MODELING PATIENTS ATTENDANCE AT A UNIVERSITY HEALTH CLINIC

(A CASE STUDY OF THE JAJA CLINIC, UNIVERSITY OF IBADAN 2001 – 2011)

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IN THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS,
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CERTIFICATION

We certify that this study was carried out under our supervision by BAMIGBADE, TAJUDEEN KOLA of the Department of Epidemiology, Medical Statistics, Faculty of Public Health, University of Ibadan, Nigeria for the award of Degree of Master of Science in Biostatistics.

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DEDICATION

To my loving parents, siblings and children.

ACKNOWLEDGEMENT

Thanks and praises are due to the most High for the gift of life. I am indeed very grateful to Professor E.A. Bamgboye, and Dr. O.M. Akpa who made it possible for me to work on this project.

My thanks also go to Pa J.A. Akinlade, Alh W.A. Oyeleke, Mr. R.J. Salako, Mr. D.Y. Babalola, Mr Ayobami Lawal, and Mrs Tayo Omole for their prayers and encouragement.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Background

Attendance at hospitals, clinics and Health Centers are something that cannot be deliberately ignored. They deserve and demand our attention in order to take appropriate steps to minimize those frequent visits. It is of utmost importance for any academic institution like the University of Ibadan to know the pattern of utilization of its health services for effective planning. The data utilization of its health services for effective planning.

Methodology

The data used in this project were the monthly number of patients attended to at the Jaja Clinic, University of Ibadan extracted from the University Of Ibadan Digest Of Statistics. The data spanned over eleven years (January 2001- December 2011) and the total number of patients considered was 230,477. Time series statistical models were built to study the dynamics, trend and predict the future figures.

Results

The least squares models revealed that quarterly increase of 14 patients for students, while the outcome of the analysis showed quarterly decrease of 5, 13, 17 and 20 patients for the senior staff, senior staff dependents, Junior staffs and junior staff dependents respectively. It was equally revealed from the analysis that Students and Senior staff attendance was at the peak during the third quarter of the year, while those of the senior staff dependants, Junior staff and Junior staff dependants occurred during the second quarter of the year.

Conclusion

The analysis revealed marked difference among the attendances of the five categories making use of the health services provided by Jaja clinic as well as their seasonal variation. It is suggested that each category of patient be adequately prepared for in the allocation of resources whenever the need arises.

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CHAPTER ONE

1.0 INTRODUCTION

The use of health care services has been attributed to its availability, quality, affordability, as well as the social-economic structure and personal characteristics of the people. (Chakraborty et al. 2003; Manzoor et al. 2009; Onah et al. 2009). Studies have shown that under-utilization of public health services is a universal phenomenon in developing countries (Zwi 2001). However health is wealth and so successive Nigerian governments have made numerous great efforts towards the provision of health care facilities to its population and adopted the primary health care (PHC) approach to achieve its objective of health for all. Notwithstanding, overt concern has not been given to the need for equity in the planning and distribution of health care facilities and many regions within the country do not have effective health care facilities .

Model formulation and estimation of the patients' volume making use of health facilities in a community such as the University of Ibadan will provide very useful information for the management which may be used in allocating both human and material resources, scheduling, staff vacation s as well as planning future expansion of the human and material resources. This study intends to develop univariate time series models for quarterly volume of patients attending Jaja clinic relying on data available from digest of statistics since year 2000, the models in no doubt allow accurate data forecasting into the future. In addition to future estimation, the study would prove very useful in bringing out or show information on trend increase in the volume of patients and the seasonal pattern exhibited by each category of patients treated at the Jaja clinic, University of Ibadan.

1.1 Background

It is a common saying that health is wealth. The economic and social affluence of any community depend on the health status of the dweller of that community. This study is necessitated inform the University of Ibadan Health Services Management about the volume of patients utilizing the heath facilities at the Jaja Clinic, University of Ibadan.

and also to determine the period of the year that records the highest number of patients visiting the clinic with a view to providing very useful information for the management which may be used in allocating resources, scheduling staff vacations and planning future expansions in personnel and physical structures. For effective planning, it is important for any institution to know the pattern of utilization of its health services. This study analyses and compares the rate at which the University of Ibadan community utilizes the health facilities in the Health center using time series technique. The study considered five groups of patients: Student, Senior staff, Junior staff, Junior staff dependants and Senior staff dependants. Time series statistical models were built in other to study the dynamics, trend and multiplicative time series model to examine the seasonality in the series. The study revealed that there is quarterly increase of 21 patients for student while that slope for the other group decreases steadily. It was further revealed that the dependant of the senior and junior staff attend the clinic more regularly than the staff themselves.

This study is necessitated to inform the University of Ibadan Health Services Management about the volume of patients utilizing the heath facilities at the Jaja Clinic, University of Ibadan, and also to determine the period of the year that records the highest number of patients visiting the clinic with a view to providing very useful information for the management which may be used in allocating resources, scheduling staff vacations and planning future expansions in personnel and physical structures. The promotion of health of the inhabitants of the community is a critical step towards quality achievements in education. It is noteworthy that Jaja clinic, University of Ibadan since inception has received considerable number of patients, for treatment, medical advice and a host of other medical issues.

University Health Service (Jaja Clinic)

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Recent increase in the population of the University community as a result of introduction of new services being provided at the centre makes utilization rate increases tremendously. Medical conditions associated with lifestyles are now on the increase when compared with communicable diseases. The centre responded to the needs of students/clients by increasing the number of available services. It has experienced tremendous growth in the areas of infrastructure, personnel and services in the recent years.

In the last few years, the community has grown more in population and desires. The range and depth of information available on the internet has turned members-inclusive students to knowledgeable and discerning consumers. The UHS remains committed to responding to the health needs of staff and students alike. The conventional wisdom is that the demand for services comes from within not from without. In addition to a compulsory medical screening of both students and staff, the centre offers the following range of services:

- General outpatient clinic
- Emergency/Urgent care
- Special clinics: Mental Health Clinic, Surgical outpatient/orthopedic clinic, Dental clinic and Diabetic Clinic
- In-patient care
- Public Health Services
- Laboratory Services
- Medical Social Works Services
- Visual Care
- Data Management/Health Records Services
- Pharmaceutical Services
- Environmental Health Services

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- Environmental Health Services

- Physical Therapy
- Electronic services
- Ambulance services

1.2 Problem Statement

Infirmity could be linked to seasonality and many factors are responsible for this. In fact, infirmity has to do with weather condition, water intake, as well as food take of a particular environment at a specified time. The rate at which patients visit the University Health Services (Jaja clinic) is noteworthy and calls for careful examination because oftentimes planning is done without due consultation to the available statistics.

1.3 Significance of the Study

This study is undertaken to show the clear picture of the current attendance of patients and forecast the likely future figures of attendance with the application of time series tool. Experiences have shown in this part of the world that planning is done without due consultations to the past and the present data.

The availability of data from the University of Ibadan Digest of statistics, a publication of the Academic Planning unit, University of Ibadan has provided a very good opportunity to examine a large set of data collected periodically over an equal interval of time which was subjected to statistical analysis to give way for adequate planning and effective policy making.

1.4 Scope and Limitation

This project will limit its analysis to the comparison of the attendance of five categories of patients viz: students, senior staffs, senior staff dependants, junior staff and junior staff dependants based on secondary data extracted from the University of Ibadan Digest of Statistics from January 2001 - December 2011.

1.5 Aim and Specific Objectives

The study is to analyze and describe the seasonal distribution of patients treated at the university Health Services by category. This study, tries to investigate the rate at which patients access the Health facilities of the University Health Service using regression analysis and Time Series models to find out the period of the year that records the highest number of patients treated by category.

Specific Objectives

1) To study the trend and pattern of patients attendance at Jaja clinic, University of Ibadan over time.
2) To describe the seasonality in the number of patients treated at the Jaja clinic, University of Ibadan Health Centre.
3) To identify the period of the year that the number of patients treated is at the peak.
4) To determine whether there is increace or decrease in patience attendance
5) To forecast the patient attendance using linear trend method.
6) To forecast the patients attendance using the fitted trends (ARIMA) equation.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Health is a major form of human capital and there exists substantial agreement in the literature on the relationship between health and economic development through its relationship between capability and poverty (Strauss and Thomas 1998). It is assumed that improvement in health leads to improvement in life expectancy, which is a robust indicator of human development. A simple channel through which health affects human development is by improving living conditions. As living conditions improve, human longevity is expected to improve and vice-versa. Empirical evidence has shown that among poor countries, increase in life expectancy is strongly correlated with increase in productivity and income (Deaton, 2003).

Every government in Nigeria holds the view that a healthy population is essential for rapid socio-economic development of the country hence healthcare is on the concurrent list in the Nigerian constitution and its allocation comes next to education and defence in the national budget (Omoruan, 2009).

2.1 Utilization of health care services

Utilization of healthcare services is an important determinant of health [Makenbach JP, et al (1988), Bonneaux L. et al(1997), Bayo A et al 1996], and has particular relevance as a public health and development issue in low income countries [Obrist B et al (2007)]. In fact, utilization of healthcare services for the most vulnerable and underprivileged populations has been recommended by the World Health Organization as a basic primary healthcare concept [WHO (1978)]. It has been suggested that healthcare should be universally accessible without barriers based on affordability, physical accessibility, or acceptability of services [Obrist B et al (2007), Gulliford M. et al (2002)]. Accordingly, increased use of health services is a major target in many developing countries [Sepehri A et al (2008)].

The valid and reliable measurement of health service utilization, productivity losses and consequently total disease-related costs is a prerequisite for health economic analysis. While health effects can be measured by numerous generic and disease-specific instruments , much less work has been done regarding standardized methods to measure health care utilization and disease-specific costs.

In Guatemala, Goldman and Heuveline (2000) found that family size and parity, educational status and occupation of the head of the family are also associated with health seeking behavior besides age, gender and marital status. Mugsha et al. (2004) identified household income, education, and expected competency of the provider as positive determinants of utilization of health care services in rural Burkina Faso. Buor (2005) identified the determinants of utilization of health services by women in rural and urban areas in Ghana using multiple regression posited that income and family size affect the rural areas in Ghana during utilization while education and marital status affect those in urban areas. The influence of education on use of health service has also been examined. Generally education, income and health seem to have positive relationship with utilization of modern health care facilities. In other words, people with higher educational attainment stand to benefit better income and invariably could afford payment for quality health care.

There are three main health providers in Nigeria. These are: government or public health service provider, private health care provider and non-governmental health care providers which are coordinated by the ministry of health. The underutilization of these health facilities in rural area which are occasioned by inaccessibility has led to deaths from illness which ordinarily could be treated and prolonged state of illness thus reducing labour productivity from the area. Ajala et al. (2005) asserted that the resultant effect of inadequate access to health care delivery, on sustainable development can be exemplified by the number of man hour loss annually to malaria alone, which culminate into lower productivity by workers. Based on this, the study is set out to address the following questions: What is the level of accessibility to health care facilities by the rural households? What are the determinants of health care utilization in the study area?

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2.2 Importance of University Healthcare Service

Providing health services in the university environment is like providing occupational health. Folashade Omokhodion (2009) reveals that the records of occupational diseases are poor, primarily because industries do not report cases to the relevant government agency. However, a survey of occupational diseases reported in the literature suggests that conjunctivitis, chronic bronchitis, dermatitis, musculoskeletal disorders hypertension/ blood pressure, brain fatigue and injuries are common workplace health problems.

The Factories decree 1987 was a landmark in legislation in occupational health in Nigeria. A substantial revision of the colonial legislation, Factories Act 1958, the 1987 decree, changed the defmition of a factory from an enterprise with 10 or more workers to a premise with one or more workers thereby providing oversight for the numerous small-scale enterprises that engage the majority of the workforce in Nigeria. The current legislation is the Factories Act 1990 which in essence is the same as the 1987 legislation. Enforcement of legislation is carried out by the Factory Inspectorate of the Ministry of Labour. This Ministry produced a National Policy on Safety and Health in 2006 which details the responsibilities of employers, workers, manufacturers and government agencies in the maintenance of the health and safety of workers.

The evidence concerning the determinants of population health continues to grow. Early work completed by Lalonde (1981) indicated that there existed three key factors determining health status: environment, genetics and lifestyle. Although this provided a basic framework from which to study health determinants, much has subsequently been learned about health. Today Health Canada (2002) contends that the key factors which are integral in population health include: individual behaviour and coping skills, heredity (biology and genetic endowment), socio-economic status (education, income, social status), social support networks, employment/working conditions, environmental influences (social and physical), access to health care, gender and culture. Healthy lifestyles are a worthy investment, not only for the quality of life of individuals, but also for the country. "Illness is costly" (Lyons & Langille, 2000) and takes considerable resources (i.e., family, county) to cope with and to enhance compromised well-being. With population aging, increasing life expectancy and the increasing prevalence of chronic conditions and physiological limitations, the burden of illness will intensify if intervention is not mandated.

Health research has relatively neglected the young adult population (18 to 22 years of age), most likely attributable to the fact that young adults typically perceive themselves to be insusceptible to infirmity and usually experience optimal levels of health (see, for example, Boehm, Selves, Raleigh, Ronis, Butler, Jacobs, 1993; Hovell, Mewborn, Randle, Fowler-Johnson, 1985; Lipnickey, 1986). Patrick (1995) raises the following issues that have failed to be addressed:

Johnson-Saylor (1980) and Lipnickey (1986) contend that educating young adults about the self-management of health maintenance and illness is beneficial from two standpoints: (1) altering unhealthy behaviours at a younger age and subsequently reducing accrued risks of disease (and enhancing health in the process); and (2) acquiring/developing behavioural techniques that will be applicable to all stages along the age continuum. Additionally, contrary to common belief, evidence exists that many students are not only concerned about their health, but feel vulnerable/susceptible concerning certain aspects of their health and in need of intervention (Boehm et al., 1993).

Institutions of higher education (i.e., universities, colleges) provide a venue for providing health information/education, reducing high health risk behaviours and providing interventions to assist students in coping with their health problems/issues. "Leaving home to attend university and living in residence is a crucial time which can influence individuals to make healthy or unhealthy lifestyle choices (Makrides et al., 1998; p 174), which can impact health practices/and the development of conditions for the remainder of their lives. Unfortunately, little is known about the overall health of university and college students (Douglas et al., 1997). Research is available concerning certain aspects of health among this population, such as smoking, drinking, sexual practices, and aspects of mental health and health service utilization (see, for example, Bormann & Stone, 2001; Carney & Barak, 1976; Carney & Savitz, 1980; Carney, Savitz, & Weiskott, 1979; Douglas et al., 1997; Hopper, 1972; Makrides et al., 1998; Meilman et al., 1993; Patrick et al., 1997; Surtees et al., 1998). Additionally, there is some indication that health problems encountered by on-campus health services have changed considerably over the past decade, and that students are now seeking assistance for conditions like sexually transmitted diseases, sports injuries, eating disorders, asthma, allergies, and stress-related issues (Thorne, 1995); however, this information is scarce, and more anecdotally-based, than research-based. Further, the literature appears to be relatively void of information concerning the following topics: prevalence of disease (i.e., number with cancer?) and conditions (number with eating disorders?); types of diseases that afflict this age group; strategies used to cope with diseases/conditions; presence of interventions to help cope, either university-based or community-based, with various health concerns (i.e., issues about body image, rape, assault, presence of medical conditions, learning disabilities, pregnancy); and knowledge of university staff and faculty regarding the issues students face today, to name a few. As tuition costs continue to rise, students will continue to be confronted with extremely demanding schedules, such as trying to balance the responsibilities of part-time jobs to pay for education, attending classes and completing assignments, as well as family responsibilities. Therefore, the need to address this population is heightened. Additionally, Patrick et al. (1997) suggest that students often enter college and university ill-prepared due to strains on secondary school systems, which compound the stressors experienced by these students. Further, declining job opportunities for graduating students also burden students with the additional stress and competition of obtaining high academic success at university/college prior to entering the labour force.

Research suggests that health problems may influence student attrition from year to year (see, for example, Cavendish, 1996; McNevin, 1996). Specifically, examining first-year students, one study revealed that 7.6% categorically did not return to school for 2nd year due to health problems, while an additional 20% "probably or possibly did not return" due to health issues (McNevin, 1996). It is critical that "problem" health areas be identified and resources be available or be developed to assist students in coping with their health concerns and maintain/develop the present and future health of students. Given the lack of information about the health status of students and the resources available to students, in addition to the "dated" information of some of the research involving student health, the overall goal of this exploratory research is to complete a thorough needs assessment of the issues affecting student health from the perspective of the student, and faculty and staff that routinely assist students concerning health issues.

Fletcher et al (2007) concluded that Institutions of higher education provide an ideal setting for the provision of health information/education and interventions to assist students in coping with issues that may compromise their well-being. Preliminary results from this survey indicate that although 1st year students are aware of available on-campus services that would help them manage their health issues, awareness does not translate into use of services. Faculty and staff members advocate for the use of many of the services on campus; however, a system to track the number of students that actually use the services upon referral is warranted. Further, the generalizability of these findings is questionable given the composition of the sample, specifically 1st year university students, who potentially could be considerably different than students more familiar with the campus and associated services, and whose issues may be different than "older" students. Additionally, the retrospective nature of the design, particularly for the staff and faculty, who were asked to comment on the students they had counseled, may have affected the results. Despite these recommendations, the fact remains that students experience a wide array of health concerns and/or conditions that have the potential to affect health status. University personnel should become more actively involved in promoting the on-campus services to first year students and advocating the potential implications that well-being may have in successfully completing university.

2.3 Time Series Analysis

The collected data for this research work is a kind of series data; therefore, one of the useful tools for this type of data is time series. Time series has the capability of studying observations ordered in time with the nature of the trend.

Time series as an applied science was first used by the following professionals: Statisticians, Engineers, Operation Researchers and Economists towards the end of the 19th century. These professionals departed from different starting point with a variety of needs and objectives in mind to develop a new and highly important area. Their work has resulted in a theoretically sound body of knowledge with considerable practical value and wide spread usage in many fields of endeavour

Time series originated in 1807, when the French Mathematician, Fourier claimed that any series could be approximated as the sum of sine and cosine terms.

Time series as an aspect of applied statistics has phases such as:

Autoregressive moving Average ARMA. The assumption of this phase is that a given time series is always a weighted linear sum of past value and a residual average model is:

$$Xt+v = \Sigma \varnothing_i Xt\text{-}1 + \epsilon_{t+v} = \varnothing_1 Xt\text{-}i + \varnothing_2 Xt\text{-}2\text{------}+\varnothing_p Xt\text{-}p\, \epsilon_{t+v}$$

where $\varnothing_i$ represents the autoregressive parameters.

FILTERING MODEL: As regarded filtering the original was Wiener (1949) but similar development of the Russian Mathematician Kolmogoroff (1941) has provided the starting point and basis of the modern filtering theory. Their work centred around ways of estimating the white noise so that the original pattern could be captured.

EXPONENTIAL SMOOTHING: The importance and relevance of smoothing cannot be done away with in time series. In reaction to this, the pioneer researcher to work on this was Holt (1957). This was elaborated and applied by Brown (1959) and Holtetal (1960).

Exponential trend in contrast to a linear trend is approximate when the time series change by a constant percentage each period. Then the appropriate regression equation is

Yt = Cebt it where C and b are constants and ut represent a multiplicative error term (S Christian Albright, 2011).

Time series decomposition method works by either breaking up the series into trend seasonal, cyclic and random noise components.

For the sake of clarity, Kolmogorov (1933) showed that the theory of probability and statistics can be applied when dealing with time series. Each time point corresponds to one dimension in the distribution and made up of two parts X generated by the real process represented through the time series, and ut, a white noise term. Thus Xt = Xt+ut with the following assumptions:

(i) E(ut) = O

(ii) E(Ut, Ut +i)

Furthermore, the use of period analysis discovered by Schister (1906) is vital in looking for hidden periodicity. This period according to Schuster is used to make sure that a given peak is statistically significant.

The process of decomposition of time series was refined by Macauley (1930), who in 1920 introduced Ratio-to-moving average method; variation of which are the most widely used today. The ratio-to-moving average model consists of three basic steps:

(i) The calculation of the seasonal factor

(ii) The calculation of trend for each point

(iii) The division of trend into the moving average data with the result of obtaining the cyclical factor.

Assuming multiplicative relationship (an additive model will behave similarly) whose seasonal pattern is of 12 period duration we have Xt = St Tt Ct Rt. If the period of decomposition is strictly used we arrive at Xt = a+bt.

According to P.S. Nagpaul (2005) a time series is a sequence of observations, which are ordered in time (or-space). In addition, he says there are two types of time series data: (ii) continuous, wherein observations are made at every instant of time, for example electrocardiograms, A continuous time series can be demoted as [X (t)] continuous Time series are sampled (measured) at discrete time points and are ultimately treated as discrete

(ii) Discrete, wherein observations are made at (usually) equi-spaced intervals. A discrete time series can be represented as (X_t:t = 1,2,...... N) in which the subscript t indicates the time at which the datum X_t was observed.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The University of Ibadan Health service showing patients attendance over a period of 11 years 2001-2011. It has experienced tremendous growth in the areas of infrastructure, personnel and services in the recent years.

In the last few years, the university community has grown more in population and desires. The range and depth of information available on the internet has turned members-inclusive students to knowledgeable and discerning consumers. The UHS remains committed to responding to the health needs of staff and students alike. The conventional wisdom is that the demand for services comes from within not from without. In addition to a compulsory medical screening of both students and staff, the centre offers the following range of services:

- General outpatient clinic
- Emergency/Urgent care
- Special clinics: Mental Health Clinic, Surgical outpatient/orthopedic clinic, Dental clinic and Diabetic Clinic
- In-patient care
- Public Health Services
- Laboratory Services
- Medical Social Works Services
- Visual Care
- Data Management/Health Records Services
- Pharmaceutical Services
- Environmental Health Services
- Physical Therapy
- Electronic services
- Ambulance services

- Without losing sight of the commitment to the health needs of students and staff, the University Health Service has recorded
- Increased utilization of the facility
- Reduced number of referrals
- Reduced waiting time (Average waiting time during peak period is 30 minutes)
- Reduced absenteeism
- Short hospital stay which is also a reflection of accuracy in diagnosis and promptness in treatment.
- Wide coverage of ailments (increased services)
- Control of communicable diseases. There is no recorded occurrence/outbreak of epidemic in the last decade
- Positive feedback from students.

3.2 Study Population

The target population includes patients who are current staff of the institution, students, and senior and junior staff dependants.

3.3 Sources of Data and Data Analysis.

The data used in this work are the monthly number of patients treated at the University Health Center (UHC) popularly known as Jaja clinic, over the period from January, 2001 to December 2011. The clinic is located in the University of Ibadan, Nigeria. The statistical technique used is the trend analysis, seasonal indices and dynamic Autoregressive Integrated moving average model (ARIMA).The statistical package used was E-View.

3.4 Time series Analysis

A time series is a collection of observations of well-defined data items obtained through repeated measurements over time. For example, measuring the value of retail sales each month of the year would comprise a time series. This is because sales revenue is well defined, and consistently measured at equally spaced intervals. Data collected irregularly or only once are not time series.

An observed time series can be decomposed into three components: the trend (long term direction), the seasonal (systematic, calendar related movements) and the irregular (unsystematic, short term fluctuations).

3.4.1 Unit Root Tests

Unit Root tests are usually performed on variables to determine if they stationary (i.e. zero mean and constant variance) and if otherwise, to determine their order of integration (i.e. number of times they are to be differenced to achieve stationarity). The time series characteristics of the variables using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (P-P) tests were examined. Basically, the idea is to ascertain the order of integration of the variables as to whether they are stationary I (0) or non-stationary; and, therefore, the number of times each variable has to be differenced to arrive at stationarity.

The standard DF test is carried out by estimating the following;

$$y_t = \rho y_{t-1} + x_t'\delta + \varepsilon_t \quad \text{.......(1)}$$

After subtracting y_{t-1} from both sides of the equation:

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \varepsilon_t \quad \text{.......(2)}$$

Where $\alpha = \rho - 1$

The null and alternative hypotheses may be written as:

H0 : $\alpha = 0$

H1 : $\alpha < 0$

The simple Dickey-Fuller unit root test described above is valid only if the series is an AR(1) process. If the series is correlated at higher order lags, the assumption of white noise disturbances ε_t is violated. The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the y series follows an AR(P) process and adding P lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ...\beta_p \Delta y_{t-p} v_t \quad ....(3)$$

The usual practice is to include a number of lags sufficient to remove serial correlation in the residuals and for this; the Akaike Information Criterion is employed. Therefore, the ADF test given in equation (3) above is first used and then the Phillips Perron test described below.

Phillips and Perron propose a non-parametric alternative method of controlling for serial correlation when testing for a unit root. The P-P method estimates the non-augmented DF test equation (2), and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The PP test is based on the statistic:

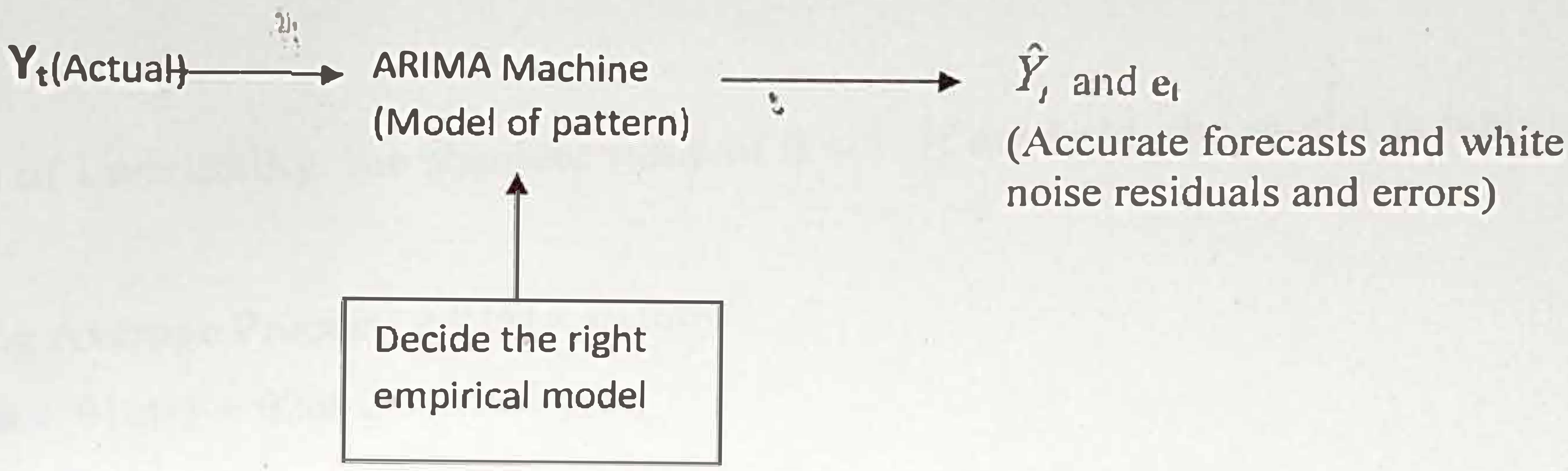
$$t_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0} \right)^{\frac{1}{2}} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{\frac{1}{2}} s} \quad ....(4)$$

Where $\hat{\alpha}$ is the estimate, and t_α the t-ratio of α, $se(\hat{\alpha})$ is the coefficient standard error, and s is the standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance in equation (2) (calculated as (T – K)s2 where k is the number of regressors). The remaining term, f0, is an estimator of the residual spectrum at frequency zero. Therefore, both equation (3) and (4) are used to test for the stationarity of the variables.

3.4.2 ARIMA Model Assumptions

In ARIMA terms, a time series is a linear function of past actual values and random shocks, that is Yt = f (Yt-k, et-k) + et, where k >0

In ARIMA model, we do not have a forecasting model a priori before Model Identification takes place. ARIMA helps us to choose "right model" to fit the time series. Put it in flow chart:



ARIMA Notation:

AR(p) Where p = order of autocorrelation

(Indicates weighted moving average over past observations)

I(d) Where d = order of integration (differencing)

(Indicates linear trend or polynomial trend)

MA(q) Where q = order of moving averaging

(Indicates weighted moving average over past errors)

3.4.3 ARIMA Processes

1. Auto-regressive Process: ARIMA (1,0,0):

$Y_t = \theta + \Phi Y_{t-1} + e_t$ or $Y_t = \Phi Y_{t-1} + e_t$

Bound of Stationary: the absolute value of $\Phi < 1$, $(-1 < \Phi < 1)$.

If $\Phi = 1$, it becomes ARIMA (0,1,0) which is non-stationary. If $\Phi > 1$, the past values of Y_{t-k} and e_{t-k} have greater and greater influence on Y_t, it implies the series is non-stationary with an ever increasing mean. To sum up, If Bound of Stationary does not hold, the series is not autoregressive; it is either drifting or trending, and first-difference should be used to model the series with stationary.

Autoregressive Process: ARIMA (p, 0,0):

$Y_t = \theta + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_p Y_{t-p} + e_t$

or

$Y_t = \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_p Y_{t-p} + e_t$

Moving Average Process: ARIMA (0,0,1)

$Y_t = \alpha + e_t + \theta e_{t-1}$ or $Y_t = e_t + \theta e_{t-1}$

Bound of Invertibility: the absolute value of $\theta < 1$. If not hold, the model is non-stationary.

Moving Average Process: ARIMA (0,0,q)

$$Yt = et + \theta 1et\text{-}1 + \theta 2et\text{-}2 + \ldots + \theta qet\text{-}q$$

The important feature of such ARIMA(0,0,q) is that the variables of et-1 to et-q are unobserved and have to estimated using the available sample data. In practice, it is usual to keep q at a small value, and it is often set at 1 or 2.

2. Integrated Processes: ARIMA (0,1,0)

Random Walk Process: ARIMA (0,1,0):

$$Yt = Yt\text{-}1 + et \quad \rightarrow \quad Yt - Yt\text{-}1 = et \quad \rightarrow \Delta Yt = et$$

All future values are expected to equal the last known actual value.

3. Deterministic Trend Process: ARIMA (0,1,0)1

$$Yt = Yt\text{-}1 + T + et \rightarrow \Delta Yt = T + et$$ T is the trend

$$Yt{+}m = Yt{+}m\text{-}1 + mT + et \rightarrow \Delta Yt{+}m = mT + et$$ m is the forecast horizon

4. ARIMA(p,0,q):

$$Yt = \Phi 1Yt\text{-}1 + \Phi 2Yt\text{-}2 + \ldots + \Phi pYt\text{-}p + et + \theta 1et\text{-}1 + \theta 2et\text{-}2 + \ldots + \theta qet\text{-}q$$

5. ARIMA(p,1,q):

$$\Delta Yt = \Phi 1\Delta Yt\text{-}1 + \Phi 2\Delta Yt\text{-}2 + \ldots + \Phi p\Delta Yt\text{-}p + et + \theta 1et\text{-}1 + \theta 2et\text{-}2 + \ldots + \theta qet\text{-}q$$

Invertibility: The infinite MA representations of ARIMA(1,0,1)

$$Yt = \Phi Yt\text{-}1 + et + \theta et\text{-}1$$

$$= \Phi(\Phi Yt\text{-}2 + et\text{-}1 + \theta et\text{-}2) + et + \theta et\text{-}1$$

$$= \Phi 2Yt\text{-}2 + et + (\theta+\Phi)et\text{-}1 + \Phi\theta et\text{-}2$$

$$= \Phi 2(\Phi Yt\text{-}3 + et\text{-}2 + \theta et\text{-}3) + et + (\theta+\Phi)et\text{-}1 + \Phi\theta et\text{-}2$$

$$= \Phi 3Yt\text{-}3 + \Phi 2et\text{-}2 + \Phi 2\theta et\text{-}3 + et + (\theta+\Phi)et\text{-}1 + \Phi\theta et\text{-}2$$

$$= \Phi 3Yt\text{-}3 + et + (\theta+\Phi)et\text{-}1 + \Phi(\theta+\Phi)et\text{-}2 + \Phi 3\theta et\text{-}3$$

$$Yt = et + (\theta+\Phi)et\text{-}1 + \Phi(\theta+\Phi)et\text{-}2 + \Phi 2(\theta+\Phi)et\text{-}3 + \ldots + \Phi n(\theta+\Phi)et\text{-}n$$

$$\Rightarrow Y_t = \sum_{j=0}^{\infty} \psi_j e_{t-j}$$

The infinite AR representations of ARIMA (1, 0, 1):

Yt = ΦYt-1 + et + θet-1

et = Yt - ΦYt-1 - θet-1

= Yt - ΦYt-1 – θ(Yt-1 - ΦYt-2 - θet-2)

= Yt - ΦYt-1 – θYt-1 + θΦYt-2 + θ2et-2

= Yt – (Φ+θ)Yt-1 + θΦYt-2 + θ2(Yt-2 - ΦYt-3 - θet-3)

= Yt – (Φ+θ)Yt-1 + θ(Φ+θ)Yt-2 - θ2ΦYt-3 – θ3et-3

et = Yt –(Φ+θ)Yt-1 + θ(Φ+θ)Yt-2 -θ2(Φ+θ)Yt-3+ …–(θ)k-1(Φ+θ)Yk-1+ ….

$$\Rightarrow e_t = \sum_{j=0}^{\infty} \pi_j Y_{t-j}$$

3.4.4 Identification: ARIMA Model Identification Tools

1. Autocorrelation function: $ACF(k) = \dfrac{\sum_{t=1+k} (Y_t - \bar{Y})(Y_{t-k} - \bar{Y})}{\sum_{t=1} (Y_t - \bar{Y})^2} = \dfrac{\text{cov}(Y_t Y_{t-k})}{\text{var}(Y_t)}$

2. Partial Autocorrelation function (PACF):

The PACF measures the additional correlation between Yt and Yt-k after adjustments have been made for the intermediate values Yt-1,…, Yt-k+1. The PACF is closely related to ACF, their value also lies between -1 and +1. The specific computational procedures for PACFs are complicated, but these formulas do not need to be understood for us to use PACFs in the model identification phase

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

This chapter presents the results of analyses. . It is organized into two broad sections, namely; descriptive analysis and empirical analysis.

4.1 Descriptive Analysis of Variables

	STUDENTS	SENIOR_STAFF	SENIOR_STAFF_DEPENDANT	JUNIOR_STAFF	JUNIOR_STAFF_DEPENDANT	NUMBER_ADMITTED TO SICK BAY
	1934.636	648.3864	968.2955	869.4773	856.3864	1302.045
an	1789.5	667	910.5	775.5	744	1305
nu	4749	879	1385	1587	1632	1953
nu	234	375	574	505	379	454
	1131.852	116.8251	218.2128	302.7029	338.0028	308.3662
	85124	28529	42605	38257	37681	57290
rvati	44	44	44	44	44	44

Table 4.1: Descriptive statistics

Table 1 shows the descriptive statistics of the variables used in the analysis. According to the table, the mean value of students in the period is 1935, that of senior staff is 648, senior staff dependent is 968, junior staff is 869, junior staff dependent is 856 while number admitted is 1302. This result shows that student takes the larger share.

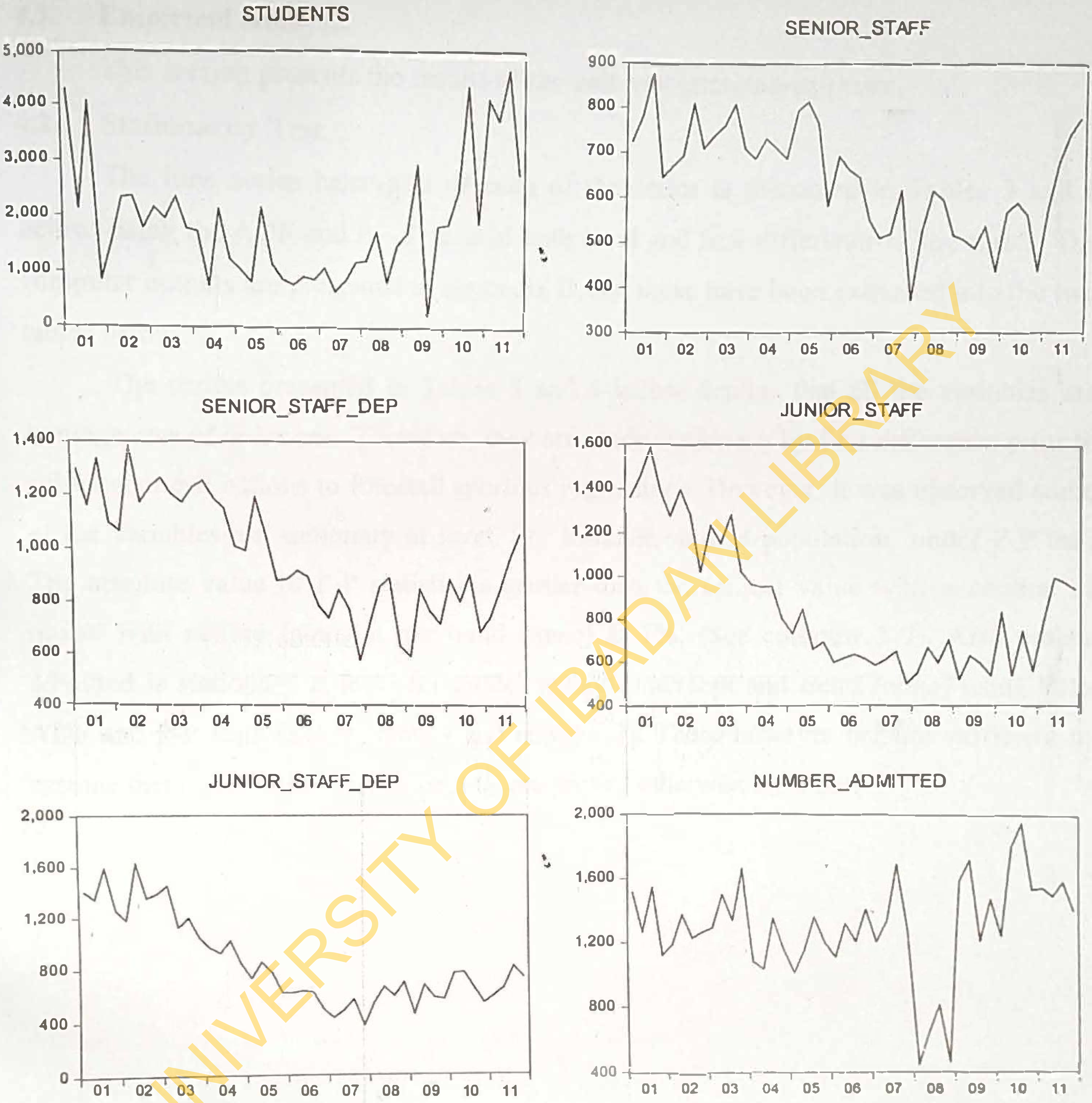


Figure1: Time plot of different categories of patients treated

Represented in figure 1is the time plot of all the variables used in this analysis. A critical look at the plots show that the series exhibited trend and seasonal effect. Since the plots cannot provide sufficient evidence to render the series not stationary, it is essential to use standard tests of stationarity.

4.2 Empirical Analysis

This section presents the results of the unit root (stationarity) tests.

4.2.1 Stationarity Test

The time series behaviour of each of the series is presented in Tables 3 and 4 below, using the ADF and P – P tests at both level and first difference of the series. The computer outputs are presented in appendix B, but these have been extracted into the two tables below.

The results presented in Tables 3 and 4 below depicts that all the variables are homogenous of order one. Therefore, they are made stationary by first difference prior to subsequent estimations to forestall spurious regressions. However, it was observed some of the variables are stationary at level. For instance student population under P-P test. The absolute value of P-P statistic is greater than the critical value with exception of model with neither intercept nor trend (none) at 1%. (See columns 5-7). Also umber admitted is stationary at level for model without intercept and trend (none) using both ADF and P-P tests (See column 4 and column 7). These however are not sufficient to assume them to be stationary since they are proved otherwise by others.

Table 4.2 : Unit Root Test at level

	ADF			P-P			
Variable	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None	Decision
Students	-1.6908	-2.0045	-0.5584	-4.5676	-4.7388	-2.1412	Likely I(1)
Senior Staff	-2.7131	-3.0583	-0.3480	-2.6021	-3.0187	-0.0296	Likely I(1)
Senior Staff Dependents	-1.6609	-0.5805	-1.0685	-2.2735	-2.7380	-0.8274	Likely I(1)
Junior Staff	-1.9497	1.3805	-1.4083	-1.8125	-1.7334	-1.2115	Likely I(1)
Junior Staff Dependents	-1.6421	-0.3883	-1.4121	-1.8026	-2.0295	-1.6377	Likely I(1)
Number Admitted	-4.0814	-4.1571	-0.8551	-4.1182	-4.1746	-0.8551	Likely I(1)
	Critical value	Critical value	Critical value	Critical value	Critical value	Critical value	
	1%=-3.5966	1%=-4.1923	1%=-2.6212	1%=-3.5925	1%=-4.1865	1%=-2.6199	
	5%=-2.9332	5%=-3.5208	5%=-1.9489	5%=-2.99314	5%=-3.5181	5%=-1.9487	
	10%=-2.6049	10%=-3.1912	10%=-1.6119	10%=-2.6039	10%=-3.1897	10%=-1.6120	

Table 4.3: Unit Root Test at First Difference

	ADF			P-P			
Variable	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None	Decision
Students	-13.7485	-6.3175	-13.9131	-15.9486	-39.7190	-15.8797	I(1)
Senior Staff	-8.4054	-6.3907	-8.5098	-11.7087	-16.2864	-11.9607	I(1)
Senior Staff Dependents	-7.9880	-5.4589	-7.9998	-10.4495	-16.0041	-9.6839	I(1)
Junior Staff	-10.4857	-4.9834	-10.4958	-10.4857	-24.0721	-10.6588	I(1)
Junior Staff Dependents	-9.7276	-8.9446	-9.7170	-10.8685	-9.8460	-10.4279	I(1)
Number Admitted	-6.9962	-6.9500	-7.0891	-10.1836	-10.0739	-10.3310	I(1)
	Critical value	Critical value	Critical value	Critical value	Critical value	Critical value	
	1%=-3.5966	1%=-4.2119	1%=--3.5966	1%=-3.5966	1%=-4.1923	1%=-2.6212	
	5%=-2.9332	5%=-3.5298	5%=-2.9332	5%=-2.9332	5%=-3.5208	5%=-1.9489	
	10%=-2.6049	10%=-3.1964	10%=-2.6049	10%=-2.6049	10%=-3.1913	10%=-1.6119	

It should be noted that all the variables has a larger negative ADF and P-P statistics at first differences which implies the rejection of the null hypothesis. Hence the unit root test shows that the series are stationary at first difference, therefore the null hypothesis is rejected and the alternative hypothesis is accepted which states that the variables: students, senior staff, senior staff dependent, junior staff, junior staff dependent and number admitted are integration of order one i.e. I(1). By I(1) we meant these variables became stationary after first difference.

4.2.2 Model Fitting, Selection and Diagnostics

This section is further divided into two. These are: Deterministic and stochastic. Under the deterministic, least square trend will be fitted for all the variables and the estimated trend equation will recorded. The stochastic part will include correlogram inspection of all the variables, fitting of the appropriate model as subjected by the correlogram, selection of adequate model using Akaike information criterion (AIC) and model diagnostic.

4.2.2.1 Least Square Trend:

The trend equations of the variables are shown below alongside the time plot. This helps us to visualize the movement of the series along the trend line. The trend equation will also help us to determine the growth rate of the series as well as the direction of the growth with changing in time. Eventually the following trend equation surfaced for each series respectively

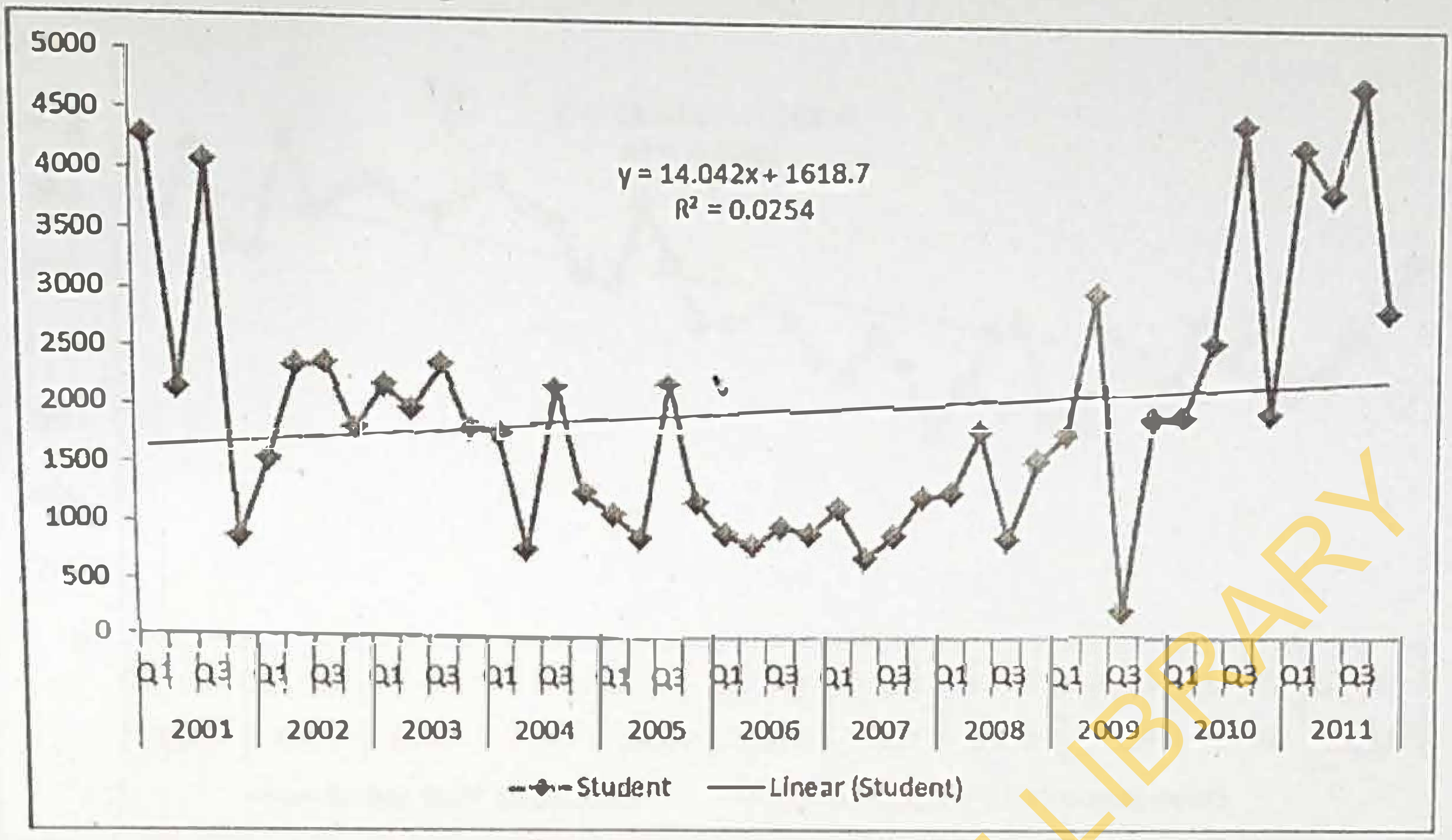


Figure 2: Least squares Trend of quarterly students attendance at the clinic (2001 -2011) Student attendance increase by 14 every quarter.

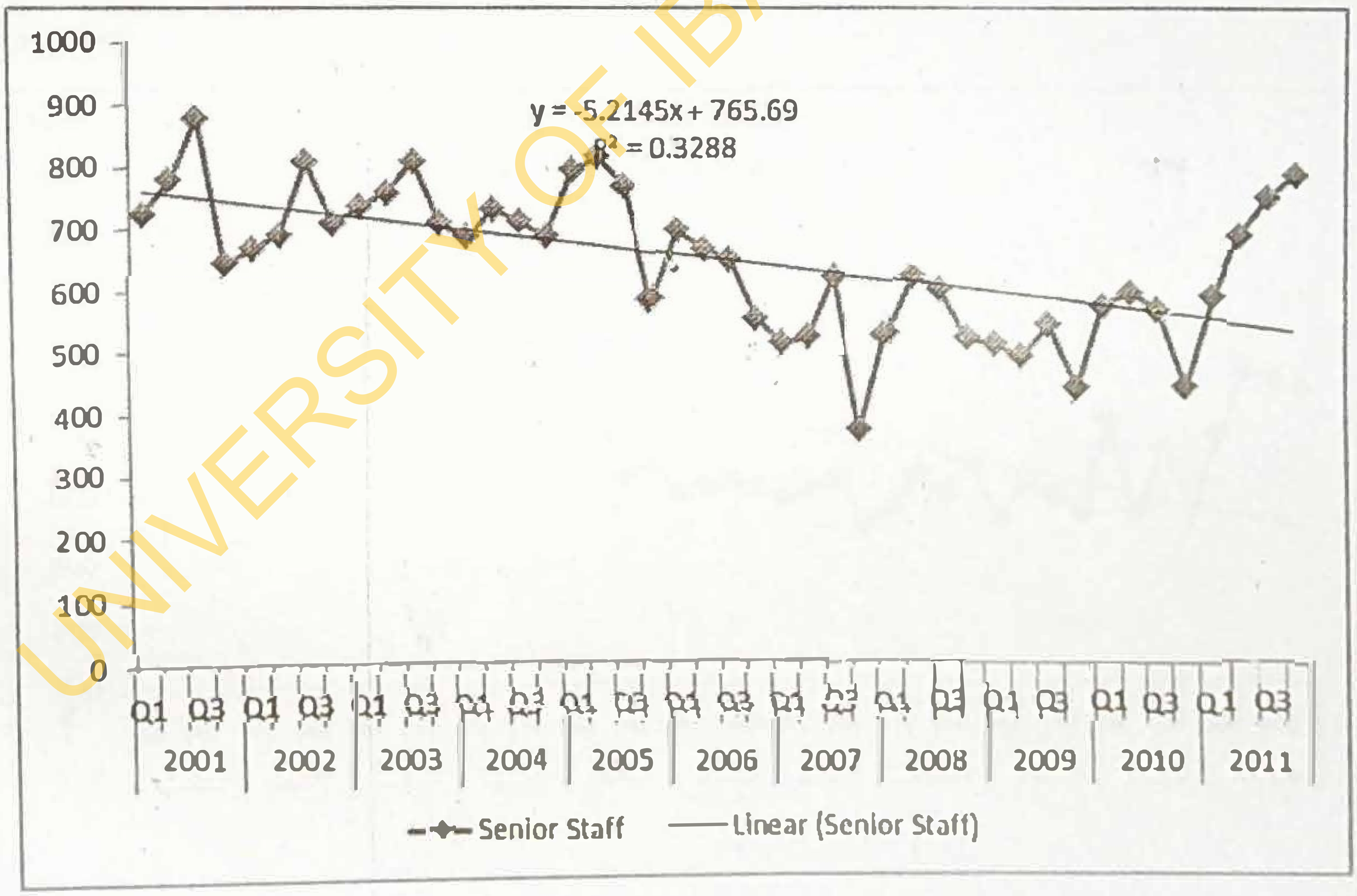
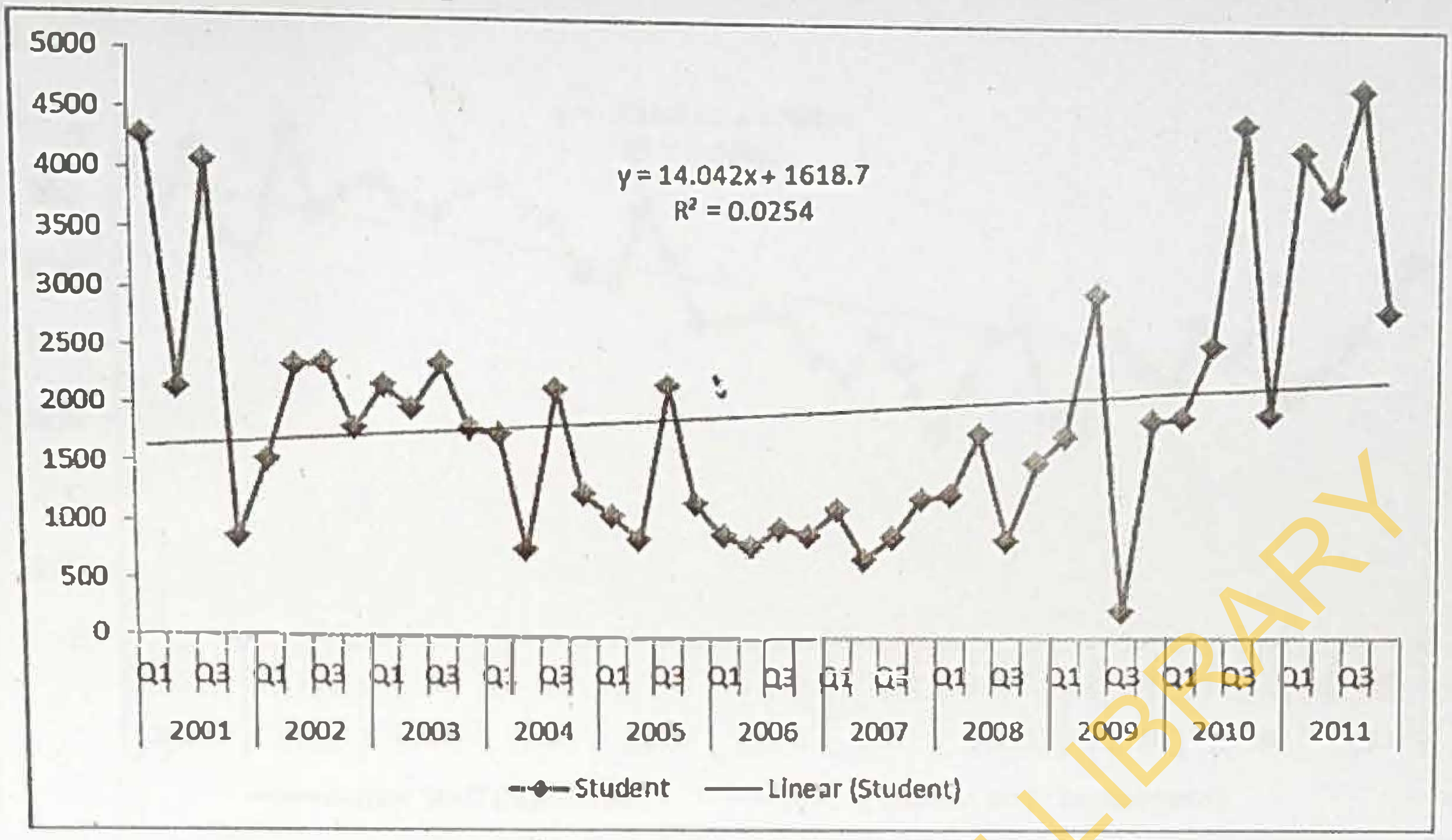


Figure 3: Least squares Trend of quarterly senior staff attendance at the clinic (2001 -2011)

The figure 3 shows that staff attendance at the clinic by senior staff decrease by 5 every quarter



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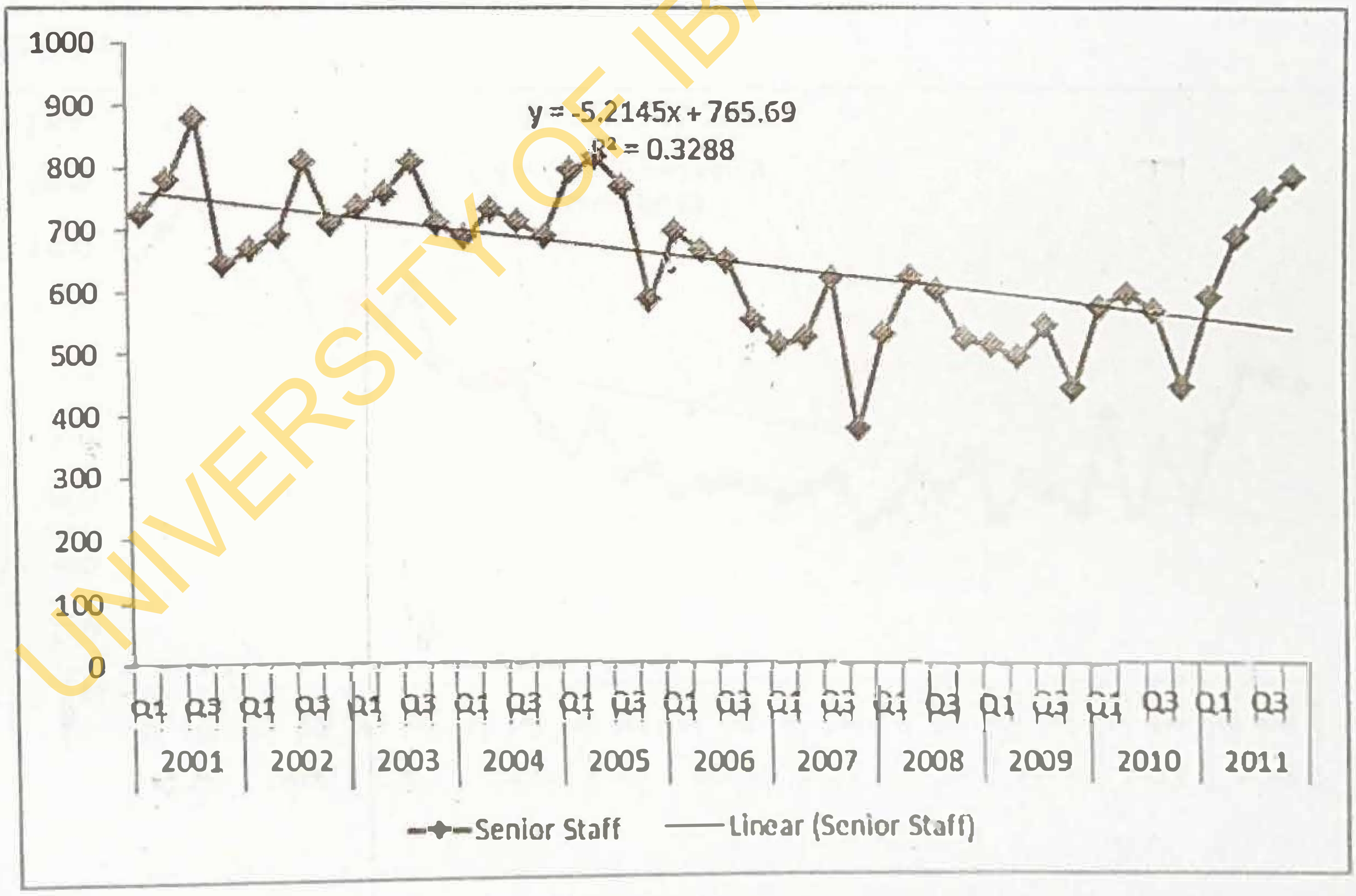

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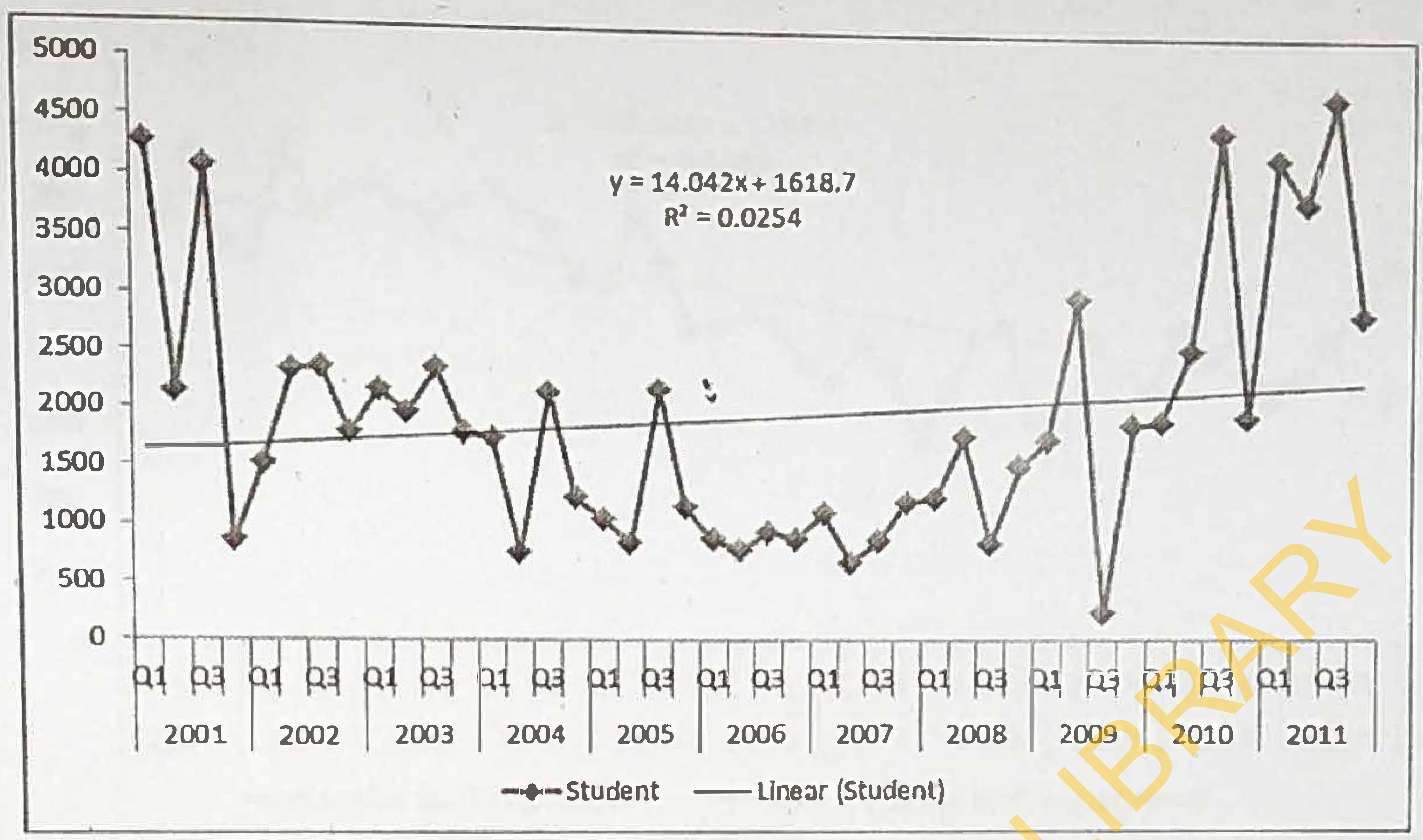

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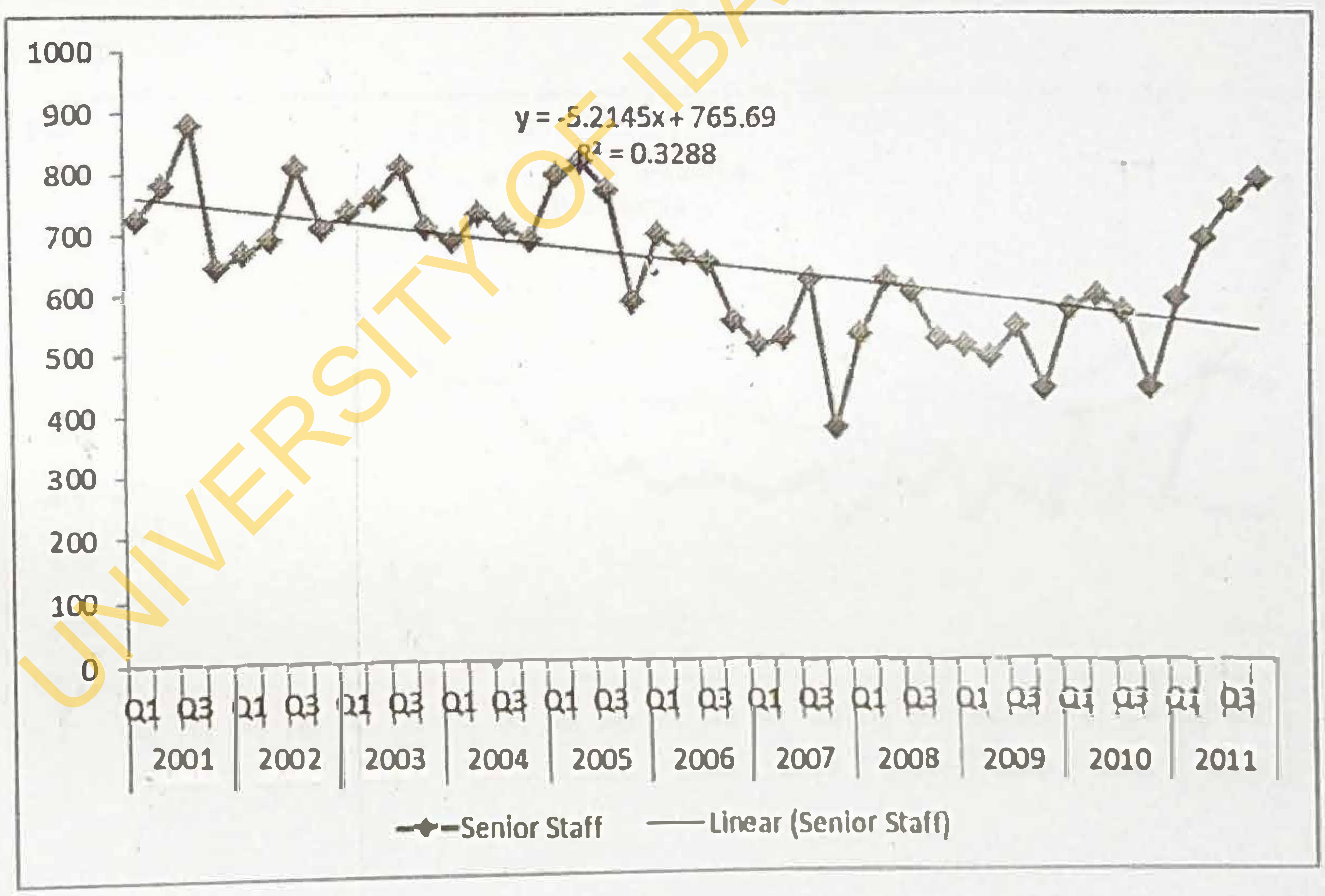

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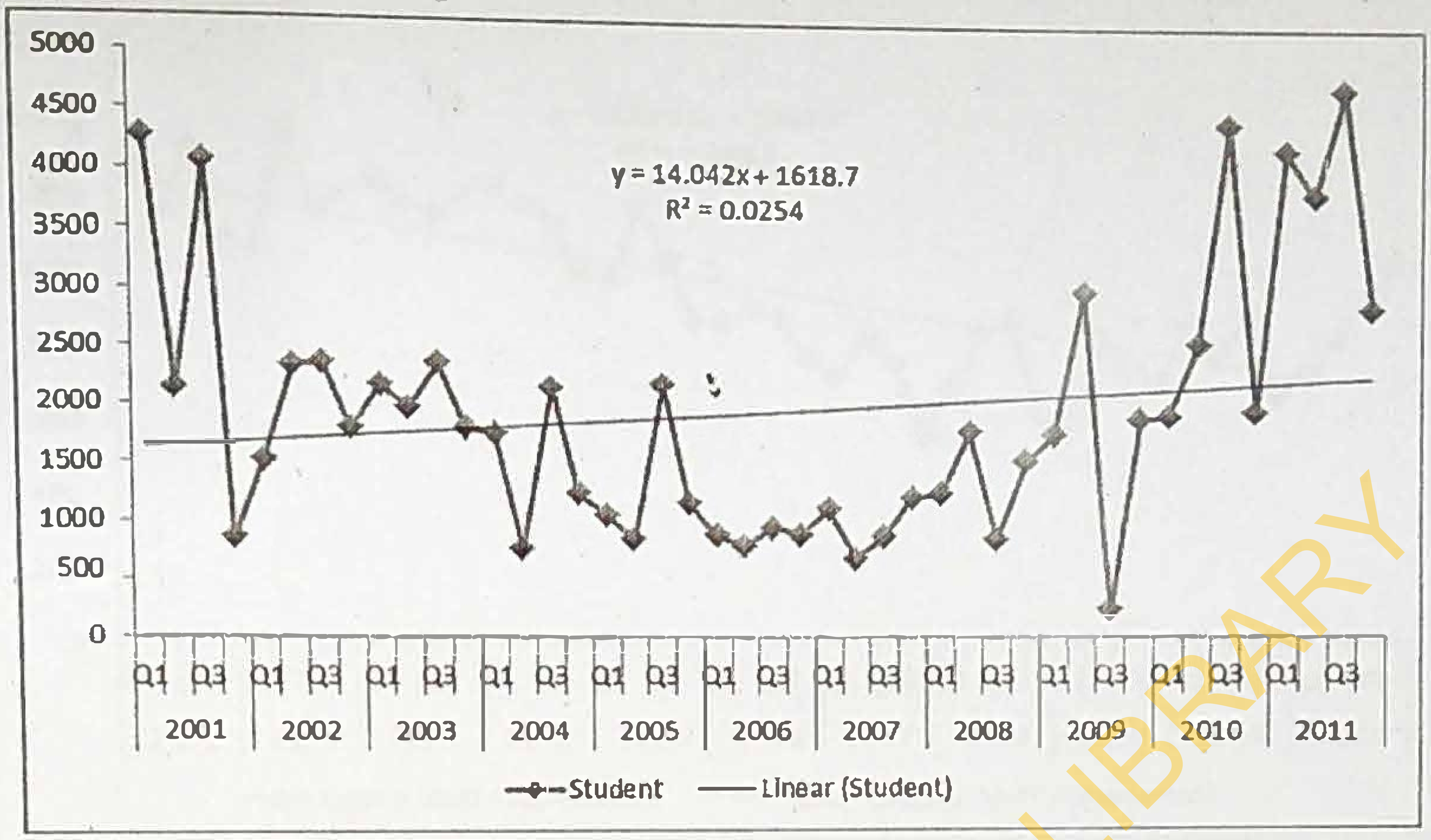

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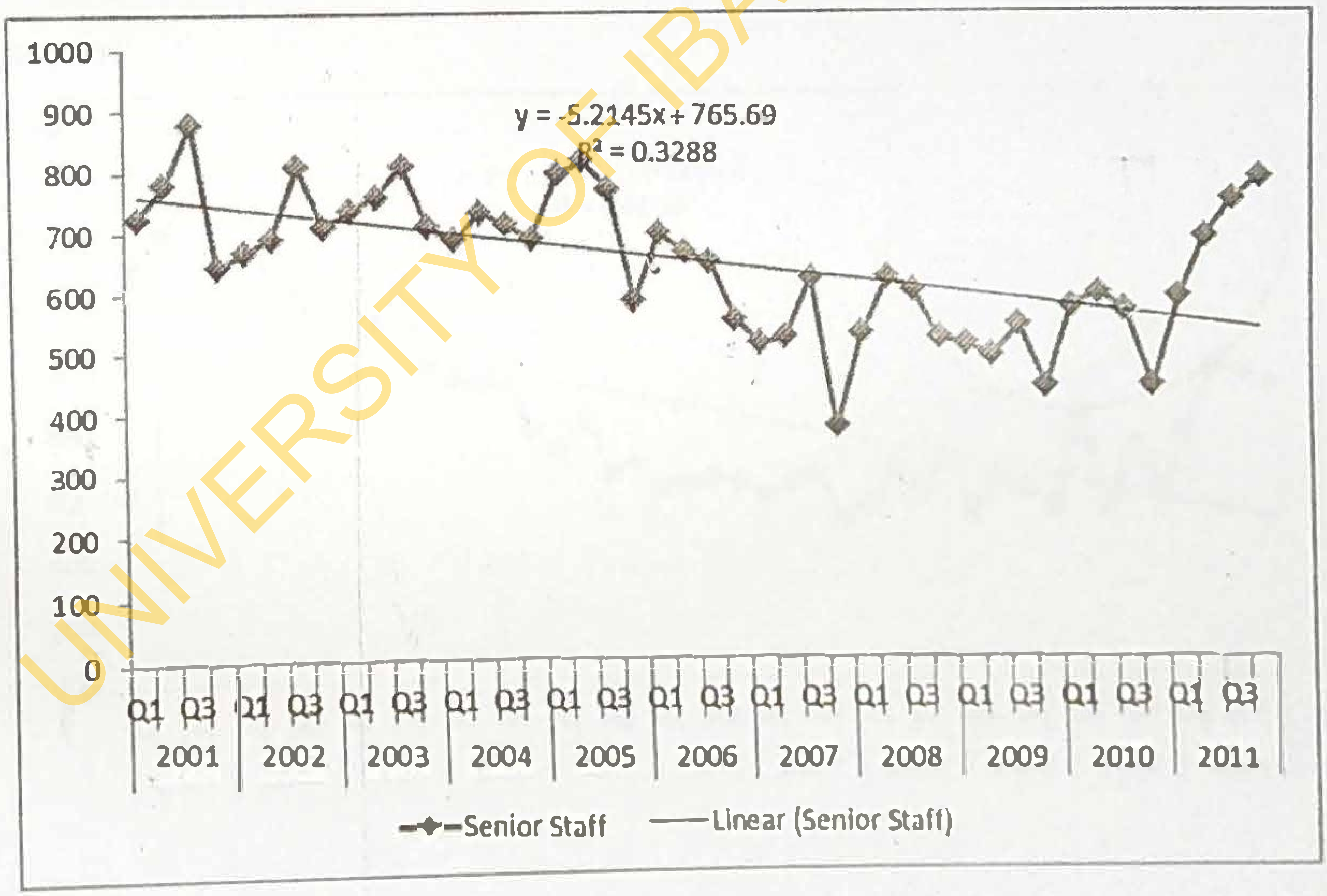

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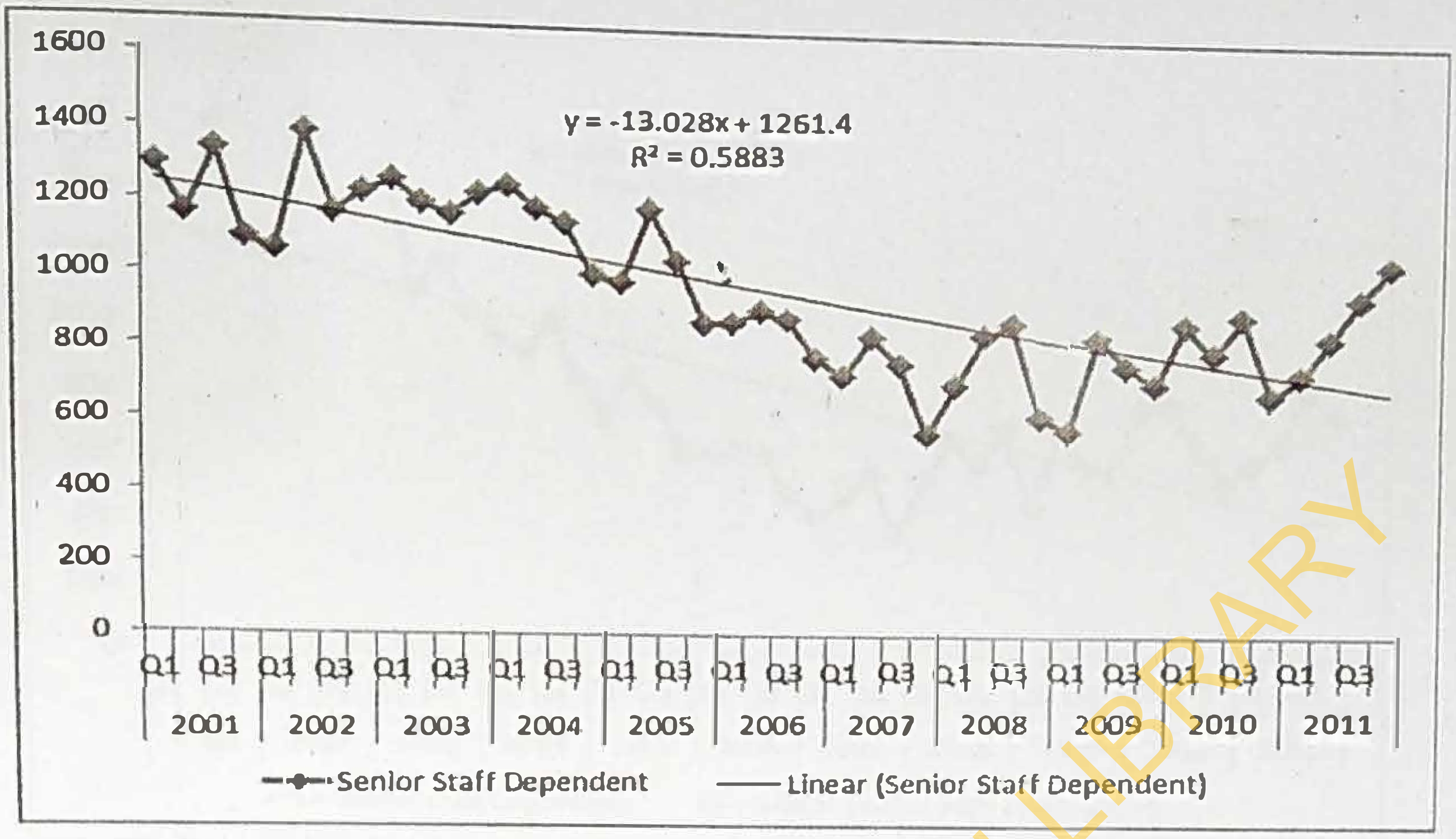

Figure 4: Least squares Trend of quarterly senior staff dependant attendance at the clinic (2001 -2011)

Figure 4 shows that staff attendance at the clinic by senior staff dependent decrease by 13 every quarter

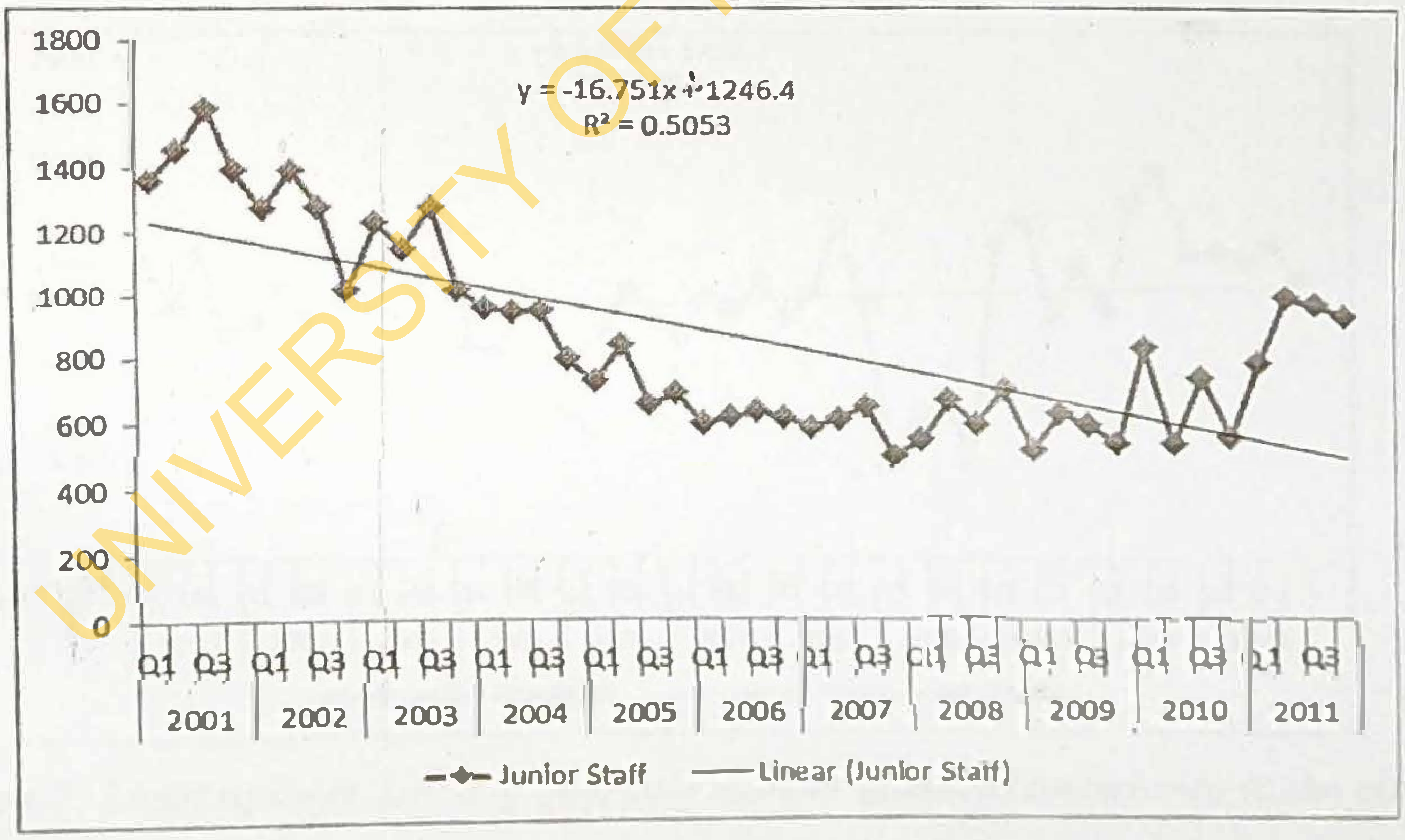

Figure 5: Least squares Trend of quarterly junior staff attendance at the clinic (2001 -2011)

Figure 5 shows that staff attendance at the clinic by junior staff decrease by approximately 17 every quarter

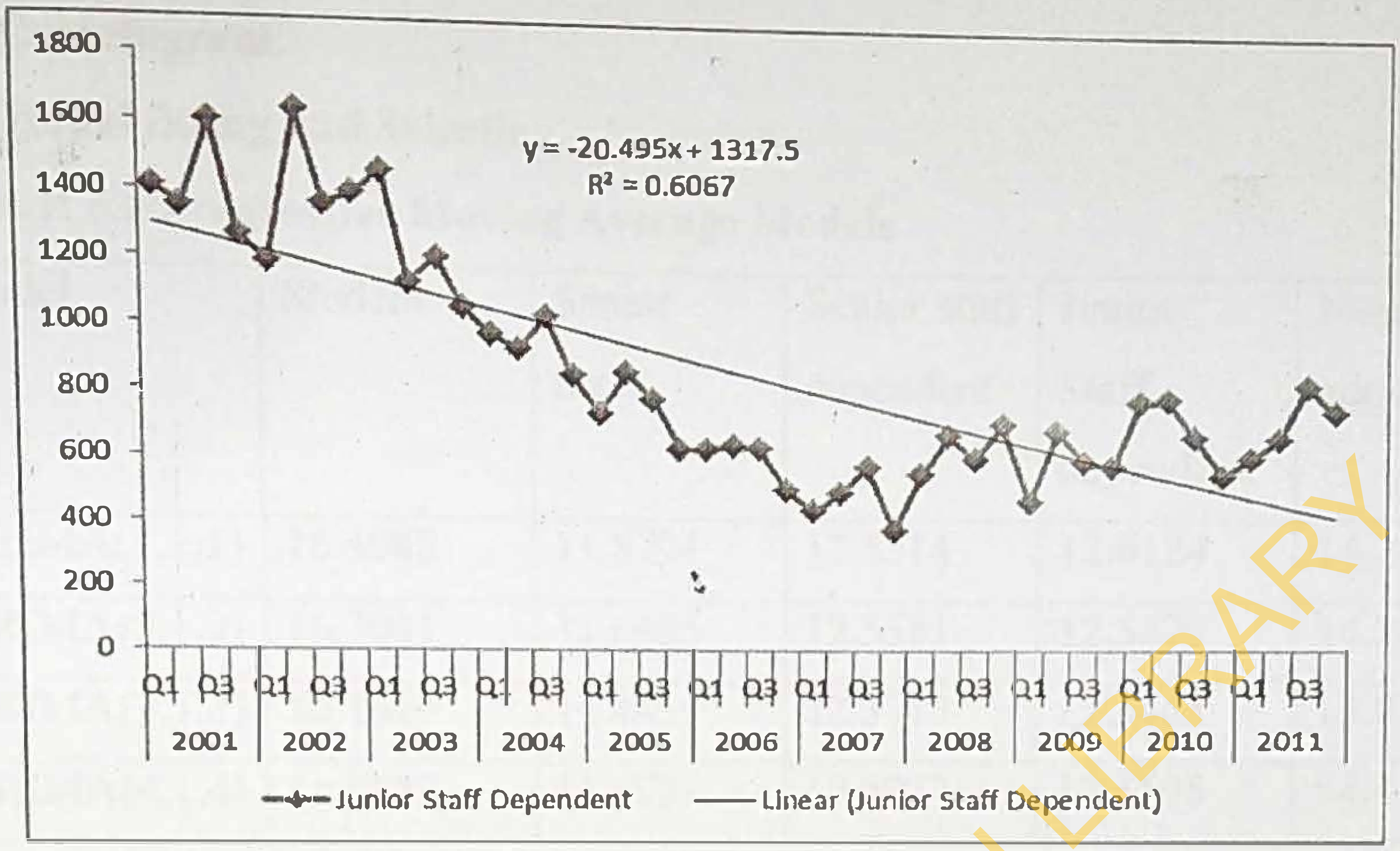

Figure 6: Least squares Trend of quarterly junior staff dependant attendance at the clinic (2001 -2011)

Figure 6 shows that staff attendance at the clinic by senior staff decrease by 20 every quarter

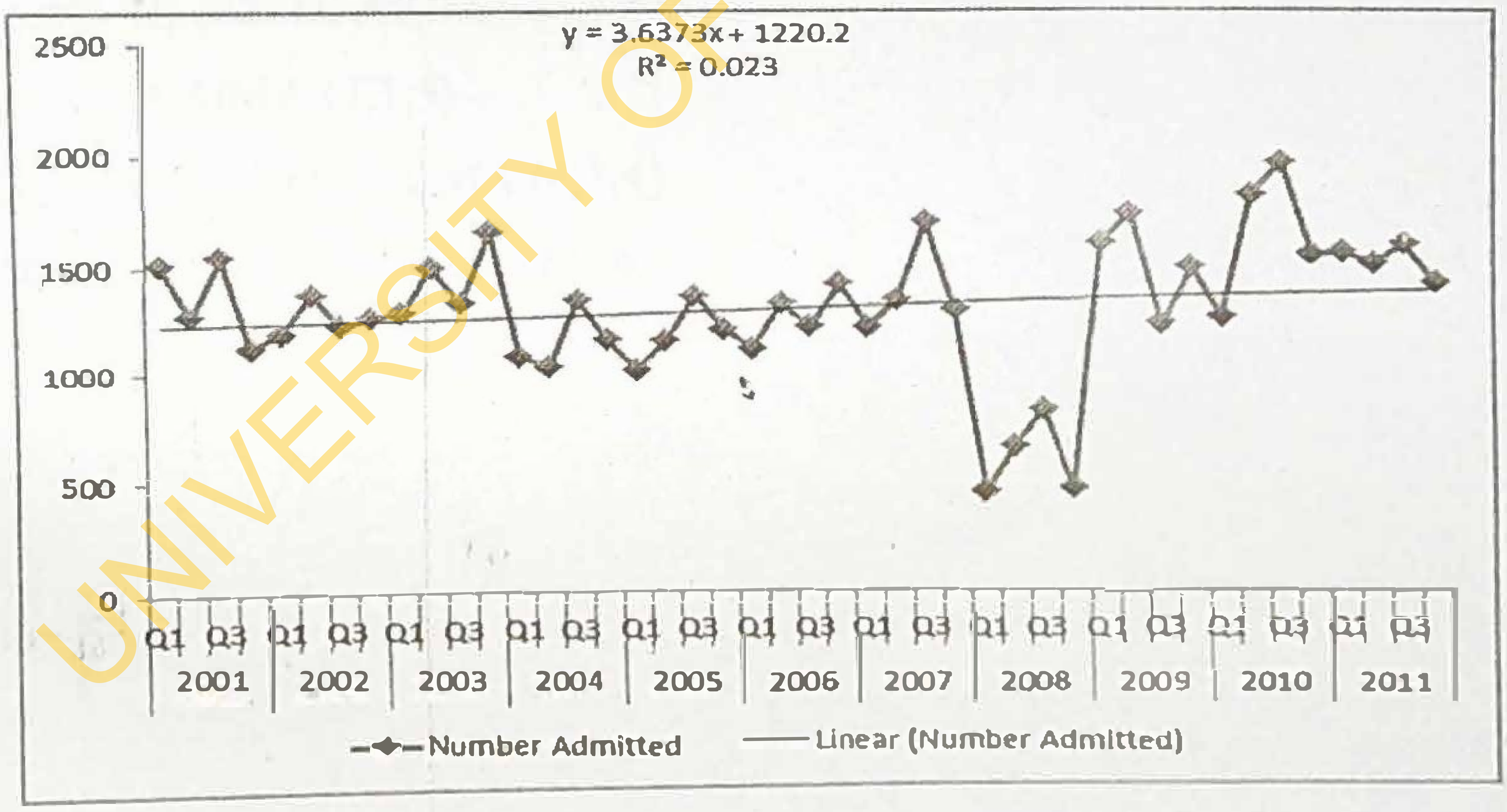

Figure 7: Least squares Trend of quarterly number admitted attendance at the clinic (2001 -2011)

The figure 7 shows that staff attendance at the clinic by number admitted increase approximately by 4 every quarter

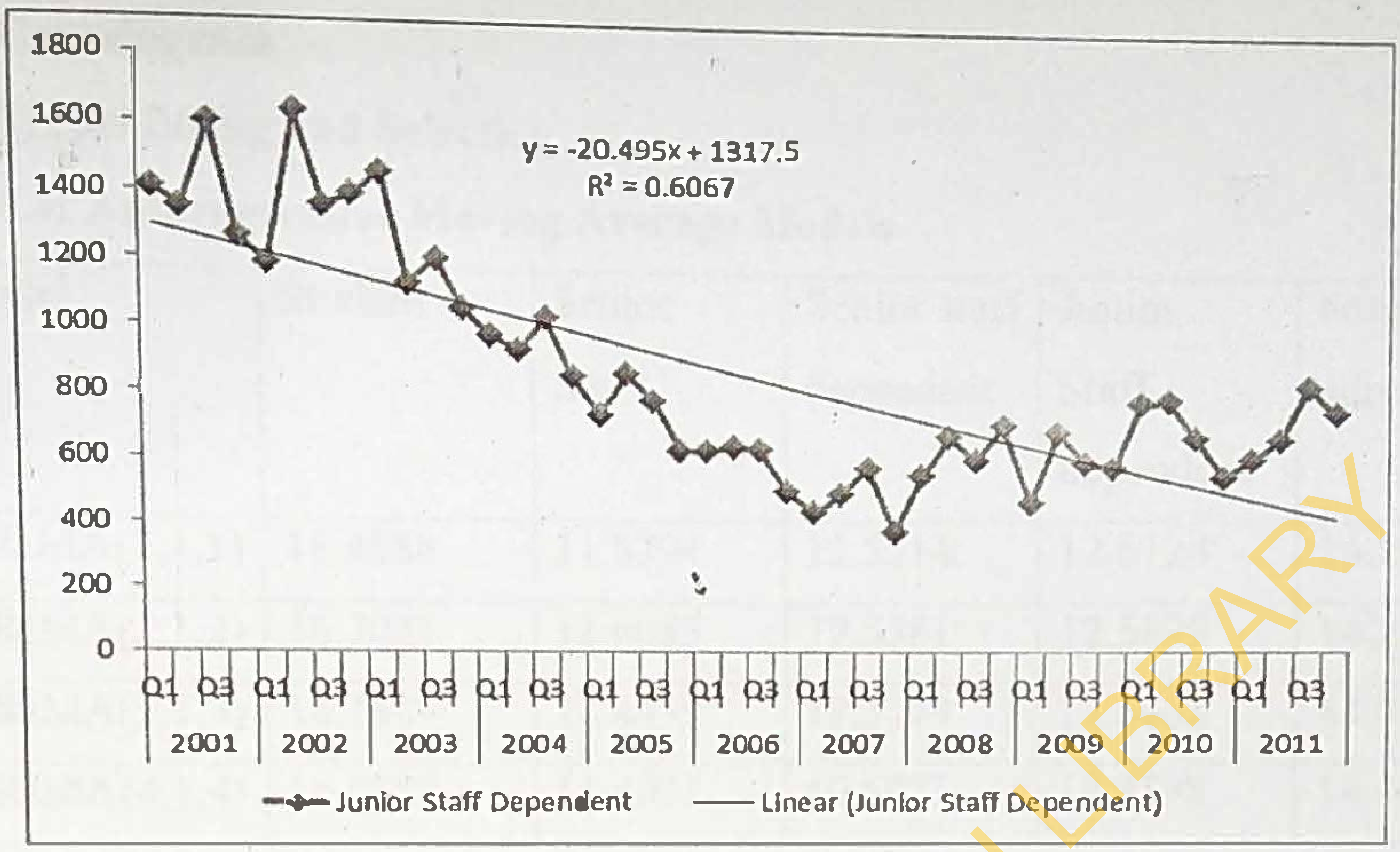

Figure 6: Least squares Trend of quarterly junior staff dependant attendance at the clinic (2001 -2011)

Figure 6 shows that staff attendance at the clinic by senior staff decrease by 20 every quarter

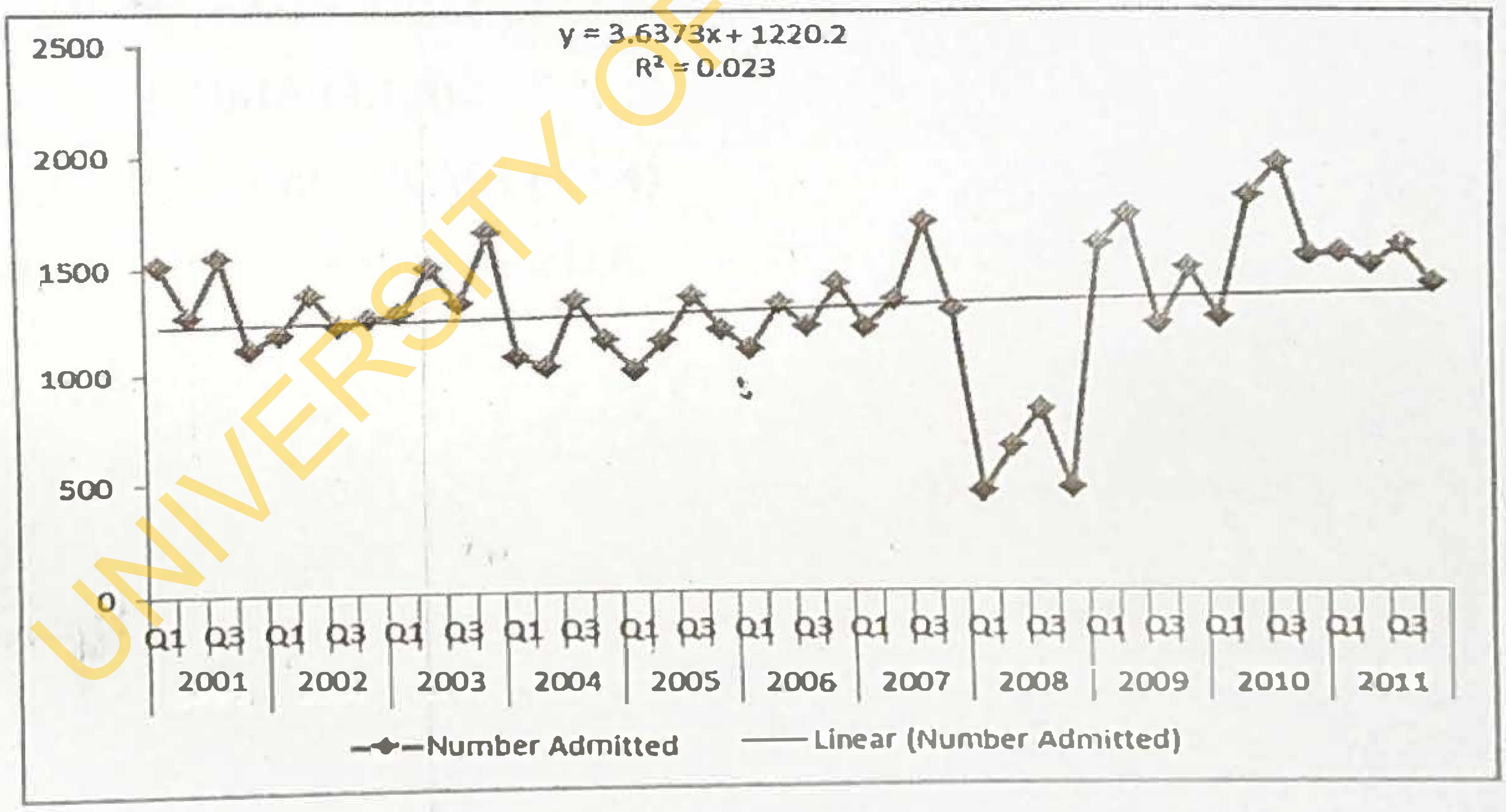

Figure 7: Least squares Trend of quarterly number admitted attendance at the clinic (2001 -2011)

The figure 7 shows that staff attendance at the clinic by number admitted increase approximately by 4 every quarter

4.3 Correlogram

4.3.1 Model fitting and Selection.

Table 4.4: Autoregressive Moving Average Models

Model	Student	Senior Staff	Senior staff dependent	Junior Staff dependent	Number admitted
ARIMA(1,1,1)	16.4888	11.8794	12.5514	12.6124	14.2471
ARIMA(2,1,2)	16.3041	11.6685	12.5581	12.5879	14.2146
ARIMA(3,1,3)	16.1699	11.4459	12.3173	12.3462	13.8174
ARIMA(4,1,4)	16.0887	11.4931	10.5927	12.3598	14.4415

Minimum AIC in the set

This gives rise to the following model:

Student: ARIMA (4, 1,4)

Senior staff: ARIMA (3,1,3)

Senior staff dependent: ARIMA (4,1,4)

Junior staff : ARIMA (3,1,3)

Junior staff dependent: ARIMA (4,1,4)

The estimated model is shown table 6.

Table 4.5: Student: ARIMA (4, 1,4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6408.052	100838.5	0.063548	0.9498
AR(1)	0.887775	0.177040	5.014555	0.0000
AR(2)	-0.771069	0.257093	-2.999189	0.0054
AR(3)	0.423032	0.238846	1.771150	0.0867
AR(4)	0.455415	0.187100	2.43f4078	0.0211
MA(1)	-2.105271	0.065766	-32.01136	0.0000
MA(2)	2.243135	0.126724	17.70099	0.0000
MA(3)	-1.969530	0.082528	-23.86506	0.0000
MA(4)	0.842307	0.030987	27.18245	0.0000

R-squared	0.669762	Mean dependent var	33.92308
Adjusted R-squared	0.581698	S.D. dependent var	1055.307
S.E. of regression	682.5334	Akaike info criterion	16.08867
Sum squared resid	13975554	Schwarz criterion	16.47257
Log likelihood	-304.7291	Hannan-Quinn criter.	16.22641
F-statistic	7.605437	Durbin-Watson stat	1.891385
Prob(F-statistic)	0.000016		

The diagnostic check shows that the Durbin Watson statistic here is approximately 2. This shows that the fitted model free of serial correlation.

Table 4.6: Senior Staff: ARIMA (3,1,3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.694966	10.47488	0.448212	0.6569
AR(1)	-1.050015	0.045407	-23.12471	0.0000
AR(2)	-1.041946	0.055516	-18.76843	0.0000
AR(3)	-0.972981	0.046746	-20.81419	0.0000
MA(1)	1.036378	0.060549	17.11629	0.0000
MA(2)	1.001972	0.056436	17.75404	0.0000
MA(3)	0.884862	0.037801	23.40857	0.0000

R-squared	0.491325	Mean dependent var	3.500000
Adjusted R-squared	0.398838	S.D. dependent var	88.20344
S.E. of regression	68.38819	Akaike info criterion	11.44591
Sum squared resid	154339.2	Schwarz criterion	11.74146
Log likelihood	-221.9181	Hannan-Quinn criter.	11.55277
F-statistic	5.312400	Durbin-Watson stat	2.052788
Prob(F-statistic)	0.000630		

Durbin Watson statistic here 2. This shows that the fitted model free of serial correlation.

Table 4.7: **Senior Staff Dependent: ARIMA (4,1,4)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.566061	4.784792	-0.954286	0.3476
AR(1)	0.032055	0.261882	0.122404	0.9034
AR(2)	-0.672640	0.137441	-4.894009	0.0000
AR(3)	0.025203	0.211961	0.118902	0.9061
AR(4)	-0.802930	0.136565	-5.879488	0.0000
MA(1)	-0.824820	0.910271	-0.906126	0.3721
MA(2)	0.566442	0.799157	0.708800	0.4839
MA(3)	-1.350207	0.847246	-1.593642	0.1215
MA(4)	3.189519	0.799766	3.988066	0.0004

R-squared	0.914441	Mean dependent var	0.307692
Adjusted R-squared	0.891626	S.D. dependent var	132.8111
S.E. of regression	43.72180	Akaike info criterion	10.59274
Sum squared resid	57347.86	Schwarz criterion	10.97664
Log likelihood	-197.5585	Hannan-Quinn criter.	10.73048
F-statistic	40.07951	Durbin-Watson stat	1.896144
Prob(F-statistic)	0.000000		

The diagnostic check shows that the Durbin Watson statistic here is approximately 2. This shows that the model is not serially correlated

Table 4.8: Junior Staff: ARIMA (3,1,3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14356.71	2035927.	0.007052	0.9944
AR(1)	0.711125	4.076530	0.174444	0.8626
AR(2)	0.264530	3.723951	0.071035	0.9438
AR(3)	0.024076	0.409055	0.058858	0.9534
MA(1)	-1.686887	4.010826	-0.420583	0.6768
MA(2)	0.524513	7.673114	0.068357	0.9459
MA(3)	0.170444	3.679943	0.046317	0.9633

R-squared	0.514871	Mean dependent var	11.17500
Adjusted R-squared	0.426666	S.D. dependent var	141.6668
S.E. of regression	107.2685	Akaike info criterion	12.34617
Sum squared resid	379715.2	Schwarz criterion	12.64173
Log likelihood	-239.9235	Hannan-Quinn criter.	12.45304
F-statistic	5.837191	Durbin-Watson stat	1.997403
Prob(F-statistic)	0.000313		

The diagnostic check shows that the Durbin Watson statistic here is approximately 2. This shows that the fitted model free of serial correlation.

Table 4.9. Junior Staff Dependent: ARIMA (4,1,4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.777771	21.36219	-0.083220	0.9342
AR(1)	0.343315	0.156377	2.195425	0.0360
AR(2)	-0.351773	0.146931	-2.394139	0.0231
AR(3)	0.423262	0.152721	2.771463	0.0095
AR(4)	-0.183746	0.131127	-1.401280	0.1714
MA(1)	-0.849791	0.095817	-8.868914	0.0000
MA(2)	0.703768	0.075542	9.316241	0.0000
MA(3)	-0.792611	0.067014	-11.82749	0.0000
MA(4)	0.964806	0.080303	12.01465	0.0000

R-squared	0.657811	Mean dependent var	-11.20513
Adjusted R-squared	0.566560	S.D. dependent var	151.6103
S.E. of regression	99.81440	Akaike info criterion	12.24368
Sum squared resid	298887.5	Schwarz criterion	12.62758
Log likelihood	-229.7517	Hannan-Quinn criter.	12.38142
F-statistic	7.208845	Durbin-Watson stat	1.889259
Prob(F-statistic)	0.000026		

The diagnostic check shows that the Durbin Watson statistic here is approximately 2. This shows that the fitted model free of serial correlation.

4.4 Seasonal - Trend Report

4.4.1 Student

Forecast Summary Section

Variable STUDENT

Number of Rows 44

Mean 1798.545

Pseudo R-Squared 0.000000

Mean Square Error 7.71771E+07

Mean |Error| 5334.508

Mean |Percent Error|264.2368

Forecast Method Winter's with multiplicative seasonal adjustment.

Search Iterations 167

Search Criterion Mean Square Error

Alpha 5.294373E-02

Beta 0,9999977

Gamma 0.1605897

Intercept (A) 15044.65

Slope (B) -390.4109

Season 1 Factor -1.565128

Season 2 Factor -7.407951

Season 3 Factor 9.475296

Season 4 Factor 3.497783

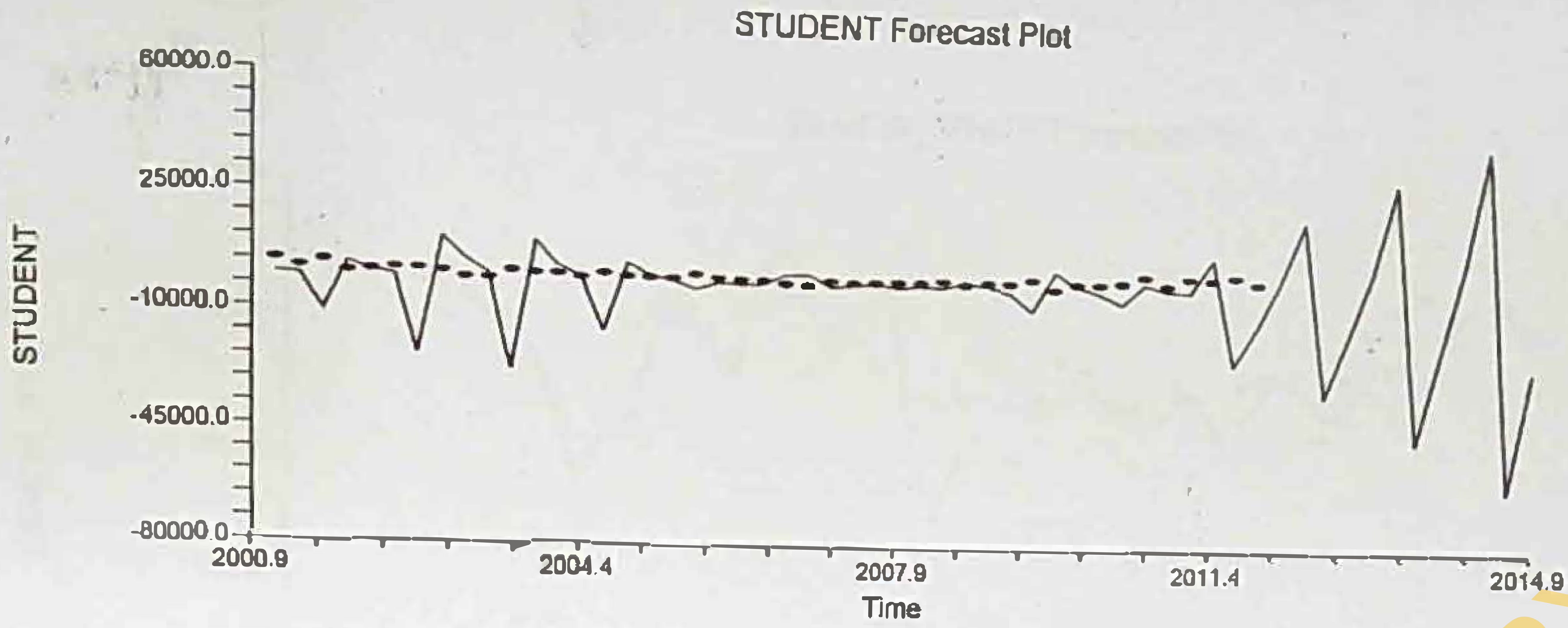

Fig. 8: Forecast and Residuals Plots

Occurrence is prevalent in the third quarter

4.4.2 Senior Staff

Forecast Summary Section

Variable SENIOR_STAFF

Number of Rows 44

Mean 587.0455

Pseudo R-Squared 0.000000

Mean Square Error 51413.98

Mean |Error| 148.1365

Mean |Percent Error| 14.34868

Forecast Method Winter's with multiplicative seasonal adjustment.

Search Iterations 124

Search Criterion Mean Square Error

Alpha 0.3677606

Beta 4.911043E-07

Gamma 8.579595E-02

Intercept (A) 725.3922

Slope (B) -1.489312E-05

Season 1 Factor 0.959393

Season 2 Factor 1.063072

Season 3 Factor 1.070458

Season 4 Factor 0.9070777

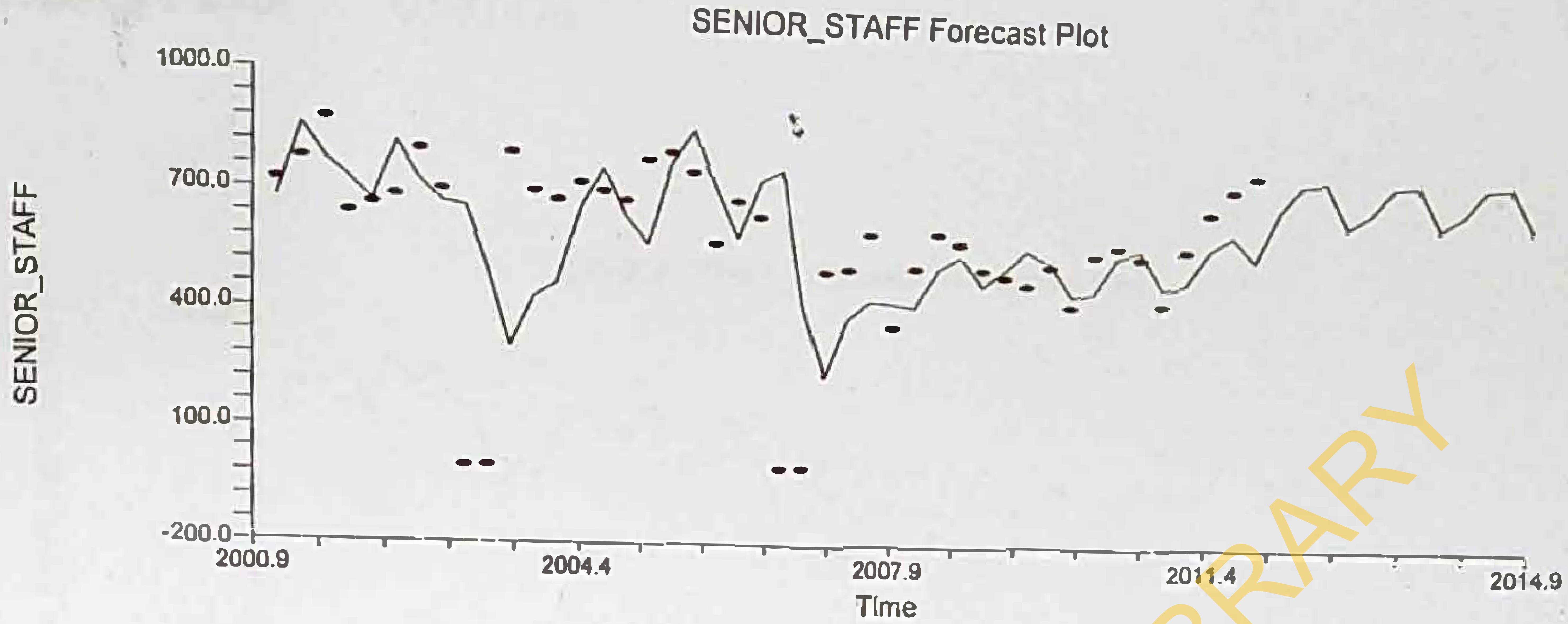

Fig. 9: Forecast and Residuals Plots

Occurrence is prevalent in the third quarter.

4.4.3. Senior Staff Dependant

Forecast Summary Section

Variable SENIOR_STAFF_DEPENDANT

Number of Rows 44

Mean 873.0682

Pseudo R-Squared 0.032225

Mean Square Error 115319.9

Mean |Error| 206.1293

Mean |Percent Error| 11.95116

Forecast Method Winter's with multiplicative seasonal adjustment.

Search Iterations 160

Search Criterion Mean Square Error

Alpha 0.1870512

Beta 5.536764E-07

Gamma 4.691918E-02

Intercept (A) 865.5253

Slope (B) -1.174567E-04

Season 1 Factor 0.9335328

Season 2 Factor	1.076541
Season 3 Factor	1.008451
Season 4 Factor	0.981476

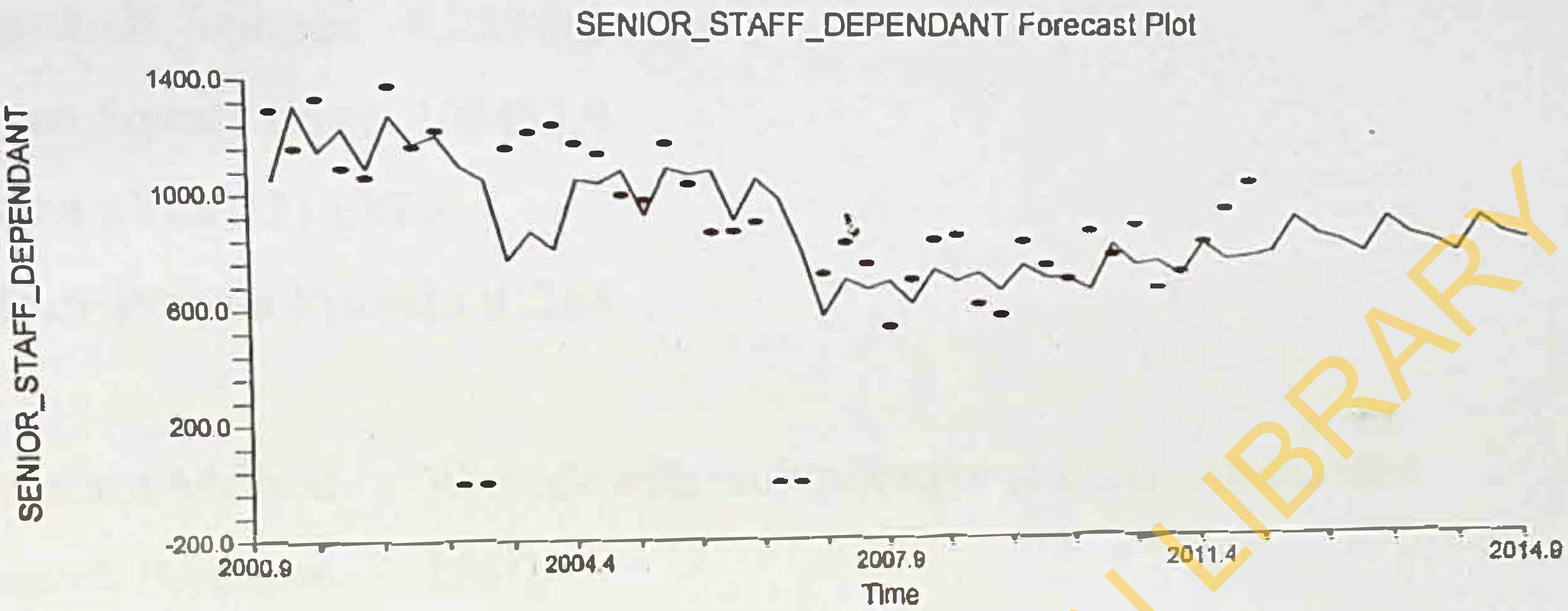

Fig. 10: Forecast and Residuals Plots

Occurrence is prevalent in the second quarter.

Season 2 Factor	1.076541
Season 3 Factor	1.008451
Season 4 Factor	0.981476

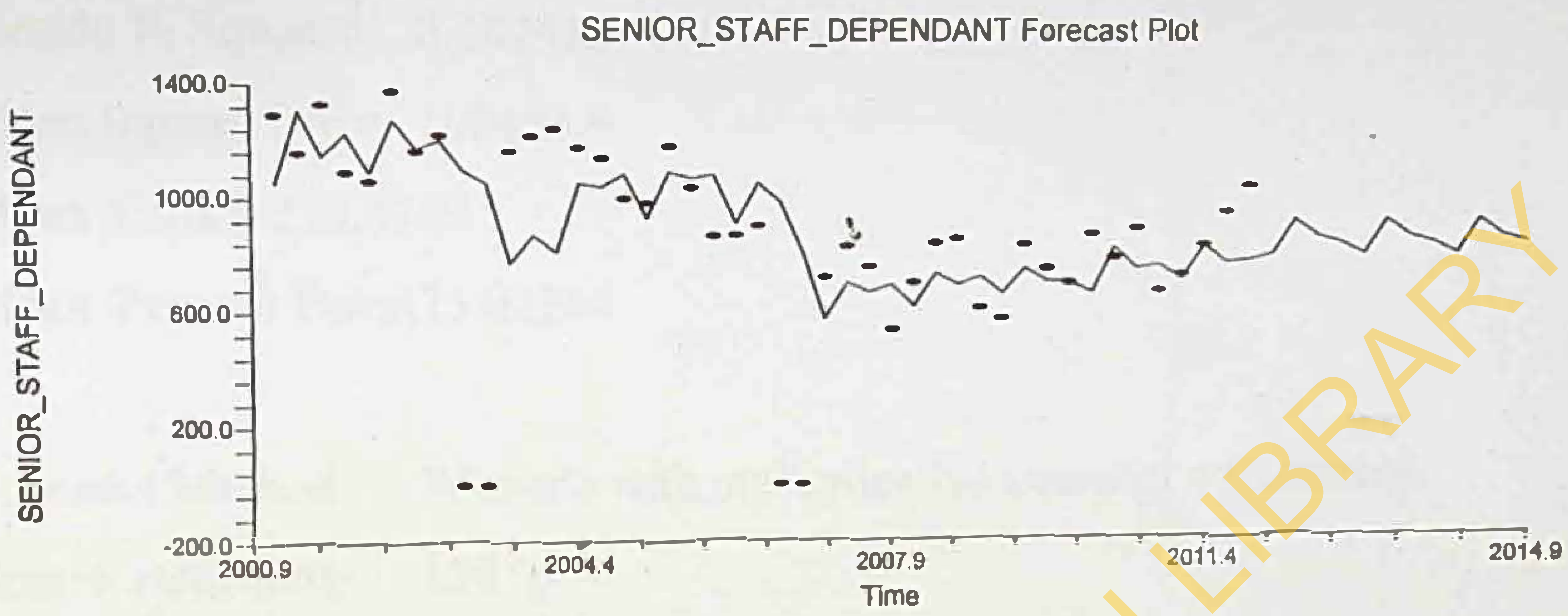

Fig. 10: Forecast and Residuals Plots

Occurrence is prevalent in the second quarter.

4.4.4 Junior Staff

Forecast Summary Section

Variable JUNIOR_STAFF

Number of Rows 44

Mean 768.3182

Pseudo R-Squared 0.282412

Mean Square Error 108453.9

Mean |Error| 210.8749

Mean |Percent Error|23.02264

Forecast Method Winter's with multiplicative seasonal adjustment.

Search Iterations 156

Search Criterion Mean Square Error

Alpha 0.3688486

Beta 4.388163E-08

Gamma 0.0531091

Intercept (A) 729.826

Slope (B) -2.595725E-05

Season 1 Factor 0.9835971

Season 2 Factor 1.067032

Season 3 Factor 0.9917009

Season 4 Factor 0.9576697

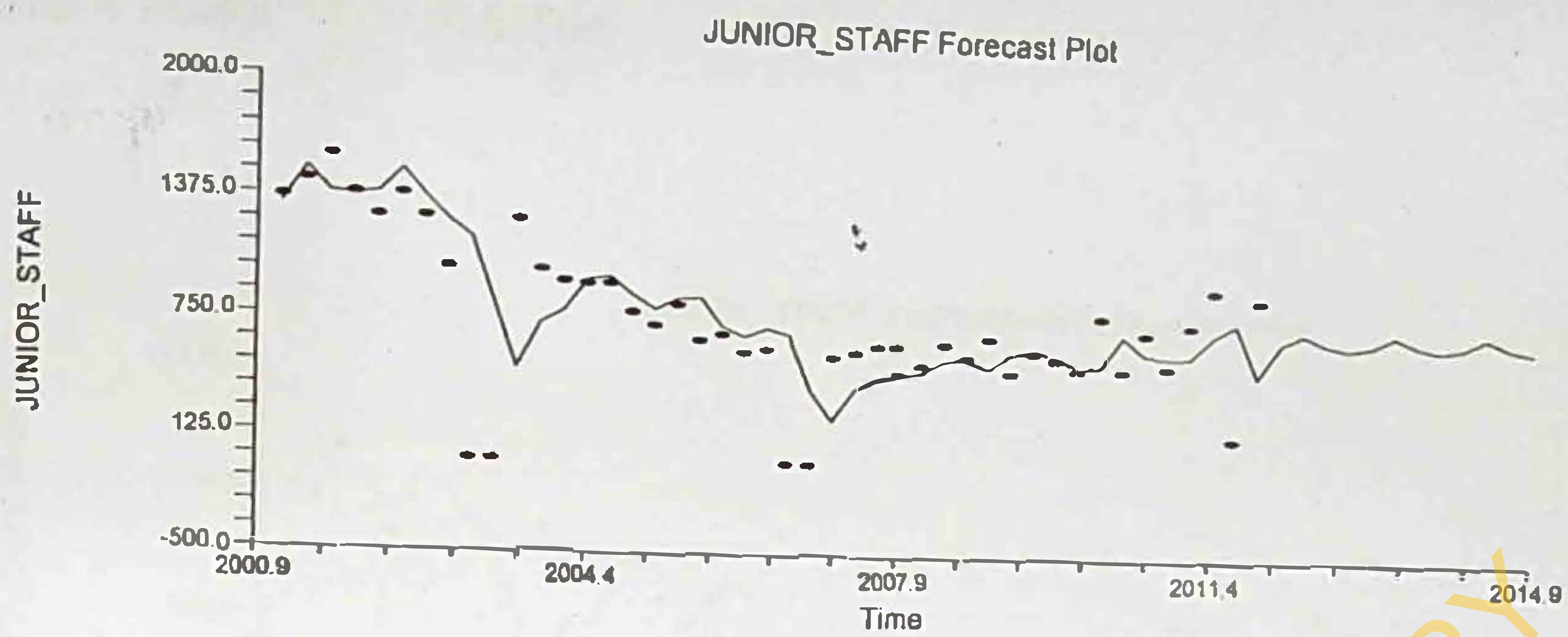

Fig 11: Forecast and Residuals Plots

Occurrence is prevalent in second quarter

4.4.5 Junior Staff Dependant

Forecast Summary Section

Variable JUNIOR_STAFF_DEPENDANT

Number of Rows 44

Mean 761.8864

Pseudo R-Squared 0.365000

Mean Square Error 96780.94

Mean |Error| 199.8716

Mean |Percent Error| 15.96441

Forecast Method Winter's with multiplicative seasonal adjustment.

Search Iterations 150

Search Criterion Mean Square Error

Alpha 0.4600265

Beta 8.195506E-07

Gamma 0.1094823

Intercept (A) 762.2292

Slope (B) -5.789594E-04

Season 1 Factor 0.9392384

Season 2 Factor 1.085456

Season 3 Factor 1.059119

Season 4 Factor 0.9161864

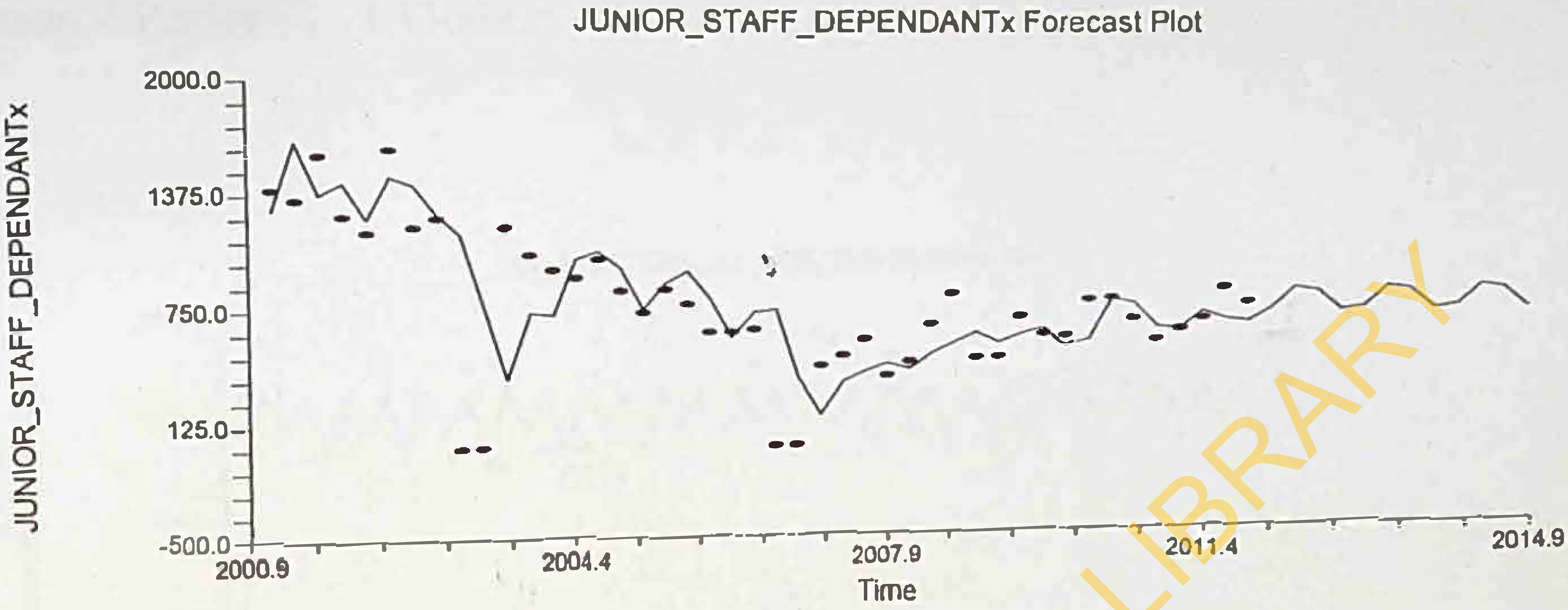

Fig. 12: Forecast and Residuals Plots

Occurrence is prevalent in the second quarter.

4.4.6 Number Admitted to Sick Bay

Variable NO_ADMITTED_TO_SICK_BAY

Number of Rows 44

Mean 1285.977

Pseudo R-Squared 0.000000

Mean Square Error 245314.2

Mean |Error| 332.8636

Mean |Percent Error|14.61283

Forecast Method Winter's with multiplicative seasonal adjustment.

Search Iterations 145

Search Criterion Mean Square Error

Alpha 0

Beta 1

Gamma 0

Intercept (A) 1362.25

Slope (B)	0
Season 1 Factor	0.8236374
Season 2 Factor	1.134153
Season 3 Factor	0.931547
Season 4 Factor	1.110662

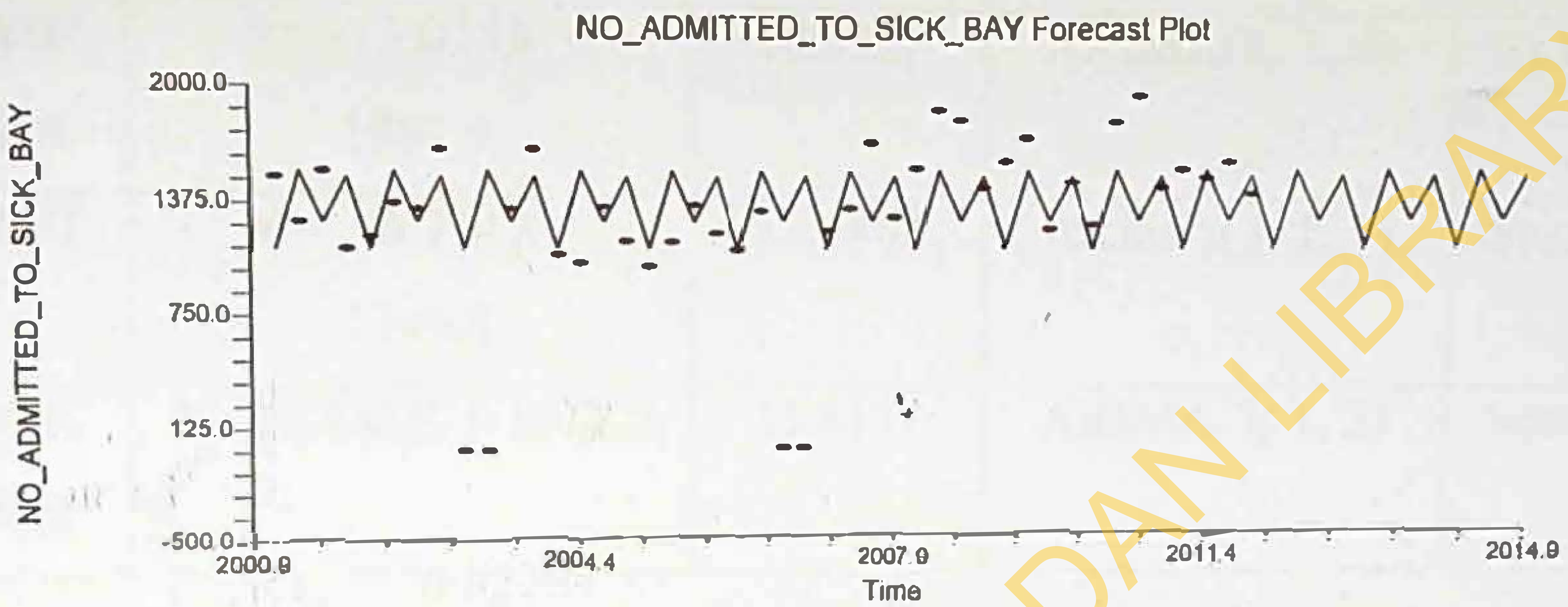

Fig. 13: Forecast and Residuals Plots

Occurrence is prevalent in the second quarter

Table 4.10: Summary of Results

VARIABLES	LEAST SQUARES MODEL	ARIMA MODEL	ARIMA ORDER	SEASONAL (PREVALENCE FACTOR)
Student	Y=14.042X + 1618.7	16,0887	ARIMA(4, 1, 4)	Season 3 (9.475296)
Senior Staff	Y= -5.2145X + 765.69	11.4459	ARIMA(3, 1, 3)	Season 3 (1.070458)
Senior Staff Dependant	Y= -13.028X + 1261.4	10.5927	ARIMA(4, 1, 4)	Season 2(1.070458)
Junior Staff	Y= -16.751X + 1246.4	12.3462	ARIMA(3, 1, 3)	Season 2 (1.067032)
Junior staff Dependent	Y -20.455X + 1317.5	13.8174	ARIMA(3, 1, 3)	Season 2 (1.085456)

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

Having analyzed and interpreted the result generated using E-View, it suffices to discuss the result and offer useful suggestions to the Management of the hospital to further enhance better medical services to the university community.

5.1 Summary of Findings

The Least squares result revealed that there is quarterly increase of 14 and 4 patients for student respectively as clearly unveiled in figures. This result calls for serious investigations on possible causes of illness in the University Community especially among the students and patients admitted to sick bay so as to curb the trends of increase in the number of patients reporting for treatment in the hospital.

The outcome of the analysis shows that there is quarterly decrease of 5, 13, 17, and 20, patients for senior staff, senior staff dependant, junior staff, and junior staff dependant respectively. This evidently suggests that categories of peoples mentioned here live in hygienically good environment.

The Unit Root Test carried out on the data revealed that each variable is stationary at order one. Four different set of autoregressive moving average (ARIMA) models were fitted to each of the series and the best of these models is selected. The selection criterion used here is AIC. The best models selected are: ARIMA(1,1,1), ARIMA(2,1,2), ARIMA(3,1,3), ARIMA(4,1,4) with the following AIC parameters 16.0887, 11.4459, 10.5927, 12.3462, 13.8174 for students, senior staff, senior staff dependant, junior staff, junior staff dependant, and number admitted respectively.

Seasonal variation using multiplicative model shows that students and senior staffs visits the Hospital prevalently during the third quarter of the year (July, August, and September) while visitation to the hospital is prevalent among the senior staff dependant, Junior staff, Junior staff dependant, and Number admitted to sick bay during second quarter of the year (April, May, and June).

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5.2 Conclusion

The health status of the University community dwellers are not the same. The number of students who visit the health center for treatment will be increasing. This is attributable to the large population of students living in the halls of residence. While attendance at the clinic by the staff has been decreasing by various magnitude,. It was also found that the senior and junior staff dependants attend the clinic more frequently than the staff themselves. The difference in attendance and seasonality will afford the management of the Jaja clinic the opportunity of allocation of resources to each category when the need arises.

5.3 Recommendations

Since the analysis revealed marked difference among the attendances of the five categories of the inhabitants of the university community, as well as their seasonal variation, it is suggested that each category be adequately prepared for in the allocation of resources.

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APPENDIX

Quarterly Data on patients attendance at the Jaja Clinic, University of Ibadan

Year	Quarter	S	SS	SSD	JS	JSD	NSB
2001	Q1	4276	725	1295	1363	1409	1513
	Q2	2144	780	1163	1455	1353	1269
	Q3	4071	879	1335	1587	1597	1545
	Q4	863	645	1097	1394	1266	1122
2002	Q1	1531	669	1066	1278	1187	1187
	Q2	2347	692	1385	1397	1632	1373
	Q3	2365	809	1173	1284	1362	1227
	Q4	1802	710	1230	1024	1394	1262
2003	Q1	2171	737	1263	1235	1462	1288
	Q2	1974	760	1202	1154	1132	1500
	Q3	2365	809	1173	1284	1207	1339
	Q4	1802	710	1230	1024	1056	1660
2004	Q1	1756	688	1253	965	974	1083
	Q2	768	733	1189	954	933	1038
	Q3	2154	712	1152	957	1030	1351
	Q4	1247	689	1009	806	853	1160
2005	Q1	1057	794	992	737	738	1018
	Q2	847	816	1194	851	862	1156
	Q3	2189	769	1050	664	782	1361
	Q4	1163	584	880	698	629	1205
2006	Q1	888	695	884	603	627	1115
	Q2	796	665	917	623	642	1322
	Q3	949	648	894	641	633	1214
	Q4	894	552	785	621	503	1414
2007	Q1	1113	513	737	590	437	1213

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	Q2	796	665	917	623	642	1322
	Q3	949	648	894	641	633	1214
	Q4	894	552	785	621	503	1414
2007	Q1	1113	513	737	590	437	1213

	Q2	687	522	846	618	494	1336
	Q3	882	620	772	656	578	1694
	Q4	1215	375	574	505	379	1288
2008	Q1	1245	528	714	554	554	454
	Q2	1777	620	855	675	675	657
	Q3	858	598	890	604	604	827
	Q4	1526	520	626	711	711	472
2009	Q1	1750	510	587	527	470	1592
	Q2	3007	491	848	638	691	1722
	Q3	234	541	764	602	594	1222
	Q4	1884	441	714	546	582	1480
2010	Q1	1918	571	884	840	779	1255
	Q2	2545	593	801	546	787	1808
	Q3	4451	566	904	752	671	1953
	Q4	1952	443	682	569	553	1541
2011	Q1	4219	587	739	799	609	1551
	Q2	3839	687	843	1000	667	1501
	Q3	4749	748	960	979	833	1589
	Q4	2854	785	1054	947	750	1413

Source: University of Ibadan Digest of statistics.