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ABSTRACT

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The Arab population in Israel constitutes an ethnic minority, at around 20% of the population. The economy of this minority is characterized by inferior outcomes relative to the Jewish majority by all indicators, including employment, wages, occupational status, social welfare, education, and housing. This paper reviews key data facts and presents a model of barriers to integration facing Arabs in Israel, taking it to the data. The empirical analysis, based on a general equilibrium model of occupational choice with optimizing agents and barriers, points to an increase over time in barriers to the acquisition of human capital in highly skilled occupations, and, concurrently, a reduction in labor market barriers in all occupations. The analysis offers insights relevant to other developed economies with large ethnic minorities.

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The Economic Outcomes of an Ethnic Minority:
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1   Introduction

This paper examines the role played by barriers in affecting the economic outcomes of a big ethnic minority. It uses data on the Arab population in Israel, which constitutes an ethnic minority, making up around 20% of the population. The economy of the Arabs in Israel is characterized by inferior outcomes relative to the Jewish one by all indicators, including employment, wages, occupational status, social welfare, education, and housing. This situation has negative effects on the standard of living in the economy, reducing tax revenues and increasing transfer payments, thereby affecting Israel's economic stability. It exacerbates the problems of Arab society, inherent in being a big minority within Israel. The relatively low level of economic development, which adversely affects the socioeconomic situation of this society, impacts the relations between Jews and Arabs and hinders the creation of an integrated society. For an extensive overview, see Kasir (Kaliner) and Yashiv (2014).

Many developed economies have big ethnic minorities. In the big European countries (Germany, France, Italy, Spain, the U.K.) these constitute 10% to 20% of the population and in the U.S. somewhat above 20%. In a review of migration, productivity, and the labor market, Peri (2016) reports that workers belonging to such minorities are demanded to perform low-skill tasks. He discusses the fact that employment in manual, low skill occupations is a salient feature among them. As will be seen below, this is exactly the situation of Arab men in Israel.

This paper reviews the current state of the Arab economy in Israel and presents a model of barriers to integration in employment facing Arabs in Israel. We have chosen to analyze two kinds of barriers – to education and in the labor market. The paper examines the various differences between Arab and Jewish societies by gender, while distinguishing between human capital barriers and labor market barriers.

The data point to an improvement over time in most of the aforementioned domains; however, they also point to the continued existence of major gaps relative to Jewish society. The empirical analysis, based on a general equilibrium model of occupational choice with optimizing agents and barriers, points to an increase over time in barriers to the acquisition of human capital in highly skilled occupations, and, concurrently, a reduction in labor market barriers in all occupations. This non-obvious finding

may shed light on the experience in other developed countries.

The paper proceeds as follows. Section 2 presents some key background facts on the Arab society in Israel in terms of demographics and geographical dispersion. Section 3 describes the Jewish – Arab differential in terms of human capital and in terms of the labor market. Section 4 presents the empirical results of implementing the occupational choice model of Hsieh, Hurst, Jones and Klenow (2019). The model makes it possible to break down and quantify the barriers, both in the acquisition of human capital and in the labor market. The paper ends with a brief concluding section.

2 Background Facts

We outline two sets of background facts on the Arabs in Israel.

Demographics. As of the end of 2019, the Arab population in Israel numbered 1.92 million, which represents 21 percent of the total population of 9.14 million. According to the forecast of the Central Bureau of Statistics (CBS), this rate is expected to decline after 2035, reaching 19.3 percent in 2065 (Halihal, 2017). The Arab population in Israel is composed of 1.6 million Muslims, 18 percent of Israel's population, 177 thousand Christians, who constitute 2 percent, and 143 thousand Druse, who constitute 1.6 percent. The Muslim population's rate of growth has declined over the past two decades, reaching 2.3 percent per annum in 2018. Nonetheless, it is still higher than the Jewish growth rate (1.7 percent per annum), the Druse growth rate (1.4 percent per annum) and the Christian growth rate (1.5 percent per annum).[1]

The TFR (total fertility rate) of the Muslim population was 3.20 in 2018. It has fallen in recent years but is still higher than that of Christian women (2.06 children), Druse women (2.16 children), and Jewish women (3.17 children). Looking at the age distribution, Arab families are relatively young but the distribution varies across residential locations. The median age of the head of the Arab household in a Jewish neighborhood in a mixed town[2] is 36 and in a Jewish town is 31, as compared to 41 and 44 in Arab towns and in Arab neighborhoods in mixed towns, respectively. It is 48 among Jews.

The Muslim population in Israel is composed of 316 thousand households (12 percent of the total in Israel) in 2018. These are relatively large

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[1]Sources are Central Bureau of Statistics (2019a,b,c,d).

[2]The term mixed town refers to towns where there are both Jewish and Arab residents.

households. with 4.7 individuals on average as compared to 3.9 individuals in a Druse household, 3.1 individuals in a Jewish household, and 3.0 individuals in a Christian household. There are 6 or more members in 32 percent of the Muslim households, as compared to only 9 percent of Jewish households and 6 percent of Christian households.

Geographical dispersion and housing. The Arab population is concentrated primarily in the North of Israel. As of 2018, one-half of the Muslim population in Israel lived in the North (35.3 percent in the Northern district and 13.7 percent in the Haifa region, a major metropolitan area in the North); 21.9 percent lived in the Jerusalem region, 11.0 percent in the Center, 16.9 percent in the Southern region and 1.2 percent in the Tel Aviv area.[3]

Most of the Arab population lives in separate towns (i.e., in towns where there are no Jewish residents) while only 2 percent live in Jewish towns. Using neighborhood socioeconomic rankings (which range from 1 to 20, where 20 represents the highest ranking), the following is reported in Bank of Israel (2017): the rank of Arabs living in Jewish neighborhoods is superior to that of Arabs living in Arab neighborhoods in mixed towns and to that of Arabs living in Arab towns. Thus, Arabs who live in Jewish towns or in Jewish neighborhoods in mixed towns enjoy higher socioeconomic-demographic outcomes. Their rates of employment are relatively high as are their annual incomes. The rank is 8.9 in Jewish neighborhoods in mixed towns and 10.1 in Jewish towns. By contrast, the ranking in mixed towns is 6.3 and it is 4.7 in Arab towns. The total annual income per standardized individual (aged 25 or older) in Arab households located in Arab neighborhoods in mixed towns is more than 20 percent higher than that of Arab households in Arab towns. However, the rate of home ownership is higher in Arab towns (86 percent as compared to 59 percent).

Housing density is higher in Arab society relative to the Jewish population, though it has declined over time. According to the Bank of Israel (2017), the main reasons for the housing shortage in the Arab sector are as follows: Arab towns have limited areas of jurisdiction; they have no approved and detailed zoning plans; there are no records of land rights and therefore builders find it difficult to obtain credit from the banks and households find it difficult to obtain a mortgage; they have little reserves of land; and until recently the Israeli State marketed very little land in Arab

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[3]The Druse in Israel live in two main regions: 81 percent in the North and about 19 percent in Haifa. Of the Arab Christian population in Israel, 70.6 percent live in the North, 13.3 percent in the Haifa region, and 9.6 percent in the Jerusalem region.

local authorities, construction tended to be low-rise, residents refrained from building new neighborhoods, and population growth was relatively high (Bank of Israel, 2017).

The emerging picture is one of a predominantly Moslem population, which is fast-growing and young, highly concentrated in the North of country in separate towns, with lower socio-economic status.

3   The Outcome Differentials Between Arabs and Jews

In what follows we describe the Arab-Jewish differential outcomes in terms of the education system and in terms of the labor market.

3.1   Human Capital

Outcomes of the education system provide evidence of significant differences between Arab and Jewish students, which are reflected in lower attendance rates and scholastic achievement. In what follows we list some key statistics, noting age, gender, and field of study differences.

Schooling.[4] The difference in outcomes of students is already evident at a young age. There are high dropout rates in middle and high school (around 5% for Arabs vs. 2%-3% for Jews), the substantial decline over time (from 5.2% to 3.5%) notwithstanding. Among high school graduates in the Arab sector, the rate of matriculation, which is the basis for continuing on to higher education, is relatively low, at 44% to 60%, as compared to 61% to 68% among the Jews. Although the difference has narrowed from 17 percentage to 9 points going from 2009 to 2014, it remains substantial. With respect to high school graduation, the situation of women is better than that of men and the rate of improvement among them has been higher. The proportion of Grade 12 students who meet the entrance requirements of universities in Israel rose among males from 26 percent in 2007 to 31 percent in 2014 and among females from 34 percent to 47 percent (see Gara, 2018). An examination of the achievements of Arabs and Jews on the matriculation exams and on the psychometric exam shows that the achievements of Arabs are lower in quantitative thinking, verbal ability, and the English language.

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[4] The following discussion mostly refers to the period 2009-2014.

PISA scores.[5] There are significant differences in achievement between Arabs and Jews, as measured by the international PISA test and shown in Figure 1. The achievements of Arab speakers on these tests has improved over the past decade but differences remain substantial and in some cases have even widened.

Figure 1

TIMSS.[6] The significant differences in achievement between the two populations can also be seen in the TIMSS test, which looks at the proportions of high and low achievers in Science and Math. The scores indicate that the proportion of high achievers in Math and Science among Hebrew speakers is higher than the median of all participating countries, while the proportion of low achievers in these two subjects is lower than the median; in contrast, among Arab-speaking students, the proportion of high achievers is similar to the international median, but the proportion of low achievers is double the median (Ministry of Education, 2016).

University entrance exams. The data show that the difference in psychometric exam scores, used for university admissions, is larger than in the matriculation exam scores and the difference is also evident in the test of basic skills, which is part of the PIAAC international evaluation program.[7] According to the most recent Central Bureau of Statistics (CBS) data in the academic year 2014–15, the average scores of Jews were similar to the OECD average, while the scores for Arabs were 40 to 50 points lower (up to a full standard deviation). Similarly, 34 percent of the Arabs were found to lack basic computer skills, as opposed to only 9 percent of Jews (CBS, 2016).

Higher education. The proportion of Arab students in higher education has risen over the years, primarily as a result of the opening of academic tracks under the auspices of the universities and also the increased accessibility to higher education by means of academic teachers colleges in the periphery, where the Arab population is concentrated. Nonetheless, the proportion of Arabs in higher education is still lower than their share in the population and these differences are higher for the more advanced degrees. Similarly, the duration of studies for Arab students is 33 percent longer than that of Jewish students, and the dropout rate is higher by 50 percent.

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[5]See https://www.oecd.org/pisa/

[6]See https://nces.ed.gov/timss/

[7]See https://www.oecd.org/skills/piaac/

Another indication of the limited accessibility to higher education for the Arab population can be found in the data of the Planning and Budget Committee and the Council for Higher Education regarding the distribution of Arabs among the institutions of higher learning (Council for Higher Education (2019)). Most of the Arab students in an undergraduate program in Israel are studying in a college, rather than in a university. Thus, in the 2017–18 academic year only 15.7 percent of Arab undergraduate students were studying in one of the main campuses of the universities, compared to 24.1 percent in teachers colleges and 31.2 percent in colleges. Although the proportion of Arab students studying in a university has grown over the years (from 8.1 percent in 2000 to 15.7 percent in 2018), the rate of growth in colleges was higher.

Moreover, a relatively high proportion of Arab students studies abroad. According to the Knesset Center for Research and Information (Letter to MK Margy, 2016), 9,260 Arab-Israeli students were studying abroad in 2012, with 60 percent of them in Jordan and the Palestinian Authority. Moreover, in 2012 the proportion of Arab students in all institutions of higher education in Israel (apart from the Open University) was only 11.5 percent, while their proportion of all Israeli students studying abroad was 38–47 percent.[8]

There is also a significant difference between the genders with respect to the integration of Arabs in the higher education system, with women integrating more successfully than men. The proportion of Muslim women receiving a bachelor's or master's degree is substantially higher than that of Muslim men, but somewhat lower in the case of a PhD. Furthermore, there has been a significant upward trend in the proportion of Arab women in the higher education system over the years. The proportion of Arab women aged 20–64 with 13 years or more of schooling rose from 14.5 percent in 2001 to 32.3 percent in 2014, as compared to a much more moderate increase among men from 20.6 percent to 27.9 percent (see Gara, 2018).

Among those graduating with a bachelor's degree, the proportion of Arab students is particularly high in the fields of education and teaching and in paramedical fields. In these occupations there is an excess supply in the labor market and therefore they are characterized by low potential income. There is a relatively low proportion of Arabs in the hi-tech industry and in the exact sciences, fields that are in high demand in the labor market, although the proportion has increased in recent years. There has also been a significant increase in the proportion of Arab students study-

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[8]Or 46–55 percent when taking into account students studying in the Palestinian Authority.

ing engineering at the Technion, Israel's leading technology institute, in recent years. This last set of facts is highly significant in the context of the empirical results on human capital barriers, reported below.

Budgets. A significant portion of the aforementioned differences between Jews and Arabs stems from disparities in budget allocation within the education system at the pre-academic stage. Figure 2 presents the Ministry of Education budget per Arab student relative to that per Jewish student.

Figure 2

The budget per Arab student was 2.4 percent lower in 2018 than that per Jewish student, a difference that has narrowed from 7.1 percent in 2015. It is also worth noting that households in the Arab sector allocate a smaller sum to the education of their children than Jewish households, due to, inter alia, their lower level of income (Ministry of Education, 2019).

The difference in the average cost of Jewish and Arab students widens as we move from kindergarten to high school and as the socioeconomic situation worsens.

Summary. In conclusion, the Arab sector faces numerous barriers in the development of human capital, due to under-budgeting and the low quality of the Arab education system. As a result, the dropout rate among Arab students is much higher, the grades of those who stay in school are lower, and their matriculation rates and psychometric scores are lower. There is lower participation in higher education in the Arab sector, dropout rates of Arab students are higher, the duration of studies to attain a degree is longer, and there is a high concentration of Arabs in fields of study with low potential earnings.

3.2   The Labor Market

Israeli Arabs are not fully integrated in the labor market, which is manifested in low rates of employment, low wages, and a relatively high proportion of workers in jobs for which they are overqualified.

Arab women employment. The rates of employment among Israeli Arabs are lower than those among Jews. This is particularly the case among women, where 38 percent of Arab women of working age (25–65) are employed as compared to 82 percent of Jewish women. The relatively low rates of employment among Arab women are the result of many factors, including a relatively low level of education (though it has risen in recent years); traditional cultural norms with respect to the role of women and

whether a woman should work outside the home; a limited geographical distribution and the resulting distance from places of employment; the high cost of commuting; and discrimination (for an analysis see Kasir (Kaliner) and Yashiv, 2013). In terms of the cross-sectional distribution, there is a high level of variation in labor force participation rates among Arab women, such that women with little education (and who therefore lack the skills demanded by the labor market) and who hold traditional views with respect to the role of women do not choose to work, while women with a higher level of education and a more modern approach do tend to join the workforce.

Daycare is an important factor in a woman's decision to work outside the home (Shahar, 2012). The subsidization of daycare encourages labor force participation among women whose earning potential is diminished by the high cost of daycare. Over the past decade, the proportion of working mothers who make use of daycare among the Arab population has increased more rapidly than among the Jewish population. The proportion of working Arab women whose children are in daycare reached 64.2 percent in 2013 as compared to 49.3 percent in 2004 (Pichtelberg-Bermatz and Greenstein, 2015). The main reason for this change is apparently the greater access to government daycare services for preschoolers in the Arab sector. Nonetheless, the proportion of working Arab women who use this service remains 20 percentage points lower than for Jewish women. The proportion of Arab children in recognized daycare is 4.5 percent, even though their proportion of the population is 23.5 percent (The State Comptroller, 2016). Moreover, according to Ministry of Finance data (Ministry of Finance, 2015), there is a difference of 80 percent between the budget for subsidization of daycare in the Arab sector and the parallel budget for the Jewish sector, as shown in Figure 3.

Figure 3

Up until 2011, there were almost no daycare centers built in the Arab sector and since then the supply of public daycare centers has been expanded from 39 to 80 out of 1,800 daycare centers in Israel in 2016; however, these constitute only 4.4 percent of all daycare centers in Israel. Since 2014, 20 percent of the budget for the construction of day care centers has been earmarked for the Arab sector. However, this allocation is insufficient to eliminate existing differences due to the cumulative under-budgeting over the years (see Ministry for Social Equality, 2016). Similarly, there has been only partial usage of the construction and subsidization budget in the Arab sector, due to, among other things, bureaucratic barriers and the

limited amount of land allocated for construction. Thus, there is still a lag in the construction of new daycare centers.

Arab men employment. A notable phenomenon in the labor market with respect to Arab men is relatively early retirement (see Kasir (Kaliner) and Yashiv, 2011 and Kasir (Kaliner) and Peled-Levi, 2015). The phenomenon of early retirement is in contrast to labor force participation among Jews in Israel, among Palestinians, and among men in Western economies and even relative to the patterns in Muslim and Arab countries. Kasir (Kaliner) and Yashiv (2011) found that the most important fact in explaining the drop in the participation rates of Arab men at a young age is the high proportion employed in manual jobs requiring physical ability, which diminishes with age. Moreover, they can be replaced by foreign workers once they become less physically fit. The option of receiving various forms of government benefits makes it possible for them to leave the labor market when they become less physically able. This early retirement is also related to the cultural characteristics of Arab society, in which there is a widespread practice of children supporting their parents from a very young age.

Most Arab men are employed in occupations that require low levels of education as seen in Figure 4, noting in particular the three low-skill occupations at the right side of the figure.

Figure 4

Occupational distribution. An analysis by industry, shows a high concentration of Arab workers in industries that are intensive in unskilled labor, such as construction, wholesale and retail commerce, repair of cars, motorcycles, motorbikes and appliances and traditional manufacturing. There is also a relatively high concentration in education. Arab men are employed at lower rates than Jewish men in occupations requiring a high level of education, such as managers, academic occupations, engineers, and technicians, and some of those with higher education are employed in occupations for which they are overqualified (Lazarus and Miaari, 2015). Others from the start avoid a field of study in which their chances of finding employment are low. Most of those with a high level of education are employed in community-oriented positions in the public sector and only a small minority of the university graduates are employed in the hi-tech sector. An examination of the distribution of occupations among Jews and Arabs by levels of education shows that the differences in level of education explain much of the differences in occupations between Jews and Arabs.

In the case of Arab women, 45 percent of those in the labor market are employed in an academic occupation, as compared to only 31 percent among Jewish women, as seen in Figure 5.

Figure 5

Nonetheless, the proportion of Arab women who are working in unskilled jobs (11 percent) is substantially higher than that of Jewish women (5 percent). It can be seen that there is a high concentration of Arab women working in sales and services (30 percent) and also in education and health services. The concentration of Arab women in these occupations is partly the result of a lack of jobs in other occupations in Arab towns. The lack of variety of workplaces in Arab towns, together with their preferences to work in their own locality – due both to the traditional character of Arab society and the high cost of commuting (Caesarea Forum, 2010) – has an impact on the field of study chosen by Arab women.

Discrimination. The Arab population in Israel suffers from discrimination and labor law violations, due to both their status as a minority group and the fact that most of them are part of a weak group of workers (who have a relatively low level of education and earn a low wage). Discrimination in hiring and in salaries is a barrier to suitable employment for many Arabs (Caesarea Forum, 2010). Violations of labor laws in the case of Israeli Arabs are more common in the case of women, skilled workers and unskilled agricultural workers, who have less negotiating power.

One of the sources of discrimination in the labor market is, according to Becker (1957), discrimination by customers who prefer to purchase goods and services from places of employment where most of the employees belong to the majority group. Bar and Zussman (2017) found evidence of discrimination in the (online) market for services, such as renovations, painting, electricity repairs, cleaning and transportation, which is consistent with a model of customer discrimination against Arabs. They found that a significant proportion of Jewish customers preferred to obtain services from suppliers that employed mainly Jewish workers and that these preferences were strongly related to concerns about personal security. It was also found that these customer preferences affect hiring decisions and that the price of services in firms who employ Arab workers is lower than among firms that employ only Jews.

Wages. The wage difference between Jews and Arabs exists at all levels of education, among both men and women, as shown in Table 1. It is among individuals with only a matriculation certificate that wage differences are narrower.

Table 1

Asali (2006) examined wage discrimination, studying wage differences between Jewish and Arab men in the period 1990–2003. The observable factors that explain the wage difference were divided into three categories: human capital differences, hiring discrimination, and wage discrimination. The findings point to the existence of wage discrimination and that it worsened over the sample period. Thus, wage discrimination in 1991–2 was found to be responsible for 5–10 percent of the wage difference and during the period 1999–2003 for 20–30 percent. Cohen and Haberfeld (2007) investigated the effect of the increase in income inequality in the Israeli labor market during the period 1975–2001 on income differences. They found that discrimination against Arab workers did not lessen from 1992 onward and perhaps even intensified. Miaari, Navuoni and Hattab (2011) found significant wage discrimination throughout the period 1997–2009, with varying intensity according to economic events, such as the large wave of immigration, the Intifada and fluctuations in the number of foreign workers. Bank of Israel (2016) used a Mincerian wage equation to examine the causes for the disparity in hourly wages among men and found that differences in skill levels explain most of the disparity in hourly wages (80 percent) between Arab and Jewish men.

4   Taking A Model of Barriers to the Data

A prominent characteristic of the population of Arab men is, as seen above, their high concentration in low-skilled and low-income occupations, while in the case of Arab women it is the low rate of labor force participation. The key questions, therefore, concern the relative roles of pre-labor-market barriers to the acquisition of human capital, barriers in the labor market after the acquisition of human capital, and workers' preferences in occupational choice. Answers to these questions require an explicit discussion of the worker's decisions to acquire education and to participate in the labor force.

In what follows, we present a model of occupational choice proposed by Hsieh, Hurst, Jones, and Klenow (2019) and apply it to data on the Israeli economy, with the goal of understanding the situation of Israeli Arabs described in the preceding section. The model is based on an enhanced version of the Roy (1951) occupational choice model, in a general equilibrium framework, which can be used to examine differences in occupational outcomes across groups in the population. Specifically, the model

takes into account decisions regarding the acquisition of education, barriers to investment in human capital, barriers related to the labor market, such as discrimination, and occupational preferences.

In what follows, we describe the model, including the relevant optimization decisions, and the main relationships which will be used to draw conclusions about discrimination, barriers, and preferences. The full description of the model can be found in Hsieh, Hurst, Jones, and Klenow (2019).

4.1 The Model

4.1.1 The Set Up

Workers. The economy is composed of a continuum of workers, each of whom is either in the labor market in a given occupation or is in the household sector. We assume three types of occupations: those requiring a high level of skill, those requiring an intermediate level, and those requiring a low level. We divide the population into four groups: Arab men, Arab women, Jewish men and Jewish women. We examine three periods of a worker's life-cycle.

Each worker has a level of skill in each of these occupations and in the household sector. Workers have preferences for working in a particular occupation and preferences vary across groups.

The individuals invest in human capital and choose an occupation in an initial "pre-period" and following that they work for three periods (young, middle, and old age). The investment in human capital and the chosen occupation are fixed at the end of the "pre-period." In each of the three periods, the workers choose between working in the occupation they chose and informally working in the household sector.

Accumulation of human capital. Workers use time and goods in order to acquire human capital during the "pre-period". This human capital remains fixed throughout their lifetime. There is no accumulation of additional human capital after the end of the "pre-period", apart from specific human capital, i.e. a return on accumulated on-the-job experience.

Forces affecting the allocation. It is assumed that discrimination exists in the labor market, as well as barriers to investment in human capital. Discrimination in the labor market can be viewed as kind of "tax" on wages. It is assumed that firm owners discriminate against all the workers in a particular group, such that the "tax" affects all of the members of the group equally and at every point in time. This idea is based on Becker (1957) who assumed that firm owners discriminate against workers belonging to

14

particular groups due to taste discrimination, whereby firms owners get lower utility when employing workers from groups for which they have a lower preference.

The barriers to investment in human capital are manifested in the higher monetary cost of acquiring specific skills for a particular occupation. Examples include discrimination in favor of certain groups in the development of certain skills; the allocation of fewer resources; restrictions on acceptance to higher education or to training programs; differences in the quality of schools between communities; and social norms that prevent the members of a certain group from entering a particular occupation.

Occupational choice. When individuals decide to invest in human capital, they assume that they will be working in that occupation. The choice of whether or not to work is made at a later stage. The occupational choice is essentially the choice of an occupation during the initial period of an individual's working life in order to maximize his lifetime utility subject to his budget constraint. The individual's utility is positively affected by his level of consumption, negatively affected by the time he invests in human capital, and positively affected by the utility gained from working in each of the occupations.

Labor force participation. After choosing an occupation, the individual decides whether to work in it or in the household. If the individual chooses to work in the household, his consumption will consist of income from household production less the payments for the investment in human capital (repayment of loans obtained to finance the investment in human capital).

Firms producing a consumption good. Firms produce the consumption good using workers in the three occupations. Following Becker (1957), firm owners (in the final goods sector) discriminate against workers in certain groups. This is manifested in lower utility from employing workers who belong to those groups. The utility of each firm owner is the firm's basic level of profit, which is affected by the firm's discrimination policy and the extent of the owner's prejudice. Thus, when the firm owners hire a worker from a group they favor less, they compensate themselves for the aforementioned loss in utility by paying a lower wage to that worker. Since it is assumed that these are the preferences of all firm owners (an homogeneity assumption), there is a full offset. In other words, the lower wage exactly compensates for the owners' loss of utility from employing workers whom they favor less.

Firms producing education (schools). These firms sell education to workers, who use it as an input that is part of their capital. As in the case of firms that produce the consumption good, the firms that produce educa-

15

tion also discriminate against various groups.

Equilibrium. Competitive equilibrium in this economy is composed of individuals' choices in consumption and the investment of time and goods in human capital over their lifetimes; their choice of occupation during the "pre-period"; the decision to participate in the labor force in each subsequent period; the total effective units of labor from each group in each occupation; the total output of the economy; and the wages in each of the occupations.

4.1.2 Key Equations

In what follows we briefly present the key formal elements of the model.

Optimal Worker Decisions

Lifetime utility is given by:

$$\log U = \left[\beta \sum_{t=c}^{c+2} \log C(c,t) \right] + \log(1 - s(c)) + \log z_{ig}(c) \tag{1}$$

where $C(c,t)$ is the consumption of cohort c at period t; $s(c)$ the time invested in human capital by cohort c in the pre-period; there is no discounting; $z_{ig}(c)$ denotes the utility benefit of working in occupation i among members of group g; β is a parameter quantifying the trade-off between lifetime consumption and time spent accumulating human capital.

The workers face:

a. a budget constraint:

$$C(c,t) = (1 - \tau_{ig}^w(t))w_i(t)\epsilon Th_{ig}(c,t) - e_{ig}(c,t)(1 + \tau_{ig}^h(c)) \tag{2}$$

where T is the return to experience (assumed to be a function of age $t - c$), $w_i(t)$ is the price per efficiency unit, and $h_{ig}(c,t)$ their human capital; agents borrow $e_{ig}(c,t)(1 + \tau_{ig}^h(c))$ in the pre-period to purchase $e(c)$ which they need to repay over their lifetime subject to the life-time budget constraint is given by:

$$e(c) = \sum_{t=c}^{c+2} e(c,t) \tag{3}$$

b. a production function for human capital:

$$h_{ig} = s_i^{\phi_i} e_{ig}^{\eta} \tag{4}$$

where ϕ_i and η are elasticities.

Talents in market occupations are drawn from a multivariate Fréchet distribution with parameter θ:

$$F_g(\epsilon_1, ..., \epsilon_M) = \exp - \left[\sum_{i=1}^{M} \epsilon_i^{-\theta} \right] \tag{5}$$

Each individual chooses the occupation that maximizes expected lifetime utility from market work. Given an occupational choice, the occupational wage w_i, and idiosyncratic ability ϵ_i in that occupation, each individual chooses C, e, s to maximize expected lifetime utility from market work given the constraints. Each individual chooses between the market occupation and the home sector in each period.

The optimal time (s_i^*) and goods (e_{ig}^*) spent on human capital are given by :

$$s_i^* = \frac{1}{1 + \frac{1-\eta}{3\beta\phi_i}}; \quad e_{ig}^* = \left(\frac{\eta(1 - \tau_{ig}^w)w_i \overline{T} s_i^{\phi_i} \epsilon}{1 + \tau_{ig}^h} \right)^{\frac{1}{1-\eta}} \tag{6}$$

where $\overline{T} = 1 + T(1) + T(2)$.

Labor Market Equilibrium Outcomes

These decisions lead to the following outcomes. The fraction of people choosing an occupation is given by:

$$\widetilde{p}_{ig}(c) = \frac{\widetilde{w}_{ig}(c)^\theta}{\sum_{s=1}^{M} \widetilde{w}_{sg}(c)^\theta} \tag{7}$$

where:

$$\widetilde{w}_{ig}(c) = \frac{\left(\frac{\overline{T}}{3} \right) w_i(c) s_i(c)^{\phi_i(c)} [(1 - s_i(c))z_{ig}(c)]^{\frac{1-\eta}{3\beta}}}{\tau_{ig}(c,c)} \tag{8}$$

$$\tau_{ig}(c,c) = \frac{(1 + \tau_{ig}^h(c))^\eta}{1 - \tau_{ig}^w(c)} \tag{9}$$

The following variables are the key equilibrium outcomes.

The variable $\tau_{ig}(c,c)$ represents total barriers. It is a composite of human capital barriers τ_{ig}^h and labor market discrimination τ_{ig}^w facing cohort c when young ($t = c$).

The variable $\widetilde{w}_{ig}(c)$ is the overall reward that a worker from group g with the mean talent obtains by working in occupation i, relative to the power mean of $\widetilde{w}$ for the group over all occupations.

The variable $\widetilde{p}_{ig}(c)$ is the fraction of people from cohort c and group g who choose occupation i, a choice made when they are young.

Labor force participation i.e., the fraction of people in occupation i, cohort c and group g at time t who decide to work rather than stay at home is given by:

$$LFP_{ig}(c,t) = \frac{1}{1 + \widetilde{p}_{ig}(c) \cdot \left[\frac{\Omega_g^{\text{home}}(c)}{T(t-c) \cdot (1 - \tau_{ig}^w(t)) \cdot w_i(t)} \right]^{\theta}} \tag{10}$$

where $\Omega_g^{\text{home}}(c)$ is the mean of home talent of group g in cohort c which is fixed over time.

Average wages in an occupation i of cohort c belonging to group g at time t are given by:

$$\overline{\text{wage}}_{ig}(c,t) = \gamma\eta \left(\frac{m_g(c,t)}{LFP_{ig}(c,t)} \right)^{\frac{1}{\theta} \cdot \frac{1}{1-\eta}} \left[1 - s_i(c))z_{ig}(c) \right]^{-\frac{1}{3\beta}}$$
$$\cdot \frac{(1 - \tau_{ig}^w(t)) \cdot w_i(t)}{(1 - \tau_{ig}^w(c)) \cdot w_i(c)} \cdot \frac{T(t-c)}{\overline{T}} \cdot \frac{s_i(c)^{\theta_i(t)}}{s_i(c)^{\theta_i(c)}} \tag{11}$$

where $\gamma = \Gamma(1 - \frac{1}{\theta} \cdot \frac{1}{1-\gamma})$ is a parameter related to the mean of the Fréchet distribution of talents; $m_g(c,t) = \sum_{i=1}^{M} \widetilde{w}_{ig}(c)^{\theta}$.

4.2 Methodology

The model is taken to census data. Here we briefly review the methodology; the Appendix elaborates. Employment data are taken from the censuses of 1972, 1983, 1995 and 2008; wage data and years of schooling for 1972 and 1983 are also taken from the censuses, while for 1995 and 2008 the data are taken from the Income Survey.

The analysis includes four groups: Jewish men, Arab men, Jewish women and Arab women, all aged 25–69. We do not include the unemployed (since the model does not explain unemployment); rather only workers and individuals not participating in the labor force are included. We define three age groups: young (25–34), middle aged (35–49) and old (50–69).

We thus obtain a panel of six cohorts over six years – the first consists of the young in 2008 and the sixth consists of the old in 1972. There is information on the following cohorts: for cohorts 3 and 4 we have all three lifecycle points; for cohorts 2 and 5 there are two points and for cohorts 1 and 6 only one point.

The division into occupations is based on the CBS occupation classification at the level of one digit (described in the Appendix).

The goal of the analysis is to identify the forces determining the occupational allocation of the various groups and their rate of labor force participation. The model makes it possible to identify three such forces: barriers in the labor market, pre-labor-market barriers (human capital barriers) and occupational preferences. The model predicts that for each group, the rate of labor force participation will be higher among individuals who choose to work in higher-earning occupations. The model also implies that the differences between the groups with respect to occupation are the result of two factors, namely skills and barriers in the labor market. When barriers rise in the labor market, the proportion of individuals choosing to work will decline. When considering participation rates of the different groups, in groups with high participation rates, the proportion of individuals choosing high-earning occupations will be higher, or the barriers they face in the labor market will be lower.

4.3   Results

After calibrating the model using the census data, as discussed in the Appendix, we get the following results. Table 2 and Figure 6 show occupational preferences and the total barriers facing the cohorts that were young in the various census years for Arab men and women.

Table 2 and Figure 6

Occupational Preferences. Consider the occupational preferences of the Arab population. The low-skilled occupations in each group are normalized to 1, and occupations with values greater than 1 indicate a preference for the occupation relative to the low-skilled, base occupation. It can be seen that while there is no clear pattern of occupational preference evolution over time, for men there is a non-monotonic rise in preferences for mid- and high-level occupations, and for women there is a hump shape evolution in terns of these two occupations.

Barriers. Next consider the barriers facing individuals in each group in the occupational choice stage relative to those facing Jewish men. The

value of the barriers for the latter is normalized to 1. To the extent that the value is greater than 1, the barrier facing the group will be higher and vice versa. Table 2 shows a downward trend in the barriers facing young Arab men in low- and intermediate-skilled occupations. On the other hand, and in contrast to conventional wisdom, the results point to the opposite trend in the highly skilled occupations. Thus Arab men have an incentive not to choose these occupations. From 1995 onward, Arab men have an incentive to choose low-skilled occupations and therefore it appears that the market "prefers" Arab workers in low-skilled occupations. These results, in addition to the model's results regarding preferences, indicate that the high concentration of Arab men in low-skilled occupations is the result of barriers they face in other occupations, rather the result of their preferences.

With respect to the barriers faced by Arab women in choosing an occupation, convergence can be seen in the barriers in all occupations. Thus, barriers were very high relative to Jewish women in the 1970s, but they decreased significantly up until 2008. Nonetheless, it appears that the barriers facing Arab women are still high relative to Arab and Jewish men, which apparently reflects the fact that they are members of a minority group and a group that has more traditional views. Interestingly, the highest barrier is in the low-skilled occupations. The high volatility in the values of preferences for an occupation make it impossible to draw any conclusions with regard to the tendency of Arab women in their choice of occupation. However, it can be said that the effect of the various barriers on the occupational choice of Arab women is declining over time.

It should be recalled that barriers consist of barriers in the labor market and barriers to human capital accumulation. The model makes it possible to separate the barriers into these two components so as to understand what drives the trends in the barriers as a whole. Table 3 and Figure 7 describe the results with respect to labor market barriers and human capital barriers and their combination, for the three occupation levels.

Table 3 and Figure 7

Arab men.

A downward trend can be seen in labor market barriers across all occupations. In the highly skilled occupations, barriers have been lowered substantially and in 2008 the barriers to Arab men in the labor market, relative to those facing Jewish men, were quite low. In contrast, in the intermediate-skilled occupations there was a more moderate decline and significant barriers persist. In the low-skilled occupations, it appears that Arab men did not face any barriers in the labor market and since the 1990s

20

they have been lower than the normalized zero "tax" level. Thus, it appears that the market is "encouraging" Arab men to work in occupations which require only a low skill level.

A different picture emerges with respect to the human capital barriers facing Arab men. While in the low- and intermediate-skilled occupations, there have been no significant changes, there appears to have been a major increase in the barriers facing Arab men who choose high-skilled occupations. This may be related to developments in the education system, in particular in higher education. There has been a substantial rise in high-tech related fields both in terms of student numbers and in terms of wages and productivity in high-tech jobs. This has become a major economic development in Israel since the 1990s. In these fields there is lower participation of Arabs. It remains to be explored what exactly are the barriers in question.

Therefore, there appears to have been a downward trend in total barriers facing Arab men in low- and intermediate-skilled occupations which is the result of the decline in labor market barriers, while the increase in barriers in the highly skilled occupations is the result of human capital barriers, offset only partially by lower labor market barriers.

The model predicts two opposing effects as a result of these trends in labor market barriers. On the one hand, the lowering of labor market barriers is expected to raise the wages of Arab men and thus to increase their incentive to work. On the other hand, the increase in total barriers in the highly skilled occupations "pushes" more men to choose intermediate- and low-skilled occupations, which have lower wages and therefore there will be a higher concentration of Arab men in those occupations. Thus, as a result of the repeated choice in each period between the labor market and household work, and given relatively low wages, Arab men will have a lower rate of labor force participation.

Arab women.

An examination of labor market barriers shows a downward trend at all skill levels. The largest decrease was in the low-skilled occupations and the most moderate was in the highly skilled occupations. In 2008, labor market barriers facing Arab women in the highly skilled occupations were lower than in the other two occupation types.

When we look at human capital barriers facing young Arab women, it can be seen that here as well there was a decrease in the low- and intermediate-skilled occupations and that the relatively high barriers that prevailed in the 1970s declined during subsequent decades, with the most dramatic decrease in the low-skilled occupations. In contrast, and as in the case of Arab men, there was a moderate increase in barriers facing Arab women

in highly skilled occupations. In 2008, the biggest barrier was in the highly skilled occupations, which is in contrast to the 1970s when the biggest barrier was in the low-skilled occupations.

In summary, the downward trend in total barriers facing young Arab women in low- and intermediate-skilled jobs is a result of declines in both human capital barriers and labor market barriers. However, it should be recalled that the barriers facing Arab women in these occupations were very high in the past, relative to both Jewish men and Arab men. Therefore, it appears that the process of convergence is not yet complete and in 2008 Arab women still faced high barriers in these occupations relative to the other groups. As in the case of Arab men, we also see two opposing trends among Arab women in highly skilled occupations: a decrease in labor market barriers and an increase in human capital barriers. However, and in contrast to Arab men, the net effect of the two trends is a decrease in the barriers in these occupations.

An examination of the trends in the barriers faced by Arab women indicates that the significant decrease in labor market barriers is what led to greater integration of Arab women in the labor force.

5   Conclusions

We have presented data and the empirical results of a general equilibrium model of occupational choice for the Arab population in Israel. The positive developments consist of progress in outcomes over time and a decline in labor market barriers. On the negative side it can be noted that the socioeconomic outcomes of the Arab population continue to be inferior to those of the Jewish population and substantial disparities remain. Moreover, it seems as though barriers to human capital acquisition increased for Arab men. Hence there is a need for greater policy efforts on the part of the government, with respect to investment in human capital.

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6 Appendix: The Empirical Work

6.1 The Data

The data are taken from the 1972, 1983, 1995, and 2008 censuses of the Israeli CBS. These are all the census years in which earnings data are available. The variables taken consist of wages, years of schooling, and occupation. We create pseudo-panel data by using synthetic cohorts over time, defining three age periods for a cohort's life cycle: the young (aged 45-35), the middle aged (36-47) and the old (48-59). These intervals are related to the minimum time period between the censuses. To facilitate calibration, repeated cross sections of the CBS Income Survey are also used.

The division into occupations is based on the CBS occupation classification at the level of one digit. We divided occupations according to skill level (low, intermediate and high) as follows:

1. In the 1995 and 2008 censuses, the division is based on the 1994 CBS uniform classification of occupations:

a. Highly skilled occupations – academic occupations (0), professionals and engineers (1), and managers (2).

b. Intermediate-skilled occupations – clerical (3) and agents, salespeople and service workers (4).

c. Low-skilled occupations – agriculture (5), professional workers in manufacturing, construction and other industries (6–8) and unskilled workers (9).

2. In the 1972 and 1985 censuses, the division is based on the 1972 occupation classification:

a. Highly skilled occupations – scientific and academic (0), professionals, engineers and similar occupations (1), and managers (2).

b. Intermediate-skilled occupations – clerical (3) and agents, salespeople and service workers (4).

c. Low-skilled occupations – service workers (5), agriculture (6), professional workers in manufacturing, construction and transportation and other professional laborers (7–8) and other workers in manufacturing and transportation and unskilled laborers (9).

6.2 Calibration

In order to solve the model and derive the dynamics of the key variables of interest, calibration of the following model parameters is needed.

(i) The parameter η denotes the elasticity of human capital with respect to education spending and is equal to the fraction of output spent

on human capital accumulation. This is calibrated using data on education spending (public plus private) as a share of GDP in Israel over the cited census years and the labor share (including imputation for the self-employed).

(ii) Fréchet distribution parameter θ – there are two ways to calculate the parameter θ. In the first, wages within an occupation for a given group are modelled to follow a Fréchet distribution with the shape parameter $\theta(1 - \eta)$. Using data from the Income Survey of the cited census years, we estimate $\theta(1 - \eta)$ to fit the distribution of the residuals from a cross-sectional regression of log hourly wages on $Mx4x3$ occupation-group-age dummies in each year.

According to the second method, the extensive margin elasticity of labor supply with respect to a wage change is $(\theta(1 - LFP_g))$. Using a labor supply elasticity of 0.26 from Chetty et al (2012) and LFP_g estimated from Income Survey data (pertains to the young, aged 25-34), the model then implies a value of θ.

(iii) The weight of consumption in the utility function β – we use the relation given by the model between the Mincerian return around mean schooling $\bar{s}$ and β. We derive the return using a regression of log average wages on average schooling across occupation-groups, with group dummies as controls.

(iv) Preferences z – we normalize preferences $z_{i,jm} = 1$ for the benchmark group, which will be Jewish men, assuming that this group suffers no discrimination, i.e., $\tau^h_{i,jm} = \tau^w_{i,jm} = 0$.

Table A-1 presents the resulting calibration values:

Table A-1
Calibration Values

| parameter	definition	value
η	Goods elasticity in human capital prod.	0.116
θ	Fréchet shape	1.39
β	Consumption weight in utility	0.157
$z_{i,jm}$	Occupational preferences, Jewish men	1
$\tau^h_{i,jm}$	Human capital barriers, Jewish men	0
$\tau^w_{i,jm}$	Labor market discrimination, Jewish men	0

7 Figures and Tables

**Figure 1: Differences in PISA Test Achievments Between Hebrew
Speaking and Arab Speaking Students
By field of study, 2006-2015**
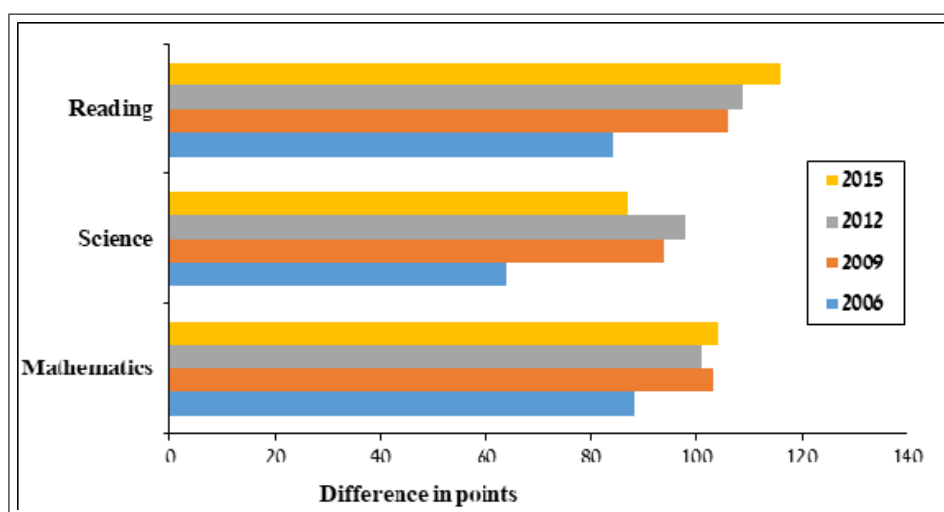
Source: National Authority for Measurement and Evaluation in Education (RAMA), Ministry of Education.

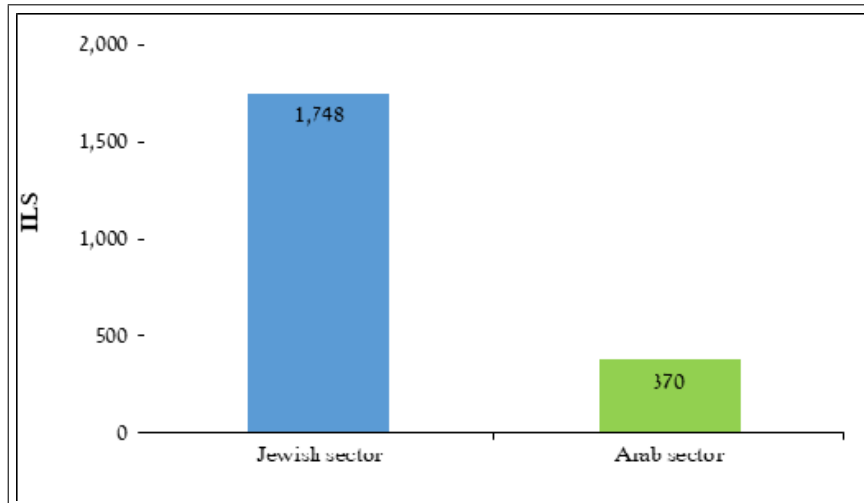**Figure 2: Budget per Student in the Education System, by sector**
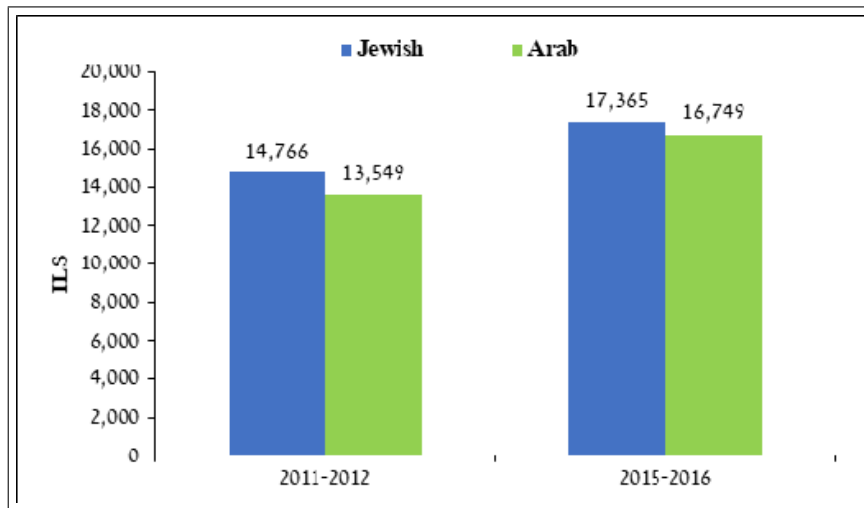
Source: Education transparency site, Ministry of Education, http://ic.education.gov.il

Note:
The data do not include the Circassians and other unclassified populations.

**Figure 3: Budget for Daycare Centers Subsidies
average per child in the age of 0-31, 2013**

Source: Ministry of Finance, 2015.
Notes:
Computed for all children in the relevant age range, not only for those in daycare.

Figure 4: Distribution of Employment of Arab and Jewish men by occupation (percent), 2016
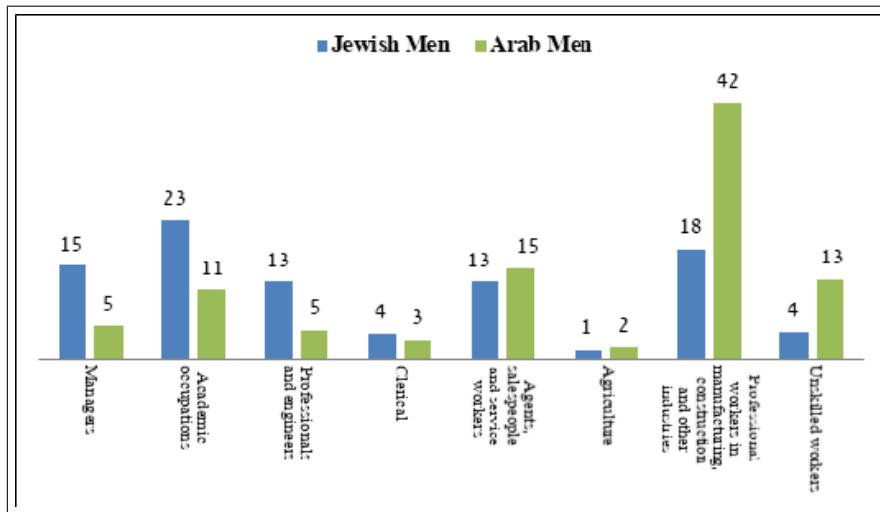
Source: CBS Labor Force Survey, 2016.
Notes:
Unknown occupations were omitted.

Figure 5: Distribution of Employment of Arab and Jewish Women by Occupation (percent), 2016
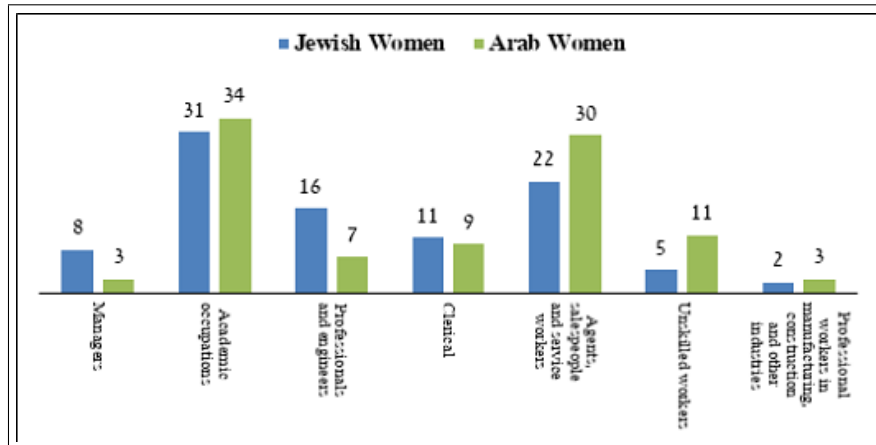
Source:. CBS Labor Force Survey, 2016.

Notes:

Occupations in which less than 2% of Arab and Jewish women are employed and unknown occupations were omitted.

Table 1: Average labor income – Arabs vs. Jews (NIS)

|	Men			Women		
	Jews	Arabs	Difference (%)	Jews	Arabs	Difference (%)
Completed elementary school or middle school	8,529	6,974	-18	4,648	3,805	-18
High school diploma (without matriculation)	10,077	7,025	-30	5,665	3,812	-33
Matriculation certificate	8,749	7,163	-18	6,255	3,930	-37
Non-academic post-high-school certificate	12,137	11,058	-9	7,771	4,598	-41
Bachelor's degree	17,721	10,909	-38	10,462	7,778	-26

Source: CBS, Household Expenditure Survey, 2017.

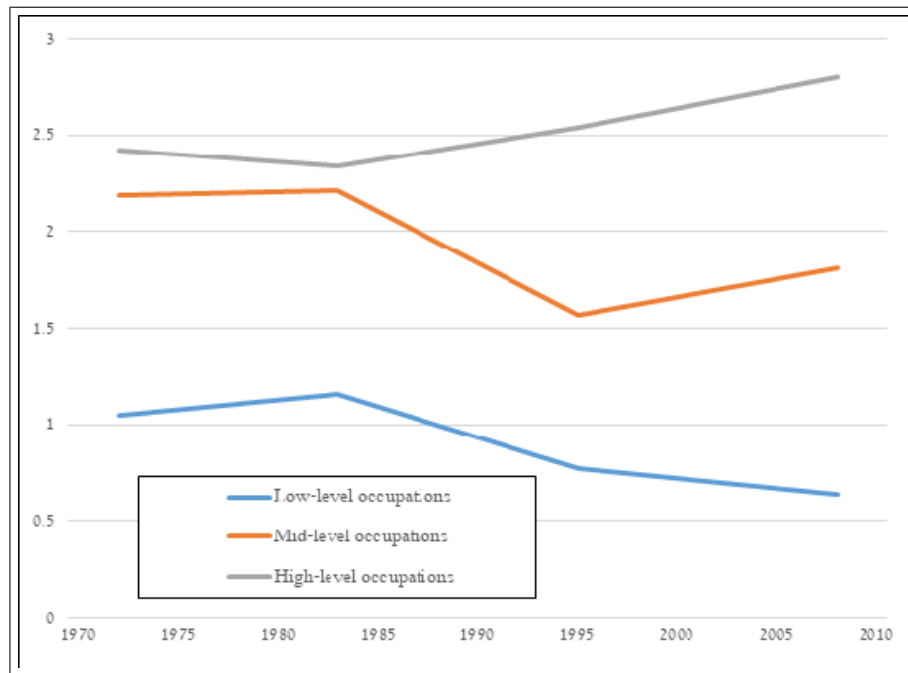# Figure 6: Occupational Prefernces and Total Barriers
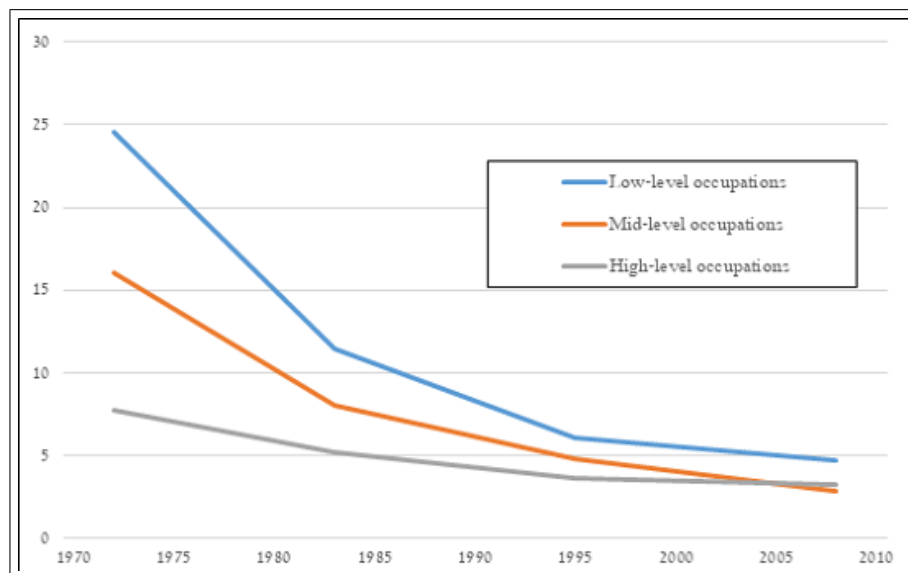
a. Occupational Preferences, Arab men
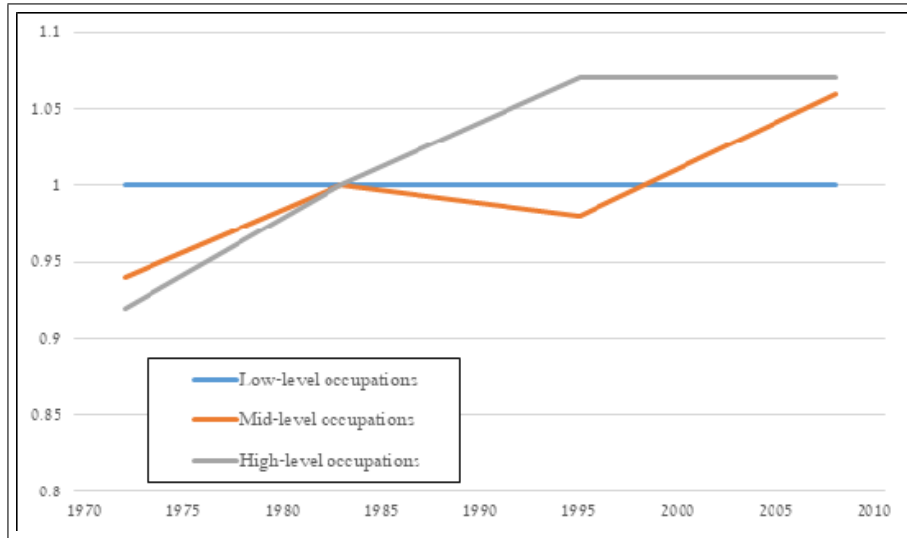
b. Occupational Preferences, Arab women
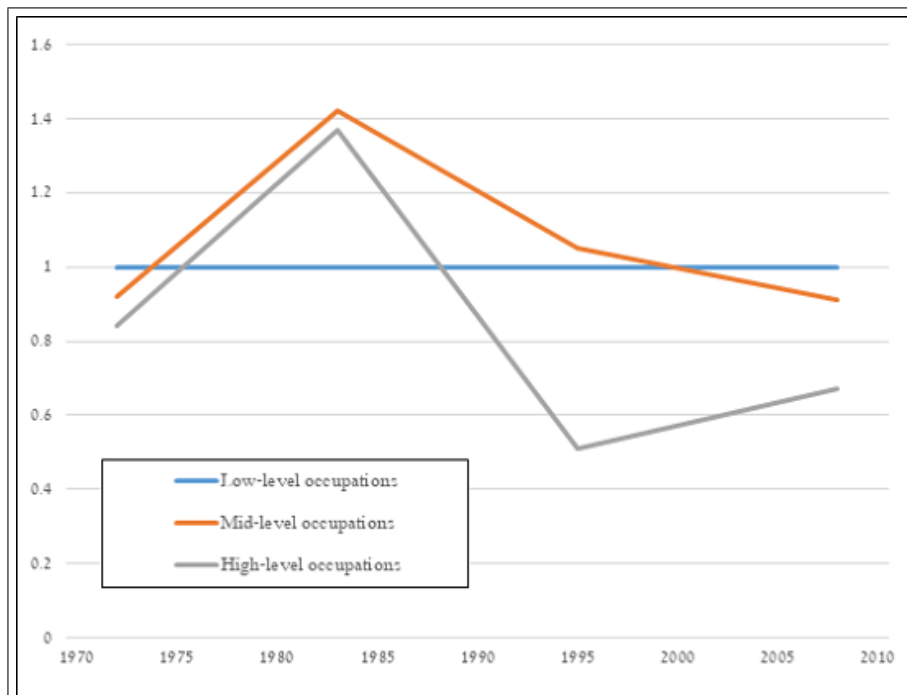
c. Total Barriers by Occupation, Arab men

d.   Total Barriers by Occupation, Arab women

Table 2: Occupational preference and barriers facing the young cohorts
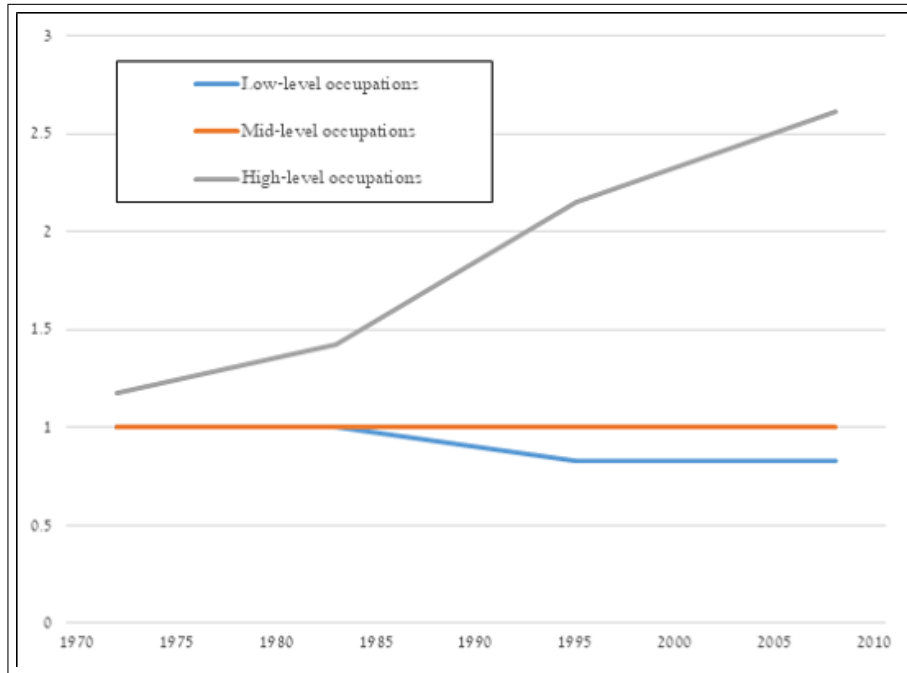
a. Occupational preference of the young cohorts

Year	Arab women			Arab men		
	Low skill level	Intermediate skill level	High skill level	Low skill level	Intermediate skill level	High skill level
1972	1.00	0.92	0.84	1.00	0.94	0.92
1983	1.00	1.42	1.37	1.00	1.00	1.00
1995	1.00	1.05	0.51	1.00	0.98	1.07
2008	1.00	0.91	0.67	1.00	1.06	1.07

b. Barriers facing the young cohorts

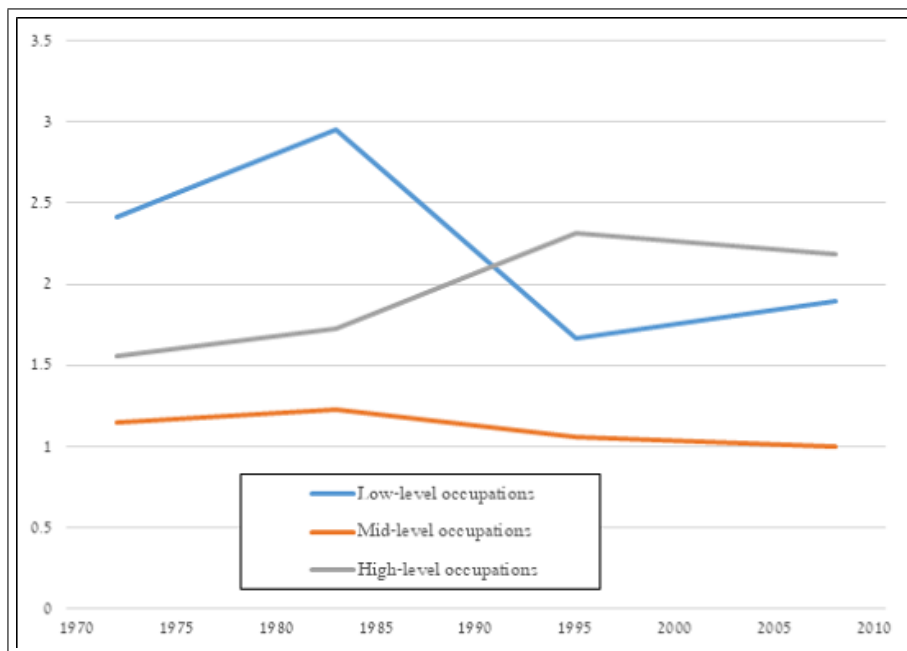| Year	Arab women			Arab men		
	Low skill level	Intermediate skill level	High skill level	Low skill level	Intermediate skill level	High skill level
1972	24.54	16.09	7.74	1.05	2.19	2.42
1983	11.43	8.02	5.21	1.16	2.21	2.34
1995	6.13	4.84	3.67	0.77	1.57	2.54
2008	4.74	2.83	3.27	0.64	1.81	2.80

36

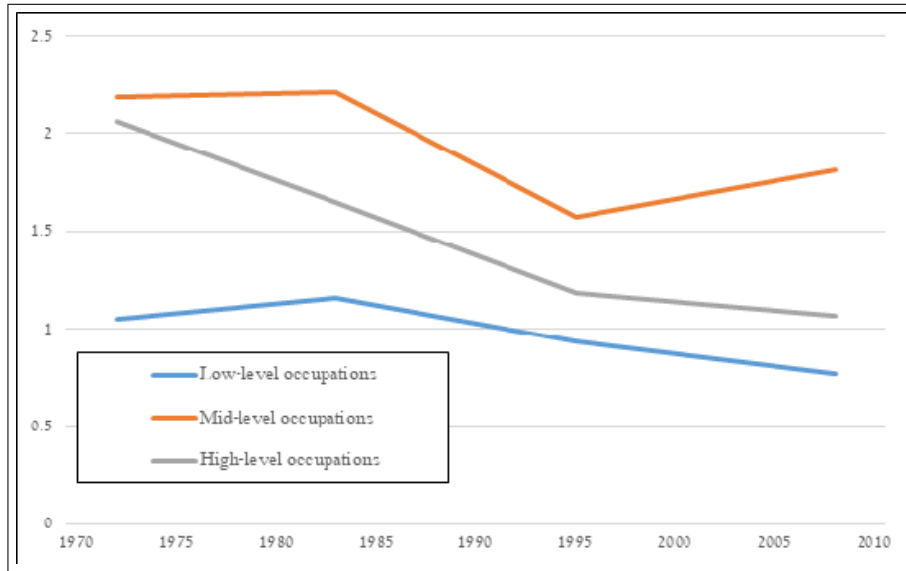**Figure 7: Human Capital and Labor Market Barriers**

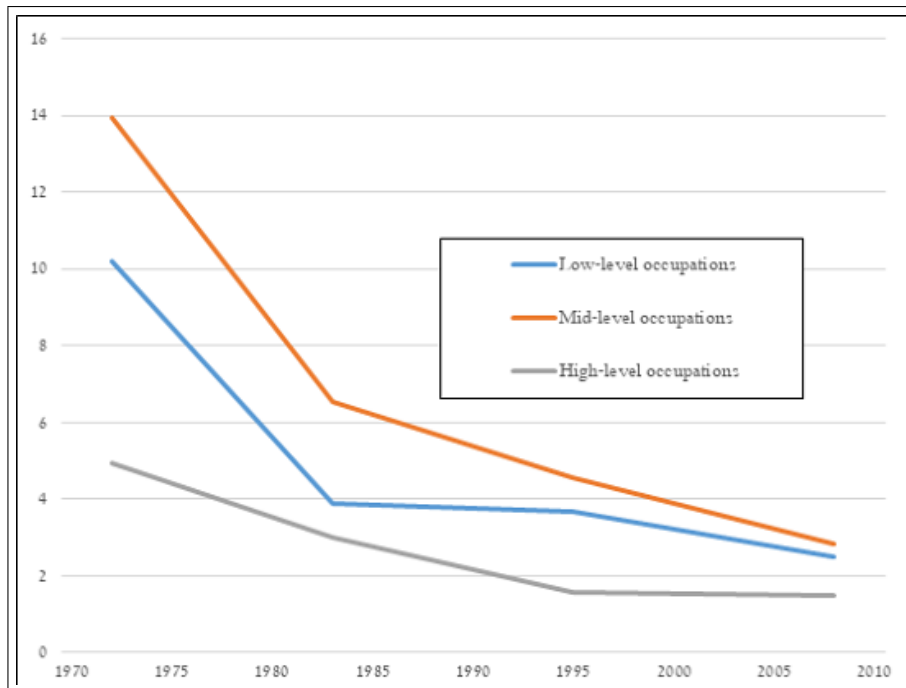**a. Human Capital Barriers, Arab men**

b. Human Capital Barriers, Arab women

c. Labor Market Barriers, Arab men

d. Labor Market Barriers, Arab women

Table 3: Labor market and human capital barriers
a. Labor market barriers

Year	Arab women			Arab men		
	Low skill level	Intermediate skill level	High skill level	Low skill level	Intermediate skill level	High skill level
1972	10.19	13.96	7.74	1.05	2.19	7.74
1983	3.88	6.54	3.00	1.16	2.21	1.65
1995	3.67	4.55	1.59	0.93	1.57	1.18
2008	2.49	2.83	1.49	0.77	1.81	1.07

b. Human capital barriers facing cohorts that were young in 2008

Year	Arab women			Arab men		
	Low skill level	Intermediate skill level	High skill level	Low skill level	Intermediate skill level	High skill level
1972	2.41	1.15	1.56	1.00	1.00	1.18
1983	2.95	1.23	1.73	1.00	1.00	1.42
1995	1.67	1.06	2.31	0.83	1.00	2.15
2008	1.90	1.00	2.19	0.83	1.00	2.61