Volume 25, Special Issue **Print ISSN: 1099 -9264**
Online ISSN: 1939-4675

AN ARIMA FORECASTING APPROACH TO EVALUATE THE SCENARIO OF MALE AND FEMALE HIGHER EDUCATION

Uzma Khan, Prince Sattam bin Abdulaziz University

ABSTRACT

Objectives: *This study is based on predicting the scenario of higher education systems, particularly graduates, in terms of gender. The objective is to evaluate both graduates' consequences on economic development through the unemployment rate in Saudi Arabia.*

Methods/Analysis: *This study used the ARIMA forecasting model (p, d, q) on yearly data from 1996-2018 to forecast for another seven years, i.e., till 2025 to evaluate the graduates and their unemployment.*

Findings: *The ARIMA forecasting indicates that female graduates have outnumbered male graduates, and the high number of female graduates and their unemployment rate has presented a threat to policymakers.*

Novelty/Improvement: *This paper is an effort to shed light on the Kingdom's education policies and their impact on economic development by studying the unemployment rate to create a concrete policy for the next generation.*

Keywords: Female Graduates, Male Graduates, ARIMA, Saudi Arabia

INTRODUCTION

The Saudi government had made tremendous efforts to decrease the gender gap at each level of education since 1959, which was when the government opened the first public schools for girls. Prior to this, in 1953, the Kingdom had established the Ministry of Education exclusively for male students. In 1960, the government established an organization responsible for girls' education under the General Presidency for Girls' Education (GPGE). The Kingdom took the benchmark decision to reduce the gender parity in education and called for the merger in 2002. The Ministry of Education has been responsible for reducing gender inequality in education ever since.

The primary impediment in decreasing gender inequality is the orthodox ideology/attitude according to which Saudi girls are not allowed to leave their parents' home until they get married or unless they have male guardianship. This made attending university nearly impossible for girls who lived in towns or villages that lacked schools or universities. To tackle this issue, the Ministry of Education opened schools and universities throughout the country, inspiring college students to pursue a university degree.

To encourage a knowledge-based economy, King Abdullah announced a research initiative program for higher education called "Aafaq" or Horizons in 2006. The program aimed to enable the country to compete with the world in the field of high-technological innovation. It is also an initial step toward lowering the dependence on an oil-based economy. In this regard,

King Salman stated that "Education in Saudi Arabia is the cornerstone through which we can achieve our nation's aspirations towards progress and advancement in sciences and knowledge." On the continuation of education, Crown Prince Mohammad Bin Salman added, "Women's work is vital. Women make up half of society, and we want it to be a productive half."

Alwedinani in her thesis, said that female education in Saudi Arabia was supervised by the broad role for girls' education established under the governor of the conservative ministers. The main aim behind this choice was to ensure that women's education fulfils the purpose for which it was established. However, it was discovered that the Saudi state had put conservative ministers in charge of women's education for two reasons. First, there was a certain apprehension of disapproval from other conventional ministers who dominate public opinion. Second, there was a fear that the classical roles of women, i.e., mothering and reproduction, might disappear (Alwedinani, 2016).

The huge increase in the number of girls' schools managed to raise the necessity for skilled female instructors to impart education. Riyadh College of Education was established in the early seventies. In 1967, King Abdul-Aziz University opened its centres, and it permitted girls to study subjects such as education, art, home economics and medicine. Around the same time period, Um Al-Qura University in Makkah permitted girls to study all subjects excluding Islamic Studies and law. The Centre for Women, established by King Saud University in 1976, allowed girls to study subjects such as languages, geography, and history. Following this, most of the King Saud colleges introduced their centres especially for girls to provide them with the chance to study the law, computer sciences, business, economics, pharmacy, medicine, and nursing (most subjects excluding architecture and engineering). In the late seventies, the University of King Faisal in Dammam opened centres for women for departments such as home economics, medicine, education, and nursing (AL-Mohsen, 2000). Eight universities and 61 colleges were built for girls by 1998. At this point, the University of Imam Mohamed bin Saud in Riyadh, despite being a religious university, opened its doors to female students. Following this, King Khalid University, located in the south of Saudi Arabia, began giving female students opportunities in different fields, including "computer sciences, biology, and English" (Hamdan, 2005). The King Fahd University of Petroleum and Minerals is one university that has not opened a centre for girls. The reason behind this could be the nature of its activities. The Petroleum and Minerals industry mainly focuses on oil extraction and refining, and this work is traditionally done by men. Despite the signs of progress made in the area of girls' higher education, there are still significant constraints on Saudi females regarding the subjects they can study. Even today there are several subjects that Saudi women cannot study, such as chemical engineering, politics, petroleum or aviation. As a result of these restrictions, many families still prefer to send their daughters to other developed countries to study these courses (Hamdan, 2005). A milestone was achieved when oil flourished in the early Seventies and had a crucial impact on female education in Saudi. Consequently, a number of schools and colleges opened for females, leading to the hiring of many teachers from the Arab world.

It is only education that has helped the Saudi female population nurture their expertise, develop acquaintances, and understand their rights (Al-Rawaf, 1991). Even with the increasing number of Saudi women in the workforce, there is a mutual conviction among the Saudi population that home is the appropriate place for women. According to them, the primary role of a female is sustaining and raising children. Thus, Saudi women continue to face difficulties and challenges in seeking education after schooling or finding a line of work (Hamdan, 2005).

In 2010, Doumato discussed women's rights in the Middle East and North Africa, "The reason for instructing a young lady is to bring her up in a legitimate Islamic manner to play out her obligation in life to be an ideal and fruitful housewife and great mother." Regardless of this, a couple of years back, the number of female students graduating from Saudi colleges surpassed the number of male graduates (Baki, 2004).

The Ministry of Education under the KSA government reserved two Universities, i.e., Prince Noura bin Abdur Rahman University in Riyadh and Iffat University in Jeddah for females to obtain higher education. Two universities reserved for male students include King Fahd University of Oil and Petroleum and The Islamic University. The remaining universities have provisions for male and female education but separate campuses.

According to Al-Saif, "The current education structure limits women's access to the labour market through restrictions on certain areas of study and access to a wider scope of jobs, such as engineering, media, and architecture." Women continue to face restrictions that affect their educational choices (AL-Saif, 2013).

The Saudi government has financed its higher education programmes for women. Princess Nora Bint Abdul Rahman University consequently proposed courses in science that were formerly limited to male students, which led to continuous improvement in the state of women's higher education prospects. However, the Kingdom is still lagging behind in healthcare services, i.e., an acute shortage in the nurse workforce. According to Almajwal, in 2013, the total number of Saudi nurses comprised 25 per cent of the total nurse workforce in the Kingdom (Al Majwal, 2016).

AlMunajjed expressed that, notwithstanding all the endeavours made by the Saudi government, the female students living in the northern and southern regions of the nation have fewer opportunities to obtain advanced education in comparison with students from other regions (AlMauajjed, 2009). This is because of the dispersion of colleges and their branches among locales and areas and the hindrances to traditional culture. There has been a steep increase in interest in advanced education due to an increase in the number of secondary school graduates each year (Yahya Al Alhareth, 2005).

The Ministry of Higher Education, during the rule of King Abdullah, introduced the King Abdullah Scholarship Program stating that "Knowledge is the foundation of the renaissance of nations; for this reason, the government of the Kingdom of Saudi Arabia has given special attention to this sector." The vision aims to prepare distinguished generations for a knowledge society built upon a knowledge-based economy and goals are ambitious and challenging" (Ministry of Higher Education).

Although there has been a significant rise in the demand for public universities, as described in the Sixth Development Plan of 1995-2000, the Saudi government authorized the re-foundation of private universities (Jammjoom, 2012). The Ministry of Planning announced in 2009 that a yearly development pace of two per cent was recorded somewhere in the range of 2004 and 2008 for secondary school graduates. Additionally, it highlighted the requirement for private advanced education establishments in Saudi Arabia to camouflage the gap between the supply and demand in advanced education. As per them, there are currently 41 private schools and ten colleges in Saudi Arabia. Two of these schools are for females only while the rest are for both (Ministry of Higher Education).

In line with this, the Minister of Labour and Social Development of Saudi Arabia stressed that Saudi Arabia's Vision 2030 based on three main axes: a vibrant society, a prosperous economy, and an ambitious homeland. According to him, "Saudi women are an important

element of our strength. We will continue to develop talents and invest their energies to enable them to obtain appropriate opportunities to build their future and contribute to the development of our society and economy". Vision 2030 states that "Saudi Women are an important component of our strength, constituting more than 50 per cent of the total number of University graduates. We will continue to develop their talent, invest their energies, and enable them to have the right opportunities to build their future and contribute to the development of our society and economy".

According to Smith and Abouammoh, about three decades ago it was possible to describe Saudi Arabia as "the society of men" because men monopolized professional work and all kinds of political, economic, and social activity and authority. Now, this image has started to change as women are carrying out essential roles in all spheres (Smith, 2013).

Chang explored the Taiwan gender parity based on the unprecedented expansion of the stages of the higher education system. He attempted to evaluate gender parity and explored potential gaps at each level of the system using a quantitative longitudinal approach that determined the effects of the system expansion. He also applied an ARIMA model to predict the Becker's coefficient of discrimination for the future forecast. His findings revealed that the number of male and female undergraduates would become equal in the next decade. Male students still preferred master's and doctoral program enrollment, so he came to the final conclusion that the disparity showed a declining trend (Dian-Fu, 2018).

Chang and Hu conducted a study on the effects of system expansion on faculty gender parity in the selected higher education system using a transfer function and ARIMA. ARIMA was used to predict the future trend and build the fittest model to interpret the trends of Becker's coefficient of discrimination (D) in the next decade. They found that the higher education system favored male faculty but that gender parity would reduce over the next decade (Dian-Fu, 2019).

Chen was of the opinion that education can act as a medium for social mobility and gender equality. She conducted a study in Japan and Korea to evaluate the impact of the expansion of higher education on gender parity in the higher education system and the labor market. She found that both nations were moving closer to gender equality in higher education and suggested that more females in the higher education system resulted in greater female participation in the labor market. In Korea, the female employment rate has remained low due to its traditions and customs. However, the scenario is not the same in Japan, hence the male unemployment rate will be higher and more severe than in Korea (Tien-Li, 2020).

The present study intends to generate forecast trends for higher education systems based on gender and the impact of higher education outcomes on unemployment generation using the Auto-Regressive Integrated Moving Average (ARIMA) Box-Jenkins time series method. It uses consistent historical time series data from 1996-2018 to evaluate ARIMA models and predict trends for the next seven-year period through four essential criteria: Akaike criterion (AIC), Schwarz Bayesian criterion (SBC), maximum likelihood, and standard error.

MATERIALS AND METHOD

The econometric model used in this study was derived from (Fattah, 2018) where the authors explained an ARIMA model in depth and categorized an ARIMA model as a (p, d, q) wherein p refers to the number of autoregressive terms, d refers to the number of differences, and q refers to the number of moving averages in a model.

The autoregressive model (p) assumes that Yt is a linear function of the preceding values as presented in the equation given below:

$$Y_t = \alpha_1 Y_{t-1} + \varepsilon_t$$

Where $\mathcal{E}$ represents the random shock and α1 represents the coefficient of self-regression.

The integrated process (d) is the time series determined by the cumulative consequence of an activity that belongs to the integrated processes class. It is the archetype of the nonstationary series, where first-order differentiation assumes that the difference between two successive values of Y is constant (Fattah, 2018).

The equation given below outlines an integrated process:

$$Y_t = Y_{t-1} + \varepsilon_t$$

Where $\mathcal{E}$ t is the random perturbation of white noise.

The moving average process (q) is a linear combination of the current disturbance with one or more previous perturbations. The moving average order shows the number of previous periods embedded in the current value [18] and can be expressed in an equation as follows:

$$Y_t = \varepsilon_t - \theta_1 \varepsilon_{t-1}$$

Finally, the predicted model equation can be represented as follows:

$$Y_t = \theta + \alpha_1 Y_{t-1} - \theta_1 \varepsilon_{t-1} + \varepsilon_t$$

Where θ is the coefficient.

To better accept and amplify the study, secondary data on the percentage of unemployment for both genders was collected from the World Bank (World Bank, 2019). The numbers of graduate students from both genders was collected from the Saudi Arabian Monetary Agency (SAMA) (SAMA, 2019) (yearly data from 1996-2018).

RESULTS AND DISCUSSION

Since the beginning of the study, the data revealed that female graduates (FGR) are always ahead of male graduates (MGR), as depicted in Appendix E. Contrarily, the number of unemployed females (FU) is consistently higher as compared to unemployed males (MU). In 1996, the number of female graduates was 17172 and the unemployment rate was 7.118 percent while the number of male graduates was 14639 and the unemployment rate was 5.72 percent. In 2018, the number of female graduates reached 117329 and the unemployment rate among females reached 22.488 percent while the number of male graduates rose to 77863 and the unemployment rate was only 2.931 percent. Hence, there was an overall increase in the number of female graduates by 14.64 percent while the number of male graduates reached 18.8 percent of their total. On the other hand, the unemployment rate in females reached 22.5 percent, whereas the unemployment rate in males dropped to only 3 percent, which indicates the approach towards male mindset policies.

The ARIMA forecasting techniques evaluated the trends of higher education and their associated effects on unemployment. The ARIMA result is delineated in Table 1, where FGR-F refers to the female graduate forecast, MGR-F is the male graduate forecast, FU-F is the female unemployment forecast, and MU-F is the male unemployment forecast. According to the ARIMA forecast, female unemployment will increase from 22.5 percent to 23.7 percent by 2019, while the male unemployment rate will drop to nearly 1 percent, though it is not alarming for policymakers. The government must focus on the female graduates' employment rates and their outcomes arising from unemployment as, by the end of 2025, the female unemployment rate will reach about 33 per cent, which poses a threat to the country that aspires to become one of the wealthiest techno-global economies in the world.

Table 1
ARIMA FORECAST

Year	FGR-F	MGR-F	FU-F	MU-F
2019	129129	84562	23.7	1.02
2020	142228	91892	25	1.07
2021	156781	99919	26.3	1.076
2022	172959	108714	27.72	0.997
2023	190956	118357	29.78	0.915
2024	211012	128934	30.78	0.857
2025	233281	140545	32.43	0.798
ARIMA	(0,1,0)	(0,1,0)	(0,1,0)	(4,1,3)

Source: Author's computation on E-views 10

Based on the above ARIMA forecasting analysis, it can be said that the Kingdom needs to implement a new and diverse tactic that accommodates both genders, predominantly females. Women can play a vital role in the formulation of the modern stages of development and actively participate in developing the Kingdom as a knowledge-based country. As Rask stated, "In an increasingly technical society, any gaps in the supply of and demand for technically trained workers and the continuing imbalances in the gender and race composition of these workforces present significant social and economic problems" (Rask, 2010).

CONCLUSION

The aim of this study was to forecast FGRs, MGRs, and their association with the unemployment rate of Saudi Arabia for the next seven years, i.e., from 2019-2025, as predicted by ARIMA forecasting. ARIMA forecasting results revealed that the female unemployment rate was critical as the number of female graduates outnumbered male graduates but had fewer employment opportunities. Therefore, it is time for Saudi Arabia to focus on women's role in contributing to the country's economic development.

"Economic development is another trend that is affecting Saudi's education" (Hamdan, 2013). Thus, the Kingdom encourages educated young Saudis with incredible marketing abilities and a capacity for innovation and entrepreneurship. The Saudi Government has made tremendous efforts in the field of women's education, and if it continues doing so, it will greatly enhance its human development index. However, the government has to now focus on creating employment within a safe arena for its female workforce.

Women's commitment to the work market and the usage of the neighborhood females' workforce will establish women's role in the Saudi market to advance the economy. The advanced education framework in Saudi Arabia needs to receive a benchmark procedure for managing the difficulties colleges are facing so they can fulfil the rising need of the economy. This will help accomplish the vision of the crown sovereign Muhammed bin Salman for the realm, i.e., the SDGs of 2030.

While no one can deny that the Kingdom of Saudi Arabia, through their SDGs and Vision 2030, has emphasized women empowerment, only time will demonstrate its outcomes on women's status in the Kingdom of Saudi Arabia.

REFERENCES

Alwedinani, J.A. (2016). "*Gender and subject in higher education in Saudi Arabia*." University of York, Department of Education.

AL-Mohsen, M. (2000). "*An exploratory study on the views of modernization of educated saudi women*." Unpublished doctoral thesis, University of Pittsburgh, United States.

Hamdan, A. (2005). "Women and education in saudi arabia: challenges and achievements." *International Education Journal, 6*(1), 42-64.

Al-Rawaf, H., & C. Simmons. (1991)."The education of women in Saudi Arabia." *Journal of Comparative Education 77*, 187-295.

Baki, R. (2004). "Gender segregation education in saudi arabia: its impact on social norms and the saudi labour market." *Education Policy Analysis Archives, 12*(28).

AL-Saif, M. (2013). "*Gender segregation in higher education*." Arab News. http://www.arabnews.com/gender-segregation-higher-education. Retrieved February 2013.

Al Majwal.(2016). "Stress, Shift Duty, and Eating Behaviour among Nurses in Central Saudi Arabia." *Saudi Med Journal, 37*(2).

AlMauajjed, M. (2009). "*Women's education in saudi arabia: the way forward*." New York, Booz & Company Inc.

Yahya Al, A. (2005). "Review of women's higher education in Saudi Arabia." *American Journal of Educational Research, 3*(1), 10-15.

Ministry of Higher Education. www.mohe.gov.sa

Jammjoom, Y. (2012). Understanding private higher education in saudi arabia - emergence, Development and Perceptions. Doctoral thesis, Institute of Education, University of London.

Al-Ghafis, A. (2018). *Vision 2030 based on three axes, Saudi women important element of Kingdom's strength: Minister*, Arab News. https://www.arabnews.com/node/1313366/saudi-arabia. Retrieved May 31, 2018

Dura Hospitality. (2019). *Saudi women… empowerment and ambition lead to professional excellence*, https://www.dur.sa/en/saudi-women-empowerment. Retrieved July 2019.

Smith, L., & Abouammoh. A. (2013). "Higher education in saudi arabia: achievements, challenges and opportunities." *Springer Netherlands, 1*(40), 1571-037.

Dian-Fu, C. (2018). "Effects of higher education expansion on gender parity: a 65-year trajectory in Taiwan." *High Education, 76*, 449–466.

Dian-Fu, C., & Hui, H. (2019). Determining system expansion on faculty gender parity by using arima." *ICIC Express Letters Part B: Applications, 11*(3), 221-227.

Tien-Li, C. (2020). "Forecasting gender parity in higher education system and labor market in japan and korea." *International Journal of Social Science and Humanity, 10*(4).

Fattah, J., Ezzine, L., Aman, Z., Moussami, H., & Lachhab, A. (2018). "Forecasting of demand using the arima model." *International Journal of Engineering Business Management, 10*, 1-9.

World Bank. 2019. www.data.worldbank.org

SAMA. 2019. www.sama.gov.sa

Rask, K. (2010). "attrition in the STEM fields at a liberal art college: the importance of grades and pre-collegiate preferences." *Economics of Education Review, 29*(6), 892-900.

Hamdan, A. (2013). *"An exploration into 'private' higher education in saudi arabia: improving quality and accessibility?"* The ACPET Journal for Private Higher Education 2(2).