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ARTICLE INFO	Giuseppe Sorrentino, Mario Situm, Yuliia Serpeninova, Milos Tumpach and Zuzana Juhaszova (2024). Supporting management decisions for M&A transactions based on the strategic allocation of intangible assets. *Problems and Perspectives in Management*, *22*(2), 539-554. doi:10.21511/ppm.22(2).2024.42
DOI	http://dx.doi.org/10.21511/ppm.22(2).2024.42
RELEASED ON	Friday, 07 June 2024
RECEIVED ON	Saturday, 30 March 2024
ACCEPTED ON	Thursday, 16 May 2024

JOURNAL	"Problems and Perspectives in Management"
ISSN PRINT	1727-7051
ISSN ONLINE	1810-5467
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
86	1	4

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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SUPPORTING MANAGEMENT DECISIONS FOR M&A TRANSACTIONS BASED ON THE STRATEGIC ALLOCATION OF INTANGIBLE ASSETS

Abstract

In the context of mergers and acquisitions (M&A), management decisions regarding asset allocation play a key role in determining the strategic value of intangible assets. This study investigates the allocation of such assets, particularly goodwill, in relation to enterprise value on balance sheets across global M&A transactions within the B2C sector from 2000 to 2021. Utilizing data from the Markables database, which includes 543 transactions, this study presents robust and quantile regression analyses to effectively address challenges arising from non-normally distributed data. The findings underscore a significant correlation between the strategic allocation of intangible assets, especially goodwill, and enterprise value, highlighting their essential role in reflecting future earning potential and growth prospects. Additionally, the study reveals specific factors, including transaction type (asset vs. share deals) and timing (transaction year), that influence these asset allocation decisions. These insights are critical for enhancing management decisions in valuation and strategic financial planning during M&A. By elucidating these dynamics, this paper significantly contributes to the literature on management accounting and corporate finance, offering a granular understanding of the valuation of intangible assets in business combinations.

Keywords brand value, customer value, goodwill, purchase price allocation, sales multiple, M&A

JEL Classification M21, M41, G34, L25

Received on: 30th of March, 2024
Accepted on: 16th of May, 2024
Published on: 7th of June, 2024

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

Mergers and acquisitions (M&A) are important strategies for growth, restructuring, and gaining competitive advantages in global markets. In the contemporary business landscape, M&A activities allow companies to diversify their portfolios, enter new markets, and achieve their strategic targets. The success of these complex transactions depends significantly on strategic management decisions. These decisions encompass a range of factors, including, but not limited to, financial assessment, due diligence, and integration processes. Central to these considerations is the strategic management of assets, particularly intangible assets, which often hold latent value on financial statements. As businesses increasingly recognize the value of intangibles such as brand reputation, intellectual property, and customer relationships, the role of strategic asset management becomes a cornerstone of successful M&A outcomes.

The strategic allocation of intangible assets during M&A necessitates an understanding of their impact on enterprise value. Goodwill, a form of intangible asset, often emerges as a key point during M&A transactions, representing the premium paid over the book value of a company's assets. Effective management decisions in this realm are

supported by rigorous methodologies that account for the complex and often non-linear relationships between asset values and their impact on the company's overall valuation. Through advanced analytical techniques and comprehensive data analysis, management can better navigate the process of asset valuation, ensuring that M&A activities are not just financially sound but strategically advantageous. This strategic approach not only optimizes the financial outcomes of M&A but also aligns them with long-term business objectives, ensuring sustainable growth and value creation in a highly competitive economic environment.

Every year, numerous M&A transactions occur worldwide. Since 2000, over 790,000 M&A have been announced globally, totaling more than 57 trillion USD in value. The highest activity occurred in 2021, with 58,308 transactions worth a total of 52.356 billion USD (Institute for Mergers, Acquisitions & Alliances, n.d.). M&A are strategic tools frequently employed by companies to increase market share, enhance core capabilities, and access capital at lower costs. These transactions are crucial for companies aiming to stay competitive in the global market (Kongpichayanond, 2009; Riya & Patra, 2020).

In the dynamic landscape of M&A, the valuation and allocation of intangible assets remain complex components of enterprise valuation (Sacui & Szatmary, 2015). Recent shifts in the global economy have magnified the significance and importance of intangible assets, ranging from intellectual property to brand equity, underscoring their role in the strategic calculus of corporate acquisitions (Corona, 2009; Srivastava, 2012; Yamaguchi, 2014). The valuation of these assets, particularly within the framework of Purchase Price Allocation (PPA), is critical as it influences not only the reported financial health of the acquiring company but also its strategic management decisions.

1. LITERATURE REVIEW

The nuanced understanding of the impact of asset allocation on enterprise value is crucial for several reasons. Firstly, it aids management decision-making in structuring acquisitions more effectively by highlighting the financial and strategic impacts of asset valuation and allocation. Secondly, it provides investors and financial analysts with deeper insights into the valuation practices that may affect their investment decisions and risk assessments. Lastly, it offers valuable feedback for regulatory bodies overseeing financial reporting and disclosure standards in M&A transactions.

The literature review on the strategic allocation of intangible assets in M&A underscores the central role these assets play in shaping corporate strategies and influencing firm valuation. In particular, intangible assets like goodwill enhance the perceived enterprise value and are crucial for delineating future economic prospects within M&A transactions (Lev, 2001). Effective strategic management of these assets is essential for optimizing the outcomes of M&A activities, aligning them with long-term business objectives, and ensuring sustainable competitive advantages (Keller, 2001). The focus on management decisions within these transactions reveals a sophisticated understanding of how intangible assets, including brands and proprietary technology, can be strategically managed to optimize company performance and market positioning. This emphasis is particularly evident in the way assets are reported and valued, affecting not only financial outcomes but also stakeholder perception.

Among all assets, intangibles appear to be the most significant contributors to sustainable competitive advantages. For instance, Battagello et al. (2019) highlight that prioritizing strategic intangible assets in decision-making processes, such as make/buy decisions, is essential for maintaining competitive advantage and optimizing performance. These resources are becoming the primary drivers behind corporate M&A, providing high-value synergies and great opportunities for growth (Albuquerque Junior et al., 2021; Huyghebaert & Luypaert, 2010; Arikan, 2002; Gupta & Roos, 2001; Lev, 2001). Intangible assets play a significant role in driving firm value and are crucial for managing a firm's ongoing operations. Additionally, intangibles hold importance in transfer pricing (Fischer & Baumgartner, 2021).

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Thornhill and Gellatly (2005) showed that the development of intangibles is positively associated with the business growth of young Canadian SMEs. Tahat et al. (2018) studied 150 non-financial UK companies and found strong evidence that intangibles significantly enhance firm performance. Specifically, the analysis highlighted that goodwill has a statistically positive impact on both the current and future performance of these firms. Next, Peng et al. (2021) and Lim et al. (2020) have demonstrated that in the knowledge economy, intangible assets can serve as financial instruments, being used as collateral for loans similar to tangible assets.

Cosmulese et al. (2020) highlight the significant role of intangible assets in enhancing the market value of companies, particularly through the mechanism of improved transparency and detailed, easily understandable reporting. It emphasizes that in the digital age, where intangible assets form a crucial part of company valuation, the way these assets are accounted for and reported can have substantial implications for market perception and company valuation.

When examining the distribution of PPA, it is noticeable that in more recent transactions, an increasingly larger portion is allocated to intangible assets (Sinclair & Keller, 2017; Mellen & Evans, 2010; Hübscher & Martynkiewitz, 2021, p. 125; Cappel & Hartmann, 2018). This trend indicates a relevant development in the knowledge society, namely that intangible assets are becoming increasingly important from a business economics perspective and now represent the relevant drivers of corporate success and effective managerial decisions (Mullins et al., 2013; Sinclair & Keller, 2014; Steenkamp & Kashyap, 2010).

Focusing on brands, Costa and Evangelista (2008) demonstrated that, especially in the consumer product industry, brands are considered the key competitive factor influencing consumer preferences for a product or service. In the context of M&A, the financial value attributed to brands can be substantial, influencing the overall transaction value. Brands often account for a significant proportion of the transaction value in M&A, reflecting their importance in achieving synergistic benefits. These benefits are not just limited to direct financial gains but also include strategic advantages like enhanced market reach and improved competitive positioning (Bahadir et al., 2008).

For instance, the acquisition of IBM's PC division by Lenovo led to an increase in Lenovo's profit, predominantly driven by gains in brand equity (Chu et al., 2021). According to Lindemann (2010), brands account for between 30 and 80% of shareholder value, especially in the consumer sector. Keller (2001) emphasized that brand equity positively influences the sustained performance of businesses over time. This is because products and services possessing substantial brand equity tend to garner increased consumer loyalty (Situm et al., 2019; Homburg et al., 2010), demonstrate greater resilience against competitors (Saienko et al., 2021), or during economic downturns, achieve enhanced profit margins or show heightened responsiveness to shifts in pricing (Paswan et al., 2016, p. 553).

According to Lo (2012), it is widely accepted that brands significantly contribute to increasing profitability and shareholder value, which directly leads to business success. According to Madden et al. (2006), firms that have developed strong brands create value for their shareholders by yielding returns that are greater in magnitude than a relevant market benchmark. Yildiz and Camgoz (2019) found that enhancing brand equity helps firms reduce unsystematic and downside systematic risk in their stock prices. Moreover, Hasan et al. (2022) indicated that high levels of brand capital are significantly linked to reduced crash risk in firms. Similarly, Mauer et al. (2022) found that firms with more brand equity have lower equity and asset volatility and higher cash flows.

Shalev et al. (2013), Bugeja and Loyeung (2015), and I. Zhang and Y. Zhang (2017) found that acquirers whose CEOs' compensation is tied more closely to cash bonus tend to allocate a higher portion of the purchase price to goodwill rather than to identified intangible assets. On the other hand, Shalev (2009) links higher disclosure in business combinations to better future performance for acquirers, measured by ROA changes and abnormal stock returns. Lower disclosure is associated with higher purchase prices allocated to goodwill. This supports disclosure theory, implying acquirers may withhold information on unfavorable acquisitions.

Kimbrough (2007) and Paugam et al. (2015) both focused on investors' reactions to PPA in business combinations. Kimbrough (2007) highlights that investors react negatively to high levels of recognized (abnormal) goodwill and positively to separately identified intangibles. That is because goodwill comprises various elements that are difficult to differentiate, making it less informative than specific intangible assets. Paugam et al. (2015) found that abnormal goodwill carries information about deal quality. They observe a negative association between abnormal goodwill and cumulative abnormal returns (CAR), particularly for deals initially perceived negatively. Additionally, abnormal goodwill is positively linked to subsequent goodwill impairments. These results suggest that abnormal goodwill serves as an informative measure regarding the quality of acquisitions, impacting both investor perception and company performance post-acquisition.

Jeny et al. (2019) suggest that disclosures about newly acquired intangible assets are valuable for financial analysts, especially the disclosure of separately identified intangible. However, goodwill is associated with downward revisions of analysts' earnings forecasts. This confirms that goodwill is perceived as informative about the extent of overpayment. This is similar to Maaloul et al. (2016), who focused on voluntary disclosure and showed that increased intangible disclosures affect analysts' earnings forecasts accuracy, dispersion, and favorable consensus recommendations.

The allocation of the purchase price to the acquired assets and liabilities in a PPA follows a specific process to ensure that the purchase price of an acquired company is correctly distributed among the individual assets and liabilities. This process is crucial for accurately reflecting the balance sheet of the acquiring company and for determining future depreciation and amortization expenses (Vulpiani, 2008; I. Zhang & Y. Zhang, 2017; Paugam et al., 2015). Analyzed studies highlight how intangible assets contribute significantly to the sustainability of competitive advantages by enabling companies to leverage synergies and growth post-acquisition (Das, 2021). Collectively, the reviewed literature not only enriches the academic dialogue around M&A but also offers practical frameworks for corporate finance leaders to enhance their strategic planning and asset management approaches in anticipation of, during, and following M&A activities.

This review demonstrates that the allocation process does not follow a fixed pattern but varies situationally, offering new insights into the strategic considerations influencing this variability. This contributes to a nuanced comprehension of the financial and strategic implications of PPAs in corporate valuations, enriching both academic discourse and practical applications in management accounting and corporate finance.

Based on the literature review, the objective of this study is to investigate the allocation of intangible assets in relation to the enterprise value on the balance sheet and to identify specific factors explaining the nature and extent of asset allocations to support management decisions for M&A transactions.

2. METHOD

2.1. Database and variables

The data for the study were collected from the Markables database, which includes Purchase Price Allocations from 2000 to 2021. In total, 543 global M&A transactions in the B2C sector (asset deals and share deals) were identified. These took place between 2000 and 2021, inclusive. All companies originate from Section 2 (Food products, beverages, and tobacco; textiles, apparel, and leather products) or Section 3 (Other transportable goods, except metal products, machinery, and equipment) according to the Central Product Classification (United Nations, 2015, p. 27). To obtain as large a sample as possible, these data were pooled, resulting in cross-sectional data (Kahane, 2008, p. 110). For this purpose, 21 annual dummy variables (YEAR) were created (Kahane, 2008, p. 112) to include them in the regressions. This also makes it possible to control for potential fixed effects arising from the time variables, thus also avoiding biases in estimating the regression coefficients (reduction of variances) (Mummolo & Peterson, 2018).

A description of the variables used in this study can be found in Table 1. The dependent variable is

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EVAL, which indicates the enterprise value (purchase price) of each transaction. The enterprise value includes the claims held by both equity and bondholders (Arzac, 2008, p. 3; Francis, 2016) and is calculated as the market value of a company's debt and equity less cash and cash equivalents (Booth et al., 2014, p. 263). To improve the distribution, it was transformed using the natural logarithm (R. B. Burns & R. A. Burns, 2008, p. 173).

The variables BRAND, CUST, GOOD, ITANG, and TANG constitute the components according to which the purchase price in the balance sheet was allocated. The absolute values were all scaled with the total assets. Scaling absolute values by total assets in regression analysis is commonly practiced to normalize financial data and make it more comparable across different entities, countries, or time periods. This approach adjusts for size discrepancies, allowing for more accurate comparisons and a better understanding of underlying trends or relationships within the data. It is especially useful in regression analysis because it mitigates the influence of outliers, improves model accuracy, and ensures that the coefficients reflect standardized effects, making the results more interpretable and applicable (Barnes, 1987; Cinca et al., 2005; McLeay & Trigueiros, 2002).

As described, transactions took place either as asset deals or share deals. A dummy variable was defined to determine whether the type of deal had an influence on the variable EVAL. The database indicated the number of years the brand's useful life was set for. Infinite useful lives were denoted with "-". For this reason, a dummy variable was also introduced here, allowing for a distinction between finite and infinite useful lives. By adding these dummy variables, one can determine whether the dependent variable exhibits certain characteristics, which may contribute to a better explanation of the model (Barreto & Howland, 2006, pp. 198-199).

2.2. Methodology

The initial descriptive analyses of the independent variables presented in Table 1 showed a significant deviation from the normal distribution. Normally distributed data fundamentally represent a relevant prerequisite for the clean and reliable application of linear regression (OLS method) (Foster et al., 2006, p. 38; Ismail & Rasheed, 2021). To reduce this issue, the independent variables were winsorized at the 1% level (99th and 1st percentile) following Löffler and Posch (2007, pp. 15-19). As can be seen in Table 2, the data remain non-normally distributed. Hence, robust regression was used for further analyses. This represents an iterative process that allows for reliable estimates for unknown parameters despite the presence of outliers (Khan et al., 2021), thus presenting a sensible methodology for the issue at hand. Since only the independent variables were logarithmized, semi-log models are present (Kahane, 2008, p. 84).

The basic model of the semi-log regression is represented as follows, including 21 annual dummy variables. The variable u_i denotes the error term, which accounts for the difference between the actual and expected values of the dependent variable.

$$\ln(EVAL) = \alpha + \beta_1 \cdot BRAND + \beta_2 \cdot CUST + \beta_3 \cdot GOOD + \beta_4 \cdot ITANG + \beta_5 \cdot TANG + \sum_{i=6}^{26} \beta_1 \cdot YEAR\_(1994+i) + u_i. \quad (1)$$

Table 1. Variables of the study

CODE	NAME	COMPUTATION / DESCRIPTION
EVAL	Enterprise Value	Ln(Enterprise Value)
BRAND	Allocated Brand Value	Allocated Brand Value / Total Assets
CUST	Allocated Customer Value	Allocated Customer Value / Total Assets
GOOD	Allocated Goodwill Value	Allocated Goodwill / Total Assets
ITANG	Allocated Other Intangibles	Allocated Other Intangible Assets / Total Assets
TANG	Allocated Other Tangibles	Allocated Other Tangible Assets / Total Assets
REASON	Reason of the Transaction	1 = Asset deal; 0 = Share Deal
USELIFE	Useful Life of the Brand	1 = Indefinite; 0 = Definite
YEAR	Year of Transaction	1 = if the transaction took place in a certain year; 0 = otherwise

To test the robustness of the results obtained, the method of quantile regression was additionally used. With this, it is possible to estimate effects not uncovered by the use of least squares methods (Lamarche, 2020, p. 13), and a complete picture of the relationships between variables can be detected and analyzed (Cade & Noon, 2003; Yu et al., 2003).

3. RESULTS AND DISCUSSION

3.1. Descriptive statistics and correlation analyses

The significant negative correlations identified in the correlation analyses between the components of PPA provide an interesting basis for in-depth discussions and analyses about the strategic decision-making processes that companies undergo during M&A. For instance, higher investment in brand value may lead to a reduction in allocated customer values, indicating a strategic focus on long-term brand equity over immediate customer value (Bahadir et al., 2008). These findings are crucial for management as they provide insights into prioritizing asset allocation to optimize company valuation and long-term strategic goals (Lev, 2001).

For example, Gore et al. (2000) explained that managers' preferences for goodwill accounting are determined by how the stock market (represented by financial analysts) would respond to the impact of the financial statement. In this context, KPMG (2010) stated that under the acquisition method, certain intangible assets are merged into goodwill instead of being listed separately on the acquirer's balance sheet. This may be due to less stringent disclosure requirements for goodwill compared to other intangible assets and to prevent significant future negative earnings impacts from intangible asset amortization (KPMG, 2010). In addition, there could be a lack of effort to measure and disclose these assets, possibly to hide unfavorable information during economic crises (Carvalho et al., 2016).

Market participants attribute relevance to goodwill in the valuation of companies and assess it as at least as important as other recorded assets (McCarthy & Schneider, 1995). An investment in brand value could be seen as an investment in the long-term growth potential and visibility of the company, while goodwill is often associated with more immediate synergies and integration benefits from the acquisition (Giuliani & Brännström, 2011). The negative correlation between these variables suggests that companies may be forced to weigh short-term synergies against long-term growth opportunities. A greater allocation of the purchase price to tangible or intangible assets reduces the goodwill recognized and vice versa (Su & Wells, 2018). Two aspects can explain these results. Firstly, myopic decisions can play a role in how the allocation distribution occurs. Managers are more likely to opt for the short-term position and thus for a higher recognition of goodwill when their compensation depends on short-term results, as this can avoid depreciation expenses and future goodwill impairments (Bugeja & Loyeung, 2015; Shalev et al., 2013; I. Zhang & Y. Zhang, 2017). Secondly, managers will try to reduce goodwill expenses by recognizing more intangible assets with indefinite useful lives to minimize amortization charges (Dinh et al., 2018). Therefore, the individual correlations thus show plausible and comprehensible results.

The descriptive statistics show that the brand value share, measured against all assets, is approximately 30%, making it the most important asset alongside goodwill (with a share of about 33%). This highlights the strategic importance of these assets in enhancing enterprise value. Table 2 shows that the independent data remain non-normally distributed despite winsorization. All statistics from the Kolmogorov-Smirnov test for normal distribution show significances below 0.00 for these variables. Therefore, there are still certain outliers present, which can affect the accuracy of the estimation results of a linear regression (R. B. Burns & R. A. Burns, 2008, p. 378). This violates a relevant precondition for the application of linear regression, thus justifying the use of robust regression (Rousseeuw, 1987, p. 8). The correlation analysis shows that there are some significant correlations between the variables. However, multicollinearity is not present, as all correlation coefficients are below +0.8 (R. B. Burns & R. A. Burns, 2008, p. 386; Kahane, 2008, p. 122). Consequently, all variables can be included in the regressions (Foster et al., 2006, pp. 37-38).

http://dx.doi.org/10.21511/ppm.22(2).2024.42

Table 2. Descriptive statistics and correlation analyses

Variable	DESCRIPTIVE STATISTICS				CORRELATION ANALYSES					
	μ	Median	σ	KS	EVAL	BRAND	CUST	GOOD	ITANG	TANG
EVAL	5.112	5.010	2.088	0.029	–					
BRAND	0.302	0.250	0.218	0.132**	0.014	–				
CUST	0.062	0.000	0.102	0.272**	−0.060	−.221**	–			
GOOD	0.326	0.330	0.204	0.055**	.204**	−.314**	−0.071	–		
ITANG	0.026	0.000	0.064	0.340**	0.015	−.163**	−0.051	−0.026	–	
TANG	0.283	0.230	0.239	0.118**	−.164**	−.506**	−.152**	−.530**	−0.076	–

Note: The table shows selected descriptive statistics on the left side (μ = Median; σ = Standard deviation). The column "KS" shows statistics of the Kolmogorov-Smirnov-Test for normality of data. All significances for the independent variables are lower than 0.00, so the non-normality of data can be assumed. On the right side, the results of correlation analyses are shown. Significances: *) 5% level; **) 1% level.

3.2. Results of regression analyses

To enable a more in-depth analysis and interpretation of the results, two models were calculated using robust regression. Preliminary to this, the Breusch-Pagan test was conducted to determine potential heteroskedasticity in the data (Abdul-Hameed & Matanmi, 2021; Brooks, 2014, pp. 181-182). Statistical significances were found for both models, indicating the presence of heteroskedasticity in the data. This leads to a distortion of the standard errors and also to the uncertainty of the model fit (Astivia & Zumbo, 2019), thus justifying the use of robust regression from this aspect as well (Subramanian & Carson, 1988). Table 3 shows two models of robust regression, with the second model demonstrating better model quality based on the adjusted R^2, and further analyses are limited to this model.

Model 2 indicates that specifically allocated components, such as goodwill (GOOD), brand value (BRAND), and customer value (CUST), show statistically significant coefficients, suggesting a positive relation with enterprise value. The positive association between GOOD and enterprise value (EVAL) underscores the importance of goodwill as an indicator of intangible values that go beyond the assets recorded on the balance sheet and potentially reflect future earning power and strategic synergies (Das, 2021). For management, this highlights the importance of accurate goodwill valuation and integration strategies to maximize M&A benefits.

The significant relationship between BRAND and EVAL reaffirms the role of strong brands as value-enhancing factors in the corporate context, while the significance of CUST highlights the importance of long-term customer relationships as an asset for the company. Additionally, the significant coefficients of ITANG (allocated other intangible assets) and TANG (allocated other tangible assets) in Model 2 suggest that these assets also play critical roles in determining enterprise value. ITANG's significance indicates that other intangible assets, such as proprietary technology, are crucial for sustaining competitive advantages and fostering innovation (Battagello et al., 2019). These assets can drive growth and provide a technological edge, making them essential for strategic positioning in the market (Lev, 2001).

TANG's positive coefficient highlights the importance of tangible assets in the valuation process. Despite the increasing focus on intangibles, tangible assets remain fundamental, especially in industries where physical assets are critical to operations and production capacity (Mullins et al., 2013). This underscores the need for a balanced approach to asset allocation, ensuring that both tangible and intangible assets are strategically managed to optimize enterprise value and operational efficiency. The analysis also reveals that the transaction year has a significant impact on enterprise value, with specific years showing significant positive coefficients. This suggests that macroeconomic conditions and market-specific events in those years could have influenced enterprise value.

Interestingly, the variable REASON, which classifies the reason for the transaction, shows a significant negative coefficient in Model 2. This implies that asset deals, compared to share deals, might have a less positive effect on enterprise value, which could be due to different valuation cri-

teria or the recognition of synergies. Share deals may offer better synergy realization and strategic alignment, providing critical insights for decision-makers in structuring M&A transactions (Shalev et al., 2013). The results underline the necessity to consider both quantitative and qualitative factors in evaluating enterprise value.

Table 3. Robust regression analyses

Variable	Model I		Model II	
	Coeff.	Robust S.E.	Coeff.	Robust S.E.
PURCHASE–PRICE ALLOCATION				
BRAND	26.581	16.242	32.156**	26.581
CUST	25.157	16.241	31.263**	25.157
GOOD	27.945*	16.291	33.200**	27.945
ITANG	26.585	16.336	32.478**	26.585
TANG	25.655	16.259	31.309**	25.655
REASON			–1.456***	0.198
USELIFE			0.191	0.236
YEAR DUMMY VARIABLES				
YEAR_2000	0.395	1.921	1.389	0.395
YEAR_2001	1.726*	1.018	2.418***	1.726
YEAR_2002	0.610	1.115	0.809	0.610
YEAR_2003	0.437	1.129	0.478	0.437
YEAR_2004	0.055	1.048	0.444	0.055
YEAR_2005	1.734*	0.992	1.965**	1.734
YEAR_2006	0.909	0.959	1.375*	0.909
YEAR_2007	0.656	0.907	0.909	0.656
YEAR_2008	0.977	0.945	1.211*	0.977
YEAR_2009	0.669	0.921	1.192	0.669
YEAR_2010	1.293	0.915	1.512**	1.293
YEAR_2011	0.725	0.924	1.192*	0.725
YEAR_2012	1.205	0.896	1.386**	1.205
YEAR_2013	1.063	0.918	1.218*	1.063
YEAR_2014	1.722*	0.905	1.977***	1.722
YEAR_2015	0.907	0.899	1.224*	0.907
YEAR_2016	1.308	0.902	1.395**	1.308
YEAR_2017	0.382	0.905	0.726	0.382
YEAR_2018	0.227	0.908	0.428	0.227
YEAR_2019	0.777	0.911	0.951	0.777
YEAR_2020	1.965**	0.963	2.132***	1.965
CONSTANT	–22.523	16.286	–28.137*	15.641
Chi–Square[1]	4.577**		7.743***	
Chi–Square[2]	4.474**		7.352***	
R^2	0.105		0.187	
R^2 (corrected)	0.060		0.142	

Note: The table shows the regression coefficients (Coeff.) and the robust standard errors (Robust S.E.). The variable "EVAL" (sales multiple) is the dependent variable. The Breusch-Pagan-Test (denoted with [1]) and the modified Breusch-Pagan-Test (denoted with [2]) show significant results indicating that heteroscedasticity is given so that the application of robust regression can be justified. Significances: *) 10% level; **) 5% level; ***) 1% level.

3.3. Robustness check of the results

Since Model 2 has the best explanatory power, a quantile regression was conducted for it, calculated for the quantiles 0.25, 0.5, and 0.75 following the same logic as in Table 3. Table 4 shows the results. The application of quantile regression is also feasible with non-normally distributed data and heteroskedasticity because reliable estimation results can be determined under these conditions as well (Wei & Carroll, 2009). The application of quantile regression reveals that the relationships between allocated assets and enterprise value vary across different distribution ranges of the enterprise value. In the 0.25 quantile, the coefficients of all PPA components remain statistically significant, similar to the results from the preceding robust regression model. This suggests that, for companies in the lower distribution range of enterprise value, the allocated assets exert a consistent and significant influence. This observation may indicate that, in this segment, enterprise value is more strongly influenced by the identifiable and measurable PPA components.

However, the loss of significance in the higher quantiles (0.50 and 0.75) suggests that the direct relationship between PPA components and enterprise value is less pronounced or obscured by other factors not captured in the model for companies with medium to high enterprise value. This could indicate an increasing complexity of enterprise valuations in general (Saksanova & Kantāne, 2016) and especially in higher value ranges, where other intangible assets, market dynamics, or strategic resources might play a more substantial role. Observing the diagrams of the parameter estimates for different quantiles reveals that the coefficients do not maintain a linear and constant trajectory across the various quantiles but instead exhibit significant non-linear changes. This non-linearity implies that the influence of PPA components on enterprise value does not increase or decrease in a straightforward manner but varies significantly across different levels of enterprise value.

This suggests that the strategic importance of these assets may differ based on the company size of the target and the market positioning. For smaller firms, the direct impact of PPA components on enterprise value is more pronounced, in-

http://dx.doi.org/10.21511/ppm.22(2).2024.42

dicating a strategic focus on maximizing identifiable intangible assets for growth and competitive positioning (Battagello et al., 2019). In contrast, for larger firms, other factors, such as market dynamics and strategic resources, may play a more significant role, suggesting a need for a nuanced approach to asset allocation strategies (Huyghebaert & Luypaert, 2010).

This can be well illustrated by the variables GOOD, ITAN, and TANG through the graphs in Figure A1. The graphs show all quantiles on the x-axis and the parameter estimates (coefficients as a dashed line including the area above and below it, which encompasses the standard error). The progression of the coefficients across the individual quantiles suggests that non-linear effects must be considered in the regressions. This non-linear behavior reveals that the relationship between allocated assets and enterprise value is more complex than a simple linear correlation. For this reason, the results of a newly calculated robust regression can be found in the last two columns of Table 4. Quadratic and cubic terms were determined for the variables of the Purchase Price Allocation, and several models were calculated as suggested by Haans et al. (2016). This revealed further insights that were not apparent from the previous analyses.

The positive coefficient for goodwill (GOOD) across all quantiles confirms its substantial role in enhancing enterprise value by reflecting potential synergies and future earnings (Das, 2021). However, the inclusion of a quadratic term (GOOD_SQU) with a significant negative coefficient indicates a diminishing return effect. Initially, goodwill positively impacts enterprise value, but beyond a certain point, additional goodwill may lead to diminishing returns, suggesting that overvaluation or excessive goodwill could potentially harm enterprise value. Similarly, the positive coefficient for other intangible assets (ITANG) demonstrates their importance in contributing to enterprise value, but the significant negative coefficient for the quadratic term (ITANG_SQU) highlights a similar diminishing return effect. This suggests that while investments in other intangible assets initially enhance enterprise value, excessive investment beyond a certain threshold may result in reduced incremental benefits, indicating the need for balanced asset allocation strategies to optimize value creation. This aspect explains the complexity of intangible assets, as also stated by Gu and Wang (2005), which makes it harder for analysts to accurately process the informational content of allocated and reported intangibles.

The significance of the cubic term (TANG_CUB) for tangible assets suggests a complex non-linear relationship. Initially, tangible assets positively influence enterprise value, but this effect diminishes after a certain point, potentially turning negative if overemphasized. The positive cubic term suggests that beyond another threshold, there might be a recovery or re-emergence of positive impact, reflecting the intricate dynamics of tangible asset valuation and its impact on enterprise value. The positive coefficients for brand value (BRAND) and customer value (CUST) across different quantiles reaffirm their critical role in enhancing enterprise value. Brands contribute significantly to market positioning and consumer loyalty (Breivik & Thorbjornsen, 2008; Costa & Evangelista, 2008; Rai & Srivastava, 2014, p. 49), while customer relationships are vital for sustained revenue streams and customer retention.

The results for the REASON variable highlight the influence of transaction structure on enterprise value, with asset deals showing a negative impact compared to share deals. This could be attributed to the challenges associated with asset deals, such as the integration and valuation of assets and potential synergies, which might be more effectively realized in share deals. The strategic implications suggest that companies might achieve better synergy realization and alignment of strategic interests through share deals, providing critical insights for decision-makers in structuring M&A transactions to maximize strategic benefits and enhance overall enterprise value.

Interestingly, the variable USELIFE, which denotes the useful life of the brand, shows an insignificant coefficient, suggesting that the distinction between finite and indefinite useful lives may not significantly affect enterprise value. This finding indicates that while the duration of brand utility is an important consideration, it may not directly influence the immediate valuation metrics captured in M&A transactions.

Table 4. Robustness test of the results using quantile regression and a modified robust regression with non-linear effects

Variable	Quantile Regression						Robust Regression with non–linear effects	
	Quantile 0.25		Quantile 0.50		Quantile 0.75			
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	Robust S.E.
PURCHASE–PRICE ALLOCATION								
BRAND	32.295**	15.173	13.198	19.038	22.043	20.051	31.664**	15.539
CUST	32.283**	15.201	13.557	19.072	20.390	20.087	29.917*	15.562
GOOD	33.598**	15.161	14.295	19.022	23.286	20.035	36.700**	15.641
GOOD_SQU							–5.848***	1.662
ITANG	29.571*	15.249	15.424	19.132	23.816	20.151	39.860**	15.620
ITANG_SQU							–29.098**	13.517
TANG	31.711**	15.172	12.285	19.036	20.600	20.049	38.653**	15.797
TANG_SQU							–20.085***	6.401
TANG_CUB							12.837***	4.770
REASON	–1.116***	0.202	–1.539***	0.254	–1.486***	0.268	–1.335***	0.204
USELIFE	0.616***	0.205	0.589**	0.257	–0.267	0.271	0.324	0.228
YEAR DUMMY VARIABLES								
YEAR_2000	–0.482	1.745	1.618	2.189	1.787	2.306	1.629	1.471
YEAR_2001	1.196	1.483	1.800	1.861	3.067	1.960	2.507**	1.047
YEAR_2002	0.391	1.508	0.376	1.892	0.102	1.992	0.973	1.166
YEAR_2003	–1.302	1.461	–0.383	1.833	1.396	1.931	0.609	1.057
YEAR_2004	–0.276	1.423	–0.364	1.785	1.236	1.880	0.448	1.026
YEAR_2005	0.001	1.400	1.014	1.756	2.899	1.850	1.930**	0.969
YEAR_2006	0.248	1.406	1.364	1.764	1.870	1.858	1.216	0.965
YEAR_2007	–0.382	1.398	0.719	1.754	1.348	1.847	1.039	0.900
YEAR_2008	–0.445	1.393	0.658	1.747	1.171	1.840	1.027	0.928
YEAR_2009	–0.111	1.416	0.771	1.777	1.860	1.871	1.145	0.933
YEAR_2010	0.521	1.387	0.971	1.741	2.033	1.833	1.438	0.914
YEAR_2011	0.043	1.387	0.809	1.740	1.563	1.833	1.041	0.914
YEAR_2012	0.098	1.381	1.107	1.733	2.236	1.825	1.206	0.895
YEAR_2013	–0.163	1.384	0.595	1.736	1.893	1.829	0.994	0.913
YEAR_2014	1.292	1.395	1.397	1.750	2.754	1.843	1.887**	0.904
YEAR_2015	0.346	1.383	0.734	1.735	1.440	1.828	1.259	0.915
YEAR_2016	0.213	1.374	0.921	1.724	1.992	1.816	1.411	0.901
YEAR_2017	–0.287	1.390	–0.155	1.745	1.132	1.837	0.775	0.898
YEAR_2018	–0.802	1.386	0.139	1.739	0.649	1.832	0.341	0.904
YEAR_2019	–0.608	1.394	1.150	1.749	1.914	1.842	0.818	0.926
YEAR_2020	0.816	1.445	1.912	1.813	2.841	1.909	2.323**	0.974
CONSTANT	–28.926*	15.231	–9.228	19.111	–16.776	20.1280	–28.694*	15.592
Pseudo–R^2	0.124		0.110		0.121			
Mean absolute error	1.781		1.484		1.853			
Chi–Square[a]							6.595**	
Chi–Square[b]							6.420**	
R^2							0.256	
R^2 (corrected)							0.210	

Note: The table shows the regression coefficients (Coeff.) and the standard errors (S.E.) for quantile regression and the robust standard errors (Robust S.E.) for the robust regression. The variable "EVAL" (enterprise value) is the dependent variable. Additionally, for the variables "GOOD," "ITANG," and "TANG," new variables with the ending "_SQU" were introduced, which were computed as the square of the mentioned variables. For the variable "TANG," a new variable with the ending "CUB" was added, which was calculated as the cubic of the mentioned variables. The Breusch-Pagan-Test (denoted with [a]) and the modified Breusch-Pagan-Test (denoted with [b]) show significant results indicating that heteroscedasticity is given so that the application of robust regression can be justified. Significances: *) 10% level; **) 5% level; ***) 1% level.

http://dx.doi.org/10.21511/ppm.22(2).2024.42

CONCLUSION

This study contributes to the existing literature by detailing the situational-specific and condition-dependent management of asset allocation in the context of M&A. The objective of this study was to investigate the allocation of intangible assets in relation to the enterprise value on the balance sheet and to identify specific factors explaining the nature and extent of asset allocations to support management decisions for M&A transactions.

The positive association between brand value (BRAND) and enterprise value (EVAL) reaffirms the role of strong brands as value-enhancing strategic factors in the corporate context. The significance of customer value (CUST) highlights the importance of long-term customer relationships as an asset for the company. It proves that management should prioritize investments in brand development and customer relationship management to enhance enterprise value.

The analysis of transaction years indicates that macroeconomic conditions and market-specific events significantly influence enterprise value, emphasizing the importance of strategic timing in M&A activities. Companies can leverage this insight to optimize the timing of their M&A transactions, aligning them with favorable economic conditions to enhance value creation and strategic outcomes.

The study enriches the strategic underpinning of asset allocation's managerial decisions. It also contributes to a more comprehensive and nuanced (non-linear) comprehension of how intangible assets are valued and represented in financial statements. These insights offer pragmatic guidance for practitioners and managers involved in valuation and M&A strategy because the visualization of the target's hidden reserves (intangible assets), especially its brand value, within the price negotiations in M&A transactions can generate price-increasing effects. Unlike previous studies that primarily focus on either the quantitative or qualitative analysis of PPAs, this paper integrates robust and quantile regression methods to uncover the underlying patterns and trade-offs in asset allocation.

AUTHOR CONTRIBUTIONS

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ACKNOWLEDGMENT

This study emerged from a cooperative project between the University of Applied Sciences Kufstein (Austria) and the University of Economics in Bratislava (Slovakia) 2023-05-15-003 "Enhancing long-term business value towards environmentally and socially sustainable economy," which was funded by the performance committee of the Austria-Slovakia Action initiative.

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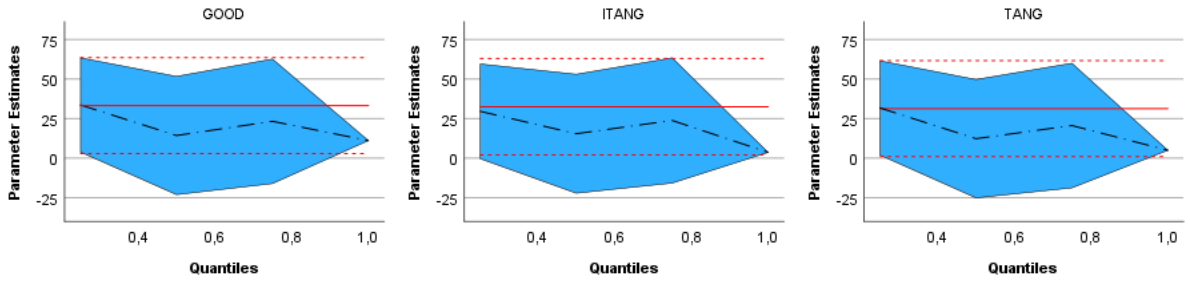
APPENDIX A



Parameter estimation for the different quantiles (GOOD)

Parameter estimation for the different quantiles (ITANG)

Parameter estimation for the different quantiles (TANG)

Figure A1. Diagrams for the estimated parameters for the variables GOOD, ITANG and TANG

http://dx.doi.org/10.21511/ppm.22(2).2024.42