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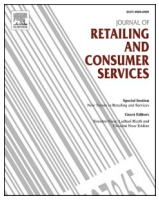

Brand competitiveness antecedents: The interaction effects of marketing and R&D expenditure

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ABSTRACT

This study aims to investigate the interaction effects of marketing and R&D expenditure on brand competitiveness based on performance indicators. While many studies have investigated the individual effects of marketing expenditure and R&D expenditure on a company's brand value, competitive advantage, and performance, there has been limited research on the interaction effect of these two indicators on brand competitiveness. Longitudinal data were collected from 145 companies over seven years, including 1015 observations. The companies were selected using the systematic removal method from 485 companies on the Tehran stock exchange market. We used a generalised method of moments (GMM) to analyse the data. Findings demonstrate that marketing, when considered independently, had a significant effect on brand competitiveness (as reflected in market share) in the long run, while R&D demonstrated a marginally significant effect. In addition, this study revealed that the interaction effect between marketing expenditure and R&D expenditure on brand competitiveness was marginally significant. These results demonstrate that companies need to invest in marketing activities to leverage the benefits of R&D in order to improve their brand competitiveness. As most companies often face budget constraints, maintaining investments in marketing and R&D is recommended to ensure sustained competitiveness in the long term.

1. Introduction

Recent challenges in the competitive markets have made brands think about their competitiveness sensitively. Market uncertainties make companies more sensitive about spending their financial and non-financial resources. Therefore, the resources that brands attempt to spend need to be justified by their performance, such as increasing income or value of the brand (Olbrich et al., 2017). Brands' foresight investments in various divisions of their organization lead to enhance their brand value, performance, and competitiveness in the short and long term (Peterson and Jeong, 2010).

Competitiveness is rooted in Porter's competitive advantage composition (Porter and Strategy, 1980; Winzar et al., 2018). Brand competitiveness refers to the presence of competitive advantage for a brand. When we define the power of a brand deliberated by a competitor's power, it leads to a superior understanding of a brand's competitiveness, in which market share would be an appropriate quantitative measure (Baumann et al., 2017). How a brand can capture the market superior to competitors displays the core meaning of brand competitiveness (Gupta et al., 2020; Tong and Wang, 2011; Winzar et al., 2018).

According to Winzar et al. (2018), which provided insights into the links between *brand equity-brand value-brand competitiveness* from the consumer perspective, the literature hardly measured brand competitiveness by considering competitors' performance outside of market share (Selase Asamoah, 2014). Hence, this study defines and measures the concept of "brand competitiveness" as a company's previous performance. Competitiveness considers incorporating competitors' performance, and some scholars argue that intra-organization performance would not be able to represent brand competitiveness. However, when

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we consider *market share* as an indicator of performance, it would be able to represent brand competitiveness and be the best output in the financial reports of companies in terms of accessibility and testability. In this way, companies' real data can be applied to assess brand competitiveness. Thus, we considered market share as a performance dimension of brand competitiveness.

Several perspectives in the literature define brand competitiveness as a brand image dimension established by companies' innovation (Jie, 2002; Liu et al., 2007; Winzar et al., 2018). Studies investigated and or discussed the exact antecedents or determinants influencing brand competitiveness are scarce. Baumann et al. (2016) found a relationship between motivation-based factors and individual competitive performance. Gupta et al. (2020) investigated the influence of brand value on brand competitiveness in the B2B context. They found it insignificant in direct effect and significant indirectly by mediating the role of marketing orientation. Winzar et al. (2018) considered brand equity and brand value as determinants of brand competitiveness. Therefore, this review highlights another significant literature gap in understanding the antecedents of brand competitiveness, and this study considers marketing and R&D expenditure and their interaction as determinants of brand competitiveness. This interaction idea comes from Peter Drucker's valuable opinion that only marketing and innovation activities of the companies (in contemporary times) shall result in growth, development, and income generation, and all other activities add on costs (Webster Jr, 2009). Thus, the research question is: What is the interaction effect of marketing and R&D expenditure on brand competitiveness?

Successful companies allocate their limited resources mostly to two main processes: 1) creating value through creativity, and productivity, and introducing new products to the market, which is related to R&D activities; and 2) possessing value (taking into consideration the market profit), which is related to marketing activities such as advertising (Mizik and Jacobson, 2003). Marketing expenditure is among the factors that potentially contribute to increased performance (Cheng et al., 2018) and brand value (Peterson and Jeong, 2010), and it has been mainly used in recent decades. Marketing and R&D are both tangible assets, where marketing is a market-based asset, and R&D is a significant asset for intellectual property (Peterson and Jeong, 2010).

Aiming to provide a comprehensive and general understanding of these two assets, this study uses an empirical longitudinal analysis of the interaction effects of marketing expenditure and R&D expenditure on market share as a performative indicator of brand competitiveness to find out how important these activities have been in enhancing brand competitiveness in the past years. Therefore, this study contributes to the current body of knowledge in the following ways. First, the study advocates the definition of brand competitiveness from the performance perspective and provides empirical evidence for market share as its performative indicator (Rao and Holt, 2005). Second, the study explores the direct effects of marketing and R&D expenditures on market share using a set of longitudinal data, thereby shedding light on the long-term performance of brand competitiveness (Peterson and Jeong, 2010). Third, we examine the interaction effect of marketing and R&D expenditures on market share and contribute to the resources-based theory (Barney et al., 2021; Ramaswami et al., 2009; Sharma and Erramilli, 2004) by demonstrating the complementary impact of resources on outstanding performance of brand competitiveness.

Based on a literature review of the effects of marketing and R&D expenditures on performance and reviewing brand competitiveness literature, this study found a lack of research in investigating the impacts of various antecedents on brand competitiveness, such as marketing and R&D expenditures, especially measured by actual company data in a longitudinal research strategy. On the other hand, the financial performance evaluation criteria are generally divided into accounting-based and market-based groups. In this study, market share (a market-based component) is used as a performance evaluation criteria for brand competitiveness. This paper contributes to the special issue on brand competitiveness by answering a call for action made by the journal. The remainder of the paper describes the theoretical lens, hypothesis development, methodology and measures, data analysis method, result, and conclusion.

2. Literature review

2.1. Brand competitiveness

Competitiveness is a core concept and a mechanism to gain economic growth and sustainable development. It helps companies preserve and improve their market share and profit (Sölvell, 2015). Competitive markets and economies are required to develop competitive brands, and the degree of competitiveness is the challenge point of companies (Assarzadegan and Hejazi, 2021; Fornari et al., 2016). The challenge that marketing managers struggle with is their incapability to employ marketing concepts to improve brand performance (Meyer et al., 2022), brand equity, and competitiveness power when they cannot understand and measure the concepts properly. This comes from the fact that they do not have an appropriate perception of the brand as one of the most important intangible assets of the company (Wong and Teoh, 2015).

Baumann and Hamin (2011) investigated the relationships between culture, competitiveness, and economic and academic performance at the individual level of the education industry. Likewise, Baumann and Krskova (2016) and Baumann and Winzar (2016) concentrated on competitiveness and performance. Baumann et al. (2021) argued a combination of competitiveness and productivity, which leads to competitive productivity, is defined as an attitude and behaviour that leads to exceeding the competitors by a pragmatic approach. Employees' perspectives also can be considered as an antecedent in improving internal brand management consequences (Meyer et al., 2022; Piehler et al., 2019) and competitiveness.

Winzar et al. (2018) illustrated that generating brand equity (perceived brand awareness and brand value) improves a brand's competitiveness. Companies are preserving their competitive position by competitiveness (Baumann et al., 2016). Therefore, brand competitiveness is an essential principle in companies' competitive strategy (Swoboda et al., 2013), and competitiveness analysis is a marketing strategy to differentiate a company's brand (Cui et al., 2014). Understanding a brand's previous performance can help determine a brand's competitiveness in the marketplace, as long-term performance can indicate how competitive the brand is. Therefore, defining brand competitiveness by using performance indicators offers a novel and non-inevitable perspective on this concept.

Market share is a commonly used metric to assess the competitive position of a company's products or services within a particular market (Lassar et al., 1995). It is often used as a proxy for brand competitiveness because it reflects the extent to which a company's offerings are preferred by consumers over those of its competitors. In other words, a higher market share indicates that a company's brand is more competitive compared to its rivals. Consumers are more likely to choose the company's products over its competitors, which can be due to a variety of factors, such as the brand's perceived quality, price, reputation, or marketing efforts (Keller, 1993).

Following Rao and Holt (2005), brand competitiveness can be measured by a firm's ability to perform well in the market. Therefore, long-term performance which reflects in a firm's market share can indicate how competitive the brand is. The performance perspective of brand competitiveness is under-researched. This study extends the current body of knowledge by shedding light on the synergistic effect of marketing expenditure and R&D expenditure on market share, which is a performance indicator of brand competitiveness.

2.2. Resource-based theory

This study is plotted based on the resource-based theory (RBT) as a theoretical lens (Barney et al., 2021). The RBT indicates that resources

that are valuable, hard to find, imperceptible, and irreplaceable can bring competitive advantages to a company and have a significant effect on its performance of the companies (Barney et al., 2021; Sharma and Erramilli, 2004). Based on this theory, companies with valuable resources are more likely to deliver more robust performance, and these resources have a remarkable effect on their success (Ramaswami et al., 2009). Recently, Barney et al. (2021) explained the resource-based approach which leads to value creation. Marketing and R&D play pivotal roles as crucial resources forming the foundation for value creation, ultimately leading to improved performance and competitiveness. The substantial investments that companies allocate to these two resources can be viewed as highly significant, firmly grounded in the principles of resource-based theory.

According to the marketing strategy literature, companies can use two essential processes to enhance their performance and brand competitiveness, i.e. creating unique value and allocating value (Mizik and Jacobson, 2003; p 63). Creating value involves providing added value to the customers through company activities such as innovation and production. On the other hand, allocating value is related to the companies' ability to create competitive advantages (Sahi et al., 2022), and the profit made by the companies depends on this ability (Mizik and Jacobson, 2003; Peterson and Jeong, 2010). Therefore, marketing activities are effective mechanisms that can contribute to creating competitive advantages and allocating value (Sahi et al., 2022; Shiu, 2021).

On the other side, R&D can be generally referred to as a principal, and well-organized activity aims to acquire new knowledge for developing new products and services and enhancing products and production processes (Alam et al., 2019) to create unique value. The effect of commercial research and development on efficiency has been investigated in many empirical studies, and its effect on all aspects (including retail units, businesses, and industries) has been proven in many countries (especially the USA) (Alam et al., 2019; Guellec & Van Pottelsberghe de la Potterie, 2004). Hence, through strategic utilization of marketing activities and investments in well-organized R&D efforts – effectively combining these essential resources – companies can bolster their competitive position, elevate overall performance, and establish a strong brand competitiveness in the market.

2.3. Marketing and R&D investments

Marketing and R&D activities offer distinct advantages that are vital for long-term growth. Therefore, the expenditures directed towards marketing and R&D are considered strategic investments that can increase brand competitiveness. Resources are defined as the combination of tangible and intangible assets that firms utilize to conceive and execute their strategies (Barney and Arikan, 2005). The majority of studies tend to focus on the advantages that resources can offer, often neglecting to consider the costs involved in building and sustaining those resources (Kozlenkova et al., 2014). Hence, the expenses incurred in building and maintaining resources, as reflected in financial statements, can be regarded as investments, given that a company's competitive advantages are rooted in these resources.

According to Srivastava et al. (1998), market-based assets are conceptualized as resources that emerge from a firm's interactions with external entities. They further differentiate between two types of market-based assets: relational (e.g., brand equity) and intellectual (e.g., market conditions) (Varadarajan, 2020). Market-based resources encompass a specific subset of firm resources, comprising assets and capabilities that are directly tied to marketing activities. These resources pertain to endeavours like brand building, relationship management, innovations, and knowledge development. Recent research emphasizes the significance of intangible, complementary resources, intangible, complementary resources, which are believed to exert a more substantial impct on a firm's sustained competitive advantage and overall performance compared to tangible resources (Kozlenkova et al., 2014; Srivastava et al., 1998).

Given that the majority of research evaluates and confirms the direct impact of resources on firm performance, often assessed by indicators like profitability (Vorhies and Morgan, 2005), market share (Hooley et al., 2001), and return on investments (Menguc and Auh, 2006), the notion of considering critical resources such as marketing as investments for companies becomes a subject of debate. However, RBT provides marketing researchers with the opportunity to theorize about the long-term consequences of marketing investments. This is because such spending often results in the development of valuable resources and capabilities, such as fostering stronger customer relationships and adopting a market-oriented approach. These aspects can significantly contribute to increasing brand competiveness and improving future firm performance (Hult and Ketchen Jr, 2001; Kozlenkova et al., 2014; Varadarajan, 2020).

According to the Financial Accounting Standards Board, expenditures on research activities aimed at developing new products, enhancing exisiting ones, and reducing operational costs in the future, are expected to produce earnings not only in the current period but also in future periods. Since the knowledge acquired through research is expected to generate earnings over a time, R&D expenditure can be regarded as a company asset or the increased value of its total current assets. Therefore, abiding by the compliance principle, R&D expenditure is recognised a strategic asset that has the potential to improve performance (Meyer et al., 2022), enhance competitive advantage (Tsao, 2014), and elevate brand competitiveness. Based on the foregoing discussion, both marketing and R&D are employed in this study as essential resources within the framework of resource-based theory, generating unique value.

In this regard, the table in the web appendix summarises a comprehensive review of the literature regarding the effect of marketing and R&D on performance. Most studies have only examined the effect of either marketing expenditure or R&D expenditure on financial ratios or firms' performance. This study goes a step further by investigating both the individual effects of marketing expenditure and R&D expenditure as well as their interaction effect on brand competitiveness. In fact, given that both marketing expenditure and R&D expenditure can be considered as capital investments, with their benefits extending beyond the current periods, and both playing similar roles in international accounting standards, it is expected that their interaction reinforces each other's effects.

2.4. Marketing and brand competitiveness

Marketing serves as a vital resource that introduces and promotes a brand, elevating the perceived value of the company's products compared to similar offerings in the market (Cheng et al., 2018). It is used as an efficient tool to deter potential competitors from entering the market and strengthen brand positioning, thereby enhancing and consolidating the revenue and sales margin of commercial units (Haryanto and Retnaningrum, 2020). Accordingly, the companies invest in advertisement and marketing expenditures not only to increase sales through promoting brand awareness but also to increase the company's overall value by promoting desirable brand attitudes (McAlister et al., 2016), which leads to improved brand competitiveness.

Previous literature has consistently demonstrated the direct influence of marketing on sales and profitability of companies (Aaker, 1996; Erickson and Jacobson, 1992; Lane Keller, 1998). Recently, Peterson and Jeong (2010) uncover a positive impact of marketing activities on brand value and firm-level financial performance. Kumar et al. (2020) find a direct relationship between brand and firm value, highlighting the significance of intangible value creation. Additionally, Cheng et al. (2018) reveal that marketing expenditure has a significant positive effect on the performance based on the market value of the shares-to-book ratio. Haryanto and Retnaningrum (2020) found that marketing expenditure can affect ROI and ROE. Therefore, the first hypothesis is:

H1. Marketing expenditure has a significant positive effect on the performance dimension of brand competitiveness in the long-run.

2.5. Innovation and brand competitiveness

R&D is an essential resource that enable firms to achieve and sustain a competitive edge in the marketplace via its enduring effects on a company's brand, product development, and market positioning. By allocating a significant portion of the R&D budget and introducing new products ahead of competitors, the company gains the exclusive right to produce and market the innovative product for several years. This advantage not only attracts consumers to use and recommend the new product but also enhances the overall performance and competitiveness of the brand (Ravšelj and Aristovnik, 2020; Tsai and Wang, 2004). In companies that invest in R&D expenditures, both internal and external users of financial statements carefully scrutinize the outcomes of these investments. The significance of this information is underscored by its impact on the company's overall value. Empirical evidence has consistently demonstrated that R&D expenditures have a considerable effect on a company's performance (Rafiq et al., 2016; Sharma et al., 2016).

Rafiq et al. (2016) found that a firm engaging in R&D activities earns 4%–11% higher sales and generates 4%–13% more profits than firms that do not engage in R&D activities. The study of Sharma et al. (2016) shows that multinational firms can use R&D expenditure to improve their product innovation and market share. Ravšelj and Aristovnik (2020) observed that in the short-term period, the R&D expenditure may not show immediate returns, but in the long-term, they bring significant benefits. This is supported by other research, such as Luo et al. (2018), Ruiqi et al. (2017), and Freihat and Kanakriyah (2017). These collective results shed light on the effect of R&D expenditure on brand competitiveness, offering valuable insights into its long-term impact. Therefore:

H2. R&D expenditure has a significant positive effect on the performance dimension of brand competitiveness in the long-run.

2.6. The interaction between marketing and innovation

Marketing and R&D can be viewed as a synergistic bundle of resources that play complementary roles in achieving a competitive advantage (Chen et al., 2016; Tanabe et al., 2004). From a practical and analytical point of view, spending on each can yield maximum benefit when the other is less prominent (Caglar and Nisel, 2017). Historical performance records of companies demonstrate that extensive innovations and research are not successful without the support of marketing activities, and likewise, comprehensive marketing endeavors are fruitful only when accompanied by essential R&D activities (Cheng et al., 2018).

Peterson and Jeong (2010) argue that companies invest their limited budgets to creating value (such as new product development and promotion) and allocating value (profitability in the market). According to the resource-based theory, simultaneous investments in R&D and marketing to create and capture value can lead to targeted performance and enhanced competitiveness. Although R&D and marketing expenditure positively impacts brand competitiveness, their combined effects might differ due to variations in their individual impacts on firms (Caglar and Nisel, 2017; Chen et al., 2016). The interaction of these two key factors, which Peter Drucker mentioned as the sole profitability factors, can lead to more substantial effects than their direct impacts alone. To the author's knowledge, comprehensive research examining the interaction relationships between these variables and their impact on corporate performance in terms of brand competitiveness has been lacking. Therefore, this study aims to test the impact of the interaction effect between marketing expenditure and R&D expenditure on brand competitiveness, and propose the following hypothesis.:

H3. There is a significant interaction effect between marketing expenditure and R&D expenditure on the performance dimension of brand competitiveness in the long-run.

3. Method

The study employed a longitudinal research strategy by analysing real data of 145 companies over seven years, dating from 2011 to 2017, including 1015 observations that provided panel data for analysis. The companies were selected using the systematic removal method, and data were analysed by the generalised method of moments (GMM) approach (Alam et al., 2019; Chen et al., 2016). This section discusses the mathematical research model and data collection and analysis strategy.

3.1. Research model and measurements

The following preliminary model is used in the present study to test the hypotheses:

$$BC_{it} = c + \alpha_1 ME_{it-1} + \alpha_2 R\&DE_{it-1} + \alpha_3 ME_{it-1} * R\&DE_{it-1} + \alpha_4 Z_{it} + \varepsilon_{it} \quad (1)$$

In this equation, BC stands for the brand competitiveness of the companies, ME stands for marketing expenditure of the companies, R&DE stands for R&D expenditure of the companies, Z is a vector of control variables, i stands for sections (companies), and t stands for the subject year. Because market share of the companies is the criteria for measuring the performance dimension of brand competitiveness, the above model is rewritten as follows:

$$MS_{it} = c + \alpha_1 ME_{it-1} + \alpha_2 R\&DE_{it-1} + \alpha_3 ME_{it-1} * R\&DE_{it-1} + \alpha_4 Z_{it} + \varepsilon_{it} \quad (2)$$

In this equations, MS stands for the market share of the companies. The control variables are leverage, the size of the company, and the age of the company. Variables and methods of measuring them are shown in Table 1.

Brand competitiveness as a dependent variable is measured by market share (share of the company from the total market) (Cheng et al., 2018; Rego et al., 2013). Market share is the portion of the total sales, revenue, or other relevant measure that a company holds in a particular market. It is a key indicator of a company's relative position in the market and can be used to compare its performance with that of its competitors. The higher a company's market share, the more dominant it is in the market. Measuring market share is an essential tool for assessing a company's competitive position and developing effective marketing strategies to gain a larger market share.

Independent variables are marketing expenditure (marketing expenditure to total sales ratio) (Cheng et al., 2018; Jacobson, 1990), and R&D expenditure (R&D expenditure to total assets ratio) (Sasaki, 2016). Marketing expenditure as a ratio to total sales is often referred to as the marketing expenditure to sales ratio. This ratio measures the percentage of total sales revenue that a company spends on marketing activities. It is a useful metric to evaluate a company's marketing efficiency and effectiveness. A higher marketing expenditure to sales ratio indicates that a company is spending more on marketing activities relative to its total sales, which can either indicate a successful marketing strategy or inefficiency in the use of marketing resources (Chen et al., 2016). R&D expenditure can be measured as a ratio of R&D expenditure to total assets. Using R&D expenditure as a ratio of total assets helps normalize R&D spending relative to the size of the company. This ratio is known as the R&D intensity ratio and is often used to compare R&D spending across different companies in the same industry (Hall and Van Reenen, 2000).

Control variables are leverage (total debts to total assets ratio), size (sale value logarithm of the company), and age (number of active years) (Cheng et al., 2018; Fan et al., 2007; Sheng et al., 2011; Wu et al., 2012). Leverage is often measured using the total debts to total assets ratio. This ratio represents the percentage of a company's assets that are financed

Table 1
Measuring variables.

Variable Type	Variable	Symbol	Definition	Measure	Source
Dependant	Market Share of the Company	MS	"A key indicator of the trend regarding customers' selection among competitors" (Farris et al., 2010).	Share of the company from the total market	Cheng et al. (2018), Rego et al. (2013)
Independent	Marketing Expenditure	ME	Spending on various marketing activities such as branding, promotions, customer services, and other intangible investments is called marketing expenditure (Chen et al., 2016).	Marketing expenditure to total sales ratio	Cheng et al. (2018), Jacobson (1990)
Independent	R&D Expenditure	R&DE	R&D expenditure is the total money that companies are spending on such as the creation of value, developing products and strategies, and solving problems (Cheng et al., 2018).	R&D expenditure to total assets ratio	Sasaki (2016)
Control	Leverage	Lev	Leverage refers to the practice of using borrowed funds to improve an investment's potential return (Dakua, 2019).	Total debts to total assets ratio	Cheng et al. (2018), Wu et al. (2012)
Control	Size of the Company	Size	The extent of activity of a firm, known as firm size, can be measured by sales, capital, employees, and profitability (Fan et al., 2007).	Sale value logarithm of the company	Cheng et al. (2018), Fan et al. (2007)
Control	Age of the Company	Age	"Firm Age is the number of years the firm has been established" (Cheng et al., 2018).	Number of active years and fields of activity	Cheng et al. (2018), Sheng et al. (2011)

through debt. A higher total debt to total assets ratio indicates that a company is more heavily reliant on debt financing and thus may be more vulnerable to financial risk (Titman and Wessels, 1988). The natural logarithm of a company's sales value is often used as a measure of the size of the company. This is because the relationship between a company's sales and its size is typically non-linear, with larger companies having exponentially higher sales values than smaller companies. Taking the logarithm of the sales value allows for a more meaningful and interpretable comparison of the sizes of companies across different scales (DeAngelo and DeAngelo, 2000). Finally, the age of a company can be measured by the number of active years it has been in operation. This is a commonly used measure of a company's age, as it reflects the length of time that the company has been in existence and operating in its industry (Lambert et al., 2007).

3.2. Data collection and sample

A statistical sample of the present study consists of 145 companies admitted by the Tehran Stock Exchange Market, with 11 industries dating from 2011 to 2017. The companies were selected using the systematic removal method from 485 companies present on the Tehran Stock Exchange Market, considering the following criteria. The reason for choosing these criteria is to ensure that homogenous samples are selected.

The Tehran Stock Exchange (TSE) is ranked in the top 20 major stock exchanges in the world (Bloomberg, 2019; Forbes, 2021). It is also Iran's largest stock exchange, which first opened in 1967. As of 5.5 million registered companies in Iran, 485 companies with a combined market capitalization of US$172 billion were listed on TSE based on the Iran Chamber of Commerce, Industries, Mines, and Agriculture (ICCIMA) report in 2019. But based on World Federation of Exchanges (WFE), the TSE is ranked 17th in the world by market capitalization among exchanges with a market cap of over US$1 trillion.

Considering the required information for 2011 to 2017, the selected companies were admitted to Tehran Stock Exchange Market by March 2011 and have not been removed until March 2018. To enhance the comparability of the selected companies, their financial period must end by the 20th of March. The companies must keep the financial year the same within the subject period. The selected companies cannot be broker companies (investment companies, holdings, leasing companies, banks, and insurance companies) because such companies have different performance, and previous studies have also included only non-financial sector companies in their sample, such as Cheng et al. (2018).

Required information about the selected companies (including said variables) must be available. The required data on R&D expenditure are extracted from the performance reports submitted to the general assembly. The data relating to other variables are extracted from the audited financial statements, including profit and loss statements, balance sheets, and production and sales statistics, which are available at the Tehran Stock Exchange Market's official website (CODAL).

Marketing expenditures and selling, general, and administrative (SG&A) expenses are reported differently in financial statements, but they can overlap to some extent. Marketing expenditures are costs related to promoting and advertising a company's products or services to potential customers. These expenses can include things like advertising campaigns, public relations efforts, and promotional events. In financial statements, marketing expenses are typically reported as a separate line item under operating expenses. SG&A expenses, on the other hand, are broader and include all of the expenses associated with running a company's day-to-day operations, such as salaries and wages, rent, utilities, office supplies, and travel expenses. This category also includes marketing expenses, but it encompasses a wider range of costs (Markovitch et al., 2020). In some cases, marketing expenses may be included in SG&A expenses, and in other cases, they may be reported separately. The exact reporting practises can vary depending on the company and the accounting standards in use. Therefore, based on the situation, the data was gathered directly and indirectly from explanatory notes in companies' annual financial reports.

The study has conducted a Sargan test to evaluate the validity of all instruments. The Sargan test, also known as the Sargan-Hansen test, is a statistical test used to evaluate the validity of the overidentifying restrictions in the instrumental variable (IV) regression model (Sargan John, 1988). In an IV regression model, instrumental variables are used to address potential endogeneity issues caused by omitted variable bias or measurement error in the independent variable(s). The Sargan test evaluates whether the IVs used in the model are uncorrelated with the error term in the regression equation, which is a crucial assumption for the validity of the IV estimator. The Sargan test compares the difference between the observed and predicted values of the dependent variable in the IV regression model and tests whether the difference is significantly different from zero using a chi-square distribution. If the test statistic is statistically significant, it suggests that the overidentifying restrictions are not valid and the IV regression model may be misspecified (Hasen, 1982).

In addition, in the context of statistical modeling, it is important to ensure that the data used to estimate the model is valid and reliable. This can be achieved by using appropriate sampling methods, carefully selecting and measuring the variables used in the model, and conducting robustness checks to ensure that the results are not sensitive to changes in the model specification or assumptions (Hair, 2009; Kline, 2016). On the other hand, while the study used secondary data, it did not include a validation or reliability test. The authors ensured that the data collected for their study met the criteria for validity and reliability.

3.3. Data analysis

Considering the defined equations, the statistical model used in the present study is the Generalised Method of Moments (GMM) (Alam et al., 2019). The GMM is a method of estimating the model parameters in the panel data solution. This method takes the effects of the dependent variables' dynamic adjustments into consideration. Variables that exhibit time-lagged effects need to be included in the model with delays. For instance, if a company invests in R&D this year, the effect of this investment on performance may only be observed in the following year. If the dependent variable delays entering the model, a correlation occurs between the descriptive variables (regressors) and error term or residual; therefore, using the normal least squares method will result in incompatible results. The GMM can solve this problem by using instrumental variables. This method consists of two important tests named Arellano and Bond (1991) tests.

The GMM is a statistical technique employed to estimate the unknown parameters in a given model by matching the statistical properties (termed as moments) of the observed data with the ones predicted by the model. The moments in question could be any of the statistical properties, such as the mean or variance, derived from the observed data (Hall, 2005). The GMM relies on the construction of moment conditions, which are the equations that establish a relationship between these moments and the parameters of the model. The goal of the GMM is to identify the parameter values that reduce the moment conditions to zero or as close to zero as possible.

A significant advantage of GMM is its ability to function in the absence of specific assumptions about the underlying data distribution, unlike other popular techniques like maximum likelihood estimation. Instead, the GMM approach only necessitates well-defined moment conditions and a stationary and ergodic data-generating process (Stock and Watson, 2003). Empirically, the GMM technique has found various applications in the fields of economics and finance, such as asset pricing, forecasting, and panel data analysis. Its widespread adoption is primarily due to its flexibility and ability to handle complex statistical models (Hasen, 1982).

The GMM is a powerful model which, unlike the maximum likelihood method (ML), does not need information on the exact distribution of error phrases. Indeed, this is a dynamic model; where, in addition to the main variables, the delayed variables enter the pattern to have a better and more realistic estimation of the model. It can be said that many of the normal econometrical estimators can be regarded as special cases in GMM. In the dynamic GMM, the delay of the dependent variable is used as a dynamic tool with specified delays (Alam et al., 2019). Also, to avoid the correlation between the dependent variable, the delay, and the error phrase, the delay of the descriptive variables is used as a tool (Arellano and Bond, 1991). Therefore, according to Arellano and Bond (1991), who introduced this estimation method, only tools without correlation with error phrases are suitable for the GMM method. If this condition applies, indeed, GMM estimations are compatible. Thus, the instrumental variables used in the model are verified by the Sargan test, which was introduced by Arellano and Bond (1991). The theoretical formulas by which the parameters are estimated in this model are usually the orthogonal situations between a function (probably linear) of the parameters, $f(\theta)$, and a series of instrumental variables (Z_t), and indeed θ is the parameter that must be estimated.

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

Indeed, if the data are entered into GMM as follows:

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

$$\text{Specification} : c\ Z\ Z(-1)$$

This orthogonal situation is calculated through the following equations:

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

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

$$\sum \left(c(1)\log y_t + X_t^{c2}\right) Z_{t-1} = 0$$

The static panel method has particular problems in the fields of serial correlation, heteroscedasticity, and endogenous for some of the descriptive variables. The GMM estimator helps the researchers solve the serial correlation, heteroscedasticity, and endogenously problems for some variables.

GMM can be used to address the issue of serial correlation by estimating the parameters of the model based on a set of moment conditions. In GMM, the parameter estimates are chosen to minimize the distance between the sample moments (i.e., the sample mean, variance, and covariance) and the corresponding population moments implied by the model. By using a set of moment conditions that incorporate lagged values of the variables, GMM can account for serial correlation in the error terms. Thus, GMM can be used to overcome the problem of serial correlation by incorporating moment conditions that account for the autocorrelation in the error terms (Hasen, 1982). In this regard, the Arellano-Bond test, also known as the AR(1) and AR(2) tests, is a test for first-order and second-order autocorrelation, or serial correlation, in panel data. It is commonly used in econometrics to check the validity of the GMM estimator in dynamic panel models (Arellano and Bond, 1991).

Since in the dynamic panel model, the delay of the dependent variable is correlated to the inference phrase, the second delay of the dependent variable and delays of the other variables (in the form of a return model) are used as instruments for the delay of the dependent variable in the GMM method. Using this method, to estimate the model, it is necessary to determine the instrumental variables used in the model.

The instrumental variables of these models are the delayed values of the dependent and descriptive variables. The compatibility of the GMM estimators depends on the validity of the employed instrumental variables and the assumed lack of serial correlation between the error phrases. This validity can be verified by the two tests recommended by Arellano and Bond (1991). The statistics proposed by Arellano and Bond (1991) and Blundell and Bond (1998) are used to check the validity of the instruments matrix. This test is known as the Sargan test and verifies the validity of all instruments used in the model.

Statistics of the Sargan test are of the chi-square distribution, where a degree of freedom is equal to several over-identifying restrictions, and the zero hypothesis indicates the lack of correlation between the instruments and the inference components. Sargan test involves predefined restrictions and is used to determine all types of correlation between the instruments and the errors. The instruments are valid only when there is no correlation between the instruments and the error phrases. The zero hypothesis in this test indicates that the instruments are valid as long as they are not correlated to the errors in the first-order differential equations; and confirming the zero hypotheses can provide evidence of the fitness of the instruments. The GMM system model is compatible when there is no second-order correlation between the remaining values. If the GMM estimator is compatible and its instruments are valid, the dynamic panel data model will also be valid.

Table 5 presents the results of the Arellano-Bond test, which confirms the zero hypotheses for both first and second order serial correlation, with a probability of the statistical error greater than 0.05. Moreover, the validity of the instruments used in all the estimated models is confirmed by the fact that the probability of the Sargan test's Prob is greater than 0.05, indicating that the null hypothesis is accepted. These results provide a strong basis for confidence in the reliability of our findings.

4. Result

The data analysis in this paper is divided into two sections: descriptive statistics and inferential statistics. Descriptive statistics provide a comprehensive overview of the statistical sample, including measures such as the mean, median, and standard deviation of variables. Inferential statistics include tests such as the unit root test, the variance inflation factor (VIF) test, and the results of the model.

4.1. Descriptive statistics

Table 2 shows the descriptive indicators of the variables, including their dispersion and concentration indicators, to provide a more accurate understanding of the statistical sample situation.

4.2. Inferential statistics

4.2.1. Unit root test

A unit root test is a statistical test used to determine whether a time series dataset is stationary or not. Stationarity means that the statistical properties of the dataset, such as the mean and variance, remain constant over time. Unit root tests help to identify the presence of a unit root, which is an indication that the dataset is non-stationary. Unit root tests are commonly used in econometric studies, especially in time series analysis, to ensure that the data meets the necessary assumptions for estimation and inference (Kwiatkowski et al., 1992).

If the unit root test indicates that the variables are stationary (i.e., the null hypothesis of a unit root is rejected), then it suggests that the variables are integrated of order zero or I(0). In this case, there is no need to test for cointegration, as the variables are already stationary and any long-run relationship between them can be captured by including a constant term in the model. However, if the unit root test indicates that the variables are non-stationary (i.e., the null hypothesis of a unit root is not rejected), then it suggests that the variables are integrated of order one or higher (I(1), I(2), etc.). In this case, the variables may have a long-run relationship, and a cointegration test is necessary to investigate whether a linear combination of the variables is stationary. Some commonly used cointegration tests include the Johansen test and the Engle-Granger test (Dickey and Fuller, 1979). Therefore the unit root test is used to verify the sustainability of the variables. The test results are provided in Table 3.

All variables are sustainable since the probability of the statistics is smaller than 0.05 in all variables. Considering the results, the research variables are of zero-order cointegration; i.e. I(0), therefore there is no need for doing the cointegration tests.

4.2.2. Variance inflation factor test

The variance inflation factor (VIF) is a statistical test used to detect multicollinearity among predictor variables in regression analysis. Multicollinearity occurs when two or more independent variables in a regression model are highly correlated with each other, leading to unstable and unreliable coefficient estimates. The VIF test measures the degree of correlation between each predictor variable and the other independent variables in the model. A high VIF value indicates that a variable is highly correlated with other variables and may need to be removed from the model to improve its accuracy (Dickey and Fuller, 1979). In this regard, if the test statistic of VIF is close to one, no collinearity exists. As an empirical rule, if VIF value is greater than 5, the multicollinearity will be higher. Only independent variables are used to calculate this coefficient. This coefficient is calculated using the following formula:

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

R^2 is equal to the R-squared coefficient of fitness of the selected independent variable on the other independent variables. Table 4 shows the results of this test for all independent variables. As can be seen, all VIF values were close to 1, indicating that there were no significant multicollinearity issues among the variables. The variables used in the regression model are therefore not highly correlated, and the regression coefficients can be interpreted with confidence.

4.2.3. Model results

Based on the results obtained from the GMM in Table 5, the result of the estimation of effects are as follows.

4.2.3.1. Marketing expenditure effect. The effect of marketing expenditure on market share (H1) was supported in both model 2 ($p = 0.03$, t = 2.14) and model 3 ($p = 0.01$, t = 2.64). The study provides strong evidence of the positive influence of this resource on brand competitiveness. In other words, as companies increase their marketing expenses, their brand competitiveness improves in alignment with their market performance and sales share. These findings underscore the significant impact of investing in marketing campaigns on brand competitiveness.

Table 3
Unit root test results.

Variable	Statistic Value	Statistic Error Probability	Test Process	Result
MS	−45.4	0.00	Intercept and Trend	Confirm
ME	−37.8	0.00	Intercept and Trend	Confirm
R&DE	−55.5	0.00	Intercept and Trend	Confirm
Lev	−19.9	0.00	Intercept and Trend	Confirm
Size	−26.0	0.00	Intercept and Trend	Confirm
Age	−4.0	0.00	Intercept	Confirm

Table 4
VIF test results.

Variable	VIF	Criteria	Result
ME	1.10	Close to 1	No collinearity
R&DE	1.02	Close to 1	No collinearity
Lev	1.02	Close to 1	No collinearity
Size	1.04	Close to 1	No collinearity
Age	1.06	Close to 1	No collinearity

Table 2
Descriptive indicators of the variables.

Variables	Operation	Mean	Median	Maximum	Minimum	Standard Deviation	N
MS	Share of the company from the total market sales	0.08	0.03	0.86	0.0000418	0.12	1015
ME	Marketing expenditure to total company sales ratio	0.02	0.01	0.24	0.000169	0.03	1015
R&DE	R&D expenditure to total company assets ratio	0.01	0.01	0.29	0.000102	0.03	1015
Lev	Total company debts to total company assets ratio	0.61	0.61	4.00	0.03	0.28	1015
Size	Sales value logarithm of the company	6.20	6.06	8.60	3.87	0.78	1015
Age	The number of active years the company has been in operation	35.92	36.00	105	7	15.10	1015

Table 5
Model estimation results.

Models	Effects on Market Share		
	1	2	3
ME(-1)		0.36	0.84
T-value		2.14	2.64
P-value		0.03	0.01
R&DE(-1)		0.03	0.95
T-value		1.12	1.93
P-value		0.26	0.05
ME×R&DE			40.62
T-value			1.72
P-value			0.09
Lev	0.01	0.03	0.06
T-value	0.56	1.25	1.67
P-value	0.58	0.21	0.10
Size	0.01	0.04	0.04
T-value	0.44	2.24	1.90
P-value	0.66	0.03	0.06
Age	0.00	0.00	0.00
T-value	0.43	−2.32	−2.45
P-value	0.67	0.02	0.01
AR(1)	−0.33	−1.49	−0.97
Prob	0.74	0.14	0.33
AR(2)	−1.02	−1.20	−0.38
Prob	0.31	0.23	0.70
Sargan Test (PVAL)	0.77	0.69	0.77

4.2.3.2. R&D expenditure effect. The effect of R&D expenditure on market share (H2) was not significant in Model 2 ($p = 0.26$, t = 1.12); however, in Model 3 it was marginally significant ($p = 0.05$, t = 1.93) in statistical significance at the 10% level. Thus, there is evidence supporting R&D expenditure as a significant antecedent of brand competitiveness, and H2 is supported. This result is intriguing, particularly considering the study's context is in Iran, where R&D expenditure may not be a primary focus. Several possible explanations for the marginal effect of R&D on brand competitiveness in this context could be the country's economic sanctions, its status as a developing nation with lower levels of R&D investment, and its reliance on adopting R&D from developed countries (Akcali and Sismanoglu, 2015).

4.2.3.3. Marketing and R&D expenditure interaction effect. The interaction effect between marketing expenditure and R&D expenditure on brand competitiveness (H3), was marginally significant in model 3 (*P value* = 0.09, T = 1.72) in statistical significance at the 10% level. Therefore, H3 is partially supported in this study, This result shows that investing in R&D and marketing together will improve the brand competitiveness of companies in the long run, further than each investment alone. In other words, by using marketing to support the company's innovations and launch new products, companies will achieve better long-run brand competitiveness.

While the results indicate it is important that both R&D and marketing are invested simultaneously, marketing expenditures play a more significant role in improving brand competitiveness, specifically in developing countries such as Iran. The existing literature in this domain remains unexplored, making this research crucial in uncovering implications for both theory and practice, supported by gathered evidence.

5. Discussion

Three hypotheses have been tested in the present study to investigate the long-term effects of R&D expenditure, marketing expenditure, and their interaction on the performance dimension of brand competitiveness. The results show the accumulative effect of these two expenditures when they are simultaneously combined to achieve high brand competitiveness in the long run (e.g. sales growth and market share, in the long run, are influenced by investments related to marketing and R&D).

H1 examined marketing expenditure on the performance dimension of brand competitiveness and the findings are in line with the previous studies (Cheng et al., 2018; Haryanto and Retnaningrum, 2020; Peterson and Jeong, 2010). It demonstrates that the market share and overall performance of companies in the market are adequately sensitive to marketing expenditure, and similar studies properly support this argument.

The study has found that H2, which examined the direct effect of R&D on performance, has a different result. In this examination, the direct effect of R&D on market share was partially confirmed. It shows that the market share of the companies is sensitive to R&D expenditures, but not as significant as marketing expenditures, especially in developing countries. The marginally significant result might be attributed to the nature of a developing country, such as Iran, where the economy operates under sanctions and R&D is at a lower level. In such circumstances, the country often relies on adopting R&D from developed countries rather than having extensive indigenous R&D capabilities (Akcali and Sismanoglu, 2015).

Finally, the result of H3, which examined the interaction effect of marketing and R&D expenditures on the performance dimension of brand competitiveness, supported their effect on market share with 90% confidence. It demonstrates that companies' market share is affected by the interaction of marketing and R&D expenditures. However, the effect was only marginally significant in the specific research context of Iran. Future research should interpret the results cautiously, especially when applying them to other research contexts. Iran's economic sanctions and lower R&D investment compared to developed nations might contribute to these findings, as the country often relies on adopting R&D from external sources instead of having extensive indigenous R&D capabilities (Akcali and Sismanoglu, 2015). Therefore, the interaction of these two key factors, which Peter Drucker mentioned as the only profitability factors, can produce more complementary effects than direct effects alone. Accordingly, companies are recommended not to overlook marketing and/or R&D investments in order to achieve long-term performance as both marketing and R&D expenditures can enhance the companies' brand competitiveness. However, as the effect of R&D was marginally significant, companies also need to invest in marketing to simultaneously increase their competitiveness.

6. Research implications

6.1. Theoretical implications

The first contribution of this study is related to brand competitiveness which explains its antecedents through the lens of the resource-based theory, which needs more research in the literature.

This study has made a significant contribution to the brand competitiveness literature by introducing a novel perspective and providing a clear definition and antecedents of the concept. By addressing the existing gaps in the literature, this study has advanced the understanding of brand competitiveness and provided new insights for future research in this area. Initially, it presented an affirmation of defining this concept by performance indicators (Baumann et al., 2021; Rao and Holt, 2005) and real data of companies. On the other hand, while the literature lacks a consistent understanding of the antecedents and consequences of brand competitiveness, this study identifies and examines two important antecedents, thereby contributing to the theoretical understanding of this concept.

Second, this is among the first longitudinal study that provides empirical evidence related to brand competitiveness through a performance indicator, extending previous research such as Gupta et al. (2020) and Winzar et al. (2018). The significant effects revealed in this study highlight the potential for remarkable performance outcomes when marketing and R&D investments are made concurrently, and marketing campaigns adequately support each R&D effort. Parallel investments in R&D (i.e., create value) and marketing (i.e., appropriating

value) leads to higher performance and competitiveness, compared to allocating the budget for just one of these activities. Finally, the study extends resource-based theory by highlighting the complementary and interaction effects of investment in marketing and R&D resources. Thus, this study contributes to the resources-based theory (Barney et al., 2021; Ramaswami et al., 2009; Sharma and Erramilli, 2004), such that various resource interactions have multiple effects on performance and competitiveness. Besides, this study considers marketing and R&D as prominent resources of companies, emphasising specific resources boosting competitive advantage and performance (Sharma and Erramilli, 2004; Vadakkepatt et al., 2021).

6.2. Practical implications

Based on the theoretical implications explained above, the results of this study provide crucial practical implications for company managers, especially in developing countries.

The study reveals that simultaneous investments in R&D and marketing lead to outstanding performance. Therefore, companies are highly recommended to invest equally in both R&D and marketing activities, as they have overlapping and complementary interactions (Webster Jr, 2009). One way that managers can leverage the complementary interactions between R&D and marketing is by utilizing the research-based functions of marketing, such as consumer insights and market analysis, to guide the step-by-step processes of developing new products designed by R&D. Since marketing activities feed into R&D activities (Peterson and Jeong, 2010), ceasing investment in marketing could result in poor performance for R&D activities and ultimately have a negative impact on overall performance and brand competitiveness. Thus, it is crucial for companies to maintain investing in marketing to maximize their performance outcomes.

Second, as companies often have to work with limited budgets (Peterson and Jeong, 2010), it is recommended to invest equally in important capabilities to achieve long-term competitiveness even during economic crises. Lastly, by adopting a balanced approach that considers resource interactions, drawing from resource-based theory, long-term competitiveness can be further enhanced. The current business environment is characterized by growing technology and complex competition, where R&D plays a vital role in developing new products and services (Tung and Binh, 2022). However, the adoption process and brand competitiveness require marketing insights throughout the process, from idea generation to production and consumption stages. Therefore, this study offers a valuable framework to guide companies in formulating effective marketing, innovation, and branding strategies to enhance their long-term competitiveness in the market.

7. Conclusion, limitations and future research directions

The study defined and measured brand competitiveness as the previous performance of a company (Rao and Holt, 2005) and based on resource-based theory (Barney et al., 2021). It illustrated how we can assess brand competitiveness by the performance of companies with their real data in financial statements. It showed that the literature needs to understand the antecedents of brand competitiveness and how the interaction effect of marketing expenditure and R&D expenditure can improve brand competitiveness more than their single effects (Liu et al., 2021). Based on the results, it has been demonstrated that marketing serves as a stronger predictor of brand competitiveness in the long run compared to R&D expenditures. The interaction between marketing and R&D has the potential to yield positive outcomes, but managers must exercise caution due to the non-attainment of the significance level of 0.05. For companies in developing countries, especially those currently possessing R&D capabilities but lacking in marketing, it becomes imperative to bolster their marketing efforts to enhance competitiveness and leverage the full potential of their R&D investments.

In this regard, similar to other studies, some limitations affected the research process, which can be considered. First, *theoretically*, there were limited sources and frameworks related to brand competitiveness, which affected the generalizability of the results of this study. Second, *conceptually*, brand competitiveness encompasses qualitative indicators, yet many companies did not provide any real data concerning them. Third, *methodologically*, the unavailability of comprehensive data from a wide range of companies posed a challenge. Additionally, some essential indicators like competitiveness, marketing, and R&D were absent from the model due to companies' non-disclosure. Furthermore, several companies submitted their statements belatedly, precluding their inclusion in the study. Furthermore, although the research was conducted using data from the Tehran Stock Exchange, future studies could enhance the generalizability of the findings by including data from other stock exchanges as well.

Hence, for future research, there are several avenues worth exploring. Firstly, conducting comparative studies of this model in diverse countries and stock markets would provide valuable insights. This would enable a deeper understanding of the findings in various contexts. Second, as this study contributed to the resources-based theory that the interaction effects of resources have more than a single effect, future research can design frameworks that explore synergetic outcomes resulting from the interaction of different tangible and intangible resources within organizations. For example, understanding which resource interactions yield greater improvements in performance and competitiveness can provide essential guidance to decision-makers. Furthermore, in-depth investigations could focus on specific components of marketing and R&D resources to identify which elements contribute the most to brand competitiveness. This knowledge would be highly beneficial for organizations seeking to optimize their strategies. Finally, future studies can conceptualise brand competitiveness through both quantitative and qualitative components and identify its antecedents and consequences in different industries and cultures.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jretconser.2023.103532.

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