

# Gender Based Differences in Educational Achievement in Turkey: What Has Changed Over Time?

Mehtap Hisarcıklılar<sup>1</sup>

*Faculty of Management, Istanbul Technical University*

Andy McKay

*School of Social Sciences and Cultural Studies, University of Sussex*

Peter Wright

*School of Economics, University of Nottingham*

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## 1. Introduction

Models of wage discrimination typically posit that there are two reasons why women are paid less on average than men. Firstly, they have lower levels of human capital. Secondly, the rate of return they receive for given human capital characteristics is lower. Whilst the latter effect is attributed to discrimination, it is common to attribute the former differential to a failure by women to invest in their human capital, both before and after entering the labour market (Becker, 1993). It is important to realise however that differences in human capital characteristics may themselves be a result of a discriminatory process in society – in access to education in particular. In explaining this differential, factors influencing the decisions of the child's parents are crucial. Preferences which arise from cultural, religious or institutional influences (Gertler and Glewwe, 1992; Hill and King, 1995; Sudha, 1997) may lead to girls having lower educational levels. Discriminatory labour market processes may also lead to a perception that the relative benefits of educating boys are higher.

There have been a continuous commitment to increase the literacy and the overall education level in Turkey since the early days of the republic<sup>2</sup>. In 1924, just after the foundation of the Turkish Republic in 1923, a law on national unification has been put into effort; following that came the adoption of Latin alphabet into the Turkish language. The focus was then directed towards increasing the literacy among rural population, which accounted for the three quarters of the population. In 1973, five years of compulsory education, which had been in force since 1924, was extended to 8 years, but has never been put into realisation since it was conditioned on the availability of

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<sup>1</sup> Address for correspondence: Faculty of Management, Istanbul Technical University, 34367, Macka, Istanbul. Tel: + 90 212 2931300. Fax: + 90 212 2248685. E-mail: hisarciklilar@itu.edu.tr

<sup>2</sup> There have been some regulations put into effort even during the 1800's, the Ottoman era, making 4 years of elementary education compulsory for both boys and girls.

secondary schools across the whole country. Until 1997, 5 years of primary schooling was compulsory for both boys and girls but the educational differences remained. In line with the introduction of an educational modernisation program within the country, the primary schools (five year) are combined with the middle schools (three year) and an 8-year compulsory education was put into force starting from the 1997/1998 academic year<sup>3,4</sup>. Besides this change in the education system, various complementary projects have also been initiated in cooperation with World Bank, EU Mediterranean Program, and UNICEF with a particular focus on modernising the education in schools and also increasing girls' education.

In line with the changes in the education system as well as in social structure and development level, the gender difference in education is decreasing, but is still very unequal. In 1990, 23.3% of the male population had achieved at least middle-school education, compared to 13.2% for girls. In 1997, the enrolment rates for male and females were, respectively, 74.3% and 53.9% for middle school education, 59.0% and 42.2% for high school education and 23.1% and 15.5% for university education<sup>5</sup>. In 1996, just before the introduction of 8-year compulsory education, the gender ratios at primary and middle school levels, respectively, were 93.84 and 69.34, the combination of both being 85.63 in 1997 and 94.11 in 2007. Although the gender ratio at high school level has also increased from 67.80 to 79.65 over this ten years period, Turkey has not yet achieved gender parity at this level. Although the gender differential in education is observed all over the country,

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<sup>3</sup> The aim in the long run is to increase the compulsory education into high school level, which will then be 12 years in total. This project has been initiated in 2005/2006, with gradually increasing the high school education from three to four years.

<sup>4</sup> Some monetary charges and imprisonment apply to parents who do not send their children to school. All children of compulsory education age can not be employed in any business.

<sup>5</sup> Enrolment rate is defined as 'the ratio of the number of students by level of formal education to population enrolling age'.

it is more severe in rural than in urban areas as children in rural areas also in general have lower educational achievement than the ones residing in urban areas.

Although it has been a continuous challenge to increase the education level of the society, and also achieve gender parity and equality in education in Turkey, there are limited number of studies examining the educational attainment of children and the factors causing gender differences. Smits and Hosgör (2006), for example, examine the enrolment to primary and secondary education levels for 1978 and 1998 while Tansel (2002) estimates ordered probit models of final grade attainment on selected samples of primary, middle and high school ages for 1994. Kirdar, Dayioglu, and Tansel (2007), on the other hand focus on the impacts of sibship size, birth order and sex composition of children within the household to examine the enrollment in urban Turkey. To our knowledge, there are not any studies examining the educational attainment after the educational modernisation program and comparing the change over time.

There are two main issues related with the estimation of educational attainment models (King and Lillard, 1983; Lillard and King, 1984). The censoring in the data due to existence of individuals who have not completed their education and the correlation in the error terms caused by the unobserved family effects which are common to children from the same household or family. Although many recent studies handle censoring, studies controlling for the common family characteristics are very rare and only a few studies handle these two important issues together in the same model (Lillard and Willis, 1994; Glick and Sahn, 2000)<sup>6</sup>.

Using household labour force survey datasets for the years 1988 and 2006, this study aims to examine the changes in the effects of the family background and socio-economic characteristics on the educational achievement of boys and girls in Turkey. It focuses on investigating the factors that are causing the gender disparities and compares the educational attainment of boys and girls residing in rural and urban areas. The datasets from two different years belonging to the pre- and post-periods of the change in the education system allow us to observe the initial effects of the educational modernisation program that took place in 1997<sup>7</sup> and compare the effects of family background characteristics in two different education systems. This study estimates final grade attainment models by adopting an ordered probit approach, accounting for right censoring and also unobserved random family effects, both of which are key considerations in modelling educational attainments.

Section two begins by discussing what factors might result in educational attainment differentials between boys and girls. Section three then provides background information on the education system within Turkey, and on the data set used in this study. The econometric techniques adopted are explained in section four. Section five presents the results of the estimations, while section six decomposes the difference in the mean probabilities of educational outcomes of both groups. Section seven concludes.

## **2. Determinants of Gender Based Differences in Educational Attainment**

The decision of how much to invest in education depends not only on the person who receives the education, but also on the parents who pay for it. Thus the educational investment decision is generally modelled within an intrahousehold allocation framework

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<sup>6</sup> Behrman and Knowles (1999), Holmes (2003), Kabubo-Mariara and Mwabu (2007), for example, control for the right censoring but not for the unobserved family characteristics; Lillard and Willis (1994), and Glick and Sahn (2000), on the other hand consider both of these issues.

<sup>7</sup> A child at the age of 6, *i.e.* at the school starting age, in 1997 is normally expected to graduate by 2005. The 2006 data, therefore includes the first graduates of this new system.

(Becker, 1979, 1998). In such a model, parents consider their children's education both as a consumption and an investment good. The consumption element derives from their preferences for having educated children. The future returns that they will receive from investing in their children's human capital forms the investment part (Al-Samarrai and Peasgood, 1998; Gertler and Glewwe, 1992) – an issue which is particularly important in environments without other arrangements for adequate old age security.

Differences in the educational attainment of boys and girls might therefore be due to differences in parents' preferences for having educated sons and daughters. Such taste preferences are likely to be determined by social factors. Girls in many societies are expected to become familiar with the household activities before they get married. Parents, in this respect, might have the impression that girls miss an important part of the 'home training' when they spend more time in formal education (Hill and King, 1995). Hence they might be reluctant to invest in their daughters' education or even to send their daughters to school. Another factor which might influence the parents' tastes towards education is the educational level of the parents themselves. Educated parents are more likely to be aware of the benefits of education. Also, it is sometimes argued that educated parents are less influenced by tradition and are less likely to discriminate between their children (Al-Samarrai and Peasgood, 1998; Binder, 1998; Blau and Grossberg, 1992; Hill and King, 1995; Kalmijn, 1994; Leibowitz, 1974). More educated women may also act as role models for their daughters, as well as increasing the 'bargaining power' of the mother within the family.

Differences in the net returns to education for boys and girls may arise from differences in the costs of education or differences in gross returns. Whilst the direct costs of schooling are similar for boys and girls, there may be big differences in the opportunity cost of a child's time whilst at school. In many societies girls might spend the time that would otherwise be spent at school caring for their younger siblings, engaged in housework or

working in farmfields. These activities will indirectly but significantly contribute to the budget of the family (Binder, 1998; Chernichovsky, 1985; Glick and Sahn, 2000; Hill and King, 1995). The returns to boys' and girls' education in the labour market also differ greatly. Indeed gender based wage discrimination or occupational segregation in the labour market may itself discourage parents from investing in their daughters' education.

Larger differences in educational attainments of boys and girls may be evident in societies where parents expect their children to provide financial support when they get old, and where traditions generally give this responsibility to boys. In such circumstances parents might value their sons' education more even if the returns to education for boys and girls were the same (Al-Samarrai and Peasgood, 1998; Binder, 1998; Sudha, 1997). Indeed, in many parts of Turkey, girls are considered to belong to their husband's family after marriage. It is also true that the lifetime earnings of females are likely to be less since many stop working after they get married or subsequent to having a child. Consequently, investing in their daughter's education may have limited financial returns for the parents.

Although the social structure is changing with development, men and women are still carrying on their traditional roles in many parts of Turkey. Mostly, girls are considered to have a higher opportunity cost for schooling and also priority is given to the education of boys due to their breadwinner roles in the family (society). Moreover, boys generally take the responsibility of providing financial support for their parents when they get old while girls are expected to belong to their husbands' families. It is also true that the lifetime earnings of females are likely to be less since many stop working after they get married or subsequent to having a child. Consequently, investing in their daughter's education may have limited financial returns for the parents.

An intra-household allocation model extended to allow for the gender based differentials in the educational investment decisions of the parents forms the basis for the discussion in this study (Alderman and King, 1998). The model assumes a two-period world, where parents work in the first period and retire in the second. It is assumed that parents consume less than their income and invest in their children's human capital in the first period. Their consumption in the second period depends entirely on financial transfers from their children, which depends on the children's future wealth and thus human capital.

For the purposes of the model and for simplicity, the family is assumed to have two children, one of each sex. The parents' lifetime utility function can be written as:

$$(1) \quad U = F(C_1) + G(C_2, W_b, W_g)$$

where  $C_1$  is consumption in period 1,  $C_2$  is consumption in period 2,  $W_b$  and  $W_g$  are the future wealth of the male and female child, respectively. Market incentives are introduced by allowing both the returns to children's human capital and children's remittance rates to differ by gender. The utility function then takes the form:

$$(2) \quad U = F(C_1) + G(\beta r_b H_b + \tau r_g H_g, r_b H_b, r_g H_g)$$

where  $H_b$  and  $H_g$  denote the human capital of the boy and girl respectively;  $r_b$  and  $r_g$  denote the rates of return to human capital for the boys and girls, respectively; and  $\beta$  and  $\tau$  are the rate of transfers per unit of wealth from the male and female child which are allowed to differ following the discussion above. Preferences between children can also be introduced by allowing the marginal utility of children's human capital to differ by gender<sup>8</sup>. The budget of the family is assumed to be allocated between first period consumption and human capital investments for the children, and is thus given by,

$$(3) \quad P_b H_b + P_g H_g + C_1 = Y$$

where  $P_b$  and  $P_g$  are the prices of investment in human capital of the boy and the girl and  $Y$  is the family income. Parents choose the level of investment in the human capital of their son and daughter by maximising their utility (Eq.2) subject to their budget constraint (Eq.3). Assuming that the direct costs of education are the same for boys and girls, the allocation of human capital investments between boys and girls is given by<sup>9</sup>:

$$(4) \quad \frac{\partial G}{\partial C_2} \beta r_b + \frac{\partial G}{\partial W_b} r_b = \frac{\partial G}{\partial C_2} r_g + \frac{\partial G}{\partial W_g} r_g$$

This expression indicates that parents invest in their son's and daughter's human capital up to the point where the marginal benefit to them of the boy's and girl's human capital are equal. Assuming equal remittance rates for boys and girls, if the market return to boy's human capital is greater than the return to girl's human capital ( $r_b > r_g$ ), Eq.4 is satisfied at a point when the investments in the boy's human capital are higher than the investments in the girl's human capital ( $H_b > H_g$ ), since the marginal utility functions are decreasing in the level of human capital ( $H$ ). When boy's remittance rate is higher than the girl's ( $\beta > \tau$ ), or if parents are concerned more with son's wealth than with daughter's wealth ( $\partial G / \partial W_b > \partial G / \partial W_g$ ), ceteris paribus, the marginal utility obtained from boy's human capital will also be greater than the marginal utility obtained from girl's human capital at the same level of human capital,  $H$ . Thus, by a similar argument, investment in the boy's human capital will exceed that for the girl.

### 3. Education of Boys and Girls In Turkey

Formal education in Turkey includes pre-school, primary, secondary, and higher education levels and is free of charge in public schools<sup>10</sup>. Prior to 1997, primary education comprised five years of primary (for children aged 6-11) and three years of middle (aged 12-14) schooling. In 1997, as a part of an educational modernisation program, a new law combining the primary and middle schools was introduced, extending the compulsory

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<sup>8</sup> If parents do not explicitly prefer one gender to the other, the marginal utility of each child's wealth will be equal.

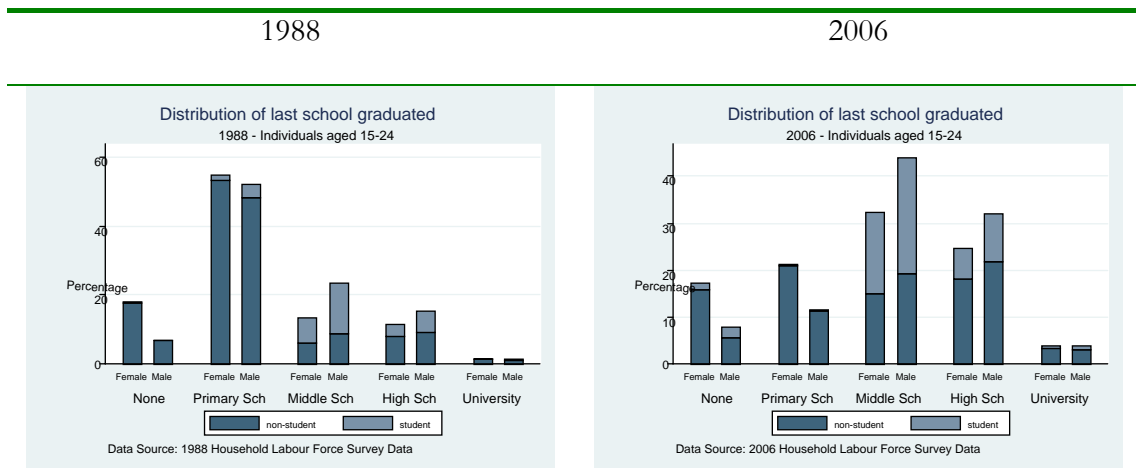
<sup>9</sup> Different direct costs for girls' and boys' schooling might also be included in the model, but it is unlikely to observe direct costs differing by gender.

<sup>10</sup> Private schools are also available at all levels of education.

education from five to eight years for children aged 6 to 14. Starting from 1997/1998 education year, middle schools stopped accepting new students for education and they are closed down as the previous students graduated. Secondary education consists of high schools with a three year educational programme. In 2005/2006, a project on increasing the high school education to four years has been initiated, which will gradually take place over the country, followed by a 12 year compulsory education system in the long run. Higher education consists of universities with at least four years of education and non-university institutions, with at least two years of education.

The data used in this study are taken from the 1988 and 2006 Household Labour Force Surveys for Turkey<sup>11</sup>. The samples used for this study were restricted to individuals aged 15-24 where information on both the child and the parents were present<sup>12</sup>.

**Figure 1. Distribution of last school graduated, individuals aged 15-24**



<sup>11</sup> 1988 is the first household labour force survey with earnings information and 2006 is the last available one during work being done for this study. Although there are a few changes in the questionnaire design of the surveys through time, these two data sets are comparable in terms of the aims of this study.

<sup>12</sup> We restrict our sample to children whose both parents were present in the household as we aim to assess and compare the importance of maternal and paternal characteristics.

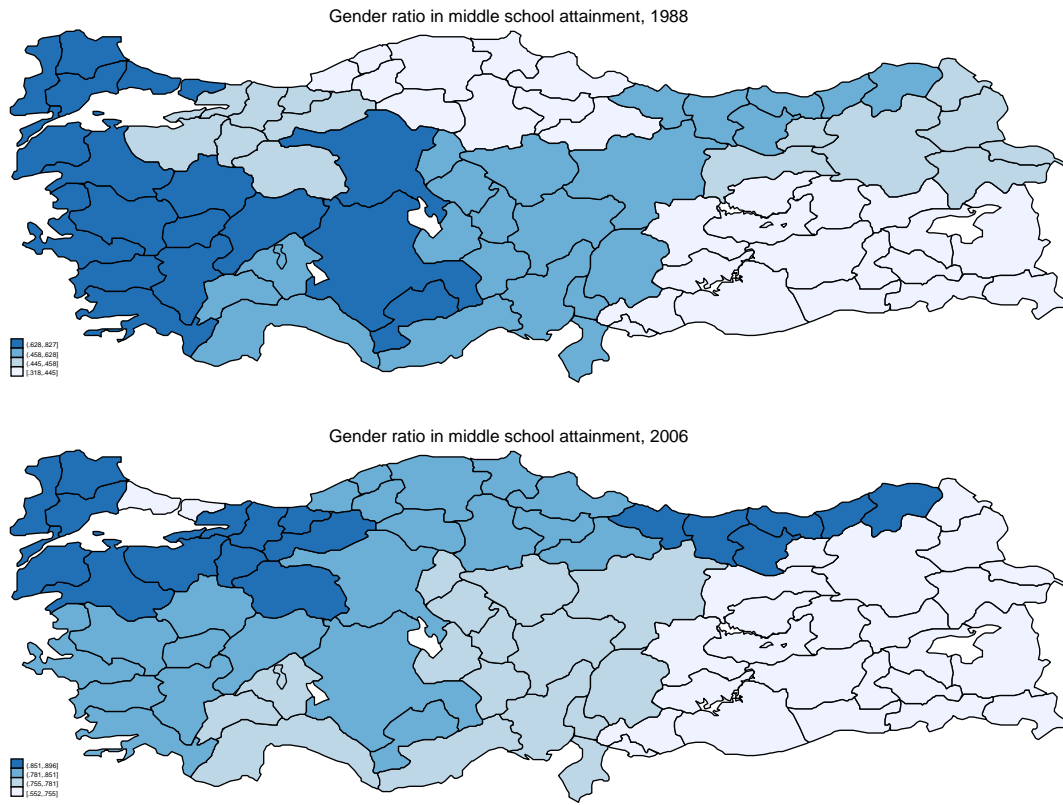
In order to examine how the relative position of the sexes is changing over time, Figure 1 compares the *last* grade attained for those aged between 15-24 in 1988 and 2006. The figures suggest that there has been an overall increase in the overall level of education through time. However, despite the new legislation and the efforts for increasing girls' schooling, the gender differences remain.

There are also important differences in the distribution of education across regions, with higher levels of educational achievement in the Western and lower levels in the Eastern regions<sup>13</sup>. There are also gender differences between the regions. Figure 2a and 2b present the gender ratio in the middle and high school attainment for the years 1988 and 2006. The gender ratio is calculated by dividing the number of middle school (or high school) graduate girls by the number for boys. The darker the color on the map, the higher the gender ratio in a particular region, signalling a lower gender differential.

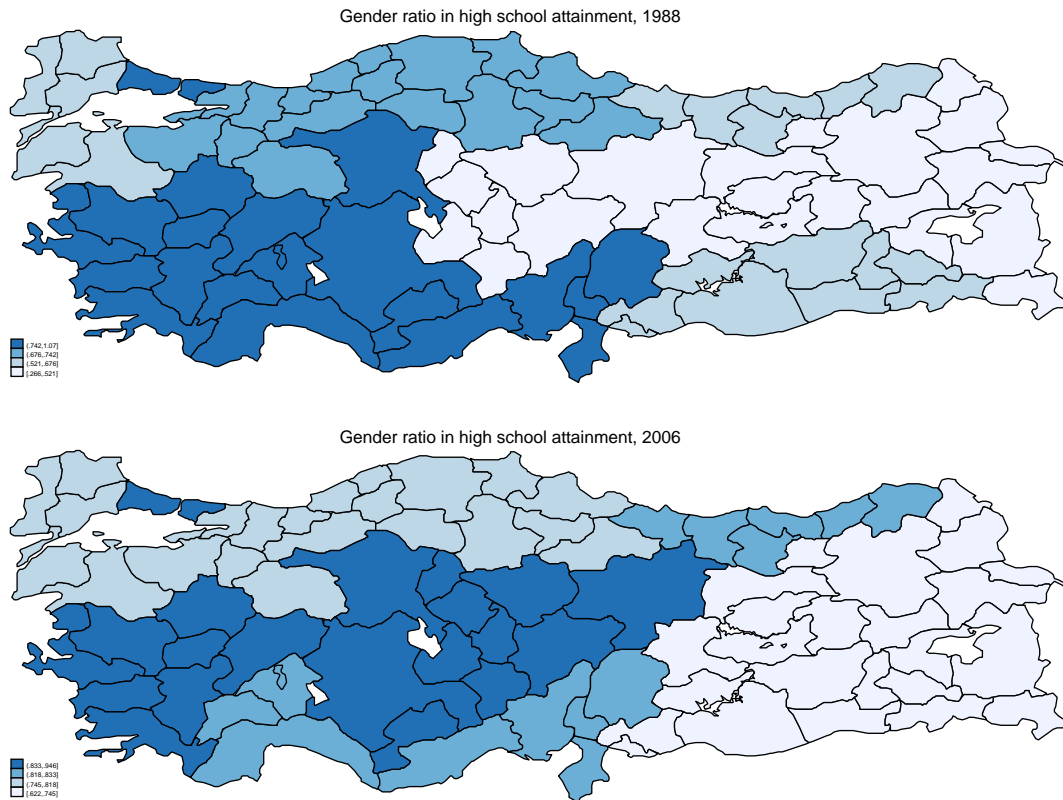
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<sup>13</sup> See Appendix 1 for the regional distribution of school attainment.

**Figure 2a. Regional Distribution of Gender Ratio in Middle School Attainment**



**Figure 2b. Regional Distribution of Gender Ratio in High School Attainment**



#### 4. Econometric Technique

Following from the theoretical discussion in Section 2, this paper examines the determinants of educational attainment focusing on the four substantial educational attainment categories identified above: no degree; primary school degree; middle school degree; and high school degree<sup>14</sup>. Since these outcomes represent a natural ordering in preferences, we use an ordered probit approach (Greene, 2002). Let

$$y_j = \beta' x_j + u_j \quad (1)$$

where  $y_j$  is the propensity of schooling for the  $j^{\text{th}}$  individual,  $\beta$  is a  $k \times 1$  parameter vector,  $x_j$  is a  $k \times 1$  vector for the individual characteristics and  $u_j$  is the stochastic disturbance term. Within such a framework higher educational outcomes will be observed for those with higher propensities:

$$S_j = s \quad \text{if} \quad \mu_s \leq y_j \leq \mu_{s+1} \quad \text{for } s = 0, 1, 2, 3 \quad (2)$$

where  $S_j$  shows the final grade that the individual has attained and takes values 0, 1, 2, and 3, respectively for individuals who have no degree, primary school degree, middle school degree and high school degree<sup>15</sup>. The  $\mu$ 's are the threshold values where  $\mu_0 < \mu_1 < \dots < \mu_4$ ,  $\mu_0 = -\infty$  and  $\mu_4 = +\infty$ .

Assuming a standard normal distribution for the stochastic disturbance term, the conditional probability of attaining  $S_j = s$  is given by

$$\Pr(S_j = s | x_j) = \Phi(\mu_{s+1} - \beta' x_j) - \Phi(\mu_s - \beta' x_j) \quad (3)$$

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<sup>14</sup> University graduation is not included in the model mainly because of two reasons. Admission to a university is based on a very competitive centralised exam and thus it does not purely reflect preferences towards education. Also, the household labour force surveys include information only for people who were residing in the household at the time of the survey. Children who are studying at a university away from their parents, who have got married or who have been doing their military service at the time of the survey are not observed and hence excluded from the sample. Because the sample is not representative for the university graduates, inclusion of a 'university' category would lead to a bias in the parameter estimates.

where  $\Phi(\cdot)$  is the standard normal cumulative distribution function.

Two main issues arise in the estimation of the above model. The first is that, since some of the individuals are still continuing with their education at the time of the survey, we do not know the final educational attainment of these individuals with certainty. Hence data will be ‘right censored’ and failure to account for this fact will lead to biased estimates (King and Lillard, 1983 and 1987; Lillard and King, 1984; Behrman and Knowles, 1999; Glick and Sahn, 2000; Holmes, 2003). Excluding such censored observations will lead to a sample selection bias, since those children whose parents value education more will be continuing their education and will therefore be under-represented in the sample. The alternative of restricting the sample to older individuals who might reasonably be expected to have completed their education (as in Kalmijn, 1994 or Tansel, 2002) severely reduces the sample size. Also, since older individuals are less likely to live with their parents, the impact of family background will be harder to ascertain.

The approach taken in this paper is to model right censoring explicitly (King and Lillard, 1983 and 1987; Lillard and King, 1984; Lillard and Willis, 1994; Glick and Sahn, 2000). To do so, we assume that the individual will at least complete their current grade<sup>16</sup>, and hence the likelihood contribution of those individuals who are continuing their education is given by:

$$1 - \Phi(\mu_{s+1} - \beta' x_j) \quad (5)$$

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<sup>15</sup> The ‘no degree’ category includes individuals who are literate or illiterate but have not completed any school. Tansel(2002), for example, differentiates between the literate and illiterates under this group, and includes them as two separate categories in her model.

<sup>16</sup> A similar approach is taken by King and Lillard (1987), Lillard and Willis (1994), and Glick and Sahn (2000). An alternative approach would be to assume that all individuals are likely to drop out before finishing their current grade. In this case the likelihood contribution will be  $1 - \Phi(\mu_s - \beta' x_j)$ . Comparison of results based on these two assumptions are provided in Hisarciklilar (2003).

where  $s$  is the individual's completed level of education at the time of the survey.

The second consideration for estimation arises because individuals coming from the same household within the sample might be sharing the same unobserved family characteristics, causing the error terms to be correlated for the individuals from the same household (King and Lillard, 1983; Lillard and King, 1984; Lillard and Willis, 1994; Glick and Sahn, 2000). Failure to account for this will lead to incorrect standard errors. The model is therefore extended to allow a random household specific component in the error term<sup>17</sup>.

The propensity for schooling for the  $j^b$  individual in the  $i^b$  household then takes the form:

$$y_{ij} = \beta' x_{ij} + \theta_i + u_{ij} \quad (6)$$

where  $\theta_i$  represents the unobserved family characteristics, that are assumed to be common to all children in the household. Further it is assumed that  $\theta_i \sim N(0, \sigma_{\theta_i}^2)$ ,  $u_{ij} \sim N(0,1)$ , therefore the correlation between the two disturbance terms is:

$$\rho = \sigma_{\theta_i}^2 / (\sigma_{\theta_i}^2 + 1) \quad (7)$$

The conditional probabilities can then be re-written as:

$$\Pr(S_{ij}) = \Phi(\mu_{s+1} - \beta' x_{ij} - \theta_i) - \Phi(\mu_s - \beta' x_{ij} - \theta_i) \quad (8)$$

for the non-censored observations, and

$$\Pr(S_{ij}) = 1 - \Phi(\mu_s - \beta' x_{ij} - \theta_i) \quad (9)$$

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<sup>17</sup> The unobserved household component could be assumed to be fixed rather than random, in which case the deviations of the variables from the household mean will be used in the estimations. This would, however, cause some computational difficulties in our model as most of the independent variables that are considered are taking the same value for all individuals from the same household (such as parental education), which would eventually drop from the model during the estimations. A specification test between the two could not be performed due to the same reasons. See Gesthuizen *et al* (2005) and Ejr n s and P rtner (2002) for a fixed effects specification in educational attainment/enrolment models.

for the censored observations. The conditional likelihood for the  $i^{\text{th}}$  household with  $n$  children is the product of all the conditional probabilities for the children in this household:

$$L_i(\theta_i) = \prod_{j=1}^n P(S_{ij}) \quad (10)$$

The unconditional likelihood is thus written by integrating the marginal likelihood over all possible values of  $\theta_i$ . Defining  $\tilde{\theta}_i = \theta_i / \sigma_\theta$ ,

$$L_i = \int_{\tilde{\theta}} \phi(\tilde{\theta}_i) \prod_{j=1}^n P(S_{ij}) d\tilde{\theta}_i \quad (11)$$

where

$$P(S_{ij}) = \Phi(\mu_{s+1} - \beta' x_{ij} - \tilde{\theta}_i(\rho/1-\rho)^{1/2}) - \Phi(\mu_s - \beta' x_{ij} - \tilde{\theta}_i(\rho/1-\rho)^{1/2})$$

for the non-censored observations, and

$$P(S_{ij}) = 1 - \Phi(\mu_s - \beta' x_{ij} - \tilde{\theta}_i(\rho/1-\rho)^{1/2})$$

for the censored observations.

The log-likelihood function for the total sample is obtained by taking the natural logarithm of the product of the unconditional likelihood functions for all the households in the sample:

$$\ln L = \sum_{i=1}^m \int_{\tilde{\theta}} \left[ \ln \phi(\tilde{\theta}_i) \sum_{j=1}^n \ln P(S_{ij}) \right] d\tilde{\theta}_i$$

where  $m$  is the number of households<sup>18</sup>.

As explained above, one of the aims of this study is to examine the changes that have happened during the 18 years period by comparing the results of the 1988 and 2006

regressions. One issue, that we have encountered, however, was that the 2006 sample includes a mixture of individuals who have done their schooling before and after the change in the education system. A child starting school at age 6 in 1997/1998 academic year would complete 8-year primary education by 2005/2006 in normal circumstances. The only concern that we have because of this mixed structure of 2006 sample is that a person who have done 5 to 8 years of schooling but dropped out before completing primary education would be considered as a primary school graduate in the 1988 sample but is considered as a non-graduate in the 2006 sample<sup>19</sup>. Also, for these people who have not graduated yet but who were continuing with their education at the time of the survey, likelihood contribution function would be  $1 - \Phi(\mu_2 - \beta'x_{ij} - \theta_i)$  in the 1988, but it is written as  $1 - \Phi(\mu_1 - \beta'x_{ij} - \theta_i)$  in the 2006 regression.

One alternative way to deal with this issue is to restrict the sample to individuals aged 20-25 to ensure that all have graduated in the old education system. However, as mentioned above, this would significantly reduce the number of observations we have and also direct our attention to an older age group where the effect of variables would be underestimated because of excluding people that are non-existent in the household at the time of the survey. It also would not allow us to examine the impacts of the change in the education system. We could alternatively have restricted our sample to younger generation, and ensure that everybody in the sample is from the new system but then there would be three educational categories left in the model which would make it more difficult to compare

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<sup>18</sup> The first derivatives for this integral are calculated making use of the hermite integration suggested by Butler and Moffit (1982). See Frechette (2001) for a discussion.

<sup>19</sup> This is because the primary and middle school education is combined under primary education with the changes adopted in 1997.

the results with those of 1988<sup>20</sup>. Besides the parameter estimates for high school graduation would not be as reliable.

In order to overcome any problems that this might have caused, we re-defined our ordered probit model, restricting the effects of the variables to be the same for individuals from both groups, while allowing the cut-off points to change for individuals who had done their schooling in the new and old system<sup>21</sup>. For those who went to school after the change in the education system, the primary and middle school categories are combined under one category, which reduced the number of threshold values from three to two. We therefore have 3 cut-off points estimated for the people in the old system and 2 cut-off points estimated for the people in the new system.

A final issue and a possible source of bias for which we are unable to take into account might arise from the fact that girls in some traditional families get married at very young ages (14-15 for example), and then leave the parental home. The sample used in this study does not have information on such individuals. This may give rise to a sample selection problem (Holmes, 2003), with the gender differential in educational achievement being underestimated, especially for higher levels of educational transitions.

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<sup>20</sup> We have estimated the models restricting the outcomes into three different categories by combining primary and middle school graduation in both samples but this is likely to create a bias in the parameter estimates as people who report to have graduated from primary school and completed their schooling would be treated as the same as people who have done no schooling at all. Still, our main conclusions remained the same.

<sup>21</sup> The survey does not have any information on which system the individuals have done their schooling in but this could be easily worked-out with some age controls. The new system has started in September 1997. A child at the age of 6 at that time is expected to finish 8 years of primary education by the time they are 14 at normal circumstances. Also, a person who was starting the 6th year in 1997 (should be aged 11 at normal circumstances) would be at age 20 in 2006. Therefore any person who is aged 20 or older would have normally started school with the old system. While writing the likelihood contribution functions, children aged 15-19, therefore are assumed to be in the new system while the older ones are considered to have completed their education before the changes in 1997.

Mentioned above, the sample used in the estimations include individuals aged 15-24. The lower age limit is chosen as 15 to ensure that we include children who are expected to complete at least their 8-year compulsory primary education. All children aged 6-14 in the 2006 sample are expected to either going school (but have not graduated yet) or not enrolled in education at all, inclusion of which would significantly increase the number of censored observations. Besides, a lower age limit of 15 will ensure that children in both the pre- and post-1997 periods would complete an 8-year or primary or middle school educations in normal circumstances<sup>22</sup>.

## 5. Results

We first consider estimations which consider boys and girls jointly, incorporating a gender differential term. Results of two different specifications for 1988 and four for 2006 are presented in Table 1. All specifications are based on random effects ordered probit models incorporating graduates and current students, allowing for censoring in the latter case. The first two 2006 models are based on the same three thresholds used for the 1988 model, the third and fourth models are based on five thresholds: three for the pre-1997 educated population and two (different) thresholds for the post-1997 population, thus allowing for the change in the educational system in 1997. Initially we focus discussion on the three threshold models, which should be easily comparable.

In all models, there is evidence for a statistically significant gender differential in favour of boys. The magnitude of this differential has fallen in absolute terms over this period, but it still remains very large in 2006. This gender gap, which was clear in the descriptive analysis above, remains substantial even controlling for all other explanatory factors in the

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<sup>22</sup> As in many other developing countries, late enrolment also is an issue in Turkey. Since we account for the censored observations in the sample, non-completion of primary education by age 15 is not an issue in our

model. Being a boy increases the probability of completing higher education by 0.26 in 1988 and 0.16 in 2006 (Tables 2a - 2b).

**Table 1. Model estimations at the National Level**

National Level Regressions	1988		2006 - 3 thresholds		2006 - 5 thresholds	
	Model I	Model II	Model I	Model II	Model III	Model IV
Gender	0.694*** (0.031)	0.691*** (0.031)	0.449*** (0.014)	0.452*** (0.014)	0.487*** (0.014)	0.491*** (0.014)
Mother primary sch. graduate	0.510*** (0.048)	0.502*** (0.048)	0.566*** (0.019)	0.560*** (0.019)	0.546*** (0.020)	0.541*** (0.020)
Mother middle sch. graduate	1.093*** (0.184)	1.025*** (0.186)	0.931*** (0.051)	0.923*** (0.051)	0.902*** (0.052)	0.894*** (0.052)
Mother high sch. graduate	1.507*** (0.238)	1.381*** (0.243)	1.456*** (0.065)	1.460*** (0.065)	1.441*** (0.067)	1.434*** (0.067)
Mother university graduate	2.233*** (0.594)	1.884*** (0.617)	1.305*** (0.130)	1.333*** (0.135)	1.367*** (0.135)	1.340*** (0.139)
Father primary sch. graduate	0.611*** (0.046)	0.592*** (0.046)	0.555*** (0.024)	0.541*** (0.024)	0.572*** (0.025)	0.561*** (0.025)
Father middle sch. graduate	1.554*** (0.105)	1.456*** (0.107)	1.017*** (0.034)	1.009*** (0.035)	1.052*** (0.036)	1.045*** (0.036)
Father high sch. graduate	2.071*** (0.121)	2.025*** (0.125)	1.507*** (0.038)	1.488*** (0.039)	1.570*** (0.040)	1.543*** (0.041)
Father university graduate	2.590*** (0.186)	2.597*** (0.204)	1.788*** (0.062)	1.764*** (0.064)	1.869*** (0.065)	1.818*** (0.066)
Mother engaged in agriculture	-0.207*** (0.064)		-0.147*** (0.029)		-0.166*** (0.031)	
Father engaged in agriculture	-0.384*** (0.062)		-0.176*** (0.029)		-0.180*** (0.030)	
Living in an urban area	0.314*** (0.055)	0.332*** (0.055)	0.341*** (0.019)	0.356*** (0.019)	0.370*** (0.020)	0.386*** (0.020)
Household size	-0.111*** (0.009)	-0.110*** (0.009)	-0.108*** (0.004)	-0.108*** (0.004)	-0.135*** (0.005)	-0.135*** (0.005)
Female relative aged 15-60	0.381*** (0.131)	0.383*** (0.131)	-0.051** (0.022)	-0.052** (0.022)	0.122*** (0.023)	0.116*** (0.023)
Female Relative aged 60 plus	0.143* (0.083)	0.13 (0.083)	0.215*** (0.029)	0.209*** (0.029)	0.212*** (0.030)	0.207*** (0.030)

model.

**Table 1. Model estimations at the National Level, *continued***

National Level Regressions	1988		2006 - 3 thresholds		2006 - 5 thresholds	
	Model I	Model II	Model I	Model II	Model III	Model IV
Istanbul	0.072 (0.105)	0.073 (0.105)	0.177*** (0.041)	0.200*** (0.041)	0.211*** (0.042)	0.230*** (0.042)
West Marmara	0.024 (0.119)	0.042 (0.119)	-0.086* (0.047)	-0.083* (0.047)	-0.084* (0.049)	-0.083* (0.049)
Aegean	0.062 (0.080)	0.094 (0.080)	-0.223*** (0.033)	-0.227*** (0.033)	-0.221*** (0.034)	-0.225*** (0.034)
East Marmara	0.018 (0.097)	0.033 (0.097)	0.038 (0.035)	0.043 (0.035)	0.076** (0.037)	0.077** (0.037)
Western Anatolia	0.269*** (0.083)	0.274*** (0.083)	-0.092** (0.038)	-0.083** (0.038)	-0.102** (0.040)	-0.097** (0.040)
Central Anatolia	0.064 (0.100)	0.073 (0.100)	-0.038 (0.043)	-0.027 (0.043)	-0.047 (0.045)	-0.042 (0.045)
Western Blacksea	0.06 (0.096)	0.077 (0.096)	-0.138*** (0.039)	-0.125*** (0.039)	-0.131*** (0.041)	-0.122*** (0.041)
Eastern Blacksea	0.562*** (0.111)	0.545*** (0.111)	0.272*** (0.054)	0.275*** (0.055)	0.285*** (0.057)	0.285*** (0.057)
North-Eastern Anatolia	-0.107 (0.098)	-0.119 (0.098)	-0.015 (0.042)	-0.022 (0.043)	0.008 (0.044)	-0.006 (0.044)
Centre-Eastern Anatolia	-0.126 (0.093)	-0.132 (0.093)	-0.029 (0.044)	-0.032 (0.044)	0.001 (0.045)	-0.006 (0.046)
South-Eastern Anatolia	-0.566*** (0.105)	-0.585*** (0.105)	-0.052 (0.044)	-0.062 (0.044)	-0.048 (0.046)	-0.065 (0.046)
Mother employer			0.049 (0.277)		0.077 (0.290)	
Mother self-employed			0.015 (0.044)		0.017 (0.046)	
Father employer			0.366*** (0.040)		0.360*** (0.041)	
Father self-employed			0.051** (0.022)		0.039* (0.023)	
Mother's monthly earning	-0.205 (0.311)		0.09 (0.089)		-0.040 (0.090)	
Father's monthly earning	0.063*** (0.020)		0.129*** (0.022)		0.073*** (0.023)	
Number of students per teacher	-0.341 (0.476)	-0.289 (0.475)	-3.722*** (0.295)	-3.716*** (0.296)	-3.821*** (0.308)	-3.831*** (0.308)

**Table 1. Model estimations at the National Level, *continued***

National Level Regressions	1988		2006 - 3 thresholds		2006 - 5 thresholds	
	Model I	Model II	Model I	Model II	Model III	Model IV
Mother manager		0.299 (0.378)		0.281* (0.156)		0.275* (0.162)
Mother professional, technician		0.64 (0.464)		0.014 (0.140)		-0.023 (0.145)
Mother clerk		1.349* (0.782)		0.054 (0.190)		0.005 (0.200)
Mother service or sales worker		-0.441** (0.182)		0.242*** (0.072)		0.236*** (0.075)
Mother skilled agriculture		-0.205*** (0.064)		-0.146*** (0.029)		-0.163*** (0.030)
Mother crafts worker		-0.051 (0.255)		-0.112 (0.080)		-0.154* (0.083)
Mother operator		-0.349 (0.315)		0.022 (0.136)		-0.024 (0.141)
Mother elementary occupation		-0.279 (0.232)		-0.128*** (0.036)		-0.178*** (0.038)
Father manager		0.356*** (0.076)		0.212*** (0.031)		0.187*** (0.032)
Father professional, technician		-0.041 (0.140)		0.189*** (0.048)		0.132*** (0.050)
Father clerk		0.479*** (0.131)		0.239*** (0.057)		0.178*** (0.059)
Father service or sales worker		0.009 (0.073)		0.017 (0.035)		-0.058 (0.037)
Father skilled agriculture		-0.327*** (0.071)		-0.095*** (0.027)		-0.135*** (0.028)
Father crafts worker		-0.102 (0.075)		0.201*** (0.028)		0.129*** (0.030)
Father operator		0.063 (0.073)		0.143*** (0.030)		0.069** (0.031)
Father elementary occupation		-0.048 (0.107)		-0.127*** (0.028)		-0.222*** (0.029)

**Table 1. Model estimations at the National Level, *continued***

National Level Regressions	1988		2006 - 3 thresholds		2006 - 5 thresholds	
	Model I	Model II	Model I	Model II	Model III	Model IV
_cut1	-1.791*** (0.219)	-1.732*** (0.219)	-2.205*** (0.086)	-2.199*** (0.086)	-2.635*** (0.091)	-2.655*** (0.091)
_cut2	1.113*** (0.218)	1.173*** (0.219)	-1.354*** (0.085)	-1.348*** (0.085)	-0.753*** (0.089)	-0.772*** (0.089)
_cut3	1.561*** (0.219)	1.621*** (0.219)	-0.457*** (0.085)	-0.449*** (0.085)	-0.201** (0.089)	-0.218** (0.089)
_cut4					-2.219*** (0.091)	-2.244*** (0.091)
_cut5					-0.811*** (0.089)	-0.836*** (0.089)
rho	0.598*** (0.011)	0.596*** (0.011)	0.413*** (0.008)	0.412*** (0.008)	0.438*** (0.009)	0.437*** (0.009)
N	14159	14159	57359	57359	57359	57359

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 2a. Marginal Effects for the National Level Estimations, 1988**

1988	none	primary	secondary	high
Gender	-0.0118	-0.2237	-0.0202	0.2557
Mother primary sch. graduate	-0.0059	-0.1552	-0.0355	0.1966
Mother middle sch. graduate	-0.0050	-0.2341	-0.1680	0.4071
Mother high sch. graduate	-0.0053	-0.2672	-0.2405	0.5129
Mother university graduate	-0.0051	-0.2798	-0.3170	0.6018
Father primary sch. graduate	-0.0094	-0.1954	-0.0237	0.2285
Father middle sch. graduate	-0.0059	-0.2810	-0.2424	0.5293
Father high sch. graduate	-0.0064	-0.3043	-0.3015	0.6122
Father university graduate	-0.0063	-0.3061	-0.3315	0.6438
Mother engaged in agriculture	0.0034	0.0686	0.0050	-0.0770
Father engaged in agriculture	0.0068	0.1277	0.0064	-0.1409
Living in a an urban area	-0.0049	-0.1026	-0.0100	0.1175
Household size	0.0016	0.0360	0.0046	-0.0422
Female relative aged 15-60	-0.0086	-0.1313	0.0060	0.1339
frel60plus	-0.0017	-0.0448	-0.0086	0.0552
Mother's monthly earning	0.0029	0.0665	0.0086	-0.0779
Father's monthly earning	-0.0009	-0.0204	-0.0026	0.0239
Number of students per teach~	0.0048	0.1104	0.0142	-0.1294

**Table 2b. Marginal Effects for the National Level Estimations, 2006**

<b>2006</b>	<b>none</b>	<b>primary</b>	<b>secondary</b>	<b>high</b>
Gender	-0.0175	-0.0579	-0.0874	0.1627
Mother primary sch. graduate	-0.0214	-0.0713	-0.1097	0.2025
Mother middle sch. graduate	-0.0149	-0.0698	-0.1689	0.2537
Mother high sch. graduate	-0.0175	-0.0841	-0.2243	0.3258
Mother university graduate	-0.0152	-0.0759	-0.2069	0.2980
Father primary sch. graduate	-0.0231	-0.0733	-0.1060	0.2024
Father middle sch. graduate	-0.0180	-0.0800	-0.1846	0.2827
Father high sch. graduate	-0.0231	-0.1004	-0.2414	0.3649
Father university graduate	-0.0191	-0.0908	-0.2463	0.3563
Mother engaged in agriculture	0.0061	0.0198	0.0286	-0.0546
Father engaged in agriculture	0.0074	0.0238	0.0341	-0.0652
Living in a an urban area	-0.0145	-0.0461	-0.0655	0.1261
Household size	0.0040	0.0137	0.0214	-0.0391
Female relative aged 15-60	0.0019	0.0066	0.0101	-0.0186
frel60plus	-0.0065	-0.0247	-0.0434	0.0747
Mother employer	-0.0017	-0.0061	-0.0099	0.0177
Mother self-employed	-0.0005	-0.0018	-0.0029	0.0053
Father employer	-0.0096	-0.0386	-0.0737	0.1218
Father self-employed	-0.0018	-0.0064	-0.0101	0.0184
Mother's monthly earning	-0.0033	-0.0114	-0.0178	0.0325
Father's monthly earning	-0.0048	-0.0164	-0.0257	0.0468
Number of students per teacher	0.1370	0.4742	0.7399	-1.3512

The models highlight the central importance of parental educational level for the attainment of children. Children of parents with a primary school degree are more likely to receive education compared to those of parents not having one; children of parents with middle school education are likely to attain higher levels compared to children of parents with a primary school degree; and so on. This is the case for both the father and mother. The marginal effects show a big positive impact of parental education on the likelihood of children attaining higher education, and a decreasing impact on the child having only primary or secondary education. These marginal effects are quantitatively very large generally, especially for 1988; if the father has graduated from high school then this increases the probability that the child completes higher education by 0.61. These marginal

effects increase with the level of parental education. The impacts are of a lower magnitude in 2006, probably reflecting the greater number of parents and children with higher levels of education; but the effects are still very large.

Consistent with our expectations and the literature (Tansel, 2002; Kabubo-Mariara and Mwabu, 2007), children belonging to large families are less likely to receive lower levels of education compared to those in smaller households. This is true to a similar extent in both years, though the marginal effects are bigger in 2006. The higher dependency rates in such households may imply that both the monetary and opportunity cost of attending school are higher. In addition this may reflect prior fertility decisions where parents may value the immediate labour of their children more highly than potential future gains from education. The father's earnings are also found to be important and to have a positive effect on the educational attainment; mother's earnings appear not to matter.

Children living in urban areas attain higher levels of schooling than those living in rural areas, this showing a large negative marginal effect. This is likely to reflect various factors including greater availability and probably quality of schools, and lower travel and opportunity costs (Al-Samarrai and Reilly, 2000).<sup>23</sup> The number of students per teacher (at primary level) has an important adverse effect on educational attainment in 2006, though surprisingly not in 1988.

Where the mother and/or father are engaged in agricultural activities, then the educational attainment of the child is lower, with the impact being greater when the father works in agriculture. This negative impact for both parents falls substantially over this period,

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<sup>23</sup> The regional dummy variables function as fixed effects, as they control for other regional differences not controlled for elsewhere in the model; they show some instability between the years.

though is still significant in 2006. This may represent an important opportunity cost element if children need to help with household agricultural activities. The existence of a prime-age female relative who can help the mother in the housework or in taking care of the children increases the likelihood of a child receiving education in 1988, while in 2006 it is the presence of an elderly female relative (aged 60 or older) that has a positive effect on the educational attainment.

The father being an employer or self employed has a positive impact on educational attainment in 2006 (this variable is not available for 1988)<sup>24</sup>. Looking at a more detailed occupational disaggregation in the second and fourth columns of the table, educational attainment is higher in cases where the father works as a manager, as a clerk or in a professional job, or when the mother works as a manager; it is lower when father or mother work in agriculture or in an elementary occupation.

Now we consider the impact of the five threshold model allowing for the fact that many of those surveyed in 2006 have been through the new schooling system and others the old system. The sign, magnitude and significance of almost all coefficients are in fact very similar. The only significant difference (apart from the location of the cut off points) is that the impact of having another prime age female relative in the household switches from being negative to being positive. But given the general similarity of the results to the three threshold model, we focus now on it, ensuring comparability with the 1988 results.

In order to examine the differential impact that the explanatory variables have on the final grade attainment of boys and girls, the models were re-estimated separately by sex (Table

3). It is very striking how important this disaggregation is. An F-test strongly confirms the appropriateness of estimating separate models for boys and girls. Comparing the boys and girls regressions, in both years the impact of parental education is quantitatively much more important for girls than boys. These differences between the impact on girls and boys are statistically significant in the case of mother's education, but are less significant or insignificant in the case of father's education. The education of the mother is clearly a very important influence on the attainment of daughters. It is true that the quantitative magnitude, and marginal effects, of mother's and father's education levels on girls attainments are similar; but the difference is that boys's attainments are much more influenced by those of their fathers than their mothers. In their studies for Turkey, Tansel (2002), and Smits and Hosgor (2006) also stress the importance of parental education on children's educational achievement and also the importance of mothers' education for girls<sup>25</sup>.

The impact of father's earnings is much more important for girls than boys, the difference being statistically significant in 2006. In 2006 the impact of mother's earnings is significant and positive for girls, while it is insignificant for boys. Household size has a more negative influence on girls attainment compared to boys attainment in both years, this difference being highly statistically significant. When household resources bite, girls attainment levels suffer<sup>26</sup>.

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<sup>24</sup> Tansel (2002) finds a negative impact of the father's self-employment on boys' schooling. However, self-employment category includes people working in agricultural activities as well as people working in their own business. The effect of self-employment becomes positive when we control for the agricultural work.

<sup>25</sup> Several other studies obtain similar results for the parental education (Leibowitz, 1974; Chernichovsky, 1985; Gertler and Glewwe, 1990; Butcher and Case, 1994; Lillard and Willis, 1994; Handa, 1996; Al-Samarai and Peasgood, 1998; Glick and Sahn, 2000; Kabubo-Mariara and Mwapu, 2007).

**Table 3. Model Estimations by Gender**

	<b>1988 Girls</b>	<b>1988 Boys</b>	<b>Gender Diff</b>	<b>2006 Girls</b>	<b>2006 Boys</b>	<b>Gender Diff</b>
Mother primary sch. graduate	0.822*** (0.09)	0.464*** (0.069)	***	0.787*** (0.033)	0.452*** (0.025)	***
Mother middle sch. graduate	2.392*** (0.393)	0.650** (0.27)	***	1.440*** (0.093)	0.661*** (0.063)	***
Mother high sch. graduate	2.703*** (0.535)	1.242*** (0.326)	*	2.073*** (0.125)	1.154*** (0.079)	***
Mother university graduate	3.362*** (0.961)	1.22 (0.791)		1.771*** (0.249)	1.090*** (0.166)	
Father primary sch. graduate	0.900*** (0.088)	0.633*** (0.065)		0.706*** (0.041)	0.539*** (0.031)	**
Father middle sch. graduate	2.200*** (0.195)	1.621*** (0.151)		1.240*** (0.058)	0.991*** (0.045)	**
Father high sch. graduate	2.809*** (0.243)	2.308*** (0.183)		1.760*** (0.066)	1.516*** (0.052)	
Father university graduate	2.908*** (0.321)	3.293*** (0.318)	**	1.908*** (0.102)	1.930*** (0.090)	*
Mother engaged in agriculture	-0.356*** (0.123)	-0.178** (0.089)		-0.215*** (0.048)	-0.127*** (0.038)	
Father engaged in agriculture	-0.557*** (0.122)	-0.424*** (0.087)		-0.258*** (0.048)	-0.127*** (0.038)	
Living in a an urban area	0.497*** (0.103)	0.277*** (0.077)	*	0.524*** (0.033)	0.213*** (0.025)	***
Household size	-0.209*** (0.017)	-0.090*** (0.012)	***	-0.178*** (0.008)	-0.084*** (0.006)	***
Female relative aged 15-60	0.512** (0.247)	0.442** (0.187)		0.170*** (0.038)	-0.174*** (0.027)	***
frel60plus	0.245* (0.148)	0.13 (0.116)		0.269*** (0.047)	0.264*** (0.039)	
Istanbul	0.492** (0.195)	-0.194 (0.149)	***	0.355*** (0.067)	0.009 (0.052)	***
West Marmara	0.047 (0.228)	0.027 (0.17)		-0.167** (0.08)	-0.018 (0.061)	
Aegean	0.309** (0.154)	-0.093 (0.115)	**	-0.229*** (0.056)	-0.207*** (0.042)	
East Marmara	0.164 (0.184)	-0.042 (0.137)		-0.013 (0.058)	0.085* (0.045)	
Western Anatolia	0.511*** (0.149)	0.189 (0.119)	*	0.025 (0.066)	-0.148*** (0.048)	***
Central Anatolia	0.029 (0.19)	0.084 (0.138)		-0.036 (0.072)	-0.005 (0.055)	
Western Blacksea	0.104 (0.182)	0.056 (0.138)		-0.314*** (0.065)	0.007 (0.051)	***
Eastern Blacksea	0.513*** (0.194)	0.766*** (0.159)		0.265*** (0.090)	0.322*** (0.070)	

<sup>26</sup> This is consistent with the findings in the literature. Leibowitz (1974) for the US and Glick and Sahn (2000) for Guinea conclude that family income is more important for girls than for boys.

**Table 3. Model Estimations by Gender, *continued***

	<b>1988 Girls</b>	<b>1988 Boys</b>	<b>Gender Diff</b>	<b>2006 Girls</b>	<b>2006 Boys</b>	<b>Gender Diff</b>
North-Eastern Anatolia	-0.261 (0.184)	-0.022 (0.141)		-0.252*** (0.067)	0.230*** (0.056)	***
Centre-Eastern Anatolia	-0.423** (0.177)	-0.028 (0.127)	*	-0.362*** (0.069)	0.325*** (0.058)	***
South-Eastern Anatolia	-1.230*** (0.202)	-0.500*** (0.146)	***	-0.306*** (0.071)	0.138** (0.059)	***
Mother employer				0.895 (0.689)	-0.125 (0.320)	
Mother self-employed				0.035 (0.073)	0.017 (0.058)	
Father employer				0.614*** (0.071)	0.273*** (0.049)	***
Father self-employed				0.098*** (0.037)	0.046 (0.028)	
Mother's monthly earning	-0.375 (0.452)	0.182 (0.700)		0.533*** (0.173)	-0.1 (0.107)	***
Father's monthly earning	0.095*** (0.032)	0.060** (0.029)		0.281*** (0.042)	0.107*** (0.026)	**
Number of students per teacher	-2.047** (0.903)	0.491 (0.672)	***	-6.407*** (0.473)	-1.508*** (0.397)	***
_cut1	-3.388*** (0.423)	-2.322*** (0.309)		-3.243*** (0.143)	-2.121*** (0.116)	
_cut2	0.737* (0.409)	0.896*** (0.306)		-2.248*** (0.138)	-1.197*** (0.113)	
_cut3	1.264*** (0.41)	1.442*** (0.307)		-1.297*** (0.136)	-0.197* (0.113)	
rho	0.777*** (0.014)	0.673*** (0.015)		0.573*** (0.013)	0.399*** (0.015)	
N	6382	7777		27258	30101	
ll	-5260.18	-7056.74		-23317.31	-25983.01	
chi2	2134.368	2307.848		12243.678	12764.243	
* p<0.10, ** p<0.05, *** p<0.01						

In addition, the benefits of living in an urban area are significantly greater for girls than boys, and probably relatedly living in Istanbul or Western Anatolia (the region of the capital, Ankara) also has a significant favourable impact for girls relative to boys. Having female relatives in the households has a consistently positive impact on girls' attainment, but this is less consistently so for boys.

**Table 4a. Marginal Effects for the Gender Differentiated Regressions, 1988**

<b>1988 Girls</b>	<b>none</b>	<b>primary</b>	<b>secondary</b>	<b>high</b>
Mother primary sch. graduate	-0.0014	-0.2448	0.0970	0.1492
Mother middle sch. graduate	-0.0007	-0.7516	0.0004	0.7519
Mother high sch. graduate	-0.0007	-0.7861	-0.0339	0.8207
Mother university graduate	-0.0007	-0.8125	-0.0849	0.8981
Father primary sch. graduate	-0.0027	-0.2333	0.1037	0.1324
Father middle sch. graduate	-0.0009	-0.7250	0.0382	0.6877
Father high sch. graduate	-0.0010	-0.8084	-0.0262	0.8356
Father university graduate	-0.0009	-0.8115	-0.0407	0.8531
Mother engaged in agriculture	0.0011	0.0868	-0.0420	-0.0459
Father engaged in agriculture	0.0019	0.1328	-0.0644	-0.0703
Living in an urban area	-0.0013	-0.1264	0.0590	0.0687
Household size	0.0004	0.0559	-0.0256	-0.0307
Female relative aged 15-60	-0.0025	-0.1061	0.0556	0.0529
frel60plus	-0.0004	-0.0714	0.0303	0.0414
Mother's monthly earning	0.0008	0.1002	-0.0459	-0.0551
Father's monthly earning	-0.0002	-0.0255	0.0117	0.0140
Number of students per teach~	0.0043	0.5478	-0.2509	-0.3012

<b>1988 Boys</b>	<b>none</b>	<b>primary</b>	<b>secondary</b>	<b>high</b>
Mother primary sch. graduate	-0.0011	-0.1825	0.0238	0.1598
Mother middle sch. graduate	-0.0008	-0.2475	0.0049	0.2434
Mother high sch. graduate	-0.0009	-0.4135	-0.0508	0.4652
Mother university graduate	-0.0009	-0.4050	-0.0520	0.4579
Father primary sch. graduate	-0.0021	-0.2458	0.0414	0.2064
Father middle sch. graduate	-0.0011	-0.4884	-0.0898	0.5793
Father high sch. graduate	-0.0012	-0.5567	-0.1530	0.7110
Father university graduate	-0.0012	-0.5723	-0.1896	0.7632
Mother engaged in agriculture	0.0006	0.0697	-0.0137	-0.0566
Father engaged in agriculture	0.0017	0.1640	-0.0347	-0.1311
Living in an urban area	-0.0009	-0.1088	0.0203	0.0894
Household size	0.0003	0.0356	-0.0063	-0.0296
Female relative aged 15-60	-0.0026	-0.1652	0.0436	0.1242
frel60plus	-0.0003	-0.0515	0.0078	0.0440
Mother's monthly earning	-0.0005	-0.0717	0.0126	0.0596
Father's monthly earning	-0.0002	-0.0238	0.0042	0.0197
Number of students per teach~	-0.0014	-0.1939	0.0342	0.1612

**Table 4b. Marginal Effects for the Gender Differentiated Regressions, 2006**

<b>2006 Girls</b>	<b>none</b>	<b>primary</b>	<b>secondary</b>	<b>high</b>
Mother primary sch. graduate	-0.0250	-0.1120	-0.1517	0.2887
Mother middle sch. graduate	-0.0131	-0.0934	-0.2425	0.3489
Mother high sch. graduate	-0.0152	-0.1050	-0.2819	0.4021
Mother university graduate	-0.0124	-0.0923	-0.2593	0.3641
Father primary sch. graduate	-0.0249	-0.1065	-0.1335	0.2649
Father middle sch. graduate	-0.0157	-0.1013	-0.2296	0.3466
Father high sch. graduate	-0.0203	-0.1237	-0.2846	0.4287
Father university graduate	-0.0157	-0.1070	-0.2788	0.4015
Mother engaged in agriculture	0.0076	0.0337	0.0414	-0.0828
Father engaged in agriculture	0.0093	0.0408	0.0495	-0.0996
Living in a an urban area	-0.0195	-0.0824	-0.0983	0.2002
Household size	0.0053	0.0259	0.0361	-0.0673
Female relative aged 15-60	-0.0045	-0.0232	-0.0352	0.0628
frel60plus	-0.0063	-0.0344	-0.0563	0.0969
Mother employer	-0.0106	-0.0745	-0.1751	0.2603
Mother self-employed	-0.0010	-0.0049	-0.0071	0.0130
Father employer	-0.0103	-0.0642	-0.1273	0.2017
Father self-employed	-0.0028	-0.0140	-0.0201	0.0369
Mother's monthly earning	-0.0159	-0.0775	-0.1079	0.2013
Father's monthly earning	-0.0084	-0.0409	-0.0570	0.1063
No of students per teach~	0.1909	0.9309	1.2972	-2.4190

**Table 4b. Marginal Effects for the Gender Differentiated Regressions, 2006,**

*continued*

<b>2006 Boys</b>	<b>none</b>	<b>primary</b>	<b>secondary</b>	<b>high</b>
Mother primary sch. graduate	-0.0088	-0.0459	-0.0992	0.1539
Mother middle sch. graduate	-0.0063	-0.0434	-0.1331	0.1828
Mother high sch. graduate	-0.0078	-0.0568	-0.1985	0.2631
Mother university graduate	-0.0069	-0.0521	-0.1872	0.2462
Father primary sch. graduate	-0.0119	-0.0583	-0.1172	0.1874
Father middle sch. graduate	-0.0086	-0.0586	-0.1860	0.2532
Father high sch. graduate	-0.0113	-0.0745	-0.2449	0.3307
Father university graduate	-0.0092	-0.0665	-0.2480	0.3237
Mother engaged in agriculture	0.0027	0.0138	0.0283	-0.0448
Father engaged in agriculture	0.0027	0.0137	0.0283	-0.0447
Living in an urban area	-0.0045	-0.0229	-0.0473	0.0746
Household size	0.0016	0.0086	0.0188	-0.0289
Female relative aged 15-60	0.0037	0.0190	0.0386	-0.0613
frel60plus	-0.0038	-0.0230	-0.0579	0.0847
Mother employer	0.0027	0.0138	0.0277	-0.0442
Mother self-employed	-0.0003	-0.0017	-0.0037	0.0057
Father employer	-0.0039	-0.0234	-0.0597	0.0870
Father self-employed	-0.0009	-0.0047	-0.0104	0.0159
Mother's monthly earning	0.0019	0.0102	0.0224	-0.0345
Father's monthly earning	-0.0020	-0.0109	-0.0238	0.0368
No of students per teach~	0.0284	0.1534	0.3361	-0.5179

The negative impact of a parent working in agriculture is worse for girls than for boys.

The student per teacher ratio has a negative impact on girls attainment levels relative to boys in both 1988 and 2006, in particular it has a large negative impact on girls attainments in 2006.

Estimation of the above models for urban and rural areas separately (not presented here) shows that many of the same gender differentials are present in both; mother's education affects girls much more than boys in both urban and rural areas; household size adversely affects girls more than boys in both locations. The adverse impact of household size is more striking in urban areas (for both boys and girls). A high student per teacher ratio has

a much bigger impact on girls than boys in both urban and rural areas, but quantitatively the magnitudes are much greater in rural areas.

## 6. Decomposition analysis

Oxaca type decomposition analysis has been widely applied in wage discrimination literature where the mean wage difference of advantaged and disadvantaged groups are decomposed into explained and unexplained components. This approach has also been recently applied to nonlinear models such as logit or probit (Doiron and Riddell, 1994; Even and MacPherson, 1993; Fairlie, 2005; Gomulka and Stern, 1990; Yun, 2005). Al-Samarrai and Reilly (2000) for example, apply this sort of decomposition to a logit model in order to examine the rural – urban differences in the primary school attendance of children in Tanzania; Barrow, Reilly, and Woodfield (2008), on the other hand, compare the university graduation success of boys and girls using the results of an ordered probit model.

We follow a similar approach and decompose the difference in the mean probabilities of girls and boys into explained and unexplained parts; the explained part reflecting differences in educational outcomes due to the differences in endowments and the unexplained part reflecting differences arising from different treatment of boys and girls. The mean difference in the predicted probabilities of boys and girls being in the  $s^{th}$  category could be written as:

$$\hat{\Delta}_s = \frac{1}{N^m} \sum_{j=1}^{N^m} \left[ \Phi(\hat{\mu}_{s+1}^m - \hat{\beta}^{m'} x_j^m) - \Phi(\hat{\mu}_s^m - \hat{\beta}^{m'} x_j^m) \right] - \frac{1}{N^f} \sum_{j=1}^{N^f} \left[ \Phi(\hat{\mu}_{s+1}^f - \hat{\beta}^{f'} x_j^f) - \Phi(\hat{\mu}_s^f - \hat{\beta}^{f'} x_j^f) \right]$$

where  $\Delta_s$  is the difference in the probabilities of boys and girls being in the  $s^{th}$  category, and  $N^g$  is the number of observations for group  $g$ , which could be male ( $m$ ) or females ( $f$ ). The regression estimates of parameters are shown with a ‘hat’. In order to observe whether or not the lower educational attainment of girls is due to them being treated differently within the family, we can use parameter estimates from the boys’ regression to predict probabilities for educational outcomes of the girls. If the predicted probability is higher than the actual distribution, for example, it signals that the girls are treated differently than boys in the society. Consider

$$\hat{\Delta}_s = \left\{ \frac{1}{N^m} \sum_{j=1}^{N^m} [\Phi(\hat{\mu}_{s+1}^m - \hat{\beta}^{m'} x_j^m) - \Phi(\hat{\mu}_s^m - \hat{\beta}^{m'} x_j^m)] - \frac{1}{N^f} \sum_{j=1}^{N^f} [\Phi(\hat{\mu}_{s+1}^m - \hat{\beta}^{m'} x_j^f) - \Phi(\hat{\mu}_s^m - \hat{\beta}^{m'} x_j^f)] \right\} \\ + \left\{ \frac{1}{N^f} \sum_{j=1}^{N^f} [\Phi(\hat{\mu}_{s+1}^m - \hat{\beta}^{m'} x_j^f) - \Phi(\hat{\mu}_s^f - \hat{\beta}^{m'} x_j^f)] - \frac{1}{N^f} \sum_{j=1}^{N^f} [\Phi(\hat{\mu}_{s+1}^f - \hat{\beta}^{f'} x_j^f) - \Phi(\hat{\mu}_s^f - \hat{\beta}^{f'} x_j^f)] \right\}$$

The first and fourth terms at the right hand side of the expression above, respectively, show the mean predicted probabilities for male and females in the sample. The third and/or the fourth expression is the mean predicted probability for females if they were facing the same structure as males within the family. The first expression in the curly brackets is the difference between the mean predictions for males and the mean predictions for females using the male coefficient estimates. It therefore shows the differences in probabilities of attaining different levels of education due to endowment differences and the second expression in curly brackets shows the differences due to different treatment that boys and girls are facing within the family.

The expression in Eq is written using the coefficient estimates from the male regressions. An alternative approach would be to construct the decomposition using the female regression coefficients:

$$\hat{\Delta}_s = \left\{ \frac{1}{N^m} \sum_{j=1}^{N^m} \left[ \Phi(\hat{\mu}_{s+1}^m - \hat{\beta}^{m'} x_j^m) - \Phi(\hat{\mu}_s^m - \hat{\beta}^{m'} x_j^m) \right] - \frac{1}{N^m} \sum_{j=1}^{N^m} \left[ \Phi(\hat{\mu}_{s+1}^f - \hat{\beta}^{f'} x_j^m) - \Phi(\hat{\mu}_s^f - \hat{\beta}^{f'} x_j^m) \right] \right\} \\ + \left\{ \frac{1}{N^m} \sum_{j=1}^{N^m} \left[ \Phi(\hat{\mu}_{s+1}^f - \hat{\beta}^{f'} x_j^m) - \Phi(\hat{\mu}_s^f - \hat{\beta}^{f'} x_j^m) \right] - \frac{1}{N^f} \sum_{j=1}^{N^f} \left[ \Phi(\hat{\mu}_{s+1}^f - \hat{\beta}^{f'} x_j^f) - \Phi(\hat{\mu}_s^f - \hat{\beta}^{f'} x_j^f) \right] \right\}$$

The third and/or the fourth expression is the mean predicted probability for males if they were facing the same structure as females within the family. In this case, the first and second expressions in the curly brackets respectively show the treatment and the endowment effects.

Coefficients from either the male or the female regressions could be used for the decomposition. A common and widely discussed issue in the decomposition literature, however, is the sensitivity of the decomposition results to the choice of the comparison structure, which is widely known as the ‘index problem’. In order to observe the sensitivity of our results to the comparison structure, we decompose the difference in the mean probabilities using both boys’ and girls’ regression parameters.

**Table 5. Decomposition Results****1988**

	Difference in predicted probabilities	Decomposition based on boys' regression coefficients		Decomposition based on girls' regression coefficients	
		Endowment effect	Treatment effect	Endowment effect	Treatment effect
None	-5.23	0.19 (0.00012469)	-5.42 (0.0000206)	1.53 (1.062x10 <sup>-6</sup> )	-6.76 (0.00017218)
Primary school	-7.18	2.35 (0.00009473)	-9.53 (0.00016036)	0.95 (1.443x10 <sup>-6</sup> )	-8.13 (0.00030735)
Middle school	5.51	-0.46 (0.00138041)	5.97 (0.00004626)	-0.43 (1.365x10 <sup>-7</sup> )	5.93 (0.00144455)
High school	6.91	-2.08 (8.870x10 <sup>-7</sup> )	8.98 (0.00011595)	-2.05 (5.904x10 <sup>-7</sup> )	8.95 (0.00010338)

**2006**

	Difference in predicted probabilities	Decomposition based on boys' regression coefficients		Decomposition based on girls' regression coefficients	
		Endowment effect	Treatment effect	Endowment effect	Treatment effect
None	-9.41	-0.11 (3.366x10 <sup>-8</sup> )	-9.30 (6.524x10 <sup>-6</sup> )	-1.82 (1.590x10 <sup>-7</sup> )	-7.59 (5.661x10 <sup>-6</sup> )
Primary school	-3.16	-0.19 (7.854x10 <sup>-8</sup> )	-2.96 (8.391x10 <sup>-6</sup> )	-0.64 (7.158x10 <sup>-8</sup> )	-2.52 (8.057x10 <sup>-6</sup> )
Middle school	5.36	-0.03 (5.378x10 <sup>-8</sup> )	5.38 (0.00001419)	0.10 (5.957x10 <sup>-8</sup> )	5.26 (0.00001444)
High school	7.21	0.33 (4.128x10 <sup>-7</sup> )	6.88 (0.00002087)	2.36 (4.027x10 <sup>-7</sup> )	4.85 (0.00002183)

The first column shows the difference in the mean predicted probabilities of educational outcomes for boys and girls, a negative value indicating that the proportion of girls in that particular category is expected to be higher than the proportion of boys and a positive value indicating a higher ratio for boys than for girls. In both years examined, the actual and predicted ratios for girls are higher than for boys in the 'none' and 'primary school' categories and are lower in the 'middle school' and 'high school' categories, presenting the gender differential in educational outcomes. The second and the third columns show the decomposition results using the boys' regression coefficients in the

calculations while the third and the fourth columns show the decomposition results based on the girls' regression estimates. The results from the two different specifications are consistent with each other signaling that the index number problem is not an issue for our conclusions. In both years, and in all categories, the treatment effect is dominating the endowment effect, implying that the gender based differences in educational outcomes are mainly due to different treatment of boys and girls within the family rather than the differences in endowments. This result is as expected since the endowment characteristics, *i.e.* the factors that are controlled in the model, do not significantly differ for boys and girls. The interesting story behind the decomposition analysis in our case is the comparison of the treatment effects among each educational category and also to observe the change across time. In both years, the treatment effects are calculated to be negative for the none and primary school and positive for the middle and high school categories<sup>27</sup>. In Table 5, the first decomposition shows the results under a scenario where the girls are facing the same treatment as boys and the second decomposition is under a scenario that boys are facing the same structure as of girls. One way or the other, the results imply the same conclusions. If, within the household, girls and boys faced the same treatment, there would be fewer girls observed in the none and primary school categories and more girls would be middle or high school graduates in both years. Depending on the coefficient vector that is chosen for the calculations, around 15-16 percent of the girls in 1988 and around 10-12 percent in 2006 would switch to a higher educational category. If both genders were treated the same, the ratio of middle school graduate girls would be around six percent higher in 1988 and around five percent higher in 2006. Considering that the graduates of the 8-year compulsory primary education are included in the middle school category in this study, the treatment effect for middle school graduation was expected to

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<sup>27</sup> Note that the sum over all educational categories is zero for each effect.

be lower in 2006 than in 1988. Although the 8-year compulsory education has increased the overall education level, it does not seem to have a reducing impact on the gender differential yet. There is, however, a significant change in the treatment effect for high school graduation, reducing around 3-4 percent over the years examined. Although it still is an issue, the gender differential at high school level has been decreasing.

## **7. Conclusion**

This study has examined how gender based differentials in educational attainment in Turkey have evolved over an 18 year period which has seen dramatic expansion of the education system. Final grade attainment for both girls and boys has dramatically increased over this period. But by 2006 there remains a large differential between boys and girls. This paper has examined how family background and household characteristics influence the final grade attainment of boys and girls in the family. A non-gender disaggregated regression shows a highly significant gender disaggregated effect, as well as the positive influence of parental education and family income on attainment. Household size and student per teacher ratios have negative impacts. Family size may reflect parents' taste and preferences towards education, as well as the financial resources available for education. Parents with fewer children may also be able to help the child with reading, schoolwork, and other activities. The traditional roles of the girls in the society makes the effect of this variable stronger for the girls, since they are expected to help the mother in the housework or taking care of the siblings.

But disaggregating the model by gender shows very important differences between boys and girls: education of the mother has a very important impact on the attainment of daughters as does availability of family resources (higher income and lower household size). This latter result suggests that families with financial limitations give priority to their

sons' education. For boys father's education matters more; and as these are higher than the levels of mothers this is a continued factor which perpetuates the gender differential.

Children living in rural areas and those whose parents work in agricultural activities are less likely to receive schooling, suggesting that the opportunity cost of schooling may be an important factor affecting the educational investment decisions of the parents. A high number of students per teacher has a particularly adverse impact on girls' education. This deficiency in supply of education may make it more difficult for the parents to invest in their children's education.

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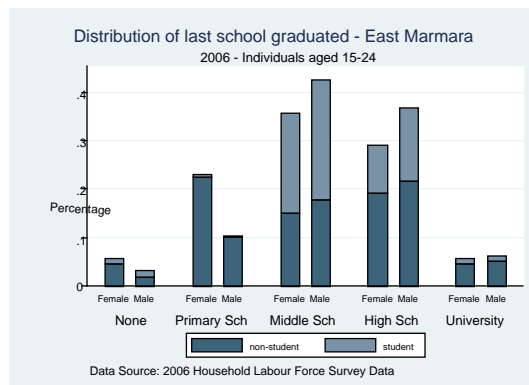
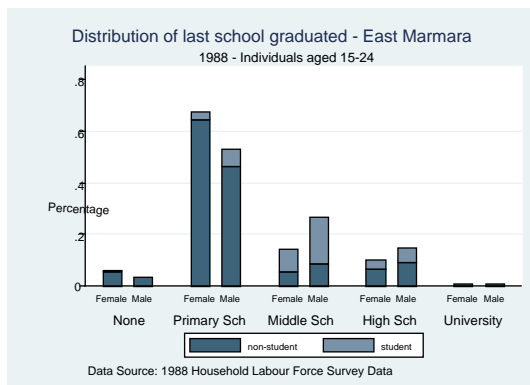
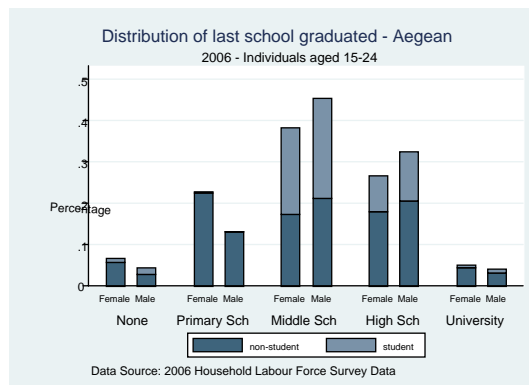
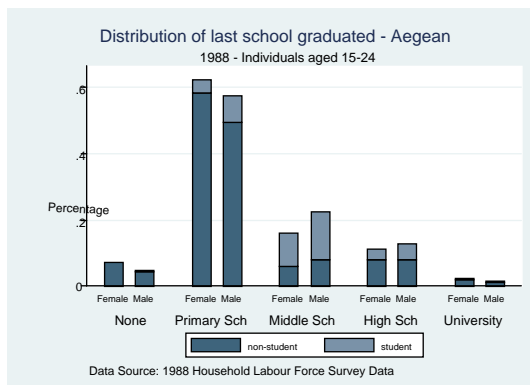
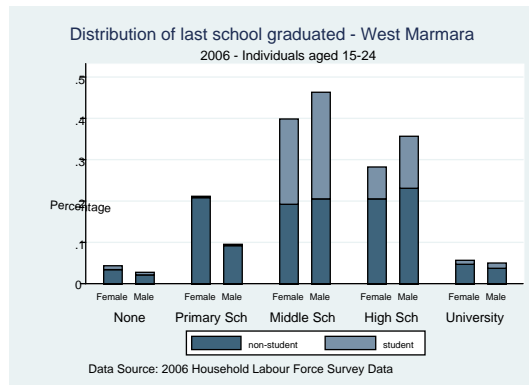
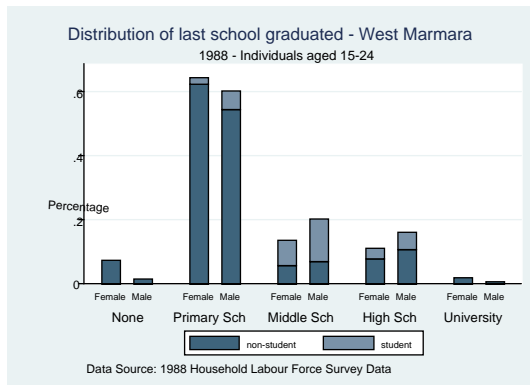
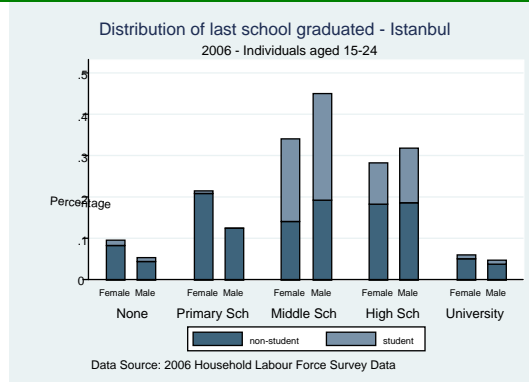
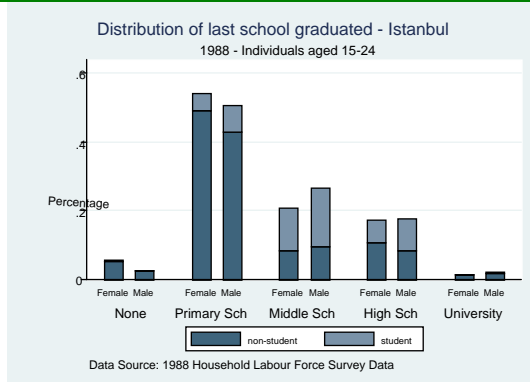
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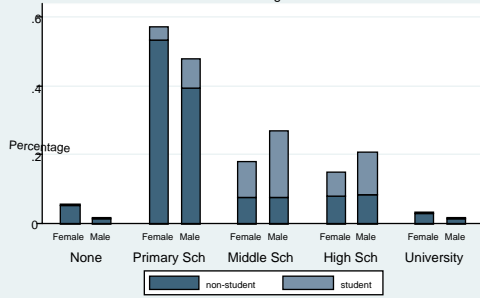
# Appendix 1. Final Grade Attainment by Region

1988

2006

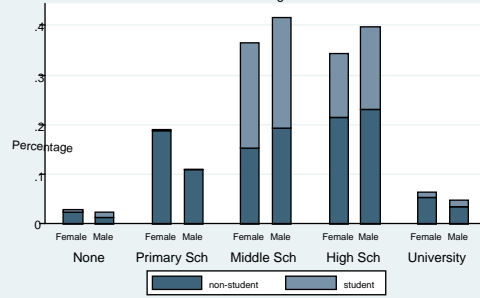


Distribution of last school graduated - Western Anatolia  
1988 - Individuals aged 15-24



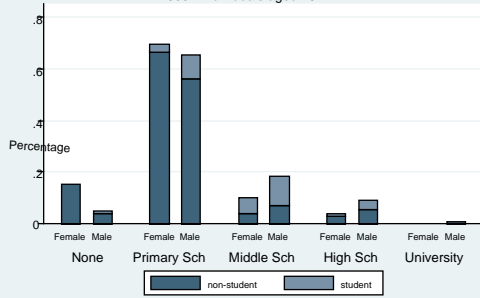
Data Source: 1988 Household Labour Force Survey Data

Distribution of last school graduated - Western Anatolia  
2006 - Individuals aged 15-24



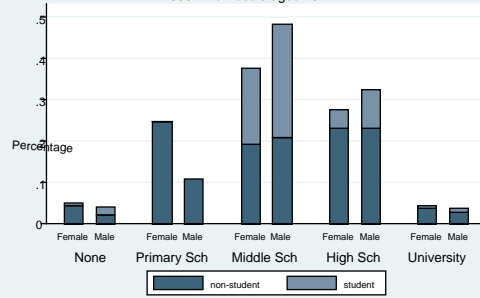
Data Source: 2006 Household Labour Force Survey Data

Distribution of last school graduated - Central Anatolia  
1988 - Individuals aged 15-24



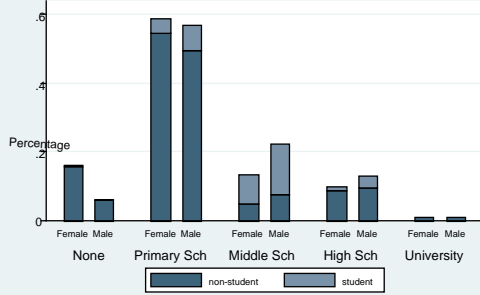
Data Source: 1988 Household Labour Force Survey Data

Distribution of last school graduated - Central Anatolia  
2006 - Individuals aged 15-24



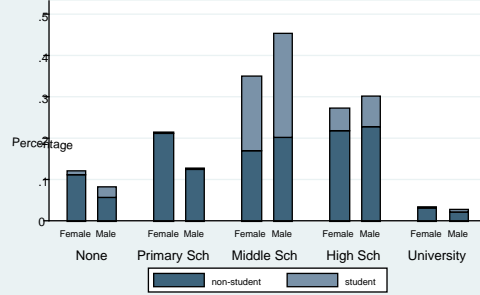
Data Source: 2006 Household Labour Force Survey Data

Distribution of last school graduated - Mediterranean  
1988 - Individuals aged 15-24



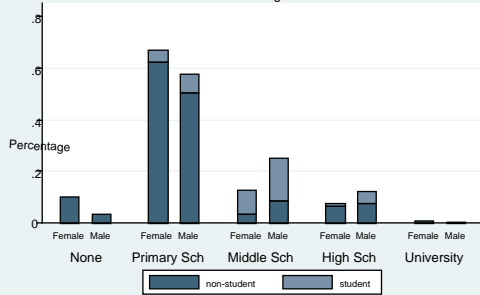
Data Source: 1988 Household Labour Force Survey Data

Distribution of last school graduated - Mediterranean  
2006 - Individuals aged 15-24



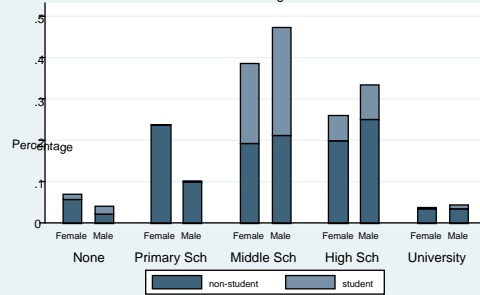
Data Source: 2006 Household Labour Force Survey Data

Distribution of last school graduated - Western Blacksea  
1988 - Individuals aged 15-24



Data Source: 1988 Household Labour Force Survey Data

Distribution of last school graduated - Western Blacksea  
2006 - Individuals aged 15-24



Data Source: 2006 Household Labour Force Survey Data

