The Effect of Education on Marital Status and Partner Characteristics: Evidence from the UK *

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Abstract

This paper uses a particular school exit rule previously in effect in England and Wales that allowed students born within the first five months of the academic year to leave school one term earlier than those born later in the year. We show those who were forced to stay on more frequently hold some academic qualification. Turning to marital outcomes we then show that those forced to stay on are neither more nor less likely to be married, but women obtained better marital outcomes in that they are more frequently married to males who hold some academic qualification and who are economically active.

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I Introduction

Two stylized facts regarding the relationship between education and marriage are very well known. First, individuals who invest more in education tend to marry more educated partners than those who invest less, i.e. there is a strong positive assortative mating on education. Second, while individuals who invest more in education tend to marry later in life, at higher ages they are nevertheless more are more likely to be married.

The strong positive assortative mating in the marriage market has led to a popular argument that one part of an individual’s economic return to acquiring education obtains through an increased probability of marrying a more qualified and higher-earning spouse. Indeed, this argument was made forcefully by Claudia Goldin (1992) who went so far as to argue that improving the chances of marrying a college-educated man was the main motive for women for entering college.

The hypothesis that by acquiring education an individual can affect the identity of his/her future spouse however assumes that education has a causal effect on the individual’s marriage outcome. Surprisingly then given the size of the literature documenting positive assortative mating, there is very little evidence that seeks to explore whether this pattern reflects a causal effects of education or whether it merely reflects other forms of sorting. Whom an individual marries might e.g. well be determined by factors such as social background, geographic location, etc., factors that are also correlated with education, thus leading the observed correlation in spouses’ education to be partly or wholly spurious.

In this paper we present new evidence on the effect of education on marital outcomes using UK data. To do so we exploit a particular historical feature of the educational system in England and Wales. In particular, we use that, in the past, individuals who were born in the first five months of the academic year (September to January) were allowed to leave school at the end of the spring term in the year in which they reached the compulsory schooling age of 16, whereas those born in the remaining seven months (February to August) had to stay on for one more term. For the academic cohorts that we consider this feature, due to its interaction with the
timing of examination, implied a substantial effect of date of birth within the academic year on the attainment of qualifications. For those born in the later part of the academic year, we observe a more than three percentage point higher rate of holding some academic qualification compared to those born before the January-February threshold.\footnote{Del Bono and Galindo-Rueda (2006), focusing on the wage returns to education, present similar finding using, in part, the same data.} Our identification strategy will hence involve exploring how marital outcomes vary with month of birth, and to relate those differences to the observed differences in academic attainment.

We also argue that this is an ideal setting for exploring the effect of education on marital outcomes since the instrument – month of birth relative a within-academic-year threshold – is suitably independent across individuals. This contrasts other potential approaches. E.g. a currently popular approach is to use whether an individual is affected by a particular raising of the mandatory school-leaving age. Such an approach would not be appropriate in the current setting due the nature of non-random matching in the marriage market. If the academic cohort to which an individual belongs at least in part defines the social group with whom an individual interacts, then an individual affected by a raising of the school leaving age will tend to interact with individuals who are also affected, thus making it impossible to disentangle whether it was the individual’s own education or the higher frequency of qualified potential partners in the individual’s social group that led to different marital outcomes. We also argue that the current setting offers an advantage over using date of birth relative to the school-entry threshold point between academic cohorts since individuals on opposite sides of the threshold will face not only different required length of schooling, but also differ in terms of absolute age at school entry (and, on average, exit) as well as in relative age within their respective academic cohorts.

The main findings from the paper can be summarized as follows. Using data on individuals belonging to 16 academic cohorts born between the Autumn of 1957 and 1973 from the Labour Force Survey we find that:

- Those born after the January-February threshold (who were required to stay on for one more term) were close to four percentage points more likely to hold some academic quali-
fication than those born before the threshold.

- Holding an academic qualification did not significantly affect the probability of being married for women, but may have had a positive impact on the probability of marriage for men. In particular women born before the threshold are as likely to be married as women born after the threshold; in contrast, while the evidence is not clearcut, men born after the threshold appear slightly more likely to be married than men born before it.

- Holding an academic qualification has positively affected the probability of participating in the labour market for both men and women. For both genders, individuals born after the threshold are more likely to economically active than those born before it.

- Holding an academic qualification positively affected a woman’s mating outcome. In particular, women born after the January-February threshold are more likely to be married to men who hold some academic qualification and are economically active. No effect of academic qualification on the mating outcome can be verified for men.

The rest of the paper is outlined as follows. The next section discusses the conceptual and identification issue using a simple theoretical model. Section III briefly reviews the literature while Section IV details the institutional context. After describing the data in Section V we present our main results in Section VI. Section VII concludes.

II Conceptual Issues: Equilibrium Education and Marriage

What are the channels through which an individual’s education can have a causal effect on his/her marital outcome? There are three distinct possibilities. First, an individual’s education may impact on how many potential partners he/she meets. Second, it may impact on the type of potential partners the he/she meets. Third, it may affect the probability of any match leading to marriage.

There are relatively few available theoretical models of marriage markets with pre-marital
investments in education. A recent exception is Chiappori et al. (2008). However, their analysis assumes a frictionless, and hence extremely competitive, marriage market in the style of Becker (1973, 1991). Here we present a related equilibrium model, the purpose of which is to illustrate the empirical identification issues. In order to allow for the probability that some individuals remain unmarried, we introduce search frictions. Moreover, for simplicity, we adopt the opposite extreme assumption to Chiappori et al. by assuming that each individual meets exactly one potential partner. This assumption implies that a woman (say) is not concerned with the impact of her education decision on her attractiveness relative to other women. Nevertheless, she will be concerned that a failure to invest in education would increase the probability of being rejected by any potential partner she might meet. Furthermore, we assume that education per se does not affect the identity of the potential partner. Hence out of the three potential channels noted above, the current illustrative model only stresses the last channel. Possible extensions to include the other two potential channels are, however, noted below.

The main points to take away from the model can be summarized as follows.

- The effect of education on the probability of marriage is likely to be heterogenous in the population.
- A “local average treatment effect” of education on the probability of marriage can be identified given the existence of an exogenous “instrumental” variable affecting the individuals’ education decisions. The instrumental variable must be unrelated not only to the individual’s own unobserved characteristics, but also to the unobserved characteristics and values of the instrument of individuals in his/her “marriage market”.
- In general, the subset of individuals who are married form a self-selected subgroup. However, when education has no effect on the probability of marriage, it may be possible to estimate the effect of an individual’s education on the education of his/her spouse without self-selection bias.

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2See also Peters and Siow (2002).
In addition, the model highlights less-apparent complementarities across genders; e.g. it is shown that when more men invest in education, more women have a positive effect of education on marriage.

The Setup of the Model

Consider an economy populated by (equal-sized) continuums of men and women. Each individual in the economy decides whether or not to invest in education, with the choice of individual $i$ denoted by $x_i \in \{0, 1\}$. The cost of education for individual $i$, which for simplicity we take to be entirely psychic, depends on two factors which we denote $\alpha_i$ and $z_i$ respectively. $\alpha_i$ is treated here as being a scalar with support $A$ – a closed interval in $\mathbb{R}$. However, more generally $\alpha_i$ could be a vector incorporating factors such as scholastic ability, social background etc. The factor $z_i$ is binary and will be referred to as the “instrument”. The vector $\omega_i \equiv (\alpha_i, z_i)$ is referred to as the individual’s “type”. A key assumption is that the factor $z_i$ reduces the cost of education for individual $i$, denoted $c(\omega_i)$.

**Assumption 1** *(Monotonic effect on cost)* $c(\alpha_i, 1) < c(\alpha_i, 0)$ for all $\alpha_i \in A$.

An individual’s earnings are assumed to depend only on his/her education choice, with $y^1$ and $y^0$ denoting the earnings level for skilled and unskilled individuals respectively. Individuals have to decide whether or not to invest in education prior to meeting potential partners.

Men and women meet through a matching process. In particular, any given individual $i$ meets one potential partner, denoted $-i$, of the opposite gender. Matches, on the other hand, are generally not random. In particular, the type distribution of the potential partner of individual $i$ (of gender $j$) will in general depend on his/her own type $\omega_i$. To represent this, we use $H^j(\omega_{-i}|\omega_i)$ to denote the CDF of the potential partner’s type. We assume full support everywhere.

**Assumption 2** *(Full support)* The conditional density $h^j(\omega_{-i}|\omega_i)$ is strictly positive for each gender $j = m, w$ and for all $(\omega_i, \omega_{-i}) \in \Omega \times \Omega$.

$^3$NB. We should be careful in talking about CDFs and densities given that one dimension is
Each match is also associated with a “match quality” \( \theta_i \) – a scalar – representing the non-material value of the partnership. \( \theta_i \) is assumed to be a continuous random variable which is independent of the individuals’ types (and actions) and is common to both potential partners. The distribution of \( \theta_i \) is described by a CDF, denoted \( G \), defined on a closed interval in \( \mathbb{R} \).

A crucial assumption of the model is that the factor \( z_i \) has an exogeneity property. The assumption implies that only the \( \alpha \)-factors can be correlated across potential partners. Moreover, for individual \( i \) him/herself, \( \alpha_i \) and \( z_i \) are not correlated.

Assumption 3 (Exogeneity of the instrument) The random vector \((\alpha_i, \alpha_{-i}, z_{-i})\) is jointly independent of \( z_i \).

An individual’s utility (not of any disutility of education) depends on her consumption and, if married, on match quality. An individual’s utility as single is simply his/her own earnings \( y_i \). In contrast, utility as married is assumed to be

\[
(1 - \gamma + \sigma) y_i + (\gamma + \sigma) y_{-i} + \theta_i
\]

with \( \gamma \in [0, 1/2] \) and \( \sigma \in [0, \gamma] \). In this formulation, a value \( \gamma > 0 \) represents that the individual has to share some of his/her income with the partner. Also, a \( \sigma > 0 \) represents that there is a certain degree of intra-household publicness of consumption.

The Marriage Decision

When individual \( i \) meets his/her potential partner \(-i\), both their education decision, and hence earnings, are fixed. A marriage will occur if and only it increases the utility of both (at least weakly) relative to singlehood. There are three types of matches: (i) a match between two unskilled individuals, (ii) a match between two skilled individuals, and (iii) a match between one skilled- and one unskilled individuals. We will label these three types of matches by \( k = 0, 1, d \) respectively where \( d \) stands for “diverse”.

continuous and one is discrete.
From (1) it follows that if \( i \) and \(-i\) have the same skill level \( k \) they marry if and only if

\[
\theta_i \geq \theta_k \equiv -2\sigma y^k
\]  

(2)

If consumption has a degree of publicness \((\sigma > 0)\), then the threshold match quality is negative and is decreasing in the common earnings level. In this case, the potential couple will accept some negative match qualities in order to obtain the material gain from marriage. In the case of a diverse match, a marriage will occur if and only if the individual with the higher earnings accept to marry (since he/she has less to gain from the publicness of consumption and more to lose from the sharing of consumption). This requires that

\[
\theta_i \geq \theta_d \equiv \gamma (y^1 - y^0) - \sigma (y^1 + y^0)
\]

(3)

Each threshold match quality determines the marriage probability for each type of match, \( \pi^k \equiv 1 - G (\theta^k) \), \( k = 0, 1, d \). From the characterization of the thresholds the conditional marriage probabilities can be ranked\(^4\).

Lemma 1 \( \pi^1 \geq \pi^0 \geq \pi^d \). Moreover, the first inequality is strict if and only if consumption has a degree of intra-household publicness \((\sigma > 0)\) while the second inequality is strict if and only if there is some degree of intra-household consumption sharing not compensated for by publicness of consumption \((\gamma > 0 \text{ and } \sigma < \gamma)\).

Hence, intuitively, consumption sharing contributes to equilibrium assortative mating since it implies that diverse matches will be more frequently rejected. Publicness of consumption on the other hand contributes to a higher marriage frequency among skilled individuals and to assortative mating (Lam, 1988).

The Incentives to Invest in Education

Whether individual \( i \) (of gender \( j \)) invests or not depends on her type \( \omega_i \). In equilibrium, there will be two jointly determined functions \( x^j (\omega_i) \), \( j = m, w \), describing the individuals’

\(^4\) All proofs are available from the authors on request.
investment behaviour. We will use $\Omega^*_j$ to denote the subset of types (of gender $j$) who choose to invest in education.

Consider then the education decision of individual $i$ (of gender $j$). He/she takes the (equilibrium) investment decisions of the opposite gender as given and hence correctly anticipates that the potential partner will be skilled if and only if $\omega_i \in \Omega^*_j$ (where $-j$ refers to the opposite gender). The equilibrium probability of meeting a skilled partner will, in general, depend on $i$’s own type. However, given Assumption 3 is can only depend on $\alpha_i$, not on $z_i$. Hence we can let $p^j(\alpha_i)$ denote the (equilibrium) probability that individual $i$ matches with a skilled potential partner.

Since match quality is only enjoyed for accepted matches we define, for each type of match,

$$\tilde{\theta}^k \equiv \int_{\theta^k}^{\theta^{\text{max}}} \theta dG(\theta), \ k = 0, 1, d. \quad (4)$$

Taking expectations over the potential partner’s skill level, and taking the difference between the expected utilities associated with investing- and not investing in education, yields that a type $\omega_i$ individual of gender $j$ will choose to invest in education if and only if

$$A^j(\alpha_i) + \left(\tilde{\theta}^0 - \tilde{\theta}^d\right)\left(2p^j(\alpha_i) - 1\right) + p^j(\alpha_i)\left(\tilde{\theta}^1 - \tilde{\theta}^d\right) \geq c(\omega_i) \quad (5)$$

where

$$A^j(\alpha_i) \equiv (y^1 - y^0)\left(1 - \pi^d\gamma\right)+\sigma\left\{\left[\pi^d y^1 - y^0 \pi^0\right] + y^0\left(\pi^d - \pi^0\right)\right\} + 2p^j(\alpha_i)\left[y^1\left(\pi^1 - \pi^d\right) + y^0\left(\pi^0 - \pi^d\right)\right] \quad (6)$$

represents the expected consumption gain associated with investing in education. It is useful to note some special cases. If consumption is entirely “private” ($\sigma = 0$) then this condition reduces to

$$(y^1 - y^0)\left(1 - \pi^d\gamma\right) + \left(\tilde{\theta}^0 - \tilde{\theta}^d\right)\left(2p^j(\omega_i) - 1\right) \geq c(\omega_i) \quad (7)$$

which, as expected, reduces further to $y^1 - y^0 \geq c(\omega_i)$ if there is no consumption sharing. Since the instrument $z_i$ enters equation (5) only on the cost side it follows trivially it has a monotonic impact.
**Lemma 2** *(Monotonic impact of instrument)* $x^j(\alpha_i, 1) \geq x^j(\alpha_i, 0)$ for $j = m, w$ and for all $\alpha_i \in A$.

For each gender $j$, we assume that there is a non-empty set of $\alpha$-types, denoted $A^*_j$ and referred to as “compliers” (see Angrist et al., 1996) who invest if and only if $z_i = 1$. In contrast, any type $\alpha_i \notin A^*_j$ will either invest or not invest irrespective of the value of $z_i$.

Formally, an *equilibrium* of the model consists of education decisions for each gender and type, described by $x^j(\alpha_i, z_i)$ for $j = m, w$, along with acceptance/rejection decisions at each type of meeting, described by the match quality thresholds $\theta^k$, $k = 0, 1, d$. Existence of an equilibrium can be verified using a standard fixed-point argument. One feature of the model is a general strategic complementarity across genders in education decisions: the more men invest in education, the stronger are the incentives for women to do the same, and vice versa. The intuition is simple. Suppose that more men invest in education. This raises the probability for each woman of matching with a skilled man and hence increases the expected material value of marriage. As a consequence women become more prone to invest education in order to reduce the probability of being rejected.

**The Effect of Education on Marriage Probability**

Consider now the effect of education on the marriage probability. If individual $i$ (of gender $j$) invests in education, then his/her probability of marriage can be written as $\mu^j(\alpha_i) \equiv p^j(\alpha_i) \pi_1 + (1 - p^j(\alpha_i)) \pi_d$. In contrast, if he/she does not invest in education, the marriage probability is $\mu^j_0(\alpha_i) \equiv p^j_0(\alpha_i) \pi_d + (1 - p^j_0(\alpha_i)) \pi_0$. Note that $z_i$ does not affect the marriage probability conditional on the individual’s education decision: $z_i$ influences the marriage probability only via its impact on education.

Taking the difference yields that the effect of education on the marriage probability of individual $i$ is

$$\mu^j(\alpha_i) - \mu^j_0(\alpha_i) = p^j(\alpha_i) (\pi_1 - \pi_d) + (1 - p^j(\alpha_i)) (\pi_d - \pi_0)$$

[NB. So far this has only been worked out for the case where consumption is shared ($\gamma > 0$) but not public ($\sigma = 0$). Need to extend the argument.]
This effect varies in the population due to differences in the probability of matching with a skilled partner. Indeed, the effect is positive for individual $i$ if and only if $p^j(\alpha_i) \geq (\pi_0 - \pi_d) / (\pi_1 + \pi_0 - 2\pi_d)$. This again implies a version of cross-gender strategic complementarity: if there is some degree of intra-household consumption sharing ($\gamma > 0$), then an increase in education among men has a positive impact on the effect of education on the probability of marriage for women, and vice versa.

**Identification**

Assume now that we have random samples $I_j$ of men and women from the population. For each individual we observe marital status $m_i \in \{0, 1\}$, educational attainment $x_i \in \{0, 1\}$ and the value of the instrument $z_i \in \{0, 1\}$. Hence, in terms of the model, we only partially observe the individual’s type, and we do not observe his/her match quality draw.

Following Imbens and Angrist (1994) we can show that the average effect of education on the marriage probability for compliers can be identified. To see this, note that the conditional expectation of marriage given $z_i$ can be written

$$E[m_i|z_i] = E\left[\mu^1_j(\alpha_i) x^j(\alpha_i, z_i) + \mu^0_j(\alpha_i) (1 - x^j(\alpha_i, z_i)) | z_i\right]$$

where the expectation is taken over $\alpha_i$. Taking the difference between $z_i = 1$ and $z_i = 0$ and noting that only compliers contribute to the difference in expectation it follows that

$$\frac{E\left[m_i^1|z_i = 1\right] - E\left[m_i^1|z_i = 0\right]}{E\left[x^j_1|z = 1\right] - E\left[x^j_1|z = 0\right]} = E\left[\mu^1_j(\alpha_i) - \mu^0_j(\alpha_i) | \alpha \in A^*_j\right]$$

where we also used that the denominator on the left hand side is the measure of compliers within gender $j$ (i.e. $\Pr(\alpha_i \in A^*_j)$).

- **Analysis of the identification of the impact of education on partner’s education** is in progress.
Further Issues

The simple illustrative model above can be extended in several directions. In a more general environment one can allow the act of investing in education to impact on the identity of the potential partner; this could be modelled e.g. by allowing the economy to be segmented into a skilled sector and an unskilled sector with matches being more likely within sectors than across sectors. One could also allow for more general preferences whereby individuals directly value some individual characteristics of their potential partners (e.g. intelligence, beauty and kindness).

Either of these extensions would be compatible with the identification conditions outlined above. One potential feature that the above model does not easily generalize to is post-marital investments in education. It could be that a substantial amount of education is undertaken by individuals once they are already married. As discussed in Lefgren and McIntyre (2006) such investments would complicate the analysis since one would ideally need to measure education at time of marriage, not completed education. However, for our analysis, this is likely to be a very minor problem. Our identification relies on an instrumental variable that operates at the level of qualifications obtained primarily at the age of 16 (and to a lesser extent at the age of 18). In the data that we use even at the age of 18, the fractions married are only 3 percent for women and little over half a percentage point for men.

III Related Literature

Since the social patterns of marriage were first brought to light, much effort has been devoted to measuring marital homogamy across time, countries and subgroups of the population. Despite the substantial literature documenting educational marital homogamy, little is known about

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whether this strong association between spouses’ education reflect any causal effects. E.g. it could be that marital decisions are primarily driven by homogamy on individual characteristics such as social background, geographic location, intelligence etc. that are correlated with investments in education, in which case a marginal increase in an individual’s level of education might have little or no effect on the level of education of his/her future marriage partner. Only a small literature has explored the causal effect of education on marital outcomes. Below we focus on reviewing this literature.

- [To do!] Add references to literature documenting the relationship between education and the timing of marriage.

**Timing and Frequency of Marriage**

Breierova and Duflo (2004) make use of a large school construction program that took place in Indonesia between 1973 and 1978 and exploit that an individual’s exposure to the program would depend on time of birth and region of residence. Using these interaction effects to generate instrumental variables for education the authors find that education increases a woman’s age at first marriage but does not affect the probability that she is currently married.

Skirbekk, Kohler and Prskawetz (2004), using Swedish registry data, note that children differ in age at school graduation due to their month of birth. The authors use differences in birth month to estimate the effect of “duration of education” and “age at graduation” on the timing of marriage (and fertility), and find that a year’s increase in age at graduation (due to being born after the January 1st school entry cutoff point) implies a significant delay in a woman’s age at first marriage, but no difference in the probability of marriage by age 45. The authors hypothesize that this may be due to women synchronizing the timing of demographic events with other women in their school cohorts, rather than with women of a similar age. If indeed an individual’s school cohort may form a “social group” that is relevant to key demographic events this suggests that absolute age effects may be confound any analysis of the effect of education based on cutoffs between academic cohorts.

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7Suppose e.g. that we observe that those born just before a school entry cutoff point are more frequently
Educational Assortative Mating

A few studies explore, with varying research designs, the degree to which the observed high degree of educational assortative mating reflect causal effects.

Behrman and Rosenzweig (2002), within the context of a larger study exploring the intergenerational effects of education, use data on 600 married female monozygotic twins from the Minnesota Twins Registry to estimate the impact of a woman’s education on the education of her spouse. They show that the correlation between spouses’ education is about 40 percent lower when using variation in education within twins pairs than when using variation in education in the cross-sectional data. Nevertheless the authors still find that a woman’s education has a causal effect on the schooling of her spouse: a one-year increase in schooling for a woman increases the schooling of the spouse that she can attract by little less than 0.4 of a year. The fact that the correlation between spouses’ education is lower when using within-twins variation than when using cross-sectional variation strongly suggests that there is positive assortative mating on various forms of individual “endowments” (a positive correlation between $\alpha_i$ and $\alpha_{-i}$ in terms of the model above).

Using the same technique and with Norwegian administrative data on married siblings and twins-pairs, Oreopoulous and Salvenes (2009) find that a one year increase in an individual’s education increases the spouse’s length of schooling by about 0.23 of a year.

The contribution most similar to ours is that by Lefgren and McIntyre (2006). Using US Census data and, following Angrist and Krueger (1991), using quarter of birth as instrument these authors explore the causal impact of women’s education on their subsequent marital status married than those born just after it. If those born before the cutoff also acquire more education, we might conclude that education had a positive effect on marriage. However, even at the same length of schooling, the individual born before the cutoff would be younger when completing education, which in itself may have had a positive impact on the probability of being marriage at any given age, especially at relatively young ages. The same type of “social age” effects are consistent with the finding in Walker and Zhu (2009) that, in the UK, summer born girls are significantly more likely to be teenage mothers than are autumn born girls.
and on the earnings of their husbands. Similar to us they find that while education has little or no impact on marital status, it positive affects husbands’ incomes. Nevertheless, in addition to providing complementary evidence from a different country, the current paper makes a number of contributions relative to Lefgren and McIntyre. First, their identification hinges, to a substantial amount, on the difference in education between individuals born in the first versus the fourth quarter of the calendar year. This gap obtains due to the interaction between a January 1st enrollment cutoff rule with the school leaving age policy which allows individuals to leave education on the day that they turn 16: a child born just after the enrollment cutoff date will have enrolled in school a year later than a corresponding child born just before it, but will be able to leave education at nearly the same time, leading the former to obtain, on average, less education. As a result, their identification comes to a substantial degree from comparing individuals who belong to different academic cohorts which also implies absolute and relative age differences: individuals born in the first quarter will be older when enrolling in school and also older within their class compared to someone born in the fourth quarter. In contrast, our identification relies on within-academic-cohort differences in academic attainment.

Second, we focus directly on academic qualifications. On the margin affected by an instrumental variable it is not necessarily the case that there is a simple mapping between length of schooling (or age when leaving schooling) and qualifications obtained. In our context there is a difference in required length of schooling depending on whether the individual’s date of birth falls on one side or the other of a specific cutoff date within the academic year. However, while there is no substantial difference in average age when leaving full-time education between those born just before and after the cutoff point there is nevertheless a substantial difference in academic qualification rates. Third, whereas Lefgren and McIntyre focus on the husbands’ incomes we focus on the spouses’ academic attainment and economic activity. Relative to income a part-

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8 The use of season of birth as instrument has also been recently criticized by Buckles and Hungerman (2008) who document large seasonal difference in the characteristics of women giving birth in the United States, and show that these differences, in some cases, explain nearly half of the relationship between season of birth and adult outcomes.
ner’s education especially is likely to be determined prior to marriage. Hence there is less risk of feedback from the individual’s education to the behaviour of the spouse.

A further recent study by McCrary and Royer (2006) consider the relationship between mother’s education and birth outcomes (birth weight, gestation period, infant mortality) using natality data from California and Texas which includes information on the mother’s exact date of birth. Using school entry policy to identify the causal effect of education, the authors also explore, as one potential channel, the possibility that a woman’s education affects the quality of the child’s father. They find that show that women born just subsequent to the school entry date (who have less education) have mates who are less educated and younger, on average, than the mates of women born just before the entry date. The fact that women born after the school entry date have younger partner may be due to an absolute age effect since they enroll a year later and, in so far as an individual’s academic cohort defines his/her social group, interact with younger peers.

IV Institutional Context

The school education system in the UK is divided into three stages: primary education, compulsory secondary education and post-compulsory secondary education. While the education and training systems of England, Wales and Northern Ireland are broadly similar, the education system in Scotland has always been completely independent with its own laws and practices. In the following, we will focus on the education system in England, Wales and Northern Ireland.

School Entry Policy

The academic year runs from 1 September to 31 August with three terms starting in September, January, and April, respectively. By UK law, all children of compulsory school age (between 5 and 16) must receive a full-time education. In England and Wales, children must start school at

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9 Unfortunately we cannot provide any corresponding estimates of the effect of an individual’s education on the income of his/her spouse since earnings data has only been collected by the Labour Force Survey since 1992 onwards.
the beginning of the term after they turn 5. There is, however, significant variation in admissions policies across local education authorities (LEAs). While the statutory policy is adopted by only around 1% of LEAs, most LEAs that operate a triple-entry-point system that admits children at the beginning of the term in which they turn 5. The system that is becoming increasingly popular over time is based on a single-entry-point, which implies that all children start school in September of the academic year in which they turn 5, regardless of age. Nearly half of the children born between 1997 and 1999 started school in an LEA where this single-entry-point system was in operation (see Crawford et al. 2007)

School Leaving Policy

The British government has raised the minimum school leaving age several times since the introduction of compulsory education in 1870. The main motivations given have been focused on generating more skilled labour by providing additional time for students to gain skills and qualifications. The current school leaving age of 16 has been in force since September 1973, as a result of the Raising of School Leaving Age (RoSLA) Order of 1972. This built on the previous RoSLA from 14 to 15 which occurred in April 1947, following the 1944 “Butler” Education Act.

Unlike in the US, children in the UK are generally not deemed to have attained the age of compulsory schooling, and therefore allowed to leave school, on the exact date in which they themselves attain the age of 16. Since the Education Act of 1962 and up until 1997, the minimum school leaving age arrangements were as follows:

- A child whose sixteenth birthday fell in the period September 1 to January 31 inclusive, was allowed to leave compulsory schooling at the end of the Spring term (which ends just before Easter).

- A child whose sixteenth birthday fell in the period February 1 to August 31, was allowed to leave on the Friday before the last Monday in May.[10]

[10]The justification for dual exit dates seems to have been the belief that a common exit date, with entire cohorts leaving school at the same time, would negatively affect the functioning of the labour market. [REF]
From 1998 onward, a new single school leaving date was set as the last Friday in June in the school year in which the child reaches the age of 16, as a result of the 1996 Education Act. However, since our empirical analysis will focus on individuals who attained the minimum school leaving age of 16 during the 1970s and the 1980s, the earlier school leaving arrangements will be the relevant ones for our purposes.

The combination of the school entry policy and the school leaving policy implied two distinct discontinuities in required length of schooling with respect to date of birth. First, a discontinuity obtained at the cutoff dates between academic cohorts, i.e. at the August-September threshold. While August-born children were forced to stay until the end of the school year, September-born children were allowed to leave at Easter. Since those born after the threshold date have shorter required schooling, this discontinuity has strong similarities to the discontinuities generated by school entry policy in the US as used by Angrist and Krueger (1991) and many after them. Second, a discontinuity obtains also at the winter cutoff date for being allowed to leave at Easter, i.e. at the January-February threshold. While January-born children were allowed to leave at Easter, February-born children were forced to stay until the end of the school year. While the two discontinuities at a first glance appear to be “flipsides” of each other there is nevertheless an important difference: while the first discontinuity obtained between academic cohorts, the second discontinuity obtained within academic cohorts. The fact the first discontinuity obtains between academic cohorts implies that the required length of schooling is not the only difference between individuals born on opposite sides of the threshold. Those born after the threshold would start school later than those born before it and would belong to a one-year later academic cohort: hence those born after the threshold would have a higher absolute age at school start and also a higher age relative to their academic cohort peers. In contrast, for the second discontinuity, by virtue of January and February born children belonging to the same academic cohort, and generally starting school at the same time, neither age effect would have obtained. For this reason the second discontinuity has stronger appeal as a pure required education effect and will be the one focused on in this paper.

The significance of the discontinuity is, however, not only that it implies a nominal difference
of two to three months (one term) of required schooling. More importantly, it interacts with the qualification system in England and Wales under which students aged 16 sit crucial intermediate-level examinations at the end of the summer term.

**Exams Sat at 16**

At the end of five years of compulsory secondary education, students in England and Wales take exams in a range of subjects. Historically, different types of schools entered their pupils for different examinations at age 16. Students who were academically inclined and attended “grammar schools” would take General Certificate of Education Ordinary Levels (“GCE O-level) examinations. In contrast, less academically oriented students attending “secondary modern schools” could take the Certificate of Secondary Education (CSE) examinations at 16 before leaving school. Less demanding than GCE O-level, results in the CSE exams were nevertheless graded on the same scale, with the top CSE grade, grade 1, being equivalent to a simple pass at GCE O-level.

The introduction in 1988 of the General Certificate of Secondary Education, which superseded the O-level and CSE exams, marked a turning point in UK educational system. The GCSE is a single subject exam and students usually take up to ten (there is no upper limit) GCSE exams in different subjects. Students are given a letter score of A-G where A is the top grade. Although grades A-G are all officially pass grades, only grades A to C are generally regarded as equivalent to the “pass” grades in the previous O-level system.

Our empirical analysis will focus on the academic cohorts that faced the previously existing O-level/CSE system for which we observe a significant difference in academic attainment by date of birth relative to the January-February threshold. With the introduction of the more inclusive GSCE system, the fraction of individuals holding some academic qualification increased and the date of birth effect vanishes. Moreover, we will focus on those cohorts that faced the minimum school leaving age of 16. Under the previous age of 15, whether or not a student could leave at Easter was effectively inconsequential since leaving at the earliest possible date meant leaving
school a year prior to the qualifications-generating examinations sat at age 16. Hence in our analysis below, the main focus will be on individuals born after September 1957 (and hence born late enough to face the current age 16 minimum school leaving age) but born before August 1973 (and hence born early enough to face the previous O-level/CSE examination system).

V Data and Sample

The data we will use comes from the UK Labour Force Survey (LFS) which is the largest regular household survey in the United Kingdom and is intended to be representative of the whole UK population. The sample design currently consists of about 50,000 responding households every quarter, representing about 0.1% of the British population. Prior to 1992 LFS data is available on an annual basis, based on interviews taking place in the Spring (March-May). However, since 1992 LFS data is available on a quarterly basis. We pool data from the survey years 1984 to 2006. The LFS surveys prior to 1983 are not comparable with later surveys because of inconsistencies in measurement, definitions and coverage, while 2006 is the last year for which month of birth has been made publicly available.

The LFS is suitable for our purposes due to its size and since it contains the basic information needed for our application: year and month of birth, educational attainment, marital status, and employment status (Future versions of this paper will also include region of residence and ethnicity).

The basic sample criteria we use are as follows. We select individuals born and currently

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11 Even when the minimum school leaving age was 16, students leaving at Easter had the option of returning for exams and evidence suggests that a substantial fraction of students did so (Del Bono and Galindo-Rueda, 2006).

12 Indeed, with the restructuring of the LFS in 1992, the survey was transformed into a “rotating panel”. Each quarter’s LFS sample is made up of five “waves”. Each wave is interviewed in five successive quarters, such that in any one quarter, one wave will be receiving their first interview, one wave their second, and so on, with one wave receiving their fifth and final interview. However, since we are not interested in time varying characteristics or outcomes, we will not be making use of the panel structure of the LFS. Instead we will only be using information provided by individuals in their first interview.
living in England or Wales who are aged 18 or above at the time of interview.\footnote{Prior to 2001 there is no information about in which country of the UK individuals are born. We then keep those born in the UK and currently living in England and Wales. Hence for earlier survey years there is some unavoidable degree of noise due to migration from Scotland and Northern Ireland. We do not impose any explicit upper limit on age. However, per construction, the oldest individual that will be included in the data will be someone born in the Autumn of 1957 and observed in the Autumn of 2006. Hence no one in the main sample will be aged above 50.} As noted above, in our main analysis we restrict further restrict our attention to individuals belonging to a certain set of academic cohort, in particular, we include individuals born between September 1957 and August 1973.

For each individual we have information on year and month of birth. Since we also know the year and month of interview we know the individual’s age in months when surveyed. For marital status we will consider exclusively at whether or not the individuals is currently married – the survey does not allow us to determine any details of the individuals’ marital histories. We observe the current employment status of each individual and label an individual as being “economically active” if currently employed or self-employed.

With regards to educational attainment we have several pieces of information. Fundamentally the individuals report the age at which they left continuous full time education and what qualifications they hold. The standard measure of age when leaving full time education is not useful for the current purposes. To see this, note that two individuals born on opposite sides of the January-February threshold will have the same age in years even if one leaves school at Easter and the other in the summer\footnote{Indeed, for our sample we observe no statistically significant differences between January and February born in terms of age when leaving full time education even though we observe substantial differences in term of the academic qualifications.}

Instead we focus on formal qualifications held by the individuals. In particular, we will focus exclusively on academic qualifications. Indeed, for most of the analysis we will simply consider whether an individual holds any academic qualification. There are several reasons for doing so, generally having to do with timing and exams. First, individuals tend to obtain
academic qualifications in a certain sequence, implying that higher levels of qualifications are obtained at higher ages. Nevertheless, whether or not an individual will ever obtain any academic qualification is typically determined by the exams sat at age 16. Hence when we consider a given academic cohort, as we observe them in across time, they will tend to improve their composition of academic qualifications over time as they age. However, the fraction of any given cohort that holds some academic qualification is effectively constant across time. Second, while we also have information on vocational qualifications, such qualifications are more frequently obtained at various stages in the individuals’ lives. As a result, when we consider the fraction of any given academic cohort that holds some qualification (academic or vocational) we observe this fraction to be increasing over time as the cohort ages. Such apparent “skill upgrading” would cause a host of problems for the analysis, including problems relating to interpretation; e.g. we would be less certain that skill acquisition comes before marriage. Third, and fundamentally, the O-level and CSE examinations taken at the age of 16, i.e. at the end of the academic year in which those born September to January would have the option to leave at Easter, each provide an academic qualification. As result we observe larger discontinuities in the rate of holding some academic qualification than discontinuities in the rate of holding any (academic or vocational) qualification.

Mostly for descriptive purposes we classify the individuals by their highest academic qualification into five “levels” where (i) “Level 1” denotes a CSE qualification, (ii) “Level 2” denotes an O-level qualification, (iii) “Level 3” denotes an A-level qualification (an “Advanced Level” examinations taken at age 18 relevant for entry into higher education), (iv) “Level 4” denotes a first degree (or equivalent), and (v) “Level 5” denotes a higher degree (at postgraduate level).

Table 1 provides summary statistics broken down by gender and current marital status. The table shows that little less than 60 percent of the sample were born in the months February to August, implying that only around 40 percent of the sample had the option of leaving education at Easter the year in the academic year in which they turned 16. Males are more frequently economically active than women. Moreover, married men are more often economically active than men who are not married. Married individuals are older than those not married. Men more
often hold no academic qualification than women, and for both genders married individuals are more likely to hold some any academic qualifications.

VI Results

We present our result in four subsections. First, we consider the impact of month of birth relative to the January-February threshold on academic attainment. We show that those born after the threshold are significantly more likely to hold some academic qualification. In particular, the gap in attainment obtains on the margin between holding no academic qualification and holding some low level (level 1 or 2) qualification. The gap in attainment is similar for men and for women, but gradually diminishes over time.

Second, we consider the impact of month of birth on marital status. For women we find no difference in marriage frequency for those born before and after the threshold date. For men, there is some weak suggestion that men born after the threshold are more likely to be married. Based on these findings we confirm that instrumental variables estimates of the effect of an academic qualification on marriage probability fail to verify any statistically significant effects. Third, before considering the effect of academic qualification on partner characteristics, we consider the impact on the own economic activity. We show that individuals born after the threshold are more likely to be economically active and that instrumental variable estimates confirm a positive effect of academic qualification on own economic activity.15

Finally, we consider the impact of month of birth on spouse characteristics for married individuals. We show that the husbands of women born after the threshold date are less likely to hold any academic qualification and also appear less likely to be economically active. For married men, there are no corresponding differences in the characteristics of their wives. Instrumental variable estimates confirm an effect of women’s academic qualifications on the academic qualifications of their husbands and while the corresponding estimates for the impact on the husbands’ economic activity are borderline significant.

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15We do not consider the impact on earnings since the LFS started recording earnings only in 1992.
Month of Birth and Academic Attainment

We begin with an analysis of the relationship between month of birth and academic attainment. Figure 1 plots the distribution of highest academic qualification by month of birth. For each gender there is a marked increase in the fraction holding a level 1 academic qualification along with a corresponding decrease in the fraction holding no academic qualification. For women the figure also suggests that women born after the January-February threshold are slightly more likely to hold a level 2 academic qualification. For higher qualifications there is no evidence of any discontinuity at the threshold date. The figure also suggests that the fraction holding level 1 academic qualification increases slightly with month of birth with corresponding decreases in the level 3-5 qualifications for men and in level 2 qualifications for women. These trends, however, are small relative to the discontinuity in the rate of holding no academic qualification observed at the threshold, and this rate in particular has no other marked trend within the academic year.

Next we consider the impact of being born after the threshold on academic attainment when we add controls. For each academic qualification level, we estimate a linear probability model for having that level of qualification or above, on a dummy for being born after the threshold (i.e. being born in the months January-August), a set of academic cohort dummies, a set of survey year dummies, and on age-in-months in linear, square and cubic form. Moreover, in order to explore the sensitivity of the estimates, we vary the “window-size” from five months on either side of the threshold (i.e. including everyone born September through June) down to one month on either side (i.e. only including those born in January and February).

Table 2 gives the coefficient on being born after the threshold in each regression. The Table confirms that the main effect of passing the threshold is on the “no qualification” versus “some qualification” margin: the effect of being born after the threshold on the probability of holding

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16 These trends may be reflecting the type of relative-age-at-school-start effect highlighted by Crawford et al. (2007) whereby those who are oldest within their academic cohort perform better.

17 Note that even two individuals born in the same academic cohort and interviewed in the same calendar year can differ in age in month due to differences in month of birth and in month of interview.
at least a level 1 academic qualification is economically significant, around three and a half percentage point for women and about three percentage points for men, and relatively stable with respect to the window size. In line with Figure 1, the table also suggests that being born after the threshold may be associated with an increase in the probability of holding an academic qualification at level 2 or above; however, the estimated effect is markedly smaller the for level 1 or above, and is sensitive to the window size.

Recall that a condition required to hold in order for the causal effects of academic attainment to be identified was that the instrument – being born after the threshold in this case – should have a monotonic impact on attainment. An important implication of the results in Table 2 is that being born after the threshold date is, indeed, unambiguously associated with attaining a higher level of academic qualification: for no academic qualification level do we obtain that those born after the threshold are significantly less likely to hold that level of qualification or above.

So far we have not considered whether the effect of being born after the threshold was the same in all academic cohorts. To consider this, Figure 2 plots the fraction of individuals in each academic cohort, separated into those born before and this born after the threshold, who hold some academic qualification. For the purpose of this particular figure we have also extended the sample to include the five academic cohorts that just before and following our main sample respectively. The five academic cohorts before the current main sample were not affected by the 1974 raising of the school leaving age (RoSLA) and hence faced a minimum school leaving age of 15. This meant that everyone had the option of leaving school before the exams taken at the end of ... [NOTE YEAR]. As a result, the fraction holding some academic qualification is markedly lower and, specifically, there are no noticeable differences between those born before and after the January-February thresholds. For the main sample cohorts, we observe that the rate of holding some academic qualification trends upwards. Moreover, Figure 2 illustrates how the gap in attainment between those born before and after the threshold was particularly large in the early years following the RoSLA. Gradually the gap subsequently reduced and was entirely eliminated for cohorts born September 1973 onward [Note date for introduction of GCSEs].
Marital Status

We now consider the individuals’ marital status. We start by noting that the marriage frequencies that we observe in the current data are in line with the stylized fact noted in the Introduction: Individuals who invest more in education tend to marry later in life than those who invest less, nevertheless, at higher ages those who invested more are more likely to be married.

This is highlighted in Figure 3 which shows the frequency of individuals who are currently married by level of academic attainment relative to individuals who hold no academic qualification. The figure shows how, up until the age of around 28-30, those who obtain a level 4-5 academic qualification (corresponding to university studies) are markedly less frequently married than those with no qualifications. A similar, but smaller, effect is evident for those who obtain a level 2-3 academic qualification. After the age of 30, however, those with no academic qualification are the least likely to be married out of all attainment groups, with the gap in marriage frequency being around 10 percentage point relative to every level of attainment. Hence there is a strong association between academic attainment and the probability of being married. However, it is less clear whether that association reflects a causal effect rather than pure selection. To consider this we examine how the fraction currently married varies with when in the year an individual is born.

The upper part of Figure 4 shows the estimated fractions currently married at each age, for individuals born before before the January-February threshold respectively, controlling for academic cohort, survey year and for differences in age in months, and using a window size of three months on either side of the threshold. Due to the scale it is difficult to visually detect any differences between those born before and after the threshold. For that reason, the lower part of Figure 4 shows the estimated difference between those born after the threshold and those born before, at each age. For men the average difference (indicated by the hatched line) is positive and around a third of a percentage point; however, the difference is not statistically
significant\textsuperscript{18} For women the average difference is actually negative, but very small and not statistically significant. Hence, we cannot confirm that for either gender, those born after the threshold are more likely to be married.

We can also consider in some more detail how the fraction currently married varies with month of birth. Since only observe a positive association between academic qualifications and marriage for individuals above their mid-20s we focus here on this age group. Figure 5 plots the fraction currently married by month of birth for individuals aged 25 and above. For both genders we see that the fraction married declines with month of birth. This is, in part, an age effect: since our sample consists of a set of academic cohorts, those born later in the academic year are, per construction, a number of months younger than those born earlier in the academic year. It can be shown, however, that even when controlling for age measured in months, academic cohort effects and survey year effect, those born later in the academic year are slightly less frequently married. This is surprising given the finding of Skirbekk, Kohler and Prskawetz (2004) which suggested that individuals demographic life events depend not only by their absolute age, but also on their “social age” defined by their academic cohort. From that hypothesis we would have expected that those born later in the academic year would be relatively more frequently married given their absolute age in months. In any case, Figure 5 does not reveal any noticeable discontinuity in the fraction currently married at the January-February threshold.

In order to explore the possibility of a discontinuity in further detail we estimate the difference in the fraction currently married between those born after the threshold and those born before using a simple linear probability model estimated by OLS which also controls for academic cohort effects, survey year effects, and age-in-months. Focusing again on those aged 25 or above, Figure 6 shows the coefficient on being born February or later as the window size is gradually reduced from five months on either side of the threshold down to using only January and February. The figure shows that, for all window sizes bar the largest, men born after the threshold are more frequently married; however, the difference is never statistically significant at the five percent

\textsuperscript{18}We have also tried varying the window size and using parsimonious specifications where the seasonal effect varies with age. However, for no specification could be obtain that the difference was statistically significant.
level. For women, the difference in the fraction currently married is effectively zero for all window sizes except the very smallest. Hence, from this analysis, we conclude that for women there is no indication that the probability of being currently married changes discontinuously with month of birth at the threshold point. For men the answer is less unambiguous. In terms of point estimates, men born after the threshold appear more likely to be married (and, moreover, the magnitude of the point estimates are “reasonable”). Nevertheless, the facts that (i) the effect only obtains in higher age groups, (ii) there is also a more general trend within the academic year, and (iii) the baseline fraction is close to 0.5, makes it hard to verify statistically any discontinuity. Hence, for men aged 25 and above, we must conclude that while we cannot reject the hypothesis of no discontinuity, the data is also consistent with a reasonably-sized (e.g. up to a percentage point) discontinuity.

Consider then using being born after the threshold as an instrumental variable for estimating the effect of holding some academic qualification on the probability of being married. Focusing again on individuals aged 25 or above, Figure\textsuperscript{7} shows the estimated effect of holding some academic qualification on the probability of currently being married, controlling also for academic cohort effects and survey year effects (using dummies) and for age in months (in linear, square, and cubic form), as the window size is gradually reduced. For comparison, the hatched lines highlight the corresponding OLS effects. The fact that, for men, the point estimates of the effect of being born after the threshold on the probability of being married are positive but imprecise implies that the same is true for the IV estimates of the effect of an academic qualification. For women, the IV estimates of the effect of a qualification are much smaller than the corresponding OLS estimates for all window sizes except the very smallest. Hence the conclusions carry over: for women there is no evidence in favour a causal effect of holding an academic qualification on the probability of being married. For men, while we cannot reject the hypothesis of no effect of a qualification, the data is also consistent with a sizeable causal effect, even exceeding the corresponding OLS effect.\textsuperscript{19}

\textsuperscript{19}For most of this section we have focused on individuals aged 25 and above. The reason for splitting the sample by age was that a positive association between holding an academic qualification and currently being married
**Own Economic Activity**

There is a strong association between the individuals’ academic qualifications and their economic activity rates. This is highlighted in Table 3 which shows the effect of holding a given academic qualification (relative to holding no academic qualification) on the economic activity rate, estimated by OLS and controlling for academic cohort effects, survey year effects, and age in months. Note in particular that the even the lowest level of academic qualification is associated with a significantly higher activity rate relative to no qualification.

Consider then how the economic activity rate varies with the individuals’ month of birth. This is highlighted in Figure 8 which plots the raw economic activity rates. For males there is a clear suggestion that men born before the January-February threshold are less likely to be economically active. For women no obvious pattern can be visually discerned. As in the case of marital status, we estimate the size of the discontinuity at the threshold by regressing the economic activity indicator on a dummy for being born after the threshold, while controlling for academic cohort effects, survey year effects and for age in months. Figure 9 illustrates how the estimated discontinuity varies with the window size. The Figure shows that, for both genders, the estimated gap is positive throughout and statistically significant at the five percent level except at the smallest window size. Hence, especially for women, adding the controls significantly reduced the noise that was present in the raw means. For men the estimated gap is fairly consistent at around one percentage point while for women it is closer to half a percentage point.

Using being born after the threshold as an instrument for holding some academic qualification, Figure 10 illustrates the IV estimates of the effect of holding some academic qualification on the own economic activity rate as the window size is varied. Each IV regression also includes controls for academic cohort effects, survey year effects and for age in months. For comparison, the figure also illustrates the corresponding OLS estimates (the hatched line).

obtains primarily from when the individuals have passed their mid-20s. We have also performed a similar analysis using only individuals aged 18 to 24. However, unsurprisingly, for this age group the estimates are too imprecise to allow any meaningful conclusions to be drawn.
The results from the IV regressions obviously directly reflect the discontinuity estimates: for both genders the estimated effects are positive throughout and statistically significant at the five percent level at all window sizes except the smallest. For men the IV estimates exceed the corresponding OLS estimates, but reduce down towards the OLS estimates as the window size is reduced. For women the IV estimates are consistently smaller than the OLS estimates. Indeed, for women the IV estimates are more closely in line with the OLS estimated effect of holding some low level academic qualification rather than any academic qualification (see Table 3). Hence the IV estimates suggest that holding an academic qualification has had a substantial causal effect on the economic activity rates of the individuals in the particular cohorts. \[Need to compare results to lit here\]

**Spousal Characteristics**

So far we have found that those who, due to being born later in the academic year, were not allowed to leave school at Easter more frequently obtained some academic qualification and, later in life, were also more likely to be economically active. In contrast, we could not find any evidence to suggest that there was any impact on the probability of being married later in life, albeit the results for men was not clearcut. However, even if it did not affect the probability of being married, it may have affected the identity of the spouse. Here we consider the characteristics of spouses for the subsample of married individuals, in terms of their holding some academic qualification and their economic activity rates.

As expected there is a strong positive association between an individual’s academic qualification and that of his/her spouse. Table 4 shows the estimated OLS effect of holding an academic qualification at various levels on the probability of the spouse holding some academic qualification, controlling for academic cohort effects, survey year effects, and age in months. Hence in the regressions presented in the table, the spouse’s academic qualification is treated as a binary variable. The table shows that individuals with academic qualifications are much more likely to be married to partners who also have some academic qualification.\[More generally it is also true that there is marital sorting by qualification level. E.g. for any academic\]
probability of being married to a partner with some academic qualification increases with the individual’s own qualification level, the largest difference obtains between individuals with no qualification and a level 1 qualification. For the partners’ economic activity rates the picture is somewhat less different. Here the main difference is precisely between individuals with no academic qualification and some academic qualification: conditional on holding some academic qualification, the partner’s economic activity rate varies little with the particular qualification level held by the individual.

Consider then how spouse characteristics vary with the individual’s month of birth. Figure 11 plots the fraction of partners with some academic qualification rate by month of birth of the individual. For males there is no obvious pattern. However, for women the figure suggests that those born after the January-February threshold are more likely to be married to husbands who hold some academic qualification. Similarly, with respect to spouse economic activity (Figure 12), for men there is no clear pattern while for women there is some weak suggestion that those born after the January-February threshold are more likely to be married to husbands who are economically active.

Figures 13 and 14 take a closer look at the potential discontinuities at the threshold date. As before, we estimate the discontinuities by OLS using a dummy for being born after the threshold date and controlling for academic cohort effects, survey year effects, and age in months, and varying the window size. For academic qualifications, Figure 13 shows that, at every window size, married women born after the January-February threshold are more likely to have husbands who hold some academic qualification than are married women born before the threshold. Moreover, the difference is fairly stable with respect to the window size and is statistically significant for all window sizes except the smallest one. In contrast, for married men, while the point estimates are positive, the gap is never statistically significant. For economic activity, Figure 14 shows that the point estimates for women are all positive and stable with respect to the window size. Moreover, the gap is statistically significant at window sizes of at least three months on either qualification level j (including no qualification) a woman with qualification level j is more likely to be married to a qualification level j male than any other women, and vice versa.
side of the threshold. In contrast, for men the point estimates are very sensitive to the window size and is never statistically significant.

These findings map into corresponding IV estimates. Figure 15 shows the estimated effect of holding an academic qualification on the probability of the spouse holding an academic qualification, using being born after the January-February threshold and controlling for academic cohort effects, survey year effects and age in months. For women the IV estimates are fairly stable with respect to the window size, at somewhere between 20 to 30 percentage points – which is somewhat less than the corresponding OLS estimates (shown as the hatched line) – and statistically significant at the five percent level at all window sizes except the smallest one. For men, in contrast, the IV estimates are converge towards zero as the window size is reduced and the estimates, while generally positive, are never statistically significant. Hence the estimates suggest that, for women, obtaining an academic qualification had a positive impact on the qualification rates of their future husbands. Nevertheless, the fact that the IV estimates are lower than the corresponding OLS estimates also suggests that the observed assortative mating by qualification is, in part, due to selection. For men, the estimates suggests that holding some qualification did not significantly affect the identity of their future wives (however, as we have seen above, it may have affected their marriage probabilities).

Figure 16 shows the corresponding IV estimates of the effect of holding an academic qualification on the probability that the spouse is economically active. For women the IV estimates are again fairly stable with respect to the window size, at around 12 percentage points – which is very similar to the corresponding OLS estimates – and statistically significant at the five percent level at all window sizes of six months or larger. For men, the estimates are highly sensitive to the window size, close to zero for medium sized windows, and never statistically significant. Hence for partner’s economic activity, we draw very similar conclusions as for the partner’s academic qualification. The estimates suggest that women who obtained an academic qualification improved their chances of, later in life, being married to an economically active husband. No such effect is can be discerned for men.
Robustness [To be completed]

• Check carefully for continuity of predetermined individual characteristics with respect to month of birth. (Possibly using the GHS).

• Work on robustness against selection.

• Comparison of identification through Jan-Feb threshold v Aug-Sep threshold.

• Consider alternative specs etc.

VII Conclusions[Preliminary]

• Preliminary findings:

  – For women, education (at low level) neither increases nor decreases the probability of being married. However, it increases the probability of being married to a qualified and economically active husband.

  – For men there is a possible positive impact of education on the probability of being married, but no indication that it increases the chances of being married to a qualified wife.

  – There are several possible channels:

    1. Higher earnings capacity and/or general knowledge increases an individual’s attractiveness as marriage partner.

    2. By participating in education an individual changes the selection of people with whom he/she interacts; e.g. it is often suggested that people meet through education.

• LATE interpretation of IV estimate. The estimated effects are “local” in the sense that they should reflect the causal effects of education on marital outcomes for those whose educational outcomes were affected by the instrument. The instrument in this case simply
forced some individuals to stay on one extra term. As such it is unlikely to have affected which schools any individuals will have attended in their lives which suggests that the estimates are relatively unlikely to reflect the first possible channel.

References


Table 1: Descriptive Statistics.

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<td>(0.362)</td>
<td>(0.353)</td>
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<td>(0.305)</td>
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<td>0.104</td>
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<td>(0.304)</td>
<td>(0.317)</td>
<td>(0.305)</td>
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<tr>
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<td>0.024</td>
<td>0.027</td>
<td>0.021</td>
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<td>(0.139)</td>
<td>(0.152)</td>
<td>(0.162)</td>
<td>(0.144)</td>
<td>(0.181)</td>
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Number of Observations: 245,714 121,393 124,321 228,280 127,735 100,545

Standard deviations in parenthesis.
Table 2: Effect of being February-August Born on the Probability of Holding Academic Qualification Level j or Above by Window Size (Nb. Sign. indicators to be added!)

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<td>(0.0021)</td>
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<td>(0.0032)</td>
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<td>-0.0006</td>
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<td>40,909</td>
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<td>0.0310</td>
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<td>(0.0029)</td>
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<td>(0.0045)</td>
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<td>0.0055</td>
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<td>(0.0033)</td>
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<td>0.0014</td>
<td>0.0004</td>
<td>0.0018</td>
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<tr>
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<td>(0.0025)</td>
<td>(0.0026)</td>
<td>(0.0028)</td>
<td>(0.0033)</td>
<td>(0.0044)</td>
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</tr>
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<td>0.0011</td>
<td>0.0007</td>
<td>-0.0001</td>
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<td>(0.0021)</td>
<td>(0.0023)</td>
<td>(0.0026)</td>
<td>(0.0035)</td>
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</tr>
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<td>0.0000</td>
<td>0.0004</td>
<td>0.0005</td>
<td>0.0006</td>
<td></td>
</tr>
<tr>
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<td>(0.0011)</td>
<td>(0.0012)</td>
<td>(0.0017)</td>
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<td>153,429</td>
<td>114,754</td>
<td>78,023</td>
<td>38,097</td>
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</table>

Significance levels: ** : 1% * : 5% † : 10%.
Table 3: Effect of Holding Academic Qualifications on Own Economic Activity Rate Estimated by OLS

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<tr>
<th>Qual. Lev.</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>0.134</td>
<td>0.168</td>
</tr>
<tr>
<td></td>
<td>(56.36)**</td>
<td>(54.87)**</td>
</tr>
<tr>
<td>Level 2</td>
<td>0.160</td>
<td>0.262</td>
</tr>
<tr>
<td></td>
<td>(82.50)**</td>
<td>(107.10)**</td>
</tr>
<tr>
<td>Level 3</td>
<td>0.073</td>
<td>0.252</td>
</tr>
<tr>
<td></td>
<td>(26.84)**</td>
<td>(75.54)**</td>
</tr>
<tr>
<td>Level 4</td>
<td>0.162</td>
<td>0.343</td>
</tr>
<tr>
<td></td>
<td>(61.16)**</td>
<td>(98.50)**</td>
</tr>
<tr>
<td>Level 5</td>
<td>0.170</td>
<td>0.365</td>
</tr>
<tr>
<td></td>
<td>(35.64)**</td>
<td>(56.42)**</td>
</tr>
<tr>
<td>Nr. Obs.</td>
<td>228,280</td>
<td>245,714</td>
</tr>
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</table>

Significance levels: **: 1% * : 5% † : 10%. 
Table 4: Effect of Holding Academic Qualifications on the Probability of Spouse Holding Some Academic Qualification and on the Probability of the Spouse being Economically Active Estimated by OLS

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<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>0.243</td>
<td>0.274</td>
<td>0.109</td>
<td>0.109</td>
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<td></td>
<td>(62.94)**</td>
<td>(64.71)**</td>
<td>(23.85)**</td>
<td>(23.85)**</td>
</tr>
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<td>Level 2</td>
<td>0.264</td>
<td>0.344</td>
<td>0.126</td>
<td>0.126</td>
</tr>
<tr>
<td></td>
<td>(82.16)**</td>
<td>(99.81)**</td>
<td>(33.05)**</td>
<td>(33.05)**</td>
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<tr>
<td>Level 3</td>
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<td>0.462</td>
<td>0.136</td>
<td>0.136</td>
</tr>
<tr>
<td></td>
<td>(62.36)**</td>
<td>(96.34)**</td>
<td>(23.78)**</td>
<td>(23.78)**</td>
</tr>
<tr>
<td>Level 4</td>
<td>0.341</td>
<td>0.531</td>
<td>0.114</td>
<td>0.114</td>
</tr>
<tr>
<td></td>
<td>(80.65)**</td>
<td>(109.45)**</td>
<td>(22.70)**</td>
<td>(22.70)**</td>
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<tr>
<td>Level 5</td>
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<td>0.542</td>
<td>0.115</td>
<td>0.115</td>
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<tr>
<td></td>
<td>(49.38)**</td>
<td>(62.97)**</td>
<td>(13.72)**</td>
<td>(13.72)**</td>
</tr>
<tr>
<td>Nr. Obs.</td>
<td>98,172</td>
<td>119,893</td>
<td>99,997</td>
<td>99,997</td>
</tr>
</tbody>
</table>

Significance levels: ** : 1% * : 5% † : 10%.
Figure 1: The Distribution of Highest Academic Qualification by Month of Birth
Figure 2: Fraction Holding Some Academic Qualification by Academic Cohort

Figure 3: Fraction Currently Married Relative to Individuals with No Academic Qualifications
Figure 4: Fraction Currently Married by Season of Birth

Figure 5: Fraction Currently Married by Month of Birth for Individuals Aged 25 and Above
Figure 6: OLS Estimates of a Discontinuity in the Fraction Currently Married at the Threshold Point

Figure 7: Instrumental Variable Estimates of the Effect of Holding an Academic Qualification on the Probability of being Married for Individuals Aged 25 and Above
Figure 8: Raw Economic Activity Rate by Month of Birth

Figure 9: OLS Estimates of a Discontinuity in the Individuals’ Economic Activity Rate at the Threshold Point
Figure 10: Instrumental Variable Estimates of the Effect of Holding an Academic Qualification on the Probability of being Economically Active

Figure 11: Spouse Rate of Holding some Academic Qualification by Month of Birth of Individual
Figure 12: Spouse Rate of Holding some Academic Qualification by Month of Birth of Individual

Figure 13: OLS Estimates of a Discontinuity in the Spouses’ Academic Qualification Rate at the Threshold Point
Figure 14: OLS Estimates of a Discontinuity in the Spouses’ Economic Activity Rate at the Threshold Point

Figure 15: Instrumental Variable Estimates of the Effect of Holding an Academic Qualification on the Probability of the Spouse Holding an Academic Qualification
Figure 16: Instrumental Variable Estimates of the Effect of Holding an Academic Qualification on the Probability of the Spouse Being Economically Active