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# A Spatial Analysis of Point-of-Sale Activity in Saudi Arabia

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**Abstract:** Point-of-sale (POS) data provides valuable insights into consumer spending habits and economic activity across various sectors. This study examines trends and regional variations in POS transactions and sales values in Saudi Arabia from 2016 to 2023. The research analyzes data from the Saudi Central Bank and the General Authority for Statistics. Utilizing descriptive statistical analysis and comparative analysis using Multivariate Analysis of Variance (MANOVA) to analyze sales values and transaction volumes across Saudi Arabian regions, the F-statistics for the Corrected Model confirmed that the estimated General Linear Model (GLM) is statistically valid and appropriate. Statistical significance among regions indicates differences in transaction volumes and sales values, which stem from regional disparities. Specifically, Partial Eta Squared ($\eta^2$) and coefficient of determination ($R^2$) values reveal that regional differences account for 86.9% of the variance in sales values and 54.6% of the variance in transaction volumes. To compare sales values and transaction volumes between regions and categorize them into groups, we employed Scheffé's post-hoc test. The study findings reveal substantial annual growth rates in both transaction numbers and sales values across these sectors nationwide. Additionally, the study highlights regional disparities in POS performance, shedding light on localized economic dynamics.

**Keywords:** Spatial analysis, comparative analysis, point of sale, multivariate analysis of variance, Scheffe test, Saudi Arabia.

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# التحليل المكاني لأنشطة نقاط البيع في المملكة العربية السعودية

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**المستخلص:** تعتبر بيانات نقاط البيع (POS) مؤشر مهم يتبين من خلاله عادات إنفاق المستهلكين والنشاط الاقتصادي عبر مختلف القطاعات الاقتصادية، حيث تهدف هذه الدراسة إلى فحص الاتجاهات والتباينات المناطقية في معاملات نقاط البيع وقيم المبيعات في المملكة العربية السعودية خلال الفترة من 2016 إلى 2023. وقد تم الاعتماد على عدد من المصادر لجمع بيانات الدراسة شملت البنك المركزي السعودي والهيئة العامة للإحصاء، وتم استخدام التحليل الإحصائي الوصفي والتحليل المقارن باستخدام تحليل التباين المتعدد (MANOVA) لتحليل قيم المبيعات وحجم المعاملات عبر مختلف مناطق المملكة. وأكدت إحصائيات F للنموذج المعدل أن النموذج الخطي العام (GLM) المقدر يُعتبر دقيقاً ومناسب إحصائياً، كما أشارت النتائج إلى وجود اختلافات في حجم المعاملات وقيم المبيعات بين مناطق المملكة، كما كشف تحليل التباين ANOVA باستخدام Partial Eta Squared ($\eta^2$) ومعامل التحديد ($R^2$) أن الاختلافات بين المناطق تفسر 86.9% من التباين في قيم المبيعات و 54.6% من التباين في حجم المعاملات. ولمقارنة قيم المبيعات وحجم المعاملات بين المناطق وتصنيفها إلى مجموعات، تم استخدام اختبار Scheffé's post-hoc وأظهرت نتائج الدراسة معدلات نمو سنوية كبيرة في كل من عدد المعاملات وقيم المبيعات عبر هذه القطاعات على مستوى المملكة. وبناء على ذلك فإن هذه التباينات بين مناطق المملكة في أداء نقاط البيع تكشف عن تأثرها بالعمليات والتفاعلات الاقتصادية التي تحدث على مستوى كل منطقة، من خلال عدد من العوامل والقوى التي تؤثر على الأنشطة الاقتصادية فيها.

**الكلمات المفتاحية:** التحليل المكاني، التحليل المقارن، نقطة البيع، تحليل التباين المتعدد، اختبارScheffé ، المملكة العربية السعودية.

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## Introduction

Point-of-sale (POS) data, encompassing both physical and digital transactions, provides essential insights into consumer spending habits and economic activity. POS systems play an important role in the operations of all sectors, performing functions such as recording sales, managing inventory, generating invoices, and calculating profits. These systems considerably enhance service delivery and operational efficiency. The evolution of POS systems has been driven by the demand for improved data management and security, particularly in businesses that previously depended on manual or paper-based processes. The implementation of POS systems has contributed to increased efficiency in terms of time and energy from an operational standpoint, alongside enhanced safety and accuracy (Dewi et al., 2021; Widjaja et al., 2021).

Previous literature underlines the pivotal role of e-commerce and e-payment methods in driving online shopping and sales growth. Empirical evidence suggests that e-payment systems considerably contribute to the expansion of online sales (Alzoubi et al., 2022). Hood and colleagues examined changes in consumer behavior and preferences for e-commerce within the grocery retail sector in Great Britain, emphasizing the impact of the growing availability of new online shopping options (Hood et al., 2020).

Furthermore, research underlines the importance of e-payment adoption for fostering economic growth, business development, and productivity (Kurniawan et al., 2024). E-payment systems also positively affect consumer behavior (Ghaith & Ghaith, 2022). Factors such as system oversight, security, and infrastructure policies within a country can further encourage the adoption of e-payment systems (Machoka et al., 2015; Kafley & Chandrasekaran, 2021).

The Saudi Arabian economy has experienced substantial transformation in recent years, fueled by Vision 2030 and a strong commitment to economic diversification. Within this framework, the sales sector has emerged as a critical economic indicator, reflecting the growing reliance on electronic technology as an alternative to traditional methods. By leveraging a robust digital infrastructure, the sales sector has become a cornerstone in supporting the digital economy and advancing financial inclusion, aligning with the nation's strategic goals for sustainable growth and modernization.

The adoption of electronic payment systems through Points of Sale (POS) has grown considerably alongside Saudi Arabia's accelerating economic growth. Between 2016 and 2023, the total sales volume transacted through POS terminals surged from approximately 180 billion Saudi Riyals to over 600 billion Saudi Riyals (Figure 1) (Saudi Central Bank, 2024). For example, the food and beverage sector, including restaurants and cafes, has exhibited substantial growth, with sales volume via POS increasing sevenfold during this period, from around 9.5 billion Saudi Riyals to over 89 billion Saudi Riyals. Similarly, the broader food and beverage sector has nearly quintupled in sales volume, rising from approximately 21.5 billion Saudi Riyals to about 96 billion Saudi Riyals (Figure 2) (Saudi Central Bank, 2024). These trends reflect a notable shift in consumer preferences and increased reliance on these sectors, underscoring their growing importance within the Saudi economy.

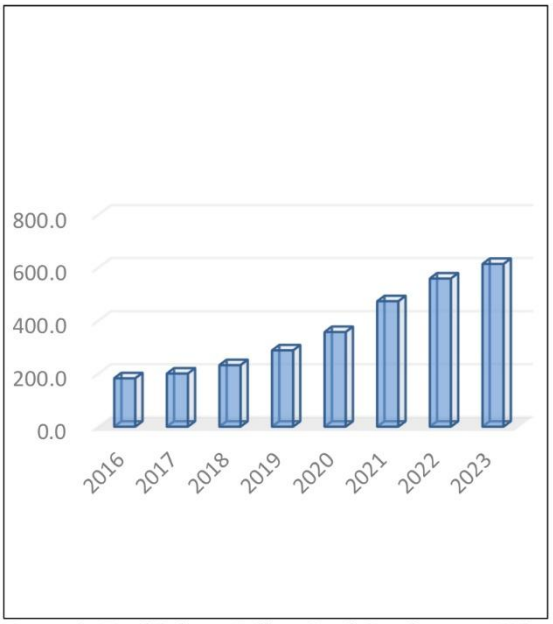


*Figure 1: Total Sales in Billion Saudi Riyals using POS*

*Source: Saudi Central Bank (2024)*

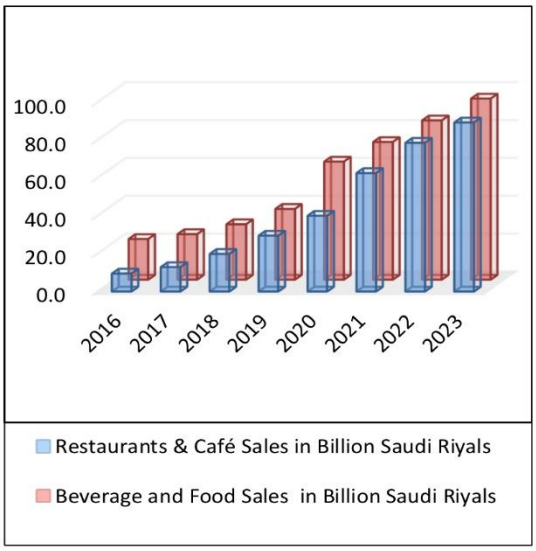


*Figure 2: Sales in Billion Saudi Riyals using POS in Restaurants & Café and Beverage and Food*
*Source: Saudi Central Bank (2024)*

This rapid adoption of electronic payment systems, particularly through Points of Sale (POS) in Saudi Arabia, is supported by numerous studies that explore various aspects of this shift. Traditional payment systems have declined in prominence, contributing negligibly to the overall payment infrastructure, while modern systems such as Debit Cards, E-payment platforms, and POS terminals have emerged as dominant players. However, challenges such as security concerns and traceability issues persist, highlighting areas for improvement to enhance user trust and satisfaction (Ali and Salameh, 2023; Alsuhaibany, 2024).

From an entrepreneurial perspective, Khan (2023) confirms that digital payments, including POS systems, significantly enhance financial efficiency and market access in Saudi Arabia. Nevertheless, these systems are hindered by inadequate technological infrastructure and ongoing security concerns, particularly affecting small and medium-sized enterprises (SMEs). This underscores the necessity for policy measures to address these structural gaps and ensure equitable access to advanced payment technologies.

The global trend toward contactless payments, accelerated by the COVID-19 pandemic, is reflected in Saudi Arabia's point-of-sale (POS) landscape. During the pandemic, health safety and hygiene became primary motivators for adopting contactless POS payments (Shishah and Alhelaly, 2021). Collectively, these studies illustrate the transformative role of POS systems in Saudi Arabia, showcasing both substantial advancements and pressing challenges. To ensure inclusivity and sustainability in the country's evolving digital economy, comprehensive strategies for optimization are essential.

Limited research has focused on the geographic variations in market dynamics, such as understanding the geodemographics of e-commerce. One study examined the demographic and geodemographic profiles of online grocery shoppers in the UK, identifying factors like age, social class, and residential location as key attributes (Kirby-Hawkins et al., 2019). Through a comprehensive spatial analysis of e-commerce sales for a major UK grocery retailer, the study revealed spatial patterns affected by urban density and geodemographics, finding that online grocery shopping is more prevalent in rural areas and regions with limited access to physical stores. Another study examined consumer preferences for local food and their willingness to pay premiums based on the marketing channel (Printezis & Grebitus, 2018). Findings revealed that while consumers generally value local food and are willing to pay a premium for it, this premium diminishes or disappears when local food is sold at farmers' markets. Additionally, consumers tend to discount local food purchased directly from urban farms. These results emphasize the critical role of the sales channel in shaping consumer perceptions of value for local food products, highlighting the need to consider the sales context when evaluating consumer willingness to pay.

The rapid adoption of electronic payment systems through Points of Sale (POS) in Saudi Arabia has transformed the country's economic landscape. While previous studies have highlighted the general trends and benefits of digital payments, a notable gap remains in understanding the regional disparities in POS activity across different regions of Saudi Arabia. This disparity is crucial for policymakers, businesses, and researchers as it provides insights into how digital payment systems are influencing consumer behavior, market dynamics, and economic growth. This study seeks to fill this gap by providing a

comprehensive spatial analysis of POS activity across different regions of the country.

Therefore, this study aims to examine the performance of POS activity in Saudi Arabia from 2016 to 2023. By analyzing an extensive dataset of POS transactions from the Saudi Central Bank and the General Authority for Statistics, the research aims to uncover regional disparities in POS activity across the country.

**Research Methodology and Data Sources**

The research analyzes and interprets the data using descriptive statistical methods, including mean calculations, relative significance, general trend equations, and variability analysis. Additionally, the study employs multivariate analysis of variance (MANOVA) to compare the number and value of sales across sectors by region in Saudi Arabia (Warne, 2014). MANOVA is used to analyze the variations in multiple dependent variables—number of transactions and value of sales—caused by a single independent variable, the regions of Saudi Arabia. For MANOVA to be valid, several assumptions must be met, such as the assumption of the natural distribution of both the independent and dependent variables. The analysis is sensitive to the violation of this requirement. Therefore, the natural distribution of the data is tested using the Kolmogorov-Smirnov test and the Shapiro-Wilk test (Mishra et al., 2019). In addition, the Mahalanobis test is recommended for identifying multivariate outliers by comparing its values against the Chi-squared $(X^2)$ distribution table, with degrees of freedom equal to the number of associated variables (Etherington, 2021). To detect extreme values impacting the natural distribution, an alpha level of 0.001 is suggested. The consistency of variances across groups will be assessed using Levene's test for equality of variances (Mishra et al., 2019). Additionally, the homogeneity of the variance-covariance matrices of multiple variables is tested using Box's M test, which should yield an insignificant result to satisfy the assumption of homogeneity.

Finally, comparative analysis is conducted using the Scheffe test, which categorizes the regions into groups based on statistically significant differences in average sales values and transaction numbers (Scheffe, 1999). This study utilizes quarterly time series data from Q1 2016 to Q2 2023, published by the Saudi Central Bank and the General Authority for Statistics. The data includes a key variable that is represented by the value of sales. These values are derived from debit card transaction records provided by the Saudi Central Bank, enabling a detailed analysis of sales trends within these sectors over the study period.

**Discussion of the Results**

**First: The General Time Trend of the Transactions and the Sales for POS**

An analysis of the current status of transactions and sales values for POS sectors during the period Q1 2016 to Q4 2023 shows a statistically significant annual growth trend. Table 1 shows the general time trend equation for all sectors, indicating an annual growth rate of 11% in the number of transactions and 4.7% in sales value. These findings highlight consistent growth in POS activities across sectors during the study period. Furthermore, the general time trend equation indicates a statistically significant annual growth in the number of transactions and sales value for the restaurant and café sector, with growth rates of 12.9% and 8.45%, respectively. The equation also reveals an increase in the relative importance of this sector within total transactions and sales value, with annual growth rates of 1.9% and 3.71%, respectively. These findings underscore the expanding role of the restaurant and café sector in the overall POS market. For the food and beverages sector, the general time trend equation shows a statistically significant annual growth rate of 1.09% in the number of transactions and 5.9% in sales value. Additionally, the equation shows a slight annual decrease in the relative importance of this sector within the total number of transactions, with a statistically insignificant decrease of 0.003%. However, the relative importance of the sector's sales value exhibited a statistically significant annual growth rate of 1.16%. These results highlight steady growth in sales value despite a minor decline in transaction share. During the study period, the general time trend equation shows a statistically significant annual growth rate of 6.98% in the number of POS devices. Additionally, the equation indicates a

statistically significant annual growth rate of 3.1% in total credit card loans. These findings reflect the steady expansion of POS infrastructure and credit card usage, contributing to the broader adoption of electronic payment systems. The results of the general time trend equations collectively highlight an overall increase in the total number of transactions and sales values across all sectors and selected sectors, alongside the growth in the number of POS devices and total credit card loans. These findings clearly show the expanding adoption of POS systems for transactions in Saudi Arabia between 2016 and 2023, reflecting the country's transition toward a more digitalized economy.

***Table (1): Time trend equations for POS across sectors and some related variables (Q1 2016 - Q4 2023)***

| Variables | | Annual growth rate % | F | $R^2$ | Equations |
|---|---|---|---|---|---|
| All Sectors | Number of transactions | 11.0 | 1751.2** | 0.98 | Lny1=4.50+ 0.11 T |
| | Sales value | 4.7 | 975.4** | 0.97 | Lny2=3.63+0.047 T |
| Restaurant and Café Sector | Number of transactions | 12.9 | 1275.5** | 0.98 | Y3=2.77+ 0.129T |
| | Sales value | 8.45 | 881.2** | 0.97 | Y4=0.69 +0.845 T |
| | % of total transactions | 1.90 | 43.41** | 0.59 | Lny5=2.876+ 0.019T |
| | % of total sales value | 3.71 | 226.0** | 0.88 | Lny6=1.667+ 0.0371T |
| Beverage and Food Sector | Number of transactions | 1.09 | 1420.6** | 0.98 | Lny7=3.097+ 0.109 T |
| | Sales value | 5.9 | 665.9** | 0.95 | Lny8=1.469+0.059 T |
| | % of total transactions | 0.003 | 0.04ns | 0.01 | Y9=3.203 – 0.0003T |
| | % of total sales value | 1.16 | 34.8** | 0.54 | Lny10= 2.447+ 0.0116T |
| Number of POS devices | | 6.98 | 660.8** | 0.96 | Y11=5.193 + 0.0698T |
| Total credit card loans | | 3.1 | 358.5** | 0.92 | Y12= 2.309+0.031T |

*Source: Calculated from data of POS transactions from the Saudi Central Bank*

**Second: Multivariate Analysis of POS Across Saudi Regions:**

This study aims to analyze the impact of regional factors on the number and value of sales across various sectors, providing insights into regional variations in sales performance. Unlike traditional methods that assess sales metrics—namely, the number of transactions and sales value—independently, this research employs MANOVA to evaluate the impact of regions on both metrics simultaneously. This approach offers a more comprehensive and nuanced understanding of regional sales dynamics. By applying MANOVA, the study will determine whether statistically significant differences exist in the mean values of the dependent variables (number of transactions and sales value) across different regions.

Normality and Homogeneity of Variance of the Independent and Dependent Variables:

The results of the normality test show that the significance levels of the Kolmogorov-Smirnov and Shapiro-Wilk tests are greater than 0.05 (Table 2). This supports the acceptance of the null hypothesis, confirming that the data follow a normal distribution. However, the results of the homogeneity of variance test, shown in Table 3, reveal that the significance level of the Levene Statistic test is lower than 0.05. This leads to the acceptance of the alternative hypothesis, indicating that the variances are not homogeneous. This issue must be addressed to ensure the validity of the analysis of variance. To address the issue of non-homogeneous variances, methods such as applying the natural logarithm or square root transformations to the data were employed. The results, presented in Table 4, show that the significance level of the Levene Statistic test is now greater than 0.05, leading to the acceptance of the null hypothesis and confirming that the variances are

homogeneous. To further ensure the reliability of the multivariate analysis, the Mahalanobis test was used to check for outliers that could affect the normal distribution. The maximum Mahalanobis value was found to be 6.491. According to the chi-square distribution table, the critical value at a significance level of 0.001 is 13.816, which is higher than the observed maximum Mahalanobis value. This indicates that the multivariate variables are free from outliers, ensuring the robustness of the analysis.

***Table (2): Normality Test for the Data of the Number of Transactions and Sales Value Between Regions of Saudi Arabia During 2016-2023***

| Variables | Region | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | df | Sig. | Statistic | df | Sig. |
| Sales value | Riyadh | .169 | 8 | .200* | .915 | 8 | .394 |
| | Jeddah | .175 | 8 | .200* | .873 | 8 | .160 |
| | Dammam | .168 | 8 | .200* | .897 | 8 | .272 |
| | Madinah | .176 | 8 | .200* | .905 | 8 | .320 |
| | Makkah | .275 | 8 | .076 | .855 | 8 | .107 |
| | Burayda | .173 | 8 | .200* | .904 | 8 | .312 |
| | Tabuk | .175 | 8 | .200* | .909 | 8 | .347 |
| | Hail | .182 | 8 | .200* | .903 | 8 | .306 |
| | Abha | .183 | 8 | .200* | .894 | 8 | .254 |
| | Jazan | .170 | 8 | .200* | .927 | 8 | .492 |
| | Najran | .186 | 8 | .200* | .912 | 8 | .366 |
| | Sakaka | .182 | 8 | .200* | .889 | 8 | .228 |
| | Arar | .191 | 8 | .200* | .879 | 8 | .186 |
| | Al Bahah | .205 | 8 | .200* | .897 | 8 | .269 |
| Number of transactions | Riyadh | .206 | 8 | .200* | .877 | 8 | .174 |
| | Jeddah | .225 | 8 | .200* | .845 | 8 | .085 |
| | Dammam | .208 | 8 | .200* | .874 | 8 | .163 |
| | Madinah | .228 | 8 | .200* | .858 | 8 | .114 |
| | Makkah | .240 | 8 | .195 | .839 | 8 | .074 |
| | Burayda | .210 | 8 | .200* | .886 | 8 | .217 |
| | Tabuk | .224 | 8 | .200* | .861 | 8 | .123 |
| | Hail | .227 | 8 | .200* | .861 | 8 | .124 |
| | Abha | .226 | 8 | .200* | .858 | 8 | .114 |
| | Jazan | .233 | 8 | .200* | .844 | 8 | .082 |
| | Najran | .224 | 8 | .200* | .851 | 8 | .098 |
| | Sakaka | .230 | 8 | .200* | .859 | 8 | .118 |
| | Arar | .243 | 8 | .182 | .837 | 8 | .071 |
| | Al Bahah | .245 | 8 | .171 | .834 | 8 | .065 |
| **** This is a lower bound of the true significance.*** | | | | | | | |
| ***a. Lilliefors Significance Correction*** | | | | | | | |

***Table (3): Test of homogeneity of variances for the data on the number of transactions and sales value between regions of Saudi Arabia during 2016-2023***

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| Sales value | Based on the Mean | 19.682 | 13 | 98 | .000 |
| | Based on the Median | 11.447 | 13 | 98 | .000 |
| | Based on Median and with adjusted df | 11.447 | 13 | 10.586 | .000 |
| | Based on the trimmed mean | 18.116 | 13 | 98 | .000 |
| Number of transactions | Based on the Mean | 18.090 | 13 | 98 | .000 |
| | Based on the Median | 7.460 | 13 | 98 | .000 |
| | Based on Median and with adjusted df | 7.460 | 13 | 11.074 | .001 |
| | Based on the trimmed mean | 15.891 | 13 | 98 | .000 |

***Table (4): Results of the test of homogeneity of variances for study data after solving the problem of non-homogeneity of variances.***

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| Sales value | Based on the Mean | 1.340 | 13 | 98 | .203 |
| | Based on Median | 1.234 | 13 | 98 | .267 |
| | Based on Median and with adjusted df | 1.234 | 13 | 85.029 | .270 |
| | Based on the trimmed mean | 1.336 | 13 | 98 | .206 |
| Number of transactions | Based on the Mean | .542 | 13 | 98 | .893 |
| | Based on the Median | .536 | 13 | 98 | .897 |
| | Based on Median and with adjusted df | .536 | 13 | 94.311 | .897 |
| | Based on the trimmed mean | .542 | 13 | 98 | .893 |

***Table (5): Results of the test of absence of outliers in the study variables.***

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | -1.3063- | 12.8139 | 7.5000 | 3.81549 | 112 |
| Std. Predicted Value | -2.308- | 1.393 | .000 | 1.000 | 112 |
| Standard Error of Predicted Value | .129 | .355 | .217 | .056 | 112 |
| Adjusted Predicted Value | -1.4730- | 12.8088 | 7.4858 | 3.82694 | 112 |
| Residual | -2.37965- | 2.93529 | .00000 | 1.35590 | 112 |
| Std. Residual | -1.739- | 2.145 | .000 | .991 | 112 |
| Stud. Residual | -1.756- | 2.200 | .005 | 1.007 | 112 |
| Deleted Residual | -2.42459- | 3.08782 | .01420 | 1.39955 | 112 |
| Stud. Deleted Residual | -1.773- | 2.240 | .005 | 1.011 | 112 |
| Mahal. Distance | .002 | 6.491 | 1.982 | 1.576 | 112 |
| Cook's Distance | .000 | .084 | .011 | .016 | 112 |
| Centered Leverage Value | .000 | .058 | .018 | .014 | 112 |

*a. Dependent Variable: Region*

After confirming the assumptions for the MANOVA test, the analysis measured the degree of difference and variance in the number of transactions and sales values across different regions of Saudi Arabia. MANOVA was employed to assess the impact of regions (independent variable) on these two dependent variables. The results, presented in Table 6, include four tests to evaluate the overall significance of the model. As the statistical significance level for all tests is below 0.05, it indicates a significant effect of the independent variable (regions) on the variance in one or more of the dependent variables (number of transactions and sales values).

The results of the general linear model (GLM) analysis indicate that the F-statistic for the corrected model is approximately 49.82, which is statistically significant. This confirms that the linear model is statistically sound and appropriate for the analysis (Table 7). Additionally, the statistical significance of the regions is below the 0.05 threshold, demonstrating significant differences and variances in the number of transactions and sales values attributable to regional differences. The analysis further reveals that regions account for 86.9% of the variance in sales values and 54.6% of the variance in the number of transactions, as shown by the values of partial eta squared and the coefficient of determination ($R^2$). These differences may stem from variations in the number of POS devices, differences in e-commerce adoption and buying culture, or differences in social and consumer habits across regions.

***Table (6): Overall Significance Tests for Analysis of Variance.***

| Effect | | Value | F | Hypothesis df | Error df | Sig. |
|---|---|---|---|---|---|---|
| Intercept | Pillai's Trace | .964 | 1301.303a | 2.000 | 97.000 | .000 |
| | Wilks' Lambda | .036 | 1301.303a | 2.000 | 97.000 | .000 |
| | Hotelling's Trace | 26.831 | 1301.303a | 2.000 | 97.000 | .000 |
| | Roy's Largest Root | 26.831 | 1301.303a | 2.000 | 97.000 | .000 |
| Region | Pillai's Trace | .999 | 7.517 | 26.000 | 196.000 | .000 |
| | Wilks' Lambda | .012 | 60.918a | 26.000 | 194.000 | .000 |
| | Hotelling's Trace | 82.103 | 303.149 | 26.000 | 192.000 | .000 |
| | Roy's Largest Root | 82.092 | 618.848b | 13.000 | 98.000 | .000 |

*a. Exact statistic*
*b. The statistic is an upper bound on F that yields a lower bound on the significance level.*
*c. Design: Intercept + Region*

***Table (7): Results of the General Linear Model (GLM) for comparing the number of transactions and the value of sales of points of sale in the regions of Saudi Arabia during the period (2016-2023)***

| Source | Dependent Variable | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| Corrected Model | Sales value | 166.923a | 13 | 12.840 | 49.821 | .000 | .869 |
| | Number of transactions | 161.825b | 13 | 12.448 | 9.052 | .000 | .546 |
| Intercept | Sales value | 433.890 | 1 | 433.890 | 1683.514 | .000 | .945 |
| | Number of transactions | 1687.752 | 1 | 1687.752 | 1227.286 | .000 | .926 |
| Region | Sales value | 166.923 | 13 | 12.840 | 49.821 | .000 | .869 |
| | Number of transactions | 161.825 | 13 | 12.448 | 9.052 | .000 | .546 |
| Error | Sales value | 25.257 | 98 | .258 | | | |
| | Number of transactions | 134.769 | 98 | 1.375 | | | |
| Total | Sales value | 626.070 | 112 | | | | |
| | Number of transactions | 1984.345 | 112 | | | | |
| Corrected Total | Sales value | 192.181 | 111 | | | | |
| | Number of transactions | 296.594 | 111 | | | | |

*a. R Squared = .869 (Adjusted R Squared = .851)*
*b. R Squared = .546 (Adjusted R Squared = .485)*

**Third: Post-hoc Analysis of Regional Variations in Sales and Transaction Numbers:**

The findings of the MANOVA analysis highlight regions with significantly different sales performance across sectors. To identify specific regional disparities, a post-hoc analysis using the Scheffe test was conducted. This analysis investigates variations in sales value and transaction numbers across regions in Saudi Arabia. The results, presented in Table 8, reveal significant heterogeneity in sales performance among the regions, underscoring notable differences in market dynamics. For sales value, three distinct groups were identified based on sales value:

Group 1: This group comprises the majority of regions, including Al-Bahah, Arar, Sakaka, Najran, Jazan, Abha, Hail, Tabuk, Buraydah, Makkah, Madinah, and Dammam. Within this group, no statistically significant differences in sales values were observed among its members, indicating relative homogeneity in sales performance across these regions.

Group 2: This group is represented solely by Jeddah, which exhibited significantly higher sales values compared to the regions in Group 1. The average sales value in Jeddah was approximately 58.56 billion Saudi Riyals, highlighting its standout performance in sales among the analyzed regions.

Group 3: This group consists exclusively of Riyadh, which demonstrated the highest sales values, significantly surpassing those of regions in both Group 1 and Group 2. The average sales value in Riyadh was approximately 117.74 billion Saudi Riyals, solidifying its position as the leading region in sales performance.

For transaction numbers, two distinct groups were identified based on transaction numbers:

Group 1: Similar to its composition in terms of sales values, this group includes regions such as Al-Bahah, Arar, Sakaka, Najran, Jazan, Abha, Hail, Tabuk, Buraydah, Makkah, Madinah, and Dammam. In terms of sales values, this group encompasses regions such as Al-Bahah, Arar, Sakaka, Najran, Jazan, Abha, Hail, Tabuk, Buraydah, Makkah, Madinah, and Dammam. Within this group, no statistically significant differences in transaction numbers were identified among its constituent regions, indicating uniformity in transaction activity.

Group 2: This group consists of Jeddah and Riyadh, both of which demonstrated significantly higher transaction numbers compared to the regions in Group 1. However, no statistically significant differences in transaction numbers were found between Jeddah and Riyadh, indicating comparable transaction activity levels within this group.

The findings from the Scheffe test highlight significant regional variations in both sales values and transaction numbers across Saudi Arabia. These disparities likely reflect underlying economic and socio-demographic factors that affect regional market dynamics and consumer behavior.

***Table (9) Results of Scheffe Test for Pairwise Comparisons of Sales Values and Transaction Numbers between Regions of Saudi Arabia***

| Region | N | Sales value | | | Number of transactions | |
|---|---|---|---|---|---|---|
| | | Subset | | | Subset | |
| | | 1 | 2 | 3 | 1 | 2 |
| Al-Bahah | 8 | 1.50 | - | - | 16.38 | - |
| Arar | 8 | 1.67 | - | - | 21.38 | - |
| Sakaka | 8 | 2.23 | - | - | 23.00 | - |
| Najran | 8 | 3.61 | - | - | 42.88 | - |
| Jazan | 8 | 4.18 | - | - | 42.88 | - |
| Abha | 8 | 5.20 | - | - | 57.50 | - |
| Hail | 8 | 5.80 | - | - | 64.63 | - |
| Tabuk | 8 | 6.35 | - | - | 74.00 | - |
| Burayda | 8 | 9.21 | - | - | 91.50 | - |
| Makkah | 8 | 13.11 | - | - | 137.50 | - |
| Madinah | 8 | 13.48 | - | - | 148.63 | - |
| Dammam | 8 | 19.93 | - | - | 166.38 | - |

| Region | N | Sales value | | | Number of transactions | |
|---|---|---|---|---|---|---|
| | | Subset | | | Subset | |
| | | 1 | 2 | 3 | 1 | 2 |
| Jeddah | 8 | | 58.56 | | 470.38 | 470.4 |
| Riyadh | 8 | | | 117.74 | | 1028 |
| Sig. | | .95 | 1.00 | 1.00 | .63 | .26 |

*Means for groups in homogeneous subsets are displayed.*
*Based on observed means.*
*The error term is Mean Square (Error) = 76540.509.*

*a. Uses Harmonic Mean Sample Size = 8.000.*

*b. The group sizes are unequal. Therefore, the harmonic mean of the group sizes is used. Type I error levels are not guaranteed.*

*c. Alpha = .05.*

## Conclusion

Point-of-sale (POS) data provides valuable insights into consumer spending patterns and economic activity across various sectors. The growing adoption of POS systems has transformed business operations by streamlining tasks such as recording sales, managing inventory, and calculating profits. This study examines trends and regional variations in POS transactions and sales values within Saudi Arabia from 2016 to 2023, utilizing data from the Saudi Central Bank and the General Authority for Statistics. Previous research highlights the critical role of e-payment methods in driving growth within the retail sector. E-payment systems have been shown to significantly expand online sales, affect consumer behavior, and contribute to economic growth. However, limited studies have examined the impact of geographic location on e-payment systems, suggesting a need for further investigation, particularly in the context of Saudi Arabia. This study utilizes MANOVA to analyze POS data on transactions and sales values across various regions in Saudi Arabia. Descriptive statistical analysis is employed to assess general trends, followed by MANOVA to examine the regional impact on POS performance. The findings reveal significant annual growth rates in transaction numbers and sales values nationwide. Additionally, the research identifies regional variations in POS performance. By applying Scheffe's test, regions are grouped based on statistically significant differences in average sales values and transaction numbers. These results highlight substantial heterogeneity in market performance across Saudi Arabia's regions.

This research offers valuable insights into consumer behavior and economic activity. By identifying regional variations in point-of-sale (POS) performance, the study enhances our understanding of the economy and consumer spending patterns. The findings offer actionable information for policymakers, businesses, and researchers interested in the evolving dynamics of economic activities using POS data in Saudi Arabia. Further research is recommended to explore the underlying factors driving these regional variations, including economic development, population density, and consumer preferences.

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