post merger performance. We measure firm performance by two types of variables: total factor productivity (TFP) and return on assets (ROA). We start with the following general models:

$$TFP_{it} = \boldsymbol{a} + \boldsymbol{b}_1 \, lnR + \boldsymbol{b}_2 DF + \boldsymbol{b}_3 Detbr + \boldsymbol{b}_4 Index + \boldsymbol{g}_i \, \dot{a} D_{year} + \boldsymbol{g}_i \, \dot{a} IND + \boldsymbol{m}_{it} \quad (4)$$

$$ROA_{it} = \boldsymbol{a} + \boldsymbol{b}_1 \, lnR + \boldsymbol{b}_2 Detbr + \boldsymbol{b}_3 Index + \boldsymbol{b}_4 TFP_{it} + \boldsymbol{b}_5 DF + \boldsymbol{g}_i \, \dot{a} D_{year} + \boldsymbol{g}_i \dot{a} IND + \boldsymbol{m}_{it} \quad (5)$$

Where R_{it} is the total revenues of firm i at time t, *Debtr* is the ratio of Debts to total Assets, *Index is the* Herfindhal index for industry sales concentration (see Martin 1994), D_{year} are year dummies *IND* are industry dummies, and *DF* is a dummy variable that takes the value of 1 if a firm has been acquired by a foreign firms and zero if it has been acquired by a domestic firm. DF therefore estimates the average effect of a foreign acquisition on firm performance. In the general models (1 and 4) DF captures the effect over all the sample period 1990-1999 for the acquisitions made between 1990-1997. We address the issue of endogeneity in DF in a later section. From these general models we estimate two sub-samples (model 2 and 3 plus 5 and 6 respectively) by dividing the period of estimation in pre-acquisition and post-acquisition period. Therefore in the first case we compare firms (domestic and foreign) in the pre-acquisition period from -3 to -1 years before the acquisition. In the second case we compare firms in the post acquisition period 1 to 5 years after the acquisition.

Time

    Pre acquisition   Post acquisition

| -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
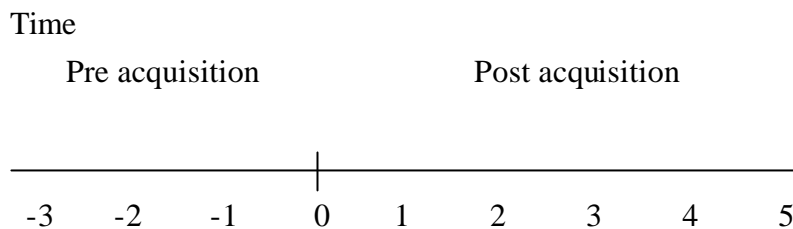
The results are presented in the following table[4]:

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[4] We used the Cook-Weisberg (1983) test for heteroskedasticity and accepted the null hypothesis of constant variance (Prob > Chi2 = 0.2908).

// Table 6 //

Table 6 presents two sets of 3 equations. In the first three models (1 to 3) we use TFP as dependent variables while in model 4 to 6 we use ROA as dependent variable. All six models are significant at the 1% significance level.

Looking at the partial coefficients of the dependent variables, in five of the six models we can observe that the coefficient of the dummy variable *DF* is negative and statistically significant different from zero (not significant in model # 6). Therefore we can reject the null hypothesis of *no association between foreign acquisitions* and firm performance. Companies that where purchased by foreign firms in the period from 1990 to 1997 (model # 1) show on average a 25.0% lower productivity than those acquired by domestic firms. In the pre-acquisition (model # 3) period average productivity for international acquisitions was 31.8% lower. In the post acquisition period (model 2), international acquisitions were 27.2% less productive than domestic ones. In other words, firms acquired by foreign acquirers are low performers and continue to be low performers after acquisition, but the performance gap is reduced after the acquisition.

The pattern for ROA is different. Overall ROA for foreign acquired firms is 3.1% lower then for the domestic firms. In the post-acquisition period ROA was 3.2% below the level in domestic firms and in the pre-acquisition period the effect continued to be negative but not statistically significant. In other word, the profitability of the firms acquired by international buyers deteriorates after acquisition. This does not necessarily imply a negative effect on international acquisition, however. It could well be that the firms acquired by foreigners were self selected (i.e. that their prospects were relatively worse because of soft variables like market conditions, overvalued assets or other

factors imperfectly observable to the foreign buyer) Closer examination is called for, and we examine the time profile in the next section. Note however, that R-square values are very low which indicates that important explanatory variables may be been omitted.

We also estimate the performance regression by measuring firms' performance relative to their industry (i.e. deviation from median performance in the 4 digit industry to which they belong). Tables 6.1 and 6.2 show our results. For the TFP model (table 6.2) we observe the same general trend. In the pre-acquisition period (t-1 to t-3) those firms that where acquired by foreign firms had a lower productivity relative to their industry median, compared to the reference group of domestic firms. We can observe a coefficient of –0.371 for the pre-acquisition and –0.184 in the post-acquisition period. (D Foreign) in the pre-acquisition period. This again implies that after the acquisition (t+1to t+5) the productivity of international acquisitions is still lower than that of domestic acquisitions compared to their industry median, but the gap seems to have been reduced during the post acquisition period.

In the ROA models relative to industry we also observe the same pattern as before: a negative value over the whole period, a significant negative value of –0.045 in the post acquisition period and an insignificant value for the pre-acquisition period. Again, R-squares are low and the results are less robust in terms of their statistical significance and their explanatory power. General significance of the explanatory variables in model 3 (table 6.1) is rejected by a standard F-test.

Evolution of the acquired firms

To get a closer look at evolution of the acquired units prior to and after acquisition we next estimate models that track the evolution of the acquired firms' performance over time. Following Lichtenberg and Siegel (1992) we estimate the regression in the following form:

$$TFP_{it} = \textbf{\textit{a}} + \textbf{\textit{b}}_1 \, lnR_{it} + \textbf{\textit{b}}_2 T\_3 + \textbf{\textit{b}}_3 T\_2 + \textbf{\textit{b}}_4 T\_1 + \textbf{\textit{b}}_5 T + \textbf{\textit{b}}_6 T1 + \textbf{\textit{b}}_7 T2 + \textbf{\textit{b}}_8 T3 + \textbf{\textit{b}}_9 Margin$$
$$+ \textbf{\textit{b}}_{10} Detbr + \textbf{\textit{b}}_{11} Index + \textbf{\textit{g}}_i \, \dot{a} D_{90\text{-}99} + \textbf{\textit{g}} \, \dot{a} D_{industry} + \textbf{\textit{m}}_t \qquad (6)$$

$$ROA_{it} = \textbf{\textit{a}} + \textbf{\textit{b}}_1 \, lnR_{it} + \textbf{\textit{b}}_2 T\_3 + \textbf{\textit{b}}_3 T\_2 + \textbf{\textit{b}}_4 T\_1 + \textbf{\textit{b}}_5 T + \textbf{\textit{b}}_6 T1 + \textbf{\textit{b}}_7 T2 + \textbf{\textit{b}}_8 T3 + \textbf{\textit{b}}_9 Detbr + \textbf{\textit{b}}_{10} Index$$
$$+ \textbf{\textit{g}} \, \dot{a} D_{years} + \textbf{\textit{g}} \, \dot{a} D_{industry} + \textbf{\textit{m}}_t \qquad (7),$$

where in equation (6) R_{it} is the log of total revenues of firm i at time t, *Margin* is the profit over sales ratios, *Debtr* is the ratio of Debts to total Assets, *Index is the* Herfindhal index for industry concentration, and *T* are dummies that refer respectively to foreign targets, indicating 'years' before and after the acquisition and they go from three years before to three years after (i.e. $T\_1 = 1$ means that firm i has been a foreign target and is observed 1 year before the acquisition; T_1=0 means that a firm is a domestic target observed 1 year before the acquisition). $D_{90\text{-}99}$ are year dummies. Equation 2 is similar to equation 1 except that we exclude the variable *Margin* from the estimation.

The following table show the results.

// Table 7 //

For the TFP model the coefficients of the variables T_3 to $T3$ have negative sign and are all statistically significant different from zero. At T_3 the companies acquired by a foreign firm in $T=0$ have average productivity 27.7% below the ones that are later acquired by domestic companies. This is valid also for T_2 and T_1 where the gap is 19.6% and 23.8% respectively. These results are in line with our previous findings. At the time of acquisition the performance gap is still high and negative 23.3% which could be attributable to integration problems, but also to financial distress or other kinds of turmoil just prior to the acquisition. One year after the acquisition the gap increases even further to 33.5% but it starts to decrease in the second year and is reduced to 19.7% in the second year after the acquisition, and to 17.5% in the third year.

 Turning to the ROA model even if the sign of the coefficients have an economically significant interpretation and show the same trend, they are for the major part not highly significant. The explanatory power of the model is also quite low (R sq.= 0.082). At time T_1 ROA for the foreign acquired companies is 4.8% below the domestic ones and goes to 7.1% at the time of the acquisition. From $T1$ to $T3$ the gap decreases to zero.

In order to take into account heterogeneity among industries the model is also estimated using industry adjusted TPF as the dependent variable (again the deviation of firm TFP to the industry median) in the third column. We observe the same trend as in the first model. At time t-3 foreign firms average industry-adjusted productivity is 26.0% below that of the domestic firms. At t+2 the gap is reduced to 17.9% At t+3 the gap is not statistically different from zero. In other words, the foreign firms improve relatively over time and catch up with the domestic firms. We also tested a model on ROA-industry median ROA. The model was not statistically significant and we decided to do not report the results.

Since the industry-adjusted gap tends to disappear over time, while the unadjusted gap remains significant, it appears that part of the selection bias is related to industry selection effects, i.e. that foreign acquirers choose the "wrong" industries in terms of financial performance. In the next section we examine the nature of the selection effect more closely.

Endogeneity

In the previous we have found evidence of an adverse selection effect of international acquisitions in terms of factor productivity and accounting profitability. We have also found evidence of a significantly lowered subsidiary performance in the first years after international acquisitions, but some improvement after that. We now put the piece together to an overall assessment of the effects of international acquisition on firm performance controlling for selection effects (Heckman, 1979; Maddala, 1983; Main Reilly, 1993 Greene, 1997). The problem is to estimate the effect of foreign acquisition on economic performance (the performance equation, as in table 6), while taking into account that factor that systematically influence whether a firm is taken over by a domestic or international buyer (the selection equation, as in table 5). Essentially, we use the following procedure:

a) We estimate a probit model, which explains the determinants of foreign vs. domestic acquisition.

b) From the probit model we compute a selection-adjustment factor (the inverse Mill's ratio) for both foreign and domestic acquisitions.

c) We insert the selection adjustment factor in the performance equation

d) We correct for heteroscedasticity of the error terms.

We estimate the following selection equations

$$DF = a + b_1 lnAssets_i + b_1 lnAssets\text{\textasciicircum}2_i + b_2DAVTFP_i + b_4DAVDebtr_i + b_5Instrument + b_6 MES_i + b_7Age_i + v \quad (8)$$

$$DF = a + b_1 lnR_{it-1} + b_2TFP_{it-1} + b_3Margin_{it-1} + b_4Debtr_{it-1} + b_5Instrument + b_6 Age_{it-1} + b_7Index_{it-1} + bZ_{indust} + v \quad (9)$$

And the following performance equations to go with them:

$$TFP_i = a + b_1 lnEmp_i + b_2DF_i + b_3Debtr_i + b_4Time_i + bZ_{indust} + b_6 MES_i + b_7Age_i + b_6 SHARE_i + m_i \quad (9)$$

$$ROA_i = a + b_1 lnEmp_i + b_2DF_i + b_3Debtr_i + b_4Time_i + bZ_{indust} + b_6 MES_i + b_7Age_i + b_6 SHARE_i + m_i$$

Where, *TFP is* total factor productivity for firm *i*, *DF* is dummy for foreigner acquisition or non, *Assets* is log of company total assets, *Debtr* is the company's debt ratio (debt/assets), *MES* is the minimum efficiency sale, *Share* is market share, *Instrument* is a dummy variable that captures the

effect of a the domestic Danish merger wave 1990-1992, which was partly motivated by industry consolidation to prepare for the European single market due then in 1992. It takes a value of 1 for the period from 1990 to 1992 and zero for the period from 1993 to 1997. This variable is supposed to affect our selection equation but not the performance equation. *Time* is a variable that captures the time trend and goes from 0 to 9 (years), *Age* is the age of the company, and $\boldsymbol{Z}_{indust}$ are industry dummies. The explanatory variables in the selection equations are one year lagged (t-1). The next tables show the result of this two-step procedure. First we show the probit models for the selection equation second we show the OLS performance equations with and without the correction for sample selection (IMR) with robust standard errors (White/Huber correction).

// Table 8 //

The above table shows the results for the two-step procedure. The selection adjustment factors (IMR) is positive and statistically significant. This implies that the coefficient of OLS regression without correction tend to overestimate the true coefficient.

We can now validate our hypothesis that firms acquired by foreign buyers are self-selected to be low performers. Without correction the foreign ownership effect in is -0.339. When we insert the IMR in the OLS equation and correct for selection, the foreign buyer effect on factor productivity of the acquired firm is found to be -1.242 (table 8.2). In contrast the effect on ROA is not significant after adjusting for selection effects.

While it might be tempting to interpret these negative coefficients as evidence of a negative productivity effect of the foreign acquisition, this is inconsistent with the finding that the performance deficit of firms acquired by international buyers stars to decrease after year 1 and possibly disappears altogether. Instead, the negative effect may be attributable to a self-selection of targets that are have below average potential in terms of productivity due to factors not easily observable by an international acquirer, but may also have attractive compensating properties (e.g. market access, proprietary technology) from the viewpoint of the acquiring company.

5. Discussion

In this paper we have argued theoretically that the liability of foreignness results in information asymmetries in the market for acquisitions. As a result international acquisitions may be subject to a double "lemons" problem in the sense described by Ackerlof (1970): because of information asymmetries international buyers will tend to acquire poorly performing firms compared to firms acquired by domestic buyers that will again buy poor performers relative to the stock of firms that are not acquired.

We found support for these propositions by comparing international to domestic acquisitions of Danish firms over the period 1990-1997. Foreign firms tend to acquire poorly firms measured by return on assets and factor productivity. However, the relative performance of the internationally acquired firms does improve significantly after acquisition. So, while selection-adjusted estimates indicated a negative effect of international acquisition, this does not necessarily indicate a negative effect of foreign ownership as such. Systematic self-selection may be at work even after the

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acquisition, since the incumbent owners of firms with below-average prospects are more likely to sell. Moreover, there may be other motives to foreign acquisition than financial performance and productivity at the subsidiary level, for example access to new markets or new technology.

One of the limitations of our study is that that a small high-income, high-wage country like Denmark may not be representative of the rest of the world. For example, cherry-picking may be a more realistic assumption in transition economies faced by financial turmoil and credit rationing. Nevertheless, we believe that the argument presented in the theory section is sufficiently general to hold in other parts of the world. However, testing it requires greater data coverage than is usually found in international business studies, including a comprehensive control group of firms acquired by domestic buyers and firms that are not acquired at all.

Another limitation is that this study has considered only surviving firm, so in principle it may be subject to survival bias, which would be the case if foreign firms had better survival chances. However, the available evidence (including Zaheer 1995, Zaheer and Mosakowski 1997, Thomsen 1999) does not point to higher, but rather to lower survival rate of the acquired units among foreign-owned companies, at least in the first years after entry. Nevertheless, survival is clearly an interesting topic for future research. Likewise, it should be possible to examine other performance indicators that match what is believed to be alternative motives for foreign acquisitions, including measures of sales growth or technology access which may be important if market access is an important objective as indicated in several earlier studies.

Table 1. List of Variables.

DF: Dummy variable 1/0 – 1: Identifies a Danish firm that has been acquired by a foreign firm - 0: Identifies Danish firms acquired by Danish firms (Domestic)
Ln Revenues: Natural log of total revenues
Ln Assets: Natural log of total assets
Profit Margin: Profit / Sales
Asset turnover: Sales / Assets
Debt ratio: Debt / Assets
Ln Age: Natural log of firm age
Instrument: Dummy variable 1/0: 1: Identifies the period before 1992(Danish ratification of EU treaty) – 0: Identifies the period after 1992 and until 1997.
Herfindahl index: Industry sales concentration (sum of squares of the market share of the firms in the industry)
Minimum efficiency scale: Smallest revenue within an industry (proxy for entry barriers and expressed in natural log)
TFP: Total Factor Productivity – Residuals from the Cobb Douglas production function
ROA: Return on Assets – Profit / Assets (Profit Margin x Asset Turnover)
SHARE: Market share at 4 digit industry level

Table 2. International Mergers and Acquisitions in Denmark 1990-1997

	1990	1991	1992	1993	1994	1995	1996	1997
Total of Acquired firms in Denmark	473	426	318	380	288	265	309	301
- acquired firms by Danish firms	388	364	256	295	218	194	251	225
- acquired by foreign firms	85	62	62	85	70	71	58	76
% of all acquisitions made by foreign firms	18,0%	14,6%	19,5%	22,4%	24,3%	26,8%	18,8%	25,2%
Revenues in foreign acquisitions as % of all acquisitions	24,2%	20,7%	31,4%	40,6%	27,4%	36,0%	38,8%	64,0%
Employees in foreign acquisitions as % of total employees	22,8%	16,1%	38,1%	34,7%	38,6%	31,5%	38,4%	64,1%
Average size (Revenues)								
Revenue per firm (foreign.) mio. DKK.	122	104	93	172	177	216	263	500
Revenue per firm (Danish) mio. DKK.	84	68	49	72	150	140	96	95
Average size (employees)								
Employees per firm (foreign) (av.)	91	82	122	144	194	133	196	385
Employees per firm (Danish) (av.)	67	73	48	78	99	106	73	73
Total size (revenues)								
Total revenues (all) mio. DKK.	42954	31045	18271	35977	45096	42470	39277	59271
Total revenues (foreign.) mio. DKK	10393	6418	5745	14610	12356	15303	15233	37963
Total revenues (Danish) mio. DKK.	32561	24627	12526	21367	32740	27167	24044	21308
Total size (employees)								
Total employees (all)	33815	31588	19836	35309	35096	29955	29574	45697
Total employees (foreign.)	7701	5086	7559	12266	13563	9431	11352	29292
Total employees (Danish)	26114	26502	12277	23043	21533	20524	18222	16405

Source: The Danish Competition authority (KonkurrenceRådet) various years.

Table 3. Descriptive Statistics and Correlation matrix

Variable	Domestic			Foreign		
	Obs	Mean	Std. Dev	Obs	Mean	Std.Dev
Ln revenues	1368	11.051	1.567	328	11.761	1.155
Ln assets	1368	10.758	1.626	328	11.586	1.079
Margin	1344	0.0335	0.215	322	0.0153	0.222
Asset turnover	1368	1.923	2.239	328	1.519	0.875
Debtr ratio	1268	0.693	0.199	306	0.692	0.183
TFP	1297	4.165	0.661	320	4.082	0.572
ROA	1344	0.04	0.17	322	0.03	0.16

Correlations

Variable	Ln revenues	Ln assets	Margin	Ass. Turn.	Debt ratio	TFP	ROA
Ln revenues	1.000						
Ln assets	0.806	1.000					
	(0.000)***						
Margin	0.112	0.135	1.000				
	(0.000)***	(0.000)***					
Ass. Turnover	0.107	-0.272	-0.0383	1.000			
	(0.000)***	(0.000)***	(0.1185)				
Debt ratio	0.106	-0.0215	-0.0324	0.0113	1.000		
	(0.000)***	(0.3942)	(0.2032)	(0.6555)			
TFP	0.451	0.0003	0.183	0.595	0.155	1.000	
	(0.000)***	(0.9909)	(0.000)***	(0.000)***	(0.000)***		
ROA	0.132	0.105	0.561	-0.0290	-0.042	0.116	1.000
	(0.000)***	(0.000)***	(0.000)***	(0.2321)	(0.0903)*	(0.000)***	

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

Table 4. Characteristics of acquired firms

Variable	Target	Non Merging
Mean Profit Margin	0.02213	0.04498
Mean Revenues	141425	48512
Growth Revenues 2y	0.1037	0.1509
Growth Revenues 3y	0.1435	0.2425
Mean Asset Turnover	1.6004	1.9194
Growth AT 2 years	0,08179	0,1021
Growth AT 3 years	0,08137	0,1126
Mean Debt/Assets	0.7656	0.7659
Debt/Assets lag 1y	0.7917	0.7603
Total Assets 1y	149495	124561
Total Employees 1y	143	36
Age Years	20	14
Average ROA	0.02131	0.07085
ROA lag 1y	0.01235	0.07487
Growth ROA 2y	0.3203	0.3755

Source Gioia (2002b).

Table 5. Determinants of international acquisition. (Logit model)

	Model 1	Model 2
Profit Margin	-0.266	
	(0.729)	
Asset turnover	-0.720	
	(0.002)***	
Age	-0.02	-0.016
	(0.033)**	(0.072)*
TFP		-1.210
		(0.000)***
Ln Assets	9.171	11.71
	(0.001)***	(0.000)***
Ln Assets squared	-0.355	-0.459
	(0.002)***	(0.000)***
Debt ratio	-0.241	-0.007
	(0.828)	(0.995)
Min. Efficiency Scale	0.567	0.354
	(0.075)*	(0.256)
Market share	-0.125	-0.102
	(0.390)	(0.485)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Constant	-64.74	-74.78
LR Chi2	178.19	171.69
Prob>Chi2	0.000	0.000
Pseudo R2	0.387	0.3785
N. Obs	396	392

Table 5.1 Industry-adjusted determinants of international acquistions

	Model 1	Model 2
Industry-adjusted Av. Profit Margin	-1.504 (0.099)*	
Industry-adjusted Av. Asset turnover	-0.509 (0.002)***	
Industry-adjusted Av. TFP		-0.920 (0.004)***
Ln Assets	6.154 (0.001)***	9.024 (0.000)***
Ln Assets squared	-0.237 (0.004)***	-0.352 (0.000)***
Industry-adjusted Debt ratio	-0.176 (0.842)	-0.161 (0.878)
Market Share	-0.08 (0.477)	-0.128 (0.531)
Age	-0.002 (0.774)	0.002 (0.736)
Min. Efficiency Scale	0.568 (0.016)**	0.333 (0.306)
Year dummies	Yes	Yes
Constant	-44.67 (0.000)***	-60.33 (0.000)***
LR Chi2	91.80	67.35
Prob>Chi2	0.000	0.000
Pseudo R2	0.1995	0.2052
N. Obs	396	288

Table 6. Effects on total factor productivity and ROA

Variables	Model 1 TFP ALL	Model 2 TFP Post	Model 3 TFP Pre	Model 4 ROA All	Model 5 ROA Post	Model 6 ROA Pre
Constant	2.629	1.476	1.527	-0.555	-0.289	-0.136
	(0.000)***	(0.000)***	(0.035)**	(0.000)***	(0.007)***	(0.276)
H. Index	0.050	-0.051	0.147	0.0131	0.0057	0.027
	(0.562)	(0.664)	(0.280)	(0.582)	(0.863)	(0.397)
Ln Revenues	0.213	0.196	0.214	0.005	0.004	0.0012
	(0.000)***	(0.000)***	(0.000)***	(0.169)	(0.389)	(0.778)
TFP				0.038	0.081	0.0374
				(0.000)***	(0.000)***	(0.000)***
Debtr	0.415	0.664	0.439	-0.072	-0.138	-0.075
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.001)***	(0.006)***
DF	-0.250	-0.272	-0.318	-0.031	-0.032	-0.004
	(0.000)***	(0.000)***	(0.000)***	(0.002)***	(0.024)**	(0.798)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies (1990-1999)	Yes	Yes	Yes	Yes	Yes	Yes
F –value	23.02	14.78	14.11	4.77	4.73	2.80
Porb>F	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Adjusted R^2	0.4334	0.5050	0.4557	0.1178	0.2198	0.1053
Observations	1498	663	674	1498	663	674

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

Table 6.1 Effects of foreign acquisition on industry-adjusted ROA (-1.5 ≤ROA ≤1.5)

	Model 1 (All)	Model 2 (Post)	Model 3 (Pre)
D Foreign	-0.034	-0.045	-0.010
	(0.002)***	(0.000)***	(0.548)
Revenues	0.009	0.009	0.009
	(0.000)***	(0.018)**	(0.031)**
Debt ration	-0.010	-0.06	-0.022
	(0.684)	(0.038)**	(0.514)
Min. efficiency scale	0.002	0.014	-0.019
	(0.678)	(0.011)**	(0.002)***
Year dummies	Yes	Yes	Yes
Constant	-0.09	-0.177	0.066
	(0.257)	(0.002)***	(0.391)
F value	2.41	3.65	1.48
Prob>F	(0.0105)**	(0.0004)***	(0.15)
Adj. R2	0.02	0.04	0.03
N. Obs	1062	526	416

Table 6.2 Regression effects of foreign acquisition on industry-adjusted Total factor productivity

	Model 1 (All)	Model 2 (Post)	Model 3 (Pre)
D Foreign	-0.246	-0.184	-0.371
	(0.000)***	(0.000)***	(0.000)***
Revenues	0.229	0.196	0.256
	(0.000)***	(0.000)	(0.000)***
Debt ration	0.059	0.299	-0.068
	(0.494)	(0.008)	(0.664)
Min. efficiency scale	-0.05	-0.020	-0.078
	(0.004)**	(0.340)	(0.007)***
Year dummies	Yes	Yes	Yes
Constant	-1.736	-1.654	-1.85
	(0.000)	(0.000)	(0.000)
F value	47.80	21.52	23.5
Prob>F	(0.0000)***	(0.0000)***	(0.0000)***
Adj. R2	0.268	0.246	0.309
N. Obs	1024	505	403

Table 7. Differences in mean levels of productivity and ROA between firms acquired by foreigners and domestic buyers

Variables	Model	Model	Model
Dependent variable	TFP	ROA	TFP adjusted for industry effects
Constant	2.788	-0.158	-2.064
	(0.000)***	(0.026)**	(0.000)***
T_3	-0.277	-0.020	-0.260
	(0.015)**	(0.529)	(0.034)**
T_2	-0.196	-0.039	-0.290
	(0.0059)*	(0.180)	(0.009)***
T_1	-0.238	-0.048	-0.259
	(0.011)**	(0.068)*	(0.009)***
T	-0.233	-0.071	-0.226
	(0.006)***	(0.002)***	(0.015)**
T1	-0.335	-0.030	-0.322
	(0.000)***	(0.260)	(0.002)***
T2	-0.197	-0.028	-0.179
	(0.035)**	(0.259)	(0.071)*
T3	-0.175	-0.040	-0.142
	(0.061)*	(0.121)	(0.153)
Margin	0.382		0.362
	(0.000)***		(0.000)***
Debtr	0.428	-0.043	0.102
	(0.000)***	(0.023)**	(0.242)
Herf. Indeks	0.037	0.011	-0.026
	(0.666)	(0.641)	(0.739)
Ln Sales rev.	0.197	0.007	0.207
	(0.000)***	(0.003)***	(0.000)***
Industry dummies	Yes	Yes	
Year dummies (1990-1999)	Yes	Yes	Yes
F –value	20.65	3.43	19.14
	(0.000) p value	(0.000) p value	(0.000) p value
Adjusted R^2	0.4402	0.082	0.2653
Observations	1475	1573	1006

Table 8.1. Selection equation Probit model – Heckman two step procedure

Variables	Probit Model
Constant	-35.48
	(0.000) ***
Ln Assets	5.382
	(0.000) ***
Industry-adjusted Av. TFP	-0.540
	(0.002)***
Ln Assets squared	-0.211
	(0.000)***
Age	-0.001
	(0.752)
Min. Efficiency Scale	0.172
	(0.371)
Industry-adjusted Av. Debt ratio	-0.229
	(0.704)
Instrument	0.350
	(0.092) *
LR Chi2	66.98
Prob > Chi2	(0.000)***
Pseudo Rsq	0.2041
N	288

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

Table 8.2 TFP performance equation with and without correction

Variables	Performance Regression With robust standard errors	Performance Regression + IMR (TFP) Two step
Constant	3.21	2.98
	(0.000)***	(0.000)***
Ln Employees	-0.134	0.060
	(0.795)	(0.150)
Debtr	0.858	0.618
	(0.000)**	(0.000)***
Time	0.005	-0.012
(1990-1999)	(0.723)	(0.343)
DF	-0.339	-1.242
	(0.000)***	(0.000)***
Market Share	0.698	0.623
	(0.000)***	(0.000)***
Min. Efficiency Scale	0.026	0.066
	(0.303)	(0.006)***
Age	0.0002	-0.0001
	(0.865)	(0.914)
Industry Dummies	Yes	Yes
Inverse Mills Ratio		0.606
Lambda		(0.000)***
R sq	0.7188	0.7657
F value	67.89	74.12
Prob > F	0.0000	0.0000
Number of Observations	255	255

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

Table 8.3 ROA performance equation with and without correction

Variables	Performance Regression With robust standard errors	Performance Regression + IMR (ROA) Two step
Constant	0.214	0.208
	(0.011)**	(0.012)**
Ln Employees	-0.016	-0.015
	(0.116)	(0.155)
Debtr	-0.044	-0.050
	(0.218)	(0.206)
Time	0.003	0.004
(1990-1999)	(0.380)	(0.372)
DF	-0.018	-0.043
	(0.310)	(0.393)
Market Share	0.082	0.698
	(0.003)***	(0.002)***
Min. Efficiency Scale	0.011	0.0124
	(0.052)*	(0.057)*
Age	0.0007	0.0008
	(0.833)	(0.813)
Industry Dummies	Yes	Yes
Inverse Mills Ratio		0.016
Lambda		(0.652)
R sq	0.3858	0.3867
F value	11.86	11.30
Prob > F	0.0000***	0.0000***
Number of Observations	255	255

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

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