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Research Article

A panel data analysis of the determinants of advertising intensity in the Turkish manufacturing sector

Türk imalat sektöründe reklam yoğunluğu belirleyicilerinin panel veri analizi

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Abstract

This study investigates the determinants of advertising intensity using panel data on 66 four-digit Turkish manufacturing industries from 1993–1999. The results from pooled OLS and fixed-effects regressions support a quadratic relationship between advertising intensity and concentration: Advertising intensity first increases with the concentration ratio, and when the concentration ratio rises above a certain threshold, increases in the concentration ratio decrease the advertising intensity. The results also indicate that more profitable and faster-growing industries advertise more intensively. Product durability, exporting intensity, and the sale of consumer goods appear to be additional factors influencing advertising intensity. However, the evidence regarding these factors is not very strong.

Keywords: Advertising Intensity, Dorfman-Steiner Condition, Inverted-U Hypothesis, Market Concentration, Profitability

Jel Codes: D21, M37, L60

Öz

Bu çalışmada 66 dört haneli Türk imalat endüstrisi için 1993–1999 dönemine ait panel veriler kullanılarak reklam yoğunluğunun belirleyenleri araştırılmaktadır. Havuzlanmış en küçük kareler ve sabit etkiler regresyonlarından elde edilen sonuçlar reklam yoğunluğu ile yoğunlaşma arasında bir kuadratik ilişkinin varlığını ortaya koymuştur: Reklam yoğunluğu yoğunlaşma oranı ile birlikte önce artmakta, yoğunlaşma oranı belli bir eşik değerin üzerine çıktığında yoğunlaşma oranındaki artışlar reklam yoğunluğunu azalmaktadır. Sonuçlar ayrıca, daha kârlı ve daha hızlı büyüyen endüstrilerin daha yoğun reklam verdiğini göstermiştir. Ürün dayanıklılığı, ihracat yoğunluğu ve tüketim malları satışı reklam yoğunluğunu etkileyen diğer faktörler olarak görünmektedir. Ancak, bu faktörlere ilişkin kanıtlar çok güçlü değildir.

Anahtar Kelimeler: Reklam Yoğunluğu, Dorfman-Steiner Koşulu, Ters-U Hipotezi, Piyasa Yoğunlaşması, Kârlılık

JEL Kodları: D21, M37, L60

Introduction

As a powerful source of product differentiation, advertising plays an important role in influencing consumer behaviour, shaping business strategies, and ultimately affecting firm sales and profitability. It can increase sales through different channels, each representing a distinct view of advertising. First, advertising can persuade consumers to purchase a product by altering their preferences, causing a rightward shift in the demand curve. Additionally, it plays an informative role, reducing search and transaction costs for consumers. Lastly, there is the potential for a business stealing effect, where advertising primarily diverts sales from one brand to another (Wang and Gambaro, 2019).

Understanding the determinants of advertising intensity is important, as it unveils the factors driving promotional investment, provides critical insights into market competition dynamics, and offers strategic guidance to businesses seeking to optimize their promotional efforts. By identifying the factors influencing advertising intensity, firms can make more informed marketing decisions, tailor promotional efforts to specific industry characteristics, and improve their financial performance. Additionally, policymakers and regulatory authorities can benefit from this research, as a deeper understanding of the determinants of advertising intensity can inform the formulation of industry-specific policies that promote fair competition and industrial development.

This study conducts an econometric investigation into the determinants of advertising intensity in the Turkish manufacturing sector, using panel data from 1993 to 1999 that covers 66 four-digit Turkish manufacturing industries. By utilising panel data, we address the potential biases associated with cross-sectional analyses and account for industry-level unobserved heterogeneity. Incorporating industry-fixed effects allows us to control for unobservable factors that may confound the relationship between advertising intensity and its determinants.

The primary motivation for the study stems from the lack of comparable research in Turkey and other developing countries. Despite the critical importance of advertising intensity in influencing profitability and market competitiveness, the scarcity of empirical studies exploring this phenomenon in the Turkish manufacturing sector is evident. Furthermore, the lack of similar investigations in other developing countries limits the transferability of existing findings to diverse contexts. Hence, this paper fills a significant research gap and contributes to the literature by offering valuable insights into the fundamental factors driving advertising expenditures and providing a better understanding of the intricacies of advertising dynamics in a developing country setting.

The structure of the article is as follows. First, we specify the model to be estimated, providing a thorough discussion of the underlying theoretical literature. Second, we provide a comprehensive overview of the relevant empirical literature on the determinants of advertising intensity. Third, we present and discuss our empirical results, unveiling the factors significantly influencing advertising intensity. The final section of the study concludes the paper and makes recommendations for future research.

Theoretical framework and the model

The model we will estimate to investigate the determinants of advertising intensity in Turkish manufacturing industries contains most of the variables employed in previous research and takes the following form:

$$ADV = \beta_0 + \beta_1 PCM + \beta_2 CR + \beta_3 CR^2 + \beta_4 GRO + \beta_5 CG + \beta_6 DUR + \beta_7 RD + \beta_8 IMP + \beta_9 EXP + \varepsilon$$

The dependent variable of the model is ADV, advertising intensity, defined as advertising expenditures divided by total industry output. The independent variables are defined as follows:

PCM: Price-cost margin. (Following Collins and Preston (1968, 1969), we calculate the price-cost margin as (Value Added – Payroll) / Total Output)).

CR: Concentration ratio (the four-firm concentration ratio).

CR^2: Concentration ratio squared.

GRO: Growth rate of industry output.

CG: Consumer-goods industry dummy (1 if the industry is a consumer-goods industry; 0 if it is a producer-goods industry).

DUR: Durable-goods industry dummy (1 if the industry is a durable-goods industry; 0 if it is a nondurable-goods industry).

RD: Research and development intensity (R&D expenditures divided by total industry output).

IMP: Import competition (share of imports in total industry output).

EXP: Exporting intensity (share of exports in total industry output).

The primary focus of this paper revolves around two fundamental research questions regarding the determinants of advertising intensity: First, how does profitability (proxied by PCM) influence the level of advertising expenditures in manufacturing industries? Second, does the concentration ratio within these industries significantly impact advertising intensity, and if so, does it support the inverted-U hypothesis, which posits a nonlinear relationship between market concentration and advertising intensity? Below, we present the theoretical rationale for including each variable in the advertising intensity model.[1]

According to the Dorfman-Steiner (1954) condition for optimal advertising for a monopolist that chooses price and advertising to maximize profit, the profit-maximizing level of advertising intensity is equal to the product of the price-cost margin and the advertising elasticity of demand:

$$ADV = \left(\frac{P-MC}{P}\right)\varepsilon_a,$$

where ε_a is the advertising elasticity of demand. According to this condition, the greater the Lerner index (the price-cost margin) and the greater the advertising elasticity of demand, the greater the optimal advertising intensity.

In an oligopolistic industry, the condition for an individual firm can be expressed by a similar equation:

$$ADV_i = \left[\frac{P-MC_i}{P}\right]\left(\varepsilon_{aq} + \varepsilon_{rq}\varepsilon_{ar}\right),$$

where ADV_i is firm i's advertising intensity, $(P - MC_i)/P$ is its margin, ε_{aq} is the elasticity of own demand with respect to own advertising, ε_{rq} is the elasticity of own demand concerning rivals' advertising, and ε_{ar} is the elasticity of response of rivals' advertising concerning own advertising (conjectural elasticity) (See, for example, Waterson (1984: Ch. 7), and Hay and Morris (1991: Ch. 5)).

Under the assumption of Cournot behaviour, where firms anticipate that their competitors' advertising expenses will remain constant in response to their advertising expenditures, ε_{ar} becomes zero. In this case, the condition simplifies to $ADV_i = [(P - MC_i)/P]\varepsilon_{aq}$. Scherer and Ross (1990: 595) suggest that Cournot's behaviour is quite probable in advertising due to the involvement of time lags and uncertainty.

The Dorfman-Steiner condition implies that additional sales become more profitable as the price exceeds the marginal cost, leading to a higher optimal advertising intensity. Therefore, we anticipate a positive sign for β_1, the coefficient price-cost margin (PCM), in the advertising-intensity equation.

The conventional theory, known as the inverted-U hypothesis (Greer, 1971; Cable, 1972; Sutton, 1974; Strickland and Weiss, 1976), underpins the relationship between advertising intensity and concentration. According to this hypothesis, advertising is expected to increase with concentration initially but then drop at higher concentration levels.

Cable (1972) explains the hypothesis relying on the impact of concentration on elasticities given the industry's demand conditions. The first term on the right-hand side of the Dorfman-Steiner condition, the price-cost margin, shows an inverse relationship with the absolute value of the price elasticity of demand. As more concentrated industries have lower absolute values of the price elasticity of demand, advertising intensity might be expected to increase with concentration.

On the other hand, the advertising elasticity of demand is expected to decrease at higher concentration levels when the market structure approaches monopoly. This is because the advertising elasticity of demand tends to be higher for an oligopolist than a monopolist, as the former registers consumers switching brands.

Consequently, at higher levels of concentration, we anticipate a negative relationship between concentration and advertising intensity because the impact of concentration on the advertising elasticity of demand is expected to outweigh its effect on the price elasticity of demand.

[1] For the specification of the advertising intensity equation, see Günalp (1997). In this study, an advertising intensity equation for the U.S. manufacturing industries is defined and estimated in a system of simultaneous equations, with profitability and concentration being the other endogenous variables.

Additional studies have also put forth arguments supporting the inverted U relationship. For instance, Ornstein (1977), Pagoulatos and Sorensen (1981), and Uri (1988) contend that with an increase in concentration, relatively larger firms will be able to capture a larger share of the industry-wide returns resulting from their advertising efforts. Moreover, to the extent that concentrated industries face more price-inelastic demands, advertising might become the primary competition tool instead of prices in industries approaching an oligopolistic structure. Consequently, it is reasonable to expect that advertising intensity will initially increase with concentration. However, advertising will likely diminish at higher concentration levels because collusion to avoid mutually offsetting advertising becomes easier (Greer, 1971; Cable, 1972; Sutton, 1974; Strickland and Weiss, 1976).

All these arguments suggest that advertising should be quadratic in concentration; that is, the advertising-intensity equation should include both CR and CR^2, with a positive sign expected for β_2, the coefficient of CR, and a negative sign for β_3, the coefficient of CR^2.

The advertising elasticity of demand (ε_a), which measures the effectiveness of advertising, is the second term on the right-hand side of the Dorfman-Steiner condition. Because it is difficult to observe and measure, the conventional strategy is to include variables that describe the demand side of the market. We incorporate several variables in the advertising-intensity equation that are expected to influence the advertising elasticity demand.

The consumer-goods industry dummy (CG) is one of the most important of these variables (for research using a dummy variable of this type, see Martin (1979b) and Pagoulatos and Sorensen (1981)). β_5, the coefficient of CG, is likely to be positive for two reasons: First, consumer goods are, in general, more differentiable through advertising than producer goods. Second, advertising, instead of direct sales, is likely a more effective way of reaching potential consumer goods customers than producer goods industries.

The model also incorporates the growth rate of industry output (GRO). As rapid growth in demand often involves introducing new products, which are typically heavily advertised, a positive correlation is anticipated between advertising and growth. Furthermore, during periods of demand growth, profits are likely to be available to finance additional advertising efforts (Comanor and Wilson, 1974; Pagoulatos and Sorensen, 1981). However, rapid growth might reduce advertising intensity if advertising expenditures fail to grow at the same rate as total industry output (Uri, 1988). Consequently, we do not have a strong prior expectation for the sign of β_4, the coefficient of the growth rate of industry output in the model.

We incorporate a durable goods industry dummy (DUR) into the model to differentiate between durable and nondurable goods industries. Given the extended lifespan of durable goods and their inherent complexity, consumers will conduct more comprehensive searches of the available products, carefully assessing their distinct characteristics and attributes.[2] Due to the generally higher prices of such goods, any errors in evaluating them would lead to greater consumer welfare losses (Resende, 2006). When buying durable products, consumers may consult unbiased sources like specialist magazines to acquire information rather than relying solely on the seller's advertising, which, besides being informative, also has a persuasive purpose (Jones, 2004). Therefore, durable products would tend to be less responsive to advertising. Furthermore, one would expect advertising to have a less important role in the case of durable goods as price rivalry becomes more important (Comanor and Wilson, 1974). These imply a negative sign expectation for β_6, the coefficient of the durable goods industry dummy variable.

If R&D and advertising are complementary inputs, R&D intensity may increase the elasticity of demand with respect to advertising (Farber, 1981). In this case, advertising intensity will increase with R&D intensity. If, on the other hand, R&D and advertising are substitutes, one would expect the opposite. Therefore, we lack a robust prior expectation for the sign of β_7, which represents the coefficient of the R&D intensity in the model.

Lastly, foreign trade factors are expected to impact advertising intensity (Martin, 1979a; Caves, Porter, Spence, and Scott, 1980). To account for this, we incorporate two variables in the advertising intensity equation: import competition (IMP) and exporting intensity (EXP). These variables aim to capture the impact of foreign trade on the level of advertising activity.

[2] Nelson (1970, 1974) distinguishes between "search goods" and "experience goods". Search goods are those whose attributes can be determined prior to purchase, making them less amenable to misleading and persuasive advertising. Experience goods, on the other hand, are those whose attributes can only be fully understood after purchase. Therefore, they are more amenable to deceptive and persuasive advertising. Durable products are usually classified as search goods rather than experience goods.

Because market rivalry is positively related to the extent of import competition, advertising intensity is expected to decrease with import competition. This suggests a negative sign for β_8, the coefficient of the import competition variable.

High exporting intensities indicate a world market with more intense competition than what is reflected by the concentration ratio in the home country. Greater rivalry implies lower advertising expenditures. However, exports may represent goods the home country holds a competitive advantage in the world markets achieved through successful product differentiation. To the extent that this product differentiation is accomplished through advertising, exporting intensity will positively correlate with advertising intensity. As a result, the sign of β_9 cannot be determined a priori.

Literature review

While some empirical studies investigating the determinants of advertising intensity are single-equation studies, others have estimated advertising intensity within a system of simultaneous equations.

Greer's (1971) pioneering study explores the relationship between advertising intensity and concentration, suggesting a potential inverted-U or quadratic pattern. He posits that a positive correlation exists between the two variables up to a certain level of concentration, beyond which advertising intensity might decrease. Greer examines 41 consumer-goods industries using IRS (Internal Revenue Service) data to test this and finds a strong quadratic relationship between advertising intensity and concentration, especially for two classes, the frequently purchased standard convenience goods and the infrequently purchased speciality or shopping goods.

Comanor and Wilson (1974) emphasize that market structure variables, demand variables, and profitability influence an industry's advertising intensity. Using a sample of 38 three-digit U.S. SIC (Standard Industrial Classification) consumer-goods industries. They find that profitability and product durability have significant effects on advertising intensity.

Employing 1963 data on 327 U.S. four-digit SIC industries, Lustgarten (1975) regresses advertising intensity on total industry sales, the percentage of sales going to final consumer demand, the four-firm concentration ratio, and the buyer concentration ratio. The results indicate that the first three variables have highly significant coefficients with positive signs. The coefficient of the buyer concentration ratio is also highly significant and has the expected negative sign.

Brush (1976) studied 28 U.S. four-digit SIC consumer goods industries, using concentration, industry growth rate, market size, and product durability as independent variables in his advertising intensity equation. The findings suggest a positive linear relationship between concentration and advertising intensity. However, support for a quadratic relationship is not found. When the squared term is included in the model, concentration and concentration squared variables become insignificant. The rate of industry growth performs relatively poorly compared to other variables. Brush also observes that the coefficients of the nondurable-industry dummy and market size are significant, with the expected positive and negative signs, respectively.

Ornstein (1976, 1977) gathered data from 329 and 324 U.S. four-digit SIC industries for 1963 and 1967, respectively. He finds support for a linear relationship between concentration and advertising intensity in all subsamples except the producer durables after running separate regressions for each subsample and each year. The findings indicate that concentration positively influences advertising, not only in consumer goods industries but also in producer nondurable goods industries. In addition to examining the linear hypothesis, Ornstein also investigates the inverted-U hypothesis. Still, the results do not provide evidence of a quadratic relationship between advertising intensity and concentration.

Industrial economists have long acknowledged the importance of modelling the interconnections among elements of industry structure, conduct, and performance using simultaneous equations. Beginning with Strickland and Weiss (1976), a number of studies have estimated what Martin (1993) calls a "generic" three-equation model, with advertising intensity, concentration, and price-cost margin (a measure of profitability) treated as endogenous. Martin (1979a, 1979b), Pagoulatos and Sorensen (1981), Coate and Uri (1986), Gisser (1991), Delorme, Kamerschen, Klein, and Voeks (2002), and Chen and Waters (2017) are some examples.

Strickland and Weiss (1976) use 1963 data on 408 U.S. four-digit SIC industries. They estimate the three equations separately for the total sample, the consumer goods, and the producer goods industries. The 2SLS (two-stage least squares) estimation results support a quadratic relationship between advertising intensity and concentration for the consumer goods industries. Advertising intensity reaches its maximum at concentration values of 0.57 and 0.46 in the total and the consumer goods samples, respectively. The variable representing the percentage of industry sales going to final consumer demand strongly and positively affects advertising in the producer goods sample. The growth rate of industry sales, product durability, and the price-cost margin variables are significant determinants of advertising intensity, at least in one of the subsamples.

Martin (1979a) points out that the system of equations in the model specified by Strickland and Weiss (1976) fails to satisfy the rank condition for identification. He solves this problem by basing his concentration equation on a dynamic limit pricing model. Employing 1967 U.S. data on a sample of 209 industries from the input-output tables, he finds that the price-cost margin significantly impacts advertising intensity. Martin's analysis also supports an inverted U relationship between advertising intensity and concentration. In a follow-up investigation, Martin (1979b) specifies the three equations slightly differently and examines the robustness of his prior research's conclusions by employing alternative profitability measures. Using the same sample and dataset, he arrives at comparable findings. The results of this study also corroborate the inverted-U hypothesis and reveal that the critical concentration level, beyond which increasing concentration begins to reduce advertising, falls within the range of 45 to 50 per cent, depending on the profitability measure utilized.

Pagoulatos and Sorensen's (1981) contribution is to include estimates for price elasticity of demand (which is made possible by restricting the sample to food industries). They analyzed data from 47 food processing industries defined at the four-digit SIC level in 1967. Their research findings reveal that higher values of concentration and price-cost margin variables lead to increased advertising intensity. Additionally, they observed that advertising intensity is higher in consumer goods than in producer goods industries. However, it was found that the price elasticity of demand does not significantly influence advertising.

In their research, Coate and Uri (1986) utilize data from 1977, focusing on a sample of 268 U.S. four-digit SIC industries. Their findings indicate that concentration has a quadratic impact on advertising intensity, although the significance of this relationship is relatively weak. They identify several other factors that significantly determine advertising intensity, including the percentage of industry sales going to final consumer demand, industry sales growth rate, product durability, and the price-cost margin.

Gisser (1991) uses a sample of 445 U.S. four-digit SIC industries. The results of the 2SLS estimation reveal that profitability has a significant positive impact on advertising intensity. Their results also indicate that industries producing heterogeneous goods tend to spend more on advertising than industries producing homogeneous products.

Delorme et al. (2002) build upon previous research using a lag structure to signify that advertising, concentration, and profitability do not affect one another contemporaneously. The 2SLS estimations based on U.S. four-digit SIC industries for 1982, 1987, and 1997 indicate that concentration, lagged growth in sales, and lagged profit are not significant determinants of advertising. The authors conclude that advertising follows a process that is independent of the factors considered in the study.

Resende (2007) formulated a simultaneous four-equation system for Brazil, in which the concentration ratio, advertising intensity, profitability, and R&D intensity are determined endogenously. The data used in the study is at the firm level and covers 7188 manufacturing firms classified within the four-digit industry classification for 1996. The findings validate the inverted-U relationship between advertising intensity and concentration. However, a counterintuitive outcome arises concerning the negative coefficient associated with profitability.

Gathering firm-level U.S. data from S&P's Compustat, the Census Bureau, and the Bureau of Labor Statistics (BLS) for 1993-2012, Chen and Waters (2017) estimate their equations system by 2SLS and 3SLS. The authors find that concentration has a nonlinear and statistically significant effect on advertising intensity. The results also show that the durable goods industry dummy, the ratio of industry personal consumption expenditures to sales, the growth rate of firm sales, and firm profitability are all significant determinants of a firm's advertising intensity.

As far as we can see, the published research on the determinants of advertising intensity in Turkey is very scant, and no study performs a panel data analysis of advertising intensity.

In their cross-sectional analysis of 82 four-digit Turkish manufacturing industries in 1998, Bal and Şengök (2003) included only the concentration and squared concentration ratios as explanatory variables in the advertising intensity equation. Their regression equation fails to control other important factors such as profitability, industry growth, and the consumer goods industries. The result of estimating this equation indicated that the coefficients of both variables were statistically insignificant. Therefore, their analysis did not support a linear or quadratic relationship between advertising intensity and industrial concentration. The authors repeated the estimations using the rate of change values for the concentration ratio and advertising intensity variables for 1993-1998; this time, the results were significant. The authors also calculated the minimum concentration ratio increase rate based on the equation estimated using the rate of change values. According to their findings, as long as the annual increase rate of the concentration ratio remains below 14.5%, the rate of increase in the advertising intensity decreases. However, after the annual increase rate of the concentration ratio exceeds the 14.5% threshold, the increase in the advertising intensity increases as the rate of increase in the concentration ratio increases.

Data and estimation results

There are 86 ISIC (Revision 2) four-digit manufacturing industries in Turkey, but some industries have been excluded due to the lack of data, leaving us with a sample of 66 industries. The time dimension of the data set covers the period 1993-1999. The period begins with 1993 since the data for advertising expenditures begins from that year. The exclusion of the years 2000 and 2001 from the sample is due to the severe impact of the earthquake that hit Turkey’s most industrialized regions in the second half of 1999 and its particularly significant repercussions felt in 2000, followed by a severe economic crisis. Additionally, for the years after 2001, it is impossible to obtain data for some variables, and the available data generally become inconsistent with the previous years. All the data used in our study were obtained from the Turkish Statistical Institute, covering all private and public establishments with ten or more employees.

The descriptive statistics for all variables are reported in Table 1 below. It is observed from this table that the mean concentration ratio is 0.47, and the sample contains highly concentrated industries as well as industries where the concentration is very low. The mean advertising intensity is greater than the mean R&D intensity, suggesting that companies rely more on advertising as a strategy for product differentiation and, consequently, increasing profitability compared to R&D. The mean of IMP is significantly higher when compared to the EXP variable. A high importing intensity value suggests a high degree of import competition faced by the manufacturing industries in Turkey. Additionally, the table shows that 41% of the industries are categorized as consumer-goods industries, while durable-goods industries make up 47% of the total.

Table 1: Descriptive Statistics (462 observations)

Variable	Mean	Standard Deviation	Minimum	Maximum
ADV	0.00929	0.01749	0.00006	0.27053
PCM	0.30842	0.08972	0.11718	0.60814
CR	0.46799	0.20536	0.07679	0.99379
CR^2	0.26132	0.21694	0.00590	0.98762
GRO	0.08462	0.30554	-0.71097	2.03862
CG	0.40909	0.49220	0	1
DUR	0.46970	0.49962	0	1
RD	0.0018	0.00379	0	0.05383
IMP	0.55666	1.10282	0.00038	7.78871
EXP	0.20050	0.23952	0.00002	1.78257

In order to detect whether there is a severe multicollinearity problem in our data, we calculated the correlation coefficients between the independent variables. Apart from the correlation between CR and CR^2 variables, the correlations between the explanatory variables are very low. The highest correlation identified is between PCM and CR variables, with a coefficient of 0.21.

Before proceeding to the estimation results, the choice of the panel data method needs to be determined. For this purpose, tests are conducted to determine whether panel data models should be pooled, use fixed effects, or employ random effects models. First, the suitability of the pooled model will be examined using the Honda (1985) test. Honda (1985) pointed out that the Breusch-Pagan (1980) Lagrange multiplier (LM) test has the problem that the alternative hypothesis is assumed to be twosided when we know that the variance component cannot be negative. He suggested a one-sided LM test for the poolability hypothesis, which has the property of being a uniformly most powerful test. In applying the Honda test, failing to reject the null hypothesis implies the absence of random effects, and therefore, the data can be pooled. Conversely, rejecting the null hypothesis suggests the presence of random effects.

The test results provided in Table 2 indicate that the null hypothesis (of poolability) of the Honda test has been rejected for both "individual" and "individual & time effects" ($p<0.05$), suggesting that random effects may exist in the model. (The null hypothesis of poolability cannot be rejected for the "time effects" alone, most probably because the time dimension of our panel is very short.)

Table 2: Results of Panel Data Model Selection Tests

Test Models	Test Method	Test Statistic	p-value
Cross-Section	LM Test (Honda)	10.857	0.0000
Time	LM Test (Honda)	-1.3564	0.9125
Cross-Section & Time	LM Test (Honda)	6.7177	0.0000
Random Effects vs. Fixed Effects	Hausman Test	18.2879	0.0107

Once it has been determined that the model cannot be pooled, the next step involves investigating whether it is suitable for the fixed- or the random-effects model. For this purpose, the Hausman test (1978) is employed. If the null hypothesis of the Hausman test cannot be rejected, it indicates the suitability of the random effects model. Conversely, its rejection implies that the fixed effects model should be adopted. According to the result of the Hausman test provided in Table 2, the null hypothesis is rejected ($p<0.05$). Therefore, based on the Hausman test result, it has been concluded that using the fixed effects method is appropriate for model estimation.

The estimation results are presented in Table 3. The second column in the table shows the results from the pooled OLS estimation, while the third column presents the estimation results with fixed industry effects. The pooled OLS results are reported for comparison purposes.[3]

The high value of the F statistic for both estimations indicates that the model as a whole is highly significant. The adjusted R^2 value in the pooled OLS estimation is relatively low, as is often the case with data where the cross-section dimension is much larger than the time-series dimension. With the inclusion of industry effects in the fixed effects estimation, it increases to 67%.

In line with the consensus of the majority of prior research, the price-cost margin (PCM) is significantly and positively associated with advertising intensity, consistent with the implications of the Dorfman-Steiner condition for optimal advertising. As previously mentioned, this suggests that the greater the price than the marginal cost, the more profitable an additional sale is, resulting in a higher optimal advertising intensity.

In both estimations, significant positive and negative coefficients on the CR and CR^2 variables, respectively, support the inverted-U hypothesis for the Turkish manufacturing industries. This finding is consistent with prior single and simultaneous equation studies, which generally supported the inverted U hypothesis. Advertising intensity peaks at the concentration values of 0.1 and 0.09 in the pooled OLS and the fixed effects estimations, respectively. Compared to the results of previous studies, these are very low concentration levels. This suggests that firms in Turkish manufacturing industries rely on advertising to compete at very low concentration levels when the competition is fierce. However, as the industry becomes more concentrated, the firms quickly recognize their mutual interdependence and avoid mutually offsetting advertising.

[3] As mentioned in the literature review section, many studies have estimated the advertising intensity equation within a system of simultaneous equations, emphasizing the presence of feedback effects in the structure-conduct-performance paradigm of industrial organization. As also noted in the literature review section, the variables most commonly considered as endogenous in these studies are advertising intensity, concentration, and the price-cost margin (profitability). In our study, we also modeled the advertising intensity within a simultaneous equations framework, with these three variables being treated as endogenous, and estimated it using the fixed effects 2SLS method. However, the results were not reported here because this estimation performed poorly.

Table 3: Estimation Results of the Advertising Intensity Model

Variable	Pooled OLS	Fixed-Effects
Constant	-0.004421[a] (0.00117)	-0.011373 (0.00884)
PCM	0.026743[a] (0.00272)	0.041231[b] (0.02172)
CR	0.108467[a] (0.00486)	0.099679[b] (0.05408)
CR^2	-0.007663[c] (0.00445)	-0.006672[c] (0.00391)
GRO	0.003625[a] (0.00082)	0.002724[b] (0.00140)
CG	0.001830[a] (0.00056)	0.001158 (0.00103)
DUR	-0.002727[a] (0.00054)	-0.001031 (0.00098)
RD	0.111382 (0.09810)	-0.0605298 (0.05576)
IMP	0.000138 (0.00023)	-0.000607 (0.00126)
EXP	-0.003853[a] (0.00096)	-0.010963[c] (0.00641)
Adj. R^2	0.34	0.67
F	25.27[a]	27.59[a]
N	462	462

Notes: 1. ADV is the dependent variable. 2. Figures in parentheses are robust standard errors. 3. a = significant at 1 percent, b = significant at 5 percent and c = significant at 10 percent.

This result differs from the finding of Bal and Şengök (2003), who did not find either a quadratic or a linear relationship between advertising intensity and industrial concentration for the Turkish manufacturing industries. However, as indicated in the preceding section, their estimation is subject to several limitations: they perform a cross-sectional analysis with a relatively low number of observations; due to their use of cross-sectional data, they fail to control for industry-level unobserved heterogeneity; and their model omits several important variables, such as profitability, industry growth, and product durability.

The coefficient of GRO is positive and highly significant. This would suggest that periods of rapid growth in industry demand involve launching new products that are extensively promoted or that profits will likely be available to finance further advertising efforts when demand grows. This result is partly in line with previous studies conducted in the US, where the growth in industry sales was either significant or exhibited weak performance.

The coefficients on CG and DUR are significant and have the hypothesized signs in the pooled OLS estimation. A positive coefficient on CG indicates that the consumer goods industries in Turkish manufacturing advertise more than the producer goods industries. This confirms that consumer goods are more differentiable through advertising than producer goods or that advertising is more effective in reaching potential buyers in consumer goods than producer goods industries. The coefficient of the durable-goods industry dummy is negative, validating the expectation that durable goods are advertised less than nondurable goods for Turkish manufacturing. This finding would suggest that consumers seek alternative, unbiased information regarding typically higher-priced durable goods rather than relying solely on the advertising provided by the sellers. However, the evidence regarding these two variables is not robust, as their coefficients become statistically insignificant when industry-fixed effects are included.

An insignificant coefficient on R&D intensity (RD) implies that R&D and advertising are neither complementary nor substitute inputs. Given the low sample mean for the RD variable, this is not a surprising result.

Finally, of the foreign trade variables, only the exporting intensity variable (EXP) is significant. Its negative association with advertising intensity might indicate that industries with high exports face a world market with correspondingly greater rivalry than recorded by the home country's concentration ratio, which in turn means lower advertising expenditures.

Conclusion

This paper investigated the determinants of advertising intensity in the Turkish manufacturing sector from 1993 to 1999 using panel data from 66 four-digit industries. For this purpose, a model of advertising intensity was specified, incorporating the most commonly used variables in previous studies, and then estimated. The significance of the study lies in the scarcity of comparable research not only in Turkey but also in other developing countries.

The findings for Turkey in this study are generally consistent with previous research, which has mostly been conducted in the US. Similar to those studies, we found that profitability and industry growth variables significantly influence advertising intensity: industries with higher profitability and faster growth tend to advertise more.

Our findings also supported the inverted-U hypothesis, aligning with the results of previous research, particularly the simultaneous equations studies. Advertising intensity increases with concentration at low levels, but the relationship changes sign at higher levels. However, compared to the results of previous studies, the concentration ratio at which advertising intensity reaches its maximum appears to be very low in Turkish manufacturing industries. This would imply that at very low concentration levels when rivalry is strong, firms in Turkish manufacturing industries rely on advertising as a strategy of competition. However, as the industry gets more concentrated, firms quickly realize their mutual interdependence and refrain from offsetting advertising activities.

Product durability, exporting intensity, and the sale of consumer goods seem to be additional factors influencing advertising intensity. Nevertheless, the evidence supporting these factors is not very robust, which also aligns with the findings of previous studies, most of which have reported conflicting results regarding these variables.

For future research, a promising direction could involve estimating an explicit simultaneous system for Turkish manufacturing that includes advertising, profitability, and industrial concentration equations. This approach would account for the feedback effects in the structure-conduct-performance paradigm. Such a study could yield intriguing new insights, especially for developing countries. Furthermore, both simultaneous equations and single equation studies could greatly benefit from utilising firm-level panel data sets, as they would significantly increase the number of observations and enable researchers to control for firm-level unobserved heterogeneity.

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