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## Great expectations: The determinants of female university enrolment in Europe

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# Great Expectations: The Determinants of Female University Enrolment in Europe

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# Great Expectations: The Determinants of Female University Enrolment in Europe

## Abstract

We empirically investigate the determinants of the female decision of investing in post-secondary education, focusing on the role played by the context where young women take their education decision. We first develop a stylized two-period model to analyze the female decision of investing in education and highlight two main determinants: the time to be devoted to child care and the probability of working in a skilled job. We then use data on educational decisions of women in the 17-21 age group drawn from EU-Silc, available for the years 2004-2008. From the same survey we construct context indicators at the regional level, and exploit regional variability to identify how women's educational investment reacts to changes in the surrounding context. We find that the share of working women with children below 5 and the share of women with managerial positions or self-employed positively affect the probability that women enrol in post-secondary education. The same does not hold for men.

JEL-Code: J160, J240.

Keywords: post-secondary education, university, child care time requirement, managerial positions, self-employment, context, EU-Silc data, repeated cross-section.

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# 1 Introduction

Female education plays a key role in modern societies. The investment in human capital by women is seen as one of the triggers of the "quiet revolution" which has characterized the US labor market starting from the Seventies (Goldin, 2006). It is the key for female empowerment and for the rise in female bargaining power within the family (Iyigun and Walsh, 2007; Chiappori et al., 2008). Increasing education also raises the attachment to the labor market of mothers (Carneiro, Meghir and Parey, 2007; Bratti, 2003 on Italy) and it leads to postponement of first births away from teenage motherhood (e.g. Monstad et al., 2008). Prominently, maternal education is shown to have large effects on children's outcomes (Haveman and Wolfe, 1995 provide a useful survey) and it increases the time devoted to children in human capital enhancing activities (see the evidence provided by Guryan et al., 2008).

Given the importance of female education, the study of its determinants is a crucial issue. In this paper we empirically investigate the role played by the context where young women take their education decision as a possible element that matters for their choice of investing in post-secondary education.

Previous studies recognize that several conditions that define the context where a person lives are important for individual decisions. Focusing on females, the literature analyzes the impact of institutions and culture on labor market participation, on the fertility decision and on the decision of leaving the parental home (see, among the others, Del Boca et al., 2009, Chiuri and Del Boca, 2010 and De Henau et al., 2007 for the role of institutions and Fernández, 2007, and Fernández and Fogli, 2009, for the role of culture<sup>1</sup>). Maurin and Moschion (2009) evaluate the influence of close neighbors on a mother's decision to participate in the labor market and ask whether the labor market behavior of a mother is influenced by that of the other mothers living in the same neighborhood. The female decision to invest in education has not yet been addressed. However, several contributions, though not focusing on females, have discussed the role of the context on individual incen-

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<sup>1</sup>A growing literature shows the impact of institutions and culture on macroeconomic outcomes. Tabellini (2010) focuses on economic development; Alesina et al. (2010) on the regulation of labor.

tives to invest in education. Local labor market conditions are in some papers included among the determinants of the decision to invest in education and the local unemployment rate is the most widely adopted measure of local labor market conditions in this literature. For example, Bozick (2009) studies the impact that local unemployment rates and the percentage of local workers employed in jobs that require a bachelor's degree have on the decision to attend post-secondary school in the US. Petrongolo and San Segundo (2002) focus on the effects of local youth and adult unemployment on enrolment rates in Spain. Betts and Farland (1995) analyze the interplay between economic conditions and labor market conditions on enrollment in two-year community colleges. Other contributions show that neighborhood or peers may have a powerful influence on individual educational decisions and outcomes<sup>2</sup>. Individual and family determinants of the acquisition of education have also been studied both at the theoretical and at the empirical level. More specifically, there is an extensive and growing literature on if and how family income, parental education and, more recently, the home environment as defined by, for example, the age of mothers of young children, maternal employment, single motherhood, family size, father's involvement, parenting practices affect children outcomes, among which education is one of the most important (see, among others, Plug and Vijverberg, 2005; Black, Devereux and Salvanes, 2005).

In this paper we focus on the relationship between the female decision to invest in education and the context where it is taken. We look at a specific education decision, i.e. the decision to invest in post-secondary education. Our starting point is to share the view that individual decisions and outcomes cannot be studied without a consideration of the contexts in which agents operate. To identify and measure the context in which individual decisions are taken is not an easy task. We focus on indicators defined at regional level that capture answers to the following questions: do mothers with young children work? Do women progress in their career? Do more educated women work more than lower educated women? We postulate that the decision to invest in education, beside being

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<sup>2</sup>See among others Patacchini and Zenou (2007), who highlight the role of neighborhood quality on the intergenerational transmission of skills. For a paper on the direction of future research into neighborhood effects, see Harding et al. (2010).

influenced by individual and family characteristics, is also affected by the labor market outcomes of older women living in the same region.<sup>3</sup> The observation of what women turn out to do can shape the incentives of younger women; the women's decisions about whether to pursue post-secondary education or not can be affected by the opportunities they observe older women having. Our story for why these context variables play a key role in shaping young women's incentives to invest in education is that, at the time of the education decision, young women have imperfect information about how much time they will be able to devote to the labor market in the event they become mothers. Time devoted to child rearing can potentially influence both female labor force participation and female career opportunities, thus having an impact on the profitability of investing in post-secondary education. The labor market outcomes of working women can inform the education decision of younger women.

To study whether the characteristics of the context can have an impact on women's decisions to invest in education we first develop a simple theoretical model. The economy lasts for two periods: in the first, women, who are heterogeneous in talent, decide whether to invest in education or not. If they invest, they devote a share of the first period to education. If they do not invest, they remain unskilled and they start working immediately. At the beginning of the second period, all women have a child who requires care time. At the time when women decide whether to undertake post-secondary education or not they have imperfect information about how large this care time requirement will be: it will depend on the nature of the child; on the bargaining power within the family, which will define the sharing of the caring responsibilities between the spouses; on the availability of formal or informal network to take care of the child. Care-taking responsibilities affect labor market participation and career interruptions, more so for women than for men, and therefore can have an impact on the profitability of investing in education. We identify a

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<sup>3</sup>As noticed above, we are not the first ones to include local labor market conditions among the determinants of the decision to invest in education. Our measure of local labor market condition is however different from the ones currently present in the literature. Moreover, in the existing literature, as far as we know, there is no attempt to assess heterogeneous effects according to gender of local labor market conditions on the enrolment decision, which is what we do in this paper.

threshold level of ability such that females find it convenient to invest in education and we point out the variables it depends upon. More specifically, we highlight two determinants - the expected time to be devoted to care responsibilities and the probability that a woman will have a skilled job.

We then use data on educational decisions of young women between 17 and 21 years old drawn from EU-Silc, a European Household Survey, available for the years 2004-2008. From the same survey we construct context indicators related to the labor market conditions and to the opportunities to combine work and motherhood at the regional level for women belonging to the 25-45 age group, and exploit regional variability to identify how women react in terms of educational investment to changes in the surrounding context.

We find that the share of working women with children below 5 and the share of women with managerial positions or self-employed positively affect the probability that women enrol in post-secondary education. The same does not hold for men: their decision to invest in education is not affected by these context variables measured for males rather than for females. This suggests that how favorable the context is to female and, more specifically, to mothers' occupation and career is crucial for the female educational decision. The same context characteristics do not seem to play a role in male decisions. This can be explained within the model we propose by considering that child rearing duties are not expected to have a relevant impact on male labor market participation and on male career opportunities.

The paper is organized as follows: the next Section develops the model, Section 3 presents our empirical strategy, Section 4 presents the data and Section 5 the results. Section 6 concludes with some policy considerations.

## 2 The model

We develop a two-period model. The total size of the population is normalized to 1 and the population growth rate is set to zero. Women are heterogeneous in talent  $\alpha^i$  and in the care time  $ct^j$  the child requires from each of them. Talent  $\alpha^i$  captures the time woman  $i$  requires in order to become skilled and it is distributed on the interval  $(0, \bar{\alpha}]$

with continuous density function  $f(\cdot)$ . The lower  $\alpha^i$ , the shorter the time required to become skilled, the more talented the woman and the lower the foregone earnings. Each woman knows her own talent type. The care time requirement  $ct^j$  is independent of the talent of the woman and it reflects the nature and health of the child; the female bargaining power within the family, which in turn determines the sharing of the caring responsibilities between the spouses; the availability of a formal or informal network to take care of the child.  $ct^j$  is distributed with continuous density function  $g(\cdot)$  on the interval  $[ct^{\min}, ct^{\max}]$ .

In the first period of time women decide whether to invest in education or not. If they invest, they devote a share  $\alpha^i$  of the first period to education and they become skilled, earning a unit wage  $w^s$  for the remaining period  $(1 - \alpha^i)$ . If they do not invest, they remain unskilled and they start working immediately and receive a salary equal to  $w^u$  for the entire first period, with  $w^u < w^s$ . In the second period all women have a child.<sup>4</sup> The second period time budget constraint for woman  $i, j$  is:

$$1 = ct^j + l_2^{i,j}$$

where  $l_2^{i,j}$  indicates the labor supply of a woman of talent  $i$  and care time requirement  $ct^j$ .<sup>5</sup> At the time when a young woman decides whether to undertake education or not she has imperfect information about how large this care time requirement  $ct^j$  will be. Some women may be characterized by high care time requirements; some others by low care time requirements.<sup>6</sup> We indicate by  $\overline{ct}$  the expected time to be devoted to care responsibilities.<sup>7</sup> When deciding whether or not to invest in education, a woman relies on

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<sup>4</sup>This is a simplifying assumption, as we do not allow for endogenous fertility.

<sup>5</sup>This is not to exclude paternal involvement in child rearing. We here focus only on female choices and paternal time features in this setup only through female expectations about the time to be devoted to child care, as we will see next. For a model where both males and females have to decide about their education and share care responsibilities, see Casarico and Profeta (2009).

<sup>6</sup>In a similar spirit, Bjerk and Hahn (2007) assume that households are heterogeneous in the amount of child care expenditures they have to incur.

<sup>7</sup>One can think that child care time needs not be provided directly by the mother as she can buy it also on the market. In this case child care would entail a direct expenditure which reduces disposable income rather than foregone earnings. As long as there is imperfect information on how high or low this expenditure is, our setup can be recasted for this alternative case, without altering the main insights.



$\overline{ct}$  in order to anticipate the time she will have to devote to care responsibilities, which through the second period time budget constraint is negatively related to the time the woman anticipates she will devote to her participation to the labor market  $1 - \overline{ct}$ . If the time requirement is high, it may be profitable for her to stay at home and provide child care directly. In this case, she will produce an amount of home production  $\eta$ , which includes both child care and taking care of other home duties. We assume that home production is constant across types.

For the production of the final good, following, e.g. Galor and Zeira (1993), we assume that there are two technologies: one combines skilled labor and capital using a concave, constant return to scale technology and the other is linear in unskilled labor.  $w^u$  is the marginal productivity in the unskilled labor sector, which is perfectly competitive. Under the small open economy assumption, the interest rate  $k$  is given. The firm's profit maximization condition for capital implies that the ratio  $K/L^S$  is constant, where  $K$  is the aggregate stock of capital and  $L^S$  is the aggregate demand for skilled labor. For given  $K/L^S$ , the profit maximization condition for skilled labor guarantees that the wage rate of skilled labor  $w^S$  is also constant.

Women maximize a utility function which is linear in consumption. The decision to invest or not in education is thus based on the comparison between the expected consumption possibilities as skilled rather than as unskilled worker. We assume that consumption takes place at the end of the second period and that wages can be transferred to it at the interest rate  $k$ . Consider first the expected consumption possibilities of a skilled worker. They read as follows:

$$Ec^i = w^s(1 - \alpha^i)(1 + k) + \mu^s w^s(1 - \overline{ct}) + (1 - \mu^s)\eta \quad (1)$$

where  $\mu^s$  indicates the probability that a skilled woman attaches to her participation to the labor market rather than to her staying at home, and where all the other variables have the meaning elucidated before.

If we now consider an unskilled woman, her expected consumption possibilities can be written as follows:

$$Ec^u = w^u(1 + k) + \mu^u w^u(1 - \overline{ct}) + (1 - \mu^u)\eta \quad (2)$$

where, again,  $\mu^u$  is the probability that an unskilled woman attributes to her participation to the labor market. A woman will find it profitable to invest in education if

$$Ec^i \geq Ec^u.$$

Comparing (1) and (2) one can identify the threshold level of ability such that women find it profitable to invest in education and become skilled:

$$\alpha^i \leq 1 - \frac{w^u}{w^s} - \frac{(1 - \overline{ct})(\mu^u w^u - \mu^s w^s)}{w^s(1 + k)} - \frac{\eta(\mu^s - \mu^u)}{w^s(1 + k)} \equiv \hat{\alpha}. \quad (3)$$

Rewriting (3), one can say that a woman will find it profitable to invest in education if:

$$\hat{\alpha} - \alpha^i \geq 0. \quad (4)$$

Women whose ability (that is time required to invest in education) is  $\alpha^i \leq \hat{\alpha}$  will find it profitable to invest in education, while all those whose ability is above  $\hat{\alpha}$  will remain unskilled. It is straightforward to notice that the larger the wage premium  $z = \frac{w^s}{w^u}$ , the larger  $\hat{\alpha}$  and the stronger the incentives to invest in education. This is a well known result in the economic literature. The larger is the value of home production  $\eta$ , the smaller is  $\hat{\alpha}$  and therefore the incentives to become skilled are reduced, as it is intuitive.

We want to focus our attention on the role in the education decision of the probability that women attach to working as skilled individuals  $\mu^s$  and of the expected care time required  $\overline{ct}$ . Noticing that  $(\mu^u w^u - \mu^s w^s) < 0$ , from equation (3) it is clear that an increase in the expected care time requirement increases the ability level which is necessary for a woman to find it profitable to invest in education. Indeed,  $\frac{\partial \hat{\alpha}}{\partial \overline{ct}} < 0$ : the higher the time a woman expects to be out of the labor market, the lower the incentive to invest.

As to the role of  $\mu^s$ , we find that:

$$\frac{\partial \hat{\alpha}}{\partial \mu^s} = \frac{w^s(1 - \overline{ct}) - \eta}{(1 + k)w^s}, \quad (5)$$

which is positive for  $w^s(1 - \overline{ct}) > \eta$ . Assuming that this condition is satisfied amounts to assuming that a woman whose care time requirement is equal to the average will find it profitable to work in the second period, rather than to stay at home looking after the child. *A fortiori*, all women whose care time requirement will be lower than the average will find

it convenient to work in the second period. In this case, an increase in the probability of having a skilled work increases the incentives to invest in human capital. Thus, the higher the probability to work as a skilled worker, the more women will invest in education.

Now that we have illustrated the main mechanisms at work, we turn to the empirical analysis. We look for evidence in support of the predictions of the model, i.e. that women invest more in education the lower the time cost of taking care of the child and the higher the expectation of working as a skilled worker. Our focus is on decisions taken by females living in European regions. The educational outcome we consider is the decision of attending post-secondary education. The measures we adopt to capture the two main variables identified in the theoretical model are introduced formally in Section 4.

### 3 Empirical methods

The decision to invest in post-secondary education is defined as follows:

$$Y_i = W'_{rt}\beta + L'_{rt}\varphi + Z'_i\gamma + S'_t\delta + \varepsilon_i. \quad (6)$$

$Y_i$  is a binary variable which takes value 1 when woman  $i$  invests in post-secondary education, 0 otherwise;  $W_{rt}$  is the vector of labor market conditions capturing the probability of having a skilled work and  $L_{rt}$  is the vector of labor market conditions capturing the care time requirement. We consider both as determinants of the propensity to invest in education, given the underlying decisional process described in Section 2. They are measured at the regional level  $r$ , in different years  $t$ ;  $Z_i$  is a vector containing information about the family background of woman  $i$ ;  $S_t$  is a vector of time dummy variables and  $\varepsilon_i$  is a disturbance error that can be written as follows:

$$\varepsilon_i = q_r + v_i, \quad (7)$$

where  $q_r$  is a time-invariant region-specific error and  $v_i$  is normally distributed.

The decision to invest in post-secondary education  $Y_i$  is only taken and observed once, making our data individual cross-sectional. However, we can exploit the panel nature of our variables of interest  $W_{rt}$  and  $L_{rt}$  and which may be observed over time for the same European regions.

We make two different assumptions about the region-specific error. In the first econometric specification, we assume  $q_r$  to be fixed over time, to follow a normal distribution and to be uncorrelated with the included regressors at the regional level,  $W_{rt}$  and  $L_{rt}$ .

These assumptions may be considered quite strong. Suppose, for example, that  $W_{rt}$  is measured by the share of women in managerial positions. It is possible that more gender-equality oriented regions (for historical or political reasons, for example) are also more progressive in terms of providing educational opportunities. The correlation between the share of women in managerial positions and (unobserved) gender-equality orientation, in this example, may lead to overestimate the true relevance of the context, as captured by the chosen measure. In order to avoid this problem, in the second econometric specification, we still assume  $q_r$  to be fixed over time, but we do not impose any relationship between  $W_{rt}$  and  $q_r$  (and between  $L_{rt}$  and  $q_r$ ). They may be correlated and may have any unrestricted relationship. We employ a fixed effects model, where the term  $q_r$  is eliminated by differentiating the data at regional level:

$$(Y_i - \overline{Y_r}) = (W_{rt} - \overline{W_r})'\beta + (L_{rt} - \overline{L_r})'\varphi + (Z_i - \overline{Z_r})'\gamma + (S_t - \overline{S_r})'\delta + (v_i - \overline{v_r}). \quad (8)$$

The assumption we are making is that unobservable characteristics of the context, which may be correlated with the observed characteristics we include in the model, do not vary over time. If they do, our estimates are still biased. For example, a particularly progressive regional council could promote female labor market opportunities and, at the same time, increase the number of scholarships, year after year. However, if scholarships are available both for women and men (which is often the case) we should also observe a positive effect of female context variables on male decisions. We assess whether this can be the case in the robustness checks. Another possibility is that gender-equality feelings are self-reinforcing, therefore spreading more rapidly in some regions than in others: in this case, the included year-trend cannot capture the phenomenon.

We estimate, for simplicity, a linear probability model in the two specifications. Robust standard errors are calculated to take into account heteroschedasticity, and adjusted for the non-independence of observations within each region (Moulton, 1990; Primo et al., 2007).

A final consideration concerns the component of the disturbance term  $v_i$ , which contains woman's ability  $\alpha_i$  (Section 2). A woman's ability  $\alpha_i$  is very likely to be correlated with her family background  $Z_i$  (parental education, for example). Therefore, we cannot claim a causal impact of any of the family variables.

## 4 Data, sample and definitions

Data are drawn from EU-Silc, a European harmonized survey, released by Eurostat, which makes the comparison of numerous social and economic dimensions among several European countries possible. The main aim of the survey is to study poverty, income distribution, social exclusion, and material deprivation in Europe. So far, data have been collected and released for the years 2004-2008. For the year 2004, the survey was conducted only in 15 of the 27 countries, in 26 in 2005-2007, in 27 in 2008. Data may be used cross-sectionally or in a panel structure. By considering survey weights, each wave of the data is nationally representative of each country in that year. Furthermore, from one wave to the other, 75% of the sample is re-interviewed, and followed for at most four waves, which allows researchers to follow part of the sample over time. Information is collected at both household and individual level. At the household level, we know the number of members and the relationship among them, the main demographic information, and other pieces of information regarding the different sources of income, deprivation, and household conditions. At the individual level, we have detailed information about work, income, child care and education.

For our purposes, we select women between 17 and 21 years old, who complete secondary schooling during the year of the interview or the previous one, and for whom we may observe current education decisions. In order to be included in the sample, they need to reside in a country for which information about the region of residence is available. The outcome variable is a binary variable equal to 1 if the woman attends a post-secondary educational course, and 0 otherwise. More than 90% of women in our sample, who are observed studying after the end of the secondary school, are attending tertiary education.<sup>8</sup>

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<sup>8</sup>Thus, we can also talk more generally of "university enrolment".

The enrolment decision is observed only once, just after the end of secondary schooling.

Our final sample is composed of 10,997 observations, in 87 European regions, in 22 countries.<sup>9</sup> On average, we have a sample of 126 women for each region. Each region is observed 4.1 times, on average. We also select a similar sample of young men, to test whether the same context variables we specified for females have a role in determining their post-secondary investment decisions. The sample of males is composed of 10,466 individuals, in 88 regions, in 22 countries; the average sample size for each region is 119 and each region is observed, on average, for 4.0 waves.

The main aim of the paper is to assess the impact that the two context variables identified in Section 2 - the time to be devoted to child rearing and the opportunities to have a skilled work - have on the probability that a young woman enrolls in a post-secondary educational course. To measure the two variables, we construct indicators of labor market conditions and of the possibility to combine work and motherhood. All measures are derived from EU-Silc data, using cross-sectional frequency weights, which make the indicators representative at the regional level. All indicators are calculated with reference to women aged between 25 and 45 with post-secondary education: we consider them as the group of the population which young women look at, and from which they form their expectations. First, to capture the labor market prospects ( $W_{rt}$ ) we include in the model the regional percentage of working women in managerial positions (with supervisory duties). This variable is meant to capture the probability for a young woman of working in a skilled job. Second, to capture the time to be devoted to child care we use the proportion of working mothers with children younger than 5 years old ( $L_{rt}$ ). Note that the two are inversely related in the model: the higher the time to be devoted to care responsibilities, the lower the labor force participation of mothers with young children. Young women are assumed to observe the proportion of working mothers to form an expectation on the average amount of time to be spent caring for a child. Finally, we also consider the regional share of women working as self-employed. Female self-employment

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<sup>9</sup> Austria, Belgium, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Iceland, Italy, Latvia, Luxembourg, Lithuania, Norway, Poland, Sweden, Slovak Republic.

has a double interpretation according to the existing literature. On the one hand, self-employment can be seen as a strategy to balance family and career (Wellington, 2006) and as a measure of career opportunities available to educated women. Devine (1994), for example, studies the relationship between the recent rise in female self-employment shares and changes in returns to skill. She finds that self-employment increased more for females who faced increasing potential earnings in wage-and-salary employment, which suggests that returns to skill were increasing by even more in self-employment. According to the results of this literature, a higher percentage of women working as self-employed should positively influence the incentive to invest in education. On the other hand, a large fraction of self-employed women could signal few labor market opportunities for women: the observation of a high share of self-employed women could therefore have negative repercussions on the incentive to invest in education. Boden (1999), for example, examines how gender inequality in wage earnings may precipitate some women out of wage employment and into self-employment. He finds that women's lower wage returns to observed worker characteristics have a positive and significant effect on women's decision to switch from wage employment to self-employment. Given that we are only measuring self-employment among women with post-secondary education, we interpret a higher share of self-employed women as a positive labor market signal for females. Note that we construct the same environmental indicators for men.

By employing the empirical strategies outlined in Section 3, we are going to test whether women living in contexts which are more favorable, are more likely to attend post-secondary educational courses. In order not to confuse the impact of the context with other factors, we include a number of control variables. We consider mother and father's level of education, whether the mother works, household disposable income, number of siblings in the household, whether the young woman lives on her own, with the two parents, or only with one of the two parents. We include dummy variables indicating the season of the interview: young women interviewed in the fall may be more likely to attend an educational course compared to young women interviewed later in the academic year, and the timing of the interview can be systematically different from one country to another. Year dummies are also included to take into account the time trend.

Tables 1 and 2 show summary statistics for personal and regional context variables respectively. Notice that women are on average more likely to invest in post-secondary education than men. The personal characteristics are quite similar for men and women, apart from the proportion of young people living on their own, which is higher among females. As expected (see Table 2), we also have a higher percentage of men in managerial positions and in self-employment, and fathers with young children are more likely to work than mothers. Table 2 also shows that our context indicators vary across regions (as confirmed by the standard deviations in brackets) and, to a lower extent, within regions (proportion of within variance in squared brackets). This is important, since we are going to exploit the variability of the context characteristics within, and across regions.

The data are very rich in terms of educational, work and child care information, and provide a large sample. However, they also have some evident shortcomings. First of all, when using cross-section information, we observe women in the region where they are (not) studying. The region in which they study may be different from the region in which they completed their secondary school, and observed the behavior of women belonging to older age groups. Studying away from home is a very common phenomenon in Northern European countries. In order to understand the direction of selection in our sample, we exploit the longitudinal component of the dataset. We select households observed for two consecutive waves: in the first wave, there is a young wo/man studying and completing secondary school; in the second wave that young wo/man is either still in the household (attending a post-secondary course or not, “stayer”) or she/he is not in the household anymore (“mover”). We do not know whether the movers are away for studying or for working, but their characteristics in the first wave may be compared to the ones of the stayers.

Another related issue concerns information about the parental background, which is only observable – completely – for young women or men living with both parents. In all other cases we will impute the minimum level of education, and the coefficients related to "living with only one parent" and "living on her/his own" will be interpreted, keeping in mind the excluded category (living with one/two low educated parent/s).

Finally, we do not include women’s expected wage as a control, since wages are mea-



sured differently (net/gross, monthly/yearly) in different countries and their inclusion would create serious measurement errors. We note also that it would be hard to disentangle a direct impact of wages from our context measures since, for example, as Table 3 shows, wages are correlated with the share of managerial positions, both for women and men.

## 5 Results

Table 4 shows the main results for women. We find a positive and significant association between female participation in post-secondary education and, respectively, the percentage of women in managerial positions, the percentage of women who are self-employed, and the percentage of mothers with young children who work (random effects model). By allowing for correlation between the included characteristics of the regional context and other unobservable characteristics at the regional level (fixed effects model), we still observe a positive – but less significant – effect of all three variables related to the context. On the one hand, by using the fixed effects model, we have more robust estimates but, on the other hand, we exploit the available information less efficiently.

The effects of the context are also positive for men (Table 5), but weaker than for women (random effects). None of our variables capturing the context remains significant in the fixed effects model.

As far as individual characteristics are concerned (Tables 4 and 5), we find a positive effect of parental education and income and maternal work and a negative effect of age and the number of siblings. Young individuals living with only one parent or on their own are more likely to attend a post-secondary educational course than individuals living with one/two low educated parent/s. We do not identify any time trend. The timing of the interview is instead significant: individuals interviewed during the summer are less likely to be enrolled, since usually the academic year starts in the fall.

A joint look at Tables 4 and 5 confirms our main argument: our measures of the context matter for the individual decision of investing in education and they are more important for women than for men. This asymmetric effect may be due to the fact that,

as suggested by the model in Section 2, when deciding whether to invest in education or not, women do not have complete information about their labor market participation and career opportunities. Obviously, even men do not have complete information about their opportunities, but the time to be devoted to child rearing is not important in their calculations. Indeed, our analysis suggests that this lack of information is not playing a relevant role in their decision.

### 5.1 Robustness checks

In the main specification, we do not include any variable describing the potential marriage market that young individuals face. A higher probability of finding a “better” spouse may induce individuals to invest in education. The incentive is particularly high if the spouse has good career opportunities. This is why in Table 6 we introduce as possible determinants of a woman’s (man’s) decision to participate in post-secondary education our measures of male (female) labor market opportunities and the expected cost of taking care of the children, i.e. the share of working fathers (mothers) and the share of men (women) in managerial positions and in self-employment. Table 6 suggests that the only significant effect of the context on individual decisions is the one of female variables on female decisions. The share of women in managerial positions is no longer significant in the fixed effects specification, which may be explained by its high correlation (0.75) with the share of men in managerial positions in the same region. Moreover, we find that the share of men in managerial positions, as well as the share of self-employed and working fathers do not affect female education decisions. We find, on the contrary, a positive association between female context variables and male decisions. This positive association however disappears in the fixed effects specification.

These results confirm that female context variables matter for female decisions; moreover, they suggest that it is unlikely that there are some time-varying regional unobservable characteristics which affect both female opportunities in the labor market and the access to post-secondary education (a progressive regional council, for example). If there were, they would bias our results.

Another issue to be considered is the lack of complete information about family background for young people living on their own or with only one parent. In Table 7 we repeat the analysis by excluding, in the top panel, young people living on their own (for whom parental information is completely unobserved) and, in the bottom one, by also excluding young people living with only one parent (for whom information on the non-resident parent is not observed). Our results are confirmed, but with lower statistical significance due to the reduction of the sample size.

As we anticipated in Section 4, a limit of our dataset is that we cannot observe individuals who left their parental home for studying. Here we try to provide at least some information about them. In Table 8 we compare the average characteristics of young people who stay at home (stayers) and who leave home (movers). We observe that movers are somewhat younger, their mothers are more likely to work, and their fathers seem to be less educated. More interestingly, movers belong to richer families and come from regions with worse context as measured by our variables. The size of the different sub-samples suggests that around 16% (14%) of young women (men) leave the household at the end of the secondary school. These figures give an idea of the size of the selection and suggest that our main samples (of stayers) include young women and men who are, on average, from “better” contexts, but from relatively less wealthy families.

Despite the large sample size, the variability exploited in the model is only due to variation in the context characteristics across 87/88 regions and 5 years of time. The regional effect is then identified only by averaging - at most - 5 points in time. This feature may impact on the efficiency of the employed estimator. We work through simulations to understand how this could affect our results. We first split the sample into two parts: in each region, we randomly divide the observations in two sub-samples, and estimate our parameters of interest for each of them. We then split randomly the regions into two sub-samples, and estimate two other sets of parameters. We define  $\beta_4$  as the average of the four estimated parameters for each of the effects of interest, as shown in the second and fifth columns of Table 9. Since each sub-sample is half of the original one, the bias should be double that in the original sample. We therefore subtract  $\beta_4$  from twice the estimated effect in our main specification (first and fourth columns of Table 9). This procedure allows

us to eliminate the bias of our main specification (Dhaene and Jochmans, 2010; Arellano and Bonhomme, 2010). The third and sixth columns show that the derived effects are quite close to our estimated effects.

## 6 Concluding Remarks

The paper studied whether the characteristics of the context can have an impact on women's decisions to invest in education. Through a stylized theoretical model we have identified two variables that can play a role in the female decision to invest in education – access to career opportunities and the average care time required by the child. We proposed some empirical counterparts of these variables and focused on the labor force participation of mothers with young children, on the share of women in managerial positions and on the share of women who are self-employed. These context variables are constructed looking at the outcomes of women in the 25-45 years old age group living in the same region of Europe in which young women taking the education decision live. We find that the share of working women with children below 5 and the share of women in managerial positions or self-employed positively affect the probability that women participate in post-secondary education. The same does not hold for men.

Field of study is one important dimension of the education decision which we could not take into account in our analysis, as we only have information about whether a student is enrolled or not, but not the course of study she (he) decides to attend. Knowing the field of study could allow us to assess whether the context variables we have identified have a stronger impact on the choice of opting for some courses of study rather than for others and whether, for instance, fewer opportunities in the labor market induce women to invest in less labor market oriented disciplines.

In terms of policy implications, our analysis suggests that measures which are generally thought to favor female employment and career, like, for instance, day care services or affirmative action strategies, may generate positive feedback effects also on the education decisions of younger generations. In Italy and Portugal only about 15% of women in the 25-64 cohort had tertiary education in 2009, in Sweden the percentage was 32%, in

Norway, Belgium and Denmark 34%. If we focus on younger cohorts this gap is smaller but not yet closed: in the cohort 25-34 23% of Italian women and 28% of the Portuguese have attained tertiary education, while this percentage is 53% in Norway and in Ireland and 49% in Finland. Focusing on measures which are generally thought to favor female employment may represent a good strategy to increase the human capital stock of any country, a priority especially in those where human capital is scarce.

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## Tables

**Table 1: Personal characteristics**

	<b>Women</b>	<b>Men</b>
<b>University</b>	0.603	0.497
<b>Age</b>	19.3 (0.9)	19.4 (0.9)
<b>Mother: tertiary education</b>	0.298	0.327
<b>Mother: secondary education</b>	0.464	0.462
<b>Mother works</b>	0.740	0.752
<b>Father: tertiary education</b>	0.269	0.292
<b>Father: secondary education</b>	0.494	0.482
<b>Household income</b>	29,483 (30,677)	32,435 (34,061)
<b>Number of siblings</b>	1.06 (1.05)	1.13 (1.09)
<b>Living with only one parent</b>	0.166	0.164
<b>Living on her/his own</b>	0.120	0.065
<b>Interview in Jan-Mar</b>	0.140	0.155
<b>Interview in Apr-June</b>	0.536	0.522
<b>Interview in Oct-Dec</b>	0.233	0.232
<b>Year 2005</b>	0.224	0.225
<b>Year 2006</b>	0.244	0.245
<b>Year 2007</b>	0.224	0.226
<b>Year 2008</b>	0.188	0.182
<b>Observations</b>	10,997	10,466
<b>Regions</b>	87	88
<b>Countries</b>	22	22
<b>Observations per region</b>	126	119
<b>Waves per region</b>	4.1	4.0

Notes: average values (standard deviations for continuous variables, in brackets).

**Table 2: Regional context characteristics**

	<b>Women</b>	<b>Men</b>
<b>Managerial positions (%)</b>	24.4 (10.8) [0.201]	39.4 (12.6) [0.253]
<b>Working parents (%)</b>	67.4 (18.3) [0.283]	96.7 (4.4) [0.560]
<b>Self employment (%)</b>	8.5 (4.7) [0.214]	14.1 (6.8) [0.164]

Notes: indicators have been constructed using weights and employing samples of wo/men (25-45 years old) with tertiary education. “Managerial positions” is the share of working wo/men in managerial positions; “Self employment” is the share of working wo/men in self employment; “Working parents” is the share of working mo/fathers among mo/fathers with the youngest child younger than 5 years old. Average regional values are reported, together with standard deviations in brackets, and proportion of within variance in square brackets.

**Table 3: Correlation between the share of Managerial Positions and Wages**

<b>Women</b>	<b>Net monthly wage (€)</b>	<b>Net yearly labour income (€)</b>	<b>Gross yearly labour income (€)</b>
<b>Managerial positions (%)</b>	0.329***	0.371***	0.012
<b>Regions</b>	209	297	60
<b>Countries</b>	10	15	7
<b>Men</b>	<b>Net monthly wage (€)</b>	<b>Net yearly labour income (€)</b>	<b>Gross yearly labour income (€)</b>
<b>Managerial positions (%)</b>	0.229***	0.282***	-0.238*
<b>Regions</b>	214	295	59
<b>Countries</b>	10	15	7

Notes: correlations, at regional level, between the share of managerial positions and the average labour income (measured in three different ways: net monthly, net yearly, gross yearly).

**Table 4: The Effect of the Context on Female University Enrolment**

	RE			FE		
	Beta	St err	Sig	Beta	St err	Sig
Age	-0.029	0.008	***	-0.026	0.008	***
Mother: tertiary	0.171	0.016	***	0.174	0.016	***
Mother: secondary	0.089	0.014	***	0.092	0.014	***
Mother works	0.030	0.011	***	0.031	0.011	***
Father: tertiary	0.147	0.018	***	0.150	0.018	***
Father: secondary	0.085	0.013	***	0.089	0.013	***
Household income	0.004	0.002	**	0.006	0.002	**
Number of siblings	-0.013	0.005	***	-0.013	0.005	***
Living with one parent	0.041	0.019	**	0.044	0.019	**
Living on her own	0.099	0.031	***	0.111	0.031	***
Interview in Jan-Mar	0.042	0.022	*	0.044	0.024	*
Interview in Apr-June	0.064	0.022	***	0.050	0.025	**
Interview in Oct-Dec	0.059	0.025	**	0.061	0.026	**
Year 2005	0.022	0.015		0.022	0.014	
Year 2006	0.010	0.011		0.009	0.011	
Year 2007	0.030	0.017	*	0.024	0.016	
Year 2008	0.029	0.017	*	0.026	0.017	
Women in managerial positions	0.047	0.014	***	0.026	0.014	*
Female self employment	0.061	0.023	***	0.069	0.027	**
Working mothers	0.016	0.005	***	0.010	0.005	*
Constant	0.686	0.174	***	0.678	0.178	***
<b>Observations</b>	10,997					

Notes: linear probability model, robust standard errors clustered by region; significance of the estimated coefficients:

\*\*\* significant at 1% level, \*\* at 5%, \* at 10%. RE stands for random effects model; FE stands for fixed effects model.

The unit of measurement of the context variables (managerial positions, self employment, working parents) is 10 percentage points.

**Table 5: The Effect of the Context on Male University Enrolment**

	RE			FE		
	Beta	St err	Sig	Beta	St err	Sig
Age	-0.029	0.009	***	-0.026	0.009	***
Mother: tertiary	0.192	0.023	***	0.196	0.022	***
Mother: secondary	0.087	0.020	***	0.091	0.019	***
Mother works	0.040	0.014	***	0.041	0.014	***
Father: tertiary	0.194	0.023	***	0.198	0.023	***
Father: secondary	0.065	0.019	***	0.069	0.019	***
Household income	0.007	0.002	***	0.008	0.002	***
Number of siblings	-0.025	0.006	***	-0.025	0.006	***
Living with one parent	0.054	0.018	***	0.057	0.018	***
Living on his own	0.280	0.037	***	0.292	0.036	***
Interview in Jan-Mar	0.039	0.015	***	0.042	0.015	***
Interview in Apr-June	0.041	0.013	***	0.032	0.014	**
Interview in Oct-Dec	0.043	0.017	**	0.040	0.019	**
Year 2005	0.004	0.015		0.008	0.015	
Year 2006	-0.009	0.013		-0.007	0.013	
Year 2007	-0.008	0.013		-0.008	0.012	
Year 2008	-0.001	0.017		0.000	0.017	
Men in managerial positions	0.015	0.011		0.010	0.009	
Male self employment	0.034	0.022		0.031	0.028	
Working fathers	0.021	0.013		0.010	0.014	
Constant	0.544	0.225	**	0.528	0.237	**
<b>Observations</b>	10,466					

Notes: linear probability model, robust standard errors clustered by region; significance of the estimated coefficients:

\*\*\* significant at 1% level, \*\* at 5%, \* at 10%. RE stands for random effects model; FE stands for fixed effects model.

The unit of measurement of the context variables (managerial positions, self employment, working parents) is 10 percentage points.

**Table 6: The Role of the Marriage Market**

	RE			FE		
WOMEN	Beta	St err	Sig	Beta	St err	Sig
Women in managerial positions	0.037	0.014	***	0.020	0.016	
Female self employment	0.072	0.022	***	0.071	0.026	***
Working mothers	0.017	0.004	***	0.011	0.005	**
Men in managerial positions	0.013	0.012		0.010	0.010	
Male self employment	-0.020	0.018		-0.021	0.023	
Working fathers	-0.002	0.019		-0.015	0.018	
MEN	Beta	St err	Sig	Beta	St err	Sig
Men in managerial positions	0.007	0.012		0.007	0.011	
Male self employment	0.036	0.022		0.032	0.027	
Working fathers	0.018	0.015		0.010	0.014	
Women in managerial positions	0.030	0.016	*	0.007	0.016	
Female self employment	0.002	0.021		-0.004	0.020	
Working mothers	0.012	0.006	**	-0.001	0.005	

Notes: linear probability models, robust standard errors clustered by region; significance of the estimated coefficients: \*\*\* significant at 1% level, \*\* at 5%, \* at 10%. RE stands for random effects models; FE stands for fixed effects models. The unit of measurement of the context variables (managerial positions, self employment, working parents) is 10 percentage points. All other control variables, as in Tables 4 and 5, are included but coefficients are not reported.

**Table 7: Sub-samples with complete parental information**

LIVING WITH AT LEAST ONE PARENT						
	RE			FE		
Women (N = 9,680)	Beta	St err	Sig	Beta	St err	Sig
Women in managerial positions	0.061	0.014	***	0.039	0.014	***
Female self employment	0.054	0.024	**	0.060	0.029	**
Working mothers	0.013	0.005	***	0.008	0.006	
Men (N = 9,789)	Beta	St err	Sig	Beta	St err	Sig
Men in managerial positions	0.017	0.011		0.013	0.009	
Male self employment	0.028	0.022		0.023	0.027	
Working fathers	0.027	0.014	*	0.015	0.015	
LIVING WITH BOTH PARENTS						
	RE			FE		
Women (N = 7,855)	Beta	St err	Sig	Beta	St err	Sig
Women in managerial positions	0.062	0.016	***	0.032	0.014	**
Female self employment	0.065	0.028	**	0.072	0.035	**
Working mothers	0.012	0.005	**	0.004	0.006	
Men (N = 8,075)	Beta	St err	Sig	Beta	St err	Sig
Men in managerial positions	0.013	0.012		0.007	0.010	
Male self employment	0.026	0.023		0.023	0.030	
Working fathers	0.038	0.014	***	0.024	0.015	

Notes: linear probability models, robust standard errors clustered by region; significance of the estimated coefficients: \*\*\* significant at 1% level, \*\* at 5%, \* at 10%. RE stands for random effects models; FE stands for fixed effects models. The unit of measurement of the context variables (managerial positions, self employment, working parents) is 10 percentage points. All other control variables, as in Tables 4 and 5, are included but coefficients are not reported.

**Table 8: Sample Selection due to Mobility**

	Women		Men	
	Stayers	Movers	Stayers	Movers
Age	18.2	18.0	18.3	18.0
Mother: tertiary	0.287	0.324	0.293	0.295
Mother: secondary	0.493	0.429	0.503	0.488
Mother works	0.728	0.770	0.732	0.773
Father: tertiary	0.240	0.255	0.255	0.279
Father: secondary	0.542	0.459	0.540	0.462
Household income	27,371	42,268	28,501	43,232
Number of siblings	2.38	2.26	2.41	2.4
Living with one parent	0.171	0.213	0.173	0.201
Living on his own	0.065	0.172	0.051	0.165
Wo/men in managerial positions	21.7	19.0	37.5	31.2
Fe/male self employment	7.7	5.7	13.4	10.8
Working mo/fathers	67.9	67.3	96.6	95.7
<b>Observations</b>	3,692	699	3,661	601

Notes: average value of the independent variables for samples of young people staying at home after the end of secondary school (“stayers”) or leaving the parental household (“movers”).

**Table 9: Split panel jackknife method**

	RE			FE		
	$\beta$	$\beta_4$	$2\beta - \beta_4$	$\beta$	$\beta_4$	$2\beta - \beta_4$
<b>Women</b>						
Women in managerial positions	0.047	0.050	0.044	0.026	0.025	0.027
Female self employment	0.061	0.065	0.057	0.069	0.069	0.069
Working mothers	0.016	0.017	0.015	0.010	0.010	0.010
<b>Men</b>						
Men in managerial positions	0.015	0.019	0.011	0.010	0.010	0.010
Male self employment	0.034	0.037	0.031	0.031	0.030	0.032
Working fathers	0.021	0.028	0.014	0.010	0.010	0.010

Notes:  $\beta$  is the estimated effect of the characteristics of the context as in Tables 4 and 5;  $\beta_4$  is the average of 4 effects estimated using the 4 sub-samples.