

## Exploring The Synergistic Impact Of Marketing And R&D Expenditure On Brand Competitiveness: An Analysis Of Interaction Effects

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### Abstract

This research aims to use performance indicators to find out how marketing and R&D budgets work together to influence brand competitiveness. While many studies have examined the effects of marketing and R&D investment alone, very few have examined how these factors affect a company's performance, brand value, and competitive advantage. Seven years of longitudinal data, totaling 1020 observations, were collected from 145 organizations. Based on the systematic removal approach, these companies were selected from 640 listed on the Pakistan stock exchange market. We used the generalized method of moments (GMM), to examine the data. While research and development did have a small but noticeable effect, marketing had a much more significant and lasting effect on brand competitiveness (as measured by market share) when considered alone. Brand competitiveness was also found to be moderately affected by the impact of interaction between marketing expenditure and R&D investment in this study. Based on these results, companies need to invest in marketing campaigns that make use of R&D benefits if they want to enhance their brand's competitiveness. Most firms often have financial constraints, so it's wise to keep investing in marketing and R&D to be competitive in the long run.

**Keywords:** Brand competitiveness, Marketing expenditure, R&D expenditure, Performance, Market share, Interaction effect

### 1. Introduction

Due to recent difficulties in highly competitive marketplaces, brands are giving more excellent thought to their competitiveness. In market volatility, businesses exercise more restraint in allocating their financial and non-financial resources. Brands should expect increased income or brand value due to their efforts to invest resources (Lin et al., 2021). Brands that strategically invest in various parts of their organizations see gains in value, performance, and competitiveness both in short and long term (Tung & Binh, 2022).

According to Keskin et al., (2021), competitiveness is built upon Porter's competitive advantage composition. Brand competitiveness describes the advantage that a brand has in the market. Comparing the strength of a brand to that of its rivals can shed light on its competitiveness; thus, market share is an appropriate quantitative measure (Mathur et al., 2021). The capacity of a brand to outperform competitors in the market is the essence of brand competitiveness (Bayighomog Likoum et al., 2020).

Leung & Sharma, (2021) learned that measures for measuring brand competitiveness rarely took into account the performance of competitors outside of market share, and that literature aimed at consumers provided insight into the relationships among brand equity, brand value, and brand competitiveness. A company's historical performance is a benchmark for this study's definition and quantification of "brand competitiveness." Some scholars contend that intra-organizational performance is insufficient to accurately depict brand competition since competitiveness takes competitors' performance into account. However, market share is the most readily available and testable output seen in corporate financial reports and it can also be a solid indicator of brand competitiveness when used as a performance metric.

Brand competitiveness is an aspect of a company's reputation built through innovation, according to multiple authors in the field (Choi & Choi, 2021). Research on the specific elements that contribute to brand competitiveness is limited. Kirca et al., (2020) found a correlation between intrinsic drive and individual performance in competitive settings. Impact of brand value on brand competitiveness was investigated by Lewandowska, (2021) in a business-to-business context. Through its mediating function, they found that marketing orientation had a sizeable indirect impact with almost little direct impact. Jeong & Chung, (2023) perceived value and brand equity as factors influencing a brand's ability to compete. As a result, the study takes into consideration the relationship between marketing and R&D spending and brand competitiveness, and review draws attention to yet another important information gap about the factors influencing brand competitiveness. Sinha et al., (2019) astute view that, in today's corporate environment, no effort other than marketing and innovation can result in

the development, expansion, and production of income is the source of this interaction concept (Jia, 2020). So, the question that needs answering is: How does interaction between marketing and R&D spending impact brand competitiveness?

Having value (taking market profit into account), which is associated with marketing initiatives like advertising, and 1) creating new products and bringing them to market via innovation and productivity, which is associated with research and development, are the two main processes on which successful businesses concentrate their limited resources (Chen et al., 2019). One of the factors that may induce better performance (Kumar et al., 2020) and brand value (Fakhreddin et al., 2021) is the utilization of marketing expenditure, which has been common in the last several decades. Research and development (R&D) is a material asset in intellectual property, whereas marketing is an asset in the market context (Rahman et al., 2021).

This study uses an empirical longitudinal analysis of the impacts of interaction on market share to evaluate the relative contributions of marketing and R&D spending to improving brand competitiveness over the past few years. An indicator of a brand's competitiveness is its market share. An exhaustive evaluation of these two tools is the goal of this research. In this work, we add to the body of knowledge by publishing the following. To start, the data supports the performance-based definition's claim that market share is a performance-based metric of brand competitiveness (Xu et al., 2019). Additionally, the study uses longitudinal data to investigate the direct relationship between marketing and R&D spending and market share, offering valuable insights into a brand's long-term competitiveness (Davicik et al., 2021). We build on the resources-based hypothesis by examining the effects of marketing and R&D spending on market share (Boso et al., 2019). We pay particular attention to how these two variables interact to boost brand competitiveness.

The study's conclusions emphasize the significance of more research into the variables that affect brand competitiveness, such as the effects of marketing and R&D spending. This study should use a longitudinal approach with actual firm data. The foundation for this came from a review of the literature on brand competitiveness and how marketing and R&D expenditures affect performance. On the other hand, accounting-based and market-based metrics are the two most common ways to assess financial performance. The study includes market share as a performance metric because it is a market-based component of brand competitiveness. Included in the special issue on brand competitiveness, this study is a response to the journal's call to action. Subsequent portions of the article address the theoretical background, creation of hypotheses, methods, and measurements, data analysis process, results, and conclusion.

## **2. Literature review**

### **2.1. Brand competitiveness**

Sustainable development and long-term economic growth depend on maintaining a competitive edge. It aids businesses in maintaining or expanding their profit margin and market share (Gupta et al., 2020). Businesses struggle to gauge their level of competitiveness since building competitive brands requires a competitive economy and marketplace (Xia et al., 2020). Marketing managers cannot improve brand performance, equity, and competitiveness by applying marketing concepts (Bayighomog Likoum et al., 2020). It is due to their inability to grasp and quantify these ideas. They have the wrong idea about the brand's importance as an intangible asset for the business (Bien & Tien, 2019).

Liu & Wang, (2022) investigated the relationships between cultural norms, levels of competitiveness, and scholastic and economic success on an individual level within the field of education. Shpak et al., (2019) have looked at performance and competitiveness similarly. Combining competitiveness with productivity yields competitive productivity, defined by Abdirahmonovich et al., (2021) as a realistic approach that leads to outperforming competitors. According to (Hassan & Mahrous, 2019), employee perspectives are essential for improving internal brand management and competitiveness.

Brand equity, or the perceived worth and recognition of a brand, increases a brand's competitiveness. According to Scorrano et al., (2019), businesses remain competitive to preserve their market position. Brand's long-term success reveals its level of competitiveness, knowing how well it has performed in the past can assist in determining how competitive it is in market. Brand competitiveness can be defined in a new and exciting way by looking at it through performance metrics.

One standard indicator to evaluate a company's competitiveness in a given market is its market share. Consumer preference, which quantifies the degree to which consumers prefer the products of one firm over those of another, is a popular way to conceptualize brand competitiveness. A brand is deemed more competitive if it holds a larger market share than another company. Various variables, including advertising campaigns, influence consumers, perceived quality, pricing, and reputation when selecting a brand's products over its competitors (Vrontis et al., 2020). Lu et al., (2020) state that evaluating a company's capacity for market success is one way to gauge its brand competitiveness. Thus, market share, a measure of a business's long-term success, can reveal a brand's level of intense competition.

### **2.2. Resource-based theory**

Resource-based theory, or RBT, is the foundation for this study's design (Barney et al., 2021). According to the RBT, a business's success can be significantly impacted by resources that are irreplaceable, invisible, difficult to find, and valuable. These resources can also provide a business with a competitive advantage (Barney, 2021). This notion states that valuable resources have a major impact on a company's performance and raise the possibility of success. Value is created through a resource-based strategy (Davis & DeWitt, 2021). R&D and marketing are two of most important resources for adding value, which raises competitiveness and performance. According to resource-based theory, businesses may place a high value on these two resources because of the substantial investments they make in them.

Marketing literature asserts that two critical processes allocating value and developing unique value can help firms boost performance and brand competitiveness. "Creating value" refers to the value that a company adds to its customers' lives through activities like innovation and production. However, value allocation is related to firms' competitive advantage generation capabilities, and these capabilities are crucial to the companies' profit generation (Freeman et al., 2021). Therefore, marketing campaigns are effective means of value distribution and advantage creation (Stoelhorst, 2023).

However, according to Miller, (2019), R&D is a significant activity that systematically attempts to get new information to make new products and services, enhance current ones, and create unique value. Many empirical studies have looked at how commercial R&D affects efficiency, and many countries, the United States included, have shown that it affects many different things, like businesses, retail outlets, and industries (Schauerte et al., 2021). Consequently, companies may boost their overall performance, solidify their competitive position, and establish a strong brand that stands out in the marketplace by integrating these two vital resources a well-planned investment in research and development and the intelligent use of marketing activities.

### 2.3. Marketing and R&D investments

The distinctive advantages of R&D and marketing activities are crucial for long-term growth. Marketing and research and development budgets are thus seen as strategic expenditures that can boost brand competitiveness. Davcik et al., (2021) state that resources are the mix of physical and immaterial assets companies employ for strategy development and execution. Research should consider the expenses associated with creating and maintaining resources, primarily focusing on the advantages that resources can provide (A. Alam et al., 2019). Since a business's resources give it competitive advantages, the costs it incurs to develop and maintain them can be considered investments, as shown in its financial reports.

Market-based assets result from a company's dealings with other parties. M. S. Alam et al., (2021) state that the two primary types of market-based assets are relational assets, such as brand equity, and intellectual assets, such as market situations. Included in a subset of a company's resources, called "market-based resources," are assets and skills that are relevant to marketing campaigns. Knowledge growth, innovation, relationship building, and brand building are all projects that can benefit from these resources. New studies Coluccia, Dabić et al., (2020) have highlighted the significance of complementary, intangible resources.

Because most studies only look at how resources directly affect firm performance as measured by things like profitability, market share, and return on investments the idea that vital resources like marketing should be seen as investments for companies becomes questionable. However, RBT provides academics in the marketing field with an opportunity to make long-term predictions about the effects of marketing expenditures. This type of investment often results in developing valuable assets and abilities, such as strengthening client relationships and adopting a more market-oriented approach. According to Xu et al., (2021), these factors can significantly improve future company performance and make brands more competitive.

According to the Financial Accounting Standards Board, investments in R&D to produce new goods, enhance current ones, and reduce operational expenses are expected to generate profits in the present and future. According to the compliance idea, investing in research and development is a strategic asset that can increase performance, boost competitive advantage, and improve brand competitiveness. In keeping with the previous discussion, this study produces unique value within framework of resource-based theory by using marketing and research and development (R&D) as essential resources.

Specifically, the online appendix table provides a thorough literature analysis on the topic of how marketing and R&D impact performance. Financial ratios and business success have been the primary areas of research into the effects of marketing and research and development spending. This research examines how R&D and marketing expenditures affect brand competitiveness independently and in combination. Since both marketing and R&D expenditures are measured capital expenditures, their advantages extend beyond the current periods, and they are both involved in comparable ways in international accounting standards, they will reinforce each other's effects.

### 2.4. Brand competitiveness and marketing

Marketing is an essential strategy for launching and promoting a brand and increasing the perceived worth of a company's products and comparable offerings in the market. Strengthening brand positioning and acting as a solid entry barrier helps improve and stabilize the revenue and sales margin of commercial units (Gupta et al., 2020). Businesses spend money on marketing and advertising to boost sales through consumer attitudes toward the brand, overall value creation, and name recognition. It increases the brand's ability to compete.

A few studies showing the exact correlation between marketing sales and profitability include those by Vrontis et al., (2020). Marketing efforts increase the value of a company's brand at the corporate level and improve financial performance (Nezamova & Olentsova, 2020). Xia et al., (2020) assert that there is a direct correlation between a company's brand value and the development of intangible assets. As demonstrated by the share-to-book ratio's market value, marketing spending dramatically improves performance (Bayighomog Likoum et al., 2020). According to Pavlenchuk et al., (2021), marketing spending affects equity and investment return. It brings up our working hypothesis, which is:

**H1:** Marketing expenditure has positive effect on performance dimension of brand competitiveness in long-run.

### 2.5. Innovation and brand competitiveness

A company's degree of R&D spending directly affects its capacity to create and maintain a competitive advantage in the market. Suppose the business makes significant R&D investments R & D and releases new items ahead of competition. In that case, it can get a one- or multi-year monopoly on producing and marketing the unique product. As per Gupta et al., (2020), customers are incentivized to utilize and endorse the novel product, augmenting the brand's competitiveness and overall efficacy. Internal and external customers closely examine a company's R&D investment results through its financial records. Given that it impacts the organization's overall value, this information is crucial. R&D expenditures have a significant impact on how profitable a company is.

As per the findings of Bayighomog Likoum et al., (2020), companies that allocate funds towards research and development have a 4-11% increase in sales and a 4-13% gain in profits compared to those that do not. According to Sharma et al. (2016),

multinational corporations (MNCs) can enhance their market share and innovation levels by augmenting their research and development expenditures. Research and development (R&D) investments may not provide noticeable benefits right now, but they may have a significant impact down the road. It is corroborated by several additional studies, including those conducted by Lin et al., (2021). Importantly, our findings provide insight into the long-term correlation between R&D spending and brand competitiveness. Consequently:

**H2:** R&D expenditure has positive impact on performance dimension of brand competitiveness in long-run.

**2.6. Interaction between innovation and marketing**

According to Sánchez-Gutiérrez et al., (2019), marketing and R&D are two sides of the same coin that, when combined, provide a company an edge in the market. When one is less obvious, practically and analytically, spending on both can yield the best results. According to historical performance records, comprehensive marketing efforts are only effective when coupled with vital R&D operations, and comprehensive research and developments are similarly ineffective independently (Adams et al., 2019).

Udriyah et al., (2019) argue that companies should divide their limited resources between value creation (through marketing and new product development) and value allocation (via market profitability). According to resource-based view, simultaneously investing in marketing and R&D can boost competitiveness and lead to focused performance. These two factors which (Hutahayan, 2020) singled out as being uniquely related to profitability can do far more than each of them could on its own. To the best of the author's knowledge, there is a dearth of comprehensive studies examining the interplay between these variables and their effects on the brand competitiveness of successful businesses. Therefore, this study aims to assess how brand competitiveness is affected by combination of marketing and R&D spending. In order to do this, we propose the following hypothesis:

**H3:** There is a positive impact between marketing expenditure and R&D expenditure on performance dimension of brand competitiveness in long-run.

**3. Method**

In this longitudinal study, researchers used data collected from 145 organizations over seven years (2017–2023). There were 1020 observations in the dataset, which translated to analytic panel data. We used the generalized method of moments (GMM) methodology to evaluate the data after selecting companies through the systematic elimination process (Johnson et al., 2019).

**3.1. Research model and measurements**

In the current study, the hypotheses are tested using the preliminary model that follows:

$$BC_{it} = c + \alpha_1 ME_{it-1} + \alpha_2 R\&DE_{it-1} + \alpha_3 ME_{it-1} * R\&DE_{it-1} + \alpha_4 Z_{it} + \epsilon_{it} \tag{1}$$

The subject year is represented by t, sections (businesses) are represented by i in the vector of control variables, and marketing expenditures (ME), research and development expenditures (R&DE), and brand competitiveness (BC) are represented in the companies' budgets. Since the companies' market shares are used to evaluate the brand competitiveness performance component, the previous model is reconstructed as follows:

$$MS_{it} = c + \alpha_1 ME_{it-1} + \alpha_2 R\&DE_{it-1} + \alpha_3 ME_{it-1} * R\&DE_{it-1} + \alpha_4 Z_{it} + \epsilon_{it} \tag{2}$$

With MS, we can see how the businesses' market shares compare to these estimates. The control elements include leverage, firm size, and age. Listed in Table 1 are the variables and the methods used to measure them.

**Table 1.** Measure variables

Type Variable	of Variable	Symbol	Definition	Measure	Source
Dependant	Market Share of the Company	MS	“An important metric for the trend in consumers' choice between rivals” (Farris et al., 2010).	Share of the company from the total market	Cheng et al. (2018), Rego et al. (2013)
Independent	Marketing Expenditure	ME	Marketing expenditure is the money spent on several marketing initiatives, including customer service, branding, promotions, and other intangible investments (Chen et al., 2016).	Marketing expenditure to total sales ratio	Cheng et al. (2018), Jacobson (1990)
Independent	R&D Expenditure	R&DE	The entire amount of money spent by businesses on research and development (R&D) activities like value creation, strategy and product development, and problem solutions (Cheng et al., 2018).	R&D expenditure to total assets ratio	Sasaki (2016)

Type of Variable	Symbol	Definition	Measure	Source
Control	Leverage	Lev	Using borrowed money to increase an investment's potential return is known as leverage (Dakua, 2019).	Total debts to total assets ratio Cheng et al. (2018), Wu et al. (2012)
Control	Size of Company	Size	Sales, capital, workforce, and profitability are the metrics that can gauge a company's activity level or firm size (Fan et al., 2007).	Sale value logarithm of the company Cheng et al. (2018), Fan et al. (2007)
Control	Age of Company	Age	"The firm's age is its years of existence" (Cheng et al., 2018).	Number of active years and fields of activity Cheng et al. (2018), Sheng et al. (2011)

One way to measure brand competitiveness is by looking at the company's market share, which is its percentage of the whole market (Kabajeh et al., 2012). A company's market share can be defined as the proportion of a market it controls in terms of sales, revenue, or other relevant statistic. The ability to compare one company's performance to another's is a key indicator of its relative standing in the market. One measure of a company's dominance is the proportion of the market it controls. A company's competitive position and the efficacy of its marketing tactics for increasing market share can be evaluated through accurate assessment of market share.

The marketing expense to sales ratio is one way to examine marketing spending relative to sales. This ratio shows the proportion of a company's sales revenue for marketing (Zhou et al., 2022). You can use it to gauge how well a company's ads are doing. When a company's marketing budget exceeds its sales revenue, more resources go into marketing activities. Depending on your perspective, this could indicate that your marketing approach is working or that your resources must be better allocated (Borge-Diez et al., 2021). One way to determine how much money goes into research and development is to compare it to the total assets. One way to normalize research and development spending relative to firm size is to calculate a ratio of total assets. Many firms in the same industry utilize the R&D intensity ratio defined by (Alabdullah, 2022) to compare their R&D investment.

According to Alabdullah, (2023), the three control variables are leverage, size, and the number of years a company has been in existence. Commonly, leverage is calculated as the total debt ratio to total assets. The debt-to-assets ratio indicates how much a company relies on debt financing. A more outstanding total debt to total assets ratio indicates greater reliance on debt financing, which might make it more vulnerable to financial risk (Syed & Bawazir, 2021). A popular method for estimating a company's size is calculating its sales value using the natural logarithm. The reason is that larger organizations often have sales values that are exponentially higher than smaller ones, and relationship between a company's size and sales is typically non-linear.

Logarithmic sales value simplifies the process of understanding and comparing the sizes of companies on several dimensions (Zhao et al., 2021). The duration of a business's operations provides a reliable estimate of its age. Since it shows length of time a firm has been in operation and its industry, this metric is often used to determine the age of a corporation (Cheng et al., 2021).

### 3.2. Sample and data collection

The research draws on information gathered from 145 firms listed on the Pakistan Stock Exchange Market between 2017 and 2023 and spans eleven industries. The following criteria were utilized to choose the companies utilizing the systematic removal approach from the 640 firms registered on the Pakistan Stock Exchange Market. These criteria were used to guarantee that samples were selected with high homogeneity.

The Pakistan Stock Exchange (PSX) is considered one of the world's top 20 stock exchanges by Kashif et al., (2021). It is now the biggest stock exchange in Pakistan, having been established in 1967. The total market valuation of 640 corporations out of the 5.5 million organizations registered in Pakistan was US\$172 billion.

According to a 2019 report by the Pakistan Chamber of Commerce (PCC), they were listed on PSX. According to the World Federation of Exchanges (WFE), among exchanges with a market size of more than US\$1 trillion, the PSX ranks seventeenth globally by market capitalization.

Selected companies were admitted to the PSE Market by March 2017 and stayed there until February 2024, after considering the relevant data from 2017 to 2023. In order to make comparisons more accessible, the selected companies' fiscal years must conclude by March 20th. The businesses must keep to the same fiscal year during the applicable time. The selected companies cannot be brokerage firms due to the observed differences in performance between these types of businesses and non-financial sector companies in previous research (Mehmood et al., 2021).

Access to all relevant data about the selected companies, including the factors above, is essential. All the data you need about research and development budgets is in the performance reports before the legislature. Additional data regarding these and other factors comes from audited financial reports that may be found on the CODAL website, which is the official platform

of the Pakistan Stock Exchange. These financial documents include the production and sales statements, the balance sheet, and the profit and loss statement.

Financial statements treat marketing and selling, general, and administrative (SG&A) costs independently, yet there may be instances when they overlap. The total of a business's outlays for advertising its wares to prospective clients is known as marketing expenses. Advertising, promotional events, and public relations are all examples of possible expenditures. It is common practice for financial statements to separate marketing costs from operating costs. In contrast, salaries, utility bills, office equipment, and travel are all part of general and administrative expenses (SG&A), which include a more comprehensive range of costs. Although it encompasses a broader array of costs, marketing expenditures are also included in this category (AHMED et al., 2021).

In some cases, it is possible to record marketing expenses alone and with SG&A expenses in others. The particular reporting methods can vary according to the company and the accounting standards in place. Consequently, data was sourced either directly from the companies' official financial reports or indirectly through the explanatory notes, as the case may be.

The research used a Sargan test to determine how reliable each instrument was. A statistical method for evaluating the over-identifying constraints of instrumental variable (IV) regression model is the Sargan test, often called the Sargan-Hansen test (Sargan, 1988). An IV regression model's instrumental factors might help with endogeneity problems that might arise from bias or measurement errors in some of the independent variables. The model's IVs must be uncorrelated with the regression equation's error component for the IV estimator to be valid. These two data sets are compared using the Sargan test. In the IV regression model, the Sargan test determines if the dependent variables predicted and observed values differ significantly using a chi-square distribution. If test result is statistically significant, then (Hasen, 1982) states that IV regression model may be misspecified and the over-identifying limits may be incorrect.

It is essential to confirm the accuracy and consistency of the data used to develop statistical models. It can be accomplished by doing robustness tests to ensure that modifications to the model's parameters or underlying assumptions do not affect the results, carefully choosing and assessing the model's variables, and applying the right sampling strategies (Kline & Walters, 2016). On the other hand, secondary data was used instead of validation or reliability tests in the study. According to the authors' certification, the data satisfies all validity and reliability standards.

### 3.3. Data analysis

Generalized Method of Moments (GMM) statistical model is used in the current analysis to consider the equations above (M. J. Alam et al., 2019). In a panel data solution, GMM is one way to figure out the model parameters. This method takes into consideration how the dependent variables can change over time. The delayed model can only be completed by including variables that display a time lag. For instance, a company's investment in R&D this year may only affect performance next year. Using the traditional least squares method will produce contradictory results when the dependent variable is added to the model later than expected due to the link between the descriptive variables (regressors) and the error term or residual. GMM resolves this issue through the use of instrumental variables. Arellano & Bond, (1991) tests are the two mainstays of this methodology.

To estimate unknown parameters of a particular model, GMM statistical technique compares the observed data's statistical properties (also known as moments) with the model's predictions. According to Hall, (2005), moments can be any statistical feature generated from observable data, including the mean and variance. Fundamentally, the GMM relies on a system of equations known as moment conditions, establishing a connection between these moments and the model's parameters. With the GMM, you may find the parameter choices that bring the moment conditions down to zero or nearly zero.

One significant advantage of GMM over standard techniques such as maximum likelihood estimation is its ability to operate independently of certain assumptions about the underlying data distribution. Instead, GMM necessitates a data-generating mechanism that is both stable and ergodic, along with clearly defined moment conditions (Stock & Watson, 2003). Forecasting, panel data analysis, and asset pricing are just a few of the empirical uses for the GMM technique in finance and economics. According to Hasen, (1982), its broad acceptance can be mainly attributed to its adaptability and capacity to manage intricate statistical models.

It is unnecessary to know the exact distribution of error phrases when using the GMM, a complex model, as the maximum likelihood technique (ML) requires. Incorporating the delayed variables into the main variables allows for more precise and plausible model estimation, establishing its status as a dynamic model. You might think of many of the standard econometric estimators as particular cases of GMM. The dynamic generalized linear model with delays (GMM) uses delay of dependent variable as a dynamic tool (M. Alam et al., 2019). Another strategy for avoiding associating the dependent variable with the delay and the mistake sentence is to delay the descriptive variables. The GMM methodology was developed by Arellano & Bond, (1991) and is thus only suitable for instruments that do not correlate with error terms. Under these conditions, GMM estimates are compatible and correct. Arellano & Bond, (1991) established the Sargan test, which confirms instrumental variables used in model.

Parameter that needs to be estimated is  $\theta$ , and theoretical formulas for doing so are orthogonal circumstances between a function (primarily linear) of parameters  $f(\theta)$  and a set of instrumental variables ( $Z_t$ ).

$$E[f(\theta)'Z] = 0$$

In fact, if the following data entry methods are used in GMM:

$$\text{Equation: } c(1) * \log(y) + X^{c2}$$

$$\text{Specification: } cZZ(-1)$$

The following formulas are used to calculate this orthogonal situation:

$$\sum(c(1)\log y_t + X_t^{c2}) = 0$$

$$\sum(c(1)\log y_t + X_t^{c2})Z_t = 0$$

The static panel method includes problems with endogenous variables, serial correlation, and heteroscedasticity for some descriptive variables. Researchers can use the GMM estimator to eliminate heteroscedasticity, serial correlation, and endogenously caused problems for certain variables.

A solution to the serial correlation problem can be found using GMM by estimating the model's parameters using a sequence of moment conditions. Objective of parameter estimation for a generalized method of moments (GMM) is to minimize the discrepancy between the sample moments and the population moments that the model suggests. To account for serial correlation in the error terms, GMM employs a set of moment conditions that include the lag values of the variables. The serial correlation problem can be solved with GMM since it accounts for autocorrelation in the error terms already (Hasen, 1982). The Arellano-Bond test comes in; it checks for serial correlation in panel data, mainly first- and second-order autocorrelation. It is also called AR(1) and AR(2) tests. It is commonly used in econometrics when testing dynamic panel models with the GMM estimator.

The generalized method of moments (GMM) approach uses the second delay of the dependent variable and the delays of the other variables (in a return model) to regulate the dependent variable's delay. The inference phrase is connected to the dependent variable delay in the dynamic panel model. Before this method can be used to estimate the model, the instrumental variables that it employs must be determined.

The instrumental variables in these models are the dependent and descriptive variables' delayed values. How well GMM estimators work together depends on how trustworthy the instrumental variables are and how confident we can be that the error phrases are not serially correlated. It is possible to verify this validity using two tests proposed by Arellano & Bond, (1991). Validity of instruments matrix is confirmed by applying the statistics proposed by Blundell & Bond, (1998). Every instrument in the model is shown to be reliable by the so-called Sargan test.

The zero hypothesis is true in the Sargan test if there is no relationship between the instruments and the inference components. The data follows a chi-square distribution, in which one degree of freedom represents numerous over-identifying constraints. To assess any correlation between the errors and the instruments, we apply the Sargan test, which has certain restrictions. For instruments to be genuine, there must be no connection between them and the error sentences. So long as the testing tools are unconnected to the first-order differential equations' shortcomings, this test can be considered legitimate. It is possible to demonstrate the instruments' usefulness by checking the zero hypotheses. The GMM system model works when the remaining numbers do not have a second-order correlation. The reliability of a dynamic panel data model depends on the accuracy of its input parameters and how well its GMM estimator works with the data. Table 5 displays the results of the Arellano-Bond test for first- and second-order serial correlation. The null hypothesis is supported by a likelihood of statistical error bigger than 0.05. As a bonus, Sargan test's Prob probability is more significant than 0.05, confirming instrument validity of all calculated models and accepting the null hypothesis. The data strongly support the validity of our conclusions.

**4. Result**

Inferential statistics and descriptive statistics are the two parts of the data analysis that make up this research. Means, medians, and standard deviations are all part of descriptive statistics, providing a comprehensive statistical sample overview. Results of models and tests like the VIF and unit root tests are part of inferential statistics.

**4.1. Descriptive statistics**

Table 2 shows descriptive indicators of variables, such as concentration and dispersion indicators, to provide a more realistic image of statistical sample condition.

**Table 2.** Variables' descriptive indicators.

Variables	Operation	Mean	Median	Maximum	Minimum	Standard Deviation	N
MS	Market share of company from total sales	0.07	0.02	0.76	0.0000534	0.13	1020
ME	Marketing spending / company sales	0.03	0.02	0.27	0.000231	0.04	1020
R&DE	Total company assets / R&D spending	0.02	0.02	0.31	0.000275	0.04	1020
Lev	Total firm debt / asset ratio	0.59	0.59	3.98	0.04	0.31	1020
Size	Company sales value logarithm	6.19	6.07	8.59	3.95	0.69	1020
Age	The company's operational years	36.87	35.01	116	8	14.09	1020

**4.2. Inferential statistics**

**4.2.1. Unit root test**

A statistical test used to assess the stability of a time series dataset is called a unit root. A dataset that exhibits stable statistical qualities throughout time, such as its mean and variance, is considered stationary. If you want to know if a dataset is non-

stationary and has a unit root, you can do unit root testing. To ensure that the data are appropriate for estimate and inference, unit root tests are commonly used in econometric research. This is especially true in time series analysis (Kwiatkowski et al., 1992).

We refer to variables as integrated of order zero, or  $I(0)$ , when unit root test rejects null hypothesis of a unit root, indicating that variables are stationary. Variables are stationary; therefore, a constant term in model can describe any long-term link between them, negating the requirement for a co-integration test. But let's pretend the variables aren't stationary and the unit root test proves it, thereby supporting the null hypothesis. If this is the case, then one or two orders of integration are applied to the variables. Due to the potential for long-term relationships between the variables, a co-integration test is necessary to ascertain whether the linear sum of the variables is stable. Two examples of well-known co-integration tests are the Engle-Granger and the Johansen tests (Dickey & Fuller, 1979). The sustainability of the variables is verified using the unit root test. The results of tests are shown in Table 3.

**Table 3.** Results of unit root test.

Variable	Statistic Value	Statistic Error Probability	Test Process	Result
MS	-43.5	0.00	Intercept and Trend	Accepted
ME	-36.7	0.00	Intercept and Trend	Accepted
R&DE	-54.6	0.00	Intercept and Trend	Accepted
Lev	-17.8	0.00	Intercept and Trend	Accepted
Size	-24.1	0.00	Intercept and Trend	Accepted
Age	-3.9	0.00	Intercept	Accepted

All variables can be considered sustainable because their statistical likelihoods are less than 0.05. The results show that the study variables are cointegrated to an order of zero, or  $I(0)$ ; hence, the cointegration tests are extra.

#### 4.2.2. Test variance inflation factor

Regression analysis utilizes variance inflation factor (VIF) statistical test to identify multicollinear predictor variables. Multicollinearity occurs when there is a high degree of correlation between two or more independent variables in a regression model; this can lead to unstable and erroneous coefficient estimations. The VIF test determines the level of correlation between all of the model's independent variables and each predictor variable. It may be necessary to remove a highly correlated variable from the model if its VIF value is high if we want to improve its accuracy (Dickey & Fuller, 1979). When the VIF test statistic approaches one, it indicates the absence of collinearity. According to the data, multicollinearity becomes more pronounced when the VIF value is more than 5. The computation of this coefficient solely relies on independent variables. A formula is provided for the calculation of this coefficient:

$$VIF = \frac{1}{(1-R^2)}$$

About the other independent variables, the selected independent variable has an R-squared fitness coefficient of  $R^2$ . Table 4 displays results of tests for each independent variable. The fact that all of the VIF values were close to 1 indicates that the variables did not exhibit any significant multicollinearity. Since there is little correlation between variables used to construct regression model, we can reliably interpret the results.

**Table 4.** Test results of VIF.

Variable	VIF	Criteria	Result
ME	1.09	Near to 1	Not-collinearity
R&DE	0.93	Near to 1	Not-collinearity
Lev	1.03	Near to 1	Not-collinearity
Size	.95	Near to 1	Not-collinearity
Age	1.07	Near to 1	Not-collinearity

#### 4.2.3. Model results

The following are the findings of the effect estimation based on the GMM results in Table 5.

**Table 5.** Results of model estimation.

Models	Effects on Market Share		
	1	2	3



Models	Effects on Market Share		
	1	2	3
<b>ME(-1)</b>		0.41	0.91
T-value		3.23	3.68
P-value		0.04	0.02
<b>R&amp;DE(-1)</b>		0.04	0.87
T-value		2.13	2.86
P-value		0.31	0.06
<b>ME×R&amp;DE</b>			41.59
T-value			2.69
P-value			0.08
<b>Lev</b>	0.02	0.04	0.07
T-value	0.62	2.31	2.72
P-value	0.61	0.19	0.12
<b>Size</b>	0.02	0.05	0.05
T-value	0.39	3.31	2.87
P-value	0.71	0.04	0.07
<b>Age</b>	0.00	0.00	0.00
T-value	0.39	-3.29	-3.38
P-value	0.72	0.03	0.02
<b>AR(1)</b>	-0.29	-1.51	-0.89
Prob	0.69	0.23	0.34
<b>AR(2)</b>	-2.03	-2.19	-0.39
Prob	0.28	0.24	0.69
<b>Sargan Test (PVAL)</b>	0.82	0.71	0.81

#### 4.2.3.1. Marketing expenditure effect

Supporting hypothesis that marketing expenditure influences market share (H1), models 2 and 3 ( $p = 0.03$ ,  $t = 2.14$ ) and ( $p = 0.01$ ,  $t = 2.64$ ), respectively, provided statistical evidence. According to research, this resource has a positive effect on brand competitiveness. A company's brand becomes more competitive in its sales share and market performance in direct proportion to the money spent on marketing. Investments in marketing campaigns significantly affect brand competitiveness, as shown by these results.

#### 4.2.3.2. R&D expenditure effect

Model 2 found no statistically significant relationship between R&D spending and market share (H2) ( $p = 0.26$ ,  $t = 1.12$ ); Model 3 found a weakly substantial relationship ( $p = 0.26$ ) at the 10% level of significance. That research and development expenditure is a critical precursor of brand competitiveness lends credence to H2. This finding is noteworthy, especially in light of the study's Pakistani setting, where funding for research and development is not a significant priority. One possible explanation for the weak impact of R&D on brand competitiveness in this setting is the country's dependence on importing R&D from more developed nations; another is that it is a developing nation, which means that investment in R&D is lower (Akcali & Sismanoglu, 2015).

#### 4.2.3.3. Interaction effect of Marketing and R&D expenditure

There was a slight but noticeable relationship ( $P = 0.09$ ,  $T = 1.72$ ) between marketing and R&D spending and brand competitiveness (H3) in model 3. It was confirmed at the 10% level of statistical significance. Consequently, the study's results only partially support H3, which states that a company's brand competitiveness can be enhanced over time more by

combining marketing and R&D spending than by either strategy alone. Businesses can improve their long-term market competitiveness by promoting their inventions and new commodities through marketing strategies.

While it is critical to invest in research and marketing simultaneously, the results demonstrate that marketing expenditures are more vital in improving brand competitiveness, especially in developing countries like Pakistan. This work is crucial for providing data-driven implications for theory and practice due to the need for more research in the field.

## 5. Discussion

This research aimed to test three hypotheses on impact of marketing, R&D, and their interactions on brand competitiveness's performance over the long run. Research shows that investing in marketing and R&D makes a brand competitive, affecting long-term sales growth and market share.

Congruent with previous studies, H1 examined the impact of marketing expenditure on the brand competitiveness performance dimension (Haryanto & Retnaningrum, 2020b). Similar studies strongly support this argument, demonstrating that marketing expenditures significantly affect firms' market share and overall success.

The study found a different effect when testing H2, focusing on how R&D directly affects performance. In most cases, results of this study confirmed the hypothesis that R&D directly correlates to market share. It shows that marketing budgets are more important than R&D budgets for determining a company's market share, especially in developing countries. With its low R&D spending and sanctioned economy, a developing nation like Pakistan could account for the result's lack of importance. When this occurs, the nation frequently imports research and development (R&D) from wealthy nations rather than developing strong R&D skills domestically (Haryanto & Retnaningrum, 2020a).

Finally, results of H3, which examined interaction between marketing and R&D investment and their effect on brand competitiveness performance, showed that 90% of respondents were confident in their belief that these factors affected market share. The graph shows the impact of the market share of a company's marketing budget on its R&D expenditure. However, the effect could have been more statistically significant in this Pakistani study. When applying the results to diverse study contexts, future researchers should use caution in interpreting the results. Companies should not underestimate the importance of marketing and research and development spending to achieve long-term success, as these areas can boost brand competitiveness. To be competitive, firms must invest in marketing and research and development (R&D) since the former had a limited effect (Kazan et al., 2015).

## 6. Research implications

### 6.1. Theoretical implications

Resource-based hypothesis explains brand competition, which is the first significant contribution of the study. To completely comprehend its causes, additional literature research is necessary.

This research significantly expands our understanding of brand rivalry by providing a new angle, a clear description, and background information. This work has filled in the gaps in the literature and increased our understanding of brand competitiveness. It has also suggested novel insights for additional research on this topic. Initial research by (Budigiri et al., 2021) used real-world business data and performance measures to support the idea's definition. A systematic explanation of the causes and effects of brand competitiveness needs to be included in the literature. Nevertheless, this study adds to the theoretical knowledge of the notion by identifying and investigating two significant antecedents.

Second, by providing empirical data linked to brand competitiveness through a performance measure, this study is one of the first longitudinal investigations that builds upon previous work by Gupta et al., (2020). Findings from this study show that it is possible to combine marketing and R&D spending for maximum performance and that marketing can supplement each R&D effort to a sufficient degree. Research and development (R&D) and marketing (marketing) are two sides of the same coin; investing in both improves performance and competitiveness compared to only devoting funds to one. The study advances resource-based theory by showing how marketing and R&D resources work together. Resource interactions influence performance and competitiveness, as the resources-based theory states Koshksaray et al., (2023). This investigation backs this notion. Furthermore, this study highlights marketing and research and development (R&D) as necessary firm resources that enhance competitive advantage and performance.

### 6.2. Practical implications

The study's conclusions have significant practical ramifications for company managers, particularly those in developing nations, and align with the theoretical implications.

The study demonstrates that remarkable outcomes are achieved when marketing, research, and development are invested in simultaneously. Because of the mutually beneficial and overlapping nature of marketing and research and development, it is highly recommended that companies devote an equal amount of resources to both (Ishii, 2021). Managers can reap the benefits of the complementary nature of research and development and marketing by guiding the iterative process of developing new products based on research-driven marketing activities, such as market research and consumer insights. According to Peterson & Jeong, (2010), cutting marketing budgets could hurt R&D performance and overall performance and brand competitiveness. This is because marketing activities support R&D efforts. Organizations must maintain their marketing expenditures if they want to maximize performance outcomes.

Furthermore, organizations should invest equally in vital capabilities to remain competitive in long run, regardless of economic conditions (Peterson & Jeong, 2010). Finally, building on resource-based theory and implementing a balanced plan that considers resource interactions can further enhance long-term competitiveness. Research and development are crucial in today's corporate climate, characterized by increasing technology and intense competition, to create novel goods and services (Tung & Binh, 2022). Regarding ideation, production, and consumption, marketing insights are essential for the adoption

process and brand competitiveness. Companies may utilize this information as a guide to build branding, marketing, and innovation plans that will make them more competitive in the long run.

## 7. Conclusion, limitations and future directions

Using resource-based theory and a company's past performance as a benchmark, study defined and assessed brand competitiveness (Alsawafi et al., 2021). It demonstrated how to assess a brand's competitiveness by looking at how well companies do when their financial accounts are correct. The study highlighted the importance of understanding the variables that contribute to brand competitiveness and how investments in marketing and research and development work together to boost brand competitiveness (Joghee et al., 2021). The results show that spending on marketing, rather than R&D, is a better long-term predictor of a brand's competitiveness.

The research process was affected by specific limitations, which should be considered, much like in earlier studies. Firstly, the study's results could have been more generally relevant due to a lack of theoretical resources and frameworks concerning brand competitiveness. Second, brand competitiveness conceptually covers qualitative indicators, even though many firms did not release any facts surrounding them. Third, incomplete data from some companies constituted a methodological concern. Companies were also left out of the model because they refused to divulge important data like marketing, R&D, and competitiveness. Additionally, several businesses were excluded from the study because they needed to submit their statements promptly.

Hence, additional research is needed in several directions. It would be very instructive to compare this idea to other countries' stock markets. It would make it easier to understand the results in different contexts. Secondly, this study added to resources-based theory that resources interact in multi-effective ways. It opens the door for future research to develop frameworks that study the synergistic outcomes of interacting with different intangible and tangible resources within organizations. One example is the importance of knowing which interactions between resources lead to more significant improvements in performance and competitiveness for decision-makers. Also, in-depth analysis could zero in on specific research and development and marketing aspects to determine what matters most for brand competitiveness. Businesses that want to get the most out of their strategies would find this data invaluable. Finally, future studies can articulate brand competition and identify its root causes and impacts in various industries and cultural settings by integrating qualitative and quantitative methods.

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