

Wharton

Financial
Institutions
Center

Can Firms Learn to Acquire? Do Markets Notice?

by
Maurizio Zollo
Dima Leshchinskii

00-01

The Wharton School
University of Pennsylvania




The Wharton Financial Institutions Center

The Wharton Financial Institutions Center provides a multi-disciplinary research approach to the problems and opportunities facing the financial services industry in its search for competitive excellence. The Center's research focuses on the issues related to managing risk at the firm level as well as ways to improve productivity and performance.

The Center fosters the development of a community of faculty, visiting scholars and Ph.D. candidates whose research interests complement and support the mission of the Center. The Center works closely with industry executives and practitioners to ensure that its research is informed by the operating realities and competitive demands facing industry participants as they pursue competitive excellence.

Copies of the working papers summarized here are available from the Center. If you would like to learn more about the Center or become a member of our research community, please let us know of your interest.



Anthony M. Santomero
Director

*The Working Paper Series is made possible by a generous
grant from the Alfred P. Sloan Foundation*

Can firms learn to acquire?

Do markets notice?

Maurizio Zollo* and Dima Leshchinskii
INSEAD
Blvd. de Constance
Fontainebleau 77305
FRANCE

Abstract

Using financial, accounting and questionnaire response data we investigate the post-acquisition performance of 47 US bank holding companies that executed 579 mergers and acquisitions in the 1964-1996 period and compare it with their competitors' performance. The objectives of the study are to identify the factors that explain the variance in the distribution of post-acquisition performance, and to test whether the financial markets efficiently predict performance outcomes by incorporating public information about the acquiring firm into the stock price following the acquisition announcement.

The tested model includes measures of post-acquisition decisions, such as the degree of integration of the target within the acquirer's structure and the replacement of the top management team, as well as approximations of the acquirer's capability to implement the integration process. We find that prior acquisition experience does not improve post-acquisition performance, but the degree to which acquirers articulate and codify their experience in ad-hoc tools does. Furthermore, a high level of integration of the target within the acquirer's organization improves long-term performance, whereas the replacement of top management worsens it. Financial markets do not seem to be sensitive to any of these predictors of performance in their short-term reactions, but long-term adjustments are significantly impacted by acquirers' integration strategies and codified implementation knowledge, in line with the variations of accounting returns.

JEL classification: G2, G21, G34, L2

Keywords: Mergers, Banking, Post-merger integration, Organizational learning, Market efficiency.

* Corresponding author. Address: Dr. Maurizio Zollo, INSEAD, Bd. de Constance, Fontainebleau, 77305 FRANCE. Phone: 33-1-60-72-44-74. Fax: 33-1-60-74-55-43-55-e-mail: zollo@insead.fr. The first author would like to gratefully acknowledge the financial support of the Sloan Foundation and of INSEAD, and the precious help provided by Prof. Harbir Singh and the Wharton Financial Institutions Center throughout the research project and the data gathering effort. The second author received financial support from the INSEAD PhD Programme. Both authors are indebted to Theo Vermaelen for his advice and to Irina Leshchinskaya for her research assistance.

Manuscript Title: “Can firms learn to acquire? Do markets notice?”

1. Introduction

Corporate acquisitions have been the subject of intense study in the financial economics literature. A primary concern of these efforts was dedicated to understand the phenomenon in terms of its overall social welfare implications (Manne, 1965; Jensen and Ruback, 1983; Jarrell et al, 1988), thereby accepting an implicit assumption of high homogeneity among the acquisitive events. The empirical inquiries have in fact prioritized the efforts to locate the mean of the distribution of acquisition performance for both acquiring and target firms, in order to assess the average impact of acquisitions on financial wealth (Franks et al., 1991; Loderer and Kenneth 1992; Agrawal et al. 1992). The industry-specific literature on bank mergers has followed suit, in their attempts to evaluate the average magnitude of abnormal gains from acquisitive growth (Hawawini & Swary, 1990; Rhoades, 1994; Pilloff and Santomero, 1998; Berger, Demsetz and Strahan, 1999).

Contingent arguments, however, have been recently introduced in order to achieve a better understanding of the variation of acquisition performance around its mean. They typically have to do with characteristics of the negotiation process, such as the degree of hostility and the number of simultaneous bidders, or with characteristics of the two firms before their merger, such as their strategic relatedness (Healy, Palepu and Ruback, 1992), the acquirer’s pre-acquisition performance (or relative “glamour” status, Rau and Vermaelen, 1998), and the acquirer’s strategic intent (Healy, Palepu and Ruback, 1997).

The objective of this article is to propose two additional classes of explanations for the variation in post-acquisition performance: (1) the decision-making process which defines the approach taken to manage the post-acquisition integration phase, and (2) the degree to which the acquiring firm has developed a specific capability to implement the post-acquisition integration decisions.

If the acquirer selects the appropriate integration approach among the available alternatives, invests sufficient time and efforts to extract from its own past acquisition experiences the valuable lessons and uses this knowledge to constantly improve its management of the integration process, then the post-acquisition performance of its transactions should be systematically superior to the one of competitors that either select sub-optimal integration approaches, or invest less time in introspecting and learning.

Using financial, accounting and questionnaire response data we investigate the post-acquisition performance of 47 US bank holding companies that executed 579 mergers and acquisitions in the 1964-1996 period. We compare it with competitors' performance to understand the role of company's previous experience and decisions at the integration phase as factors explaining the variation in post-acquisition performance of the acquiring firms.

Our results suggest that both integration decisions and learning from prior experiences do play an important role in explaining the variation in performance of the focal acquisition. The level of integration of the acquired firm within the acquirer's organization is positively related to performance, while the replacement of the target's management influences performance in a strong and negative way. With respect to the integration capability, the accumulation of prior acquisition experience is not conducive of improved performance, but the degree of codification of acquisition-specific knowledge in manuals and systems does improve post-acquisition performance. These findings are confirmed by both accounting and long-term financial performance measures, but do not hold using short-term stock price reactions.

Some of the implications of the uncovered evidence for market efficiency theory are discussed in the final section of the paper. The rest of the paper is organized as follows. Section 2 describes the theoretical arguments advanced in order to explain the role of post-acquisition integration decisions

and of organizational learning processes. Section 3 describes the data used and the methodologies applied for the empirical testing of the research hypotheses. Section 4 summarizes the results of the analysis and Section 5 concludes with a set of implications for the development of the acquisition performance and market efficiency theories.

2. Theory Development

Why do post-acquisition decisions matter as drivers of acquisition performance? What do these decisions look like? What do we mean by integration capability and how does it develop? These are some of the key questions that we intend to tackle in the present section of the paper. In doing so, we also proceed with the submission of a set of testable hypotheses.

Post-acquisition Decisions

The literature on acquisitions has been focusing on the pre-requisites and on the performance implications of acquisitive events, leaving the process through which the acquiring firm creates (or destroys) shareholders value by integrating the target into its own organization, largely unexplored and unexplained. This “black box” approach was so far justified on two principal accounts. On a theoretical level, existing views of the firm as a nexus of contracts (Fama, 1980) or as a mechanism to minimize transaction costs (Williamson, 1979) did not allow for idiosyncratic differences in the endowment of resources and capabilities, which can in turn explain why firm might behave differently in similar circumstances. In other words, pre-acquisition conditions should dictate, in a world without stable differences among firms with respect to their resources, routines and competencies, a predictable and homogeneous set of post-acquisition decisions and actions. Therefore, in a performance model with both pre-acquisition conditions and post-acquisition decisions, the former will turn out to be the drivers of the variation in performance, while the latter will not be significant factors. In addition, the limited attention to post-acquisition integration processes was justified, on an empirical level, by the lack of publicly available data and the difficulties in gathering sufficiently reliable estimates.

In a more realistic account of firm behavior, though, this does not necessarily have to be the case. Both the work of the behavioral school (March and Simon, 1958; Cyert and March, 1963, March, 1994) and of evolutionary economics (Nelson and Winter, 1982; Winter, 1987; Nelson, 1995; Winter, 1995; Cohen et al., 1996) propose that the firm is to be viewed as a stable set of routinized behaviors which slowly evolve through the accumulation of knowledge, primarily derived from internal, direct, experience. If this is true, then post-acquisition decisions and consequent behaviors might be the outcome of established routines developed by the acquiring firm, over and above the characteristics of the individual transaction that needs to be managed. In a theoretical model of acquisition performance, then, post-acquisition decisions might have a role to play irrespectively of pre-acquisition conditions.

In this paper, we make an exploratory attempt to pursue this line of thought by taking into consideration two important types of post-acquisition decisions. The first has to do with the degree to which the acquired organization is integrated within the acquirer's. In a banking context, this implies to know whether the information systems have been converted, the product lines standardized, the payroll and MIS uniformed, the staff functions centralized, etc. The second dimension relates to the degree to which the pre-acquisition resources of the target company have been either substituted with equivalent ones from the acquirer, or disposed of. Examples include, but are not limited to, the replacement of the top management team, of the company name and identity, of the headquarters and other facilities, of brand names, and so on. Given a certain level of organizational integration targeted, the acquirer has a choice in deciding how aggressive it wants to be in replacing pre-existing resources. Does it prefer to build consensus in aligning the use of target's resources to the practices adopted by the acquirer, or does it find it more appropriate to speed up the process and eradicate opposition and uncertainty by replacing or disposing of target's resources ? The answer will have to control for the obvious explanation based on the quality of the

target's resources, as the probability of replacement will obviously be inversely proportional to their quality.

In each of these decisions there are important trade-offs to be managed. In the case of the level of integration, the acquiring firm will have to weight the benefits from realizing economies of scale and scope with the costs derived from higher levels of complexity in the management of the integration process. The higher the level of integration between the two organizations, the higher the number of semi-simultaneous and highly inter-related decisions that have to be made by an increasing number of organizational functions. This translates in larger amounts of data requirements to support the decision-making efforts and in more people and teams to coordinate during the execution phase. The probability to disrupt existing routines and inadvertently destroying valuable competencies will also be positively associated with the level of organizational integration among the two firms. It will be important, then, to provide an empirical test for the following hypothesis:

H1: *The higher the level of post-acquisition integration, the better the performance of the acquisition*

Further, the decision about the replacement of target's resources can be viewed as the result of attempts to balance the benefits deriving from (i) reduced uncertainty in the outcomes of the decision process (employees know sooner what their fate is) and (ii) faster implementation of the integration process (higher NPV of cost efficiencies and revenue enhancements), with the costs suffered as a consequence of disruptions in existing routines, of increased conflict and of undesired loss of competencies, as many of the employees targeted for retention (usually the best quality ones) end up leaving. If the benefits of resource replacement outweigh the costs, the standard view of acquisitions as a policing mechanism for agency problems, whereby better top management teams replace poorly performing ones on the market for corporate control, would be supported. However,

the only existing evidence on the performance implications of the replacement of the target's top management team (Cannella and Hambrick, 1993; Krishna, Miller and Judge, 1997) seems to indicate that costs are superior to the benefits of replacing existing resources, and that this second dimension of the integration process has a negative overall impact on acquisition performance. We will then test the following hypothesis:

H2: *The higher the degree of replacement of the top management team of the acquired firm, the worse the performance of the acquisition*

Integration Capability

In addition to differences in the post-acquisition integration approach, another important source of heterogeneity between acquiring firms concerns the degree to which they develop and master the process to integrate the two organizations. For example, many acquiring banks in the US have now learned how to convert the information systems and the entire branch network of the acquired institution following a so-called "big bang" approach, where all happens during the space of a week-end. During the 80s, however, few acquisitions were managed with this technique, and information systems were either not converted or converted slowly, in batches of branches grouped by geographic zone. European bank acquisitions, a rather new phenomenon compared to the US, are still typically managed with the conservative "batch", as opposed to the faster but riskier "big bang" approach. The ability to convert information systems in one solution can therefore be considered an example of an acquisition-specific capability collectively developed by the acquiring organization (Thakor, 1999). Another example is the completion of the personnel evaluation process and the communication of its results within a few weeks from the closing of the transaction. This might have an important effect on the ability of the combined entity to retain and motivate employees (Schweiger and DeNisi, 1992), and therefore on the probability to successfully implement the integration decisions.

How does an integration capability emerge ? And, more in general, how do organizations create and evolve organizational capabilities? In this paper, we propose a model of acquisition performance which takes into consideration two learning mechanisms. The first one relies on “learning-by-doing” processes and can be approximated by the simple accumulation of prior acquisition experience (Yelle, 1979; Dutton and Thomas, 1984 for good reviews of the “learning curve” literature in operations management). The second is derived from the articulation and codification of knowledge derived from prior experiences, through which the firm produces an improved understanding of the causal relationships between decisions/actions made and performance outcomes obtained. By developing integration manuals, check-lists and decision support software, by analyzing process performance metrics and writing post-mortem documents, acquiring firms can keep on improving their understanding of the performance implications of their actions.

A manual on the information systems conversion process or on the affiliation of the target’s human resources, an electronic model to support decisions about the staffing of the acquired bank’s branches or about comparing and standardizing the two product lines are some examples in point.

Knowledge codification might have a positive influence on the performance of acquisition processes for several reasons:

1. These tools serve as repositories of organizational memory; they provide a trace of what was decided and done in past instances, particularly useful in relatively infrequent and complex processes such as acquisitions
2. They facilitate the diffusion of knowledge to parts of the organization different from the one where the higher level of understanding is achieved. For example, a manual provides a fast and effective training for people new to the process.

3. They clarify the roles, responsibilities and deadlines for all the people involved in the execution of large numbers of inter-dependent tasks, thereby facilitating the coordination of the entire process.
4. Finally, and in our opinion most importantly, the process by which these tools are created and developed necessitates collective cognitive efforts to identify the links between decisions, actions and performance implications. It is by creating and updating these tools that acquirers figure out what worked and what did not work in their past experiences and formulate ideas for the improvement of future integration processes.

Effectiveness and Limitations of Learning Mechanisms

The next and final step in our analysis consists in the assessment of the relative effectiveness of experience accumulation and knowledge codification processes in influencing acquisition performance. The accumulation of acquisition experience relies on the ability of individuals exposed to past experiences to recall the lessons tacitly absorbed and apply them to the current situation. This works well when the task to be mastered is frequent, sufficiently homogeneous and relatively unambiguous in its links between the actions or decisions made and the performance outcomes obtained. If one or more of these assumptions are relaxed, though, learning becomes correspondingly more difficult. In extreme cases, characterized for instance by particularly high heterogeneity and causal ambiguity, individuals might end up applying lessons learned in one context to a seemingly similar but inherently different one. In these cases, known in cognitive psychology as negative transfer effects (Cormier and Hagman, 1987), past experience not only does not help enhance the performance of the current task, but might actually hinder it. Corporate acquisitions, unfortunately, are likely to be part of this last category of organizational tasks, where the coupling of low frequency, high heterogeneity and high causal ambiguity might very well increase the probability of negative learning effects. In the first empirical study on these issues, in fact, Haleblan and Finkelstein (1999) find support for a quadratic, U-shaped relationship between acquisition experience and performance, with minimum at around 9 acquisition experiences.

In these difficult learning conditions, though, explicit cognitive efforts aimed at understanding the causal links between past actions and past performance might actually represent at least a partial solution to the limitations of the tacit experience accumulation mechanism. Knowledge codification, then, might prove to be a more powerful learning mechanism, compared with tacit experience accumulation in particularly complex learning environments, such as acquisition processes. Even knowledge codification comes at a price, though. The costs related to the investment of time, energy and managerial attention in creating and updating these tools might at some point overcome the benefits of developing collective competence. At some point, then, the positive influence of knowledge codification on performance might reach a plateau and even turn into a negative one. A virtuous bureaucratic process, such as learning-driven codification efforts, might hit the point of decreasing, and perhaps negative, returns.

Cognizant of the boundaries to the effectiveness of the learning mechanisms considered, we submit the following hypotheses:

H3: *The larger the acquiring firm's past acquisition experience, the better the performance of the acquisition*

H4: *The higher the degree of codification of knowledge derived from past acquisition experience, the better the performance of the acquisition*

In addition, if the intuition on the relative superiority of the knowledge codification-based mechanism under increasing levels of complexity and causal ambiguity is right, we can advance the following hypothesis relative to the interaction between the degree of knowledge codification and the level of integration (as a proxy of process complexity).

H5: *At increasing levels of integration, the positive influence of knowledge codification on acquisition performance strengthens.*

3 Empirical Analysis

The data

The test of the hypotheses derived above was carried out on a sample of acquisitions in the US banking industry. The industry selected was considered particularly appropriate in light of the intense acquisition activity characterizing the sector, and the qualitative evidence, gathered through a round of interviews with 27 managers in 12 experienced acquirers, of both cross-sectional and longitudinal differences in the way acquirers manage the integration process and develop standardized and codified implementation procedures.

We use data from several sources of different nature. For the time period from 1977¹ to 1998, we collect information about the announcement dates and participants of bank acquisitions from the SNL and/or SDC databases. In event studies it is very important to identify the exact dates of events. We consider SNL data to be a more reliable source, as it is specialized in tracking down acquisitions in the banking sector and it routinely follows up any announcement with a brief questionnaire sent to the acquiring bank to check and gather precise data. When different dates existed for the same event, we consulted the Lexis-Nexis database as a third source. In cases of discrepancies, we always selected the earliest announcement date as the event date.

We then used CRSP tapes from January 1977 to December 1998 to extract company's daily returns for 250 days before and 10 days after the announcement and monthly returns for five years before and four years after the announcement. We also used CRSP value-weighted index return as a proxy for the market return.

¹ Although we had information about some mergers dated as early as 1964, missing observations for these data rendered them impossible to use as focal events. Therefore, the earliest mergers that were actually used in the analysis are dated to 1982 with data necessary for the calculations going back to 1977

In order to gather non-public data on post-acquisition integration decisions and on the acquisition-specific tools eventually developed by the acquiring firms, a questionnaire-based survey was administered under a grant by the Sloan Foundation and with the support of the Wharton Financial Institutions Center. The survey was developed after a one-year fieldwork and in cooperation with 12 experienced bank acquirers and then rolled out to the largest 250 U.S. bank holding companies. The survey consisted of an “Acquisition History Profile”, where information on a set of variables, including target’s asset quality, market overlap (in-market vs. out-market transaction), post-acquisition integration level and target’s management replacement, was gathered for each acquisition completed since founding. It also had a 5-page questionnaire on the general characteristics of the acquisition process adopted by the respondents, including the existence and the time of development of acquisition-specific tools, such as due diligence check-lists and manuals, system conversion manuals, branch staffing and product mapping software, HR affiliation manuals and so on.

Of the 250 bank holding companies contacted, 83 turned out to have had no significant acquisition experience within the previous 10 years. Of the remaining 167, we received complete responses from 47 firms that had executed 579 acquisitions since their founding (or their creation from a merger of equals). The timeframe covered by the acquisitions in the sample starts from 1964 (date of the oldest acquisition recorded by any respondent) and ends in 1995 (year of the survey). Mean comparison tests confirmed that the sample was not biased with respect to the original universe in terms of earning ratios (ROA, ROE and efficiency ratios), but biased in terms of asset size (the sample was larger, $p < .05$).

It is important to note that the measures of the key theoretical variables measured through the survey instrument are not “opinions”, but factual reports. Acquisition experience was computed by counting the number of transactions completed by the acquirer before the focal one. Knowledge

codification was proxied with the count of tools developed by the acquiring firm at the time of the focal acquisition. The level of integration was the response to a detailed question that mentioned actual integration activities, such as the conversion of information systems, the alignment of the lending procedures and the standardization of the product line. The replacement of the top management team was also the response to a question, which clearly spelled out the meaning of four increasing levels, from complete retention to complete substitution. In addition, construct validity of the single item scales (integration, replacement, relatedness and quality) was checked with multiple item scales gathered on a sub-sample of 57 acquisitions by 29 acquirers through a second, survey conducted with an 8-page questionnaire gathering detailed data on the characteristics of the acquired bank and of the post-acquisition integration decisions. All, but the relatedness construct, resulted highly correlated both with the single factor extracted by the multidimensional scales, and with the sum of their standardized values (Nunnally, 1978). The relatedness measure was correlated only with external factors, such as the geographic location and the type of customers served, and will hence be referred to as “market overlap”, as opposed to the wider notion of resource relatedness.

Finally, we used Compustat tapes to get historical accounting information about these 47 companies or their predecessors for a period starting in 1985 and ending in 1997. The decreasing number of banks covered in the years previous to 1985 discouraged us in pursuing older starting years. We also collected annual returns on assets (ROA) data for all the (330) bank holding companies available on Compustat for the same period. We divided the U.S. into 7 geographic regions and calculated annual equally weighted average ROA for each region using the ROAs of their banks.

In order to enhance the comparability among observations and the precision of the exercise, mergers of equals and acquisitions with repeated announcements from the data set were excluded from the sample.

The methodology

We use a standard event study methodology to examine the effects of our variables of interest on both short-term returns surrounding the acquisition announcement and on long-term performance. Short-term performance is calculated over windows of ± 3 , ± 5 and ± 10 days around the announcement. The abnormal results are calculated relative to the beta-adjusted market model, when the CRSP value-weighted index is used as a proxy for market returns. To estimate the market model parameters, alpha (an intercept) and beta (a slope), we take a sample of stock-price daily returns at $\{-250;-30\}$ days before the announcement and regress it on the CRSP value-weighted index daily returns over the same period. Then we use the regression coefficients (market α and β) to calculate the predicted stock returns and use the predicted values to calculate the cumulative abnormal returns (CARs).

For long-term performance, we calculate results for up to 48 months following the announcement. We use three different types of measures to evaluate performance, with the first two being the standard measures of other event studies (see, for example, D. Ikenberry, J. Lakonishok and T. Vermaelen (1995)). The first technique is based on CARs relative to a benchmark, the second type calculates abnormal performance assuming buy-and-hold strategy and the third type is using accounting data as a performance with respect to competitors. For CARs, abnormal returns are calculated relative to two benchmarks: beta-adjusted market model and size- and market-to-book (MTB) based benchmark. We also used the Fama-French three-factor model, which gave results similar to the beta-adjusted model. In order to estimate the market α s and β s for the beta-adjusted and the Fama-French model, we use a period of 60 months before the announcement date.

Abnormal returns adjusted for both size and MTB ratio were computed dividing the universe of companies on the CRSP tape into 100 portfolios for every month of observation. Unlike traditional

portfolio selection, where companies are first ranked by their size and then within each size decile by their MTB ratio, we rank our portfolios by size and by the MTB ratio simultaneously and do it for every month. The unconditional ranking and the larger number of reference portfolios (100 instead of more traditional 50) allow us to combine the advantages of a closer match of firm characteristics offered by the control company method, with the statistical stability of the benchmark portfolio method. The abnormal performance of each firm from our sample is then calculated each month in comparison to the portfolio the firm belonged to in that particular month.

For the buy-and-hold abnormal returns, we use the same size- and MTB-based benchmark portfolios to calculate returns on the investment in the acquiring firm's stock that is held for a period of up to 48 months. Abnormal performance is therefore computed through the difference between the acquiring firm's stock return and the equal weighted investment into the size- and MTB- ranked portfolio that the acquiring bank belongs to. This portfolio is rebalanced every month and the classification of each bank in the (Size x MTB) matrix re-evaluated.

The third type of long-term performance measures used is based on accounting data.

$$ACQROA_{c,i} = (ROA_{c,t+i} - ROA_{Reg,t+i}) - (ROA_{c,t-1} - ROA_{Reg,t-1})$$

$ACQROA_{c,i}$ is computed as the difference between the change in the acquiring company's ROA over $i+1$ years starting from one year before the acquisition and similar change in the region's average ROA_{reg} over the same period.

The Model

The model tested in this study is specified as follows:

$$\text{Abnormal performance}_n = a + b \times \text{integration}_n + c \times \text{replacement}_n + d \times \text{experience}_n + \\ e \times \text{codification}_n + f \times \text{codification-integration}_n + \text{controls}_n + \varepsilon_n,$$

where n is the number of the focal event (a particular merger announcement), the abnormal performance measure can be CAR over ± 10 days around the announcement date, CAR over 36 and 48 months after the announcement, abnormal returns for buy-and-hold strategy for 36 and 48 months and $ACQROA_{c,3}$. The interaction term between codification and integration is meant to capture eventual increasing performance effects of the knowledge codification process at increasing levels of the complexity of the task, as per H5. The expected sign for the coefficients are: $b > 0$, $c < 0$, $d > 0$, $e > 0$, $f > 0$, whereas the error term is distributed according to the standard normality assumptions.

We use ordinary least squares regression to estimate the coefficients of the model. Weighted-least squares and stepwise regression produce essentially the same results and are not reported here. Since codification and integration are highly correlated with their interaction term, z-scores transformations of both variables were utilized and then multiplied to create the interaction term. This eliminated the multicollinearity problem in the estimated model (VIF was lower than 3 for all the covariates). Outliers were identified as the observations more than 3 standard deviations away from the mean of the dependent variable, and excluded from the analysis.

Controls

Among the control variables included in the model we entered:

- Pre-acquisition characteristics of the target, which have been considered important in the literature: the degree of geographic overlap as an approximation of resource relatedness (Healy, Palepu and Ruback, 1992) and the quality of the assets purchased.
- The total asset size of the acquiring firm and the relative size of the acquired firm with respect to the acquirer.

- The number of acquisitions completed by the same acquirer in the same year of the focal transaction. The objective is to partially control for the fact that the impact of the explanatory variables might be influenced by the simultaneous completion of multiple acquisitions.

4 Results

The mean, standard deviation and the correlation coefficients of the variables entered in the model specified above are shown in Table 1. A set of t-tests confirm that none of the accounting and financial measures adopted to approximate short-term and long-term performance result to have a mean value significantly different from zero, confirming the prevailing result of the literature (Jensen and Ruback, 1983; Jarrell et al., 1988; Frank et al. 1991; Loderer and Martin, 1992). With respect to the correlation coefficients, it is interesting to notice that long-term accounting performance significantly correlates with long-term portfolio-adjusted stock price variations but not with the short-term ones. Even more surprisingly, short-term returns are not significantly correlated with any of the long-term return measures. Also, post-acquisition decisions exhibit large and significant coefficients with all long-term performance measures, with a positive sign for the level of integration and a negative sign for the degree of replacement of the target's management. The capability-development measures, however, show a weaker correlational evidence, in that acquisition experience was not correlated with any performance measure, while knowledge codification was positively correlated with the longer range ones (4 years ROA variation and 4 year stock price variation). This is a first clue to the importance of explaining organizational learning processes with two distinct effects: the experience accumulation and the knowledge codification processes. While they are clearly correlated with each other, they do exhibit different implications for acquisition performance². Given the large and significant correlation coefficients tying many of

² On Figure 1 a plot of the experience and codification levels of the 47 institutions surveyed shows that, while at high experience levels (>25 events) process codification is widely diffused, at low and medium experience levels there is a wide dispersion of the degree of codification. Some acquirers develop acquisition tools from just a handful of experiences, while others do not invest in codification processes even after having completed 15-20 acquisitions.

the explanatory variables, though, a multiple regression analysis is necessary in order to verify the net contribution of each of them to the variation of the dependent variable.

Table 2 contains the results of OLS estimations of the model presented above with each of the performance measures utilized. It shows the variation in accounting performance, the stock price immediate reaction to the acquisition announcement and long-term abnormal returns regressed on control and independent variables. The standardized coefficients of the impact of each independent variable on the different performance approximations are presented in the different columns. The first column presents the results for the accounting measure used, the difference between the change in the company's ROA from one year before to three years after the acquisition and the average change in the region's average ROA_{reg} over the same period. The second and third columns presents the impacts on benchmark portfolio-adjusted CARs over 3 and 4 years, respectively³. The fourth and fifth column, then, shows the results of the analysis in the case of a buy-and-hold strategy in the presence of the same benchmark portfolio-adjusted return. Finally, the sixth column offers the same analysis in the case of daily cumulative abnormal returns starting 10 days before the announcement and ending 10 days after the announcement⁴.

The overall fit of the model tested with the data utilized is strong in all the long-term performance specifications (F values ranging from 4.7 to 8.8, adjusted R^2 statistics as high as 0.399), but is barely significant for the short-term performance specification (F statistic =1.767, $p < 0.10$).

The individual regression coefficients show remarkably similar effects for all the long-term (financial and accounting) approximations of the performance construct. With respect to the post-acquisition integration decisions, the level of integration influences performance in a significant and positive way (p values < 0.01 , except 3 year buy-and-hold with $p < 0.05$), lending support to H1,

³ Similar analyses were performed using the CARs with a beta-adjusted model and using CARs relative to the Fama-French three-factor model, with essentially similar results with respect to the experience and the knowledge codification variables, while weaker results for the post-acquisition integration decisions variables.

while the replacement of the top management team of the acquired firm has a negative and significant impact ($p < 0.01$), as per the formulation of H2. It is to be noted that the magnitude of these coefficients is the largest among the explanatory variables of the model and reaches values of absolute relevance, particularly for the management replacement impact (standardized beta varies between 0.4 and 0.65).

Regarding the capability-building part of the model, acquisition experience does not show any significant impact, failing to support H3, while the degree of knowledge codification has positive effect on the accounting performance as well as on the benchmark adjusted cumulative abnormal returns over 4 years ($p < 0.05$), thereby supporting H4 at least for the longest periods utilized. Interestingly, the interaction term between the level of integration and the degree of knowledge codification show a positive and significant impact on accounting performance ($p < 0.05$) and on all the long-term financial measures ($p < 0.01$), confirming the proposition advanced in H5 on the increasing role that knowledge codification assumes, as a collective learning mechanism, with increasing degrees of complexity of the integration task.

The short-term abnormal returns are not sensitive to any of the hypothesized effects. Neither integration decisions, nor organizational learning processes influence them in a statistically significant way. While the lack of sensitivity to integration decisions can be explained by the fact that they are rarely communicated at the time of the announcement, the inconsistency between the short-term and the long-term performance implication of the explicit learning efforts that acquirers make in order to develop their integration practice represents a puzzle for market efficiency theory. The implication, in fact, is that markets systematically discount their understanding of the acquirers' integration capability at the time of the announcement, and then adjust upward their expectations on the acquiring company's stock performance as they learn about its ability to deliver on the integration strategies. This is even more worrying if one considers the fact that the sample under

⁴ The analysis was replicated with (-3,+3) days, and (-5,+5) days windows without significant changes in the results

study is composed of relatively experienced acquirers (avg. experience = 11.25), whose past track record of integration decisions and performance outcomes should be available to market analysts and allow them to form informed opinions as to the effectiveness of the acquiring firm's integration practices.

For what concerns the other control measures entered in the model, the quality of the target's assets has a significant and negative impact on all dependent variables. This means that transferring acquirer's resources and capabilities to the target is a more powerful way to create shareholders' value than doing the opposite (i.e. learning from the target), at least in the context under study. The premium paid will typically be of more modest magnitude, and the immediate stock price reaction after the acquisition announcement for poorly performing targets should reflect that. However, the long-run performance should not depend on this factor, as it should have been entirely anticipated at the announcement. Therefore, the market is either too optimistic about the post-acquisition acquirers' performance after acquiring good firms or too pessimistic about their performance after acquiring poorly performing firms.

Acquirer's size also has a significant and negative impact on all dependent variables, except changes in ROA. Abnormal returns are not size adjusted, but the presence of the acquisition relative size in the model should help control for this potential bias in the estimates. Again, it is interesting to note that only part of this effect is captured at the announcement, and that markets are systematically overoptimistic about the ability of large acquiring firms to extract value from their acquisitions.

Contrary to the conventional wisdom among banking scholars and practitioners, the target's geographic market overlap with the acquirer has little predictive power about the acquirer's future performance. The coefficient of the regression on accounting performance is not significant, and the financial performance ones become significant only after 4 years. This is surprising because

acquiring a bank having at least part of its branch network in areas where the acquirer is present should allow superior potential from the rationalization of the geographic coverage and the cost savings from closing redundant branches. However, this might come at a cost due to the complexity of managing the entire process, cost that is typically not identified and allocated to the acquisition process (i.e. it is hidden in the administrative cost structure of the combined entity). Also, “out-market” acquisitions can create shareholders’ value in ways different from cost efficiencies, such as cross-selling products and transferring capabilities (e.g. marketing or loan processing practices) across the two organizations, enhancing the revenue growth of the combined firm.

Robustness of the results

In order to check for the stability of these results to varying specifications of the dependent variable, we replicated the analysis with different time windows ((-3, +3) days and (-5, +5) days) around the announcement for the short-term event study, as well as different specifications of the long-term stock returns (monthly CARs using beta-adjusted model and Fama-French three-factor model), obtaining results substantially similar to the ones reported.

The other direction of exploration to test for the robustness of these results was towards a deeper understanding of the effects of the capability development mechanisms on post-acquisition performance. As described in the theory section, there are several reasons to believe that the tacit and explicit learning effects might not be linear. The first acquisition experiences might be inappropriately applied to seemingly similar but inherently different contexts, therefore having a negative effect on performance, which will attenuate and eventually reverse with increasing experience levels. Haleblan and Finkelstein (1999), for example, find a U-shaped relationship between acquisition experience and performance. The degree of codification of the acquisition process might suffer from the opposite problem, as the costs of updating the manuals and systems created, as well as the implicit bureaucratic load rise as the acquirer reaches very high levels of

explicit learning behavior. An inverted U-shaped curve between codification and performance might therefore be expected in this case.

To investigate the empirical relevance of these arguments in our sample of acquisitions, we include square terms for knowledge codification and acquisition experience into the regression equation. As an additional check we split the sample in two parts and run linear regressions separately for companies with low (high) knowledge codification and with low (high) acquisition experience. The break-point (10 acquisitions experienced and 7 acquisition tools developed) have been identified as the points of maxima and minima estimated from the equations with the squared terms.

For the sake of space, in Table 3 we report only the results for the coefficients related to the integration decisions and the capability building variables. Panel A shows results of OLS regression analyses when square terms for the knowledge codification and the acquisition experience variables are included. Performance and knowledge codification exhibit an inverted U-shaped relationship, with significant and positive main effect and significantly negative quadratic coefficient for all the specifications of the dependent variable. Contrary to expectations, though, acquisition experience does not reach significance levels neither in its main nor in its quadratic effect, even though the signs reveal a unanimous directional tendency towards the U-shaped relationship (negative main and positive quadratic effects).

These results are confirmed through further analyses with split samples on high and low end observations for knowledge codification and acquisition experience (panels B, C, D and E). Knowledge codification has a significant and positive coefficient when the low codification sample (Panel B) is considered, and significantly negative for ROA in the high knowledge codification one (Panel C). As before, the evidence on the performance implications of acquisition experience is overall inconclusive.

5 Conclusions

This paper advanced a set of theoretical arguments as possible explanations of the mechanisms through which acquiring firms can learn how to manage the post-acquisition integration process, and under what conditions these mechanisms might and might not work. The empirical analysis used a combination of financial, accounting and questionnaire response data to estimate the performance implications of a complex model which included, in addition to tacit and explicit learning mechanisms, post-acquisition integration decisions as well as pre-acquisition characteristics of the two firms. Results suggest that firms do learn from their past acquisition experience, but in a complex and non-linear way. Experience accumulation is not sufficient to directly impact performance, as the low frequency, the high heterogeneity and the fundamental causal ambiguity inherent in acquisition processes prevent standard learning-by-doing mechanism from displaying their positive effects. However, specific investments in explicit learning processes aimed at the articulation and codification of lessons learned from prior acquisition experiences do exhibit significant and positive impact on performance. The development of acquisition-specific tools, such as manuals and decision-support systems, has in fact a positive linear effect on performance, but is also subject to decreasing marginal benefits, presumably due to increasingly high updating costs and bureaucratic loads.

The second important set of findings relates to the performance effects of post-acquisition integration decisions. The level of integration positively impacts performance while the replacement of the target's top management, controlling for the effect of target's asset quality, negatively impacts performance. These results suggest that the value creation process in acquisitions is crucially influenced by the way acquirers manage the integration phase, over and above the pre-acquisition characteristics of the acquired business. In particular, the negative sign in the performance impact of the replacement of the target's top management team indicates that the dominant view of acquisitions as tools through which management teams compete on the market for corporate control (and the winners sweep away the losers) might represent a good description of

how acquirers approach the task, but should be qualified with respect to the performance implications. All other things being equal, the substitution or disposition of the target's leadership is likely to destroy, as opposed to enhance, shareholders' value. Not only is the value of human capital as well as social capital lost, but the complexity of the integration process might grow exponentially, due to the non-cooperative or even antagonistic environment which is typically established as a consequence of the perception of unfair decision-making in the integration phase.

These effects, however, are only present in the models with long-term accounting and financial performance measures, which brings us to the third and final finding. The financial markets do not seem to incorporate all publicly available and potentially valuable information into prices immediately after the acquisition announcement. Significant long-term abnormal returns have been identified in connection with acquirer's size, target's asset quality, acquirer's learning (both linearly and non-linearly) and acquirer's post-acquisition decisions. A possible explanation for this result rests on two arguments. The first has to do with the lack of communication of these decisions on the part of the acquiring firm. Acquirers refrain from disclosing the integration decisions both at the time of the announcement and afterwards in order to avoid threats of legal suits. Doing so, though, does not allow the financial markets to form a thorough opinion on the chances of success of the completed acquisition. The second explanation is that financial markets should be able to anticipate at least the general integration approach, based on past acquisitive behavior, and to assess the acquirer's ability to deliver, based on past performance record. The fact that they do not seem to have been able to do so (at least at the time of the sample) poses some important questions as to the limits of market efficiency in the context of complex events such as the announcement of acquisitions. An interesting extension of this study, in fact, would be to verify the markets' ability to anticipate firms' post-event behavior and evaluate their ability to implement in similarly complex contexts, such as the announcement of joint-ventures, of strategic alliances, of market entries, and so on.

Other studies could address the numerous limitations of the present one as well. First, the study is situated in a specific industry context, the banking sector, which might be subject to idiosyncratic mechanisms for the creation of value in acquisition contexts, for the management of integration processes and for the development of integration-specific capabilities. Generalizability of our results can be then probed by replicating the analysis with data from significantly different industry domains, such as the high-tech sector, or through a multi-industry study. Second, the design of the present study has deliberately excluded the acquisition of non-banking assets by banking firms. Some of our results might be dependent upon the fact that no diversification-driven acquisitions have been allowed in the sample, and should be probed by extending the sample to a wider variety of targets. On a more theoretical ground, the dimensions of the integration process studied might not, and probably are not, exhaustive of the possible list of key factors explaining integration behavior by acquiring firms. The speed of execution, for example, is a relevant dimension that has not been looked at neither theoretically, nor empirically. Similarly, the learning mechanisms identified and studied in this work might be a poor representation of the alternatives available to the acquiring firm to develop collective competence specific to the management of acquisition processes. For example, external aid might come from management consulting firms, and the attention of top management at the corporate level towards the execution of the first few integration processes at the divisional level might be a powerful stimulus to speed up collective learning.

While we have little doubt that a lot of work is needed in order to uncover the possible contingencies that might explain the variation between superior and poor performance in acquisition processes, we also believe that the theoretical arguments as well as the empirical findings of the present study might at least contribute to shift the attention of scholars away from the assessment of the average performance implications of the phenomenon and towards a more stimulating debate on the root causes of value creation and value destruction in corporate acquisitions.

References

- Acquith, P., Bruner R., Mullins, D., 1983. The gains of bidding firms from merger. *Journal of Financial Economics* 11, 121-139.
- Agrawal, A., Gaffe, J.F., Mandelker, G.N., 1992. The post-merger performance of acquiring firms: a re-examination of an anomaly. *Journal of Finance* 47(4), 1605-1621.
- Berger, A.N., Demsetz, R.S., Strahan, P.E., 1999. The consolidation of the financial services industry: Causes, consequences and implications for the future. *Journal of Banking and Finance* 23, 135-194.
- Calomiris, C.W., 1999. Gauging the efficiency of bank consolidation during a merger wave. *Journal of Banking and Finance* 23, (1999) 615-621.
- Cannella, A.A. Jr., Hambrick, D.C. 1993. Effects of executive departures on the performance of acquired firms. *Strategic Management Journal*, 14, 137-152.
- Cohen, W. M., et al., 1996, Routines and other recurring action patterns of organizations: contemporary research issues. *Industrial and Corporate Change*. 5(3), 633-698.
- Cormier, S., Hagman, J. 1987. *Transfer of Learning: Contemporary Research and Applications*. Academic Press Inc: San Diego.
- Cyert, R. M., March, J.G. 1963. *A Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, NJ.
- Dutton, J.M., Thomas, A., 1984. Treating Progress Functions as a Managerial Opportunity. *Academy of Management Review* 9, 235-247.
- Fama, E.F., French, K.R., 1993. Common risk factors in returns on stocks and bonds. *Journal of Financial Economics* 33, 3-56.
- Franks, J., Harris, R., Titman, S., 1991. The post-merger share price performance of acquiring firms. *Journal of Financial Economics* 29, 81-96.
- Haleblian, J. Finkelstein, S., 1999. The influence of organizational acquisition experience on acquisition performance: A behavioral learning perspective. *Administrative Science Quarterly* 44, 29-56.

- Hawawini, G., Swary, I., 1990. Mergers and acquisitions in the US banking industry: evidence from the capital markets. North-Holland, Amsterdam.
- Healy, P.M., Palepu, K., Ruback, R.S., 1992. Does corporate performance improve after mergers? *Journal of Financial Economics* 31, 135-175.
- Healy, P.M., Palepu, K., Ruback, R.S., 1997. Which take-overs are profitable: strategic or financial? *Sloan Management Review*.
- Ikenberry, D., Lakonishok, J., Vermaelen, T., 1995. Market underreaction to open market share repurchases. *Journal of Financial Economics* 39, 181-208.
- Jarrell, G.A., Brickley, J.A., Netter, J.M., 1988. The market for corporate control: the empirical evidence since 1980. *Journal of Economic Perspectives* 2, 49-68.
- Jensen, M.C., Ruback, R.S., 1983, The market for corporate control: the scientific evidence, *Journal of Financial Economics* 11, 5-50.
- Krishnan, H.A., Miller, A., Judge, W.Q., 1997. Diversification and top management team complementarity: is performance improved by merging similar or dissimilar teams? *Strategic Management Journal*, 18. 361-374.
- Loderer, C., Martin, K., 1992. Post-acquisition performance of acquiring firms. *Financial Management*, Autumn 1992, 69-79.
- Manne, H. G. 1965. Mergers and the market for corporate control. *Journal of Political Economy* 73-74. 110-120.
- March, J.O. 1994. *A primer on decision making: how decisions happen*. The Free Press, New York, NY.
- March J.G., Simon, H., 1958. *Organizations*. Wiley, New York.
- Nelson, R., Winter, S., 1982. *An evolutionary theory of economic change*. Cambridge, MA. Harvard University Press
- Nelson R., 1995. Recent evolutionary theorizing about economic change. *Economic Literature*. 33 (1).
- Nunnally, J. C., 1978. *Psychometric Theory*. (2nd ed.). MacGrow-Hill Book Company, New York,.

Pilloff S., Santomero, A., 1998. The value effects of bank mergers and acquisitions. In: Amihud, Y. Miller, M. (Eds.), *Bank Mergers and Acquisitions*, pp. 59-78.

Rau, P. R., Vermaelen, T., 1998. Glamour, value and the post-acquisition performance of acquiring firms. *Journal of Financial Economics* 49, 223-253.

Rhoades, S.A. 1994. A summary of merger performance studies in banking 1980-93, and an assessment on the “Operational Performance” and “Event Study” methodologies. Board of Governors of the Federal Reserve System, Washington, D.C.

Schweiger, D. M. & DeNisi, A. S. 1991. Communication with employees following a merger: A longitudinal field experiment. *Academy of Management Journal*, 34: 110-135.

Thakor, A.V., 1999. Information Technologies and financial services consolidation. *Journal of Banking and Finance* 23. 697-700.

Yelle, L.E., 1979. The Learning Curve: Historical Review and Comprehensive Survey, *Decision Sciences* 10, 302-328.

Winter, S. 1987. Knowledge and Competence as Strategic Assets. In: Teece, D.J. (Ed.), *The Competitive Challenge: Strategies for Industrial Innovation and Renewal*. Ballinger, Cambridge, MA, pp. 159-184.

Williamson, O. E. 1979. Transaction-cost economics: The governance of contractual relations. *Journal of Law and Economics*, 22: 233-261.

Winter, S. 1987. Knowledge and competence as strategic assets. In Teece, D. J. (Ed.), *The competitive challenge: Strategies for industrial innovation and renewal*: 159-184. Cambridge, MA: Ballinger.

Winter, S. 1995. Four Rs for profitability: rents, resources, routines and replication. In: Montgomery, C.A. (Ed.), *Resource-based and Evolutionary Theories of the Firm: Towards a Synthesis*. Norwell, MA, 147-178.

Appendix

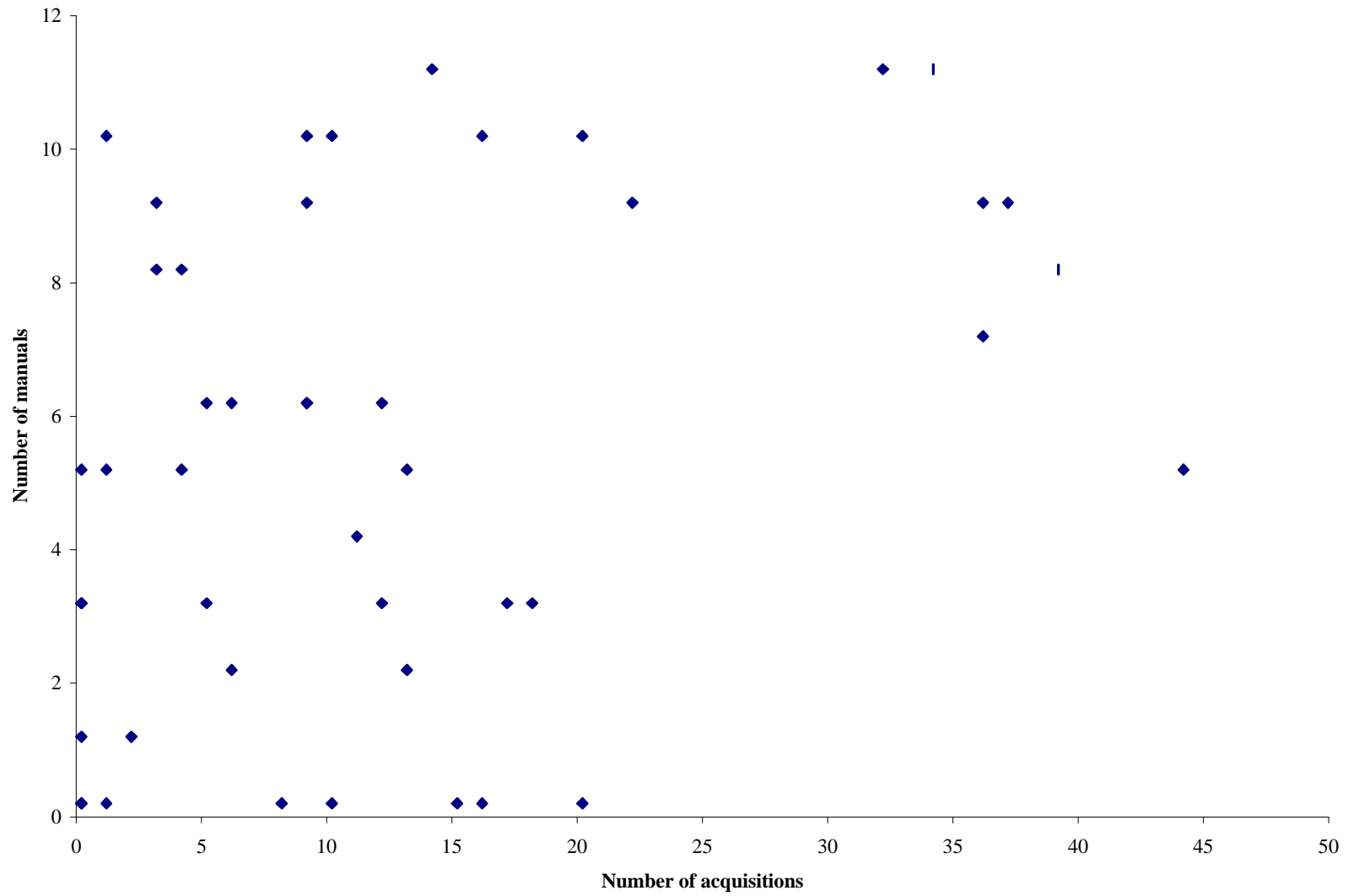


Figure 1. The plot of experience and codification levels of the surveyed banks

Table 1. Post-Acquisition Performance: Correlation Matrix

Table 2 shows statistics (average and standard deviation) and correlation matrix for the variables used.

	VARIABLES	N	Avg	Std	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	ROA change (-1, +3 years)	339	-.0053	.374															
2	CAR 36 months	209	.0300	.282	.366														
3	CAR 48 months	174	.0695	.331	.507	.841													
4	Buy & Hold 36 m.	209	.026	.467	.346	.969	.806												
5	Buy & Hold 48 m.	174	.0595	.597	.478	.839	.975	.829											
6	CAR 10 days	307	-.0027	.064	-.093	.0061	.0161	-.024	.0215										
7	Acquirer's size	452	23.072	23.01	.123	-.004	-.053	.016	-.055	-.148									
8	Relative target size	422	6.085	11.4	-.014	-.001	-.016	-.002	-.006	-.082	-.027								
9	Simultaneous acquisitions	564	3.578	2.82	.215	.145	.195	.149	.203	-.016	.480	-.220							
10	Target quality	458	-.01	1.06	-.086	-.168	-.144	-.154	-.167	-.0689	-.064	.049	.052						
11	Target relatedness	479	.614	.485	.074	.205	.175	.177	.170	.0408	.184	-.083	.143	-.198					
12	Level of integration	478	2.632	.702	.165	.106	.134	.074	.123	-.0168	.098	-.091	.171	-.214	.397				
13	Top management replacement	466	1.455	1.32	-.221	-.143	-.215	-.146	-.196	.0295	-.061	.021	-.210	-.308	.347	.414			
14	Acquisition experience	564	11.25	10.16	.036	.107	.127	.092	.087	.0087	.502	-.087	.515	.033	.169	.121	-.053		
15	Knowledge Codification	508	4.874	3.66	.138	.113	.207	.088	.163	-.0308	.431	-.052	.362	.172	.03	-.108	-.108	.455	
16	Codification x Integration	430	.168	1.15	.15	.140	.069	.169	.104	-.0048	-.022	.071	.05	.058	.059	-.148	-.109	-.06	-.173

Pearson's correlation. Bold numbers are significant at the 0.05 and bold and italic at 0.01

Table 2. Post-Acquisition Performance: Changes in ROA and Stock Abnormal Returns After and Around the Acquisition Announcement Dates vs. Benchmark Portfolio Returns. OLS regressions

Table 2 shows regression standardized coefficients, F-statistics and adjusted R². The dependent variable in the first column is the difference between the change in the company's ROA over 4 years starting from one year before the acquisition and similar change in the region's average ROA_{reg} over the same period. Dependent variables in columns 2 and 3 are cumulative abnormal returns over 3 and 4 years adjusted for size and market-to-book ratio by comparing with corresponding benchmark portfolio returns. 100 benchmark portfolios are formed using size and market-to-book ratio ranking. Dependent variables in columns 4 and 5 are the abnormal returns of the "buy-and-hold" strategy for 3 and 4 years holding periods using benchmark portfolio adjusted returns. In the last column, the dependent variable is short-term beta-adjusted abnormal returns in a (+10,-10) days window.

	ROA change (+3, -1) years adjusted for competitors	Benchmark portfolio adjusted CAR in 3 years	Benchmark portfolio adjusted CAR in 4 years	Buy and Hold for 3 years	Buy and Hold for 4 years	Daily abnormal returns +/- 10 days
Controls						
Acquirer's size	-.032	-.206**	-.280***	-.162*	-.274***	-.2**
Relative acquisition size	.059	-.066	.096	.052	.096	-.105
Simultaneous acquisitions	-.014	-.007	.021	.030	.092	-.049
Target quality	-.2***	-.301***	-.314***	-.280***	-.317***	-.235***
Target's market overlap	.0086	.152	.186**	.116	.19**	.098
Post-acquisition Decisions						
Level of integration	.261***	.277***	.392***	.246**	.33***	-.101
Degree of replacement	-.388***	-.542***	-.652***	-.487***	-.597***	-.028
Integration Capability						
Acquisition experience	-.048	.054	.028	.03	-.035	.078
Knowledge codification	.212**	.119	.248**	.082	.231**	.044
Codification x Integration	.164**	.222***	.228***	.214***	.254***	.099
F statistic	6.104***	5.853***	8.818***	4.707***	8.052***	1.767*
Adjusted R ²	.180	.248	.399	.201	.374	.0367
N	233	148	119	148	119	

Standardized coefficients. Significant at the 0.01 (***), 0.05(**) or 0.10 (*) level

Table 3. Nonlinear Effects of Learning and Experience. Transaction Level of Analysis

Panel A reports coefficients associated with learning and experience when the square terms are included into full regression (only the coefficients of interest are shown). Panels B-C report coefficients associated with learning and experience in full linear regression when sample is restricted to low codification (Panel B), to high codification (Panel C), to low experience (Panel D) and high experience (Panel E).

	ROA Change (+3, -1) years	Portfolio adjusted CAR in 3 years	Portfolio adjusted CAR in 4 years	Buy and Hold for 3 years	Buy and Hold for 4 years
Panel A. Regression with quadratic terms (114 observations)					
Knowledge codification	1.217***	1.241***	1.166***	.9**	1.116***
Square of knowledge codification	-1.424***	-1.059***	-.997***	-.68**	-.926***
Acquisition experience	-.083	-.284	-.27	-.318	-.451
Square of acquisition experience	.021	.251	.336	.212	.454
Level of integration	.269**	.098	.266**	.096	.205*
Degree of replacement	-.525***	-.608***	-.603***	-.564***	-.546***
F statistic	6.297***	5.984***	8.323***	4.444***	7.604***
Adjusted R ²	.36	.346	.438	.268	.412
Panel B. Regression with low knowledge codification (less than 7 tools). 60 observations.					
Knowledge codification	.324**	.292**	.335**	.204	.353**
Acquisition experience	.192	.052	.143	-.01	.042
Level of integration	-.012	-.242	.051	-.301	-.021
Degree of replacement	-.096	-.13	-.057	-.044	.019
F statistic	1.907*	2.459**	2.397**	1.729	2.204**
Adjusted R ²	.133	.198	.191	.11	.17
Panel C. Regression with high knowledge codification (more than 6 tools). 54 observations					
Knowledge codification	-.395**	-.203	-.198	-.130	-.195
Acquisition experience	-.382*	-.123	-.067	-.207	-.064
Level of integration	.667*	.514	.373	.572	.399
Degree of replacement	-.453***	-.659***	-.726***	-.645***	-.733***
F statistic	7.439***	7.386***	12.061***	7.177***	13.519***
Adjusted R ²	.549	.547	.676	.625	.703

Panel D. Linear regression with small experience (less than 10 acquisitions) 50 observations					
Knowledge codification	.518***	.7***	.814***	.668***	.797***
Acquisition experience	-.063	.031	-.058	.060	-.046
Level of integration	.062	-.069	-.171	-.033	-.154
Degree of replacement	-.12	-.28**	-.139	-.262*	-.074
F statistic	7.526**	8.934**	9.691***	7.25***	7.726***
Adjusted R ²	.571	.618	.640	.561	.579
Panel E. Linear regression with high experience (greater than 9 acquisitions) 64 observations					
Knowledge codification	-.518***	.197	.044	.229	.104
Acquisition experience	-.063	.020	.188	-.017	.172
Level of integration	.434***	.239	.365**	.065	.27*
Degree of replacement	-.519***	-.783***	-.796***	-.663***	-.768***
F statistic	6.104***	3.802***	6.350***	3.266***	6.374***
Adjusted R ²	.448	.308	.459	.265	.460

Standardized coefficients. Significant at the 0.01 (***), 0.05(**) or 0.10 (*) level