

## The Optimal Level of Advertising and Long-Run Equilibrium Relationship Between Advertising and Profit: The Case Study of Iranian Sepah Bank

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**Abstract:** The existence of a long-run equilibrium relationship between advertising expenditures and sales revenues or profits suggests that firm's decisions to fix advertising as a ratio of performance index (Dorfman-Steiner condition) might represent optimal behaviour. This study attempts to provide evidence for such a relationship between advertising expenditures and profit using a sample of monthly time series data in Sepah Bank over the period 2002-2008. The results show the existence of long-run equilibrium relationships between the bank profitability and advertising expenditure in the sample period. This suggests that in long-run the bank's advertising expenditure is in optimal level. The evidence also bears out the hypothesis of existence a two-way causation between advertising expenditures and profit of Sepah Bank in long-run.

**Key words:** Bank, profitability, advertising intensity, Dorfman-Steiner condition, co-integration, Iran

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### INTRODUCTION

Iranian banking sector has recently experienced a structural change by authorizing the creation of private banks as well as recapitalization and partial privatization of the existing commercial banks. This reform has led to more competition between banks. Therefore, the banks are seeking different strategies to spread their role in the market. Following the central bank's implementing policies such as equating loan rates with deposit rates, the banks attempt to achieve maximum profitability through non-price strategies, including advertisement. Accordingly, researchers examine the long-run equilibrium relationship between advertising expenditures and operating profit of Sepah Bank (Oldest Iranian bank). Existence of a long-run equilibrium relationship (co-integration) between advertising expenditures and profitability provides an evidence for the accuracy of optimal strategic behaviour of firms in determining advertisement expenditures as a constant ratio of their sales. Dorfman and Steiner (1954) and Schmalensee (1976) showed that if advertisement led to demand shift and the profit maximizing monopolist determined the price and advertisement volume simultaneously, there would be an optimal level of advertising expenditures-sales ratio which has a reverse relationship with demand elasticity. Hence, the higher the price elasticity of market demand, the more attention is paid on advertisement by profit maximizing firm instead of price-cutting. Consequently, the existence of a long-run equilibrium relationship between advertising

expenditures and level of sales revenue (or profitability) implies that the firm's choosing to establish advertising expenditures as a portion of sales represents its optimal behaviour. Lack of the relationship between these two variables indicates that the firm is moving away from its long-run behaviour.

### ADVERTISEMENT AND SALE

In business, advertisement is usually defined as providing information about the price, quality and situation of goods and services. Advertising expenditures has been a tool for preventing competing firms to enter the industry and execution of distinction policy (Beath and Ulph, 1990; Beath *et al.*, 1987; Schmalensee, 1976). Output distinction is determined by substitution indicators such as percentage of registration, patent and brand costs of total cost and advertising intensity. Advertisement affects sale and, therefore, profit through increasing demand and decreasing demand elasticity (Bagwell, 2005). According to theory of financial economics, there must be long-run relationship between operating cash flows (Profitability) and capital expenditures (Ahmadi, 2005). Since advertisement cost is part of capital expenditures, it might have a long-run impact on bank's profitability. Empirical researches in the field of adverting effectiveness often suggest that advertisement has significant effects on firm's sale. The only distinction is about the duration of effectiveness in different industries or markets. Many researchers have

used co-integration techniques to capture the long-run equilibrium relationship (Baghestani, 1991; Zanas, 1994; Leach and Reekie, 1996). Using data at corporate level, they showed that co-integration existed between advertisement expenditures and sales amount. Seldon and Jung (1995) also indicated that advertisement expenditures and sales amount are co-integrated at aggregated level in the United States. However, Chowdhury (1994) concluded that no long-run equilibrium relationship existed between England's total investment expenditures and total consumption.

**DORFMAN-STEINER MODEL**

The optimal amount of advertising expenditures is an important subject in analysing advertising expenditures. For a profit-maximizing firm, the optimal value of such expenditures determined so that the firm's profit is maximized in the long-run. However, in the short-run, advertising expenditures of an incumbent firm in the industry could be consumed to achieve other objectives, including making hindrance for entrants. This is beyond the scope of the present study.

Dorfman-Steiner Model provides the optimal value of advertising expenditures given a firm incumbent performing in an oligopolistic market. Assuming that advertisement can affect demand, researchers can write:

$$Q = Q (A, P), Q_A > 0, Q_P < 0$$

Where:

Q = Amount of demand

A = Advertising amount and

P = Price

Hence, the firm's profit function is as:

$$\pi (P, A) = PQ (P, A) - C (Q (P, A)) - KA$$

Where, K is the cost of each unit of advertisement. According to first-order conditions of profit optimization, we have:

$$\frac{\partial \pi}{\partial P} = 0 \rightarrow (P - C') \frac{\partial Q}{\partial P} + Q = 0$$

$$\frac{\partial \pi}{\partial A} = 0 \rightarrow (P - C') \frac{\partial Q}{\partial A} - K = 0$$

Let K = 1, then from first-order conditions researchers have:

$$\frac{\partial Q}{\partial P} (P - C') = -Q$$

$$\frac{\partial Q}{\partial A} (P - C') = 1$$

From the above equations, researchers can write:

$$(P - C') = \frac{-Q}{\frac{\partial Q}{\partial P}} = \frac{1}{\frac{\partial Q}{\partial A}}$$

Given the definitions of price elasticity of demand and advertising elasticity of demand, researchers can write:

$$\frac{A}{PQ} = \frac{\epsilon_{Q,A}}{\epsilon_{Q,P}}$$

In this equation, the left-hand side is the ratio of advertising expenditures to sale revenue, known as advertising intensity and the right-hand side is the ratio of advertising elasticity to price elasticity of demand. Since this relation has been derived based on the assumption of profit maximizing behaviour, it can serve as a basis for calculating the optimal amount of profit maximizing advertising expenditures. Accordingly, the amount of advertising calculated by this equation can be called the optimum level of advertising. If a long-run relationship exists between advertising expenditures and sales revenue, the hypothesis of strategic optimal behaviour of the firm in setting advertising expenditures as a constant percentage of sales revenue would be approved. In this case, lack of co-integration between advertising and sale is an indicator of firm's deviation from optimum advertising behaviour (Esteve and Requena, 2006). Therefore, evaluation of this relationship is useful in appraising the profit maximizing behaviour of a monopolistic firm which is using advertising as a market developing tool.

**LONG-RUN EQUILIBRIUM RELATIONSHIP BETWEEN ADVERTISING AND PROFIT**

Another description of a constant relationship between advertising and sale or profit, known as optimum advertising intensity, is that these variables do not change independently or in more precision they are co-integrated. As a result, evaluation of co-integration could be useful tool to examine the existence of a long-run relationship between those variables. Also, co-integration and error correction models enable us to distinguish short-run fluctuations from long-run equilibrium. To test the long-run relationship existence between advertising expenditures and profitability of Sepah Bank, the following model is used:

$$\text{Profitability}_t = \alpha + \beta \text{advert}_t + u_t$$

In order to exist a long-run relationship between two variables, it must be  $u_t = 0$ . In fact,  $u_t$  is non-equilibrium error which is expected, assuming a long-run equilibrium relationship to be fluctuating around its mean and to have a systematic tendency to decrease over time. This requires  $u_t$  to be stationary. This argument is the basis of Engel-Granger test of co-integration. In contrast, Johansen's co-integration test is a multi-variable approach obtained great importance in recent years.

The first hypothesis says: In the long-run, advertising expenditures and profitability change in the same direction. If this is the case, then it must be  $u_t = 0$  and the variables must be co-integrated. Assuming the existence of co-integration, testing the first hypothesis is summarized in testing for co-integration parameter ( $\beta$ ) in co-integration vector being positive:

$$\begin{aligned} u_t = 0 &\rightarrow -\text{profitability}_t + \alpha + \beta \text{advertising}_t^* = 0 \\ H_0 : \beta &\leq 0 \\ H_1 : \beta &> 0 \end{aligned}$$

The  $\chi^2$  statistic is used for testing the hypotheses at 5% significant level. By rejecting the null hypothesis, the first hypothesis of research is approved.

The second hypothesis says: In the long-run, changes in advertising expenditures cause changes in bank's profitability. To test the causality between two variables, Granger causality test is usually performed. In this test, presence of one of lagged variable in the other variable equation is examined. If and only if all lagged coefficients in the equation are equal to zero, then the causality is not Granger causality. In case of co-integration between two variables, causality test should be carried out based on the Error Correction Model (ECM). The ECM for two variables is as:

$$\begin{aligned} \Delta \text{profit}_t &= \sum_{i=1}^{p-1} \alpha_{11}^i \Delta \text{profit}_{t-i} + \sum_{i=1}^{p-1} \alpha_{12}^i \Delta \text{advert}_{t-i}^* + a_1 \text{ecm}_{t-1} + \varepsilon_{1t} \\ \Delta \text{advert}_t^* &= \sum_{i=1}^{p-1} \alpha_{21}^i \Delta \text{advert}_{t-i}^* + \sum_{i=1}^{p-1} \alpha_{22}^i \Delta \text{profit}_{t-i} + \alpha_2 \text{ecm}_{t-1} + \varepsilon_{2t} \end{aligned}$$

Table 2: Ratio of advertising expenditures to total costs and total loans of Sepah Bank

Parameters	2002	2003	2004	2005	2006	2007	2008
Ratio of Ad Exp to total cost	0.0042	0.0028	0.0025	0.0005	0.0008	0.0004	0.0011
Ratio of Ad Exp to total loan	0.0002	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001

Findings of the research

ECM leads to short- and long-run causality test so that rejection of hypothesis  $\alpha_1 = 0$  in the first relation means the approval of long-run causality from advertising expenditures to profitability and rejection of hypothesis  $\alpha_{12}^i = 0$  for every  $i$ , means the approval of short-run causality from advertising expenditures to profitability.

Examining the second hypothesis requires testing the error correction term coefficient ( $a_1$ ) being zero in the advertising expenditures ECM. This hypothesis is also strongly rejected which means changes in advertising expenditures cause changes in bank's profitability.

### STATISTICAL DESCRIPTION OF DATA

This study used monthly data of Sepah Bank's advertising expenditures and profitability to estimate the optimum level of advertising expenditure and appraising the long-run equilibrium relationship between the two variables. The idea behind choosing monthly data was to be able to appraise short-run as well as long-run impacts. As findings of Baghestani (1991) suggest, advertising impacts on sales amount (profitability) are observed over various monthly periods rather than annual periods. Also, utilizing annual data to estimate co-integration might lead to overestimation of impacts due to bias resulted from data intervals (Zanias, 1994). Furthermore, the other rational assumption is that consumers may forget the information provided by advertisements during a year completely. Nevertheless in statistical examinations of long-run relations, the covered span relative to number of observations is of high importance. Therefore, this research is able to cover the relationship between the variables only over an 8-years period from 2002-2008. The sources of data are the balance sheets of Sepah Bank. Table 1 shows a simple statistical description of variables. Advertising expenditures and profits are in absolute and monthly amounts. Table 2 depicts the trend of advertising cost-total cost ratio and advertising cost-total loans ratio of the bank.

Table 1: Statistical description of data (million rials)

Variables	No. of observations	Mean	SD	Maximum amount	Minimum amount
Profitability	84	582264.2	919205.2	6730073	-609873
Ad Exp	84	5566.107	5259.939	28976	31

Findings of the research

**ESTIMATION OF OPTIONAL LEVEL OF EXPENDITURES**

To estimate the relationship between profit and advertising expenditures, we can consider Sepah Bank's profit index as a function of advertising, square of advertising and trend. Since some costs are calculated annually, advertising expenditures are much different in March (Equivalent to Esfand, the last month of Iranian calendar) compared to other months. Hence, a dummy variable ( $d_t$ ) of amount one is used to control the effect of this month.

Estimation of this function, performed by STATA show that with advertising expenditures increasing, profitability rises decreasingly. Regarding equilibrium condition in Dorfman-Steiner Model, researchers differentiated profit function relative to advertising expenditures and calculated the profit maximizing amount of advertising. It is proved through Wald test whether the calculated amount is optimal?

$$\text{profit}_t = 3.05 \times 10^7 + 143.93 \text{advert}_t - 0.073 \text{advert}_t^2 + 1513292d_t + 5053 \text{time}$$

$$SD(2.65 \times t^7)(41.17)(0.0018)(475532.1)(3840.93)$$

$$\frac{\partial \text{profit}}{\partial \text{advert}} = 143.93 - 0.0143 \text{advert} = 0$$

$$\text{advert}^* = 10065$$

Comparing the obtained optimal amount with real expenditures on advertising in Sepah Bank suggests that in most months, advertising expenditures are below the optimal level. It is also approved by comparing the optimum amount with mean of advertising expenditures in Table 1. On the other hand in view of data being absolute values, estimated coefficients are not comparable. Hence, researchers use  $\beta$  coefficient to remove this problem. Results are provided in the end.

To test if the optimal amount of advertising expenditure is statically significant,  $H_0$  and  $H_1$  hypotheses in Wald test are developed as:

$$H_0 : b_1 - 2b_2 \text{advert}^* = 0$$

$$H_1 : b_1 - 2b_2 \text{advert}^* \neq 0$$

Estimating the restricted regression and comparing calculated Wald statistic with table, F suggests that advertising expenditures are optimal at this value.

**EVALUATION OF LONG-RUN EQUILIBRIUM RELATIONSHIP**

To examine the existence of long-run constant relationship between advertising and profit, co-integration techniques can be used. To this end, we should firstly check the statistical properties of data by examining the stationary of data using unit root tests. To achieve this, we have applied Dickey-Fuller unit root tests. The results in Table 3 shows that all variables are stationary of order zero. Applying Johansen-Juselius co-integration test requires that all variables would be stationary of order one. Now using the primary VAR Model, optimal number of lags are determined based on Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Likelihood Ratio test (LR) and multivariable criterion. The results exhibit one period lag for the variables, meaning that the disturbance term is white noise.

To perform the Johansen-Juselius co-integration test using the optimum selected lag, the existence of co-integration and the number of long-run relationships between the two variables is identified through trace test ( $\lambda$ -trace). In eigenvalue ( $\lambda$ ) trace test, two sets of hypothesis are tested:  $H_0$ : No existence of co-integration against  $H_1$ : Existence of one co-integration; and  $H_0$ : Existence of one or less co-integration against  $H_1$ : Existence of 2 co-integration. The results from Table 4 suggest a co-integrated vector between the two variables at 95% confidence level.

In the next step, using Johansen method, the only normalized co-integration vector which reflects the long-run equilibrium relationship between the two variables is calculated:

$$\text{profit}_t = 1.55 \times 10^7 + 2499.89_4 \text{advert}_t - 3.6 \times 10^8 d$$

As it can be seen, the coefficient obtained for advertising expenditures is statistically significant and has the expected sign in long-run relationship. Accordingly,  $H_0$  hypothesis is rejected and the alternative hypothesis is accepted in that advertising expenditures and profitability of the bank change in the same direction.

Table 3: Dickey-Fuller test for stationary of order zero

Variables	Without trend	With trend	Without trend and drift	Critical values
Profitability	-4.78	-4.76	-3.06	-2.90, -3.46, -1.95
Ad Exp	-3.97	-4.09	-1.49	

Critical values are based on 95 % confidence level; one period lag is considered for variables based on Schwarz test

Table 4: Results of trace test

Johansen critical value	Trace test statistic	Alternative hypothesis	Null hypothesis
12.53	17.05	$r \geq 1$	$r = 0$
3.84	2.40	$r \geq 2$	$r = 1$

Two period lags are considered for the variables; this model is estimated without trend and drift

The next phase is to identify the short-run dynamics via VECM and optimal lag. In ECM, error correction coefficient is very important because it exhibits how much percentage of short-run disequilibrium will be adjusted in the direction of long-run equilibrium. In other words, how many periods does it take the variable to return to its long-run trend? The dynamic model moving toward long-run equilibrium requires the coefficient of error correction term be negative and less than one (in absolute value). The VECM calculated the short-run adjustment coefficient to be -0.01, meaning that in each period, about 1% of short-run deviation is adjusted toward long-run equilibrium value. This coefficient is statistically significant at 95% confidence interval, hence, the second research hypothesis in that in the long-run, changes in advertising expenditures cause changes in bank's profitability is accepted. Also,  $\alpha_2$  coefficient is calculated to be -0.00005 and is statistically significant at 95% confidence interval. Hence, researchers can conclude that in the long-run, the causality relationship between advertising expenditures and profitability of Sepah Bank is a two-way relation. This means that higher profitability leads to higher expenditures on advertisement and vice versa. Results also exhibit that  $\alpha_1$  coefficient is estimated to be -91.095 and is statistically significant at 95% confidence interval, meaning that the short-run causality relationship from advertising expenditures to profitability is approved.

### CONCLUSION

In this study, researchers examined the long-run equilibrium relationship between advertising expenditures and performance of Sepah Bank. In the theory of financial economics, a long-run relationship exists between operating cash flows (profitability) and capital expenditures. Therefore, advertisement cost as one of capital expenditures might have a long-run impact on bank's profitability. Results from performing Johansen method indicate a long-run equilibrium relationship between advertising expenditures and profitability of Sepah Bank. The presence of such a relationship implies that the bank's decision to establish advertising expenditures as a constant ratio of its profits (Dorfman-Steiner condition) exhibits its optimal behaviour. Also, the results from VECM show that in each period 1% of disequilibrium in Sepah Bank's profitability is adjusted toward its long-run equilibrium value. Causality tests results through VECM suggest that the long-run relationship between advertising expenditures and

profitability of Sepah Bank is a two-way relation, meaning that higher profitability leads to higher expenditures on advertisement and vice versa. There is also a one-way relation from advertising expenditures to profitability in the short-run. To summarize, researchers can say that findings of this study support Baghestani (1991), Zanias (1994) and Leach and Reekie (1996) in that the existence of a long-run relationship between advertising expenditures and profitability is an evidence for accuracy of optimum strategic behaviour of firm in setting advertising expenditures as a constant ratio of performance index.

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