



# **AN APPLICATION OF POOLED REGRESSION MODEL OF TWO-WHEELER INDUSTRY FOR ADVERTISING IMPACT**

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## **ABSTRACT**

Statistical applications are rarely used for conducting research in applied areas. This research is conducting to evaluate an application of pooled regression model for two-wheeler industry and examining the advertising impact on the model. An application of multiple and partial correlation, relative applications on regression model are tested such as collinearity. The results are concluded at the end of the application of model

**Keywords:** Pooled Regression, Collinearity, Step Regression

## **INTRODUCTION**

India is the second biggest maker of the bikes. The bike sections contribute the biggest volume among every one of the portions in car industry. The nation remains alongside China and Japan regarding creation and deals individually. The business is developing at 30 % every year. It comprises of three sections: Scooters, cruisers and moped. Lion's share of Indians, particularly the adolescents lean toward motorbikes instead of autos. Catching a vast offer in the bike business, bicycles and bikes cover a noteworthy section. Bicycles are thought to be the top choices among the young age, as they help in simple replacement

## **PRESENT AND FUTURE TREND OF TWO-WHEELER INDUSTRY IN INDIA**

Car is one of the biggest ventures in worldwide market. Being the pioneer in item and process advances in the assembling area, it has been perceived as one of the drivers of financial development. Amid the most recent decade, well- - coordinated endeavours have been made to give another seek the car arrangement for understanding the part's maximum capacity for the economy. Steps like nullification of authorizing, evacuation of quantitative confinements and activities to carry the strategy system inconsonance with World Trade Organization necessities have set the business in a dynamic track. Removal of the prohibitive condition has helped rebuilding, and empowered industry to assimilate new advancements and adjusting itself to the worldwide improvement and furthermore to understand its potential in the nation. The progression approaches have prompted constant increment in rivalry which has at last brought about modernization in accordance with the worldwide gauges and in generous cut in costs. Forceful advertising by the car fund organizations have additionally assumed a noteworthy part in boosting car request, especially from the populace in the centre wage gathering.

## **TWO-WHEELER INDUSTRY IN INDIA**

Bike portion is a standout among the most imperative parts of the car area that has experienced huge changes because of move in strategy condition. The bike business has been in presence in the nation since 1955. It comprises of three portions viz. bikes, bikes and mopeds. As indicated by the figures distributed by Society of Indian Automobile Manufacturer, the offer of bikes in vehicle area regarding units sold was around 85% amid 2004-05. This high figure itself is suggestive of the significance of the segment in the underlying years, passage of firms, limit development, selection of items including limit blend and innovation, every basic region of working of an industry, were successfully controlled by the State apparatus. The omissions in the framework had welcomed new arrangement alternatives that appeared in late sixties. Among these arrangements Monopolies and Restrictive Trade Practices and Foreign Exchange Regulation Act were gone for managing imposing business model and remote speculation individually. This controlling component over the business brought about: (a) Few firms working underneath least size of productivity; (b) Under-use of limit; and (c) Use of obsolete innovation. Acknowledgment of the harming impacts of permitting and chaining strategies prompted start of changes, which at last took a more unmistakable shape with the presentation of the New Economic Policy in 1985. However, the real arrangement of changes was propelled in the year 1991 in light of the major macroeconomic emergency looked by the economy. The modern arrangements moved from an administration of direction and tight control to a more changed and focused period. Two noteworthy consequences of strategy changes amid these years in bike industry were that the, weaker players ceased to exist offering route to the new



participants and predominant items and a sizeable increment in number of brands entered the market that constrained the organizations to contend based on item properties. At last, the two-wheeler industry in the nation has possessed the capacity to witness an expansion of brands with presentation of new innovation and in addition increment in number of players.

## **PLAYERS IN THE TWO-WHEELER INDUSTRY**

In the wake of confronting its most exceedingly bad subsidence amid the mid-1990s, the bike business ricocheted back with a 25% expansion in volume deals in February 1995. The bikes are considered as family vehicles. There are numerous bike producers in India. Real players in the 2-wheeler business are Hero Motors Ltd, Bajaj Auto Ltd. and TVS Motor Company Ltd. The other key players in the bike business are Kinetic Motor Company Ltd., Kinetic Engineering Ltd., LML Ltd., Yamaha Motors India Ltd., Majestic Auto Ltd., Royal Enfield Ltd. and Honda Motorcycle and Scooter India Pvt. Ltd.

## **TERMINOLOGY USED FOR STUDY**

The researcher has collected information regarding the two-wheeler industry through reliable sources. This information is a secondary data collected and published by Ministry of Statistics and Program Implementation for the year 2001 to 2011. Main purpose of this research is to construct statistical models about the advertising impact. Thus, the relative information till the end year is not estimated by researcher. The necessary terms defined in the field of advertising media are classified for further study and ready reference. The terms used for study are defined as follows:

### **1.5.1 SALE DURING THE YEAR**

Sales alludes to the fleeting need to bring a sale to a close, get an assertion marked, or eventually do what should be done to offer whatever it is you are offering. Deals systems and procedures are extremely in view of what it takes to 'bring home the bacon', which is critical to any business. On the off chance that you get clients in the entryway however can't motivate them to purchase an item; there is an issue with your business system. Sales methodologies are centered on the individual purchaser and what should be improved the situation them to haul out their wallet, or tap on the purchase catch with regards to internet offering. Organizations commonly set sales volume focuses for a period such as -weeks, months, years of quarters and have procedures set up where the people in charge of really offering can make those objectives.

### **1.5.2 MARKET SHARE COVERED BY FIRM**

Market share is defined as - a level of aggregate sales volume in a market caught by a brand, item, or organization. In this research it is computed by taking ratio of units sold out by the firm and total number of households in state during that particular year.

### **1.5.3 MARKET SHARE FOR OUTSIDE PRODUCTS**

Market share for outside products is defined as - a level of aggregate sales volume in a market caught by other brand, item, or organization. In this research it is calculated by taking difference from one to the ratio of units sold out by the firm and total number of households in state during that particular year.

### **1.5.4 GOODWILL STOCK OF ADVERTISING**

Accepted estimation of the appealing power that produces deals income in a business, and enhances its benefits. Altruism is an impalpable however saleable resource, relatively indestructible with the exception of by tactlessness. It is fabricated carefully finished the years for the most part with (1) substantial and nonstop use in advancement, (2) creation and upkeep of strong client and provider connections, (3) high calibre of merchandise and enterprises, and (4) high calibre and lead of administration and representatives. Altruism incorporates the value of corporate character, and is upgraded by corporate picture and an appropriate area. Its esteem isn't perceived in account books yet is acknowledged when the business is sold, and is reflected in the company's offering cost by the sum in overabundance over the company's total assets.

### **1.5.5 CUBIC CAPACITY OF ENGINE IN VEHICLE**

Motor relocation is the cleared volume of the considerable number of cylinders inside the chambers of a responding motor in a solitary development from top right on target to base perfectly focused. It is generally indicated in cubic centimetres, liters, or cubic inches.

### **1.5.6 AVERAGE LENGTH OF AREA IN KM.**

Geographic area of each state covered by road density in kilometres is taken as average length of area for vehicles.



### **1.5.7 MAXIMUM SPEED OF VEHICLE**

As far as possible is upheld by transport organizations with a little resistance given to take into account fluctuations in speedometer exactness and to permit drivers some slack on the off chance that they incidentally float up finished the point of confinement by a couple of kilometres for every hour.

### **1.5.8 AVERAGE OF VEHICLE OR FUEL CONSUMPTION PER LITER**

Average of vehicle or fuel consumption per litter is a unit of estimation that says what number of units of separation gone for every unit of fuel spent. It is just a normal of the fuel spent while driving vehicle.

### **1.5.9 AVERAGE AGE OF VEHICLE**

This is a valuable pointer of the status of the armada. On the off chance that the armada has an even age profile, the normal age of the armada will be roughly a large portion of the age of the most seasoned vehicle. An adequate normal age relies upon elements; for example, the sort of vehicles worked, levels of usage and working conditions, and is once in a while affected by enactment: in a few nations the task of transports over a particular age isn't allowed.

A high normal age might be on the grounds that exclusive requirements of support empower vehicles to be effectively worked over a long life, however more regularly is on account of deficient assets are accessible for armada substitution. A low normal age might be on the grounds that vehicles are supplanted when they are generally youthful yet may show that poor upkeep has brought about a short vehicle life. By and by, where the last is the situation, it isn't generally reflected in the normal age in light of the fact that more youthful vehicles have a tendency to stay on the "book" armada quality notwithstanding when they are never again fit for additionally utilize. For a sensibly all around kept up armada of premium quality vehicles working on urban administrations in a creating nation, the normal armada age would commonly be in the vicinity of five and eight years.

### **1.5.10 SPENDING FOR ADVERTISING BY FIRM**

Publicizing Budget is fundamentally a quantitative articulation of the measure of cash that must be spent for promoting in the coming time frame. It is a gauge of the assets required for meeting publicizing destinations of the firm that are produced in line to the organization's targets, vision and mission. It additionally includes allotment of money related assets among various types of promoting plans, media, deals domains, items and offering exercises and so forth. This plainly portrays how, where, and for what purposes the assets would be appropriated and used. The promoting spending plan of a business is created based on publicizing destinations and objectives of the organization that are subject to showcasing objectives and goals of the organization. In any case, the advertising organizer receives this procedure just if the assets are accessible. The advertiser assesses the measure of cash that would be expected to accomplish the set-up objectives and destinations and builds up the financial plan. The method of getting ready spending plan gets switched, when enough stores are not accessible i.e. spending plans get set up first and afterward objectives and destinations are changed by reserves. The setting of publicizing spending plan depends on the computation of aggregate sum of cash required to accomplish promoting goals of a firm. Publicizing supervisor and promoting director of the organization set it up. At that point it is gone through the endorsement of best administration for its usage. Be that as it may, in private company houses that does not have enough measures of assets to frame isolate promoting office, the work obligation of planning publicizing spending rests with the showcasing administrator of the best administration. The restricting component decides the extent of the publicizing effort. The periodicity of publicizing spending plan differs from a time of one month or one quarter or a half-year term to the whole money related year. At times the spending time frame may reach out to the whole wander on the off chance that it is a brief span wander or program.

### **1.5.11 AVERAGE FLEET HELD**

This pointer demonstrates the degree to which vehicles are utilized, and should not be mistaken for accessibility. There are different measures of use; these incorporate mileage or hours - kilometres per vehicle per period or operational hours/days per vehicle per period; investigation of days or hours of activity as a level of aggregate accessible time; or the quantity of vehicles worked in a day as a level of the number accessible. The most valuable marker is the quantity of vehicles utilized on income gaining administration at a specific time as a level of the quantity of transports which are accessible for benefit around then. In most city activities the morning crest is more thought, and accordingly it is typically most helpful to utilize this as the reason for computation. Where there is no detectable pinnacle, the most extreme number of transports in benefit whenever amid the day might be utilized. Usage is some of the time communicated as a level of the aggregate authorized or claimed armada, yet this may give a false impression since a low level of use might be on the grounds that inadequate



transports are accessible, due for instance to countless off the street for repairs, and not on account of the activity's office can't discover beneficial work for the entire armada. Use typically changes between various circumstances of the day, distinctive days of the week, and diverse circumstances of the year. At crest times use on urban transport administrations ought to ordinarily be in the vicinity of 95% and 100%. Few vehicles might be kept as extras if there should arise an occurrence of breakdown, however a few administrators plan every accessible buss at crest periods, taking a chance with the need to wipe out some excursions in case of a breakdown. Poor use might be because of an overflow of vehicles, wasteful booking, and lack of driving or potentially leading staff, or street or climate conditions which keep the activity of a few administrations. An abnormal state of usage does not really mean a high level of effectiveness or sinfulness. An armada might be very much used, yet on administrations for which there is little request and which thus lose cash.

#### **1.5.12 AVERAGE FLEET OPERATED**

Vehicle administration can incorporate a scope of capacities, for example, vehicle financing, vehicle upkeep, vehicle telematics, driver administration, speed administration, fuel administration and well-being and security administration. Armada Management is a capacity which permits organizations which depend on transportation in business to evacuate or limit the dangers related with vehicle venture, enhancing proficiency, efficiency and diminishing their general transportation and staff costs, furnishing 100% consistence with government enactment and some more.

#### **1.5.13 PASSENGER KM. PERFORMANCE**

Passenger Kilometre is a measure of development of travellers by a method of transport. It is computed as  $PKM = TPC \times TDC$  Where, TPC is Total Passengers Carried estimated regarding number of travellers and, TDC is the Total Distance Covered estimated in kilometres

#### **1.5.14 TOTAL REVENUE OF FIRM**

Add up to income in financial aspects alludes to the aggregate offers of a firm in light of a given amount of merchandise. It is the aggregate salary of an organization and is ascertained by duplicating the amount of products sold by the cost of the merchandise.

### **METHODOLOGY**

The study implies for selected 14 parameters of two-wheeler industry for the financial year 2001 to 2011. It shows the study is executed for last decade. Each of them defined earlier in this study. Amid them spending for advertising is given final outcome for two-wheeler industry. As this research is having goal orientation of advertising models. The ups and downs or any progression of two-wheeler industry can be measured based on its total revenue. Thus, it has been defined as a key factor of the study. Total revenue affected by many of the parameters, which are called independent variables and listed above. The impact of each of the parameter is considered that they have direct effects on total spending for advertising and thus they all are taken as independent variables in study. To understand the impact of each of the parameter it is necessary for researcher to test their inter relationship by using multiple correlation. The defined parameters are directly or indirectly related to each other that may cause higher collinearity between them. Thus, it is required to check the multicollinearity between the selected parameters. The functional changes can be studied by using multiple regression analysis, but as each parameter directly related linearly and it cannot clear the actual impact on dependent variable spending for advertising. So, to check the nature of each of the parameter it is required to study step regression. Particularly each of the parameters has been given equal chances. Thus, enter and remove step regression with forwarding method has been implied. To understand the statuses of residuals in study an application of F – values, VIF, Durbin Watson statistics and VIF for higher and lower tolerance of variables are tested.

### **POOLED PANEL REGRESSION ANALYSIS ON TWO-WHEELER INDUSTRY ADVERTISING**

As of late, observational research in financial aspects has been advanced by the accessibility of an abundance of new wellsprings of information: traverse time. The accessibility of panel information has animated a fast development in both methodological methodologies and applications as of late. What is by and large alluded to as the panel information way to deal with monetary research gives a few noteworthy focal points over customary cross-sectional or time-arrangement information approaches. This encourages the development and testing more sensible behavioural models that could not be distinguished utilizing just a cross segment or a solitary time-arrangement informational index. In any case, the accessibility of new information sources raises new issues. Then again it merits stressing that the abundance of two-dimensional information has potential for creating better induction with respect to either time-arrangement or cross-segment approaches.



### 1.7.1 POOLED PANEL REGRESSION

Panel information examination is a technique for concentrate a specific subject inside different locales, intermittently saw over a characterized time span. Inside the sociological, panel examination has empowered specialists to embrace longitudinal investigations in a wide assortment of fields. In financial matters, panel information examination is utilized to ponder the conduct of firms and wages of individuals after some time. In political science, it is utilized to examine political conduct of gatherings and associations after some time. It is utilized as a part of brain research, human science, and well-being exploration to consider qualities of gatherings of individuals took after over the long haul. In instructive research, specialists examine classes of understudies or graduates after some time. With rehashed perceptions of enough cross-segments, panel examination allows the scientist to think about the elements of progress with brief time arrangement. The blend of time arrangement with cross-areas can upgrade the quality and amount of information in ways that would be outlandish utilizing just a single of these two measurements (D. C. Gujarati). Panel investigation can give a rich and intense investigation of an arrangement of individuals, on the off chance that one will consider both the space and time measurement of the information. The benefits of utilizing panel information: In brief the vital favourable circumstances of panel information are as following.

1. More perceptions are for the most part accessible, particularly with respect to time arrangement information.
2. The ability to distinguish and separate between substantial quantities of contending speculations. This takes after from the way that we watch the same monetary units over the long run.
3. The ability to control for imperceptibly heterogeneity at the level of the person.

We underline that panel information bear the cost of the way to investigate all the more completely the idea of the idle, or imperceptibly, unsettling influence terms in econometric connections. In what tails we will utilize the word individual in a nonexclusive sense, where the utilization of the term singular impact will allude to the quantifiable impact of the cross-sectional unit of perception, regardless of whether this be a firm, a nation, an area, or a man.

Panel information examination blesses relapse investigation with both a spatial and fleeting measurement. The spatial measurement relates to an arrangement of cross-sectional units of perception. These could be nations, states, provinces, firms, products, gatherings of individuals, or even people. The transient measurement relates to intermittent perceptions of an arrangement of factors portraying this traverse a specific time traverse. A best example of a panel information arrangement is a collection of states for which there are the same parameters affects the advertising —such as sale during the year, market share covered by firm, market share for outside products, goodwill stock of advertising, average fleet held, average fleet operated and total revenue of firm. This pooled data set, sometimes called time series cross-sectional data, contains a total of  $168 \times 28 = 4704$  observations.

### 1.7.2 PANEL SET STRUCTURE

Panel informational indexes for the most part incorporate successive pieces or cross-areas of information, inside every one of which lives a period arrangement. A commonplace panel informational collection, including states, market share covered by firm, market share for outside products, goodwill stock of advertising, average fleet held, average fleet operated and total revenue of firm and other parameters under study. The structure of panel form can be constructed and presented follows. Aside from the variable number, the information structure presents upon the factors two measurements. They have a cross-sectional unit of perception, which for this situation is states I. They have a fleeting reference, t, for this situation the year. The blunder term has two measurements, one for the states and one for the year.

TABLE 1.10 PANEL DATA STRUCTURE

Year	Sales	Market Share	Market Share for Outside Goods	Goodwill Stock of Adv.	Spending for Adv.
AP 2001	3966	0.198	0.802	4361.6	17272
2002	4389	0.224	0.776	4827.9	18233
2003	5002	0.275	0.725	5501.2	18143
2004	5720	0.281	0.719	6292	19582
Ar P					
2001	21	0.09504	0.90496	23.1	9326.88
2002	22	0.10752	0.89248	23.1	9845.82
2003	24	0.132	0.868	23.1	9797.22
2004	23	0.13488	0.86512	23.1	10574.28

In this illustration, expect that there are three states and three years of time. Despite the fact that time is settled inside the cross-area in this illustration, Lois Sayrs (1989) composes that under a few conditions the cross-areas

might be settled inside time. In the event that there are no missing esteems, the informational index is known as an adjusted panel, yet in the event that there are missing esteems, the informational collection is alluded to as a lopsided panel.

### 1.7.3 PANEL EQUATION

Details short in part 1.10.2 can be form in terms of equation as follows.

The basic panel model is formed for cross sectional and year base parameters and is presented as:

$$y_{it} = a_t + b_1x_{1it} + b_2x_{2it} + \dots + \epsilon_{it}$$

The study model can be structured on ground of the model can be constructed as:

$$SP\_AD_{it} = a_t + b_1SALE + b_2MS\_F + \dots + \epsilon_{it}$$

here, SP\_AD = spending for advertising, SALE = total sale during the year, MS\_F = market share covered by firm, the example covers few of the parameters and the constructive models is presented as an example. There are a few kinds of panel information expository models. There are steady coefficients models, settled impacts models, and arbitrary impacts models. Among these sorts of models are dynamic panel, strong, and covariance structure models. Answers for issues of heteroskedasticity and autocorrelation are of enthusiasm here. We will attempt to outline a portion of the conspicuous parts of this sort of approach, yet first we have to consider the information structure. One sort of panel display has consistent coefficients, alluding to the two catches and inclines. If there is neither huge nation nor huge transient impacts, we could pool the greater part of the information and run a customary minimum squares relapse demonstrate. Albeit more often than not there is either nation or worldly impacts, there are events when neither of these is factually critical. This model is now and then called the pooled relapse show. The researcher has developed pooled regression models for collected information about the advertising related data for two-wheeler industry for the selected 28 states of India. The proposed pooled panel model is constructed as follows for further study.

### 1.7.4 ADVERTISING PANEL MODEL:

$$SP\_AD_{it} = a_t + b_1MS\_F_{1it} + b_2MS\_OP_{2it} + b_3GSA_{3it} + b_4AL\_AKM_{4it} + b_5AVG\_FH_{5it} + b_6AVG\_OP_{6it} + b_7PKMP_{7it} + b_8TRF_{8it} + b_9TIME_{9it} + b_{10}SALE_{10it} + \epsilon_{it}$$

The constructive model is analysing for the incremental impact of advertising cost and relative factors inputs on advertising cost for two-wheeler companies of India for twelve years i.e. 2001 to 2011. This examination inspects the structure and relative significance of the parameters that influence varieties in advertising impact for two-wheeler industry of India. This study is undertaken by taking annual time series data from 2001 to 2012 for 28 states of India which covers higher sale of two wheelers in India. An application of pooled panel regression is used for study. The basic elements of this model construction are to know the following objectives.

- Does spending for advertising affect the sale of two-wheeler in India?
- What is the impact of advertising on total revenue of firm?
- Is the advertising parameter affect the market share of firm?
- Is the advertising affect the other parameter under study?

## RESULTS AND DISCUSSION

The pooled regression model is analysing from the detailed construction of influence of element inputs on disparity of spending after advertising for 28 states of India and the constructive model with model statistics is presented in table 1.11.

Table 1.11 Pooled OLS, using 334 observations, Included 2 cross sectional units Time-series length = 167, Dependent variable: Spending for Adv. (SP\_AD), Robust (HAC) standard errors

	<i>Coefficient</i>	<i>Std. Error</i>	<i>z</i>	<i>p-value</i>	
SALE	0.557	0.029	19.20	<0.0001	***
MS_F	0.014	0.0028	4.979	<0.0001	***
MS_OP	0.043	0.0062	6.973	<0.0001	***
GSA	- 0.53	0.034	-15.37	<0.0001	***
AL_AKM	0.14	0.032	4.300	<0.0001	***
AVG_FH	- 0.073	0.0346	-1.096	0.0360	**
AVG_OP	0.09	0.0678	1.327	0.01845	**
PKMP	- 0.096	0.0036	-26.38	<0.0001	***
TRF	1.08	0.00118	915.2	<0.0001	***
TIME	- 0.045	0.00103	-43.94	<0.0001	***

Mean dependent var	0.032910	S.D. dependent var	1.161895
Sum squared resid	1.363113	S.E. of regression	0.085402



R-squared	0.998482	Cantered R-squared	0.998482
F(10, 1)	0.986388	P-value(F)	0.662264

The pooled regression results clearly demonstrate the role of each of the variable. GSA, AVG\_FH, PKMP, TIME are noticed negative which have major impact over the model. As usual these are the major parameters for any of the industry for performing advertising, model indicating that this all have negative effect on total spending on advertising. If the said parameter has controlled by the two-wheeler firms it may affect well for advertising expenses and the. P- Value for all the variables are lies between 0.05 to 0.1 and indicating that the model is significant. The determination of regression indicates that the explained variation in 99% ( $R^2 = 0.99$ ) after diagnosed collinearity only 1% is due to the other causes affects the cost of advertising. Durbin – Watson statistics also indicating the best fit of model as noticed 1.30, which is less than 1. We may write the specified model as follows:

$$SP_{AD_{it}} = 0.557SALE_{10it} - 0.014MS_{F_{1it}} + 0.043MS_{OP_{2it}} - 0.53GSA_{3it} + 0.14AL_{AKM_{4it}} - 0.073AVG_{FH_{5it}} + 0.09AVG_{OP_{6it}} - 0.096PKMP_{7it} + 1.08TRF_{8it} - 0.045TIME_{9it}$$

The model spending for advertising by firms is clearly point out about the positive and negative effects of the parameters.

## CONCLUSION

As discerned earlier GSA, AVG\_FH, PKMP, TIME have negative impact, the results shows that higher the value of goodwill stock of products will be reduced as the advertising expenses are increased. Similarly, the average fleet held of vehicles does not require any promotional activities can be affected advertising cost negatively. The passenger performance for kilometre increases by vehicle is gained the feature of vehicle and do not require any advertising in future. Thus, it is directly reduced the advertising cost. Time being the technological aspects changed in modern market thus the new inbuilt features can be represented by constructing of new advertising and the advertising cost can be reduced. On other hand SALE, MS\_F, MS\_OP, AL\_AKM, AVG\_OP, TRF have positive effects which specify advertising model. Increased the advertising cost will improve the sale and due to that the total revenue of firm can be enriched. The higher profitability of firm can generate higher share in market. The market share of other products can also be generated higher due to higher competition. The average length of area in kilometres can be only covered by advertising of product. An average fleet operated by firms has been not affect by the advertising of primary advertising.

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