

Merger and acquisition and synergy: a meta regression analysis

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Abstract

Purpose – The aim of this study is to perform an empirical literature review (meta regression analysis) to identify the factors that contribute to synergies in mergers and acquisitions, examine publication bias, and explore heterogeneity across existing studies.

Design/methodology/approach – This study uses meta regression analysis, utilizing 375 *t*-statistics from 38 empirical studies. We assess potential publication bias and explore the sources of heterogeneity in the findings across these studies.

Findings – The FAT-PET test results show no publication bias in the literature. Revenue ratio, leverage, asset size, and Q ratio significantly impact synergy, while the acquirer's liquidity amplifies synergy. Most regulatory variables have no effect on synergy. The payment method used in deals (cash or equity) is crucial in explaining synergies. Past studies have mainly focused on industry relatedness, target type and acquisition type (hostile or friendly).

Research limitations/implications – Financial drivers like leverage, profitability and the Q-ratio, along with market returns and liquidity, play a significant role in synergy realization. Regulatory variables appear less influential, challenging traditional regulatory-based theories. Larger firms with more assets experience higher post-merger profitability, supporting resource-based theories. Practically, firms should focus on liquidity management, leverage decisions and asset size when planning M&As. Strategic alignment in target selection, payment method (cash vs. equity) and operational integration are also crucial for maximizing synergy outcomes.

Originality/value – To the author's knowledge, this research is the first empirical meta regression analysis conducted in the field of mergers and acquisitions.

Keywords Merger and acquisition, Meta regression analysis, Financial synergy, Operating synergy, Publication bias

Paper type Research article

1. Introduction

Mergers and Acquisitions (“M&As”) are a prevalent method of business expansion. After the year 2000, more than 790,000 transactions have been registered globally, totalling more than 57 trillion dollars ([Institute for Mergers, Acquisitions and Alliances, 2019](#)).

Over the past few decades, scholars have been particularly interested in the success effects of M&As. The most popular reason for looking for M&As is to upsurge the worth of the acquiring entity's stakeholders ([Tuch & O'Sullivan, 2007](#)). “Synergies” can be created, market share and negotiating power can be increased, and risk diversification can be strengthened by acquisitions.

Synergies may come from a variety of sources. Financial synergies are created when a company's cost of capital is reduced, for example, by tax incentives or increased leverage ([Chatterjee, 1986](#)). Larger economies of scale and reach, greater efficiency, or access to new sectors, consumers or technology are some of the other drivers of synergies ([Salter & Weinhold, 1978](#)).

The objective of this article is to perform an empirical literature review (meta regression analysis, MRA) to identify the factors that contribute to synergies in mergers and acquisitions. Meta-analysis is a structured framework to analyse and integrate the extant research and



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studies (Stanley, 2001). Each research is presented as a single result with details on the nature of the statistical association when meta-analysis is used.

We gathered 38 studies that presented estimates of variables that contribute to financial and operational synergies, as well as many facets of research design, such as variable description, research framework, data types, study periods and statistical measures. We look for possible publication bias in the studies and investigate the origins of heterogeneity in the results of different investigations.

The remainder of this article is organized as follows. The papers considered in the MRA are briefly reviewed in Section 2. The objectives and methods of the article are described in Section 3. Section 4 covers the application of the technique and the findings of the analysis, while Section 5 presents the conclusion.

2. Literature review

Corporate restructuring refers to any modification in an organization's portfolio, capital structure or ownership through inorganic means. This change can occur through various methods, such as the acquisition of a company, a merger or demerger involving one or more companies, delisting or the sale of a company or its key asset. According to Godbole (2015), corporate restructuring refers to any inorganic change made to a company's ownership or capital structure. The most common method of corporate restructuring is through mergers and acquisitions, which primarily serves as a strategy for inorganic growth. "Mergers" and "Acquisitions" are a prevalent method of business expansion. After the year 2000, more than 790,000 transactions have been registered globally, totalling more than 57 trillion dollars (Institute for Mergers, Acquisitions and Alliances, 2019).

The concept that the combined value and capabilities of two companies exceed the total value of each individually is known as synergy. This anticipated financial benefit from merging firms is often a driving factor behind mergers. When a company's stock price increases after a merger due to the synergistic effects, shareholders benefit. The expected synergy from a merger can be attributed to various factors, including higher revenues, combined expertise and technology, or cost reductions.

The extra value created by merging two businesses is known as synergy, because it offers chances that independent businesses might not have (Seth, 1990). The relation can be expressed as $U(AB) > U(A) + U(B)$, where $U(AB)$ corresponds to the worth of the merged firms, and the separate value of A and B refers to $U(A)$ and $U(B)$. It implies that the meaning of synergy is the gap between the worth of the merged entities and the stand-alone worth of the two companies, $S = U(AB) - (U(A) + U(B))$.

Mixed conclusions have been found in studies that evaluate synergies in terms of operating performance following mergers and acquisitions. While research on pretax cash flows, such as that conducted by Linn and Switzer (2001), Moeller and Schlingemann (2005), Switzer (1996), Parrino and Harris (1999), and Powell and Stark (2005), has demonstrated a rise in post-acquisition cash flows; other studies have found a general decline in cash flow (Kruse, Park, & Suzuki, 2003), lower profitability (Meeks, 1977), an inconsiderable increase in operational efficiency after the acquirer's acquisition (Herman & Lowenstein, 1988; Lev & Mandelker, 1972; Ghosh, 2001; Sharma & Ho, 2002) and a significant decrease in return on asset (Yeh & Hoshino, 2002; Dickerson, Gibson, & Tsakalotos, 1997).

2.1 Theoretical framework

The following theoretical approaches provide distinct insights into what factors influence success or failure in the analysis of M&A performance determinants:

- (1) Resource-Based View (RBV): Holds that the ability of the acquirer to locate, acquire, and incorporate uncommon, invaluable, distinctive and irreplaceable resources is essential to the success of M&A transactions (Barney, 1991; Hitt, Harrison, & Ireland, 2001).

- (2) Dynamic Capabilities: According to Teece (2007) and Helfat et al. (2009), it is essential to extend the RBV by emphasizing the role that organizational processes play in rearranging resources to accommodate quickly changing environments.
- (3) Organizational Learning Theory: Highlights the value of acquisition experience and knowledge transfer and proposes that businesses can improve M&A performance through experiential learning (Barkema & Schijven, 2008).
- (4) Agency Theory: Draws attention to possible disputes between management and shareholders and provides information on how incentive alignment and governance frameworks affect M&A choices and results (Meckling & Jensen, 1976; Masulis, Wang, & Xie, 2007).

2.2 Financial synergy

Tax savings, diversification, a higher leverage potential, and ways for surplus capital are examples of financial synergies. Higher cash balances and lower discount rates are two examples of how they manifest themselves (Aswath, 2009). The realization of financial synergies can be studied in the terms of offer premium paid to target shareholders (Kim & Canina, 2013), coinsurance effects and asset liquidity (Mooney & Shim, 2015), of post-merger integration duration (Huang, Pierce, & Tsyplakov, 2015) and so on.

Merged firms have much higher asset productivity than their respective industries, resulting in higher cash flow yields. For companies with extremely overlapping assets, this performance improvement is particularly significant (Healy, Palepu, & Ruback, 1992). On the contrary Dickerson et al. (1997), Martynova, Oosting, and Renneboog (2007) and Mailanyi (2014) show no evidence that acquisition has a net beneficial effect on firm performance after an acquisition in terms of profitability.

2.3 Operating synergy

Studies suggest creation of long-term “operating synergies” which is constructive and substantial (Hoberg & Phillips, 2010). In addition, cutbacks in capital expenditure are the most important cause of operating synergies, while market power is not important after acquisition. In addition, both total and operating synergies in targeted deals are greater (Hamza, Sghaier, & Thraya, 2016). Devos, Kadapakkam, and Krishnamurthy (2009) also suggest that operating synergies contribute more to the total synergies.

Operating cash flow has been one of the significant variables studied in the literature. The occurrence of irregular operational cash flow returns after a merger has been proven in several research (Yen & Andre, 2007). While mergers based on compatible resource combinations result in a modest increase in cash flow return, mergers looking for market share synergies result in virtually no shift in cash flow return (Junge, 2014).

3. Objectives and methodology

3.1 Objectives of the study

The aim of this study is to explore the following research questions:

- (1) To do empirical literature review via Meta-Analysis, where Y is synergies and X is all the factors that lead to synergies.
- (2) The presence of “publication bias” in the literature on synergy.
- (3) The presence of heterogeneity in the reported results in existing literature.

3.2 Methodology

Step 1: Identifying the dataset and Literature Retrieval Process

Step 2: Effect Size Measure using Partial Correlation Coefficient, where Y is synergies and X is all the factors that lead to synergies.

Step 3: Publication Selection Bias in literature on synergies in M&A was conducted using Funnel Asymmetry Test (FAT) and Precision Effect Test (PET).

Step 4: Step 4: Identifying the heterogeneity in the relationship between synergies and all factors contributing to synergies through MRA.

Step 1: The Dataset of the effects of the accounting variables on synergies: We extract data from existing research as a first step in our meta-analysis. We concentrate on research that estimate synergies in mergers and acquisitions. To measure between and within research effects, [Stanley and Jarrell \(1998\)](#) elucidate the panel MRA equation as:

$$Y_{it} = \alpha_0 + \alpha_1 X_{it} + \sum_j \alpha_j W_{jit} + \mu_{it} \quad (1)$$

Where; Y_{it} is the dependent variable (synergies measure), X_{it} represents explanatory/ accounting variables, W_{jit} is the vector of the other control variables which takes into account other parameters considered important for synergies), i -cross-sectional effect, t -time period and μ_{it} is the error term.

Additionally, we only consider papers that offer a metric of precision of the effect of accounting variables on synergies, as precision is critical for modern meta-analysis techniques (standard error, t -statistics and p -values). The resulting dataset contains 38 studies. We find every study is heterogenous in its approach, which indicates that different researchers have used different variables to capture synergies. Likewise, we face a very heterogenous approach used by extant studies while defining Y variable (the Y variable of the present study is reported in [Table 1](#)). In the present study, we have defined synergies on a broader parameter. When it comes to defining of X or factors leading to synergies, we have observed that extant studies have used various variables like leverage, size, product differentiation, location diversification, tobin Q, corporate governance to name a few ([Carline, Linn, & Yadav, 2002](#), [Carline, Linn, & Yadav, 2009](#)). As a result, we gather all estimates, yielding 375 distinct observations.

Step 2: Effect size measure using partial correlation coefficient: We are concerned with the coefficient α_1 from [equation \(1\)](#). The accounting factors' influence on synergies is captured by the regression coefficient. The estimates are also not exactly comparable since various research employed diverse units of measurement. It is important to test t -statistics because they are used to quantify the relationship between synergies and the factors that leads to synergies. Using a numerical scale, an effect size measures the strength of an interaction between two variables. It's a mathematical measure that reveals the intensity and trajectory of a relationship.

The expression for the "Partial Correlation Coefficient" ("PCC") is as shown in:

$$r_{ij} = \frac{t_{ij}}{\sqrt{t_{ij}^2 + df_{ij}}} \quad (2)$$

Where r_{ij} : "partial correlation coefficient", t_{ij} : t -statistics of the studies, df_{ij} : degrees of freedom i and j denotes the i^{th} regression estimation of the j^{th} study.

Table 1. Summary statistics

Study ID	Number of t-statistics	Min	Mean	Max	Standard deviation	Kurtosis	Skewness	Initial year	Last year
1	4	0.56	2.9075	6.78	2.929	−0.888	0.928	1991	2009
2	8	0.000007	0.0002	0.0004	0.000	−2.085	0.238	1998	2008
3	18	−2.74	−1.2429	2.088	1.228	1.734	0.912	1978	2007
4	9	−0.039	−0.0099	0.022	0.024	−1.697	0.254	1996	2008
5	8	−1.283	1.6798	8.126	3.746	−0.038	1.338	2000	2002
6	2	−0.735	−0.3385	0.058	0.561			1980	2004
7	8	0.38	1.0175	1.84	0.513	−0.243	0.914	1977	1996
8	13	−0.261	0.8425	3.071	0.906	1.931	1.931	1988	2008
9	1	−3.757	−3.7570	−3.757	−3.757	−3.757	−3.757	1998	2011
10	2	−4.85	−2.7150	−0.58	3.019			1984	1988
11	10	0.08	0.9790	2.43	0.840	−0.860	0.667	1998	2003
12	16	−19.583	−4.5009	0.823	8.060	−0.334	−1.284	1980	1999
13	4	−0.175	0.0170	0.223	0.168	−0.075	0.222	2001	2011
14	2	2.1	2.1500	2.2	0.071			1979	1984
15	8	2.05	2.7088	3.43	0.510	−1.640	0.130	1990	2000
16	6	−1.413	−0.8442	−0.4	0.346	0.898	−0.644	1996	2004
17	12	−0.174	0.0325	−0.061	0.237	−1.631	0.687	1980	1999
18	4	−0.068	0.0075	0.083	0.082	−5.851	0.000	1997	2006
19	10	−0.093	0.0787	0.254	0.126	−1.599	0.174	1999	2011
20	8	−1.36	0.1788	1.79	1.402	−2.417	0.078	1987	2007
21	4	−0.0189	−0.0163	−0.0145	0.002	−1.061	−1.061	1948	1977
22	7	0.4399	0.9070	2.326	0.641	5.989	2.383	1980	2004
23	14	−0.007	−0.0043	−0.001	0.003	−2.263	0.056	1994	2004
24	2	2.122	3.1260	4.13	1.420			1993	2005
25	10	−1.387	−0.1877	0.041	0.441	7.705	−2.730	1996	2002
26	14	−2.92	−0.5359	2.18	2.442	−2.342	0.000	1964	2004
27	1	−1.38	−1.3800	−1.38	−1.380	−1.380	−1.380	1975	2002
28	8	−0.013	0.0075	0.029	0.014	−0.064	0.371	1998	2015
29	6	−1.9027	−0.8818	0.4417	1.087	−2.905	0.132	2000	
30	20	0.27	2.4490	10.24	2.537	5.498	2.410	1995	2007
31	26	−0.28	0.7246	2.89	1.100	−1.310	0.747	1982	2015
32	1	−1.612	−1.6120	−1.612	−1.612	−1.612	−1.612	2000	2016
33	18	−0.67	−0.0142	0.202	0.173	13.758	−3.422	1995	2008
34	34	0.0451	0.5901	1.7507	0.492	0.701	1.239	1984	2014
35	4	−0.59	1.6100	4.08	1.915	1.539	0.419	1977	2004
36	4	22.303	22.66	23.5	0.566	3.854	1.952	1950	1994
37	10	1.059	2.2839	3.846	1.155	−2.008	0.258	1979	1981
38	39	−4.5	−0.4528	0.329	0.981	14.571	−3.820	1994	2003

Source(s): Authors’ own estimation

The PCC has a similar sign as the coefficient α_1 in [equation \(1\)](#), which is linked to the accounting variables. To use contemporary meta-analysis techniques, the associated standard error for each partial correlation coefficient must be obtained. The following equation can be used to calculate the standard error ([Fisher, 1992](#)):

$$SEr_{ij} = \frac{r_{ij}}{t_{ij}} \tag{3}$$

Where SEr_{ij} denotes the standard error of the PCC r_{ij} and t_{ij} is the t -statistic from the j^{th} study’s i^{th} regression.

Since the PCC are not normally distributed, we use the “Fisher’s Z transformation” to find a normal distribution of effect sizes ([Card et al., 2011](#)).

$$zr_{ij} = 0.5 \ln \left(\frac{1 + r_{ij}}{1 - r_{ij}} \right) \quad (4)$$

where, zr_{ij} : Fisher transformation using log normal function. We may use this modification to create normal confidence intervals in our assessments. To measure the effect, we use [Babecky and Havranek \(2014\)](#), [Cohen \(1988\)](#) and [Doucouliagos \(2011\)](#) basic arithmetic mean, fixed-effect estimator and random effect estimator, if the PCC values are smaller than 0.07, there is no significant effect; more than 0.07 but less than 0.17, there is a negligible effect; more than 0.17 but less than 0.33, there is an intermediate effect; and greater than 0.33, there is a large impact.

Step 3: Publication Bias: Publication bias skews the sample in meta-analyses, leading to inaccurate conclusions about the relationship between accounting variables and synergies. Researchers may avoid publishing results that diverge from existing literature, causing studies with insignificant outcomes to remain unpublished ([Rosenthal, 1979](#); [Stanley, 2008](#)). This misreporting can understate or overstate average effect estimations, leading to misleading conclusions ([Stanley, 2005](#); [Babecky & Havranek, 2014](#)). Therefore, prior research must be carefully evaluated to understand the relationship between synergy and its influencing factors.

Funnel Graphs: In meta-analysis, funnel plots are extremely useful for detecting publication bias. The use of a funnel plot to present publication prejudice is also recommended by [Stanley and Doucouliagos \(2010\)](#). Precision rises as the size of the components under study becomes larger, and the funnel becomes asymmetric due to low t -statistics ([Babecky & Havranek, 2014](#)). The funnel graph is a scattered diagram of precision vs partial correlation coefficient. In the nonexistence of publication selection, an inverted funnel is the anticipated form. Evidence of publishing bias suggests that the plot is skewed on one side or the other. To identify publication bias, [Egger, Smith, Schneider, and Minder \(1997\)](#) and [Stanley and Doucouliagos \(2010\)](#) proposed the following regression model:

$$r_{ij} = \gamma_0 + \gamma_1 SEr_{ij} + \mu_{ij} \quad (5)$$

Where, r_{ij} : Partial correlation coefficient, SEr_{ij} : Standard error of PCC.

γ_0 and γ_1 : True effects and measure of magnitude, respectively, i and j : i^{th} regression estimates of j^{th} study.

Funnel Asymmetry Test and Precision Estimate Test: Various studies have employed a variety of accounting variables, which can be quite diverse in terms of their dimensions. As a result, standard error varies according to the type of variable utilized. As a result, distinguishing the dimensional effect of selection bias may be challenging. Furthermore, because the explanatory variable in [equation \(5\)](#) equals the response variable's calculated standard deviation, the equation is heteroskedastic. To solve the issue of heteroskedasticity of the error term, [Equation \(5\)](#) should be divided by standard error, according to [Doucouliagos and Stanley \(2009\)](#). We can re-write weighted least square (WLS) form of [equation \(6\)](#) ([Rose & Stanley, 2005](#); [Stanley, 2008](#)). This is known as Fixed effects in meta-analysis estimator ([Babecky & Havranek, 2014](#)).

$$\frac{PCC_{ij}}{SEpcc_{ij}} = t_{ij} = \beta_0 \left(\frac{1}{SEpcc_{ij}} \right) + \beta_1 + \mu_{ij} \left(\frac{1}{SEpcc_{ij}} \right) = \beta_1 + \beta_0 \left(\frac{1}{SEpcc_{ij}} \right) + v_{ij} \quad (6)$$

Where t_{ij} is t stats of i^{th} regression estimation of j^{th} study, SEr_{ij} is Standard error of partial correlation coefficient. The equation can be described as Funnel Asymmetry Test (FAT). It examines for publication bias by rotating the funnel plot's axis and dividing the resultant

vertical axis by the computed standard error. We should use the fixed effect multi-level model to adjust for potential dependency of estimates within the research because we are using various estimates (Havranek & Irsova, 2011; Doucouliagos & Stanley, 2009). For the robustness check, we follow Hamilton (2006), as in it, the iterations are run by reweighted least square, FAT-PET, which is proposed by Stanley (2008).

$$t_{ij} = \beta_1 + \beta_0 \left(\frac{1}{SEpk_{ij}} \right) + \alpha_j + \varepsilon_{ij} \quad (7)$$

The overall error term v_{ij} from Equation (6) now has two components, with α_j representing the study level random effect and ε_{ij} representing the estimate level disturbances. In traditional panel data analysis, this specification is the same as using the random effect model. When there is large heterogeneity between research, the mixed effect method gives each one about the equal weight.

Step 4: Capturing the heterogeneity: Meta regression differs from simple regression in two ways. Because studies are weighted by the precision of their individual effect estimates, larger studies have a greater influence in determining the relationship than smaller studies. Second, it allows for residual heterogeneity among intervention effect not modelled by the explanatory variable. The study investigates this heterogeneity using an MRA given by Stanley and Doucouliagos (2013) and Stanley (2008):

$$t_{ij} = \beta_1 + \beta_0 \left(\frac{1}{SEpcc_{ij}} \right) + \sum_{k=1}^K \frac{\gamma_k Z_{ijk}}{SEpcc_{ij}} + \alpha_j + \varepsilon_{ij}, k = 1, \dots, K \quad (8)$$

Where, t_{ij} is reported t -statistics, $SEpcc_{ij}$ is the standard error of PCC, Z are moderator variables, γ_k is the regression coefficients reflecting biasing effect and k is the total number of moderator variables (Stanley & Jarrell, 1998). MRA synthesizes the extant findings by identifying and reflecting significant study characteristics or model specifications in Z_{ijk} .

4. Application of methodology

Step 1: Procedure for retrieving the literature

To be able to perform a reliable meta-analysis, we devised guidelines for highlighting appropriate studies within a wide body of prior research. As a result, we decided to include research that:

- (1) Consider that synergy (“Financial” and “Operating”) as the dependent variable, and that an analytical measurement of synergy is available.
- (2) Investigate either a time series or a cross-section or a panel of study.
- (3) Give adequate statistical data, particularly on the coefficient and associated t -statistic or standard error of the independent variables that contribute to financial or operating synergy.
- (4) Examination of variable in terms of a multivariate regression model.
- (5) Those studies are considered where the synergy estimation for pre-post analysis has been done for minimum two years i.e. two years before and after the mergers & acquisition has taken place. Some studies have been excluded due to methodology used other than regression analysis, providing no t -stat values.

We began our quest for related publications by searching Scopus' electronic library using the word "synergy" and "Accounting Variables". We review the abstracts of the papers and save any study that has a probability of getting empirical estimations of accounting variables' effects on synergy (Stanley *et al.*, 2013). Scopus, which is our main database, yielded 898 studies with a diverse set of hypotheses and methodological approaches. 360 studies related to Merger & Acquisition estimates were identified by reviewing the paper after studying the abstract. An analysis can put forward the outcomes of one or more model specifications, meaning thereby that different measures of synergy are used by different authors. Some studies have worked on Abnormal Returns, some on Financial synergy and others on Operating synergy. Still, there are studies that worked on overall synergy gains in the M&As. Some studies have normalized the data by dividing it with asset value or sales. Additionally, a single paper may have employed multiple measures of synergy, using different variables as proxies in its model specification. Even when only one measure of synergy is used, the study may examine various financial parameters either individually or in an integrated manner. Of these studies, 141 studies were identified to be related to different types of synergies that are studied for the firms undergoing Mergers & Acquisition. When searching for related literature in two alternate electronic data bases, "JSTOR" and "Google Scholar", we used the same approach. This research yielded several studies, including 57 additional studies (JSTOR = 6 and Google Scholar = 51). Of these 198 studies related to various types of synergies, we identified those studies that are related to Financial and Operating synergy in particular, that use multivariate regression methodology and undertake a pre-post analysis for a minimum of two years. We found 38 studies after conducting exhaustive literature research based on our three inclusion criteria. The study analysed 375 *t*-statistics from the 38 studies. Wherever possible, we used the *t*-statistics from a study's major regressions as well as robustness tests.

The PRISMA approach is used during this study to report systematic reviews and meta-analyses. In the context of Systematic Literature Reviews (SLRs), the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) technique is well-known for being a thorough and methodical way to perform a careful synthesis of previous research. The PRISMA method, which is distinguished by its rigorous and systematic structure, uses a series of predetermined steps to determine the identification, screening, eligibility evaluation and inclusion of relevant studies, and it ends with a thorough summary of the body of evidence in a particular field (Page *et al.*, 2021).

Describing and Summarizing the Data: From the shortlisted studies, we obtained 375 estimates of Financial synergies, Operating synergies and Realised returns. The descriptive stats of the 38 studies used in the meta-analysis are summarized in Table 1. Maximum *t*-value among the stated studies is 23.5 and minimum *t*-value is -19.583. Study id 36 has the highest mean value of 22.6550 and study id 12 has the highest standard deviation of 8.060. Out of 38 stated studies, 23 studies have kurtosis less than zero indicating relatively flat distribution.

The BOX PLOT Figure 1 helps to display distribution of the dataset, exhibiting minimum value, maximum value, median value, value at 25th and 75th percentile. It indicates distribution of data, outliers in data and skewness in factors used in different studies. The maximum outliers are present in study id 30 (2) (Huang *et al.*, 2015), followed by study id 8 (1) (Junge, 2014), 9 (1) (Mohanty & Mishra, 2014) and 38(1) (Seo, Lee, & Wang, 2010). Box plot indicates that studies across are not normally distributed and are skewed.

Step 2: Measuring the effect size of accounting variables on synergies

The results of effect size are reported in Table 2 and graphically represented in graph 2 with degree of freedom on vertical axis and PCC on the horizontal axis. With a 95% confidence interval, the basic arithmetic mean provides a PCC of 0.02 (0.004, 0.037). The fixed effects and random effects models, as defined by Borenstein, Cooper, Hedges, and Valentine (2009) and Card *et al.* (2011), can be used to generate more suitable summary statistics that account for the estimate precision.

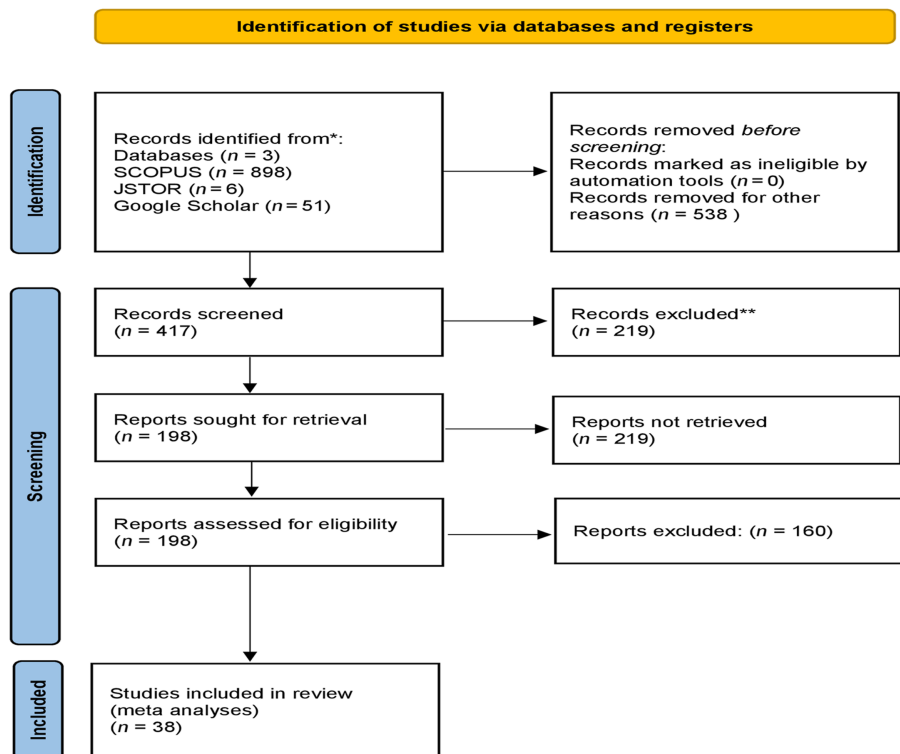


Figure 1. Prisma flow chart for the systematic literature review

Table 2. Estimating effects of accounting variables on synergy

Method	Estimated effect	95% confidence interval	
Simple Average	0.0203	0.004	0.03656
Fixed Effects	0.025	0.022	0.028
Random Effects	0.017	0.005	0.029

Source(s): Authors' own estimation

All reported findings in the fixed effects model are derived from the same population. We weight every estimation by the inverse of its variance to obtain the fixed effects estimate. With a 95% confidence interval, the model generates a PCC of 0.025 (0.022, 0.028), which is a little higher than the simple mean. This finding indicates that as greater weight is given to larger studies, the average effect increases, suggesting that there is no selection bias. The method yields a PCC of 0.017 with a 95% confidence interval of (0.005, 0.029). The random effects model assumes that the variations among the underlying effects are random and unobservable.

Table 2 shows a small effect on synergy, with values between 0.07 and 0.17 (Cohen, 1988; Doucouliagos, 2011). The funnel graph in Figure 2, which plots effect size against degrees of freedom and partial correlation coefficient, shows points clustered on the right, mostly under 0.2, indicating a very small effect. This also suggests a positive association between synergies and their influencing factors.

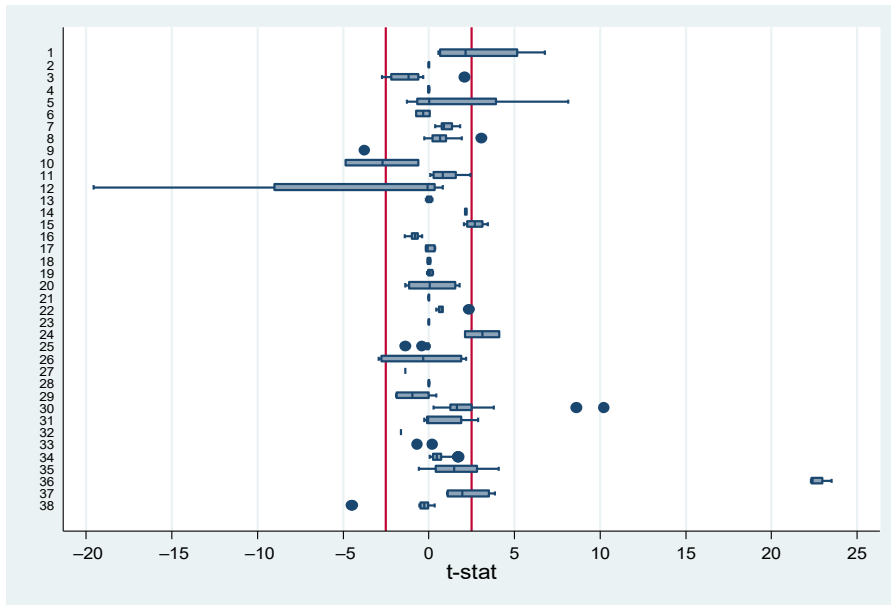


Figure 2. BOX PLOT to display distribution of the dataset. Source: Authors' estimation

Step 3: Publication Bias:

Funnel Graph: The funnel graph in Figure 3 shows asymmetries when the regression intercept deviates from the inverse of the standard error of PCC. PCC is on the horizontal axis and estimate precision on the vertical axis. Precise estimates cluster near the true effect, while

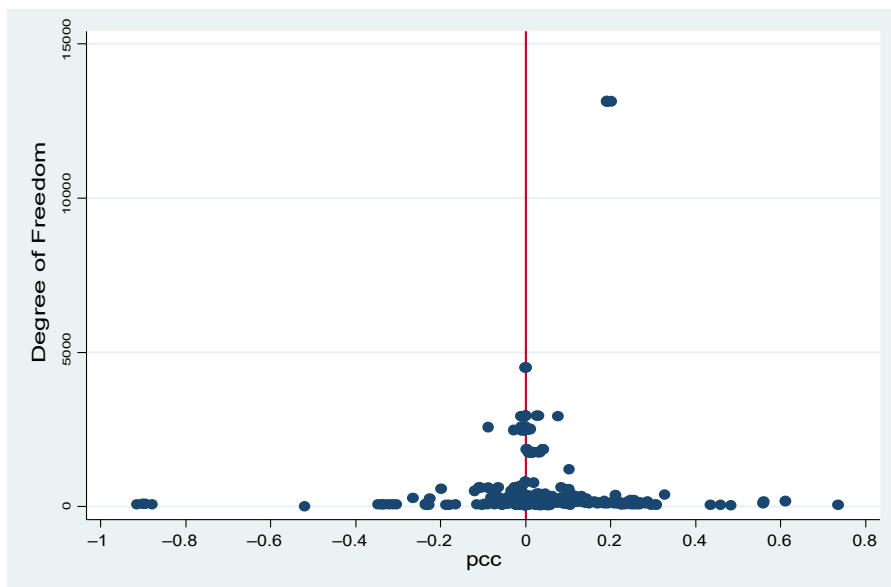


Figure 3. Effect of accounting variables on synergies. Source: Authors' estimation

imprecise ones disperse at the funnel’s base. Figure 4 should depict an inverted funnel without publication bias, but it appears unbalanced, with a heavier right side indicating more reported positive estimates. Due to the subjectivity of visual methods, we use Stanley and Doucouliagos (2010) approach, regressing the estimated effect size on the standard error, to detect and correct publication bias.

The null hypothesis that the coefficient of publication bias (β_1) equals zero, if rejected, indicates funnel asymmetry and publication bias. A positive β_1 suggests selection for greater positive effects, while a negative β_1 indicates preference for negative estimates. Rejecting the null hypothesis that the constant term (β_0) equals zero suggests a real effect of accounting variables on synergy beyond publication bias. This is known as the PET test.

Table 3 reports the test for publication bias using regression analysis for fixed, robust and clustered effects. The significant constant term indicates publication selection, with a positive constant showing selection based on large positive effects. The statistically insignificant β_0 estimates suggest no genuine effect of accounting variables on synergies. The null hypothesis, which posits no heterogeneity between studies, is not rejected, indicating homogeneous results across studies.

Step 4: MRA

The study grouped 110 components into 12 factors to review those leading to synergies. Research on synergy generation in M&As is growing, with increasing focus on various

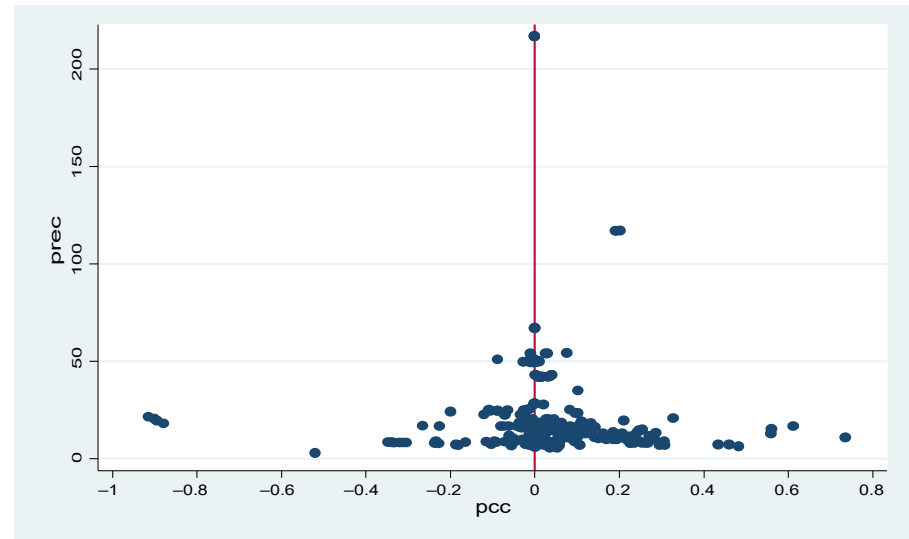


Figure 4. Funnel graph plotted capturing asymmetries. Source: Authors’ estimation

Table 3. Test for true effect and publication bias in literature

	Fixed	Robust	Clustered
Coef. β_0 (Publication Bias)	−6.235181 (4.161742)	−0.4937083 (1.086941)	−6.235181 (9.650704)
Constant β_1 (Effects Beyond Bias)	0.8820738 (0.3499453)**	0.230083 (0.0913968)**	0.882074 (1.032054)
Observations	375	375	375

Note(s): The standard errors are reported in parentheses. ** Significant at 1 percent level
Source(s): Authors’ own estimation

contributing factors. Thus, it's crucial to discuss these factors from the above meta-analysis in relation to synergy occurrence. Table 4 presents the MRA results, showing how different variables impact Realized Returns, Financial synergy, and Operating synergy in M&As. The following indicators explain the incidence of synergy in M&As.

The MRA results show that panel data and cross-sectional datasets are commonly used to examine the relationship between synergy and its influencing factors. Probit analysis, 2-stage/3-stage least squares, and simple OLS regression are widely used methodologies, often incorporating dummy and control variables. The studies mainly focus on industry relatedness, type of target and type of acquisition (hostile or friendly). The payment method in M&A deals (cash or equity) is crucial for realizing post-merger synergies.

Important variables explaining synergy include leverage and the Q ratio. The revenue ratio, sales and profitability of both the acquirer and target significantly impact synergy. Liquidity variables such as cash of acquirer, free cash flow and relative cash liquidity amplify synergy. Corporate governance and most regulatory variables do not contribute to synergy gains. Asset size variables (return on assets, asset size, target relative size and bidder capital stock) enhance synergy and post-M&A profitability. Market returns also influence synergy gains.

5. Conclusion and implications

Mergers and Acquisitions are complex and have sparked research across various management areas, including organizational, financial, and cross-cultural aspects. This article conducts a MRA to identify variables contributing to synergies in M&As, focusing on financial and operating synergies. Meta-analysis integrates and analyses existing literature to provide a comprehensive view of how different variables affect M&A synergy (Stanley, 2001).

The analysis indicates no publication bias in reporting the relationship between various factors and synergy, as shown by the Funnel Graph and FAT-PET test. Key variables explaining synergy include leverage, the Q ratio, revenue ratio, sales, and the profitability of both the acquirer and target. Acquirer liquidity variables, such as cash, free cash flow, and relative cash liquidity, significantly amplify synergy. Most regulatory variables do not impact synergy gains, while asset size variables enhance post-M&A profitability. Market returns also influence synergy gains.

Commonly used methodologies in these studies include probit analysis, two-stage/three-stage least squares and simple OLS regression, often incorporating dummy and control variables. Past studies mainly focused on industry relatedness, target type and acquisition type (hostile or friendly). The impact of the payment method (cash or equity) on synergy is less studied, but it is a crucial parameter for realizing post-merger synergies.

5.1 Implications

5.1.1 Theoretical implications.

(1) Theory of Synergy in Mergers and Acquisitions

- **Leverage, Q-ratio, and Profitability as Key Synergy Drivers:** The present study suggests that variables like leverage, the Q ratio (a measure of investment efficiency), and profitability (for both acquirer and target) are important in explaining synergy. This aligns with theoretical frameworks on synergies, where financial health and efficient use of capital are seen as essential for realizing post-M&A value.
- **Market Returns and Synergy Gains:** The significant impact of market returns on synergy implies that synergy realization is not only dependent on the internal financial and operational factors but also influenced by external market conditions. This expands traditional theories on synergy, indicating that market

Table 4. Meta regression analysis

S. no.	Broad factor	Variable	Coefficient value	Standard error
1	Type of Data	Panel data	0.0315119***	0.006429
		Time series data	−0.098685	0.096345
		Cross-section data	0.150282**	0.059394
2	Estimation Method	Probit	0.062993**	0.026808
		Tobit	0.096987	0.081472
		2SLS/3SLS	−0.04972**	0.021325
		Endogeneity parametric approach	0.096356	0.071805
		OLS	0.018177*	0.010254
		Dummy	0.159402***	0.013829
		Control Variables	−0.16192***	0.013365
3	Characteristics of Deal	Industry Relatedness	0.065157***	0.018086
		Focused Merger	0.096164	0.067022
		Target Type	0.160303***	0.043586
		Country/Cross-border	−0.13236***	0.028485
		Year	−0.04836	0.056757
		Acquisition type (Hostile or Friendly)	−0.05776***	0.016812
4	Management Dimensions	Merger Dummy	−0.01917	0.021337
		Ownership	−0.03589*	0.019316
		Labour Union (A or T)	0.24596**	0.113929
		Employment cost (operating expense)	−0.12013	0.136077
5	Payment Options	Cash	0.1663994***	0.0130108
		Equity	−0.1846***	0.038743
		Premium	0.014575	0.030851
6	Capital Structure Dimensions: Book Perspective	Relative leverage	−0.06602	0.150286
		Pre-merger leverage deviation	0.172071**	0.085736
		Loan loss provisions	−0.14272	0.158676
7	Capital Structure Dimensions: Market Perspective	Tobin Q/Relative Q Ratio	−0.05523**	0.023512
		Market to Book Ratio	0.067029*	0.035814
		Pre-Acquisition Adjusted Performance	−0.08632	0.14038
8	Revenues/Income	Revenue Ratio	0.441577***	0.115372
		Sales	0.185366***	0.038847
		Profitability of Acquirer	−0.0879*	0.06369
		Profitability of Target	−0.09715*	0.063687
		Non-interest income (operating)	−0.09344	0.129227
9	Liquidity Related Variables	Cash flow correlation	0.511162***	0.079793
		Pre-acquisition Cash Reserve	−0.05172	0.087733
		Cash Acquirer/FCF/Cash liquidity	−0.57656***	0.071952
		Cash Target	−0.55204***	0.087955
		Cash book asset	0.191464***	0.04709
		Relative Cash Liquidity	0.265463***	0.100816
		Cash cycle	0.238716***	0.085361
		CF Equity	0.588166***	0.072238
		Bidder Liquidity	0.042338	0.055648
10	Regulations	Corporate Governance A	−0.02781	0.096202
		Regulation	−0.0398	0.123167
		Bidder E-index Presence	0.020179	0.128833
		Post-merger integration duration	0.156527***	0.055686

(continued)

Table 4. Continued

S. no.	Broad factor	Variable	Coefficient value	Standard error
11	Asset size	Return on Assets	−0.02188*	0.011779
		Log Size/Size	0.019455*	0.011256
		Target Relative Size	−0.0462*	0.028814
		Bidder Capital Stock	−0.18417***	0.038767
12	Market Returns	Stock Return/BHAR/CAR	0.006004	0.010499
		Bidder Stock Price Run-up	−0.17141***	0.037965
		Bond Yield	0.185946***	0.050078

Note(s):***, **, * indicates at 1%, 5%, 10% significance levels, respectively

Source(s): Authors' calculation

dynamics, such as investor sentiment or broader economic conditions, play a vital role in the success of M&As.

- **Liquidity's Role in Synergy Realization:** The amplification of synergy by liquidity variables (cash, free cash flow and relative cash liquidity) offers theoretical support for the idea that financial flexibility is crucial for M&As. These findings enrich agency theory, which argues that the liquidity of the acquirer can mitigate risks, reduce transaction costs, and facilitate better integration, thus improving synergy realization.

(2) Regulatory and Market-Related Synergies

- **Limited Impact of Regulatory Variables:** The fact that most regulatory variables do not have a significant impact on synergy suggests that regulatory constraints might be less influential than previously thought in determining the post-merger success. This could challenge the relevance of regulatory-based theories that focus on the role of government and antitrust interventions in shaping M&A outcomes.
- **Asset Size and Post-M&A Profitability:** The results emphasize the role of asset size variables in enhancing post-merger profitability, reinforcing resource-based theories that emphasize the importance of tangible and intangible assets in achieving competitive advantage. Larger firms tend to have more resources and economies of scale that contribute to higher synergy potential.

(3) Expansion of Methodological Approaches

- **Methodological Innovation in M&A Studies:** The use of advanced econometric techniques (such as probit analysis, two-stage/three-stage least squares and OLS regression) with control variables provides a more nuanced understanding of how different factors influence synergy. This enhances the methodological rigor of M&A research, suggesting that combining multiple regression techniques can yield more reliable and detailed insights into M&A outcomes.

5.1.2 Practical implications for industries.

(1) Financial Planning and M&A Strategy

- **Focus on Liquidity Management:** The significant role of liquidity variables (such as cash and free cash flow) in amplifying synergy gains highlights the importance of maintaining financial flexibility during and after the merger process. Acquiring

firms should prioritize strong cash flow management and ensure they have enough liquidity to handle integration costs and potential challenges.

- **Leverage and Capital Structure Decisions:** Firms considering mergers or acquisitions should carefully evaluate their leverage ratios. While higher leverage can enhance synergies through financial efficiency, it could also introduce financial risk. Acquirers should align their capital structure with synergy realization strategies, ensuring that financial health is not compromised during the transaction.

(2) **Industry-Specific Considerations:**

- **Asset Size and Post-M&A Profitability:** Industries with large firms may benefit more from mergers in terms of post-merger profitability due to the economies of scale and resource pooling. Smaller firms considering acquisitions should be mindful of how asset size differences between the acquirer and target might impact post-merger performance.
- **Industry Relatedness and Target Selection:** Industry-relatedness continues to be a key factor in realizing synergy. Firms should prioritize acquisitions in industries or sectors where they have complementary capabilities or where strategic fit is strong.

(3) **Payment Method in M&A Transactions:**

- **Cash vs. Equity as a Strategic Decision:** The relatively under-researched role of payment method (cash vs. equity) in synergy realization in the study suggests that this should be a focal point for both acquirers and targets. Using cash might signal stronger liquidity and commitment, while equity might align the interests of both parties in the long term.

(4) **Regulatory Landscape Considerations:**

- **Regulatory Compliance and Synergy Realization:** While regulatory interventions might not directly impact synergies, they could introduce delays or added costs that indirectly affect the merger's success.

(5) **M&A Integration Strategy:**

- **Focus on Operational Synergies:** Since the study emphasizes that sales, revenue ratios and profitability are important variables for synergy realization, acquirers should prioritize operational integration, focusing on aligning sales channels, product offerings and operational processes to maximize synergy gains.

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