

GENDER DISTRIBUTION IN UNDERGRADUATE FIELDS OF STUDY: AN EMPIRICAL INVESTIGATION ACROSS FOUR TIME PERIODS IN EGYPT

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Abstract

Higher education is very important in today's modern society. To promote equal opportunity to access higher education, several countries, including Egypt, have long implemented egalitarian policies to allow equitable access to it. Some studies, examining trends of gender bias in higher education, provided evidence of improvement during the past few decades. This enhancement, however, failed to reduce the sex segregation in the labour market, and hence returns to education. Many studies attributed this paradox to gender differentiation by field of study, particularly along the humanistic-scientific dimension. Barone (2011), however, suggested the care-technical dimension to contribute, as a second dimension, in the explanation of the association between gender and field of study. Since no research on this important topic has been conducted in Egypt, the current study aims to investigate gender distribution by field of study in higher education in Egypt since the 1952 revolution. To achieve this objective, the study first reviews prior literature to identify the trend in female higher education enrolment in the Egyptian context across four historical time periods characterized by significant changes in the social, economic, and educational circumstances. Next, the study investigates gender bias in higher education across the four time periods and nine fields of study using a sample of 3826 respondents from the latest round of the Egypt Labour Market Panel Survey (ELMPS 2012). Multinomial logistic regression results suggest that the expansion in higher education enrolment as a result of the adopted egalitarian policies were accompanied with an increase in female enrolment percentage since the 1952 Egyptian revolution. Moreover, there is a trend toward gender parity for most fields of study because the degree of gender imbalance varies considerably within the humanistic-scientific dimension, providing some support for the argument made by Barone (2011). A supplementary analysis investigates the gender distribution by faculty social prestige in Egypt. Results contend that females are becoming over-represented in higher education in Egypt but do not hold an advantage in the high prestige faculties.

Keywords: Higher education, gender segregation, fields of study, Egypt.

1 INTRODUCTION

Higher education is very important in today's modern society. It promotes social and economic development by supporting the job market with the knowledge, skills, and experience of the graduates, who benefit from higher salaries and intrinsic rewards. In some countries, such as Egypt, a secondary school diploma does

not provide students with the skills required by the labour market. It is assumed, however, that these skills can be acquired by enrolling in higher education. Consequently, the importance of equal opportunity to access higher education has been emphasized, and in the twentieth century many countries, including Egypt, have implemented egalitarian policies (national examinations, expanded access, elimination of fees, etc.) to expand the higher education system and to allow access to higher education regardless of race, gender, socio-economic status, or religion.

Several studies, conducted in different settings and across different countries, have assessed the effect of higher education expansion policies on inclusiveness and have produced contradictory findings (Shavit and Blossfeld, 1993; Raftery and Hout 1993; Lewis and Dundar 2002; Deer 2005; Arum et al. 2007). Other studies have examined trends of gender bias in higher education, and provided evidence of improvement during the past few decades. Women's enrolment in higher education has become equal to or greater than that of men in some countries (Bradley, 2000). For instance, in 1990, 53.2% of undergraduates and 49.9% of postgraduates in the USA were women (Jacobs 1995).

This greater gender parity in higher education, however, failed to reduce sex segregation in the labour market, and consequently returns to education. Therefore, several studies examined the reason behind this apparent paradox. They concluded that gender differentiation across the different fields of study in higher education and accordingly women's underrepresentation in particular fields, especially highly rewarding scientific fields, may be responsible (Jacobs 1995; Bradley 2000; Charles and Bradley 2002; Charles and Bradley 2009).

Even though most studies have focused on examining gender differentiation by field of study along just the humanistic-scientific dimension, Barone (2011) claimed that this dimension accounts for only 50% of the association between gender and field of study, and that there is high variability of gender segregation within the humanistic and scientific fields. He suggested the care-technical dimension as a second dimension so that both dimensions together account for more than 90% of the addressed association. It deals more with the occupational prospects of the different disciplines regardless of their curriculum content. For instance, the field of medicine has a practical, scientific curriculum, but it prepares students for care jobs.

To date, no research has been conducted on this important issue in the Egyptian context. Therefore, the current research study aims to investigate the gender distribution, by field of study in higher education in Egypt since the 1952 revolution, i.e. since the implementation of the egalitarian policies. To achieve this objective, the study first reviews prior literature in order to examine the trend in female higher education enrolment in the Egyptian context across four historical time periods (Nasser, Sadat, and two phases of Mubarak's reign), characterized by significant changes in the social, economic, and educational circumstances. Next, the study examines gender bias in higher education across fields of study and over time in Egypt using Egypt Labour Market Panel Survey (ELMPS) 2012 data set, and analyzes it statistically using multinomial logistic regression.

2 METHODOLOGY

2.1 Higher Education in Egypt across Four Historical Time Periods

2.1.1 Nasser Era (1956-1970)

In Egypt, higher education started since the establishment of Cairo University in 1908. Until 1950, there were only four public universities (Cairo, Alexandria, Ain Shams, and Al-Azhar), in addition to the American University in Cairo, enrolling 33,595 students including only about 2500 females (Szyliowicz, 1973:462 and see Table 1).

The rapid growth of higher education in Egypt, as shown in table 1, began after the 1952 revolution. President Nasser had growing was concerned about economic reorganization and social equality, and therefore adopted various reforms based on several five-year plans that reflected economic, social, and educational goals (Szyliowicz, 1973:254). With respect to education, these five-year plans focused, among others, on vocational, technical, and scientific education because Nasser required graduates from these disciplines for his big developmental projects. More important was Nasser's attempt to expand educational opportunities that transformed the education system into a fully social system, and the constitutional amendment stated that education shall be the right for every Egyptian (Szyliowicz, 1973:259-264). In July 1962, all public education was made absolutely free (Szyliowicz, 1973:283/4), and in 1963, the government codified the principle of open admissions to university for all successful secondary school graduates (Waterbury 1983:236). Moreover, according to Decree 185 of 1964, the Egyptian civil service and public

sector committed itself to provide employment to all graduates of universities, higher and technical institutes (Waterbury 1983:234), which further motivated students to continue their education.

During the Nasser era, the country faced severe economic problems due to the lack of capital, inadequate planning, and ineffective bureaucracy (Szyliowicz, 1973:255/256). However, national income and per capita income increased steadily at an increasing rate except for the last few years of his ruling (Waterbury, 1983:210). Nevertheless, higher education enrolment increased tremendously (see Table 1) with a female proportion that increased from 7% in 1950 to 26% in 1969, driven by the egalitarian policies and the social status associated with higher education (Szyliowicz, 1973:283). Hence, the economic and political problems, in addition to problems associated with the quality of the educational system did not represent a barrier to higher education expansion and the reduction of the gender gap in higher education.

Table 1: Higher education enrolment growth in Egypt, female percentage (in Total and in scientific disciplines)

Year	Total	Female (percent)	Science (percent)	Female in Science (percent)
1950	33,595	7	-	-
1960	106,780	17	-	-
1965	177,123	21	-	-
1969	196,077	26	-	-
1976	418,932	29.8	41.4	-
1981	555,970	32.7	33.3	-
1984	660,357	32.6	26.3	-
1988	585,447	34.7	25.9	-
1993	612,884	37.7	21.6	32.2
1996	1,034,539	40.4	20.2	34.8
1999	1,354,204	44.4	22.8	37.6
2001	1,494,647	46.5	23.8	40.6
2005	1,880,460	47.8	19.4	42.5
2009	1,928,112	49.4	19.2	42.5

Sources: Szyliowicz 1973: p.462 (year 1950-1969); Richards 1992:p.27 and p.36 (years 1972-1988); CAPMAS Statistical Yearbook 2012:p.37 (year 2001-2010); CAPMAS Statistical Yearbook 2002:p.214 and 223 (year 1994- 2001).

2.1.2 Sadat Era (1970-1981)

When Sadat came to presidency, the economy was stagnant, the bureaucracy expanding, and the public sector was seeking control over resources (Waterbury 1983:260). Sadat changed many of the economic and political policies implemented by Nasser, launched the open-door "infitah" policy, and led Egypt in the October 1973 war. The public sector, however, continued to expand, and about one third of the Egyptian work force was on public payroll in 1980, i.e. about 3.2 out of 10 million persons (Waterbury 1983:242). Guaranteed employment by the public sector had been putting much pressure on the state, especially in terms of cost. There was a shortage of job opportunities, and higher education graduates had to wait for years to get a job in the public sector. Hence, they had to search for work in the open-door joint ventures, the private sector or the gulf countries (Waterbury 1983:246).

The rise in higher education enrolment continued, from almost 200,000 by the end of the 60s (including 26% females) to approximately 600,000 students (including 33% females) in 1981 (See Table 1 and Table 3), irrespective of the mentioned problems and problems associated with the quality of the education system, that continued from the Nasser era and exacerbated with obsessive concern with the secondary school leaving exam "Sanawya Ama" and private tutoring (El-Badawy et al. 2004; El-Badawy 2009; Shady 2013).

2.1.3 First Phase of Mubarak Regime (1981-1998)

The presidency of Mubarak has also witnessed many economic, social, and educational problems that have existed in the two preceding regimes. Since the 1980s, successive governments have adopted economic reform programs and policies, such as privatization and trade liberalization, in order to deal with the economic problems (El-Mahdi and Marfleet 2009:48).

The privatization program started in 1991, and had a significant impact on the employment of graduates. Instead of offering new job opportunities, the public sector (the major employer of females) laid off current

employees. It is argued that the reduction in female employment by public companies (75% decline) as a result of the privatization program is higher than the reduction in male employment (57% decline) (Handoussa 2005:131). Also, the privatization program was not in favour of females given a significant wage-gender gap in the private sector (at 25%) (Mona Said, 2002).

As a result of trade liberalization, employment in the industrial sector decreased for both sexes during the 1985-2000 period due to several factors, including the reliance on temporary and informal employment, the limited competitiveness of exports, and the timing of trade liberalization which came along with privatization of public companies. Two nationwide labour force sample surveys' results claim that young educated people, particularly women suffered the most from unemployment (Mona Amer 2002).

Despite the significant economic problems (unemployment, wage inequality, etc), the first phase of Mubarak era witnessed an expansion in educational enrolments at all levels, including higher education. As shown in table 1, reports issued suggest that total higher education enrolments were around 560,000 (including 33% females) and increased until it reached almost 1.4 million students (almost 45% of them females) by the end of the first phase of the Mubarak regime in 1998. One exceptional drop in the number of higher education enrolments was in the period between 1984 and 1988 (Richards, 1992; CAPMAS Statistical Yearbook, 2012). According to Richards (1992: 11), "1984 was a water-shed year, in which fundamental policy decisions were taken and began to be implemented: university enrolments have fallen in every year since then, at a compound rate of about 3% per year, by 1989 the total number of university students had been reduced by nearly 100,000, a decline of some 14%".

It is claimed, that the reasons behind the significant increase in higher education enrolment were the better social image of higher education graduates, and the significantly larger demographic higher education age-group. These reasons have possibly outweighed the significance of the economic and structural problems.

In order to face the higher education expansion, the Egyptian governments continued adopting the same policies of the two previous regimes (new university branches and the system of external students), in addition to opening the door for the establishment of private universities according to law 101 for the year 1992. This motivated the establishment of new types of institutions; however, private universities enrolled only a very small proportion (approximately 0.6%) of general secondary graduates (MHE p.5, 8).

2.1.4 Second Phase of Mubarak Regime (1999-2011)

During the second phase of Mubarak regime, economic circumstances deteriorated gradually, further affected by the world economic crisis that began in 2008. "Social inequality has significantly increased with wealth concentrated in the hands of privileged few" (El-Mahdi and Marfleet, 2009:6).

While technical secondary school graduates experienced the highest unemployment rates during the first phase of Mubarak reign, post-secondary and university graduates became the most likely to be unemployed in 2006. In terms of female labour force participation, a sharp decline occurred particularly among females of 20 to 24 years old and among those with technical secondary or university degrees between 1998 and 2006. This declining trend is significant as increased education enrolment rates did not lead to increased participation in economic activities by these women. This may be explained by several factors, such as the retrenchment of the public sector and the severe barriers to entry women face in the private sector (Mona Amer 2009:186).

By 2006, the relative rewards of women significantly improved compared to the situation in 1998. They witnessed larger real wage improvements in comparison to males. This is due to the fact that women are concentrated in the government sector where real wages increased by 40% as opposed to only 17% in the private sector. But even in the private sector, the unexplained gender pay gap was almost halved in comparison to its magnitude in both 1988 and 1998. Moreover, rewards to the university level of education became highest in the private sector, and the government sector had a much more decentralized wage structure than it did in the 1980s (Mona Said 2009).

Despite the low labour force participation rate and high unemployment rates, the second phase of Mubarak era also witnessed an expansion in higher education enrolments (1.4 million in 1999 to almost 2 million by the end of his regime). Female higher education enrolment proportions (from 44.4% to 49.4%) and enrolments in scientific disciplines (from 37.6% to 42.5%) increased as well.

2.2 Empirical study

The current study used a sample of 3826 responses (see Table 3) from the 2012 latest round of the Egypt Labour Market Panel Survey (ELMPS), which has been conducted by the Economic Research Forum (ERF)

and whose data were collected by the Central Agency for Public Mobilization and Statistics (CAPMAS).

The sample was chosen based on survey responses from those who have completed/and those in the process of completing their undergraduate degrees. Since the dataset included very few responses from postgraduate students and graduates, these were not included in the sample.

Coded sample responses to the questions "What degree and specialization did you receive?" (ELMPS 2012 Education Section: question #2108) and "What degree were/are you studying for?" (ELMPS 2012 Education Section question#2108) were assigned to the following nine fields of study: "Teacher Training Education", "Physical Education", "Humanities and Arts", "Social Sciences", "Political Science", Economics, Journalism, or law", "Life sciences, Physical Sciences, Mathematics, Statistics, Agriculture, or Veterinary", "Computing, Engineering, or Architecture", "Social Work", and "Medicine" (See Appendix B for description of the nine fields). The fields of study have been chosen, guided by the 14 categories used by Barone (2011) in developing his topological model for gender segregation in higher education (See Appendix A), and the "Broad Groups and Fields of Education" in the UNESCO International Standard Classification of Education (ISCED) 2011 (UNESCO Institute for Statistics, 2012: 73-75). Moreover, some fields of study had to be integrated with others because of its limited responses.

To be able to investigate enrolment behaviour by gender and field of study across time, sample data for the different fields of study were examined across four age groups, reflecting different social, economic, political, and educational time periods in Egyptian modern history, as shown in Table 2.

Table 2: Analyzed age groups and the corresponding historical time periods

	Group(at 2012)	Time Period
1	61 - 74 years	Attended University during Nasser era from 1956 to 1969
2	49 - 60 years	Attended University during Sadat era from 1970 to 1981
3	32 - 48 years	Attended University during the first phase of Mubarak presidency from 1982 to 1998
4	19 - 31 years	Attended University during the second phase of Mubarak presidency from 1999 to 2011

The study estimated a multinomial logistic regression model that describes the influence of gender ("1" for male and "2" for female) on the choice of field of study (9 fields of study) and controlling for the urban/rural variable. "Female", "social science", and "rural" are used as reference categories for gender, field of study, and region respectively. "Social science" has been selected as the omitted field because it has the highest frequency, and is the closest to gender parity across the four age groups.

As a result, the effect of being male is examined on the chances of graduating from one of the remaining eight fields of study. The same model is estimated separately for each of the four age groups.

In order to be able to compare the results of multinomial logistic regression across the four age groups in a reliable manner given that "social science" as the reference field does not have an equal gender distribution among the four groups, the sample is weighted to achieve equal standard gender distribution in "social science" across all four age groups, as shown in Table 5.

3 RESULTS

Descriptive statistics shown in Table 3 provide evidence again that the gender distribution of university graduates/students in Egypt has been increasingly moving towards gender parity by time, with females even showing to some extent majority over males in the youngest age group.

Table 3: Sample distribution by sex and age group

	Male	Female	Total #
Age Group (61-74 years)	78.7	21.3	211
Age Group (49-60 years)	62.9	37.1	455
Age Group (32-48 years)	61.3	38.7	991
Age Group (19-31 years)	47.9	52.1	2169
Total #	2097	1729	3826

Appendix E shows the results of gender distribution by field of study across the different time periods in Egypt after standardizing the data. With regard to the percentage of the field of study to the total age group sample, Appendix E shows that the percentage of the "the science, math, stat, agri/vet" has been declining by time, while the "humanities and arts" represented a consistent large percentage of the total sample for all age groups.

In order to examine the gender distribution, plots (Figures 1 - 4) are exhibited using the results of multinomial logistic regression for each age group (See Appendix C for the Beta coefficients' results). The x-axis in the figures refers to different fields of study. The y-axis plots the logit parameters for the effect of gender on the chances of graduating from each of these fields (relative to "Social Science").

If a field is highly masculinised, this effect is strong and the field is located on the top part of each graph. Conversely, feminized fields are located on the bottom part of each graph. Finally, if a field has a value close to zero, it is as masculinised as social science (reference category), which displays a balanced gender composition (Barone (2011), however, used economics as the reference field).

3.1 Main Analysis

3.1.1 Nasser era – age group (61-74 years)

Prior studies suggest that during the Nasser era the number of students in technical and scientific fields has significantly increased, and in higher education, the number of graduates "quintupled in engineering and science, tripled in medicine, and sextupled in agriculture" (Szyliowicz, 1973:289). This was due to Nasser's five-year plans that focused on the scientific and technical education to increase the number of graduates in these disciplines for the sake of Nasser's big developmental projects.

According to Fig. 1, "computing, engineering, or architecture" and "Life sciences, physical sciences, math/stat, or agri/vet" are highly masculinised, (2.859 and .919 respectively, see Appendix C). "Political science, economics, journalism, or law" is also masculinised to some extent relative to social science (.433). Females are overrepresented in "Humanities and Arts" (-2.64), "Social Work" (-2.77), and "Teacher Education" (-4.81). An interesting result, however, is that "Medicine" is highly feminized (-1.007). This could be due to the small sample size of this field of education or, if analyzed using the Barone (2011) second dimension "Care-Technical", it shall be regarded as not only a scientific discipline but also a "care" one in which females are also expected to be highly represented.

Consequently, the increase in scientific higher education during the Nasser era was in favour of males, and females were mainly represented in humanistic fields of study, except for "medicine".

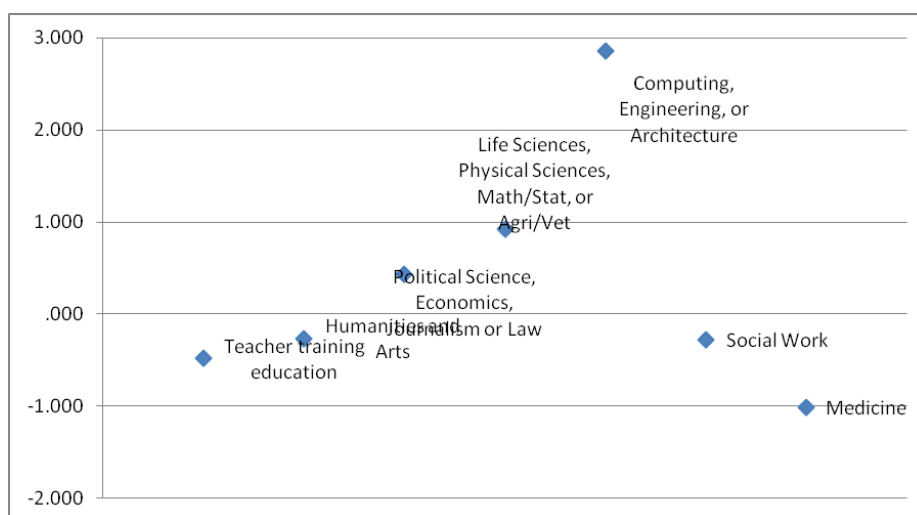


Fig. 1: Gender distribution by field of study during the Nasser era

3.1.2 Sadat era – age group (49-60 years)

During the Sadat regime, prior studies contend that the percentage of students enrolled in scientific fields has fallen from 38.6% in 1968/9 to 32.6% in 1976/7. And, the percentage enrolled in non-scientific fields has risen from 32% in 1968/9 to 59.6% in 1976/7 (Waterbury 1983:238). It is argued that this may be due to two reasons. On the one hand, there was no emphasis on scientific fields because there were no infrastructural

projects to provide job opportunities in engineering, like in the Nasser era. On the other hand, non-scientific fields can easily absorb the increasing number of higher education students, in particular those with low scores that are not allowed in more prestigious scientific faculties. Current results also provide a similar evidence, with a larger percentage of students enrolled in "Social Science" and "Political science, Economics, Law, or Journalism", and a smaller percentage enrolled in "Life sciences, Physical Sciences, Math/Stat, Agri/Vet", "Computing, Engineering, and Agriculture", and "Medicine".

No data are available in prior studies about the gender distribution by field of study during the Sadat era, and the multinomial logistic regression model depicted in Figure 2 for the Sadat era is insignificant for the gender variable and, hence, Figure 2 results cannot be used for explanation and further data and analysis is required for this important historical time period.

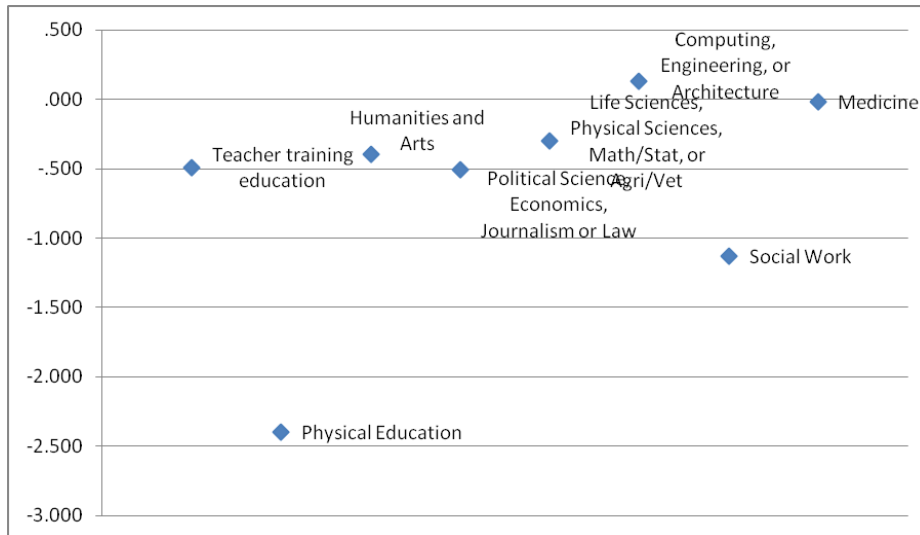


Figure 2: Gender distribution by field of study during the Sadat era

3.1.3 First phase of Mubarak regime – age group (32-48 years)

During the first phase of the Mubarak regime, most of the expansion in university enrolments has also been in the humanistic disciplines: the share of science students in total enrollments has been falling (33.3% in 1981, 26.3% in 1984, 25.3% in 1989, 21.6% in 1996), except for a small increase by the end of the first phase (22.8%) (See Table 1). In addition, statistical figures in Table 1 suggest that females enrolling in scientific disciplines have increased from 32.2% in 1993 to 37.6% by 1999.

Multinomial logistic results show that, compared to Nasser era, "Computing, Engineering, or Architecture" and " are still overrepresented by males but to a lesser degree (shifted downward the plot); while "humanities and arts" and "teacher training education" have become more feminized.

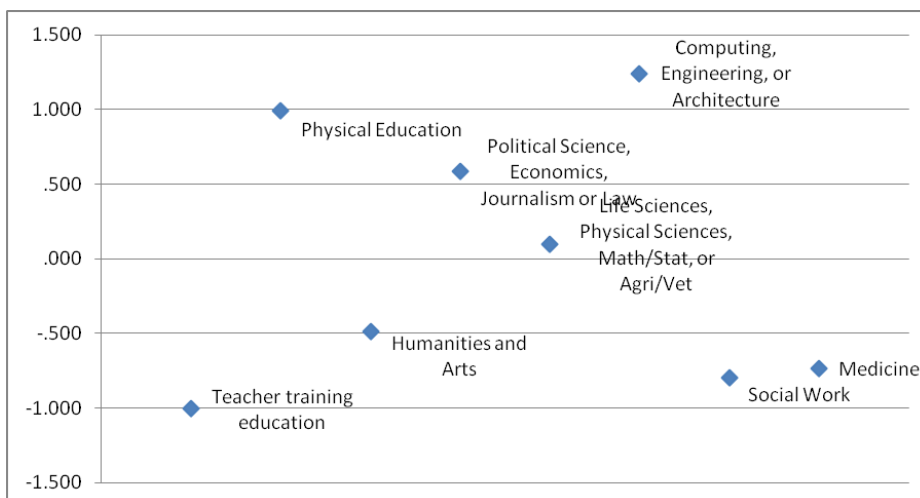


Figure 3: Gender distribution by field of study during the first phase of Mubarak era

3.1.4 Second phase of Mubarak regime – age group (19-31 years)

During the second phase of Mubarak regime, prior statistical findings suggest that female total higher education enrolment percentages (from 44.4% to 49.4%) and enrolment percentages in scientific disciplines (from 37.6% to 42.5%) continued to increase, irrespective of the economic problems and social inequality widening gap (See Table 1). A report issued by the Ministry of higher education states that 79% of the students studied humanities and social sciences by the end of the Mubarak regime; even though the economic reform that Egypt seeks requires a substantial investment in scientific research and innovation (MoHE, n.d.:9).

Figure 4 shows a great variation within humanistic and scientific disciplines when analyzing gender bias in field of education. "Life sciences, physical sciences, Math/Stat, or Agri/Vet became overrepresented by females (-.439), a shift down the plot compared to the first phase of Mubarak era. On the other hand, "Computing, Engineering, or Architecture" remained highly masculinized (1.116). Interestingly, "Medicine" remained significantly feminized (.743), with a large sample in this age group. And "Political Science, Economics, Journalism or Law" remained masculinized like in the first phase of Mubarak era.

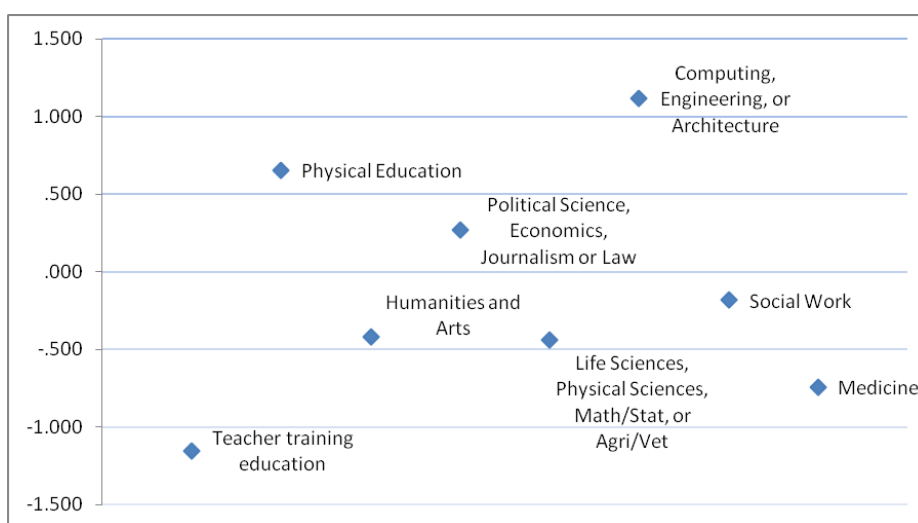


Figure 4: Gender distribution by field of study during the second phase of Mubarak era

3.2 Supplementary Analysis

Prior literature contends that the expansion in higher education enrolment in Egypt may be due in part to the social prestige associated with this level of education (Szyliowicz, 1973; Waterbury, 1983). However, little, if any, research is done on the gender distribution in the different faculties according to its social prestige. Therefore, the supplementary analysis seeks to examine this issue in Egypt across the four historical time periods or age groups, already used in the main analysis, and using again the ELMPS 2012 data.

Table 4 shows the gender distribution in the "High Prestige", "Moderate Prestige", and "Low Prestige" faculties (i.e. groups of university departments) across the four age groups. The supplementary analysis uses faculties instead of the fields of study, used in the main analysis, because public universities in Egypt are organized in terms of a number of faculties; and students are mainly concerned with choosing the faculty of interest. Therefore, in Egypt, social prestige is associated with the faculty rather than the field of study; in particular, since some fields may be studied in several faculties with different social prestigious levels. For instance, statistics can be studied in the Faculty of Economics and Political Science, the Faculty of Science, and the Faculty of Commerce.

Table 4: Faculty Social Prestige by Age Group and by Gender (Standardized Results)

Prestige	High	Moderate	Low	Total
Age Group 1 (19-31 years)				
Male%	57.1	47.6	50	1106
Female%	42.9	52.4	50	1093
Total #	308	662	1229	2199
% of Total	14	30	56	
Age Group 2 (32-48 years)				

Male %	69.6	42	50	490
Female%	30.4	58	50	524
Total #	69	381	564	1014
% of Total	7	38	56	
Age Group 3 (49-60 years)				
Male %	51.8	47.1	50	221
Female %	48.2	52.9	50	227
Total #	56	136	256	448
% of Total	13	30	57	
Age Group 4 (61-74 years)				
Male %	76.5	66.7	50	115
Female %	23.5	33.3	50	75
Total #	34	66	90	190
% of Total	18	35	47	

In Egypt, admission to the different faculties is determined based on the percentage scores of those demanding to enter the given faculty and the supply of available seats. In order to associate a faculty to one of the three different social prestigious levels, the study hence used the minimum acceptable percentages for entry to the different faculties for the academic year 2012 as a proxy for the demand for them, or their social prestige. Appendix D shows the resulting distribution of the faculties by social prestige.

The supplementary analysis estimated a multinomial logistic regression that describes the influence of gender ("1" for male and "2" for female) on the choice of Faculty Social Prestige (three faculty prestigious levels) and controlling for the urban/rural variable. "Female", "Low Prestigious", and "Rural" are used as reference categories for gender, faculty social prestige, and region respectively. "Low Prestigious" has been selected as the omitted faculty social prestigious level because it has the highest frequency, and is the closest to gender parity across the four age groups, except for the third age group in which the high prestigious faculties had a better gender balance and gender variable is insignificant for the model. As a result, the effect of being male is examined on the chances of graduating from one of the remaining two prestigious levels. The same model is estimated separately for each of the four age groups.

In order to be able to compare the results of multinomial logistic regression across the four age groups in a reliable manner given that "low prestigious" as the reference level does not have an equal gender distribution among the four groups, the researcher has weighted the sample to achieve equal standard gender distribution in "low prestigious" across all four age groups. Multinomial logistic regression models are significant for all four historical time periods. However, the gender variable is insignificant in the Sadat era model.

3.2.1 Nasser era – age group (61-74 years)

Table 5 shows that male students dominated both high (1.190) - and moderate (0.647) prestige faculties compared to the low prestige faculties that displayed relative gender parity. These results are consistent with the results of the main statistical analysis that contends that Nasser's emphasis on scientific and technical education was mainly in favour of male students.

Table 5: Beta Coefficients for Multinomial Regression – Supplementary Analysis

Faculty Social Prestige Level	(19-31 years)	(32-48 years)	(40-60 years)	(61-74 years)
High Prestigious	0.324	1.015	0.275	1.190
Moderate Prestigious	-0.152	-0.505	-0.215	0.647

3.2.2 Sadat era – age group (49-60 years)

Table 5 shows that males are still overrepresented in high prestige faculties (0.275), while females have become overrepresented in moderate prestige faculties (-0.215). However, the gender variable is insignificant for the model representing the Sadat regime. And therefore, this period of Egypt's history requires further analysis in terms of faculty social prestige.

3.2.3 First phase of Mubarak regime – age group (32-48 years)

During the first phase of Mubarak regime, the gender distribution of the highly prestigious faculties are still in favour of males (1.015) but to a lesser degree compared to the case during Nasser era (1.190). The moderate prestigious faculties are, however, dominated by females (-0.505). These results support the statistical figures in Table 1 suggesting that the percentage of female enrolment in scientific disciplines has been increasing.

Prior studies contend that during Sadat and Mubarak eras most of the expansion in university enrolments has been in the humanistic disciplines. Faculties under the humanistic domain (such as Arts, Fine Arts, Education, Commerce, Tourism, Archaeology, etc.), are considered moderate or low prestigious according to the current study. Results show that females dominate moderate prestigious faculties, while low prestigious faculties display an almost gender balance. This is perhaps the reason why it is argued that females are currently overrepresented in higher education in Egypt.

3.2.4 Second phase of Mubarak regime – age group (19-31 years)

During the second phase of Mubarak regime, the gender distribution of the highly prestigious faculties continues to be in favour of males (0.324) but significantly to a lesser degree compared to the case during the first phase of Mubarak (1.015) and Nasser eras (1.190). The moderate prestigious faculties are still, however insignificantly, dominated by females (-0.152).

Consequently, results of the gender distribution by faculty social prestige (irrespective of the insignificant results of the Sadat era) suggest that high prestigious faculties are overrepresented by males but to a lesser degree over time. Moderate prestigious faculties shifted from being dominated also by males to being overrepresented by females. Taking into consideration that low prestigious faculties reflect an almost gender parity and that most of the increase in higher education enrolment across time has been in humanistic disciplines represented in moderate and low prestigious faculties, results support the argument that females are becoming overrepresented in Egyptian higher education. Results, however, do not show an advantage in the highly social prestigious faculties.

4 CONCLUSION

Adopted egalitarian policies in education in Egypt led to an expansion in higher education enrolment, accompanied with an increase in female enrolment percentage since 1952 revolution and till present. Prior studies, mainly conducted in developed countries, have examined the effect of education expansion policies and the effect of macroeconomic circumstances on education enrolment and inclusiveness. Moreover, the gender distribution by field of study in higher education has not been examined in the Egyptian context.

Therefore, the objective of the current study is to examine gender segregation by field of study in higher education in Egypt. It examines the trend in female higher education enrolment in Egypt across four historical time periods, characterized with significant changes in the social, economic, and educational circumstances. Second, it investigates gender bias in higher education during the four same historical time periods, using ELMPS 2012 data.

The study argues that irrespective of the economic circumstances that Egypt faced, the increase in female higher education enrolment continued. Although gender distribution of university students/graduates is increasingly becoming balanced by time in Egypt, multinomial logistic regression results suggest that the gender distribution by fields of study does not reflect the same trend. The degree of masculinisation (feminization) of fields of study varies considerably across the four historical time periods. Furthermore, the humanistic-scientific divide does not tell the whole story about gender segregation, because the degree of gender unbalance varies substantially within both humanistic and scientific fields. Results of the study support the argument made by Barone (2011) that both dimensions, humanistic/scientific and care/technical explain gender segregation by field of study, rather than just the humanistic/scientific dimension.

A supplementary analysis investigates the gender distribution by faculty social prestige in Egypt. Results contend that females are becoming over-represented in higher education in Egypt but do not hold an advantage in the high prestige faculties.

Nevertheless, the current study is subject to several limitations. First, the study assumed that students enrolled in university choose their fields of study. In Egypt, however, students choose their faculties and not their fields of study. A student may study the same field in several faculties. Second, the sample sizes of the age groups analyzed in the study were not equal, because age groups were created in a manner to be

consistent with the four historical time periods. Particularly, the age group reflecting the Nasser era had a small sample size. This resulted in some fields of study with insignificant responses.

Several future research opportunities are suggested. Gender segregation by field of study can be examined not just for undergraduates in public universities, but also for those enrolled in postgraduate and private universities. Also, the effect of family socio-economic and education characteristics on the gender distribution by field of study in Egypt can be examined.

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Appendix A:

Matrices Defining the Topological Model for the Association between Gender and Field of Study

Field of Study	Humanistic–Scientific Divide		Care–Technical Divide	
	Humanistic	Scientific	Care	Technical
Teacher training education	1	0	2	0
Humanities	1	0	1	0
Social sciences	1	0	1	0
Economics	0	0	0	0
Law	0	0	0	0
Biology	0	1	1	0
Physics	0	1	0	0
Mathematics	0	1	1	0
Computing	0	1	0	1
Engineering	0	1	0	1
Architecture	0	0	0	1
Agriculture/veterinary	0	1	0	0
Social work	0	0	2	0
Medicine	0	1	2	0

Source: Barone 2011, p.165

Appendix B:

Description of fields of study used in the study (UNESCO Institute for Statistics, 2012:73-75)

1. Teacher Training Education
2. Physical Education
3. Humanities and Arts: Fine arts: drawing, painting, sculpture; Performing arts: music, drama; Graphic and audio-visual arts: photography, cinematography, music production, radio and television production, printing and publishing; Design; craft skills, Religion and theology, Foreign languages and cultures; Native languages; Other humanities: interpretation and translation, linguistics, comparative literature, history, archaeology, philosophy, ethics.
4. Social Sciences: Hotel and catering, travel and tourism, sociology, demography, anthropology (except physical anthropology), ethnology, futurology, psychology, geography (except physical geography), peace and conflict studies, human rights, Business and administration, Retailing, marketing, sales, public relations, real estate; Finance, banking, insurance, investment analysis; Accounting, auditing, bookkeeping; Management, public administration, institutional administration, personnel administration.
5. Political Science, Economics, Journalism, or Law: Economics, economic history, political science, Journalism and information Journalism; library science; Archival sciences, Law, jurisprudence, history of law.
6. Life Sciences, Physical Sciences, Math/Statistics, or Agriculture/Veterinary: Biology, botany, bacteriology, toxicology, microbiology, zoology, entomology, ornithology, genetics, biochemistry, biophysics, other allied sciences, astronomy and space sciences, physics, other allied subjects, chemistry, other allied subjects, geology, geophysics, mineralogy, physical anthropology, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, marine science, vulcanology, palaeoecology, agriculture, crop and livestock production, agronomy, animal husbandry, horticulture and gardening, forestry and forest product techniques, natural parks, wildlife, fisheries, fishery science and technology, veterinary medicine, veterinary assisting, mathematics, operations research, numerical analysis, actuarial science, statistics and other allied fields.
7. Computing, Engineering, or Architecture: Computer sciences: system design, computer programming, data processing, networks, operating systems – software development; Engineering drawing, mechanics, metal work, electricity, electronics, telecommunications, energy and chemical engineering, vehicle maintenance, mining and extraction, architecture and town planning: structural architecture, landscape architecture, community planning, cartography; Building, construction; civil engineering.
8. Social Work
9. Medicine: Anatomy, epidemiology, cytology, physiology, immunology and immuno-haematology, pathology, anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, neurology, psychiatry, radiology, ophthalmology; public health services, hygiene, pharmacy, pharmacology, therapeutics, rehabilitation, prosthetics, optometry, nutrition; nursing; dental services: dental assisting, dental hygienist, dental laboratory technician, odontology.

Appendix C:

Fields of Study	(19-31 years)	(32-48 years)	(40-60 years)	(61-74 years)
Teacher training education	-1.153	-1.007	-.491	-.481
Physical Education	.652	.993	-2.399	17.939
Humanities and Arts	-.419	-.488	-.396	-.264
Political Science, Economics, Journalism or Law	.270	.584	-.510	.433
Life Sciences, Physical Sciences, Math/Stat, or Agri/Vet	-.439	.095	-.301	.919
Computing, Engineering, or Architecture	1.116	1.242	.133	2.859
Social Work	-.183	-.794	-1.131	-.277
Medicine	-.743	-.732	-.018	-1.007

Appendix D: Faculties by Social Prestige

High Prestigious	Moderate Prestigious	Low Prestigious
Faculty of Medicine	Faculty of Science	Faculty of Commerce
Faculty of Engineering	Faculty of Fine Arts	Faculty of Arts
Faculty of Economics and Political Science	Faculty of Agriculture	Faculty of Law
Faculty of Mass Communications	Faculty of Archeology	Faculty of Tourism& Hotels
Faculty of Alsun	Faculty of Education	Faculty of Social Work
	Faculty of Nursing	Faculty of Home Economics
	Faculty of Islamic Studies	
	Other	

	Teacher educ	Physical educ	H&A	Social Science	Political,Eco,Law, Journalism	Science,math,stat, Agri, Vet	computing,eng, Arch	social work	medicine	Total
Age group (19-31 years)										
Male (%)	27	68.6	44.3	50	58.7	40.6	74.6	47.4	33.3	1048
Female (%)	73	31.4	55.7	50	41.3	59.4	25.4	52.6	66.7	1086
Total #	270	35	377	592	293	96	252	114	105	2134
% of Total	13%	2%	18%	28%	14%	4%	12%	5%	5%	
Age group (32-48 years)										
Male %	34.5	72.2	47.6	49.8	69.7	57.9	75.5	34.7	30	486
Female %	65.5	27.8	52.4	50.2	30.3	42.1	24.5	65.3	70	500
Total #	229	18	166	279	119	57	49	49	20	986
% of Total	23%	2%	17%	28%	12%	6%	5%	5%	2%	
Age group (49-60 years)										
Male %	49.1	0	48.3	50	40.7	42.6	51.4	30.8	44.4	206
Female %	50.9	100	51.7	50	59.3	57.4	48.6	69.2	55.6	238
Total #	53	5	58	154	54	61	37	13	9	444
% of Total	12%	1%	13%	35%	12%	14%	8%	3%	2%	
Age group (61-74 years)										
Male %	39.1	100	43.6	50.9	63.6	72.4	95.2	40	28.6	108
Female %	60.9	0	56.4	49.1	36.4	27.6	4.8	60	71.4	85
Total #	23	1	39	57	11	29	21	5	7	193
% of Total	12%	1%	20%	30%	6%	15%	11%	3%	4%	

Appendix E: Field of education by age group and by gender – Main analysis (Standardized results)