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Inequality in Education and Its Effects on Economic Growth in Saudi Arabia

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Statement of Candidate

I certify that the thesis entitled ‘Inequality in Education and Its Effects on Economic Growth in Saudi Arabia’ has not previously been submitted for a degree nor as part of the requirements for a degree to any university or institution other than Macquarie University.

I further certify that the thesis is original research that has been written by me. Any assistance received during the research and my preparation of the thesis has been appropriately acknowledged.

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Abstract

This thesis investigates the direct and indirect effects of gender inequality in education on economic growth in the Kingdom of Saudi Arabia. This issue has much policy relevance because it might affect the effectiveness of the government's Vision 2030 to diversify the economy. Furthermore, while important research has been conducted on the impact of gender inequality in education and employment on economic growth, no such study exists for the Saudi Arabian context. Following Klasen (2002) and Klasen and Lamanna (2009), this study employs a set of equations, using OLS, to measure these direct and indirect impacts over the period of 1971–2017. The findings show that while gender inequality in education has been improving overtime, its impact on economic growth has been negligible. This is perhaps due to regulatory issues related to the labour market and university courses offered to females, as well as social and cultural issues.

Chapter 1: Introduction

The notion of well-being is defined by a range of measurements that include personal security, environmental quality, education, skills, income, wealth, housing, living conditions, employment, and health status (OECD, 2017). These measurements are essential in evaluating a society's quality of life during its growth and development. It is likewise crucial to investigate the effects of gender inequality on well-being, as considerable gender gaps, which may threaten well-being, still exist in society (Klasen & Lamanna, 2009). Furthermore, most concepts of equity define gender gaps as a form of injustice (Elson, 2009). These gaps may be present in wages, political power, mortality, educational opportunities and attainment, access to employment, and control over economic resources (Dollar & Gatti, 1999). The perspective that defines them as a form of injustice advocates for narrowing gender inequalities in these dimensions of well-being, and recently a growing body of literature has examined the instrumental impacts of gender inequality on a number of essential development outcomes, particularly economic growth. Without denying the importance of narrowing gender gaps on intrinsic grounds, this thesis aims to contribute to that body of literature.

1.1 Research background

An extensive body of literature has examined the relationship between gender inequality and well-being (see, for example, Abu-Ghaida & Klasen, 2004; Klasen, 2002; Knowles, Lorgelly, & Owen, 2002; Lagerlöf, 2003), and this research has been extended to include inequality's instrumental effect on economic growth. Even though more recent studies suggest that gender inequality in education actually decreases economic growth (Abu-Ghaida & Klasen, 2004; Dollar & Gatti, 1999; Forbes, 2000; Galor & Weil, 1996; Hill & King, 1995; Klasen, 2002; Lagerlöf, 2003; Knowles, Lorgelly, & Owen, 2002), some studies have proposed

that gender inequality in education may positively impact economic growth (Barro & Lee, 1994; Barro & Sala-i-Martin, 1995). Barro and Lee (1994) and Barro and Sala-i-Martin (1995) found a partial negative correlation between economic growth and female secondary education and a partial positive correlation between economic growth and male secondary education. Nevertheless, subsequent studies recognised possible econometric issues with these earlier findings and consequently produced opposite results. Dollar and Gatti (1999) found that the addition of regional dummy variables produced results with a positive relationship between economic growth and female education. These variables can also rectify the potentially mistaken findings of these earlier studies, which were caused by the combination of unexpectedly high female secondary achievement and lower growth in the Latin American region (Dollar & Gatti, 1999). Klasen (2000) also identified multicollinearity issues; for most countries, female and male education levels were closely correlated in studies conducted by Barro and Lee (1994) and Barro and Sala-i-Martin (1995).

A number of arguments have been advanced in the theoretical literature regarding gender inequality in education. First, it is claimed that gender inequality in education decreases the average amount of human capital, which negatively affects economic performance by restricting talented women's enrolment in education, thus eliminating highly qualified females in favour of less qualified males (Dollar & Gatti, 1999). The second argument is connected to externalities associated with female education and posits that encouraging female education will decrease fertility, lower mortality, and encourage the education of future generations. Those factors have a positive effect on economic growth. Therefore, gender gaps in education decrease the benefits that society reaps from high female education (for example, see Galor & Weil, 1996; Lagerlöf, 2003; World Bank, 2001). The third argument asserts that international competitiveness is increased by female-intensive, export-oriented manufacturing industries, a

practice that is widespread in East Asian countries, some South Asian countries and individual developing countries (for example, see Seguino, 2000a, 2000b).

Additionally, a number of closely related arguments have been advanced in the theoretical literature on gender gaps in employment. The first argument asserts that, as with gender gaps in education, gender gaps in employment negatively impact an economy by reducing the number of talented people that employers can hire, thus lowering the average workforce ability (for example, see Esteve-Volart, 2004). A second, closely-related argument is that gender inequality in employment may decrease economic growth through its demographic impacts. Cavalcanti and Tavares (2007) argue that the gender gap in employment may be associated with higher fertility rates, which negatively affect economic growth. A third argument, suggested by Seguino (2000a, 2000b), claims that gender inequality in pay affects international competitiveness; when women lack equal access to employment, their countries cannot use relatively cheap female labour as a competitive advantage in an export-oriented development strategy, thus hampering economic growth. The fourth argument concerns the significance of females' employment and wages in regard to their bargaining power at home. A substantial body of literature demonstrates that females' employment and earnings increase their bargaining power in their families (for example, see Haddad, Hoddinott, & Alderman, 1997; King, Klasen, & Porter, 2008; Klasen & Wink, 2003; Sen, 1990; Thomas, 1997; World Bank, 2001). The benefits of an increase in bargaining power extend beyond those affecting females directly and include a number of growth-enhancing effects, such as an increase in savings (as females and males vary in their savings behaviour) (see, for example, Seguino & Floro, 2003), an increase in productive investments, credit use, and repayment (Stotsky, 2006), and greater investments in their children's education and health, which enhances the human capital of the next generation and thus contributes to economic growth (for example, see Thomas, 1997; World Bank, 2001). The last argument connects to governance; a growing

(albeit suggestive and speculative) body of literature has collected evidence that, on average, female workers are less prone to nepotism and corruption than male workers (Swamy, Knack, Lee, & Azfar, 2001; World Bank, 2001). If these findings prove to be robust, greater female employment could be advantageous for economic performance.

1.2 The Background of Saudi Arabia's Economy

The Saudi economy is largely driven by oil, and any fluctuation in the oil price will significantly affect it. Figure 1 shows that per capita GDP growth is affected by any change in oil prices. For example, the per capita GDP growth was very high in the 1970s, but it fell to a negative number in the 1980s due to the oil shocks of the 1970s. A similar pattern may be seen in the growth of oil prices; the 1970s saw a high growth whereas the 1980s brought a decrease. Therefore, the diversification of the Saudi economy is vital for its sustainability.

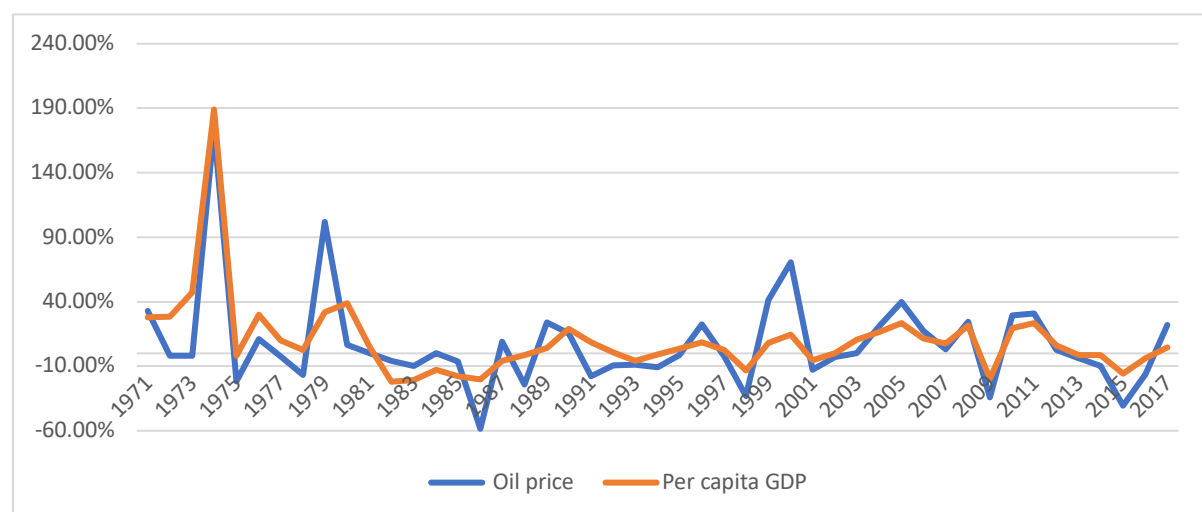


Figure 1. Annual percentage growth in per-capita GDP in current US dollars and the North Sea (Brent) oil price in US dollars (2005) (Source: Saudi Arabian Monetary Agency)

Since 2016, Saudi Arabia's government has devised a new plan called Vision 2030 to reduce its dependence on oil by expanding its investments into additional sectors.¹ One of its

¹ Vision 2030 includes a number of structural changes in sectors beyond education and labor, such as infrastructure, health, and tourism.

aims is to improve education's contribution to economic growth, with the government investing in education and training to equip young men and women for future jobs. The government is also refining the national curriculum of general education by training both teachers and educational leaders, developing early childhood education, and establishing a centralised student database to track students' journeys through tertiary education (either higher or vocational) to improve education and outcomes. This is being done to close the gap between higher-education outputs and labour market requirements, especially in the private sector. The Ministry of Labour has also launched the National Labour Gateway (TAQAT), and a plan has been developed to establish sector councils to determine precisely the skills and knowledge that every socio-economic sector requires. Additionally, there is a plan to expand vocational training to enhance economic growth (Vision 2030, 2016).

The goal of providing equal opportunities for everyone in Vision 2030 will be monitored by the recently established Job Creation and Anti-Unemployment Commission. More than 50% of the Saudi population is under the age of 25 years, and the government plans to exploit this demographic dividend by expanding entrepreneurship and enterprise opportunities as well as by harnessing the energy of youth. As over 50% of university graduates are female, the plan aims to strengthen their future, invest in their productive capabilities, and empower them to develop their talents, thus contributing to society and its economic development. These educational goals aim to decrease the unemployment rate for both males and females and to increase female participation in the workforce from 22% to 30% (Vision 2030, 2016).

All of these goals show that the Saudi government understands the important impact of education on economic growth. Improving educational attainment will increase participation in the labour market, which will contribute to a structural change in the Saudi economy, increasing its diversity and reducing its dependence on the oil sector.

1.3 Research objective and research questions

Based on the latest data from the Planning and Development Agency of the Saudi Arabian Ministry of Education (2018), 1.87% of the total population were females who finished secondary school in 2017, whereas the figure was only 0.02% in 1970. By contrast, 1.96% of the total population were males who graduated from secondary school in 2017, compared to 0.24% in 1970. However, in 2017, the percentage of unemployed females who had finished secondary school was 40.5% while, in the same year, the percentage of unemployed males who had finished secondary school was 6.1% (General Authority for Statistics, 2018). These data show that the Kingdom of Saudi Arabia has made a considerable effort to close the education gap, but the employment gap remains very wide. Hence, it is important to evaluate if the decline in the educational gap between males and females makes a significant impact on economic growth. On this front, there is a lack of studies in the Saudi Arabian context.

More specifically, this thesis will investigate the direct and indirect effects of education and gender inequality on Saudi Arabia's economic growth through the estimation of a set of equations using OLS to answer the following: To what extent gender inequality in education in Saudi Arabia affects the country's economic growth? What are the reasons behind this impact, and what are the changes to be made and reforms to be conducted to materialise the benefits of education? Based on the findings and the characteristics of the labour market and the employment history in Saudi Arabia, this research offers a number of policy recommendations. Accordingly, it may assist the government in designing gender equality policies to facilitate economic growth. For instance, it may encourage the government to change its policies to give women access to different fields in education and employment and to develop policies to encourage women to participate in the workforce.

Overall, this study makes a number of contributions. To start with, given that this will be the first study in the context of Saudi Arabia, it expands the existing empirical literature. Second, this study provides an extensive discussion on gender gap in employment, the underlying reasons behind such a gap, and how the employment story may influence the impact of the gender educational gap on economic growth. Finally, it offers a few policy implications by providing evidence regarding the effects of gender inequality.

1.4 Thesis structure

This thesis is organised as follows: Chapter 2 reviews the theoretical and empirical literature; Chapter 3 covers the challenges of female education and employment in Saudi Arabia, the achievements to date and the government's policies to mitigate education and employment challenges; Chapter 4 describes the methodological framework, the model and the data sources and tests the methodology; Chapter 5 describes the results and offers policy implications; and Chapter 6 concludes the thesis.

Chapter 2: Literature Review

In recent years, much attention has been paid to gender inequality and its effects on economic growth and social well-being, which have often been sensitive topics. Some studies have indicated that gender inequality has a positive impact on economic growth by presenting an export-oriented strategy. These studies argue that in a number of Asian countries large gender pay gaps have stimulated the manufacturing sector to employ intensive labour, even though these countries have low skill labour capital. These countries want to use this competitive labour advantage to increase export volume by employing females—which entails comparatively low labour costs—thus reducing the overall cost of production (Busse & Spielmann, 2006; Forbes, 2000). The links between educational and employment gaps and economic growth have been considered in both theoretical literature (Cavalcanti & Tavares, 2016; Galor & Weil, 1996; Lagerlöf, 2003) and empirical studies (Cavalcanti & Tavares, 2016; Hill & King, 1995; Klasen, 2002; Klasen & Lamanna, 2009).

2.1 Theoretical literature

The theoretical literature suggests that several channels can cause gender inequality to have an impact on economic growth (Cavalcanti, 2016; Galor & Weil, 1996; Lagerlöf, 2003). Galor and Weil (1996) postulated that a smaller educational gender gap leads to a reduction in fertility rates and an increase in levels of female participation in the labour force, which consequently contributes to higher economic growth. They demonstrated that the decrease in fertility rates will slow the population growth rate, leading to a higher capital-per-worker level and thereby higher output per worker. Also, changes in the economic environment can lead to lower fertility and, in the process, increase the wealth of a country.

Accordingly, Galor and Weil's (1996) general equilibrium model generates a positive feedback loop and a different mechanism that links fertility and economic growth. First, the fertility decision that the household takes is a function of the relative wages of females and males. Higher female wages will increase the cost of children relatively more than the increase in the income of a household, which will encourage women to substitute childrearing for participation in the labour market. Second, population growth rates impact capital-per-worker levels. Third, a further reduction in fertility rates, resulting from rising relative wages for women, may increase female participation in the labour force and the cost of raising children, potentially causing the latter to rise above household income levels. Thus, women's high relative wages are both a causal factor and a product of economic growth. Reducing the gaps between the genders may therefore boost economic growth as well as economic development.

A theoretical growth model developed by Lagerlöf (2003) aimed to determine whether the Industrial Revolution in Europe had a long-term impact on gender equality in education. Focusing on the role of fertility, the author found that shrinking gender gaps made women's time more valuable and the levels of human capital more equal; families could therefore substitute the quantity of children for the quality of children. Additionally, in agreement with Galor and Weil (1996), Lagerlöf asserted that when fertility levels decrease both human capital and per capita income growth tend to increase. In addition, increasing human capital may reduce mortality and temporarily augment population growth. Ultimately, as mortality rates level off and fertility rates decrease, there is a drop in population growth, and per capita income rises until it stabilises on a balanced growth path. Consequently, increasing gender equality may lead to an increase in economic growth in the long run.

Cavalcanti and Tavares (2016) conducted a theoretical and empirical study on the impact of gender discrimination on economic growth using data from 118 developing and

developed countries between 1975 and 2000. For this, the authors developed a structural model to measure the quantitative impact that gender discrimination may have on economic growth over the course of the development process. They presented a growth model in which labour market participation, fertility rates, and savings were endogenous in the presence of gender-based wage discrimination. The model was built to mimic the performance of the US economy and included factors such as relative rates of female participation in the labour market and the gender pay gap.

The model's predicted level of output per capita was compared with the actual level of output per capita in each country. Gender discrimination was found to decrease output per capita for two reasons: The first is that it appears to discourage female participation in the labour force, and the second is that there is a resulting steady rise in fertility rates and population growth. These two effects have comparable quantitative relevance, although the reduced female participation in the labour force finding may be the more significant result.

Additionally, the US benchmark economy was compared with a counterfactual economy in which all parameter values except the gender pay gap were similar to those calibrated in the US economic model. After the output cost of a rise in gender discrimination was computed, the results indicated that a 50% increase in the pay gap would lead to a fall in income per capita corresponding to 25% of the initial output. Next, independent estimates of female-to-male earnings ratios were compiled for a wide range of countries to build a new economic model that excludes the gender discrimination variable.

The results showed that a large portion of the difference between the US's outputs per capita and those of several other countries may be caused by gender inequality in the latter. If the US model were to display the degree of wage inequality present in, for example, Egypt, its output per capita would decrease by 42.68% from its actual level. The level of the gender pay gap in the US benchmark economy was the only parameter that, when changed, matched that

of Egypt to obtain this estimation. All the other parameters were kept similar to those calibrated according to the US model economy. Moreover, the results suggested that an increase in fertility rates caused by gender discrimination may be responsible for approximately 50% of the decline in output per capita, which may be equivalent to the direct decrease in output caused by low levels of female participation in the labour market.

2.2 Empirical literature

The notion of gender gaps and their effects on economic growth were explained in Hill and King's (1995) study in terms of non-economic indicators, while the majority of empirical studies have examined the impact of educational gender gaps on economic growth using panel and cross-sectional regression analyses (Klasen, 2002; Klasen & Lamanna, 2009).

2.2.1 Non-economic indicators and growth. Hill and King (1995) explored the effects of educational gender gaps on the economic growth and social development of various countries. Their study showed that large gender gaps in education levels are associated with a reduction in economic growth and reduced overall social well-being, as measured by the total fertility rate and infant mortality rate, as well as male and female life expectancy. They found that a 10% increase in the female primary enrolment rate leads to an infant mortality rate decrease to 4.1 deaths for every 1,000 live births. Furthermore, countries with greater gender equality in schooling experience higher life expectancy.

Hill and King (1995) also illustrated that education not only improves the productivity of the labour market, but also provides income growth for everyone. The education of women produces a range of social benefits, including fostering economic growth, enhancing the functioning of political processes, and increasing the average life expectancy of the population. In addition, the education of women has positive impacts on social well-being, although this is not always measured by the market. Increasing women's education levels also enhances the

productivity of women at home, which may improve investment in children's human capital, child survival rates, and family health.

Significant barriers to female education, such as expectations of early marriage, housework, unpaid labour responsibilities and childcare—mainly in the Middle East, Africa, and Asia—have been found to be the major causes of educational gender gaps. Such barriers persist despite evidence that education and gender equality in education acquisition and enrolment can benefit women (Hill & King, 1995).

Even though female primary and secondary school enrolment rates have significantly increased around the world since the 1990s, a noticeable variation appears to exist in the rate at which educational gaps have closed in different regions (Abu-Ghaida & Klasen, 2003). Countries in Latin America and the Caribbean (LAC), Europe and Central Asia (ECA), and East Asia and the Pacific (EAP), as well as the OECD countries have demonstrated relatively fast rates of educational gender gap closure, with the OECD countries showing smaller educational gaps than those in the aforementioned regions. On the other hand, the countries in Sub-Saharan Africa (SSA), the Middle East and North Africa (MENA), and South Asia (SA) have comparatively higher levels of educational gender inequality and slower rates of educational gap closure (Abu-Ghaida & Klasen, 2003). The regional disparities in MENA, SSA, and SA countries may be caused by certain barriers to female education relating to religion, culture, political corruption, and certain institutions (Hill & King, 1995; World Bank, 2001).

2.2.2 Empirical Growth Modelling: A neoclassical growth model was developed by Mankiw, Romer, and Weil (1992) to examine the positive correlations between economic growth, human capital (as an educational attainment measurement), and income. Knowles, Lorgelly, and Owen

(2002) estimated the different long-run impacts of male and female schooling on labour productivity and economic growth based on Mankiw et al.'s (1992) augmented version of Solow's neoclassical growth model. In this growth model, male and female education were included separately as explanatory variables. Knowles et al. (2002) reparametrised the model to include the gender education gap in order to observe its effect on economic growth. The study used data from 1960 to 1990 for a number of different countries to estimate the effects of the gender education gap and male and female human capital on the steady-state level of income. The results showed that female education has a large, positive, and statistically significant impact on labour productivity compared with male education (Knowles et al., 2002), which suggests that education gaps, especially in relation to lower female education, delay economic growth.

2.2.3 Cross-country and panel regression. There is a tendency to conduct quality cross-country comparisons due to the availability of reliable country data on economic growth for both developing and developed countries (Bandiera & Natraj, 2013). The availability of such data has encouraged the use of panel and cross-country regressions as a research method for determining economic growth. Robert Barro (1991) introduced the use of these regressions. Since then, they have been used in a growing amount of macro-economic literature on gender inequality and economic growth (Klasen & Lamanna, 2009; Bandiera & Natraj, 2013). Barro and Jong-Wha Lee established educational attainment datasets for a number of countries (Barro & Lee, 2001; Barro & Lee, 2013). The data in these sets concern educational attainment rates for the total population and rates disaggregated by gender for different countries across different time points. In 2016, Barro & Lee updated the dataset to include 146 countries as well as additional data about educational attainment for the adult population aged 15 and over and population aged over 25 at 5-year intervals from 1950 to 2010. A number of cross-country and

panel regression studies have used this dataset to investigate the impact of education on economic growth (for example, see Dollar & Gatti, 1999; Klasen, 2000; Klasen, 2002; and Klasen & Lamanna, 2009). However, this dataset did not include any data about Gulf countries such as the Kingdom of Saudi Arabia.

Dollar and Gatti (1999) designed two equations to capture the effect of gender inequality in education on economic growth over three decades for over 100 developing and developed countries, using Barro's regressions (1991, 1996, and 1998). Some gender inequality measures were used, including improvement in health by gender (measured by life expectancy) as well as access and achievement in secondary education. Using ordinary least squares (OLS) the regressions showed that gender inequality in secondary education negatively affects countries' economic growth (Dollar & Gatti, 1999). The findings suggest that an exogenous rise in opportunity and access to education for females positively impacts the economic growth of a country, especially in middle-income countries. Additionally, Dollar and Gatti (1999) have suggested that societal preferences and religious and cultural expectations could explain gender inequality in education and other areas. Gender inequality may also lower the economic growth of countries greatly influenced by these preferences. The regressions were run on religions as well as countries, and the results showed a variation in gender inequality levels between religions. For example, while Protestantism was correlated with low gender inequality in education, Hinduism and Islam were linked with high inequality (Dollar & Gatti, 1999).

Klasen (2002) examined how educational gender inequality impacts economic growth through cross-country and panel data regression analyses. While Hill and King (1995) attempted to explain cross-country differences in terms of the levels of output per capita, Klasen (2002) focused on differences in the long-term growth rates of GDP per capita. The study further differs from that of Hill and King's in its use of broader and larger datasets and

more reliable human capital measures. A five-equation model was developed using panel data in which dependent and independent variables were divided according to the three decades across which they were measured: the 1960s, 1970s, and 1980s. The study also separated the 109 included countries into seven different categories: the MENA, SSA, OECD, EAP, SA, ECA, and LAC. The results indicated that educational gaps were most prominent in MENA, SSA, and SA countries.

Klasen (2002) assumed that the distribution of innate abilities between boys and girls was similar, and that those with greater ability would have a higher chance of receiving an education. Gender inequality in education means that boys who are less able than girls will have a greater chance of entering an educational system; therefore, the average innate ability of educated children is lower than it would be if both boys and girls had similar opportunities for education. In addition, Klasen (2002) assumed that the amount of a person's human capital is the outcome of a combination of education and innate ability. Accordingly, gender inequality in education may lower the average level of human capital in an economy and thus slow the growth of the economy. Furthermore, gender inequality could lower the effects of male education on economic growth and increase the effects of female education.

In the same study, Klasen explained that gender inequality in education levels may have a major effect on economic growth and that increases in levels of gender inequality may translate into decreases in economic growth. This effect is notable in many developed and industrial economies, as well as in developing economies, especially those in SSA. Qualitatively, these results are consistent with Hill and King's (1995) findings, which used regressions to estimate GDP per capita levels. The impact of educational gender gaps on economic growth appear to be consistent and may, therefore, be significantly affected by initial levels of educational gender bias. Furthermore, these findings show that educational gender gaps may limit economic growth in two ways: directly over the long term by decreasing

average levels of human capital (and, thereby, educational attainment) and indirectly through the impacts on population growth and investment, since some countries have smaller returns on investment due to lower human capital. Some 0.4%–0.9% of the annual per capita growth rate differences between EAP, SSA, SA, and MENA countries could be accounted for by the differences in educational gender gaps between these regions.

One of the few studies that considers the impact of both educational and employment gender gaps on economic growth is that of Klasen and Lamanna (2009), who used the cross-country and panel data regression analysis methods established by Barro (1991). They employed the same approach as Klasen (2002), albeit with updated data for 140 countries. Furthermore, they updated the previous findings of Abu-Ghaida and Klasen (2003) and Klasen's (1999, 2002) studies on the impacts of educational gender gaps on economic growth and expanded their analyses to assess the effects of employment gender gaps using panel data. They found that employment and educational gap costs in SA and MENA countries represent 0.1%–1.6% and 0.9%–1.7% of annual reductions in growth, respectively, compared with those of countries in East Asia. The panel analysis also illustrated that employment gaps may have a negative impact on economic growth in the MENA and SA and that these regions may also suffer from slower growth in female participation in the labour market.

In SA, women continue to face discrimination in both education and the labour market (Klasen & Lamanna, 2009), while in the MENA, although educational gender gaps have narrowed, employment gender gaps remain pervasive. In contrast to some Asian countries where, in the last few decades, the growth in export-oriented industries has led to a decrease in the labour market gender gap, increasing female education levels in the MENA have not led to an increase in female participation in the labour force in the majority of the region's countries.

Klasen (2002) and Klasen and Lamanna (2009) showed that there are external direct impacts for inequality on economic growth. Narrowing the education gap means an increase in

female education in all male education levels. Since it is believed that female education has a positive external impact on both the quantity and quality of children's education, the decrease in gender inequality may improve the next generation's human capital, possibly enhancing economic growth in turn. This improvement in human capital can directly increase economic growth by enhancing worker productivity. However, it may also have an indirect impact by growing the returns on physical investment, which will consequently increase investment rates and, thereby, economic growth.

There are a few external indirect impacts for inequality that function through demographic effects, whereby the increase in female education—as a result of narrowing the education gap—reduces fertility rates, with this reduction impacting long-run economic growth in four ways. First, reduced fertility rates decrease population growth, which may enable investment to be used for deepening capital (increasing capital per worker) instead of widening it (equipping new employees with capital), and that may in turn encourage economic growth. Second, lower fertility rates reduce the dependency burden, thus increasing savings rates, which may enhance economic growth. Third, decreased fertility rates—for a limited time—increase the proportion of workers in the population. High population growth in previous periods may have caused a noticeable increase in the number of workers entering the labour force, which increases the investment demand for social overhead capital and capital equipment, such as housing. If this increased demand is met by enlarged domestic savings or capital inflows, or both, economic growth is enhanced (Bloom & Williamson, 1998). This impact functions primarily through the population growth effect on investment and its effect on economic growth instead of impacting growth directly. Fourth, if the labour force increase is absorbed by boosted employment, per capita economic growth will increase despite the changes in productivity and wages because more employees will share their wages with fewer dependents, improving average per capita income. The third and fourth impacts are temporary

because after a few decades the number of elderly people increases and working-age population growth decreases, causing a higher dependency burden (Bloom and Williamson, 1998).

Chapter 3: Female Education and Employment in Saudi Arabia: Achievements and Challenges

3.1: Education and employment in Saudi Arabia

When informal education for females in Saudi Arabia was implemented by King Saud Al Saud in the 1950s, the focus was mainly on religious study. However, the government did not implement formal education for females until the reign of King Faisal, who ruled from 1964 to 1975 (Hamdan, 2005). In 1952, Princess Iffat, Prince Faisal's wife, convinced her husband to establish a school in the royal palace for their daughters (Alsuhaibani, Khan, & Shaker, 2017) to teach them a range of subjects. This strategy was intended to instil a sense of importance in women's education, both within the royal family and in the wider society (Al-Sudairy, 2017).

Prior to 1960, education for Saudi females was aligned to Saudi religious and social beliefs (Hamdan, 2005). Females received informal training that focused primarily on domestic work, such as childcare, cooking, and other roles related to being a wife and mother (Al-Sudairy, 2017). Conservative groups in Saudi society resisted the formalisation of education for females and tried to slow this process and the expansion of informal schools. Consequently, the formalisation of education for females did not begin until 1960, with the official launch of all-female schools (Al-Sudairy, 2017). Extremists claimed that educating females would distract them from their primary role as wives and mothers and was a Western-inspired concept that would corrupt their thinking (Alsuhaibani, Khan, & Shaker, 2017). Nevertheless, the government determined that education for both males and females was essential for the modernisation of the nation (Al-Sudairy, 2017).

Although formal introduction for girls was implemented in 1960 (Alsuhaibani, Khan, & Shaker, 2017), basic education for females was not compulsory until 2004 (Kelly & Breslin, 2010), and any progress in terms of quality and access was slow, especially in rural areas. Even when the government began to support female education, the conservative point of view was accommodated to some extent, as the Ministry of Education wanted to ensure that Islamic values were preserved in the curriculum without being subject to the influence of Western culture (Alsuhaibani, Khan, & Shaker, 2017).

Education for both males and females in Saudi Arabia has always been free. When enrolment became mandatory in 2004, the number of females in school almost equalled the number of boys (Kelly & Breslin, 2010). The Ministry of Education initiated a ten-year plan (2004–2014) to develop technical education for females, reduce the school dropout rate, develop special needs education, improve the education of teachers, make basic education compulsory and increase kindergarten enrolment to 40% (Alsuhaibani, Khan, & Shaker, 2017). The launch of this plan changed attitudes towards female education to some extent and encouraged universities to create more majors for women. For example, Imam Abdulrahman Bin Faisal University introduced a Cyber Security and Digital Investigations programme in 2018; in the same year, Princess Norah University introduced the first female bachelor's degrees in Electrical Engineering and Industrial and Systems Engineering; in addition, a degree in Sports Training and Fitness was introduced at King Saud University in 2019². Although this plan did not have an immediate impact, Figures 2, 3, and 4 show that female enrolment in general education³ (primary, intermediate, and secondary) increased in the following years, and the gap between males and females narrowed dramatically.

² However, the period of this thesis covers until 2017, therefore, these changes will not be captured in the dataset.

³ General education in Saudi Arabia is compulsory and free. It is divided into three stages. The primary stage consists of six years of study, beginning at age six. The intermediate stage involves three years of study, as does the secondary stage. All stages are supervised by the Ministry of Education.

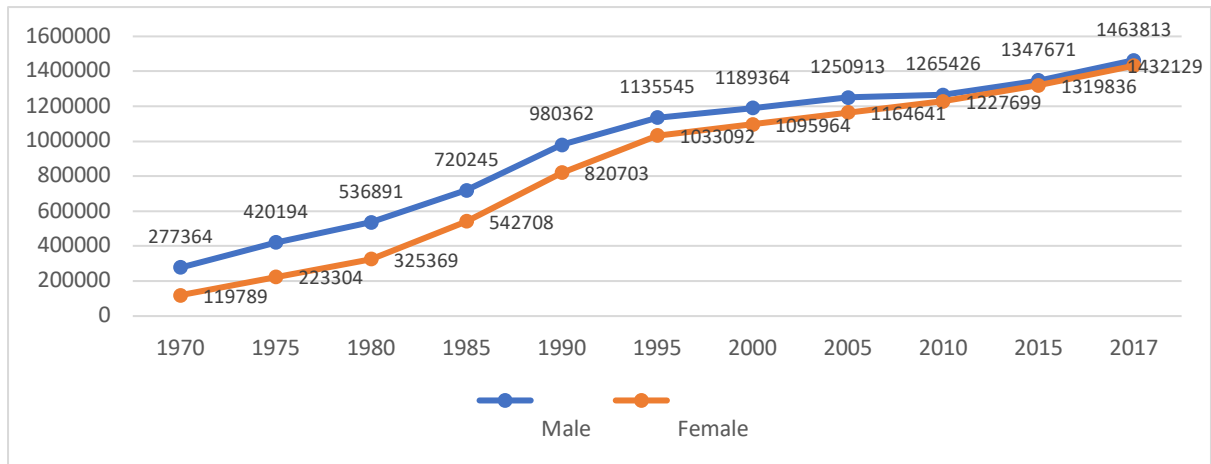


Figure 2. Enrolment in primary schools (Source: Saudi Arabian Monetary Authority, 2018)

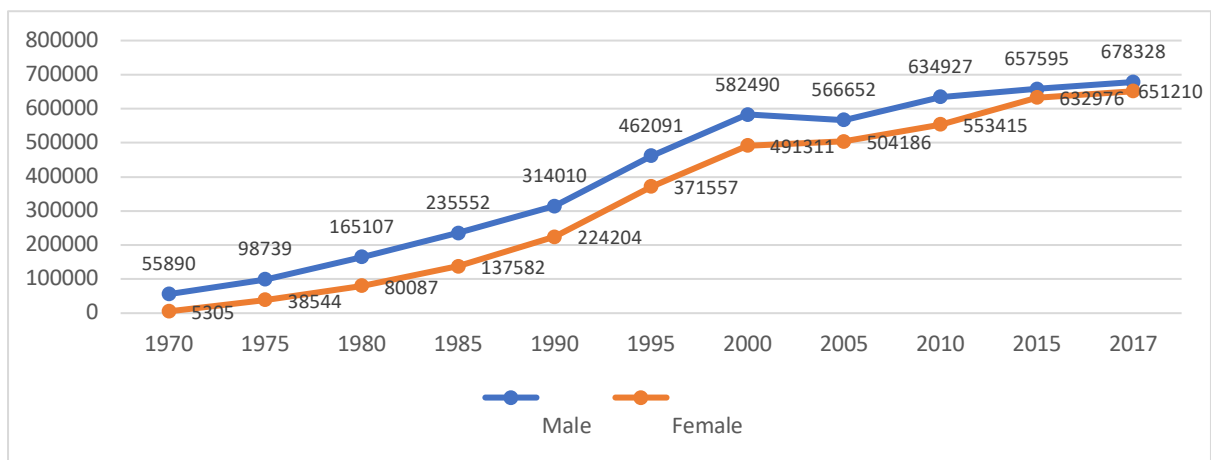


Figure 3. Enrolment in intermediate schools (Source: Saudi Arabian Monetary Authority, 2018)

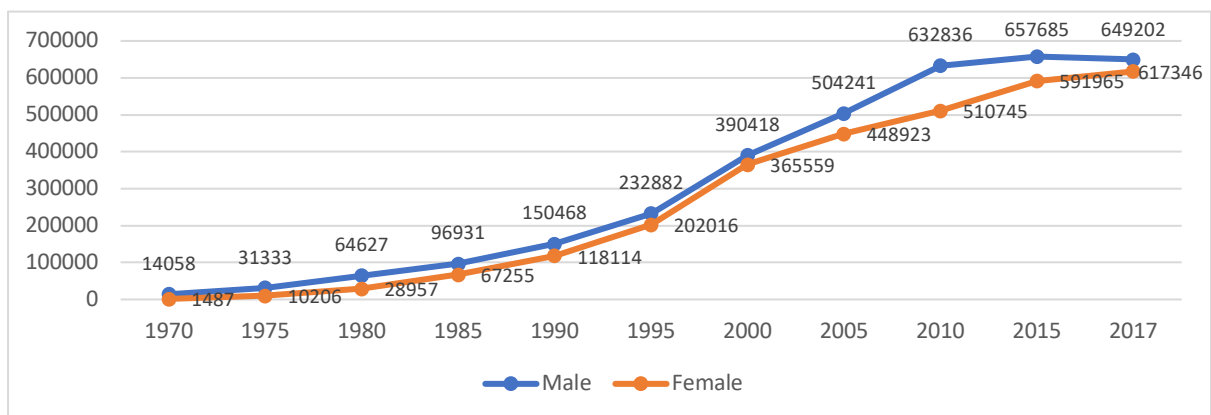


Figure 4. Enrolment in secondary schools (Source: Saudi Arabian Monetary Authority, 2018)

Figures 2, 3, and 4 summarise enrolment by gender in general education in the Kingdom of Saudi Arabia from 1970 to 2017. For both males and females, enrolment has increased over time at all general education levels, with an overall growth of public and private schools, as

families became more aware of the importance of education. With an increasing number of emigrants enrolling their children in public education and higher minimum jobs requirements (Al-Sudairy, 2017), the gap in enrolment has narrowed over time at all levels. For example, in 1970, female intermediate and secondary enrolment represented only 10% of the total; currently, this figure has increased to almost 49%.

In 1961, only four female students were enrolled at a higher learning institution in Saudi Arabia, which was King Saud University (Al-Sudairy, 2017). By 2017, the number of females enrolled in higher education⁴ had reached 809,119 as compared to 871,794 males (Saudi Arabian Monetary Authority, 2018) (see Figure 5). By 2019, there existed 30 state universities (Ministry of Education, 2019) and 13 private universities in different areas of Saudi Arabia (Ministry of Education, 2019). Despite the high fees, female students tend to favour private universities because they offer majors that are not available at public universities (e.g., industrial engineering), enabling them to participate in non-traditional sectors (Al-Sudairy, 2017).

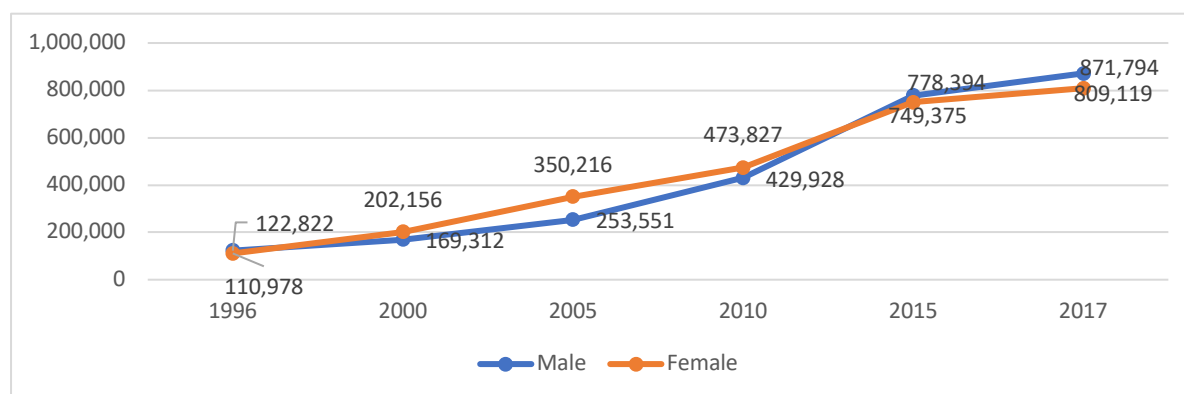


Figure 5. Higher education enrolment (Source: Saudi Arabian Monetary Authority, 2018)

Higher education enrolment has increased over time for both males and females as a result of the growth in public and private universities and higher job skills requirements (Al-Sudairy, 2017). In 1996, the number of males enrolled in higher education was 122,822 while

⁴ Saudi Arabian Monetary Authority statistics for higher education include Intermediate Diploma, Bachelor's degree, Higher Diploma, Master's degree, Fellowship, and PhD.

the number of females was 110,978. From 1998 to 2013, female enrolment exceeded male enrolment, but the number of males has subsequently overtaken the number of females in higher education. This trend may relate to demographic changes and the high unemployment rate among females, who are often discouraged from undertaking further study beyond bachelor level (Smith & Abouammoh, 2013). Despite progress in education enrolment at all levels, the available data indicate that the unemployment rate⁵ among Saudi females is significantly higher than among males.

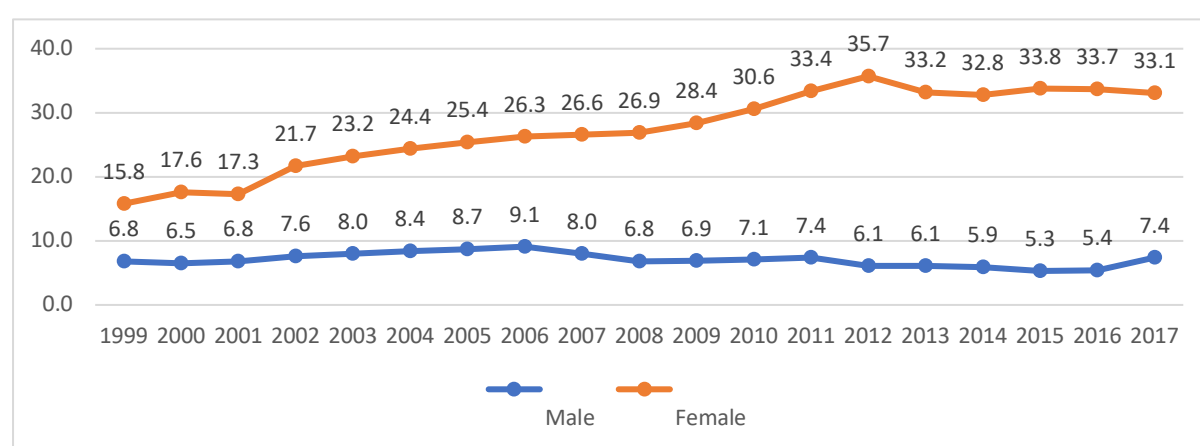


Figure 6. Saudi unemployment rate by gender (Source: Saudi Arabian Monetary Authority, 2018)

As shown in Figure 6, the unemployment rate among females is considerably higher than males and is increasing over time. In 1999, the female unemployment rate was around 15.8%, but this gradually increased to reach 33.1% by 2017. During the same period, male unemployment fluctuated between 5.3% and 9.1%. Although female unemployment decreased by 2.5% in 2013, no major changes have since occurred, and the gap between males and females remains wide. This high and persistent increase in female unemployment relates to a number of issues, including personal choices, traditions and customs, as well as legislative provisions that prevent females from working in certain sectors.

⁵ Based on Saudi Arabian Monetary Authority data, the unemployment rate was calculated as the number of unemployed individuals across the total labour force.

3.2: Education and employment challenges in Saudi Arabia

Despite the progress made in recent decades, females in Saudi Arabia face many obstacles in terms of education and employment. Some of these factors are related to the existing regulatory restrictions that, for example, prevent female students from enrolling in certain university majors (Al-Sudairy, 2017). Table 1 shows the disciplines that do not allow female enrolments in Saudi Arabia according to the Directory of Specializations in Higher Education Institutions in Saudi Arabia (Ministry of Education, 2019). In 2001, around 80% of female students at higher learning institutions in Saudi Arabia were enrolled in humanities and arts courses, such as Islamic Studies and Education (Budhwar & Mellahi, 2006). This percentage continues to be high, with an increase in business graduates (Al-Dossary, 2018). Female enrolment in certain majors is impacted by segregation policies and a lack of societal acceptance in some fields such as nursing. In 2003—41 years after the establishment of nursing education—only 731 females entered nursing colleges (Al-Sudairy, 2017). According to the Ministry of Health, the percentage of female nurses at hospitals is around 75%, but only 39.8% of these are Saudi (Statistical Yearbook, 2017), which is a low proportion by comparison with other countries (Al-Dossary, 2018).

Table 1. *Disciplines that exclude women from enrolling in Saudi Arabia*

Department	Disciplines
High Judicial Institute	Personal Status, Criminal Justice, Labour Justice, Commercial Judiciary, Administrative Justice, Comparative Jurisprudence and Islamic Policy
Sport Science and Physical Activity	Athletic Training, Physical Fitness, Sports and Recreational Management, and Teaching Physical Education (A degree in Sports Training and Fitness was introduced at King Saud University in 2019.)
Physical Education and Biomechanics Sciences	Physical Education, Biomechanics Sciences
Information Science	Information Sources Management and related Services, Records Management and Electronic Keeping, Learning Resource Centres, Information Services, Libraries and Information/Information, and Library and Information Sciences
Asian Languages and Translation	Japanese Language, Persian Language, Hebrew Language, Chinese Language, Turkish Language, and Urdu Language

European Languages and Translation (except English and French)	Russian Language, Italian Language, German Language, and Spanish Language
Modern Languages and Translation	Russian Language and Translation, Modern Languages, Chinese Language and Translation, Persian Language and Translation, Turkish Language and Translation, Japanese Language and Translation, German Language and Translation, Spanish Language and Translation
Language and Culture	Language and Culture, Intensive Program
Geology	Palaeontology, Hydrogeology and Petroleum Geology
Industrial Engineering	Industrial Engineering - Systems of Industrial Processes and Supply, Industrial Engineering - Human and Safety Factors, Human Systems, Industrial Engineering, Manufacturing Systems, Industrial Systems (Princess Norah University introduced the first female bachelor's degree in Industrial and Systems Engineering in 2018.)
Electrical Engineering	Intelligent Systems and Control, Communications Systems, Electrical Engineering, Electrical Machines, Communications and Electronics, Electric Power, Computer and Control, Control Systems and Computer, Electronics, Automatic Control and Computers, Communication (Princess Norah University introduced the first female bachelor's degree in electrical engineering in 2018.)
Chemical Engineering	Bioprocess Engineering, Operations and Control, Chemical and Petrochemical Industries, Desalination and Water Treatment, Materials Engineering, Chemical Engineering -Polymer, Chemical Engineering, Transport Phenomena, Chemical Industry Control Systems
Civil Engineering	Civil Engineering, Water Resources and Environment, Transport and Construction Management, Engineering and Construction Management, Transportation Engineering, Structural Engineering, Surveying Engineering, Environmental Engineering, Water Resources, Transport and Construction, Geotechnical Engineering, Water and Environment, Construction and Geotechnical
Mechanical Engineering	Science in Materials Engineering, Mechanical Power, Jet Propulsion Systems, Mechanical Design, Mechanical Engineering, Solid-State Mechanics, Refractory products and fluid systems, Fluid, Refractories, Dynamics and Control, Fluid and Temperature, Design and Applied Mechanics
Petroleum Engineering and Natural Gas	Oil Reservoir Engineering, Drilling Engineering, Oil Production Engineering, and Petroleum Engineering and Natural Gas
Architecture	Architecture (available in limited private universities)
Architecture and Building Science	Architecture and Building Science, Architectural Design
Urban Planning	Urban Planning and Design, Science in Urban Design, Real Estate Development, Urban Design, Planning of Settlements, Planning of Settlements, Urban Design, Urban and Regional Planning, and Urban Planning
Agricultural Guidance and Rural Community	Agricultural Guidance
Agricultural Economics	Agricultural Economics and Food Marketing, Applied Economics, and Agricultural Economics
Animal Production	Science of Livestock and Poultry Production, Poultry Production, Animal Production, and Farm Animal Production
some Plant Production	Vegetables, Ornamental, Forests and Grasslands, Fruit, Science of Plant Production, Crops

Agronomy	Machinery Engineering and Agricultural Powers, Bioengineering Agricultural Systems and Irrigation, Agronomy, Irrigation and Drainage Engineering, Food Process Engineering, Facilities and Environmental Engineering and Agricultural
Soil Science	Soil Science
some Plant Protection	Plant Protection, Plant Diseases
Emergency Medical Services	Emergency Medical Services
Management of Heritage Resources and Tourism Guidance	Heritage Resources Management, Tourism Guidance
Tourism and Hotel Management	Tourism Management, Hotel Management

Source. Data was gathered from the Directory of Specializations in Higher Education Institutions in Saudi Arabia

Another major obstacle facing women in Saudi Arabia related to the existing regulatory restrictions is segregation, which extends beyond education settings to the labour market, where females are often excluded. For example, at all education levels (even university), males and females cannot study in the same classroom. In female schools and universities, the majority of teachers are female, thus limiting the available courses which females can teach. In some universities, male professors can teach female students via closed circuit television, thus avoiding direct contact (Rao & Latha, 2004). Beyond education, the government supports segregation at all workplaces other than in hospitals, where females and males can work together, and any violation of this law is a criminal offence that leads to arrest (Baki, 2004). These segregation laws prevent women from entering areas of the labour market that may require interaction with men. For example, although the country had about 23 vocational training institutes by 2016, cultural barriers in sectors such as the clothing industry has meant that employers are unable to hire female graduates from these institutions, and the law further prevents females from starting their own businesses (Al-Sudairy, 2017). These segregation and employment laws also meant that there were no female law students or lawyers prior to 2006 (Douglass, 2014), and women still cannot become judges. The number of women in medical fields also remains quite low due to strict laws that regulate work in these areas. For example, female pharmacists cannot work in pharmacies outside hospitals or shopping malls. These

restrictions explain why Saudi Arabia has one of the world's lowest rates of female employment.

In addition, there are four factors related to the sociocultural challenges that impact upon women's education and employment. First, women in Saudi Arabia are subject to male dominance in all aspects of their lives. Having an official male guardian or *mahrem* is a long-running tradition and is a legally binding requirement for every Saudi female (Alsuhaibani, Khan, & Shaker, 2017). By law, the *mahrem* has complete authority to make decisions on the female's behalf; this is not a formality but is enforced and sanctioned by the government. For example, the *mahrem* decides whether the female can have a bank account, enrol in education, own a business, work, travel outside the country, or (in some situations) access healthcare (Alsuhaibani, Khan, & Shaker, 2017). Regardless of her status in society or her level of education, every woman must have a *mahrem* who is either present or who gives documented permission for the woman to access activities and services or to live alone (Alsuhaibani, Khan, & Shaker, 2017).

Second, the conservative Saudi culture remains an obstacle for women to access education and employment. Despite remarkable changes in women's thinking, traditions continue to control and constrain their career choices, confining them to education or other fields that ensure gender segregation. In most workplaces, females cannot be recruited without their guardian's permission. This attitude is embedded in guardians' concerns about family reputation, which usually relates to females and how they behave. Saudi society tries to ensure women's 'modesty' and has gone to great lengths to protect it through certain practices, such as veiling and strict monitoring by parents and male guardians, as well as gender segregation. These practices constrain education and employment opportunities; for example, Saudi laws prohibit women from driving in order to ensure her safety and modesty, causing everyday difficulties for female students and workers (Alwedinani, 2016).

Third, gender stereotyping also hampers female education and employment in Saudi Arabia. This stereotyping is reproduced through subject segregation in learning institutions, with 90% of Saudi females enrolled in traditional fields, such as education, social sciences, religious sciences, and humanities. As the majority of women graduate from the same majors, the labour market is saturated in these areas, and women are prohibited from entering other fields such as politics, aviation, and engineering (Alwedinani, 2016). The employment gender gap reflects these limitations, and the influence of government policies and Saudi culture means that resources are misallocated.

Fourth, the barriers to women's aspirations include social traditions such as the disapproval of working women and the prevention of females from participating in certain jobs. Other difficulties that limit women's ambitions include a preference to employ males because females are not considered sufficiently knowledgeable about some jobs and are thought unlikely to fulfil their responsibilities, as some jobs require travel or long absences from home (Al-Sudairy, 2017). While women's status and role in society differs across cultures, these issues present challenges for females throughout the Arab world. Under these constraints, females are calling upon the provision of suitable employment opportunities for all areas within the traditions, in accordance with *Shari'a*⁶ regulations, which call for segregation to provide psychological comfort for all members of society and not only for working females (Al-Sudairy, 2017).

Even though the majority of Saudi families embrace education for females, the government plays an essential role in ensuring that every female is enrolled in school and that women are afforded opportunities for entrepreneurship. As Saudi females face tough sociocultural challenges, such as the need for a male guardian's permission before pursuing

⁶ *Shari'a* is an Arabic term for the Islamic law, which is usually taken from the Quran (Islam's religious text), which is the main source of law implementation in Saudi Arabia.

employment or education opportunities, they may be unable to access certain demanding positions or careers that are seen to pose a threat to their religion-prescribed roles as mothers and wives. Certainly, Saudi tradition and society still require females to fulfil their traditional responsibilities in the home, regardless of their education level (Smith & Abouammoh, 2013).

Beyond government legislation and sociocultural challenges, individual factors may also contribute to the high female unemployment rate, as Saudis tend to be less attracted to certain professions (Mohammed, 2012). This is apparent in the scarcity of Saudi workers and the high employment rates among foreigners, who are in high demand in Saudi Arabia, especially in the private sector. Economic growth in Saudi Arabia relies on foreign labourers who will accept lower wages. Saudis prefer to work in the public rather than the private sector, and this is seen as a fundamental cause of the high unemployment rate among Saudi females and males. Figure 7 shows that 75% of the workers in the Saudi labour market are foreigners, confirming that the private sector prefers to employ non-Saudis. Additionally, 66.6% of the workforce are non-Saudi males, highlighting the preference for male workers in the Saudi labour market.

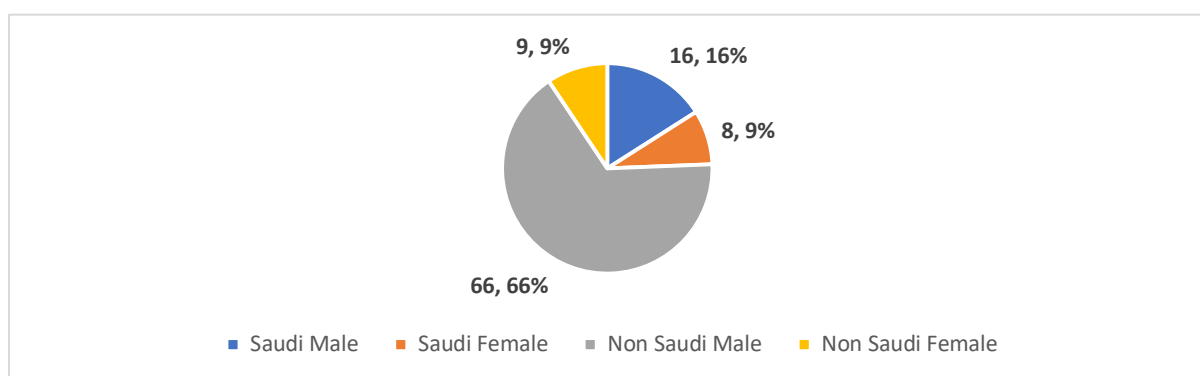


Figure 7. Percentage employment by gender and nationality in 2018 (Source: General Authority for Statistics, 2018)

Women's own decisions also contribute to the high unemployment rate. Many educated females prefer to work in the public sector because it offers fully paid maternity leave, better

retirement packages, shorter working hours, and higher wages. However, female employment opportunities in the public sector are more limited than for men,⁷ and many educated females remain jobless because they do not want to take certain private sector jobs, such as domestic service, where the proliferation of migrant labour means that wages are low. About 40% of government employees are women, and the majority are employed in the education sector. The fact that over 90% of Saudi females in formal employment are working in the public sector is a problem that economists, policymakers, and the government must address, as the private sector is likely to be the main source of future employment (Al Rajhi, Al Salamah, Malik, & Wilson, 2012).

In terms of demand, the Saudi labour market is subject to fluctuations in oil prices, which is the Kingdom of Saudi Arabia's main source of revenue (Ghaban, 2002). Both educated and uneducated Saudi females suffer from high unemployment rates, as their fields of study do not provide the skills demanded by the labour market. The large number of unskilled non-Saudi workers in the labour force is a major reason for Saudi unemployment (Ba Ishen, 2002). The private sector prefers to hire foreign labourers rather than Saudis for a number of reasons, including cheap wages, which makes foreign recruitment more profitable (Al-Nowaiser, 2001). The discrepancy between general and university education outcomes and labour market demands is another cause of Saudi unemployment. Job descriptions and recruitment criteria differ fundamentally in the government and private sectors, impacting negatively on Saudis' pursuit of jobs in the private sector (Ghaban, 2002). Key differences in the private sector include fewer vacation days, absence of job security, no clear promotion system, and long working hours.

⁷ Males and females in the public sector work in a segregated environment, which means the same opportunities are not available to men and women, who may work in the same ministry or department but in different areas or buildings to preserve the women's modesty.

Private sector employers prefer to recruit foreigners because they believe that Saudi qualifications do not provide the requisite skills, and highly trained and qualified foreigners are willing to work for lower salaries (Al-Sultan, 1998). As well as claiming that universities in Saudi Arabia do not supply graduates in the relevant areas (Al-Shammary & Al-Dikheelallah, 2007), employers believe that Saudi youth are dependent and reckless as a result of the financial boom in the early 1970s. Employers also claim that Saudi job seekers lack the required ambition and experience for high-productivity private sector working environments (Al-Sheikh, 2001). Another widespread belief among private sector employers is that Saudis lack the necessary communication skills, especially in English, even though many of these jobs do not require such skills (Ghaban, 2002). There is also a perception that Saudis who secure administrative and managerial positions are reluctant to move to a different city.

A widespread practice among Saudis that can cause more qualified workers to be passed over for employment is *wasta*. *Wasta* is an Arabic term that refers to enlisting the assistance of a person who has a connection with an individual whose power or authority enables the accomplishment of a specific favour for another individual (the seeker), which the seeker cannot attain him or herself due to their difficulty in obtaining it or a lack of eligibility (National Anti-Corruption Commission, 2017). Individuals who use *wasta* rely on their relationships to attain a particular outcome. These relationships may be direct or may occur through a *waseet*, a mediator between the favour seeker and the favour provider. These connections are not limited to relations among family members but may be tied to job status, tribal relations, social standing, and seniority (Almutairi, 2017). Even though the practice of *wasta* is considered disreputable and is banned in Western countries, it is widespread in Saudi Arabia and in other Arab countries (Barnett et al., 2013).

Wasta is still practised in Saudi Arabia in many private and public organisations even though it clashes with Islamic principles, contravenes government regulations, and constitutes an ethical crime that merits punishment according to the Saudi Arabian Anti-Corruption Commission (Almutairi, 2017). Using *wasta* in the labour market means that a person need not possess the relevant qualifications nor have graduated with a certain degree to be eligible for a job so long as this individual has the right connections (Algumzi, 2017). In the workplace, employees rely on *wasta* to jump queues and overcome obstacles to obtain favours, advantages, sought-after procedures, special services, and official paperwork or procedures from organisations. In addition, *wasta* can be used in seeking a superior position in the workplace (Barnett et al., 2013). Individuals who do not have *wasta* may be disadvantaged in negotiations, have their requests ignored or face long waiting times associated with official procedures (Barnett et al., 2013). Therefore, the continuance of *wasta* as a cultural practice in Saudi Arabia can impede economic growth. Any improvement in education levels may not have a concomitant effect on economic growth, and a disconnect between educational outcomes and the labour market outcomes can be seen.

3.3: Government policies to mitigate education and employment challenges

One government initiative designed to solve the unemployment problem is the concept of ‘Saudisation’. This policy encourages firms and companies in Saudi Arabia to employ educated Saudis because non-Saudi citizens currently comprise 75% of the workforce, while local males account for 16.16%, and females account for the remaining 8.9%. The policy of Saudisation was implemented by the Ministry of Labour in 2012 to provide 50,000 work opportunities for females (Al-Sudairy, 2017). Within that same year, the Ministry of Labour reported that almost 47,000 females had been hired in industrial settings, especially in the retail business sector (Al-A’ali, Al-Shammari, & Masri, 2017). This number was expected to

increase as advanced learning was not required in this sector (Al-Sudairy, 2017). According to SAMA data, this policy did not affect the male unemployment rate, which remained stable at 6.1% during 2012 and 2013. However, the female unemployment rate decreased from 35.7% in 2012 to 33.2% in 2013, before stabilising over the following years. This policy proved somewhat effective but requires a stronger response from the private sector and stricter government legislation if the policy's aims are to be achieved.

In 2005, the government passed a labour law to extend the fields in which females are allowed to participate. However, there are still some restrictions in relation to most technical jobs, which are considered unsuitable for females. Additionally, a labour law implemented in 2015 sought to increase the number of Saudi females in formal employment by regulating the spatial environment for women working in the private sector—such as shops that sell women's supplies—encompassing the Saudisation and feminisation of appropriate industrial jobs for women and support for the employment of women in large companies, institutions, the retail sector, commercial kitchens, and recreational parks (Ministry of Labour, 2019). In February 2019, the Ministry of Labour and Social Development published *The Uniformed Organization of Women's Working Environment* (Ministry of Labour, 2019), giving females the opportunity to start their own businesses and loosening the restrictions on jobs they can apply for.⁸

One required major change that could positively impact female employment in Saudi Arabia would be to allow women to select a course of their own preference and to work freely

⁸ In 2019, the Ministry of Labor and Social Development prohibited the employment of women in industrial activities that include underground work in mines and quarries, extraction of minerals and stones, installation and distribution of gas and other petroleum products, sewage treatment, construction, restoration, painting, drilling, paving, laying of concrete, climbing on scaffolding, and jobs related to the asphalt industry, the tanning industry, smelting tasks, generating, transporting and distributing energy, welding, oxygen, electrolyte and electricity, jobs in manure depots, jobs related to animal dung or blood, jobs related to loading and unloading goods in ponds, docks, ports, and warehouses, jobs related to the manufacture, filling, or spraying of paints, jobs related to the processing, preparation, or reduction of lead ash and the extraction of lead silver, jobs related to the tin industry and metal compounds containing Li or more than 10% lead, direct mixing and kneading in manufacturing processes or the repair of electric batteries and cleaning workshops.

in the labour market, which would benefit both the public and private sectors. Providing equal education and employment opportunities for women would contribute to economic growth in Saudi Arabia by providing more diverse human capital. At family level, female employment would introduce another income source, which would improve living standards and household financial stability (Sayigh, 2014). Additionally, women could increase overall productivity by ensuring that the entire community participates in national development. A few universities, such as King Saud University, allowed females in 2007 to study for their chosen degree without obtaining consent from their male guardian (Human Rights Watch, 2008), and the government announced that females would finally be allowed to study law from 2006 onward (Douglass, 2014).

Over the past 20 years, a significant proportion of Saudi Arabia's budgetary expenditure has been on education; the 2018 figure of 19.7% is one of the highest in the world (Saudi Arabian Monetary Authority, 2018b). Due to government concerns that investment in female education might be wasted, efforts were made to encourage greater female participation in both the public and private sectors. For instance, rising unemployment among Saudi females has forced the government to open new courses available to women, including politics, architecture, media, law, and engineering. However, more higher education reforms are required if there is to be meaningful growth in the number of Saudi females employed in vocational and technical areas (Badry & Willoughby, 2015). For example, the percentage of engineering programmes currently open to female students is less than 5% of those offered to Saudi males, and all are provided by private universities (Alwedinani, 2016).

Government has also improved women's situation by lifting the ban on women driving, making day-to-day life and communication easier by freeing women from their male guardians. In October 2017, King Salman issued a royal decree granting females the right to obtain a

licence and drive unaccompanied (Kirk, 2017). By providing more opportunities for employment more generally and allowing women to compete with men for jobs that involve driving, this will benefit the economy by reallocating the resources and money (currently billions of dollars) paid every year to foreign chauffeurs and increase Saudi GNP.

Policy must change to encourage Saudi females to enter the private sector by endorsing their involvement, and the private sector must be legally compelled to support this—for instance, by providing new mothers with special nursing areas and by offering paid maternity leave. Recent government policy has encouraged women to enter private sector employment by relaxing some restrictions on females selling goods in retail shops, and in 2016, Saudi women assumed more key positions in airports; beyond merely verifying the identities of covered women, Saudi females were employed as security guards for the first time (Al-Sudairy, 2017, p. 121). While the government has attempted to make the private sector more open to female recruitment, women must also be willing to look beyond the public sector to support family financial needs, as well as for their own personal fulfilment and career development.

Female education in Saudi Arabia can be seen as an investment in the future. Higher levels of female education and literacy are usually associated with lower child mortality rates, lower HIV/AIDS infection rates, and lower rates of fertility (Seiple, Hoover, & Otis, 2013). Educated females are more likely to prioritise their children's education, resulting in substantial increases in per capita income, agricultural production, and economic growth. However, Saudi Arabia has more to do, as female educational participation is still limited, accounting for about half of the students and graduates from higher education institutions. Saudi Arabia cannot depend on oil forever; and a sustainable future labour force must include females (Alsuhaibani, Khan, & Shaker, 2017). Recent economic trends suggest that if half of society is excluded from

participation in national development, human security is unachievable, and the economy cannot prosper (Seiple, Hoover, & Otis, 2013).

In summary, there are two sources of gender inequality in education: enrolment rates and educational content. The latter is problematic because it creates a mismatch of supply and demand in certain industries, leading to employment inequality for same-skilled females. On the demand side, cultural, policy, and social settings restrict the demand for female workers—a prototype of discrimination in the labour market.

Chapter 4: Methodology and Data

To measure the direct and indirect impacts of education and gender inequality in education on economic growth, this study implements the approach used by Klasen (2002) and Klasen and Lamanna (2009). Accordingly, a set of equations will be employed using OLS to capture these direct and indirect effects. The ultimate dependent variable, economic growth (G), is defined as the annual growth rate of per capita GDP. Education (GED) is measured by the growth in male education. The gender inequality in education variable ($RGED$) is defined as the female-to-male ratio of secondary school enrolments. A value of one would indicate an equal number of enrolments for males and females, and thus no inequality gap at all, and the lower the ratio the larger the inequality.

Table 2. *Variable definitions and data sources*

Variable	Variable name	Definition	Data Source
G	Per capita GDP growth	Annual growth rate of per capita gross domestic production in current US dollars from 1971–2017	World Bank national accounts data and OECD national accounts data files
$GFCF$	Gross fixed capital formation growth (investment)	Annual growth rate of gross fixed capital formation in current US dollars from 1971–2017	Saudi Arabian Monetary Agency (SAMA)
PG	Population growth	Annual total population growth rate from 1971–2017	World Bank national accounts data and OECD national accounts data files
LFG	Labour force growth	Annual growth rate of the working-age population (15–64) from 1971–2017	World Bank national accounts data and OECD national accounts data files
GED	Growth in male education	Annual growth in male enrolment in secondary school from 1971–2017	SAMA
$RGED$	Education ratio (inverse measure of gender inequality)	Annual female: male ratio of secondary school enrolments from 1971–2017	SAMA

<i>OS</i>	Change in the price of oil	Annual price change of North Sea (Brent) oil in US dollars (2005) from 1971–2017	SAMA
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In addition, the present study also includes a number of variables reflecting the country's characteristics. For instance, as the Saudi Arabian economy is largely driven by the oil sector, the annual increase in the North Sea (Brent) oil price in US dollars will be used as a variable to represent the impact of oil sector prices on per capita GDP. It is also possible that investment is a function of the variability of the price of oil; consequently, excluding the oil price from the investment function could lead to omitted variable bias, as the impact of other variables may depend on how those variables correlate with oil prices.⁹ While table 2 presents a list of all the variables, their definitions and their data sources, Table 3 displays the descriptive statistics of these variables.

Table 3. *Descriptive statistics of variables of interest*

Variable	Period	Mean	Standard deviation	Minimum	Maximum
G	1971–1980	40.41%	0.545	-2.07%	189.06%
	1981–1990	-7.27%	0.139	-21.97%	19.06%
	1991–2000	2.68%	0.080	-13.24%	14.53%
	2001–2010	8.53%	0.135	-19.75%	23.30%
	2011–2017	1.69%	0.119	-15.68%	23.27%
	Entire period	9.69%	0.312	-21.97%	189.06%
GFCF	1971–1980	49.86%	0.465	-7.08%	150.40%
	1981–1990	-10.93%	0.226	-62.55%	25.39%
	1991–2000	4.34%	0.088	-14.54%	20.70%
	2001–2010	15.26%	0.122	-6.76%	27.98%
	2011–2017	4.18%	0.097	-13.73%	17.54%
	Entire period	13.08%	0.321	-62.55%	150.40%
PG	1971–1980	5.07%	0.004	4.43%	5.88%
	1981–1990	5.16%	0.010	3.56%	6.36%
	1991–2000	2.41%	0.005	1.92%	3.27%
	2001–2010	2.83%	0.001	2.57%	2.97%
	2011–2017	2.69%	0.004	2.00%	3.09%
	Entire period	3.69%	0.014	1.92%	6.36%

⁹ Data on the annual growth rate of investment is not available for Saudi Arabia prior to 2000; therefore, data on the annual growth rate of gross fixed capital formation have been used instead.

<i>LFG</i>	1971–1980	5.42%	0.005	4.56%	6.25%
	1981–1990	5.65%	0.014	3.64%	7.27%
	1991–2000	3.09%	0.003	2.74%	3.70%
	2001–2010	4.26%	0.001	4.05%	4.45%
	2011–2017	3.64%	0.008	2.36%	4.58%
	Entire period	4.46%	0.013	2.36%	7.27%
<i>GED</i>	1971–1980	16.60%	0.057	9.26%	29.31%
	1981–1990	8.85%	0.029	1.93%	12.75%
	1991–2000	10.04%	0.031	4.33%	14.40%
	2001–2010	4.97%	0.025	0.65%	8.25%
	2011–2017	0.40%	0.030	-3.30%	5.78%
	Entire period	8.67%	0.063	-3.30%	29.31%
<i>RGED</i>	1971–1980	0.307	0.130	0.102	0.448
	1981–1990	0.682	0.091	0.518	0.785
	1991–2000	0.872	0.044	0.806	0.936
	2001–2010	0.882	0.057	0.782	0.950
	2011–2017	0.862	0.062	0.800	0.951
	Entire period	0.712	0.240	0.102	0.951
<i>OS</i>	1971–1980	28.26%	0.623	-21.63%	174.72%
	1981–1990	-5.53%	0.230	-58.47%	23.98%
	1991–2000	5.09%	0.309	-33.06%	70.55%
	2001–2010	8.63%	0.221	-34.15%	39.73%
	2011–2017	-2.10%	0.238	-40.35%	30.68%
	Entire period	7.44%	0.370	-58.47%	174.72%

Table 3 shows that the per capita GDP growth was very high in the 1970s and then fell to a negative number in the 1980s due to the oil shocks of the 1970s. Because the economy of Saudi Arabia is mainly driven by oil prices, they present a similar pattern—oil prices rose strongly in the 1970s and decreased in the 1980s. The gross capital formation growth matches the pattern of per capita GDP growth and oil price growth. Population and labour force growth both declined over time, which is consistent with the decline in birth rate in Saudi Arabia. It can also be observed that the growth in male education is relatively strong, and that gender inequality in education moved from almost zero to close to 1, which shows that there was a noticeable movement to educate women, especially from the 1970s through the 1980s.

The following equations will be employed using ordinary least squares (OLS) to observe the direct impacts of gender inequality in education on economic growth:

1. $G = \alpha + \beta_1 GFCF + \beta_2 PG + \beta_3 LFG + \beta_4 GED + \beta_5 RGED + \beta_6 OS + \varepsilon$
2. $GFCF = \alpha + \beta_7 PG + \beta_8 LFG + \beta_9 GED + \beta_{10} RGED + \beta_{11} OS + \varepsilon$
3. $PG = \alpha + \beta_{12} GED + \beta_{13} RGED + \varepsilon$
4. $LFG = \alpha + \beta_{14} GED + \beta_{15} RGED + \varepsilon$
5. $G = \alpha + \beta_{16} GED + \beta_{17} RGED + \beta_{18} OS + \varepsilon$

The first equation measures the direct impact of education and gender inequality in education on per capita GDP growth in addition to assessing a few controlling variables, such as the growth rate of gross fixed capital formation (investment), population growth, labour force growth, and the annual change in the price of Brent oil to capture the impact of the oil sector. However, education and the gender gap in education may impact some of these controlling variables in the future (Abu-Ghaida & Klasen, 2004; Klasen, 2002; Knowles, Lorgelly, & Owen, 2002). Therefore, equations (2)–(4) will be employed to measure the indirect effects of education and gender inequality in education on economic growth via their impact on investment, population, and labour force. Based on the regression results in equations (1) to (4), the study employs the path analysis to calculate the total impact of gender inequality in education on economic growth by summing the direct and indirect impacts. Equation (5), a reduced form regression, omits the three variables (labour force, population growth and the growth rate of gross fixed capital formation). In this regression, the education coefficient is expected to measure the total direct impact of gender inequality in education on economic growth. The outcomes can then be compared to the sum of the direct and indirect impacts estimated in the path analysis.

Chapter 5: Results and Discussion

Table 4 presents the resulting coefficients of the five regressions, with the p -values in brackets. In terms of the F -test, all regressions are statistically significant at the 1% level. The explanatory power of the regression (R^2) is at reasonably acceptable levels given the regression specification. In order to increase the credibility of the result, a robustness test was conducted by running a number of different autoregressive alternatives,¹⁰ but the results were quite similar.

Table 4. *Gender inequality in education and its impact on long-term economic growth in Saudi Arabia (time series basic specification)*

Dependent variable	G (1)	GFCF (2)	PG (3)	LFG (4)	G (5)
Constant	0.39 (0.1017)	1.31 (0.0001)	6.26 (0.0000)	0.07 (0.0000)	0.34 (0.0003)
GFCF	0.25 (0.0132)				
PG	0.00 (0.9740)	-0.08 (0.4421)			
LFG	-3.15 (0.5342)	-3.40 (0.6764)			
GED	3.65E-08 (0.8249)	1.84E-07 (0.4867)	-2.28E-06 (0.0030)	9.56E-09 (0.2857)	1.57E-07 (0.2830)
RGED	-0.34 (0.0865)	-1.14 (0.0000)	-2.67 (0.0006)	-0.02 (0.0071)	-0.47 (0.0026)
OS	0.55 (0.0000)	0.25 (0.0182)			0.62 (0.0000)
R^2	0.80	0.49	0.64	0.37	0.73
Prob. (F -statistic)	0.0000	0.0000	0.0000	0.0000	0.0000
Sample size (N)	46	46	46	46	46

Note. The correlation between RGED and GED was 0.70, with a p -value of 0.0000, which indicates that the data move together (a positive correlation), which may also be seen in the data in Table 3.

¹⁰ A number of attempts have been made including using independent variables with lag, using the total enrolment (both males and females), and using both lagged independent variables with the total enrolment, but the results were similar or less significant.

The results in column (1) reveal that the gross fixed capital formation and oil price are statistically significant at a 5% level and correlate positively with the growth in per capita GDP. More specifically, the annual growth in per capita GDP will increase by 0.25% when the growth in fixed capital formation increases by 1%. When the price of oil rises by 1%, the annual growth in per capita GDP will be 0.55% higher. Population growth and labour force growth are expected to have a significant impact if the regression is run on GDP, but its impact will be less significant if the regression is run on per capita GDP because both the nominator and denominator will increase. Regarding the main variables of interest, gender inequality in education is statistically significant at the 10% level, although it still has a negative coefficient, while education is not statistically significant. In particular, a 1% increase in gender inequality in education will decrease the annual growth in per capita GDP by 0.34%.

The fact that education is not significant is interesting because one would expect that an increase in education for both males and females would increase the level of per capita GDP. It is expected that per capita GDP growth would be impacted by the lags in the education variables because of the time required for educated students to join the labour force, which affect the per capita GDP. However, this was tested, and no causal link was found. Another explanation, based on what was presented in Chapter 3, is that no tight link exists between educational attainment and labour market outcomes.

The results in column (2) show the effects of growth in education and gender inequality in education on gross capital formation (investment). Once again, the oil price, as expected, shows a very significant impact on capital formation. In particular, a 1% increase in the oil price will increase the annual growth of gross fixed capital formation by 0.25%. This is probably because an increase in oil prices results in more investments, which in Saudi Arabia are mostly in the oil sector.

Nevertheless, population and labour force growth seem to impose no effect on capital formation. More importantly, education and inequality also appear to be either statistically insignificant or significant in an unexpected way. This equation suggests that reducing gender inequality reduces the growth in gross fixed capital formation, which is a counterintuitive result because one would expect that reducing gender inequality would increase the growth in gross fixed capital formation. A possible explanation is that the period when gender inequality declined happened to coincide with a time when oil prices also declined; thus, gross fixed capital formation decreased when gender inequality in education became a matter of concern.

The regression in the third column explains population growth in relation to the education variables. These variables explain a significant amount of the variation in population growth (64%). Gender inequality in education is significant with a negative coefficient, which means that decreasing gender inequality in education by 1% will reduce population growth by 2.67%. This finding is consistent with numerous studies (see Cavalcanti & Tavares, 2016; Hill & King, 1995; Lagerlöf, 2003) that suggest that population growth declines as gender inequality declines. These studies have shown that reducing the educational gender gap by educating more females leads to a reduction in fertility and an increase in the level of female participation in the labour force, which consequently contributes to greater economic growth. However, the estimated coefficient of education, although statistically significant, is close to zero, implying a negligible impact of education on population growth.

Similarly, column (4) reports the regression result of the growth in the labour force on the education variables. The regression is significant overall, but it cannot broadly explain the changes in the growth of the labour force. The estimated coefficient on education is not significant, suggesting the growth of the labour force is independent from the growth of education. Inequality in education is significant, although with a small negative coefficient, which suggests that the growth in labour force declines as females become more educated. Two

explanations may be proposed for the negative relationship. The first relates to population: as female education rises, fertility falls, and thus the age cohort that represents people of working age (i.e., those in the labour force) will be reduced. The second explanation proposes that income rises as education increases, and households may consequently choose to rely on one income rather than two.

Based on the regression results for equations (1) to (4), we can calculate the indirect impact of inequality in education on the GDP growth rate. Then, by applying the path analysis, the total impact is measured as the sum of the direct and indirect effects. Detailed calculations are shown in Table 5.

Table 5. *The total impact of gender inequality in education*

Coefficient	Estimated coefficient	Value
β_5	The direct effect of the change in the female:male ratio of secondary school enrolments (an inverse measure of gender inequality) on per capita GDP growth	-0.34
$(\beta_{10} \cdot \beta_1)$	The indirect impact of the change in the female:male ratio of secondary school enrolments on per capita GDP growth through gross fixed capital formation	$(-1.14 \cdot 0.25)$
$(\beta_{13} \cdot \beta_2)$	The indirect impact of the female:male ratio of secondary school enrolments on per capita GDP growth through population growth	$(-2.67 \cdot 0.00)$
$(\beta_{13} \cdot \beta_7 \cdot \beta_1)$	The indirect impact of the change in the female:male ratio of secondary school enrolments on per capita GDP growth through population growth and the growth in fixed capital formation	$(-2.67 \cdot -0.08 \cdot 0.25)$
$(\beta_{15} \cdot \beta_3)$	The indirect impact of the female:male ratio of secondary school enrolments on per capita GDP through growth in the labour force	$(-0.02 \cdot -3.15)$
$(\beta_{15} \cdot \beta_8 \cdot \beta_1)$	The indirect impact of the female:male ratio of secondary school enrolments on per capita GDP through growth in the labour force and gross fixed capital formation	$(-0.02 \cdot -3.40 \cdot 0.25)$
Total effect	The sum of the direct and indirect effects	= -0.49

Note. The same calculation method is applied to measure the total impact of the oil price and education on per capital GDP, and the total values are reported in Table 6.

Another way to grasp the total impact on economic growth of education and gender inequality in education is through the fifth regression (the reduced form), which shows the change in economic growth in relation to education, inequality in education, and changes in the price of oil. In other words, by omitting the growth in the labour force, in population, and in gross fixed capital formation, this regression directly measures the total impact of gender inequality in education.

The results in column (5) show that these variables explain a significant amount of the variation in per capita GDP (73%). The most important part of this regression is oil, which accounts for a great deal of the effect on economic growth. In line with estimations from the other equations, education does not appear to matter in this case, which may suggest a problem in the labour market, to wit, a weak link between educational attainment and labour market outcomes not only for females but also for males. Furthermore, there is a significant negative relationship with inequality in education. A correlation appears between oil prices and per capita GDP in the 1980s and 1990s and during periods of increased female education (i.e., a narrowing in the education gap). There was a strong push for females to enter education during the period when per capita GDP did not grow very quickly, an overlap that drives this negative relationship.

Table 6. *Path analysis for the impacts of inequality in education, education, and the oil sector on per capita GDP*

	Total effect (equations [1]–[4])	Reduced form (equation [5])
Inequality in education	–0.49	–0.47
Education	8.99E–08	1.57E–07
Oil price	0.6125	0.62

Table 6 compares the total effect values with the reduced form coefficients in equation (5). The total effect segregates into the direct and indirect effects (first column) while the

reduced form regression provides the full effect (second column). The calculated total effect values from equations (1)–(4) are virtually identical to the coefficient of the reduced form in equation (5).

The total effect values, calculated through either approach, reveal that the strong push to educate both men and women over the past 47 years did not create a statistically significant effect on per capita GDP. Moreover, although the problem of inequality in education is diminishing over time, the regression results show that this progress has no material impact on the per capita GDP. These findings can be explained by several factors. First, this may be partly because the vagaries of the oil-driven economy overwhelm the impact of education. Second, a potential explanation is that the real problem is in the labour market, where, even if the government should improve levels of education, the effort would not be reflected in per capita GDP. The problem is that the labour market outcomes are disconnected from the education outcomes. Third, gender inequality in education only looks at secondary education, in which many school graduates, especially females, may not proceed to further study in order to build more knowledge and skills ready for jobs. If this is the case, the gender inequality in education at tertiary level might be much higher than at the lower level, thus causing an adverse impact on economic performance.

Other factors may also explain these results, such as the impact of *wasta*, the difficulty that women experience in starting a business in Saudi Arabia, and the large proportion of non-Saudi workers in the labour market due to employer preferences. These factors may explain why the coefficients for education and inequality in education are not significant.

From a policy perspective, one possible explanation is that the real story in Saudi Arabia may not be education but the need to liberalise the labour market so that education matters in the labour force. Presently, however, education does not have a noticeable impact. Once this problem is addressed, the impact of education on per capita GDP may become more

evident. This is consistent with the observation that there is a weak relationship between educational outcomes and labour market outcomes in Saudi Arabia because of *wasta*.

Given the findings above and the current plan to structurally change the Saudi economy, this thesis offers several recommendations for changing the labour market and regulations related to education and employment. It suggests changes that could improve women's participation in education and the labour market. Since Saudi women tend to favour private universities because they offer majors unavailable at public universities, one suggestion is that public universities emulate the private model to offer instruction in a variety of disciplines. There is also a need to relax higher education regulations to provide universities the incentive to offer a range of courses that appeal to both male and female students. This approach to reduce the gender gap in education could have a long-term positive impact on economic growth.

Second, female participation in the labour force could be improved by reducing segregation laws and rolling back legislation that prevents women from working in some sectors. The third recommendation is that labour market reforms are needed, especially in the private sector. The government should encourage more people to work through the Saudisation policy, as the success or failure of that initiative will influence the educational side. In other words, the government could achieve better labour market outcomes by supporting individuals in their pursuit of skills and education. Additionally, changing employment policy by making it compulsory for all companies—both private and public—to provide paid maternity and parental leave will encourage women to participate in both sectors. Finally, the government should provide subsidies to businesses intending to operate in areas consistent with Vision 2030, such as the tourism industry, which traditionally employs a high ratio of females.

Chapter 6: Conclusion

This thesis has examined the extent to which gender inequality in education may negatively impact economic growth in the Kingdom of Saudi Arabia. While the data show that the problem of inequality in education is improving over time, this narrowing of the education gap is associated with a negative impact on economic growth. Additionally, the impact of education is close to zero, which may suggest a problem in the labour market that weakens the link between educational attainment and labour market outcomes not only for females but also for males.

Diverse factors explain the gender gap in education and employment in Saudi Arabia, including *wasta*, gender stereotyping, the segregation policy, the conservative Saudi culture, women's work preferences, females' exclusion from particular university majors, the influence of the official male guardian (*mahrem*), and a preference in the private sector for foreign employees. However, the government is trying to narrow the gap through a number of decisions, such as implementing the Saudisation policy, lifting the ban on women's driving, and extending the fields in which women can participate.

This thesis offers several suggestions for changing the labour market and regulations related to women's education and employment. First, there is a need to relax higher education regulations to provide universities with incentives to offer a range of courses that treat male and female students equally with regards to course selection. In particular, public universities must offer instruction in a variety of disciplines for women. This approach to reduce the gender gap in education may have a long-term positive effect on economic growth. Second, there is a need to reduce segregation laws and roll back legislation that prevents women from working in some sectors, which could increase female participation in the labour force. Third, labour market reforms are needed, especially in the private sector. The government should encourage more people to work through the Saudisation policy. In addition, changing employment policy

by making it compulsory for all companies in the private sector to provide public sector advantages, such as maternity and parental leave with pay, may encourage women to participate in both sectors. Finally, the government should provide subsidies to businesses that operate in areas consistent with the 2030 Vision, especially businesses that traditionally employ a high ratio of women, such as the tourism industry.

In terms of future research, since portions of data are not available, a primary research study that separates the GDP into oil and non-oil GDP to better measure the impact on non-oil GDP of reducing inequality in education may be required, as the majority of women work in the non-oil sector, and that is where the impact would be seen. Beyond the factors that this thesis examines, inequalities that may affect economic growth persist in education, especially at the micro level, such as the subjects that females are allowed to study. There is also a need to look more deeply into the operation of the labour market, sector by sector, to understand how the market functions and especially how firms and workers make employment decisions. Additionally, today's labour market structures could be analysed to ascertain how employment discrepancies have occurred, to assess whether there is a skills and training gap in the labour market, and to determine which sectors would benefit from more Saudisation.

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