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Using education to reduce the wage gap between men and women

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ABSTRACT

Using a theoretical model we analyzed the decision of men and women to acquire human capital in the form of extra education. We found that women tend to seek higher levels of education than men in an attempt to reduce the wage gap between themselves and their male peers. We also showed that for women with strong abilities, this strategy is an effective one.

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1. Introduction

There are many reasons for examining women's increased involvement in paid work. Although work has many different implications for one's personal life, economic status, social class, self esteem, self perceptions, political views, feelings of efficacy, worth, and empowerment and is influenced by one's level of education, interests, abilities, and personality (Hedley, 1992; Dunn, 1995), we chose to focus on the social and economic implications for women of paid employment. Such a focus may help us understand and explain the structures and processes that facilitate or impede equal opportunities for women (Dubeck and Dunn, 2006).

1.1. Gender segregation in the labor market

There has been a significant increase in the percentage of women participating in the work force. In 2008, 57.8% of the work force in OECD countries were women (<http://stats.oecd.org/>) (51% in Israel). Nevertheless, across all cultures and at all times, the labor market has been segregated by sex to varying degrees (Rau and Wazienski, 1999). While researchers differ over the causes of segregation by sex in the work place, there is general agreement about its pervasiveness and persistence (Reskin and Roos, 1990; Blau and Kahn, 1995, 2003; Albrecht et al., 2003; Kumlin, 2007). Women are per-

ceived as secondary breadwinners who pay a price for the right to join the labor market. These attitudes affect women's chances in the labor market, the evaluation of their work, their chances of promotion as well as their salary (Herzog, 2006).

Women find it easier to enter fields identified with women, which often have less prestige and command lower salaries. The massive entry of women into certain occupations turns them into 'women's jobs' (Yizraeli et al., 1999). Women who enter male-dominated occupations do earn more money than other women (Reskin and Roos, 1990), but are still paid less than comparable men in these jobs (Valian, 1999).

Among industrialized countries, gender can explain differences in salary between people with the same skills, experience and education. The smallest wage gap in the world is between Swedish women and men, where in 2006 women earned on average 84% of men's wages. In Israel, Japan and Austria, women earned 67%, 46%, and 40% of men's wages respectively, while in Muslim countries such as Turkey, they earned 28% or less (<http://stats.oecd.org/>). Despite the improvement in women's education and the on-the-job experience they have gained, women are paid less, promoted slowly and are less likely to reach the top ranks that are accorded power and authority.

Changes in labor relations in many Western countries from traditional employment with full-time, stable, long-term employment contracts to more flexible contractual relations including part-time or temporary employment, and the use of outsourcing companies and personal contracts have had a damaging effect on women (Shteyer, 2006). Today, with women representing almost half of the workforce, it is important to understand what motivates women to

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be productive at work, to understand the structures and processes that facilitate or impede equal opportunities for women (Dubeck and Dunn, 2006).

1.2. In-role conflict

The gender gap, which is reflected in the economic domain, is deeply rooted in social and psychological gender schemas (Valian, 1999). The roles of women and men in the labor market are inter-related with their roles in the household. The total amount of household and paid work and the amount of time allocated to these two realms by both sexes differ substantially (Blau et al., 2006). Women in many families still perform a disproportionate share of domestic tasks in addition to their paid work (Dubeck and Dunn, 2006). This unequal division of responsibilities influences the amount of men's and women's leisure time as well as their achievements on the job (Blau et al., 2006).

Working women perform a much larger share of domestic and child care responsibilities and hence spend on average more of their potential work time on child care and household maintenance (Valian, 1999). In numerous studies almost all women with children noted that they struggled with the conflict between spending time caring for their children and spending time performing their work (Okin, 1989; Harrington, 1993). The results are reflected in the over-representation of women in lower level positions and the commensurate salaries. Until family duties demand equal time from men and women, the wage gap may never vanish (Larson, 2006).

However, the importance of paid work cannot be overestimated. It provides women with independent status in their own right, increases their power and influence in decision-making within the family, and raises the family's standard of living (Boserup, 1970; Tuovi, 1992).

1.3. Human capital

According to the human capital theory, education, experience, and certain other qualifications are definitely necessary for success (Valian, 1999). Therefore, individuals can increase their productivity by learning important work skills while they are on the job. However, given that women in the labor force generally follow the traditional gender role assigned to them, they acquire less of this valuable on-the-job training (Blau et al., 2006; Dubeck and Dunn, 2006). Hence, women begin their careers with less human capital than men and therefore reap fewer rewards than men (Becker, 1957; O'Neill, 1991).

Work place inequality may stem from supply and demand factors, productivity related factors or the different skills and experience of the sexes arising from education level or more on-the-job training rather than from intentional discrimination. Some economic models assume that women choose to invest less in acquiring marketable skills, so their lower level of human capital is a rational choice (Becker, 1993). In spite of the fact that it is more difficult for women to acquire human capital than it is for men (Madden, 1985; England and McCreary, 1987), studies clearly show that even when men and women produce the same amount of work, women are paid less than men and are promoted less rapidly (Stack, 1994; Koplin and Singell, 1996; Sonnert and Holton, 1996). Women benefit less than comparable men do from investments in human capital; even when women's qualifications are equal to those of men, they are not evaluated equally positively (Valian, 1999). Productivity related differences are responsible for only a small portion of the inequality in the workplace (Treiman and Hartmann, 1981; Dubeck and Dunn, 2006). Discrimination against women in the labor market is also an important factor (Blau et al., 2006). It can be convincingly argued that men receive an additional benefit sim-

Table 1
Labor force attributes by gender.

	Participation rate in the labor force (2008)	Unemployment rate (2008)	Average income per hour (2008)
Males	62%	5.7%	48Nis
Females	51%	6.5%	41Nis
Total	57%	6.1%	45Nis

Source: Statistical Abstract of Israel (2009), Tables: 12.2, 12.23, 12.41.

ply from being male. They have a net advantage, even after a wide range of human capital variables are considered (Valian, 1999). Furthermore, certain jobs are low paying simply because women hold them (Dubeck and Dunn, 2006).

Education is considered the principal fast track for obtaining senior positions, professional prestige, and a high salary (Cohen, 2006). Gender differences in educational achievement are fairly small in economically advanced countries and have narrowed over time within educational categories (Blau et al., 2006). Today women receive about the same level of education as men (Sapiro, 1994; Dubeck and Dunn, 2006). Nonetheless, men continue to earn substantially more than women within each educational category (Blau et al., 2006; Larson, 2006). To illustrate, in 2007, the average monthly income for Israeli women with 13–15 years of education was 5713 NIS compared to 9366 NIS for the same group of men. In other words, women made only 64% of men's wages. For women with 16 years of education or more, the figure was 69% of men's wages (8283 NIS compared to 14,022 NIS) (Central Bureau of Statistics, 2009: 448). Israel is not an exceptional case.

As noted above, evidence suggests that both women who are more educated, more experienced, and more committed to the labor market and those who are less educated, less experienced, and less committed earn less than comparable men. Hence, the gender gap is assumed to be due to discrimination against women in the labor market. Indeed, a recent study demonstrated that in the United States discrimination based on gender accounts for about 40% of the differences in earnings between men and women (Blau et al., 2006).

As Table 1 shows, the disadvantage of women in the labor market is reflected in their participation rate, unemployment rates and their wages. The participation rates of women are much lower than those of men, their unemployment rates are higher, and women who are working receive lower wages than men. Despite the advances that women have made in the last 10 years in all areas related to the labor market, including improved levels of education and increased experience, nothing has proved sufficient in narrowing the wage gap (Larson, 2006).

In the next section we will use a theoretical model to formulate the interplay between discrimination against women in the labor market, human capital and role conflicts that leads to a wage gap between the sexes.

2. The model

The model is based on the framework developed by Malul and Luski (2009) and Malul (2009). We assume two groups in the economy – male and female. While each individual has different abilities, we assume that the distribution of abilities is identical in the two groups.

Every individual has to make two decisions. One is whether to be employed or to stay out of the work force. The second decision relates to his/her desired professional level and a determination about how much to invest in training and learning. These decisions are not independent of one another. The individual's optimal deci-

sion is affected by his/her personality traits as well as the situation in the labor market.

2.1. The labor market model: assumptions and notations

The professional level of an individual (e_i) is determined by his/her investment in training and learning. Individuals can raise this level by investing time and money in training and learning. The value of a worker's output (y_i) is a function of his/her professional level. We assume that each individual can work in a nonprofessional job. In such a case the individual's professional level remains zero and his or her output is equal to a . If the worker decides to acquire an education, his or her output will be $y_i = a + e_i$. w_i denotes the worker's wages. We assume that $w_i = y_i$.

The assumptions and notations regarding training and learning are as follows: every individual has different characteristics μ_i that determine his/her ability to learn and to be trained. Individuals can change their professional level e_i by investing $0.5(1/\mu_i)e_i^2$.

For convenience, we organized all of the definitions of the different variables below:

- w_i – the wages of individual i .
- y_i – the output of individual i .
- e_i – the professional level of individual i .
- μ_i – the ability of individual i .
- a – the output of an unskilled individual (professional level of 0).
- B – the utility of unemployed individuals, including the value of home production (for example: childcare).

The variables w_i , B , y_i are actually the current values of income from wages, the utility of the unemployed, and the individual's output.

2.2. Individuals' decisions about working and training

Following Agell and Lommerud (1997), it is assumed that in order to maximize utility the individual must first determine the level of training that maximizes his/her returns from work and then compare it to the alternative option of not working. Each individual determines his/her professional level e_i by investing in training. The cost of training to achieve a professional level of e_i is $0.5(1/\mu_i)e_i^2$. The individual maximizes the following utility function:

$$\max_{e_i, L} U = L \left(w_i - 0.5 \times \frac{1}{\mu_i} e_i^2 \right) + (1 - L)B$$

The value of the utility of an individual who works ($L = 1$) is: $U^* = a + 0.5 \times \mu_i$ (U^* is the maximum utility that a working individual can achieve). One who remains out of work receives a utility level of B . Therefore, an individual works if his/her parameter of ability satisfies $\mu_i \geq \max \{2(B - a), 0\}$. An individual whose ability satisfies $\mu_i < \max \{2(B - a), 0\}$ does not work and chooses the lowest possible professional level ($e_i = 0$). Note that if $B < a$ all individuals will choose to work anyway.

2.3. The effect of gender differences on wages and the return on education

We assume that due to discrimination against women a woman will receive a salary that is equal to a fraction of her preliminary product. However, we assume that the return on education is higher for women. Therefore, the salary is equal to:

$$w_i = \lambda_i \times a + \varphi \times e_i$$

where $0 < \lambda < 1$ (see, for example, Kumlin, 2007) and $\varphi > 1$ for females (see, for example, Psacharopoulos, 1989). For males, $\lambda = 1$ and $\varphi = 1$.

The maximization problem is now:

$$\max_{e_i, L} U = L \left(\lambda \times a + \varphi e_i - 0.5 \times \frac{1}{\mu_i} e_i^2 \right) + (1 - L)B$$

The amount of education that a working woman will acquire is equal to $\varphi \mu_i$ which is higher than the level of education that a man with the same abilities will acquire. This result is in line with the fact that in Israel the average number of years of schooling for working women is 14, while among men the median is only 12 years (The Israeli Central Bureau of Statistics, 2008). In addition, the share of women among graduates from universities and colleges in Israel is 59% (Central Bureau of Statistics, Statistical Abstract of Israel 2009, Table 8.57). Women with ability $\mu_i > (2(B - \lambda a))/\varphi^2$ will choose to work. We assume that for each level of education the salary of men is higher than that of women: $a + e_i > \lambda a + \varphi e_i$. In addition, for certain values of the model's parameters unemployment among women will be higher than among men. Specifically, the difference between their rates of unemployment will be: $\Delta UN = ((2(B - \lambda a))/\varphi^2) - 2(B - a)$.

We should note that in some cases the value of B for women will be higher than that for men $B_{\text{female}} > B_{\text{male}}$ (see, for example, Blau et al., 2006). For example, taking care of children will lead to higher unemployment among women. In cases in which child care is an issue, unemployment among women will be much higher than unemployment among men.

2.4. The economic impact of gender based differences in the labor market

The wages of women will be $w_i^* = \lambda a + \varphi^2 \mu_i$ (w_i^* results from the optimal professional level that each individual chooses when maximizing his or her utility), while for men it will be $w_i^* = a + \mu_i$. The first part of the equation is outside a woman's control and therefore remains fixed. However, women may use education to increase their wages. The increased return that women receive from advanced education creates an incentive for women to pursue this avenue, which, as Fig. 1 illustrates, further diminishes the gap between the sexes.

Fig. 1 describes the wage differences for each level of ability for men and women, where w^{male} represents the wages of men, w^{female} represents the wages of women and $\overline{w^{\text{female}}}$ represents the expected wages of women for each μ . Given λ and φ , the expected wage gap between women and men is: AC for a given μ . However, as a result of the parameters λ and φ women acquire a higher level

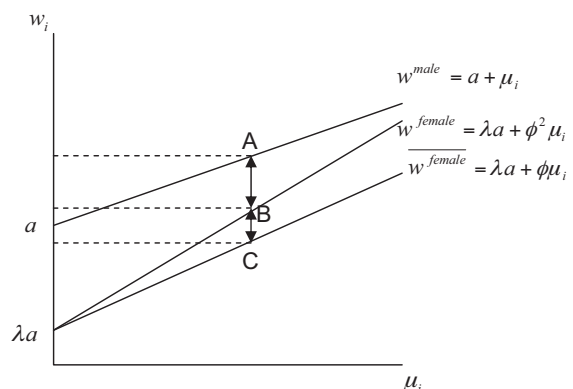


Fig. 1. Wage gap between men and women.

of education for any μ . Doing so reduces the wage gap by BC , so that the final gap remains AB .

2.5. The economic consequences of the distorted wage function among women

For each μ_i the following condition holds: $\lambda a + 0.5\varphi^2\mu_i < a + 0.5\mu_i$. In other words, the utility from work is higher for men than for women, leading to higher unemployment among women and to a loss to the economy. Actually, women with abilities in the range of $((2(B - \lambda a))/\varphi^2) < \mu_i < 2(B - a)$ will not work and will choose unemployment over employment. However, men with the same ability will choose to work. Thus, the loss to the economy is the gap between the potential utility that women could achieve if discrimination in the labor market were eliminated, which is $a + 0.5\mu_i$ while the utility that women obtain

$$\text{is only } B. \text{ The economic loss is } \int_{\frac{2(B-\lambda a)}{\varphi^2}}^{2(B-a)} (a + 0.5\mu_i - B) d\mu_i.$$

Another distortion is the one that stems from the extra education that women choose in order to compensate for the discrimination effect. Such an approach does not come without extra costs to the economy. The extra cost for each woman with ability that satisfies $(2(B - \lambda a)/\varphi^2) < \mu_i$ is $0.5\mu_i(\varphi^2 - 1)$. The distorted wage structure for women leads to undesirable outcomes in terms of economic efficiency. Therefore, it is actually a market failure that calls for government intervention. One way to steer the economy toward an efficient outcome in the labor market is a negative income tax (EITC) for women that would reduce the initial gap in wages between the genders. Such a negative income tax would increase the initial wages of women (as represented by (λa) in our model), which, in turn, might increase the incentive of women to go to work. The negative income tax might also be helpful in diminishing the gap in the return on education (as represented by φ in our model) between men and women. Creating a similar wage structure for all employees at the professional level regardless of gender would lead to a more efficient allocation of resources in the economy.

3. Empirical analysis

In order to validate the theoretical model, we ran a regression that measures the return on education (the λ and φ) for men and women using data from the Israel Central Bureau of Statistics for 2008.

The dependent variable

- $\log w$ – $\log$ of gross income per hour in new Israeli shekels (NIS).

The independent variables

- Schooly – number of years of schooling.
- Sex – dummy, male = 1, female = 0.
- Age.
- Status as an immigrant – dummy, 1 for new immigrants, 0 for natives.
- Academic degree – dummy, academic = 1, non academic = 0.

The log-linear model is commonly used in the literature for calculating equations related to wages (see, for example, Mincer, 1997; Albrecht et al., 2003; Chirwa and Matita, 2009). Defining the dependent variable as $\log(w)$ means that the coefficients of the regression reflect the percentage of change in W when a given independent variable increases by one unit. Thus, the use of $\log(w)$ will allow us to see the percentage of increase in wages for every additional year of education.

Table 2
Regression results dependent variable: $\log(\text{wage})$.

Variable	Coefficient	t
(Constant)	2.470	27.619**
Sex	0.350	6.276**
Age	0.029	8.521**
Age ²	−0.000	−8.792**
Immigrant	−0.427	−25.587**
Academic degree	0.282	14.239**
Schooly	0.041	11.644**
Schooly × Sex	−0.009	−2.307*

Adjusted $R^2 = 0.293$. $N = 5380$, $F = 320.119^{**}$.

* $p < 0.05$.

** $p < 0.01$.

Table 2 shows that gender plays a significant role in the behavior of wages in the labor market. The coefficient for men is higher by 0.35 ($\lambda < 1$) than that for women, a result that is well established in the literature (see, for example, Kumlin, 2007). The relationship between wages and age is an inverted U shape, which is expected (Albrecht et al., 2003; Kumlin, 2007; Chirwa and Matita, 2009). The salaries of immigrants are also lower than those of natives, which also accords with previous studies (see, for example, Albrecht et al., 2003).

As Chirwa and Matita (2009) determined, having an academic degree has a significant impact on wages. The regression indicates that $\varphi > 1$ as we assumed in the theoretical model. While the return on education for men is 3.2%, for women it is 4.1% (see the coefficient: Schooly × Sex). This result is consistent with that of Psacharopoulos (1989), who found that returns on education were higher for women than for men because of the projected lower earnings for the former, as reflected by their lower wages. Thus, the results confirm the assumptions about the key parameters of our theoretical model ($\lambda < 1$ and $\varphi > 1$), thereby strengthening our results from the previous section.

4. Conclusions

Using a theoretical model we analyzed the decision of men and women to acquire human capital in the form of additional education. We found that women pursue higher levels of education more than men because of the differences in wage structure between the two groups. Women use their higher level of education to compensate for being discriminated against in the job market. We showed that women with strong abilities can use this extra education to reduce the gender based wage gap.

In the second part of the paper we examined the model's parameters empirically using data from Israel. We found that wage discrimination exists in Israel and that the return on education is higher for women by 0.9% than the return for men. These results support our assumptions regarding the wage structure of men and women.

The results of our model highlight two distorted outcomes of the labor market. The first is the value of home production, which sets the threshold for entering the work force. That value may be higher for women than for men because of the responsibilities that women undertake at home. Shouldering such responsibilities makes the cost of going out to work higher for women than for men, leading to reduced rates of female participation in the labor market. The second outcome is the distorted wage structure, which is created in part by discrimination. This distortion in the labor market is inefficient from an economic point of view because it results in an inefficient allocation of resources in the economy. In addition, it has negative social effects such as higher unemployment among women and greater inequality in income distribution between the genders.

The government can play a role in mitigating the distortions that stem from the discriminatory wage structure in the labor market by instituting a negative income tax (EITC) for women. Such a negative income tax would reduce the initial gap in women's wages, represented by (λa) in our model, and might increase the incentive of women to go to work. Such a tax might also reduce the gap in returns on education (represented by φ in our model) between men and women, leading to a similar wage structure for all employees at the professional level regardless of gender. Leveling the playing field in this manner would lead to a more efficient allocation of resources in the economy.

We believe that the trend we revealed here should be investigated further because it has a major effect on men and women in every aspect of their lives. An increase in women's earnings would most likely increase their social status and improve their self-esteem, thereby increasing their ability to be more productive and make important contributions to society.

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