Leveraging Correlation Analysis for Business Decision Making – A Case Study

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Abstract: *Correlation analysis uses historical data to help inform decisions such as those related to marketing campaigns, product offerings, and workplace efficiencies. It is critical for businesses to use both qualitative and quantitative strategies for decision making, and correlation is an efficient way of quantitatively assessing performance of current and historical initiatives to see what works well. Understanding the impact of business initiatives on desired outcomes can help companies identify trends, uncover hidden opportunities, refine strategies, allocate resources more efficiently, and make better decisions overall. In the world of statistics, where data reigns supreme, there exists a powerful tool known as correlation analysis. In this article, embark on a journey to explore the intricacies of correlation analysis, unearthing its significance, numerous benefits, potential limitations, and practical applications.*

Keywords: Significance, Dependency, Forecasting, CPI, Predictive Analytics, Business Value

Introduction

At the heart of statistical analysis lies the essence of correlation analysis — a sophisticated method geared towards identifying linear relationships between two or more variables. By meticulously scrutinizing these relationships, we can uncover the mysteries of how fluctuations in one variable may coincide with changes in another. To illustrate its power, imagine a study exploring the effects of various diets on weight gain. Through correlation analysis, we can discern which variables closely align with weight gain, such as calorie intake, while also revealing which factors, like the type of calories consumed (high-fat or high-carbohydrate), may hold lesser significance.

In today's business world we come across many activities, which are dependent on each other. In businesses we see large number of problems involving the use of two or more variables. Identifying these variables and its dependency helps us in resolving the many problems. Many times there are problems or situations where two variables seem to move in the same direction such as both are increasing or decreasing. At times an increase in one variable is accompanied by a decline in another. For example, family income and expenditure, price of a product and its demand,

advertisement expenditure and sales volume etc. If two quantities vary in such a way that movements in one are accompanied by movements in the other, then these quantities are said to be correlated.

Correlation is a statistical technique to ascertain the association or relationship between two or more variables. Correlation analysis is a statistical technique to study the degree and direction of relationship between two or more variables. A correlation coefficient is a statistical measure of the degree to which changes to the value of one variable predict change to the value of another. When the fluctuation of one variable reliably predicts a similar fluctuation in another variable, there's often a tendency to think that means that the change in one causes the change in the other.
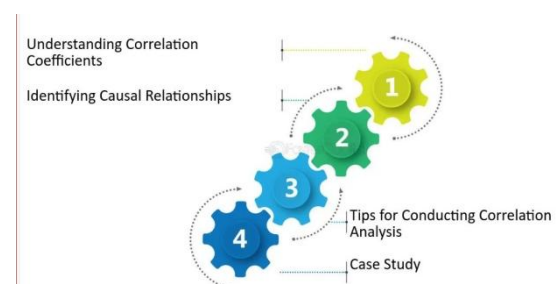

Fig.1 Introduction to correlation analysis for Market research Insights

Correlation analysis is a tremendous tool to use in understanding how one variable affects another. By providing a distinct perspective on which factors impact your business the most, you can feel more confident in the actions you take after the report.   Take customer experience, for example. Let's say you have the overall customer satisfaction score you need. But then, you want to know how that correlates with other aspects of the customer experience such as product price, shipping time, or quality.

Measuring the Correlation

It is to conduct an online survey to analyze the correlation between two variables. The process includes writing, programming, and fielding a survey. The results are later used to determine strength scores. It is to find a useful application for them in customer satisfaction surveys, employee surveys, customer experience (CX) programs, or market surveys. These surveys typically include many questions that make ideal variables in a correlation analysis.

Below is the process our online survey agency follows to measure correlation.

Step 1. Write the survey

The first step in running a correlation analysis in market research is designing the survey. You will need to plan ahead with questions in mind for the analysis.

This includes anything that yields data that is both numerical and ordinal.

Think of metrics such as:

- Agreement scales
- Importance scales
- Satisfaction scales
- Money
- Temperature
- Age

Step 2. Program + field the survey

Once the survey is finalized, you will need to program and test it to ensure the questions are functioning correctly.

This is important because mislabeled scales or improper data validation in the programming will taint the data used for correlation analysis.

Use our online survey testing checklist for what to look for because launching the questionnaire into fieldwork.

Once everything checks out, it's time to administer the fieldwork of the survey.

Step 3. Analyze the correlation between 2 variables

Next, clean the survey data after the target number of responses is reached. This protects the integrity of the data for analysis.

The two most common ways to run a correlation include:

1. The Pearson r correlation is best used when the relationship between variables is linear, quantitative, and has no outliers.

2. The Spearman rank correlation is best used when you want to see when one ranked variable increases if the other ranked variable increases or decreases.

Though, most data analysis software features a tool to run a correlation analysis after you enter the inputs automatically.

For instance, you can run the analysis through some sort of spreadsheet software, like Microsoft Excel.

How Correlation Affects Business Decisions

In summary then, the key importance of correlation in business decision making processes is that it protects us from uncertainty, volatility, complexity and ambiguity. It does this by compelling the process to account for these four by means such as these:

- Holding resources in reserve and taking small steps against uncertainty

- Avoiding instant decisions until volatility shows a more definite trend

- Simplifying complexity or finding those who can handle it well

- Allowing for flexible responses as ambiguity becomes clearer

In short, seen in this way then, correlation in business decision making processes protects us from what we don't know. Along with probability then, they ensure that we make decisions that properly account for the risk at hand.

Application of Correlation Analysis to Business Research

The purpose of this research is to analyze the relationship between two macroeconomic variables as a means of improving the accuracy of estimations for demand for retail sales. The two macroeconomic variables are the rate of inflation and real wage levels.

The chain of assumptions upon which this analysis is based is as follows: (1) an increase in the rate of inflation causes goods to be more difficult to purchase, all other factors remaining unchanged; and (2) an increase in the rate of inflation causes the purchasing power of wages to decrease, all other factors remaining equal. A decrease in the rate of inflation is assumed to have the opposite effects. The chain of assumptions leads to the following hypothesis: A change in the rate of inflation will lead to a decrease in demand for retail sales.

To test this hypothesis, the relationship between changes in the rate of inflation and changes in the level of real wages was assessed through the application of quantitative analysis. The quantitative procedure applied was Pearson product-moment correlation analysis. Statistical significance of the relationship between the two variables was established at the p<.05 level.

Inflation was represented by the Consumer Price Index (CPI) for all items. For purposes of this analysis, changes in the CPI from the prior year were used, as opposed to the actual CPI. The changes in the CPI from the prior year were calculated for each year included in the analysis.

The real wage level was represented by the average hourly wage rate for factory employment. "Real," however, refers to inflation adjusted data. Therefore, average hourly wage rate data were adjusted for the rate of inflation for each year included in the analysis. For purposes of this

analysis, changes in the real wage level from the prior year were used, as opposed to the actual average real wage rate. The changes in the real wage level from the prior year were calculated for each year included in the analysis.

Correlation and Regression Analysis are used in business to forecast potential outcomes so that businesses can make informed data-driven decisions based on predicting the outcome of events.

The following demonstrates a few different businesses scenarios in which these analytics techniques provide value:

- Predictive Analytics

Predicting risk and opportunities is one of the most important aspects of correlation and regression analysis used in business today, and is often used by data scientists and business analysts to forecast future outcomes.

- Enhance Decision Making

Business leaders rely on data analytics to aid decision making with greater levels of accuracy and trustworthiness and help to support management in testing hypotheses and developing smarter business strategies.

- Reveal New Business Opportunities

Correlation and regression analysis help to reveal new business opportunities that might not have otherwise been available or that would have gone unnoticed by decision-makers, revealing new insights that can be put to strategic use.

- Reduce Errors and Risk

It's possible to test new theories, strategies, and hypotheses and determine if they will be successful and applicable, which results in fewer errors and reduced risks. This supports evidence-based decision making instead of relying purely on past experience and business intuition.

- Improved Management

Better allocate resources, present new marketing, and advertising opportunities, tailor products, and services, and improve employee productivity

finding new opportunities to improve management processes.

An Example of Correlation in Business Monitoring

Consider the applicability of correlation analysis in the realm of eCommerce promotions. For many retailers, the last quarter of the year accounts for more than 50 percent of their annual sales. Most merchants run various promotions to boost sales that correspond with Black Friday, Cyber Monday, and other holiday-related events.

Multiple factors are at play with any promotion, including the promotion type, promotional pricing, audience targeting, purchase intent, timeliness,

media used for the promotion, and numerous other factors.

Correlation analysis finds a natural fit to determine which factor(s) play a key role in driving the top and bottom lines in the sales. The ability to identify strong correlations would help marketers double down on the corresponding promotions.

To illustrate, consider the figure below, which shows how two correlated anomalies – a spike in page views (top chart) and add to carts (bottom chart) – for an eCommerce site points to an anomalous sales pattern. The shaded area (the baseline) is the normal pattern of sales for a promotional event of this nature.
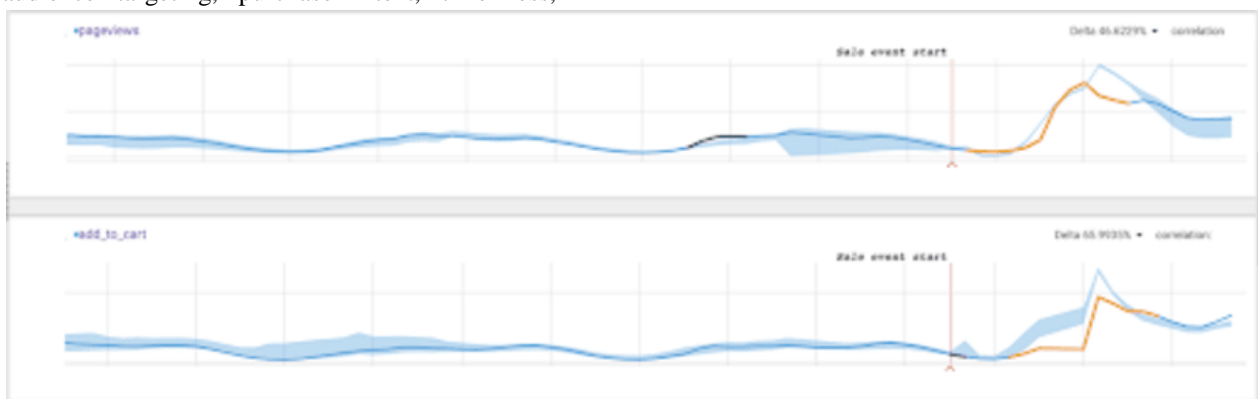

Fig.2 Correlation of an anomalous sales pattern

Clearly, the add to cart metric is underperforming. Correlating the relevant event (the sale) and the related metrics together, it underscores the irregularity of a drop in both those metrics.

When the event started, the team was alerted about the fact that the sales event did not yield the expected increase in both the correlated metrics; in fact, page views actually dropped(!) 46 percent compared to the expected spike, leading to a drop of 66 percent in add to cart. These drops were identified because the effect of the sales event (an "external" variable to the metric), was correlated to the values of the metric. If the correlation between the metrics and the event was not taken into account, the drop would have seemed like an increase.

Discovering the relationships among data metrics has many practical applications in business monitoring. Correlation analysis can help identify the root cause of a problem and vastly reduce the time to remediate the issue. It also helps to group

events together in order to reduce the number of alerts generated by the events, in turn reducing alert fatigue among support personnel and the cost of investigating duplicative alerts.

Business Value of Correlation Analysis

Correlation analysis SPSS is a significant concept that is used in examining data gathered to assist leaders in gaining useful insight regarding the relationship among various business outcomes. The relationship between outcomes in business is to be understood in making functional decisions that can boost the growth of the business. In finding correlation coefficients or performing correlation analysis in business, **SPSS software** is always used. For instance, a business may be involved in analysing trends of sales of their products to determine whether the lower pricing strategy is effective over the higher pricing strategy to improve sales in the given period. In case the pattern is determined, the leaders can make effective decisions regarding the optimal price to be

set for the products to get the desired level of sales in the market. Correlation in other words can be referred to as the identification of repeated patterns as more than one instance is required for creating a correlation. During the execution of a correlation analysis, the increased availability of data points assures increased results of the analysis. This is essential in gathering sufficient knowledge before relying on correlation in making decisions for business purposes.

Value of Correlation Analysis in Business

In linear correlation **data analysis SPSS** which occurs between two variables, the strength is identified by the extent to which they can move together within a data set. The use of Pearson's correlation coefficient analysis indicates that the correlation values are between -1 and +1. The weaker correlations indicate values near 0 whereas the stronger correlation is present near the values of +1 or -1. The weaker correlation is indicated to have less power of prediction but is useful in making valuable insights regarding business outcomes. The poor strength of the correlation coefficient does not indicate that the values gathered are useless. It indicates that there may be an option for the organisation to make cost savings by analysing the data. For instance, an organisation notices that the relation between radio Ads, the amount of money spent on marketing, and sales boosts are not found to be strongly correlated. It indicates that the organisation is to decide on lowering advertisement to be done through radio regarding the products to save the unnecessary cost of advertising and invest the money in other forms of online promotion of products.

The correlation analysis can be divided into two main types which are positive and negative correlation data analysis. The positive correlation analysis which is often gathered through **SPSS data analysis** results indicates that one of the variables considered for analysis increases while the other also shows an increase. This nature of the relationship is often seen in healthy marketing performance and customer buying patterns. For example, a business can see a positive correlation analysis between their advertisement and sales indicating that their advertisement effort to promote the product has increased and sales also grew at the same time. The negative correlation analysis is one when one of the selected variables shows an

increase while the other variable shows a decrease in analysis. For instance, higher quality customer services are effective in lowering complaints by customers. The relationship helps allow the business to examine the success of newly hired employees in offering customer services.

Correlation Analysis for Informed Business Decisions

The correlation analysis gathered through **SPSS Help** results is not considered to be causation results. It is essential to be considered in business to understand the difference between avoiding falling into pits during decision-making and causing devastating decisions in managing business. This indicates that the correlation analysis results are not considered as one variable is causing influence on another variable as they are interrelated. For the leaders in business to gather meaningful ideas from the conclusion of analysed data, it must be taken into account that any possible factors that could influence the observed correlation such as trends in the market towards buying certain products may have led the business to achieve decreased sales of certain products and not due to their failure in delivering attractive advertisement of their products.

It is suggested that the leaders perform additional research to understand the inner reason for the observed correlation before developing any decision to manage the business. The business leaders think that because two allocated variables are always correlated, it does not indicate that they are indeed in the relationship that will be considered in the future. Therefore, leaders are always required to consider the outside influences that may affect the relationship in future endeavours. The **correlation analysis** uses data to help in making decisions that are related to marketing campaigns along with workplace efficiencies and product offerings. For instance, the positive relation analysis information shows that there is increased employee satisfaction at work with increased paid leave provided to them. However, poor correlation analysis results indicate that employees show poor working performance with increased working days.

Thus, the decision to promote effective working by employees in the business organisation could be taken that leaves are an essential factor to be

considered in boosting individuals to show enhanced work. Another example indicates that businesses that perform online marketing campaigns over social media show an increased boost in sales of GenZ products. However, poor correlation analysis is seen when the offline advertisement is used for marketing campaigns about sales of GenZ products. This indicates the leaders have decided to focus on increasing online marketing campaigns in selling GenZ products.

Correlation analysis is used in business to understand the effect of initiatives of business on their desired outcomes. The correlation analysis is an effective **qualitative data** assessment performance method of initiatives used in business to determine the things that work and make decisions accordingly in managing the business. The correlation analysis results in business help leaders to identify hidden opportunities, refine the use of strategies, determine ways to allocate appropriate resources, identify proper trends, and others.

To illustrate the practical application of correlation analysis in market research, let's consider a case study. A retail company wants to understand the relationship between customer satisfaction scores and repeat purchase behavior. By conducting correlation analysis on a large customer dataset, the company discovers a strong positive correlation between high customer satisfaction scores and repeat purchases. This finding prompts the company to prioritize initiatives aimed at improving customer satisfaction, ultimately leading to increased customer loyalty and revenue.

In conclusion, correlation analysis is a valuable tool for market researchers seeking to uncover relationships between variables and gain insights into consumer behavior and market trends. By understanding the basics of correlation coefficients, considering the context, and exploring non-linear relationships, researchers can use this technique effectively. The case study demonstrates the practical application of correlation analysis in driving business decisions.

Finding the correlation coefficient between age and playing habits of the following students using Karl Pearson's coefficient of correlation method.

Age	21	22	23	24	25	26
No. of students	46	44	36	30	25	19
Regular Players	41	38	26	21	14	7

To find the correlation between age and playing habits of the students, we need to compute the percentages of students who are having the playing habit.

Percentage of playing habits = No. of Regular Players / Total No. of Students * 100

Now, let us assume that ages of the students are variable X and percentages of playing habits are variable Y.

As you have probably already noticed, the output of this calculator is... verbose. Although most of the information provided below is self-explanatory, there are a few things worth noting. First, the five text boxes spread across the middle of the page represent the calculations that would be required if you were to calculate the R value in stages. Second, there is more than one way to calculate the R value, but these are all mathematically equivalent, so you shouldn't worry if you don't recognize the equation used here. Third, in the "Result Details & Calculations" box, you'll find what we've called a cross-check value, which is the R value calculated using an algorithm supplied by the Meta Numeric statistical library. This should be identical to the value that we've calculated.

The value of R is -0.9679.

This is a strong negative correlation, which means that high X variable scores go with low Y variable scores.

Conclusion

Thus, it can be concluded that correlation analysis could be used in business in making major decisions regarding the key variables to be used in promoting business. It also helps business leaders determine the perfect decision to be made for sales improvement, employee satisfaction, resource allocation, and others. This intricate technique delves into the depths of relationships between variables, providing invaluable insights into how changes in one factor may influence changes in another. From the dynamic realm of business to the

realms of science, research, and beyond, correlation analysis plays a pivotal role in understanding the hidden connections that shape our world. Correlation analysis is only sometimes used alone and is usually joined by the relapse analysis. The contrast between correlation and relapse lies in the way that while an analysis stops with the estimation of the correlation coefficient and maybe a trial of importance, a relapse analysis communicates the correlation as a situation and moves into the domain of expectation.

References:

Altman DG, Bland JM. Measurement in Medicine: The Analysis of Method Comparison Studies. *The Statistician.* 1983;32:307–317.

Altman DG. *Practical Statistics for Medical Research.* Chapman & Hall/CRC

Bland JM, Altman DG. Calculating correlation coefficients with repeated observations: part 2–correlation between subjects. BMJ. 1995;310:633.

Clarke GM, Cooke D. *A basic course in Statistics.* 3rd ed

Hinkle DE, Wiersma W, Jurs SG. *Applied Statistics for the Behavioral Sciences.* 5th ed. Boston: Houghton Mifflin; 2003.

Kumar, N., Rath, A., Singh, A.K. and Akoijam, S.L.S. (2023), "Decision-making using regression analysis: a case study on Top Tier Holidays LLP", , Vol. 19 No. 2, pp. 273-289.

Mukaka MM. Statistics corner: a guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012;24:69–71.

Nishimura A, Tabuchi Y, Kikuchi M, Masuda R, Goto K, Iijima T. The amount of fluid given during surgery that leaks into the interstitium correlates with infused fluid volume and varies widely between patients. Anesth Analg. 2016;123:925–932.

Ozer DJ. Correlation and the coefficient of determination. Psychol Bull. 1985;97:307–315.

Porter AM. Misuse of correlation and regression in three medical journals. J R Soc Med. 1999;92:123–128.

Schober P, Bossers SM, Schwarte LA. Statistical significance versus clinical importance of observed effect sizes: what do *P* values and confidence intervals really represent? Anesth Analg. 2018;126:1068–1072.

Song, M., Wang, S., Wu, J. and Yang, L. (2011), "A new space-time correlation coefficient and its comparison with Moran's Index on evaluation", *Management Decision*, Vol. 49 No. 9, pp. 1426-1443.

Swinscow TDV. In: *Statistics at square one.* Nineth Edition. Campbell M J, editor. University of Southampton; Copyright BMJ Publishing Group 1997.