# SUSTAINABILITY AND FINANCIAL DYNAMICS

EDITOR
Assoc. Prof. Özlem ÜLGER DANACI

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## PREFACE

Today's people continue to experience faster and more complex lives than ever before. With technology making our lives easier in almost every field, countless opportunities have begun to emerge to access information and thus improve our existing knowledge base. However, it should not be overlooked that the uncontrolled explosion of information poses a danger to today's intellectuals in many ways. This situation increases the importance of accessing scientific knowledge that is reliable at the highest level, as well as the effective use of means of accessing information. Considering that educational sciences aim for long-term learning outcomes, it can be argued that it is critical for this field for scientific research to provide meticulously obtained and concrete evidence. Based on this argument, it is thought that the need to address new research from a holistic perspective in order to adapt to the existing knowledge and depth in educational sciences has become one of the primary needs of today's responsible global citizens. In line with this need, we have taken the first steps of a new book series with the book "Research in Educational Sciences-I". You can access theoretical and practical research related to the field of education in the book. The aim of the book is to introduce the research covered in a broad scope to potential readers and to lead to the emergence of new research ideas. As the editor, I would like to thank all the researchers, the publishing house and the staff who contributed to the preparation and publication process of the book.

**Editor: Assoc. Prof. Dr. Ümit DURUK**

## CHAPTER 1

# STRATEGIC QUALITY MANAGEMENT IN HIGHER EDUCATION: ENHANCING STUDENT SATISFACTION AND EMPLOYABILITY

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## 1. INTRODUCTION

In recent years, the quality of higher education has become a matter of increasing concern worldwide. As competition among educational institutions intensifies, the ability to provide high-quality education and ensure student satisfaction has become a crucial factor in attracting and retaining students. This is particularly relevant in the context of business schools, which play a pivotal role in preparing future professionals for the dynamic and complex business environment. In this study, we aim to measure the level of quality management in the AYBU Business School and explore its implications for enhancing student satisfaction and academic excellence.

Measuring the quality of education necessitates a comprehensive evaluation framework that considers multiple dimensions and perspectives. One widely recognized approach to assessing service quality is the SERVQUAL model proposed by Parasuraman, Zeithaml, and Berry (1988). The SERVQUAL model offers a valuable tool for measuring and evaluating service quality in various industries, including higher education. It focuses on five dimensions of service quality: tangibles, reliability, responsiveness, assurance, and empathy.

According to a study conducted by Tantawy, El-Nahas, and Mahmoud (2017), service quality has a significant impact on student satisfaction in higher education institutions. The findings of their research indicated that there is a significantly positive relationship between service quality and student satisfaction, suggesting that institutions that prioritize quality management are more likely to achieve higher levels of student satisfaction.

Moreover, previous studies have highlighted the role of service quality in influencing students' academic achievement and success. For instance, a survey by Aydin and Aydin (2019) explored the impact of service quality on student engagement and academic performance in higher education institutions. Their findings revealed a positive

correlation between service quality and student engagement, which in turn positively influenced academic performance.

While several studies have examined the measurement of service quality in higher education institutions, there is a dearth of research specifically focusing on business schools. The AYBU Business School is an intriguing case study for exploring the level of quality management in this specialized educational context. By assessing the various service quality dimensions, we can gain insights into the strengths and areas for improvement within the AYBU Business School.

Existing literature demonstrated the need of the study and its capacity to contribute to the existing literature by measuring the level of quality management in the AYBU Business School using the SERVQUAL model. By understanding the current service quality in the business school, this research will provide valuable insights for enhancing the educational experience and improving student satisfaction. Furthermore, it will highlight the significance of quality management practices in fostering academic excellence and competitive advantage in higher education.

In the following sections, we will present the literature review, which is explained in two titles: Measuring Quality in Higher Education and The relationship between Quality Management and Satisfaction of Students and the methodology employed to measure service quality in the AYBU Business School, analyze the results, and discuss their implications for enhancing the educational experience and overall quality management practices in business schools.

## 2. LITERATURE REVIEW

### 2.1 Literature Review

Kurum (2021) explain higher education institutions' essential tasks and responsibilities as economic, political, cultural and technology-based institutions that train qualified human resources for various sectors. Higher education institutions have a specific target to train eligible employees for public or private organizations; this objective differs among universities according to the need of countries (Çınkır & Yıldız, 2018). The recent development of technology and the socio-political environment affect the expectations of owners or managers of public and private organizations; higher education institutions try to satisfy the needs of the public and private organizations (Gürbüz & Ergüden, 2008).

### 2.2 Measuring Quality in Higher Education

Measurement and management of quality in higher education is a recent topic researched in the literature. For instance, analysis relationship between the quality of service and student satisfaction is essential for the management of universities (Douglas, McClelland, and Davies, 2008) because students question and critique the qualifications of higher education institutions. Students choose the most eligible higher education institution to register (Binsardi & Ekwulugo, 2003).

Donaldson and McNicholas (2004) demonstrate that choosing the proper university is an uncertain and risky decision; the quality features of the universities reduce this uncertainty and become less risky from students' perspectives. Higher education institutions that get certifications from international and national accreditation institutions attract more students, and the quality of students will increase in requirements (Sultan & Wong, 2010).

The quality criteria of higher education institutions are differed by various researchers (Kurum, 2021). However, most measures derived from service sectors such as reliability, responsiveness, understanding consumer needs, kindness, communication, and

performance (Owlia and Aspinwall, 1996, p. 18). On the other hand, other measurement scales are provided and tried to apply in higher education: SERVQUAL (Parasuraman et al., 1988), SERPERF (Cronin & Taylor, 1992), Total Quality Management (TQM) (Ho & Wearn, 1996), HEdPERF (Abdullah, 2005), PHed (Sultan & Wong, 2010), HiEdQUAL (Annamdevula & Bellamkonda, 2012), and 5Q Model (Zineldin et al., 2011). Bektaş and Ulutürk Akman (2013) support that those scales are provided to measure the quality of service in profit organizations, and they are not applicable in higher education. In addition, Abdullah (2006) proves that the SERPERF scale is a weak measurement of higher education performance. Especially, SERVQUAL and SERVPERF are the most common scales to apply in business schools. However, some research demonstrated that those scales do not appropriate for application in higher education (Kurum, 2021).

Consequently, Kurum (2021) proposed a new scale specially prepared to measure the quality of higher education and student satisfaction. The name of the scale is "Yükseköğretimde Hizmet Kalitesi Ölçeği (YüHKÖ)", which is The Scale of Service Quality Measurement in Higher Education (Kurum, 2021, p. 23).

### 2.3 The relationship between Quality Management and Satisfaction of Students

Students are primary consumers of higher education institutions, and universities seek to improve academic service quality in the UK (Hill, 1995). In the research, business faculties seek ways to enhance the quality of service. Service quality management is an intangible concept which is hard to measure in higher education (Parasuraman, 1986). Students compare their expectations from their universities to measure quality in higher education (Hill, 1995). The obvious factor of service quality in higher education is academic services. Students visit university websites, attend classes, meet professors and get accurate information about the curriculum of departments. When current students and academic services interact,

student satisfaction emerges according to academic staff attitudes and behaviours through prospective students. Students compare observed academic services among universities (Kurum, 2021).

The quality of universities is measured with administrative services such as librarian attitudes and the richness of the library, the behaviour of securities, the role of student affairs and their attitudes, the quality of administrative staff, and the quality of administrative physical and human resources have the essential impact on the student perception of university quality management (Onditi & Wechuli, 2017). The university's structure, hierarchy, and features are other crucial factors in satisfying student satisfaction and the industry's need (Bektaş & Ulutürk Akman, 2013).

Campus and services and student support facilities are other critical measures of satisfaction level (Emily et al., 2004). The more the amount of these facilities and services, the more will the level of satisfaction and the happier they will be. (Holley et al, 2005). The direct relationship between campus facilities and student overall satisfaction is demonstrated at Norwegian Business School (Hanessen & Solvoll, 2015). University facilities, the host city, job prospects, the cost of studying and the university's reputation affect the satisfaction level in Norwegian Business Schools. Comprehensive campus facilities have an essential role in raising the quality of a university, and the adequate infrastructure of universities are facilitator to increasing student overall satisfaction (Elliott & Healy, 2001). Libraries, computer and internet access, study hall, rooms for group work, auditoriums and social areas are considered campus facilities (Hanessen & Solvoll, 2015). Providing adequate campus facilities improve students' academic and research skills and helps them student access world-class information resources (Hossain & Islam, 2012). Quality of access to library resources, IT facilities and the Internet significantly predicts student overall satisfaction (Mai, 2005).

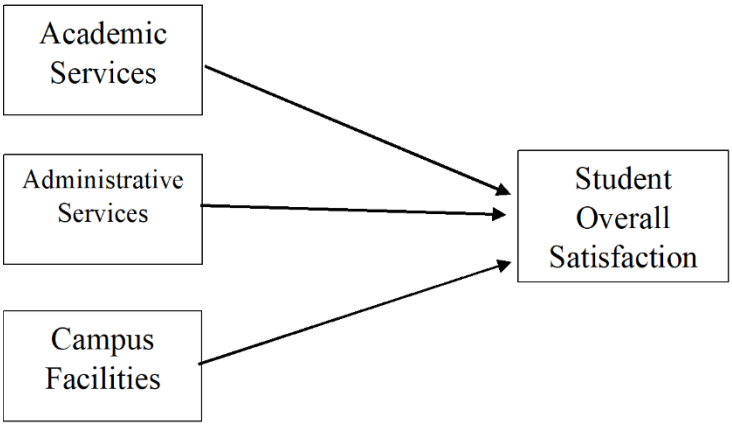
## 3. METHODOLOGY

This research aims to understand the satisfaction level of AYBU Business School, Management students and examine the effect of academic services, administrative services, and campus facilities on the satisfaction level of Business Department Students. In addition, we look at the satisfaction level of graduate students and their perception of academic services, administrative services and campus facilities and the effect of their satisfaction level during their university years.

### 3.1 Research Model

In this research, the relationship between academic services, administrative services, campus facilities and student overall satisfaction. The research model is demonstrated in Table 1.

**Table 1:** Research Model




### 3.2 Sampling

The universe of this research is AYBU Business School, Business Department, and recent and graduate students. The measurement of the higher education quality scale is derived from Kurum (2021), Yükseköğretimde Hizmet Kalitesi Ölçeği (YüHKÖ). The reliability and validity test is applied to universities in Türkiye to 500 students from different departments. In our research, we aim to focus on one faculty and one department. Our universe consists of 270

current and graduate students, about 200 students. The survey questions are prepared in Turkish and English in the Google E-Forms to spread questionnaires to Turkish and international students. Other questions in the survey are the students' nationality, year, department, and 29-item scale questions.

***Descriptive Statistics***

The current paper aims to conduct pilot research on AYBU Business School, Business department students. We have collected data from 80 students. Specifically, 63.6% of students are Turkish, and 36.4 % are international. The participation of first-year students is 16.3 %, the participation of second-year students is 15 per cent, and third-year students' percentage of participation is 25 %. Lastly, fourth-year student participation is 23.8 % of total students. In addition, we enrich this research with graduate students' data. Graduate students' participation is 20.1 % of the total. We collect data only from Business department students.

### 3.3 Hypothesis:

Personal interactions between academics and students shape the perception of students on academic services; this relation is seen as a critical factor that affects academic service quality and reliability and makes it more realistic in higher education institutions (McElwee & Redman, 1993). Reliability sustains the consistency of high-quality performance in universities and directly impacts students' performance in higher education (Hill, 1995). Therefore, the following hypothesis proposes.

*H1: Academic services have a significant impact on the level of quality service at AYBU Business School.*

Quality in higher education is a complex concept, and a single correct definition of quality needs to be improved (Harvey & Green, 1993). The purpose of best service quality is divided into three primary perspectives: academic, administrative and campus facilities (Clewes, 2003, p. 71). By referring to Oliver and DeSarbo's (1989) definition of

satisfaction, Elliott and Shin (2002, p. 198) describe student satisfaction as "the favourability of a student's subjective evaluation of the various outcomes and experiences associated with education. Here, administrative services have an essential role in sustaining the quality of education in the faculty. The quality of service maintained by administrative staff such as the dean, dean's assistant, faculty secretary and other administrative staff. The following hypotheses are proposed.

*H2: Administrative services have a significant impact on the level of quality service at AYBU Business School.*

Facilities have also been considered one of the quality dimensions in higher education. Parasuraman et al. (1985) introduced tangibles as service quality determinants. According to Parasuraman et al. (1985), tangibles refer to physical evidence, such as physical facilities; personnel appearance, tools, and equipment of the provided service; or physical representations of that service. Therefore, we offer the following.

*H3: Campus facilities have a significant impact on the level of quality service at AYBU Business School.*

### 3.4 Measurement Tools

In the literature, we examine various measurement tools of service quality management. However, we decided to use Yükseköğretimde Hizmet Kalitesi Ölçeği (YüHKÖ) by Kurum (2021). This scale is prepared for higher education service measurement. This scale is the most appropriate scale to apply Business department, and we expect the most relevant result from this scale. This scale measures the quality of academic services, administrative services, and campus facilities, which are the essential factors considered in a bachelor student’s life. Scale specific to Turkish Higher Education Institutions to determine the quality of services. This scale has a 29-item structure with three sub-dimensions and 5 Point Likert [1 (hiç memnun de¤ilim) ile 5 (çok memnunum)]. Three Sub-factors of Scale: “Akademik

hizmetler", "İdari hizmetler" ve "Kampüs olanaklar›" which are in order "Academic Services", "Administrative Services" and "Campus Facilities".

### 3.5 Results and Data Analysis

Alpha was developed by Lee Cronbach in 1951 to measure the internal consistency of a test or scale; it is expressed as a number between 0 and 1. Internal consistency describes the extent to which all the items in a test measure the same concept or structure and is therefore linked to the relationship of the items in the test to each other.

**Table 2:** Range of reliability and its coefficient of cronbach's alpha

| **Coefficient of Cronbach's Alpha** | **Reliability Level** |
|---|---|
| $\alpha \geq 0{,}90$ | Excellent |
| $0{,}80 \leq \alpha \leq 0{,}90$ | Good |
| $0{,}70 \leq \alpha \leq 0{,}80$ | Acceptable |
| $0{,}60 \leq \alpha \leq 0.70$ | Questionable |
| $0{,}50 \leq \alpha \leq 0{,}60$ | Poor |
| $\alpha \leq 0{,}50$ | Unacceptable |

**Source:** George and Mallery, (2003)

To analyze the research hypotheses, reliability tests were performed for every scale used in the survey, and the validity of these scales was tested. The Cronbach's Alpha coefficient was used to measure the reliability of the scales used in the research.

**Table 3:** Reliability analysis of the scales used in the research.

| **Scales** | **Cronbach's Alpha** |
|---|---|
| Academic Services | ,913 |
| Administrative Services | ,944 |
| Campus Facilities | ,936 |
| Student Overall Satisfaction | ,919 |

As can be seen in Table 3, the reliability of scales used in the research, all scales were established to be highly reliable in the survey. This table demonstrates Cronbach's Alpha for every scale in the survey. The validity test for academic services, administrative services and campus facilities (Kurum, 2021) is shown in their research. We accepted their validity according to their results. On the other hand, another analysis was applied to test the normality of the data obtained from the survey. The research is a test technique to determine whether data has a normal distribution, which is the primary condition for parametric test methods. Skewness and Kurtosis values are expected to be in the range of -1,5 to +1,5 in the normality test (Tabachnick & Fidell, 2013). If this condition is fulfilled, the data is assumed to have a normal distribution. As can be seen in Table 9, the measurements of skewness and kurtosis.

**Table 4**: Normality test of variables used in the research.

| **Scales** | **Skewness** | **Kurtosis** |
|---|---|---|
| Academic Services | -1,013 | 1,109 |
| Administrative Services | -1,193 | 1,069 |
| Campus Facilities | -1,189 | ,288 |
| Student Overall Satisfaction | -,919 | ,235 |

According to the results of the Skewness and Kurtosis tests, no problems require the normalization of data. As it can be understood from the skewness and kurtosis values, for all data, all measures fall within the accepted range, which is from -1.5 to 1.5. Thus, the normality tests are satisfied by the dataset.

**Table 5:** Confirmatory Factor Analysis

| Scale | Items | Factor Loadings | KMO | Bartlett's Test of Sphericity | Explained Variance | Eigenvalue | Factor |
|---|---|---|---|---|---|---|---|
| AS | AS 1 | ,725 | 0,867 | $\chi^2(105) = 597{,}015$, $p<0{,}001$ | %39,275 | 5,891 | Single Factor Structure |
| | AS 2 | ,775 | | | | | |
| | AS 3 | ,654 | | | | | |
| | AS 4 | ,700 | | | | | |
| | AS 5 | ,508 | | | | | |
| | AS 6 | ,831 | | | | | |
| | AS 7 | ,795 | | | | | |
| | AS 8 | ,595 | | | | | |
| | AS 9 | ,633 | | | | | |
| | AS 10 | ,595 | | | | | |
| | AS 11 | 0,666 | | | | | |
| | AS 12 | 0,685 | | | | | |
| | AS 13 | 0,576 | | | | | |
| | AS 14 | 0,649 | | | | | |
| | AS 15 | ,725 | | | | | |

The EFA results revealed a single-factor structure for the AS Scale, indicating that all items are strongly related to a single underlying factor. The factor loadings ranged from 0.508 to 0.831, suggesting a moderate to high association between each item and the factor. The KMO measure of sampling adequacy was 0.867, indicating good suitability for factor analysis. Bartlett's test of sphericity was significant ($\chi$^2(105) = 597.015, p < 0.001), confirming the presence of underlying factors in the data.

| Scale | Items | Factor Loadings | KMO | Bartlett's Test of Sphericity | Explained Variance | Eigenvalue | Factor |
|---|---|---|---|---|---|---|---|
| SA | SA 1 | ,720 | 0,815 | $\chi^2(28)$ = 265,235, p<0,001 | %44,85 | 3,588 | Single Factor Structure |
| | SA 2 | ,728 | | | | | |
| | SA 3 | ,787 | | | | | |
| | SA 4 | ,771 | | | | | |
| | SA 5 | ,564 | | | | | |
| | SA 6 | ,608 | | | | | |
| | SA 7 | ,598 | | | | | |
| | SA 8 | ,531 | | | | | |

The factor analysis reveals a unidimensional structure for the SA Scale, indicating that all items strongly relate to a single underlying factor. The factor loadings range from 0.531 to 0.787, indicating a moderate to high association between each item and the factor. The KMO measure of sampling adequacy is 0.815, signifying good suitability for factor analysis. Additionally, Bartlett's test of sphericity yields significant results ($\chi$^2(28) = 265.235, p < 0.001), confirming the presence of underlying factors within the data. Furthermore, the

analysis demonstrates that the single factor explains 44.85% of the total variance. The eigenvalues for other factors fall below a predetermined threshold, further supporting the unidimensional structure. The proportion of explained variance highlights the SA Scale's ability to capture a substantial portion of the intended construct.

| Scale | Items | Factor Loadings | KMO | Bartlett's Test of Sphericity | Explained Variance | Eigenvalue | Factor |
|---|---|---|---|---|---|---|---|
| CF | CF 1 | ,806 | 0,738 | $\chi^2(15) = 167,313$, $p<0,001$ | %44,74 | 2,685 | Single Factor Structure |
| | CF 2 | ,777 | | | | | |
| | CF 3 | ,756 | | | | | |
| | CF 4 | ,657 | | | | | |
| | CF 5 | ,514 | | | | | |
| | CF 6 | ,506 | | | | | |

The factor analysis results reveal a unidimensional structure for the CF Scale, indicating that all items are strongly related to a single underlying factor. The factor loadings range from 0.506 to 0.806, suggesting a moderate to high association between each item and the factor. The KMO measure of sampling adequacy is 0.738, indicating good suitability for factor analysis. Additionally, Bartlett's test of sphericity is significant ($\chi$^2(15) = 167.313, p < 0.001), providing further confirmation of the presence of underlying factors within the data. Furthermore, the analysis demonstrates that the single factor explains 44.74% of the total variance. The eigenvalues for other factors fall below a predetermined threshold, supporting the unidimensional structure. The proportion of explained variance highlights the CF Scale's ability to capture a substantial portion of the targeted construct.

| Scale | Items | Factor Loadings | KMO | Bartlett's Test of Sphericity | Explained Variance | Eigenvalue | Factor |
|---|---|---|---|---|---|---|---|
| SOS | SOS 1 | ,754 | 0,625 | $\chi^2(15) = 165,37, p<0,001$ | %35,86 | 1,284 | Single Factor Structure |
| | SOS 2 | ,696 | | | | | |
| | SOS 3 | ,789 | | | | | |
| | SOS 4 | ,586 | | | | | |
| | SOS 5 | ,729 | | | | | |
| | SOS 6 | ,700 | | | | | |

The EFA results reveal a single-factor structure for the SOS Scale, indicating that all items strongly relate to a single underlying factor. The factor loadings range from 0.586 to 0.789, suggesting a moderate to high association between each item and the factor. The KMO measure of sampling adequacy is 0.625, indicating acceptable suitability for factor analysis. Additionally, Bartlett's test of sphericity is significant ($\chi$^2(15) = 165.37, p < 0.001), confirming the presence of underlying factors within the data. Furthermore, the analysis demonstrates that the single factor explains 35.86% of the total variance. The eigenvalues for other factors fall below a predetermined threshold, further supporting the unidimensional structure. The proportion of explained variance highlights the SOS Scale's ability to capture a substantial portion of the targeted construct.

**Table 6:** Regression Analysis

| Model | | Unstandardized Coefficients | | t | Sig. |
|---|---|---|---|---|---|
| | | B | Std. Error | | |
| 1 | (Constant) | 3,136 | ,282 | 11,129 | ,000 |
| | AS | ,432 | ,032 | 12,875 | ,000 |
| | SA | ,356 | ,019 | 14,846 | ,000 |
| | CF | ,050 | ,001 | 11,258 | ,000 |

The constant term in the model represents the expected value of the outcome variable when all predictor variables are zero. In this case, the constant term is 3.136 with a standard error of 0.282. The t-value of 11.129 suggests that the constant term is statistically significant ($p < 0.001$). The predictor variable "AS" has an unstandardized coefficient of 0.432 with a standard error of 0.032. The t-value of 12.875 indicates that the coefficient is statistically significant ($p < 0.001$). For a one-unit increase in "AS," holding other variables constant, there is an expected increase of 0.432 units in the outcome variable. The predictor variable "SA" has an unstandardized coefficient of 0.356 with a standard error of 0.019. The t-value of 14.846 suggests that the coefficient is highly significant ($p < 0.001$). For a one-unit increase in "SA," holding other variables constant, there is an expected increase of 0.356 units in the outcome variable. The predictor variable "CF" has an unstandardized coefficient of 0.050 with a standard error of 0.001. The t-value of 11.258 indicates that the coefficient is statistically significant ($p < 0.001$). For a one-unit increase in "CF," holding other variables constant, there is an expected increase of 0.050 units in the outcome variable. Overall, the regression model suggests that all predictor variables (AS, SA, and CF) have statistically significant relationships with the outcome variable. The positive coefficients indicate that increases in the predictor variables are associated with increases in the outcome variable. However, without further context or information about the variables and the research context, it is not possible to provide a more detailed interpretation.

## 4. Discussion

To support the findings related to tangibles and the quality of physical resources, a study by Ladhari, Souiden, and Dufour (2008) found that tangible aspects of service quality significantly influence student satisfaction in higher education institutions. Regarding reliability, a study by Alves and Raposo (2007) emphasized the importance of reliable educational services in higher education, as they contribute to students' perceived value and overall satisfaction.

Concerning responsiveness, a study by Al-Shakhshir and Zairi (2003) highlighted the significance of prompt response and efficient handling of student inquiries and complaints in higher education institutions. Their findings demonstrated that responsiveness positively influences student satisfaction and loyalty. In terms of assurance, the study by Aydin and Aydin (2019) also emphasized the role of confidence in shaping student engagement and academic performance in higher education. Supporting the importance of empathy, a study by Dabholkar, Thorpe, and Rentz (1996) highlighted the positive impact of kindness on customer satisfaction in service encounters. Although not specific to higher education, the findings have implications for creating a student-centred and empathetic environment within educational institutions.

The recent paper indicates that hypotheses are accepted with our analysis. First, we examine the relationship between academic services and overall student satisfaction. The factor loadings ranged from 0.508 to 0.831, suggesting a moderate to high association between academic services and student overall satisfaction. Next, the factor loadings of administrative services range from 0.531 to 0.787, indicating a moderate to the high association between administrative services and students' overall satisfaction between administrative services and students' overall satisfaction. Lastly, the factor loadings of campus facilities range from 0.506 to 0.806, suggesting a moderate to high association between campus facilities and students' overall satisfaction. Our findings demonstrate that the test of our research model is normal

and applicable to AYBU Business School. Data result shows that all hypotheses are accepted in this research. To conclude that the expectation of good administrative services, academic services and campus facilities affect the student's overall satisfaction. The satisfaction level might affect transferring to other universities or staying at the current university.

Furthermore, this research is unique because other studies in literature applied to whole universities. There needs to be more application to faculty-level research. In addition, many studies in the literature are applied to engineering and medicine schools. Only some studies applied this model to social sciences, and fewer to Business Schools. Another originality of this research is applied to a business school's current and graduate students to compare the view of previous students and recent students.

## 5. CONCLUSION

In conclusion, it is essential to reiterate the main findings and their implications. Researchers can refer back to the previously mentioned citations to support their findings. However, emphasizing the importance of addressing responsiveness, a study by Sohail (2003) found that responsiveness significantly influences student satisfaction in higher education institutions. The study underscores the need for institutions to establish effective communication channels and promptly address student concerns to enhance overall satisfaction.

Concerning assurance, a study by Ladhari (2009) highlighted that students' perception of the competence and reliability of faculty and staff significantly influences their satisfaction with educational services. Student perceptions reinforce the importance of investing in faculty development programs and ensuring the availability of comprehensive support services to enhance student confidence.

Moreover, to emphasize the significance of empathy, a study by Lu, Lu, and Lu (2008) revealed that empathetic interactions between faculty and students positively affect student satisfaction and loyalty in

higher education. The study supports that a student-centred and empathetic approach contributes to a positive educational experience. Including these additional citations will strengthen the discussion and conclusion sections by providing a broader foundation of supporting evidence from the service quality literature in higher education.

In light of the information in the literature and within the framework of recent research, administrative services, campus facilities, and academic services directly impact student satisfaction levels. Findings demonstrated that academic services ($\chi^2(105) = 597.015$, $p < 0.001$), administrative services ($\chi^2(28) = 265.235$, $p < 0.001$) and campus facilities ($\chi^2(15) = 167.313$, $p < 0.001$) have a significant effect on student's overall satisfaction. Limitations are the low level of sampling. In the future, this research question might be applied to bigger sampling.

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**Appendix:** Survey Questionnaire

| | |
|---|---|
| **Academic Services (Akademik Hizmetler)** | |
| **AS1** | Öğretim elemanlarının bize sıcak ve dostça (iletişim) yaklaşımından |
| **AS2** | Öğretim elemanlarının akademik başarıyı ölçme-değerlendirme yöntemlerinden |
| **AS3** | Derslerde öğretim elemanlarının kullandığı öğretim yöntemlerinden |
| **AS4** | Ölçme ve değerlendirmede öğretim elemanlarının objektif davranmasından |
| **AS5** | Öğretim elemanlarının bilgi, beceri ve tutumlarımızı geliştirmeye yönelik çabalarından |
| **AS6** | Danışmanlık saatlerinde öğretim elemanlarının ulaşılabilir olmasından |
| **AS7** | Çalışmalarımla ilgili zamanında geri bildirim almaktan |
| **AS8** | Bölümümdeki öğretim elemanlarından aldığım danışmanlık hizmetlerinden |
| **AS9** | Bölümümdeki öğretim elemanlarının alan bilgisinin yeterliliğinden |
| **AS10** | Derslerin bizi çalışma hayatına hazırlamasından |
| **AS11** | Fakültemden aldığım eğitimin beklenti-ihtiyaçlarımı karşılamasından |
| **AS12** | Öğrencilere sınavlarla ilgili zamanında geri bildirim sunulmasından |
| **AS13** | Derslerle ilgili, kitap, ders notu gibi basılı ve görsel materyalin yeterliliğinden |
| **AS14** | Dönem başında ölçme değerlendirme ölçütlerinin açıklanmasından |
| **AS15** | Derslerde kuramsal bilginin yanında uygulamaya yeterince yer verilmesinden |
| **Administrative Services (İdari Hizmetler)** | |
| **SA1** | Öğrencileri ilgilendiren işlemlerin (kayıt-kabul, not öğrenme, diploma alma, vb.) sistemli ve düzenli biçimde işlemesinden |
| **SA2** | İdari personelin öğrencilerin sorunlarını çözebilmesinden |

| | |
|---|---|
| **SA3** | İdari personelin sıcak ve dostça (iletişim) davranışlarından |
| **SA4** | Yönetimin hızlı ve etkili geribildirimler vermesinden |
| **SA5** | Yemekhane yemeklerinin kalitesinden |
| **SA6** | Üniversitede verilen idari hizmetlerden (ders kayıt, belge alma, askerlik işlemleri vb.) |
| **SA7** | Kampüsteki yemek ücretlerinden |
| **SA8** | Kampüsteki yemekhane olanaklarından (büyüklük, temizlik vb.) |
| **Campus Facilities (Kampüs Olanakları)** | |
| **CF1** | Kütüphane kaynaklarına erişimden |
| **CF2** | Kütüphane iç/dışı çalışma olanaklarından |
| **CF3** | Kütüphane koleksiyonları/veri tabanlarının akademik ihtiyaçlarımızı karşılamasından |
| **CF4** | Kampüs düzeninden |
| **CF5** | Kampüse ulaşımın hızlı ve kolay olmasından |
| **CF6** | Kampüs içinde internete erişim olanaklarından |
| **Student Overall Satisfaction** | |
| SOS1 | I am satisfied with Quality of Equipment & facilities |
| SOS2 | I am satisfied with Quality of Services |
| SOS3 | I am satisfied with Quality of Support Services |
| SOS4 | I am satisfied with Overall Maintenance |
| SOS5 | I am satisfied with Quality of Admin Services |
| SOS6 | I am satisfied with Quality of Academic Services |

# CHAPTER 2

## EXPLORING RANGE VOLATILITY IN BORSA ISTANBUL

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## 1. INTRODUCTION

Volatility forecasting plays a crucial role in financial decision-making, with applications ranging from risk management to asset pricing and portfolio optimization (Poon and Granger, 2003). The selection and evaluation of econometric models in this domain often involve two key steps: in-sample analysis, which focuses on model fit to historical data, and out-of-sample analysis, which assesses the model's predictive power on new, unseen data (Engle, 1982; Bollerslev, 1986). While in-sample performance provides an initial indication of a model's ability to capture underlying patterns in volatility, it is limited by its reliance on training data, which can lead to overfitting and may inflate performance metrics (Diebold and Mariano, 1995).

This study examines a range of econometric models to evaluate their effectiveness in forecasting the BIST range volatility. The models considered in this analysis include AR, ARMA, ARFIMA, CARR, ECARR, GARCH, EGARCH, HAR, and ECON Fc. Utilising range-based data, this research aims to present a more comprehensive analysis than return-based methods, as range-based data includes more detailed information about market movements.[2]

This study points out the importance of including both in-sample and out-of-sample evaluations to achieve a balanced assessment of model robustness. Models such as the Heterogeneous Autoregressive (HAR), Autoregressive Moving Average (ARMA), and Exponential Conditional Autoregressive Range (ECARR) have demonstrated notable out-of-sample performance across various accuracy metrics, underscoring their robustness in volatility forecasting (Corsi, 2009; Chou et al., 2015). The HAR model, with its multi-scale design, has been particularly effective in capturing different temporal aspects of volatility, which enhances its applicability in forecasting future trends (Andersen et al., 2003).

[2] This study does not compare range-based volatility to return-based volatility, which is a different topic.

In contrast, traditional models such as the GARCH, EGARCH, and ARFIMA, while often strong performers in in-sample analyses, tend to struggle in out-of-sample settings. This discrepancy highlights the limitations of relying solely on in-sample results when evaluating forecasting models, as they may capture specific features of past volatility but fail to adapt to new patterns. The out-of-sample evaluation thus provides a more reliable test, serving as a safeguard against overfitting and providing insights into the model's generalizability and real-world applicability. This analysis supports the notion that out-of-sample testing is essential for validating the robustness of forecasting models. Models that perform consistently well in both in-sample and out-of-sample evaluations are more likely to yield reliable predictions, making them more suitable for practical applications in finance and economics.

The remainder of this article is organized as follows. Section 2 gives the data and methods used in this work. Section 3 presents the results. Lastly, Section 4 provides the conclusion of this study.

## 2. DATA AND METHODOLOGY

### 2.1. Data

The dataset for this study consists of historical data on the Borsa Istanbul 100 (BIST 100) Index, obtained from Yahoo! Finance. The BIST 100 Index, represented by the ticker XU100.IS, is a significant stock market index in Türkiye, reflecting the performance of the top 100 companies listed on the Borsa Istanbul. The analysis covers a period from January 5, 2007, to October 4, 2023, providing a comprehensive view of the index's fluctuations and trends over nearly 17 years. This extensive timeframe captures various economic cycles and market conditions, offering a robust foundation for evaluating volatility models.

## 2.2. Methodology

### Price Range Calculation

The high and low prices of a respective stock index can be symbolised by *H* and *L* over a day, respectively. Using this notations, the difference between high and low prices of a respective index or stock in a day is calculated as follows:

$$R = 100 * (\log(H) - \log(L)) \quad (1)$$

***GARCH model estimated by price range***

The GARCH model settings are given as follows:

$$h_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \, \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \, h_{t-j}^2 \quad (2)$$

The non-negativity constraints require that $\alpha_0 > 0$, $\alpha_i \geq 0$ *for i=1,2,...,q and* $\beta \geq 0$ *for j=1,2,...,p*. This model produces one-step-ahead variance forecasts based on a weighted average of the long-term variance, $\alpha_0$, past volatility, $\sum_{i=1}^{q} \alpha_i \, \varepsilon_{t-i}^2$, and the previous forecast variances, $\sum_{j=1}^{p} \beta_j \, h_{t-j}^2$. Covariance stationarity is achieved if $\alpha_i + \beta_j$<1.

***EGARCH model estimated by price range***

Nelson (1991) identifies a significant negative autocorrelation between returns and volatility. To capture this asymmetric effect, he proposes the EGARCH model, which is given as follows:

$$\log(h_t^2) = \alpha_0 + \alpha_1 \frac{|\varepsilon_{t-1}|}{h_{t-1}} + \gamma \frac{\varepsilon_{t-1}}{h_{t-1}} + \beta_1 \log(h_{t-1}^2) \quad (3)$$

where the parameter, $\gamma$, reflects the leverage effect if $\gamma < 0$. A significant $\alpha_1$ coefficient indicates volatility clustering. The model's logarithmic form guarantees that the conditional variance remains non-negative, even if parameters are negative.

***CARR/ECARR model***

Chou (2005) introduces the CARR model as an alternative approach for modelling and forecasting financial volatility. The CARR model of order (p, q) is represented as follows:

$$R_t = \lambda_t \, \varepsilon_t \qquad (4)$$

$$\lambda_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \, R_{t-i} + \sum_{j=1}^{q} \beta_j \, \lambda_{t-j} \qquad (5)$$

$$\varepsilon_t \mid I_{t-l} \sim f(l, \xi_t)$$

At time *t*, the price range of a speculative asset is observed, with $\lambda_t$ representing the conditional mean of this range based on all available information up to that point. As noted by Chou (2005), the disturbance term, $\varepsilon_t$ , defined as the normalized range $\varepsilon_t = \frac{R_t}{\lambda_t}$, follows a distribution with density function $f(.)$ and a unit mean. All coefficients in the conditional mean equation are positive to ensure that $\lambda_t$ remains positive. The ECARR model could be derived from the CARR model with the same way as it is in Equation 3.

***AR, ARMA, and ARFIMA models***

Granger and Joyeux (1980) introduced the autoregressive fractionally integrated moving average (ARFIMA) model, a long-memory model capable of capturing the persistent nature of volatility. Andersen et al. (2003) recommend the univariate ARFIMA model specifically for modelling realized volatility. An ARFIMA model of order *(p,d,q)* is represented as follows:

$$\varphi(L)(1-L)d(RVt - \mu) = \theta(L)\varepsilon_t \qquad (7)$$

where $\varphi(L)$ and $\theta(L)$ represent the lag polynomials for the autoregressive (AR) and moving average (MA) components. $\varepsilon_t$ is the error term which is distributed approximately as a Gaussian white noise [$N(0,\sigma_u^2)$]. AR(p, 0, 0) and ARMA(p, 0, q) models are plain forms of ARFIMA specification. In other words, removing the Moving Average (MA) component and the Fractional Differencing Parameter *(d)* from

ARFIMA reduces it to an AR model. Similarly, removing only *d* results in an ARMA model. The parameter *d*, shown in equation (7), captures the long memory properties of volatility, while the AR and MA components account for short memory behaviour. For long memory modelling, *d* should fall between 0 and 0.5, as Andersen et al. (2003) found *d=0.401*. Empirically, the ARFIMA model has been shown to outperform traditional GARCH models (Hansen and Lunde, 2010).

***HAR model***

The HAR-RV model is based on the heterogeneous market hypothesis proposed by Müller et al. (1997), which suggests that investors differ in their risk preferences and responses to new information. Building on this idea, Müller and colleagues developed the HARCH model. Inspired by the HARCH model and its underlying hypothesis, Corsi (2009) introduced the HAR-RV model as an additive cascade model incorporating multiple volatility components. The model is defined as follows:

$$RV_{t+h}^{d} = \beta_0 + \beta_d RV_t^d + \beta_w RV_t^w + \beta_m RV_t^m + \varepsilon_{t+h} \quad (8)$$

where $RV_t^d$ is daily RV; $RV_t^w$ refers to weekly RV, and then $RV_t^m$ indicates monthly RV. $RV_t^w$ and $RV_t^m$ can easily be calculated as follows:

$$RV_t^w = \frac{1}{5}(RV_{t-5}^d + RV_{t-4}^d + \cdots + RV_{t-1}^d)$$

$$RV_t^m = \frac{1}{22}(RV_{t-22}^d + RV_{t-21}^d + \cdots + RV_{t-1}^d)$$

The HAR-RV model can be easily estimated using the ordinary least squares (OLS) method and serves as an effective alternative to the ARFIMA model. Although it does not belong to the long memory model class, the HAR-RV model can still capture long memory characteristics of volatility.

***Recursive window forecasting technique***

The recursive window forecasting method operates by progressively expanding the estimation sample over time. It does not maintain a fixed length by dropping the oldest observation and adding the most recent one. Instead, the recursive technique keeps all prior observations in the estimation process. This means that as new data points become available, they are added to the existing dataset, allowing the model to utilize a continuously growing sample for its forecasts. In practice, this involves starting with an initial sample and using it to generate one-step-ahead forecasts. For each subsequent forecast, the model includes all previous observations without excluding any, thereby providing a richer dataset that can improve the quality of predictions. In this regards, the first 2500 (60%) observations are used for in-sample estimation. The last 1440 (40%) observations are employed for generating out-of-sample one-step-ahead recursive window forecasts.

***Loss functions***

In this analysis, several well-established loss functions are used to evaluate the forecasting accuracy of the volatility models. The key loss functions utilized include Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and Mean Absolute Percentage Error (MAPE), and quasi-Gaussian log-likelihood (QLIKE). These loss functions collectively assess model performance, enabling us to identify the most effective volatility forecasting approaches.[3]

## 3. RESULTS

### 3.1. In-Sample Model Comparison Analysis for BIST Range Data

This document presents an in-sample model comparison analysis for the BIST range data (high-low price difference of

[3] This study skips the formulas of these criteria to save some space. The formulas of these loss functions can be seen in the methodology section of Sahiner et al. (2023).

respective day). The analysis considers the eight well-known volatility models, including CARR, ECARR, ARFIMA, GARCH, EGARCH, AR, ARMA, and HAR. The primary aim is to evaluate model performances in terms of their coefficients, statistical significance, and overall model fit. Most similar studies focus on return-based data; however, this study utilizes range-based data, as it is shown to contain more information regarding market dynamics (Chou, 2005; Molnar, 2012; Chou, Chou, and Liu, 2015).

Table 1 summarizes the estimation results of various models for the BIST range data. The models exhibit varying degrees of explanatory power when fitted to the data. The Heterogeneous Autoregressive (HAR) model stands out with the highest R-squared value (0.3409), indicating its strong in-sample explanatory power. The HAR model's performance is supported by its significant coefficients on all time horizons—weekly, monthly, and daily—demonstrating its ability to capture multi-scale dependencies in the data.

**Table 1:** Full sample estimation results of volatility models.

| Parameter/Model | CARR | ECARR | ARFIMA | GARCH | EGARCH | AR | ARMA | HAR |
|---|---|---|---|---|---|---|---|---|
| **SQRT_RA_BIST(-1)** | 1.3009* | 1.3382* | - | - | - | - | - | - |
| **Constant** | 0.1110* | -0.1477* | 1.8927* | 1.6691 | 1.6836 | 1.9801 | 1.9805* | 0.3271* |
| **RESID(-1)^2** | 0.2575* | - | - | - | - | - | - | - |
| **GARCH(-1)** | 0.6773* | - | - | - | - | - | - | - |
| **D (frac. diff.)** | - | - | 0.2708* | - | - | - | - | - |
| **AR(1)** | - | - | 0.6373* | - | - | 0.5337 | 0.8681* | - |
| **MA(1)** | - | - | -0.5169* | - | - | - | -0.5169* | - |
| **Omega** | - | 0.1312* | - | 0.1509 | -0.2551 | - | - | - |
| **Alpha** | - | 0.2632* | - | 0.3130 | 0.3199 | - | - | - |
| **Gamma** | - | 0.8019* | - | - | 0.2055 | - | - | - |
| **Beta** | - | - | - | 0.6162 | 0.7812 | - | - | - |
| **ra_bist_week** | - | - | - | - | - | - | - | 0.2469* |
| **ra_bist_month** | - | - | - | - | - | - | - | 0.2692* |
| **ra_bist_1** | - | - | - | - | - | - | - | 0.3186* |
| **R-squared** | 0.2403 | 0.2509 | 0.3382 | 0.3145 | 0.3349 | 0.2850 | 0.3339 | 0.3409 |

**Note:** Asterisk * denotes rejections of null hypothesis at 5% significance levels, which show the significance of the coefficients.

The ARFIMA model, known for its ability to capture long memory or persistence in data, has an R-squared of 0.3382. It uses fractional differencing (D = 0.2708) to achieve a balance between short-term and long-term dependencies. However, despite its relatively strong fit, ARFIMA may be less interpretable in terms of economic impact compared to models such as EGARCH, which directly account for asymmetries in volatility. This is because Corsi (2009) considers the model as a mathematical trick, which does not have a clear economic interpretation.

Following closely, the EGARCH model also performs well with an R-squared of 0.3349. The EGARCH model includes asymmetric terms, such as the gamma parameter (0.2055), which captures the impact of negative shocks more effectively than the basic GARCH model. This characteristic makes the EGARCH model suitable for data with leverage effects, where volatility responds differently to positive and negative shocks (Nelson, 1991).

In contrast, the CARR and ECARR models focus on the autoregressive structure of conditional autoregressive range (CARR) processes. The ECARR model, an extension of the CARR, yields a slightly higher R-squared (0.2509) than the CARR model (0.2403). The significant coefficients in both models highlight their capability to capture autoregressive conditional range dynamics, although they surprisingly fall short in performance compared to HAR and GARCH/EGARCH.

The AR and ARMA models provide basic autoregressive representations with limited explanatory power. The AR model, with an R-squared of 0.2850, captures only the simplest dynamics, while the ARMA model incorporates moving average (MA) terms in capturing the complexity of the volatility structure, with an R-squared of 0.3339 (the second best fitted model after the HAR and EGARCH models).

In summary, the HAR, EGARCH, and parsimonious ARMA models demonstrate the best in-sample fit and predictive capability due to their ability to capture multi-scale dependencies and asymmetries,

respectively. Notably, HAR model captures multi-period dependencies. Such diverse modeling approaches allow us to leverage range-based data, which is known to contain more information than return-based data in capturing market fluctuations (see, e.g., Andersen and Bollerslev, 1998). The ARFIMA model is also notable for capturing long memory, making it relevant for persistent series, while simpler models (AR and CARR) demonstrate more limited explanatory power. This analysis suggests that models incorporating asymmetry or multi-scale dependencies are better suited for BIST range volatility data.

### 3.2. Out-Of-Sample Model Performances for BIST Range Data

Out-of-sample analysis is crucial in evaluating the robustness and predictive accuracy of volatility forecasting models. Unlike in-sample analysis, which assesses model performance on the data used for model estimation, out-of-sample testing measures a model's effectiveness on unseen data, providing a more rigorous test of its forecasting power. Table 2 presents a comparison of various volatility models based on out-of-sample forecasting performance using a recursive window approach, highlighting key metrics such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), and QLIKE. These metrics provide different perspectives on model accuracy, with lower values indicating better performance.

The HAR model demonstrates the best overall performance across most metrics, with the lowest MSE (1.213), RMSE (1.101), MAE (0.713), and QLIKE (1.641), indicating that it is the most reliable model in the out-of-sample setting. Its multi-scale approach, capturing daily, weekly, and monthly variations, likely contributes to its robustness in forecasting volatility more accurately than other models.

**Table 2:** Comparison of Volatility Models (Recursive Window)

| Models/Criteria | MSE | RMSE | MAE | MAPE | QLIKE |
|---|---|---|---|---|---|
| **Econometric Models** | | | | | |
| AR | 1.258 | 1.122 | 0.731 | 0.407 | 1.651 |
| ARMA | 1.229 | 1.109 | 0.715 | 0.387 | 1.643 |
| ARFIMA | 1.790 | 1.338 | 0.874 | 0.521 | 1.696 |
| CARR | 1.368 | 1.170 | 0.721 | **0.371** | 1.655 |
| ECARR | 1.345 | 1.160 | 0.725 | 0.384 | 1.653 |
| GARCH | 1.966 | 1.402 | 0.836 | 0.416 | 1.719 |
| EGARCH | 1.960 | 1.401 | 0.835 | 0.417 | 1.718 |
| HAR | **1.213** | **1.101** | **0.713** | 0.388 | **1.641** |
| ECON Fc | 1.379 | 1.174 | 0.725 | 0.391 | 1.652 |

**Note:** ECON Fc stands for the forecast combination of all econometric models in the table, which is an arithmetic average of all the models' forecasts.

Close contenders are the ARMA and ECARR models, both of which also perform well, particularly on the MAPE and QLIKE criteria. However, the ARFIMA model, which performed relatively well in-sample, falls behind in the out-of-sample evaluation, with higher MSE and RMSE values. This discrepancy highlights that while ARFIMA captures long memory effects in-sample, it may not generalize as effectively when applied to new data.

On the other hand, models such as GARCH and EGARCH, while traditionally used for volatility modelling, show relatively poor performance in this out-of-sample assessment. The high MSE, RMSE, and QLIKE values for these models suggest that their ability to capture conditional volatility is limited in this study, possibly due to their sensitivity to recent data, which may introduce bias when applied to unseen data.

The ECON Fc model serves as a balanced forecast by averaging individual model predictions, yielding lower volatility estimation errors

across various metrics compared to individual econometric models. It cannot outperform the best performers but provides a stable, averaged alternative.

## 4. CONCLUSION

This study highlights the importance of both in-sample and out-of-sample evaluation when assessing the performance of econometric models in volatility forecasting. In-sample analysis helps in estimating model parameters and understanding the initial fit of the model to the historical data. However, it is limited by its reliance on data used for model training, which can lead to overfitting and inflated performance metrics. As a result, models that perform well in-sample may not necessarily be reliable for forecasting in new, unseen data.

In comparing the models, the HAR, ARMA, and ECARR models demonstrated strong out-of-sample performance across multiple accuracy metrics, with HAR emerging as the best overall. These models' robustness can be attributed to their ability to capture different aspects of volatility dynamics, with HAR's multi-scale design being particularly effective in this context. Conversely, models like ARFIMA and traditional GARCH and EGARCH, which showed relatively stronger performance in-sample, did not generalize as effectively in the out-of-sample setting. This suggests that while these models capture specific features of volatility well in historical data, they may be less adaptable to new, unseen patterns, which is a limitation in practical forecasting applications.

The out-of-sample analysis emphasizes the necessity of independent testing to validate the real-world applicability of volatility models. Models that perform well in both in-sample and out-of-sample evaluations are more likely to offer reliable and robust forecasts, making them more suitable for practical use. This analysis supports the importance of including out-of-sample testing as a standard part of model validation, especially in fields where accurate forecasting is critical for decision-making.

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# CHAPTER 3

## EXPORT-IMPORT BASED MACROECONOMIC PERFORMANCE ANALYSIS FOR THE COUNTRIES OF THE ORGANIZATION OF TURKIC STATES

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## INTRODUCTION

Tourism plays a crucial role in driving the economic growth of developing countries. Due to its close links with industries like food and beverage, accommodation, and travel, it has both direct and indirect effects on a wide range of sectors. Additionally, tourism is a key contributor to a nation's economy, influencing macroeconomic indicators such as balance of payments, employment growth, workforce multiplier effects, economic development, and foreign exchange earnings (Arabacı, 2018). The impact of tourism on gross domestic product (GDP) has been a subject of interest for numerous researchers, such as Bozgeyik and Yoloğlu (2015), and Akdağ and Seçilmis (2018). They argue that the development of developing countries can be driven by tourism revenues. Moreover, it is highlighted that these countries have the potential to achieve high growth rates through tourism, which can, in turn, foster broader economic development (Akdağ and Seçilmis, 2018).

Macroeconomic indicators are essential tools for evaluating the overall economic performance of countries, encompassing factors such as economic growth, social welfare quality, employment rates, and the cost of living. Optimization methods that consider multiple criteria are crucial for producing more accurate evaluations. Multi-criteria decision-making approaches are frequently employed to assess and compare the macroeconomic performance of various countries. Numerous studies have examined the fluctuations in the economic strength of individual nations or groups of countries over different time periods, for example, Ordu (2023), Öztürk and Başar (2023), Ersoy (2023), Pınar et al. (2023), Coşkun (2022), Koşaroğlu (2021) and Oğuz et al. (2020). Unlike the existing literature, this study concentrates on assessing the macroeconomic performance of full member countries of the Organization of Turkic States taking into account foreign trade parameters.

This study seeks to rank the macroeconomic performance of the full member countries of the Organization of Turkic States based on their export-import activities. To achieve this, the performance of five full member countries (i.e., Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan, and Turkey) was analyzed using World Bank data for 2022. Data envelopment analysis (DEA) was employed, with exports and imports as input parameters, and gross domestic product (GDP) and total reserves as output parameters. The countries that were identified as efficient were then ranked against each other using the super-efficiency method.

The subsequent sections of the study outline the decision making units and input-output considered, as well as a thorough explanation of the methods used in the analysis. This is followed by a discussion of the findings and the study's conclusion.

## METHOD

### Data

This study aims to evaluate the macroeconomic performance of major member countries of the Organization of Turkic States (TDT) through foreign trade. The countries analyzed are Azerbaijan, Kazakhstan, the Republic of Cyprus, Turkey, and Uzbekistan, which are regarded as decision-making units. The countries' performance rankings were determined using data envelopment analysis, focusing on the input-output relationship. Import and export were considered as input parameters, while gross domestic product (GDP) and total reserves were the output parameters. The 2022 data for these variables were obtained from the World Bank database (World Bank Open Data, 2024). Figure 1 illustrates the data pattern of the countries considered as decision making unit in this study.

**Table 1:** Descriptive statistics of the input and output variables (values in million US Dollar). SD: Standard deviation

| Variables | | Mean | SD | Maximum | | Minimum | |
|---|---|---|---|---|---|---|---|
| | | | | Country | Value | Country | Value |
| Input | Export | 103.41 | 127.00 | Turkey | 350.00 | Kyrgyz Republic | 10.61 |
| | Import | 102.64 | 142.77 | | 386.30 | | 3.63 |
| Output | GDP | 260.94 | 330.52 | | 907.12 | | 12.13 |
| | Total Reserves | 41.74 | 43.00 | | 123.74 | | 2.80 |

Descriptive statistics are provided in Table 1, showing the mean, standard deviation, minimum, and maximum values for four variables. Turkey records the highest value for all variables, whereas the Kyrgyz Republic has the lowest values. In addition, Table 2 displays the correlation coefficient values between the input and output variables. A very high correlation is observed among all variables. The strongest correlation is between GDP and import, while the weakest correlation is between total reserves and export.

**Table 2:** Correlation Coefficients of Parameters

| | Export | Import | GDP | Total Reserves |
|---|---|---|---|---|
| **Export** | 1.0000 | 0.9879 | 0.9976 | 0.9654 |
| **Import** | | 1.0000 | 0.9943 | 0.9775 |
| **GDP** | | | 1.0000 | 0.9783 |
| **Total Reserves** | | | | 1.0000 |

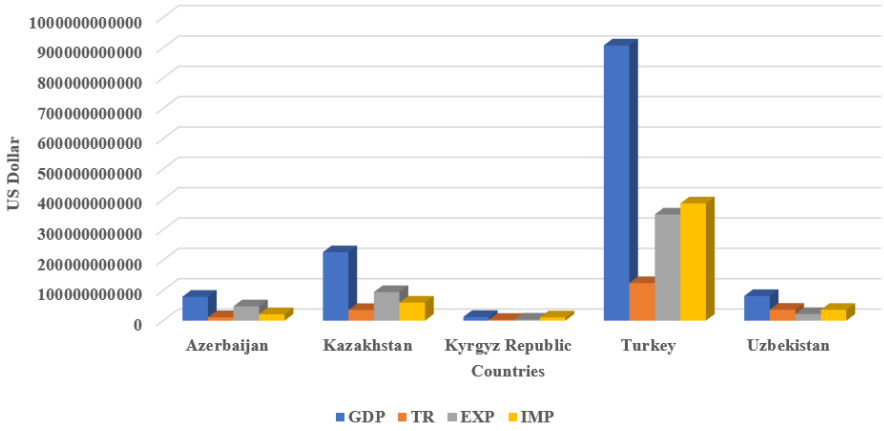


**Figure 1:** The Data Pattern of Countries

### Data Envelopment Analysis (DEA) Method

The Data Envelopment Analysis (DEA) method has been extensively applied across various research areas, with several extended versions developed. For instance, the DEA method using the CCR (Charnes-Cooper-Rodes) model was developed by Charnes et al. (1978), and the DEA model incorporating the BCC (Banker-Charnes-Cooper) model was introduced by Banker et al. (1984). The DEA method is an efficient tool for assessing the relative effectiveness of decision-making units (Ordu and Fedai, 2023). The standard DEA model for the first DMU in this study is outlined as follows. The objective function (1) seeks to maximize the ratio of output to input. Constraint (2) adjusts the input related DMU to be equal to 1. Constraint (3) ensures that the ratio for each DMU does not surpass 1. Constraints (4) and (5) require the variables to be positive.

$$Max\ \theta = \mu_1 y_{11} + \mu_2 y_{21} \quad (1)$$

$$v_1 x_{11} + v_2 x_{21} = 1 \quad (2)$$

$$\mu_1 y_{1j} + \mu_2 y_{2j} \leq v_1 x_{1j} + v_2 x_{2j} \quad (3)$$

$$v_1, v_2 \geq 0 \quad (4)$$

$$\mu_1, \mu_2 \geq 0 \quad (5)$$

where $\mu_i$ presents the weight for output i, $v_j$ means the weight for input j, $y_{mn}$ is the value for output m for decision making unit n, and $x_{jn}$ denotes the value for input j for decision making unit n.

The DEA method calculates the maximum efficiency scores for decision making units (DMUs) as 1. However, DMUs with the maximum efficiency score can still be ranked using the super efficiency method. To achieve this, the constraint (see Eq. 3) associated with the relevant DMU must be removed.

**FINDINGS**

This study examines the macroeconomic performance of five full member countries of the Organization of Turkic States using the data envelopment analysis (DEA) method, which is a nonparametric approach. Five data envelopment analysis models were developed by assessing GDP and total reserve parameters in relation to export and import parameters. The DEA method, based on linear programming, was developed using the output-oriented CCR model, aiming to keep inputs constant and maximize outputs. The initial analysis results, presented in Table 3, revealed that three countries were inefficient decision-making units, with an effectiveness rate of 40%. It was observed that Turkey, despite having the highest GDP and total reserves, was unable to generate sufficient outputs relative to its input levels. On the other hand, Azerbaijan and the Kyrgyz Republic were relatively more efficient. The rankings of the other two efficient countries among each other were determined using the super-efficiency method. In this approach, the super-efficiency score for each decision-making unit was calculated by removing the constraint that the sum of its weighted outputs must be less than the sum of its weighted inputs. The final results, shown in Table 4, indicated that Uzbekistan was the most efficient country.

**Table 3:** The summary of the data envelopment analysis modelling

| | |
|---|---|
| Maximum efficiency score | 1.0000 |
| Minimum efficiency score | 0.8593 |
| Number of efficient DMUs | 2 |
| Total number of DMUs | 5 |
| % of efficient DMUs | 40.00 |

**Table 4:** The results of the decision making units

| **Decision Making Units (DMUs)** | **Efficiency Score** | **Super Efficiency Score** |
|---|---|---|
| Azerbaijan | 0.9754 | - |
| Kazakhstan | 1.0000 | 1.2094 |
| Kyrgyz Republic | 0.9023 | - |
| Turkey | 0.8596 | - |
| Uzbekistan | 1.0000 | 2.9937 |

## DISCUSSION AND CONCLUSION

This study analyzed the macroeconomic performance based on the export and import of the full member countries of the Organization of Turkic States. After identifying the efficient countries, their super efficiency scores were calculated. Among the five countries, Uzbekistan was found to be the most efficient. There are some limitations to the study. For instance, only the full member countries were evaluated, while observer member countries could have been included as well. Additionally, the analysis was based solely on data from 2022. A broader study period could be chosen for year-over-year comparisons. Future research could address these limitations by conducting a more comprehensive analysis. Furthermore, a comparative analysis could be carried out using other multi-criteria decision-making approaches. Performance analysis could also be explored in a new dimension by assigning different weights to the criteria using subjective weighting and performing sensitivity analysis with these weights.

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# CHAPTER 4

# SCOPE AND INTERACTION BETWEEN SCIENCE AND RELIGION

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## 1. INTRODUCTION

Science and religion are one whole and interrelated science, because knowledge cannot be separated from science based on the Al-Quran and Hadith which there is no doubt in it. But there are some scientists who say that science and religion stand in their respective positions, because the field of science is very dependent on empirically supported data to ensure the truth of a science. While religion is inversely proportional to science, religion can be said to be able to accept something that is still abstract and uncertain based only on variables that are tangible from belief. Therefore, religion and science must stand side by side with one another.

Education in Indonesia is currently still reaping problems in the process of development is still not broad and abstract and even far from real life, so that students have difficulty in understanding the values that exist in learning. Education in Indonesia is in a low order because it does not see the learning process but sees the output so that when students apply it, there is a discrepancy between theory and the world of work. Contextual processes in learning can be done with interactive learning. Interactive learning can be packaged with topics.

This is because at this time there is a lot of debate in the name of science and religion, even in foreign countries there are those who have considered that science is a separate religion apart from the religion that has existed in ancient times. So with this paper can add to our insight into the basic concepts, characteristics of science and religion, also learn a little about the objectives and scope covered by science and religion.[2]

## 2. METHODE

This research uses a literature review method which is carried out by collecting, reviewing and analyzing various relevant literature

[2] . Baharuddin, 'Relasi Antara Science Dengan Agama', *Al-Hikmah*, 8.2 (2015), pp. 71–85, doi:10.24260/al-hikmah.v8i2.81.

regarding the concepts, characteristics, objectives and scope of science and religion from books, journals and scientific articles.

## 3. RESULT AND DISCUSSION

### 3.1 CONCEPT SCIENCE AND RELIGION

Science and religion, according to Cuk Ananata Wijaya (2006: 175) are human achievements, which in essence, arise from the same spirit - so that humans can survive. In other words, science and religion were born out of necessity, namely to answer the various challenges that humans always face in their existence. On the other hand, science has a relative truth value, because it depends on how human reasoning and experience in the process of searching for the essence of truth. Therefore, according to Kuswanjono, science is often said to be anthropocentric; which places truth in human reasoning and experience (2016: 303). Science and religion, according to Arqom Kuswanjono, initially did not experience problems before Copernicus (1473-1543) and Galileo Galilei (1564-1642) presented their scientific findings about the center of the universe, namely that the center of the universe is the sun (heliocentrism theory), not the earth (geocentrism theory); as believed by the church for centuries.[3]

Since then, the relationship between science and religion has always been interesting to discuss because it often creates problems that are never finished and obsolete, both in the ontological, epistemological and axiological realms (2010: 1). Scientific problems in the West, especially the issue of the relationship between science and religion, continued and gained a second momentum, after the feud between the church versus Copernicus and Galilei, which was supported by scientists, when in 1870 Max Muller surprisingly stated that the relationship between science and religion was not the same as that between religion and the church.[4]

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[3] Syarif Hidayatullah, 'Konsep Ilmu Pengetahuan Syed Hussein Nashr: Suatu Telaah Relasi Sains Dan Agama', *Jurnal Filsafat*, 28.1 (2018), p. 113, doi:10.22146/jf.30199.

[4] .

### 3.2 CHARACTERISTICS OF SCIENCE AND RELIGION

Science is closely related to the nature of science (NoS). Science refers to the characteristics, activities and scientific attitudes carried out by scientists. The characteristics of science can be subjective, tentative, there is a difference between law and theory, empirical, and has a closeness to social culture. The activities of scientists in obtaining science are carried out by the process of scientific method, investigation, observation and inference, scientific study, creative thinking. Therefore, in studying science must have a scientific ethos / scientific attitude (Tursinawati & Widodo, 2019). Thus, science can be interpreted as an aspect to solve problems with a process of scientific methods and scientific research to obtain a conclusion of the knowledge studied, and instill a scientific attitude in the process of obtaining this knowledge.

In most verses of the Qur'an, the concept of knowledge absolutely appears in its general meaning, such as surat al-Zumar (39) verse 9 which reads “Say: Are those who know equal with those who do not know”. The same thing in QS Albaqarah (2) verse 31, QS Yusuf (12): 76; QS Anfal (16): 70 (Fakhri, 2010). He also explained that about 750 verses, which is about one meter of the Qur'an, encourage believers to study the universe by contemplating and investigating it using their intellect in order to understand the universe.[5]

### 3.3 THE PURPOSE OF SCIENCE AND RELIGION

The purpose of this religious and general science is an attempt to dissolve the polarism between religion and science caused by the mindset of closure between religion as an independent source of truth and science as an independent source of truth. This is because as explained at the beginning of the introduction - their existence is mutually necessary and complementary. As felt by countries in the Western part of the world that are known to be sophisticated and

[5] Hidayatulloh Hidayatulloh, ‘Realasi Ilmu Pengetahuan Dan Agama’, *Proceedings of The ICECRS*, 1.1 (2016), pp. 901–8, doi:10.21070/picecrs.v1i1.627.

advanced in the field of science and technology, they are moved and begin to realize the need for a review of the dichotomy of science that is detached from the values they have initially developed, especially religious values. Religion is very wise in organizing relationships with nature, which is the ecosystem where humans live. Considering the urgent capacity of religion in human life, religion should be developed as the basic value of science development. Because the development of science without being accompanied by the progress of its religious values, causes a gap, a chasm. As a result of leaving religion, science arrogantly exploits nature resulting in various ecosystem damage (Roswantoro, 2007).

### 3.4 SCOPE OF SCIENCE AND RELIGION

Science and religion are often considered to have different scopes, but some views show that there is a meeting point between the two. In the teachings of Islam, there is a view that religion and science are compatible and do not contradict each other. Some research also shows that there is a constructive relationship between science and religion, where both can support each other. Ian G Barbour, a thinker, says that if there is a conflict between science and religion, then dialog and integrity between the two can be a solution. In this context, science and religion have different fields of study, where science focuses on understanding the cause-and-effect relationship of natural phenomena, while religion focuses on the metaphysical. However, this view does not rule out the possibility of interdisciplinary collaboration to reduce the clash between science and religion. Therefore, even though science and religion have different focuses, there are efforts to find common ground and collaboration between the two.[6]

## 4. CONCLUSION

The conclusion is that while science understands cause-and-effect relationships among natural phenomena, religion's goal is to

[6] Martha Mulyani Kurniawan, 'Dilema Sains Dan Agama', *Alucio Dei*, 4.1 (2022), p. 1, doi:10.55962/aluciodei.v4i1.14.

follow a way of life within a larger framework of meaning. Science and religion are often considered to have different scopes, but some views point to a common ground between the two. In the teachings of Islam, there is a view that religion and science are compatible and do not contradict each other. Some research also shows that there is a constructive relationship between science and religion, where both can support each other.

In this context, science and religion have different fields of study, where science focuses on understanding the cause-and-effect relationships of natural phenomena, while religion focuses on the metaphysical. Therefore, although science and religion have different focuses, there are efforts to find common ground and collaboration between the two.

Conclusion Religion is a belief system that comes from God must be accepted with confidence, the truth here will be a reference for other truths. Religion and science are very interrelated because people who have a lot of knowledge if without being supported by religion all knowledge will not bring benefit to the people. Science can be interpreted as a science that aims to seek truth based on facts or natural phenomena. Science and religion are two different entities, but both have a very important role in human life. Religion and Science are not always in conflict and incompatibility. Many scientists are trying to find a connection between the two. The Qur'an is not a book of science, but all knowledge about science should be referred to the Qur'an. The Qur'an has explicitly explained everything that exists and occurs on this earth and it is with science that we prove it. The integration of religion and science is a very good discourse, because it tries to connect religion and science, which have been considered as things that cannot be found. Religion and science are not something that is separated, instead we must look for the relationship between the two. Religion and science are actually two things that have the same entity. The proof is that many things researched by science are in line with what is confirmed by religion. In fact, long before the research, religion had already explained it in the holy book. Therefore, religion and science

are two things that are interconnected with each other. Religion needs science, and science also needs religion.[7]

[7] Muhartini Muhartini and Amril Amril, 'Integrasi Agama Dan Sains Dalam Perspektif Abdussalam Solutif-Sintesisnya Terhadap Problema Pendidikan Islam', *SOKO GURU: Jurnal Ilmu Pendidikan*, 3.2 (2023), pp. 01–14, doi:10.55606/sokoguru.v3i2.2098.

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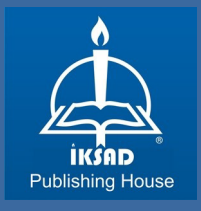


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