



Contents lists available at ScienceDirect

Journal of Business Research



Value creation and appropriation following M&A: A data envelopment analysis

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ARTICLE INFO

Article history:

Received 1 July 2015

Received in revised form 1 January 2016

Accepted 1 March 2016

Available online xxxx

Keywords:

Mergers and acquisitions (M&As)
Post-merger marketing performance
Data envelopment analysis (DEA)
Marketing efficiency

ABSTRACT

Mergers and acquisitions (M&As) are typically inspired by a desire for revenue growth and/or cost efficiency leading to an improvement in financial performance. Post-merger performance has received considerable research attention from scholars in finance and accounting, but the marketing dimension has remained largely unexplored. This research focuses on marketing efficiency as a measure of post-merger performance, and this is investigated via an empirical study of 20 M&A deals within the US commercial banking industry. Data Envelopment Analysis (DEA) is used to measure efficiency, employing two input and two output variables. The results demonstrate that M&A transactions do have a positive effect on the marketing efficiency of the combined firms, although the effect size is small.

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1. Introduction

The number and value of M&A deals in the banking industry have accelerated over the past decade in line with other industries (Beccalli & Frantz, 2013). Several factors have contributed to this including technological advancement, globalization of financial markets, deregulation, and intensified supervision. The global crisis in 2008 saw a sharp decline in the number of deals but the market regained its momentum in 2010 and has continued upwards since then, reaching 40,400 deals worth \$3.5 trillion in 2014 (Swaminathan, Groening, Mittal, & Thomaz, 2014). In the US banking industry, there were 1112 deals in 2014, valued at \$81.5 billion (Thomson Reuters, 2014).

The predominant motive for M&As is to enhance firm performance through the realization of cost and revenue efficiencies (Capron, 1999; Martynova & Renneboog, 2008). *Cost efficiency* may be achieved through asset disposals and redeployment of assets and capabilities by the combined firms. *Revenue efficiency* is the possibility of the merged firms generating additional revenue by exploiting complementary assets and capabilities (Barney, 1991; Capron, 1999). Whether such efficiencies are actually realized post-merger is an empirical question that has received extensive research attention from several disciplines, with most from scholars in finance and accounting, and least from researchers in marketing (e.g. Bahadir, Bharadwaj, & Srivastava, 2008; Homburg & Bucerius, 2005).

Only a handful of studies have investigated post-merger *marketing performance* and nearly all of these have employed just a single measure, either market share or sales revenue (e.g. Ghosh, 2004; Gugler,

Mueller, Yurtoglu, & Zulehner, 2003; Mueller, 1985). These variables only capture *marketing outputs* while ignoring *marketing inputs* such as advertising and distribution costs. To the best of our knowledge, no study has taken a holistic view of marketing activities and examined the effect of M&As on the *marketing efficiency* of the merged firms by incorporating both marketing input and output variables.

The objective of this research is to fill this gap in the post-merger performance literature by investigating the *marketing efficiency* of merged firms using a composite input–output model drawn from the resource-based view (RBV) of firm performance. Our study focuses on a sample of horizontal M&A deals among US-based commercial banks, employing data envelopment analysis (DEA).

The paper is organized as follows. In the next section, we present a short overview of the relevant literature and the theoretical foundation of this study, culminating in a set of testable hypotheses. The third section describes the methodology employed in the study and the fourth section presents the findings. The discussion of findings and implications for theory and practice are presented in section five. The paper concludes with a discussion on the limitations of the study and suggestions for future research.

2. Literature review and hypotheses

2.1. Post-merger performance

Post-merger performance is commonly defined as the amount of value created and appropriated as a direct consequence of an M&A transaction (King, Dalton, Daily, & Covin, 2004). Value creation means that the value of the combined firm is greater than the sum of the values of the merging firms due to a synergetic effect (Barney, 1991). Such synergies might occur due to the acquisition of strategic assets and

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resources that enhance organizational capabilities to achieve differentiation and cost minimization through economies of scope and economies of scale (Barney, 1991; Capron, 1999). Value appropriation means the amount of value the merging firms are able to capture from the combination of the two firms (Mizik & Jacobson, 2003).

While post-merger performance has been investigated by various disciplines, the financial implications have received the lion's share of research attention (Haleblian, Devers, McNamara, Carpenter, & Davison, 2009). The two most widely-utilized perspectives on post-merger financial performance are the shareholder perspective, which measures returns based on share value, and the accounting perspective, which measures returns based on operating performance. Despite the considerable volume of research and the variety of methodologies applied, the evidence is extremely mixed, with a broad consensus that M&A transactions do not lead to value creation or value appropriation (Haleblian et al., 2009; Tuch & O'Sullivan, 2007).

With respect to stock market returns, the evidence suggests that the short-term announcement effect of takeovers is at best insignificant, and long-term performance is overwhelmingly negative (King et al., 2004; Tuch & O'Sullivan, 2007). Moreover, there is no evidence that merger performance improves over time; indeed, it seems that more recent takeovers may have been the most detrimental to shareholder wealth (Haleblian et al., 2009; Tuch & O'Sullivan, 2007). Accounting research tries to evaluate post-merger operating performance, defined as profitability and efficiency changes in the combined entity following M&A. Typically, these studies examine a range of performance variables such as operating margins, return on assets, return on equity, etc. over one, two or three years after the merger, compared to the pre-merger years (Haleblian et al., 2009). The evidence from this stream of research is also negative, suggesting that the operating performance of the merging firms tends to decline in post-merger years (Haleblian et al., 2009; Martynova & Renneboog, 2008; Tuch & O'Sullivan, 2007).

2.2. Post-merger marketing performance

Our literature research produced only a small number of studies that measured post-merger performance variables over which marketing has some control, such as sales volume and value, sales growth rate, and market share. Table 1 summarizes the findings of seven studies on post-merger marketing performance.

Six out of seven focus on only a single dimension of marketing performance, either sales revenue or market share, with just one using two measures, and none using multiple measures. It is difficult to draw a concrete conclusion based on these studies as the findings are very mixed. All of these studies consider only marketing *outputs*, i.e. sales performance, without taking into account the marketing *inputs* that generated those sales, such as expenditure on advertising, selling and distribution. It is not possible, therefore, to find any evidence from this body of work regarding the net effect of M&A on the post-merger marketing performance of the combined firms.

The objective of this study is to fill this knowledge gap in the literature by addressing the following question: *What is the impact of horizontal mergers and acquisitions on the marketing efficiency of the merged*

firms? In order to answer this question, this study examines the impact of mergers and acquisitions on the marketing *outputs* in relation to the marketing *inputs*.

2.3. A resource-based view of M&As

The resource-based view (RBV) sees a firm as a bundle of resources and capabilities which constitute its asset base and which provide the source of competitive advantage (Barney, 1991; Day, 2011; Srivastava, Fahey, & Christensen, 2001; Wernerfelt, 1984). The resources of a firm refer to tangible and intangible assets that have been accumulated over time and which enable it to devise and implement its strategy (Barney, 1991; Wernerfelt, 1984). Capabilities are the managerial skill-sets and knowledge garnered through experience in deploying these resources in the marketplace (Day, 2011; Vorhies & Morgan, 2005).

Various types of marketing resources or assets have been identified and investigated in the marketing literature. In their extensively cited study, Hooley, Greenley, Cadogan, and Fahy (2005) comment that "a great many factors may be considered market-based resources. No listing will ever be exhaustive and none can claim completeness". However, marketing scholars have attempted to identify and classify critical resources or assets. Hooley, Broderick, and Möller (1998) identify four types of marketing assets, namely, customer-based assets such as brand equity and reputation; internal assets, such as information and cost control systems; supply chain assets such as relationships with distribution partners; and alliance-based assets, such as access to market and shared technology. Doyle (2001) identifies market knowledge, brands, customer loyalty, and strategic relationships as marketing assets.

Various conceptualizations of marketing capabilities have also been proposed, but they tend to fall into two interrelated categories: capabilities pertaining to marketing strategy development and implementation, and capabilities concerning 'marketing mix' processes (Morgan, Vorhies, & Mason, 2009; Vorhies & Morgan, 2005). Hooley et al. (2005) suggest that market-facing capabilities, such as customer-relationship management, reputation management, product innovation and human resource capabilities directly affect corporate performance.

Firms engage in M&As to strengthen their resource base through the addition of complimentary assets to their existing set and also to enhance existing capabilities by acquiring new capabilities (Capron, 1999; Haleblian et al., 2009). They seek to acquire resources and capabilities that are compatible with their existing resources and capabilities, as well as those that are difficult and time consuming to develop and are not easily obtained in the open market (Capron & Hulland, 1999). An example of the type of marketing resources accessed via acquisition would be a channel of distribution to which the firm did not previously have access. In this way, M&A can be viewed as a tool for resource orchestration — for the search, selection, configuration and deployment of resources (Sirmon, Hitt, Ireland, & Gilbert, 2011).

M&As can increase the market coverage of the acquiring firm through geographic expansion, by entering new countries or markets, and/or by access to additional market segments. This wider market

Table 1
Studies of post-merger marketing performance.

Study	Sample size, period and country	Industry	Variable examined	Findings
Goldberg (1973)	44 conglomerate mergers. 1950s and 1960s. USA	Mixed	Market share	Market share increase for 28 firms and decreased for 13 firms
Mueller (1985)	209 M&As. 1950–1972. USA	Manufacturing	Market share	Declined
Baldwin and Gorecki (1990)	Population of Canadian manufacturing firms	Manufacturing	Share of value-added	Increased by 10% for 3 years but fell by 50% by year 8
Knudsen, Finskud, Törnblom, and Hogna (1997)	23 cases of brand acquisition in the US	Mixed	Market share	Declined in more than 50% of cases
Ghosh (2001)	315 M&A 1981–1995	Manufacturing	Cash flow and sales revenue	No improvement in sales growth
Gugler et al. (2003)	1250 M&As. 1981–1998. Different countries	Mixed	Sales revenue	Declined
Ghosh (2004)	2254 M&A. 1985 to 1999. USA	Mixed	Market share	Increased

coverage should allow the merged firm to sell existing products to more consumers, thus providing an opportunity for sales growth (Ficery, Herd, & Pursche, 2007). In other words, the market and customer complementarity of the target and the acquiring firms will create an opportunity to sell each other's products following the merger (Capron, 1999; Clemente & Greenspan, 1996).

Complementarities between the product and brand portfolios of the target and the acquiring firms should also result in scope economies, providing a further opportunity for increasing sales of the merged firms. Complementary marketing capabilities between the target and the acquiring firm should also produce benefits, such as enhanced market-sensing, product innovation, and customer relationship management. In sum, these synergies should result in scope economies leading to increased sales which would be evidence of enhanced *revenue efficiency* (Haleblian et al., 2009; Morgan et al., 2009).

Summarizing, it can be postulated that complementarity between the acquiring firm and the target firm in terms of market coverage, customer-base, product/brand portfolios, and marketing capabilities should enhance sales performance or *revenue efficiency* following a merger. We therefore hypothesize:

H₁. Mergers and acquisitions will have a positive effect on the sales performance of the combined firms, post-merger, thereby delivering revenue efficiency.

There is also the potential for cost savings following M&A, deriving from an overlap of assets between the target and acquirer firms. This offers potential for the elimination of costs through the sale of surplus assets, as well as cost savings in personnel and other resources from reducing duplication (Capron, 1999). Cost reductions in production, distribution, marketing, and elsewhere, as well as the elimination of overlapping facilities are often cited as likely sources of cost savings that would represent gains in cost efficiency (Capron, 1999; Martynova & Renneboog, 2008).

Overlapping marketing assets also suggest a possibility of cost reduction or *cost efficiency* for the combined firms following M&A. Selling off surplus or duplicate assets can allow firms to realize cost savings in distribution and retail outlets. Economies of scale may also be possible in many marketing and selling activities such as in media buying, and in joint promotion of the acquirer's and target's brands. Such savings ought to enable the combined firm to offer products to customers at lower costs compared to competitors and ultimately to achieving cost leadership. Thus, we hypothesize:

H₂. Mergers and acquisitions will lead to cost reductions in the marketing activities of the combined firms post-merger, thereby delivering cost efficiency.

The two hypotheses presented so far identify two separate factors – revenue growth and cost saving, the net product of which should be an enhancement in overall *marketing efficiency*. To complete the picture, these two factors can be brought together to yield a composite view, articulated in a third hypothesis:

H₃. Mergers and acquisitions will have a positive net effect on the marketing efficiency of the merged firms in the post-merger years compared to the pre-merger years.

3. Methodology

Studies of firm efficiency have predominantly used ratio analysis or regression, both of which have their shortcomings (Harris, Ozgen, & Ozcan, 2000). Regression focuses only on the central tendency and cannot incorporate multiple inputs and outputs (Donthu & Yoo, 1998). Data envelopment analysis (DEA) offers a number of advantages over

regression which make it a very useful tool to disentangle relationships which would otherwise remain hidden (Donthu & Yoo, 1998). DEA has grown in popularity in many academic disciplines (Cook & Seiford, 2009), although it has not yet been used much in marketing (Haugland, Myrteit, & Nygaard, 2007).

Unlike regression, DEA can incorporate multiple inputs and outputs, as well as identifying an efficient frontier and the distance of inefficient observations from that frontier. It focuses on individual observations and constructs a piecewise linear 'surface' that interpolates between (envelops) the most efficient observations (Cook & Seiford, 2009; Donthu & Yoo, 1998). In DEA, decision making units (DMUs) can be any set of entities that transform comparable inputs into comparable outputs such as firms operating in a similar industry (Cook & Seiford, 2009). In the current study, each M&A deal in the sample has been treated as an individual DMU whose marketing efficiency has been computed for the pre and post-merger years.

This study measured the *relative* marketing efficiency scores of each M&A deal (DMU) under investigation for both pre and post-merger years by determining the minimum possible marketing inputs required to produce a set of marketing outputs or by determining the maximum possible marketing outputs that can be produced from a given set of marketing inputs.

3.1. DEA window analysis

Most studies using DEA have analyzed cross-sectional data wherein each DMU was observed only once. However, data on DMUs are often available over a span of time which makes it possible to detect and compare efficiency over multiple time periods (Harris et al., 2000). In such cases, each DMU in each time period is treated as if it were a distinct DMU. This DEA technique is popularly known as window analysis and it offers the advantage of being able to conduct a longitudinal analysis (Harris et al., 2000; Kao & Liu, 2014). This study uses window analysis to compare the marketing efficiency score of each of the DMUs (firms engaged in M&As) in the sample for the pre-merger years and post-merger years.

3.2. Type of DEA model: CRS or VRS

A wide variety of DEA models have been proposed in the performance measurement literature (Cook & Seiford, 2009). Two of the most popular and extensively-used are the CRS and VRS models. The CRS model, developed by Charnes, Cooper, and Rhodes (1978), assumes Constant Returns to Scale (CRS) while the VRS model, introduced and popularized by Banker, Charnes, and Cooper (1984) assumes Variable Returns to Scale (VRS). The CRS model assumes that an increase in the input(s) will lead to a proportionate increase in the output(s), while the VRS model assumes that an increase in the input(s) will result in either an increase or a decrease in the output(s) (Harris et al., 2000).

One of the fundamental assumptions of DEA is homogeneity of the DMUs. In other words, it is assumed that all DMUs under observation undertake similar activities and produce comparable outputs using similar inputs (Cook & Seiford, 2009). This may not be a valid assumption, however, in the context of M&A, where the existence of economies or diseconomies of scale may represent potential sources of non-homogeneity. The CRS model does not take into account the scale effect, but the VRS model can accommodate the scale effect in its analysis (Banker et al., 1984; Charnes et al., 1978). This study used both the CRS model and VRS models in the data analysis to see which provided a better measure of marketing efficiency for the merging firms.

3.3. Input and output variables

DEA models can be either input-oriented or output-oriented. An input-oriented DEA model aims to minimize the inputs while retaining the same level of outputs, while an output-oriented model aims to

maximize the level of outputs given the existing level of inputs. In other words, an input approach assumes little control over the outputs while an output approach assumes that DMUs have direct control over the outputs (Harris et al., 2000). Coelli, Rao, O'Donnell, and Battese (2005) suggest that the selection of input or output orientation in DEA analysis is not as important as in econometric orientation because linear programming such as DEA does not suffer from statistical problems such as a simultaneous equation bias. Moreover, the selection of input or output orientation has an insignificant effect on the efficiency score obtained (Coelli & Perelman, 1999).

Commercial banks, which provide the context of this research, may have limited control over the borrowing behavior of their clientele depending upon a number of factors such as the repayment ability of the borrowers and fixation of their lending rates. However, banks have far greater control over their own marketing activities since they have full discretion over how much to spend and how best to utilize marketing inputs such as advertising and branch networks.

This research utilized an input-oriented model, therefore, in keeping with most M&A studies of banks (Pasiouras, 2008a). Drawing from the existing literature on the measurement of bank performance, this study identified a set of input and output variables that have been demonstrated to be particularly related to bank marketing activities. Table 2 shows the input and output variables used in the study, which have been developed from similar studies measuring overall bank efficiency (Ahn & Le, 2014; Pasiouras, 2008b; Tsolas, 2010).

This study adopted two input and two output variables to measure marketing efficiency. The input variables include the marketing activities supporting various banking products, plus the branch network and layout. The rationale behind inclusion of promotional activities as an input variable was that earlier studies have shown that banks endeavor to achieve differentiation for their products by way of brand-building initiatives (Dibb & Simkin, 1993; Zineldin, 1996). Furthermore, banks are increasingly stepping up their marketing expenditure to attract new customers as well as to retain their existing ones.

Even though the role of branch network to provide customer service seems to be on the decline, due to technological advancement, bank branches still remain relevant and important. Hence, the second input variable included in this study was the branch network and branch layout which have been shown to be important criteria for customers when selecting banks (Almossawi, 2001; Hirtle, 2007). There is evidence that customers prefer to bank with banks that have an extensive branch network, thereby making banking more accessible. Retail banks are increasingly treating their branches as sales centers as opposed to their traditional use as service centers, and this is reflected in new, customer-friendly layouts (Cook & Hababou, 2001).

A typical product portfolio for a commercial bank consists of deposit products and loan products and these products have been treated as output variables by previous studies of bank performance. In line with similar studies (e.g., Dekker & Post, 2001), the sales of deposit products and loan products were the output variables used in this study. Both of these have been used as output variables by earlier studies in the banking industry (Paradi, Rouatt, & Zhu, 2011; Yang, 2009).

3.4. Pre- and post-merger marketing efficiency

Since the objective of this research was to evaluate the effect of M&A on the marketing efficiency of the combined firms, a comparison of the

pre- and post-merger marketing efficiency scores was necessary to facilitate detection of any improvement or deterioration subsequent to the M&A transaction. This study compared the marketing efficiency scores of the merged firms for both pre-merger and post-merger years. In line with an influential study by Cornett, McNutt, and Tehranian (2006) that measured bank performance following M&A, this study examined the marketing efficiency of the firms for the two years before and two years after the merger, with the year in which the merger took place being excluded.

Since there were two firms before the M&A deal, we constructed pro-forma values of the input and output variables for the combined firms for the pre-merger years based on the sum of the actual values of the two firms. This method of calculating the pro-forma values has been used widely by preceding studies (e.g., Healy, Palepu, & Ruback, 1992). DEA analysis was conducted on the pro-forma values to measure the pre-merger marketing efficiency of the sampled firms. These pro-forma figures were then compared with the actual performance of the combined firms, post-merger.

3.5. Data collection

Data collection for this study was conducted in two phases. In the first phase, all M&A deal-related data such as deal year and deal value were collected from the Thomson One Banker database, a comprehensive database for global M&As, which has been widely used in similar studies. Data for all input and output variables on the selected firms were then obtained from COMPUSTAT, which is also an extensively used database for financial data (e.g., Ghosh, 2001).

3.6. Sample

Following similar studies (e.g., Healy, Palepu, & Ruback, 1997), this research used a number of sample selection criteria to rule out confounding factors so as to enable us to detect any change in marketing efficiency between pre- and post-merger years. The criteria for sample selection were as follows:

- The sample was drawn from the USA since it is the biggest market for M&As, and it allowed us to rule out cross-border effects.
- The sample was restricted to national, commercial banks sharing a similar 4-digit SIC code (6021), as distinct from the two-digit SIC code utilized by other studies (e.g., Gugler et al., 2003). To the best of our knowledge, our study was the first to investigate post-merger performance at a four-digit SIC code level which offers the possibility of greater depth and stronger validity.
- The sample period was 2001–2011 because there is evidence in the literature that deals during this period were motivated by genuine value enhancement rather than market hubris (Capron, 1999; Tuch & O'Sullivan, 2007).
- Both the target and acquiring firms had to be public firms so that data on the input and output variables were available in the public domain.
- The acquirer had to acquire full ownership (100%) of the target firm so as to have full control over future strategy. Partial acquisitions were not included.
- Data on input and output variables for both the target and acquiring firms had to be available for the two years before and two years after the M&A deal.

Table 2
Inputs and outputs for DEA.

	Description	Operationalization
Input variables	<ul style="list-style-type: none"> ▪ Promotional activities of assets and liabilities products ▪ Bank branch network size 	<ul style="list-style-type: none"> ▪ Yearly dollar value of advertising expenditure ▪ Yearly dollar value of expenditure on bank branch premises
Output variables	<ul style="list-style-type: none"> ▪ Sales performance of deposit products ▪ Sales performance of loan (asset) products 	<ul style="list-style-type: none"> ▪ Yearly dollar value of total deposits ▪ Yearly dollar value of total assets

Table 3
Descriptive statistics: inputs and outputs (in USD million) [Mean (Standard deviation)].

Input and output variables	Pre-merger year (t – 2)	Pre-merger year (t – 1)	Post-merger year (t + 1)	Post-merger year (t + 2)
Advertising expenditure	29.72 (57.28)	32.83 (62.99)	35.28 (61.01)	37.55 (68.24)
Bank premises expenditure	86.64 (146.26)	94.44 (160.14)	99.97 (170.35)	104.40 (174.55)
Total deposits	22,562.99 (38,039.97)	24,810.77 (43,109.85)	28,175.12 (47,062.25)	29,060.14 (46,776.12)
Total assets	33,713.97 (58,974.99)	37,572.06 (68,665.87)	40,628.80 (68,487.99)	41,445.37 (68,141.82)

The sample size for this study was 20 M&A deals involving 40 firms which is consistent with a number of previous M&A studies (e.g. Carline, Linn, & Yadav, 2009; Fraser & Zhang, 2009). Additionally, it is consistent with other studies using Data Envelopment Analysis (Harris et al., 2000). The DEA window analysis actually increased the effective sample size to a total of 80 merged banks (20 commercial banks × 4 years). Furthermore, this sample size did not cause any bias in the DEA results because there is unanimity among the DEA experts that the number of sample units should be at least 2 M × S where M × S is the product of the number of inputs and outputs, a criterion that this research fulfilled (Cook & Seiford, 2009).

4. Findings

4.1. Sample characteristics

Table A in the appendix shows that the sampled M&A deals were approximately evenly distributed across the sample period. The median M&A deal value stood at USD 252.33 million with a minimum M&A deal value of USD 20.41 million and maximum of USD 7025 million (Table B in the appendix).

4.2. Descriptive statistics

Table 3 reports descriptive statistics for the input and output variables used in this research. It is evident that the sample firms increased their sales in the post-merger years, as measured by total deposits and total assets, but their marketing expenditure also increased. The crucial question is whether the net gain – the overall marketing efficiency – actually improved.

4.3. Hypothesis testing

To test our hypotheses, a paired sample t-test was carried out, the results of which are reported in Table 4. This table reports the results for hypotheses 1 and 2, pertaining to revenue efficiency (H1) and cost efficiency (H2). Similar to earlier studies (e.g., Sharma and Ho, 2002), the means of the pre-merger and post-merger years were compared in order to detect any changes in revenue and cost efficiency.

Table 4
Results of paired sample t-test.

Input and output variable	Pre-merger mean	Post-merger mean	T (sig)
Advertising expenditure	31.28	36.41	1.39 (0.18)
Bank premises expenditure	90.54	102.18	2.16 (0.04)
Total deposit	23,686.88	28,617.63	2.97 (0.008)
Total asset	35,643.02	41,037.08	2.53 (0.02)

Table 5
Analysis of marketing efficiency scores under constant-return-to-scale (CRS) model.

DMUs (M&A deals)	Pre-merger (t – 2) efficiency score	Pre-merger (t – 1) efficiency score	Post-merger (t + 1) efficiency score	Post-merger (t + 2) efficiency score
A	0.99137	1.00000	0.99125	0.88743
B	0.78119	0.71974	0.82071	0.83523
C	0.86327	1.00000	1.00000	0.93999
D	0.41160	0.39902	0.40153	0.44656
E	0.73062	0.89195	0.85889	0.77646
F	0.70944	0.79752	0.74619	0.70497
G	1.00000	0.99303	0.96902	0.93739
H	0.62096	0.76589	0.81804	0.72887
I	0.63790	0.62848	0.74072	0.80276
J	1.00000	1.00000	0.96530	1.00000
K	0.65055	0.65383	0.98370	1.00000
L	0.68498	0.75537	0.71755	0.78515
M	1.00000	1.00000	1.00000	1.00000
N	0.60763	0.52613	0.57393	0.64630
O	0.89346	0.93308	1.00000	1.00000
P	0.59898	0.68642	0.81649	0.72250
Q	0.85573	0.92376	0.86322	0.95880
R	0.67446	0.72284	0.86105	0.76644
S	0.70167	0.77334	0.81630	0.79928
T	0.57364	0.55573	0.67562	0.66284

Consistent with our hypothesis, the results show that the sample firms did achieve revenue efficiency in the post-acquisition years, as measured by total deposits and total assets. Our findings show that the sales of deposit products increased by 21% (p < 0.05) in the two years after the acquisition, while the sales of the asset products increased by 15% (p < 0.05).

The findings of the paired-sample t-test on the two input variables (cost efficiency) demonstrate that firms engaged in M&A spent more on advertising and on their branch networks following the merger compared to in the pre-merger years. In other words, contrary to our hypothesis (H2), firms failed to achieve cost efficiency following merger. Advertising expenditure registered a 16.4% increase (p > .05) in the post-merger years vis-à-vis pre-merger years, while outlays on the branch network rose by 13% (p < .05) in the post-acquisition years. It appears, therefore that our sampled firms spent more on marketing activities in the post-acquisition years in comparison to pre-acquisition years.

Table 6
Analysis of marketing efficiency scores under variable-return-to-scale (VRS) model.

DMUs (M&A deals)	Pre-merger (t – 2) efficiency score	Pre-merger (t – 1) efficiency score	Post-merger (t + 1) efficiency score	Post-merger (t + 2) efficiency score
A	1.00000	1.00000	1.00000	0.92038
B	0.91394	0.78648	0.93737	0.83531
C	0.91324	1.00000	1.00000	0.94770
D	0.44269	0.45216	0.65401	0.57985
E	0.78871	1.00000	1.00000	0.78957
F	1.00000	1.00000	1.00000	1.00000
G	1.00000	1.00000	0.98500	0.96866
H	1.00000	1.00000	1.00000	1.00000
I	0.67704	0.67097	0.74143	0.80573
J	1.00000	1.00000	0.96936	1.00000
K	0.83060	0.91230	0.98372	1.00000
L	0.76981	0.82320	0.71915	0.78695
M	1.00000	1.00000	1.00000	1.00000
N	0.89111	0.84876	0.70676	0.81580
O	1.00000	1.00000	1.00000	1.00000
P	0.60579	0.71025	0.82315	0.73938
Q	0.94138	0.98059	0.89284	0.95945
R	0.67852	0.73269	0.87903	0.79025
S	0.87497	0.99045	1.00000	0.98077
T	0.74405	0.66789	0.75444	0.75232

Table 7
Summary of the marketing efficiency results under CRS and VRS model.

	Marketing efficiency score under CRS model				Marketing efficiency score under VRS model			
	Pre-merger years		Post-merger years		Pre-merger years		Post-merger years	
	t – 2	t – 1	t + 1	t + 2	t – 2	t – 1	t + 1	t + 2
Mean	0.7494	0.7863	0.8310	0.8200	0.8536	0.8788	0.9023	0.8836
St. Deviation	0.1675	0.1792	0.1586	0.1476	0.1594	0.1603	0.1222	0.1213
Minimum	0.4116	0.3990	0.4015	0.4466	0.4427	0.4522	0.6540	0.5799
Maximum	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000
Number of efficient DMUs	3	4	3	4	7	9	8	6
Number of inefficient DMUs	17	16	17	16	13	11	12	14

4.4. Pre- and post-merger marketing efficiency

We then calculated and compared the net marketing efficiency scores of our sampled firms for both pre-merger and post-merger years using window analysis. Tables 5 and 6 show the results of the window analysis under both the CRS and VRS models for each of the sample banks. Following similar studies (e.g. Harris et al., 2000), the window width was set at one period. The first column contains the DMU identifier for the merging banks. The second and third columns report the marketing efficiency scores for the two years before the merger. The fourth and fifth columns show the marketing efficiency scores for the two years after the merger.

Table 7 summarizes the findings of the DEA window analysis for both the CRS (constant return to scale) and VRS (variable return to scale) models. Our analysis demonstrates that while the number of efficient and inefficient DMUs (merging banks) remained fairly consistent in the pre-merger and post-merger years, the mean marketing efficiency scores improved slightly in the post-merger years for both models. Under the CRS model, the mean marketing efficiency score of the sampled banks hovered between 0.7494 and 0.7863 in the two years leading up to the merger, rose to 0.8310 one year after the acquisition, and dipped marginally to 0.8200 in the second year after the acquisition. Under the VRS model, the marketing efficiency of the sample banks registered an improvement in the post-merger years as compared to the pre-merger years. The marketing efficiency score stood at 0.8536 and 0.8788 in the pre-merger years, but increased to 0.9023 and 0.8836 in the two years following the acquisition.

To further investigate whether there was any statistically significant difference between the pre-merger and post-merger marketing efficiency scores, and to test our third hypothesis (H3), a paired sample t-test was carried out. Rather than arbitrarily selecting and comparing one year from the pre- and post-merger years, the two year average of the marketing efficiency scores for pre-merger and post-merger years was computed and compared through the paired sample t-test. Table 8 below presents the findings of the paired sample t-test.

The paired sample t-test demonstrates that the overall marketing efficiency score of the sample banks improved on average under both the CRS and VRS models. Therefore, we find support for hypothesis H3. Under the CRS model, the two-year mean score rose from 0.7678 in the pre-merger years to 0.8255 (p < .05) in the post-merger years, a

Table 8
Results of paired sample t-test.

	Marketing efficiency score under CRS model	Marketing efficiency score under VRS model
2 year pre-merger mean	0.7678	0.8662
2 year post-merger mean	0.8255	0.8929
Pre and post-merger mean difference	0.0577	0.0268
Sig. (two tailed)	0.008	0.107
N	20	20
T (df)	2.958 (19)	1.692 (19)

Table 9
Results of Malmquist productivity index analysis.

DMUs (M&A deals)	TFPG (MI)
A1	0.99
B2	1.08
C3	1
D4	1.1
E5	0.9
F6	0.9
G7	0.99
H8	1.11
I9	1.11
J10	0.94
K11	1.46
L12	0.92
M13	1
N14	1.06
O15	1.05
P16	1.16
Q17	0.93
R18	1.19
S19	1.04
T20	1.21

growth of 7.52%. The two-year mean under the VRS model rose from 0.8662 in the pre-merger years to 0.8929 (p > .05) in the post-merger years, an average growth of 3.08%.

Additionally, we calculated the Malmquist productivity index (MPI) for one year before and one year after the merger to examine how the productivity changed between the pre and post-merger years. An analysis of the Malmquist productivity index in Table 9 shows that the productivity of eleven firms increased in the post-merger year compared to the pre-merger year, the productivity of two firms remained unchanged, and seven firms experienced a decline. Overall, our analysis shows that M&A have a positive effect on the marketing productivity of the merged firms.

4.5. Analysis of effect size

Even though statistical tests of significance reveal the likelihood that results differ from chance expectations, they cannot evaluate the magnitude of the results (Vacha-Haase & Thompson, 2004). Effect-size measurements tell us the relative magnitude of the performance effect. One of the most important characteristics of effect size is that it is independent of sample size (Xuehua & Zhilin, 2008). Hence, we calculated the effect size to further investigate the effect of merger on the post-merger marketing efficiency (Cohen, 1965; Olejnik & Algina, 2000).

We used eta squared (η^2) to calculate effect size using the following formula.

$$\eta^2 = \frac{t^2}{t^2 + df}$$

The results of eta squared (η^2) are as below (Table 10).

Table 10
Results of effect size.

DEA models	Eta squared (η^2)
Constant return to scale (CRS)	0.32
Variable return to scale (VRS)	0.13

Our analysis shows that mergers and acquisitions have an effect on the marketing efficiency of the merged firms.

5. Discussion and conclusion

M&A has been a topic of considerable interest to researchers in a wide range of disciplines for several decades. Numerous studies have been published on post-merger performance in leading Finance, Accounting and Strategic Management journals. Despite the large body of literature, it is still very difficult to draw a definite conclusion as to the effect of M&A on firm financial performance. What is even more noteworthy is that marketing performance, which is one dimension of financial performance, has remained largely unexplored.

The main objective of this study was to fill this gap in the literature by examining post-merger *marketing efficiency*. The small number of studies that have investigated post-merger marketing performance took a narrow approach to measure post-merger performance focusing only on a single variable, either sales or market share. Furthermore, this approach meant that these studies measured the effect of M&A only on *marketing outputs*, while ignoring *marketing inputs* such as expenditure on advertising, selling and distribution. In contrast, this study measured the effect of M&A both on marketing inputs, i.e. *costs*, and marketing outputs, i.e. *revenue*, leading to an assessment of the effect on the overall *marketing efficiency* of the merged firms.

The results of this study show that commercial banks engaged in M&A transactions were able to increase the sales of their combined products, thereby achieving revenue efficiency in the post-merger years. The sales of their combined deposit products increased by 21% in the two years after the acquisition while the sales of the asset products increased by 15%. It seems likely, therefore, that the combined firms were able to capitalize on the complementary product portfolios of the merging partners. In other words, the merging firms may have been able to cross-sell their products to each other's customers, contributing to this enhanced sales performance.

Our findings of improved sales performance are consistent with earlier studies. For example, Ghosh (2001) found that sales grew in the first three years following merger, although the rate of growth declined year by year, 8% growth in year 1, but 1% in year 2, and –2% in year 3. In a recent study of firms drawn from a wide cross-section of US industries, Rahman and Lambkin (2015) also find that the merged firms were able to enhance sales revenue, by 25% on average, in the three years after merger.

Our results also found, however, that the merged firms failed to achieve *cost efficiency* in their marketing activities following merger. Our findings showed that the advertising expenditure of the merged firms increased by 16.4% in the post-merger years vis-à-vis the pre-merger years. Likewise, outlays on the branch networks of the combined firms rose by 13% in the post-acquisition years. This finding is consistent with earlier studies which have shown that US banks increased other dimensions of their operating expenditure (i.e., employee costs) following merger (e.g., Hagendorff & Keasey, 2009).

Putting these input and output variables together, we found that the overall marketing efficiency of the merged firms improved following merger, but the degree of improvement was minimal. The net marketing efficiency of the sampled banks improved by a statistically significant 7.52% under the constant return to scale (CRS) model and by 3.08% under the variable return to scale (VRS), which

is not statistically significant. Even though minimal, this improvement in marketing efficiency points to the realization of some synergy between the merged firms. There was evidence of a significant growth in sales by the combined firms, compared to their previous record as separate firms. However, the achievement of this growth required them to ramp-up their expenditure on their brand networks and marketing activities, resulting in very little net gain in marketing efficiency in the post-merger period compared to that of the pre-merger period.

These findings are not directly comparable to those of the earlier studies because, to the best of our knowledge, no other study has empirically investigated post-merger *marketing efficiency*. Nonetheless, our findings are consistent with studies that measured overall post-merger efficiency gain with samples from the banking industry (e.g., Figueira & Nellis, 2009). For example, Figueira and Nellis (2009) reported that banks engaged in M&A activities were able to enhance their overall efficiency in the post-merger years.

6. Limitations and directions for future research

The sample for this study was drawn from a single industry - commercial banking, and thus the results of this study may not be generalizable to other industries which are also active in M&A. It is recommended, therefore, that future studies should draw samples from other industries to improve the generalizability of the results. Moreover, even though the sample size of this study was consistent with similar studies, future studies should be conducted with larger samples from a diverse range of industries.

The DEA literature suggests that only the most important input and output variables should be included in the model and the number of variables should be proportional to the sample size. This study focused on a set of input and output variables that are central to bank marketing, but future studies should try to examine other variables that might have an effect on marketing efficiency. For instance, customer service quality, number of service personnel, and size of the product portfolio are also likely to affect the marketing efficiency of firms.

One of the fundamental assumptions of DEA is that all DMUs are homogeneous. However, even though all the firms in the sample were commercial banks, the homogeneity of the sampled commercial banks could not be ascertained owing to lack of data availability. Future studies should endeavor to establish the homogeneity of the sampled firms by taking into account variables such as the target market segments, the range of core and add-on services, and the focus of corporate strategy, all of which might vary across different firms in the same industry.

Appendix A

Table A
Distribution of sample M&A deals during the sample period.

Merger year	Frequency
2002	1
2003	2
2004	5
2006	2
2007	2
2008	3
2010	3
2011	2
Total	20

Table B
M&A deal value of the sample firms.

	USD million
Mean	1102.8715
Median	252.3350
Minimum	20.41
Maximum	7025.00

References

- Ahn, H., & Le, M. (2014). An insight into the specification of the input–output set for DEA-based bank efficiency measurement. *Management Review Quarterly*, 64(1), 3–37.
- Almossawi, M. (2001). Bank selection criteria employed by college students in Bahrain: an empirical analysis. *The International Journal of Bank Marketing*, 19(3), 115–125.
- Bahadir, S. C., Bharadwaj, S. G., & Srivastava, R. K. (2008). Financial value of brands in mergers and acquisitions: Is value in the eye of the beholder? *Journal of Marketing*, 72(6), 49–64.
- Baldwin, J., & Gorecki, P. (1990). Mergers placed in the context of firm turnover. In *Bureau of the Census, 1990 Annual Research Conference, Proceedings* (pp. 53–73). Washington DC: US Department of Commerce.
- Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, 30(9), 1078–1092.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Beccalli, E., & Frantz, P. (2013). The determinants of mergers and acquisitions in banking. *Journal of Financial Services Research*, 43(3), 265–291.
- Capron, L. (1999). The long term performance of horizontal acquisition. *Strategic Management Journal*, 20, 987–1018.
- Capron, L., & Hülland, J. (1999). Redeployment of brands, sales forces, and general marketing management expertise following horizontal acquisitions: resource-based view. *Journal of Marketing*, 63(2), 41–54.
- Carline, N. F., Linn, S. C., & Yadav, P. K. (2009). Operating performance changes associated with corporate mergers and the role of corporate governance. *Journal of Banking & Finance*, 33(10), 1829–1841.
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2(6), 429–444.
- Clemente, M. N., & Greenspan, D. S. (1996). Getting the biggest marketing bang from the merger. *Mergers & Acquisitions: The Dealer's Journal*, 31(1), 19.
- Coelli, T., & Perelman, S. (1999). A comparison of parametric and non-parametric distance functions: With application to European railways. *European Journal of Operational Research*, 117(2), 326–339.
- Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. Springer Science & Business Media.
- Cohen, J. (1965). Some statistical issues in psychological research. In B. B. Wolman (Ed.), *Handbook of clinical psychology* (pp. 95–121). New York: Academic Press.
- Cook, W. D., & Hababou, M. (2001). Sales performance measurement in bank branches. *Omega*, 29(4), 299–307.
- Cook, W. D., & Seiford, L. M. (2009). Data envelopment analysis (DEA) – thirty years on. *European Journal of Operational Research*, 192(1), 1–17.
- Cornett, M. M., McNutt, J. J., & Tehranian, H. (2006). Performance changes around bank mergers: Revenue enhancements versus cost reductions. *Journal of Money, Credit and Banking*, 38(4), 1013–1050.
- Day, G. S. (2011). Closing the marketing capabilities gap. *Journal of Marketing*, 75(4), 183–195.
- Dekker, D., & Post, T. (2001). A quasi-concave DEA model with an application for bank branch performance evaluation. *European Journal of Operational Research*, 132(2), 296–311.
- Dibb, S., & Simkin, L. (1993). The strength of branding and positioning in services. *International Journal of Service Industry Management*, 4(1), 25–35.
- Donthu, N., & Yoo, B. (1998). Retail productivity assessment using data envelopment analysis. *Journal of Retailing*, 74(1), 89–105.
- Doyle, P. (2001). *Value-based marketing*. Chichester: Wiley.
- Ficery, K., Herd, T., & Pursche, B. (2007). Where has all the synergy gone? The M&A puzzle. *Journal of Business Strategy*, 28(5), 29–35.
- Figueira, C., & Nellis, J. (2009). Bank merger and acquisitions activity in the EU: Much ado about nothing? *Service Industries Journal*, 29(7), 875–886.
- Fraser, D. R., & Zhang, H. (2009). Mergers and long-term corporate performance: Evidence from cross-border bank acquisitions. *Journal of Money, Credit and Banking*, 41(7), 1503–1513.
- Ghosh, A. (2001). Does operating performance really improve following corporate acquisitions? *Journal of Corporate Finance*, 7(2), 151–178.
- Ghosh, A. (2004). Increasing market share as a rationale for corporate acquisitions. *Journal of Business Finance & Accounting*, 31(1/2), 209–247.
- Goldberg, L. G. (1973). The effect of conglomerate mergers on competition. *The Journal of Law & Economics*, 16(1), 137–158.
- Gugler, K., Mueller, D. C., Yurtoglu, B. B., & Zulehner, C. (2003). The effects of mergers: An international comparison. *International Journal of Industrial Organization*, 21(5), 625–653.
- Hagedorff, J., & Keasey, K. (2009). Post-merger strategy and performance: Evidence from the US and European banking industries. *Accounting and Finance*, 49(4), 725–751.
- Haleblian, J., Devers, C. E., McNamara, G., Carpenter, M. A., & Davison, R. B. (2009). Taking stock of what we know about mergers and acquisitions: A review and research agenda. *Journal of Management*, 35(3), 469–502.
- Harris, J., Ozgen, H., & Ozcan, Y. (2000). Do mergers enhance the performance of hospital efficiency? *Journal of the Operational Research Society*, 801–811.
- Haugland, S. A., Myrvtveit, I., & Nygaard, A. (2007). Market orientation and performance in the service industry: A data envelopment analysis. *Journal of Business Research*, 60(11), 1191–1197.
- Healy, P. M., Palepu, K. G., & Ruback, R. S. (1992). Does corporate performance improve after mergers. *Journal of Financial Economics*, 31(2), 135–175.
- Healy, P. M., Palepu, K. G., & Ruback, R. S. (1997). Which takeovers are profitable? Strategic or financial? *Sloan Management Review*, 38(4), 45–57.
- Hirtle, B. (2007). The impact of network size on bank branch performance. *Journal of Banking & Finance*, 31(12), 3782.
- Homburg, C., & Bucerius, M. (2005). A marketing perspective on mergers and acquisitions: How marketing integration affects postmerger performance. *Journal of Marketing*, 69(1), 95–113.
- Hooley, G., Broderick, A., & Möller, K. (1998). Competitive positioning and the resource-based view of the firm. *Journal of Strategic Marketing*, 6(2), 97–116.
- Hooley, G. J., Greenley, G. E., Cadogan, J. W., & Fahy, J. (2005). The performance impact of marketing resources. *Journal of Business Research*, 58(1), 18–27.
- Kao, C., & Liu, S.-T. (2014). Multi-period efficiency measurement in data envelopment analysis: The case of Taiwanese commercial banks. *Omega*, 47, 90–98.
- King, D. R., Dalton, D. R., Daily, C. M., & Covin, J. G. (2004). Meta-analyses of post-acquisition performance: Indications of unidentified moderators. *Strategic Management Journal*, 25(2), 187–200.
- Knudsen, T. R., Finskud, L., Törnblom, R., & Hogna, E. (1997). Brand consolidation makes a lot of economic sense. *McKinsey Quarterly*, 189–193.
- Martynova, M., & Renneboog, L. (2008). A century of corporate takeovers: What have we learned and where do we stand? *Journal of Banking & Finance*, 32(10), 2148–2177.
- Mizik, N., & Jacobson, R. (2003). Trading off between value creation and value appropriation: The financial implications of shifts in strategic emphasis. *Journal of Marketing*, 67(1), 63–76.
- Morgan, N. A., Vorhies, D. W., & Mason, C. H. (2009). Market orientation, marketing capabilities, and firm performance. *Strategic Management Journal*, 30(8), 909–920.
- Mueller, D. C. (1985). Mergers and market share. *The Review of Economics and Statistics*, 67(2), 259–267.
- Olejnik, S., & Algina, J. (2000). Measures of effect size for comparative studies: Applications, interpretations, and limitations. *Contemporary Educational Psychology*, 25(3), 241–286.
- Paradi, J. C., Rouatt, S., & Zhu, H. (2011). Two-stage evaluation of bank branch efficiency using data envelopment analysis. *Omega*, 39(1), 99–109.
- Pasiouras, F. (2008a). Estimating the technical and scale efficiency of Greek commercial banks: The impact of credit risk, off-balance sheet activities, and international operations. *Research in International Business and Finance*, 22(3), 301–318.
- Pasiouras, F. (2008b). International evidence on the impact of regulations and supervision on banks' technical efficiency: An application of two-stage data envelopment analysis. *Review of Quantitative Finance and Accounting*, 30(2), 187–223.
- Rahman, M., & Lambkin, M. (2015). Creating or destroying value through mergers and acquisitions: A marketing perspective. *Industrial Marketing Management*, 46, 24–35.
- Sharma, D. S., & Ho, J. (2002). The impact of acquisitions on operating performance: Some Australian evidence. *Journal of Business Finance & Accounting*, 29(1–2), 155–200.
- Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage breadth, depth, and life cycle effects. *Journal of Management*, 37(5), 1390–1412.
- Srivastava, R. K., Fahey, L., & Christensen, H. K. (2001). The resource-based view and marketing: The role of market-based assets in gaining competitive advantage. *Journal of Management*, 27(6), 777–802.
- Swaminathan, V., Groening, C., Mittal, V., & Thomaz, F. (2014). How achieving the dual goal of customer satisfaction and efficiency in mergers affects a firm's long-term financial performance. *Journal of Service Research*, 17(2), 182–194.
- Thomas Reuters (2014). Mergers and acquisitions review. http://dmi.thomsonreuters.com/Content/Files/4Q2014_Global_MandA_Legal_Advisory_Review.pdf (accessed on January 30, 2016)
- Tsolas, I. E. (2010). Modeling bank branch profitability and effectiveness by means of DEA. *International Journal of Productivity and Performance Management*, 59(5), 432–451.
- Tuch, C., & O'Sullivan, N. (2007). The impact of acquisitions on firm performance: A review of the evidence. *International Journal of Management Reviews*, 9(2), 141–170.
- Vacha-Haase, T., & Thompson, B. (2004). How to estimate and interpret various effect sizes. *Journal of Counseling Psychology*, 51(4), 473–481.
- Vorhies, D. W., & Morgan, N. A. (2005). Benchmarking marketing capabilities for sustainable competitive advantage. *Journal of Marketing*, 69(1), 80–94.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180.
- Xuehua, W., & Zhilin, Y. (2008). A meta-analysis of effect sizes in international marketing experiments. *International Marketing Review*, 25(3), 276–291.
- Yang, Z. (2009). Assessing the performance of Canadian bank branches using data envelopment analysis. *Journal of the Operational Research Society*, 60(6), 771–780.
- Zineldin, M. (1996). Bank strategic positioning and some determinants of bank selection. *The International Journal of Bank Marketing*, 14(6), 12–22.