The Effects of the 2006 Tuition Fee Reform and the Great Recession on University Student Dropout Behaviour in the UK

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Abstract

This paper investigates the causal effect of the Great Recession, and an indirect conditional effect of a tuition fee reform, on the risk of students dropping out of HE. For students from high unemployment areas the effect of the recession was positive for males and females. The tuition fee reform counteracted the recession effect for males, whereas for females the reform effect reinforced the recession effect. For students from low unemployment areas, the recession had no effect whereas the tuition fee reform reduced the risk of dropout. Differences in dropout behaviour occur between high and low income groups, and between different types of university.
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1 Introduction

Dropping out of education can be costly for individuals, especially if there is an increased risk of unemployment and associated lower lifetime earnings (**?**), for universities insofar as income is reduced, and for society as a whole, especially when the state subsidy to education is high. The financial crisis, which precipitated the so-called Great Recession (late 2007-2009 in the UK), led to rising rates of unemployment especially amongst school-leavers and graduates (**?**). Substantial increases in unemployment are likely to create uncertainty regarding future employment and wage prospects post-graduation and so may have also influenced student drop out behaviour. Furthermore, countries like the US and the UK have witnessed an increase in participation rates in higher education, and dropout rates have remained high as more marginal (in terms of ability) students have enrolled on university courses. With the increase in participation rates, and associated increased taxation to finance this expansion, it is no surprise that governments should look for alternative funding mechanisms. In recent years, successive UK governments have sought to reduce the subsidy to higher education and have pushed more of these costs onto the beneficiaries of their education - the students.

A tuition fee was first introduced for students enrolling at universities in the UK in 1998/99 when they were required to pay approximately 1,000 GBP per annum. The Higher Education

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Reform Act, approved in 2004, which was effective from the academic year 2006/07, raised the cap on fees to 3,000 GBP per annum in England.[1] This increase applied equally to all universities and all undergraduate programmes. From 2006 students could defer the payment of fees by taking a Tuition Fee Income Contingent Loan (TICL) up to the maximum amount of fees being charged. Repayment of the loan was linked to income obtained after graduation, at a 9 per cent fixed interest rate for everything earned above 15,000 GBP and at a zero real interest rate. Hence, graduated students only repaid when they could afford it.[2] Nevertheless, students, parents and the wider public still perceive that students will leave university with considerable debt. In fact, Table 1 shows that in 2009, the year in which the first group of students on the TICL entered the labour market, only 128,100 students had reached the necessary threshold out of 780,000 to repay the loan. However, the perception of high student debt was reinforced in 2012 when the government allowed universities to increase their fees to between 6,000-9,000 GDP per annum, with most universities charging 9,000 GDP.[3]

Students did receive financial support through both loans and grants. From 1999 support for living costs was entirely through Income Contingent Maintenance Loans (ICML), a quarter of which were means tested. Some students also received means tested tuition fee grants. In 2004/05, to help cover the cost of participating in higher education, the government introduced the Higher Education grant, and this was fully means tested and non-repayable. However, this grant was replaced from 2006/07 by the maintenance grant, which was also an income-assessed support.[4]

Table 1 shows the evolution of fees and student support from 2003 to 2009. We note that, although students could choose to pay fees up-front, the majority took out a tuition fee ICL from 2006.[5] The percentage of students eligible and on ICMLs has remained substantially unchanged (around 80%). The number of tuition fee grants drastically decreased from 2006 and they have been partially offset by maintenance grants.

We use administrative data collected by the Higher Education Statistics Agency (HESA) to analyse the dropout behaviour of university students. These data refer to the population of university students in the UK for the period 2004-2010, and we map information on unemployment rates at the Travel-to-Work Area (TTWA) level from the National Statistics Office. In our data we know the exact month of university exit for each student, which generates time variation to dropout within each academic year. Employing standard linear models would only exploit the cross-sectional variation in dropout rates, and hence we would lose one important feature of our data. Therefore, we adopt duration models. We first estimate the determinants of the risk of dropout, including the effect of unemployment, and a 'before-after' effect of the tuition fee reform (hereafter policy reform). Students dropping out before the end of the calendar year in which they enrolled at university were exempt from the repayment of any accumulated debt, therefore, the estimation of the time to dropout allows us to evaluate whether the policy reform has induced changes in the timing of the dropout decision.

[1] The 2006 reform represented a three-fold increase in tuition fees and was targeted at students whose nationality was English or Northern Irish. Fees at Scottish universities were unchanged, but English, Welsh and Northern Irish students studying in Scotland were liable for the fee increase. Scottish student studying in England were subject to the fee increase, whereas the tuition fee reform for students studying in Wales was introduced a year later and a substantial scholarship or bursary was made available to these students.

[2] Before 1998/99 loans were repaid on mortgage style basis.

[3] They also added a tapered rate of interest which would rise to 3% depending on earnings, and the earnings threshold at which the loans start to be repaid was increased from 15,000 to 21,000 GBP. This 'debt' will be written off after 30 years.

[4] In 2016 the maintenance grant was also replaced by a loan.

[5] Tuition fee ICL were also available to pre-2006/07 entrants if they made a full or partial contribution to their fixed fees, but we observe in Table 1 that the number of these loans are now negligible.

The main purpose of this paper is to separately estimate the recession effect and the reform effect. Hence, we combine duration analysis with a number of difference-in-differences models, which exploit spatial and temporal variations in the unemployment rates at local labor market level. We assume that the "treatment" is the severity of local unemployment, measured as a relatively large increase in the local (TTWA) unemployment rate which is compared with those areas experiencing a relatively small increase (i.e. the control group). To ensure that we have more homogenous comparison groups, we also distinguish between 'high' and 'low' unemployment areas, and in each area we define the treated and control groups. We are able to identify the causal effect of the Great Recession on the incidence and timing of dropout behaviour of first year undergraduate students at English universities, by exploiting the fact that the recession impacted local labour markets in a spatially uneven way.[6]

It is difficult to identify a causal effect of the policy reform on student drop out behaviour, simply because we do not have data on students pre-enrolment, which means that we cannot model the decision to go to university or not. If the decision to participate in HE is endogenous to the decision to subsequently drop-out, which is likely, then the effect of the policy reform on the drop out decision would be biased, therefore, we argue that our estimate of the policy reform is at best a conditional effect. Nevertheless, evaluating the effect of the policy reform, and disentangling this from the effect of the recession, is still instructive for policy makers and practitioners. To obtain our estimate of the policy reform, we compare the cumulative treatment effects on the risk of dropout over two partially overlapping sub-periods (2005-2009 and 2007-2009), and we assume that the only difference between the two sub-periods is the introduction of the policy reform. Therefore, the difference between those two effects should provide an indirect (and conditional) estimate of the policy reform.

Our base, or naive, model estimates suggest that the policy reform increased the risk of dropout by 19 percent for males but had no effect for females. We also show that the hazard of dropout is not constant, tending to increase towards the end of the first year. Of course these effects are likely to be confounded by the recession effect. A richer story emerges when we apply difference-in-differences methods and distinguish between students coming from 'high' versus 'low' unemployment areas. Estimates show that in high unemployment areas the causal effect of the recession on dropout behaviour was positive, statistically significant and substantial (10-15 percent) with some differences between male and female students. The effect of the policy reform counteracted the recession effect for males, with a 2 percent reduction in the risk of drop out, whereas for females the effect was positive and so reinforced the recession effect. In contrast, and as expected, for students from low unemployment areas, the recession had no effect but the policy reform reduced the drop out rate by between 8-10 percent. We interpret these two sets of effects as reflecting debt aversion for students from high unemployment areas and increased effort amongst students from low unemployment areas.

We also present evidence of differences in dropout behaviour in high and low unemployment areas between high and low income groups, and for students who attend different types of university. Specifically, we find that for students from high unemployment areas the recession effect increased the risk of drop out by about 15 percent, regardless of family background. There is no statistically significant effect of the policy reform on students from higher income backgrounds. However, for students from poorer backgrounds the risk of drop out is lower, possibly because they have fewer opportunities in the labour market. The recession does not have a statistically significant effect in a low unemployment areas, regardless of family background. For students from poorer backgrounds

[6]We argue that students are likely to have far more information on labour market conditions in their home area, which thereby influences the formation of expectations regarding their wage and employment prospects post-graduation.

the reform effect increases the risk of dropout by 10 per cent.

In terms of the type of university attended, we find a very strong effect of the recession in increasing the dropout behaviour of students enrolled in research focused universities, whereas the effect of the policy reform reduces the risk of dropout, regardless of whether the students come from high or low unemployment areas. In contrast, for students enrolled in teaching focused universities both the recession effect and the policy reform effect are very small in magnitude and positive, regardless of the whether we consider high or low unemployment areas.

In the next section of this paper we review the recent literature on dropout behaviour. This is followed by a detailed discussion of our data in Section 3, and in the proceeding section we outline our econometric modelling strategy. The results of our analysis are presented in Section 5 which is followed by our conclusions and policy implications

2 Literature and hypotheses

2.1 A review of the literature

Models of the decision to attend university or not, and the subsequent decision to drop out or not, are based on the solution to a series of optimisation problems that are well known in the literature (**??** and **?**). Individuals maximise their expected lifetime utility by choosing their level of education, conditional on the present value of the expected lifetime wealth. Lifetime utility is a function of consumption which is affected by the individual's rate of time preference, risk aversion, the inter-temporal elasticity of substitution and the non-pecuniary benefits of education. Uncertainty is another important factor that may have an effect on drop out decisions.

With respect to debt aversion, **?** show for the US how student debt can affect graduates employment decisions. They evaluate, in a very selective US college, the effects of the replacement of students loans with grant aid to students in financial need. They find that student debt reduces the probability of accepting low-paying jobs (e.g. in education, government and non-profit sectors) and an increased probability of accepting jobs with high starting salaries. **?** offers a clear example of how psycho-social costs of debt can affect career decisions, by looking at the effects of an experiment run at the NYU School of Law. Students randomly selected in a lottery obtained income-contingent tuition fee waivers to be repaid only if after graduation they obtain a high-paying (private sector) job. Students not selected obtained tuition loans which were repaid by NYU if after graduation they decided to work in low-paying (public sector) jobs. Thus the two packages of financial aid were equivalent in terms of net present values and, according to the standard economic theory, students should have been indifferent to the lottery outcomes. However, Field finds that graduates that received the tuition fee waiver were more willing to work in low-paying jobs. This, they argue, can only be attributed to the different perception, and the associated psychological costs, of the debt horizon between the two financial packages. **?**, who extends the structural model of **?**, finds that changes in the size of government loans, which relax students' borrowing constraints, do not have important effects on degree completion rates. Johnson interprets these results as a consequence of the reluctance to borrow.

Another strand of the literature focuses on the effects of financial aid on college completion, for example **?** finds that the elimination of a student benefit programme reduced college attendance probabilities by more than a third. **?** show that the introduction of mixed financial aid (loans and grants) has increased the enrolment rate of low-income minority students. However, **?** using Danish data find that subsidies increase college enrolment but to a lesser extent compared to findings for the US. **?** employs duration models to estimate the effect on dropout of a Danish reform that

increased student grants. He finds a reduction of around 50% of the probability of dropout for third and the fourth year students.

In terms of labour market effects, there is a small but growing literature which has attempted to uncover a causal effect on high school dropout behaviour. Higher rates of (youth) unemployment have been shown to increase the risk of dropping out of high school (**?**), whereas some studies show no effect (**??**). Several authors have also found a negative relationship between unemployment and the risk of drop out (**?**). Very little work has been undertaken for university students, although **?** using data for a single cohort of HE students in the UK who enrolled in 1989-90, do find a positive effect of unemployment on the risk of drop out. However, there has been little discussion of the 'mechanisms' through which local labour market conditions, reflected by the unemployment rate, affects student drop out behaviour. We argue that students may be uncertain about their ability, the availability of graduate and non-graduate level jobs, the distribution of earnings in graduate and non-graduate jobs, as well as the possibility of short-term credit constraints during university attendance. The increase in unemployment following the recession is likely to have led to increased uncertainty amongst students but in a spatially uneven way. Indeed, **?** study the effects of the Great Recession in Italy on university dropouts exploiting regional variations in adult and youth unemployment. They find a positive effect of adult unemployment on dropout whereas youth unemployment has a negative impact; the net effect of the recession is a reduction in the probability of dropping out.

Family background, prior attainment, personal characteristics and the subject studied at university also have an effect on drop out behaviour. A study by **?** focused on drop outs from UK HE institutions in 1993 investigates the role of student-course matches and the effect of the student's peer group. Although it is difficult with this data to mitigate the reflection problem (**?**) they do provide some descriptive evidence that males with low ability peers are more likely to drop out. Students in higher quality universities are less likely to drop out. **?** analyse the effect of prior qualifications, following eight cohorts of university entrants over the period 1984-1992. Perhaps unsurprisingly, weaker students are more likely to drop out. Females were less likely to drop out, and they confirm the negative effect of university quality on student drop out behaviour. **?** assess the effect of socio-economic background using administrative data for 1st year students who enrolled at a university in 2004-05. Students from families of higher socio-economic status are less likely to drop out; interestingly, students from an ethnic minority background were also less likely to drop out. Although of less relevance to our paper, there are many more studies of drop out behaviour at the secondary school level. **?**, for instance, suggests that economic disadvantage, or family background, accounts for nearly 50% of the hispanics-whites gap in dropout rates. Studies that use more sophisticated econometric techniques, such as **?** and **?**, find a limited effect of family income on high school dropout behaviour.

There are very few studies of the decision to drop out of higher education and even fewer that investigate the duration to dropping out. Many of the studies that do exist for the UK are largely descriptive and do not assess the impact of policy reforms on drop out behaviour. An exception is **?** who evaluate the re-introduction of grants in the UK universities in 2004/05. Using a difference-in-differences approach they find that the increase in grants raised first-year degree participation (in 2005/06) by around 4 percentage points. As suggested above, and by implication, one might expect the introduction of the policy reform, which has a prospect of higher student debt, to reduce university participation possibly because of increased debt aversion.

2.2 The expected effects of the policy reform and the recession on student drop out behaviour

In this section we draw on the existing literature to determine the expected direction of the effects of the recession and of the reform on student drop out behaviour. The recession may affect dropout decisions in two opposite ways. The first is a reduction of dropout due to the lower opportunity costs of education as consequence of the higher unemployment rate, leading to an expectation amongst students that it will be difficult to find a job post-graduation. The second is an increase in dropout, due to the worsening of labor market conditions that may affect the financial situation of the family and generate a lack of liquidity for the children at university. The effect of the reform may reinforce or counteract these possible effects of the recession. Indeed, an Income Contingent Loan system provides liquidity which is not means tested or related to the family background, thus reducing the risk of dropout for non-debt averse students. On the other hand, the loan obtained during the years of study may translate into a debt which has to be repaid once the student has entered a job and received a wage above the earnings threshold. If students become more debt averse, which could arise in the case of students whose academic performance is weak or for students from poorer family income backgrounds where there is a greater reluctance to borrow, then the policy reform could increase the risk of dropout. These effects of the policy reform and the recession are likely to vary amongst students from high unemployment and low unemployment areas.

High unemployment areas. We expect that the recession effect will increase the dropout rate. This is because the relatively larger increase in unemployment creates uncertainty about individual (and parental) labour market prospects that cannot be balanced by the lower opportunity cost of remaining at university. However, the net effect of the reform in this context may reduce the probability of dropping out if the decision to study mainly depends on potential liquidity problems, which is possibly resolved by an ICL. Some confirmation of the latter interpretation would arise if we find a statistically significant negative effect on dropout rates for students from poorer backgrounds.

Low unemployment areas. The opportunity cost of education should be higher when compared to that in the high unemployment areas because there are better labour market conditions for those students who drop out. Nevertheless, it is still expected that an increase in unemployment in these areas should lead to a positive, albeit weaker effect of the recession on the risk of dropout. However, the net effect of the reform should decrease the risk of dropout, since better market conditions should lead to graduate level jobs post-graduation. However, for debt averse students it is feasible that there will be an increase in the risk of dropout, especially amongst students from poorer background, since they might seek to exploit labor market opportunities in their home labour markets immediately.

3 Data and Descriptive Statistics

We use administrative data which refers to the population of students who first enrolled at an institution of Higher Education in the UK between 2004-2010. The data were obtained from the Higher Education Statistics Agency (HESA) who had, in turn, obtained the data from each university and institute of higher education in the UK. There are several important features of these data. First, they record a student start date and end date and hence allow us to calculate the duration of stay in education in days.[7] Second, the data contains personal information on age,

[7]We have analysed the end dates to ensure that they are not determined by administrative decisions of universities. Dropping out occurs throughout the year which does not support the idea of an administrative driven process - see

ethnicity, gender, family information on parental occupation, which corresponds to broad income status, as well as information on the university attended and programme of study. Third, since the data refer to the population of students there is no attrition which is a common problem in survey data. Finally, we are able to make use of repeated cohort data for students who enrolled in HE prior to the reform (2004-2005) and post-reform (2006-2010) to investigate the hazard of exit from university.

There are various restrictions that we impose on the data. Students who enrol at a university between 2004 and 2010 are included in the analysis, however, we restrict our attention to drop out behaviour amongst first year undergraduate students. This is because most drop out occurs in the first year of study, and we believe that the determinants of dropout behaviour are likely to vary by year of study. The first year of study is the period in which students learn most about their ability and either adjust, or not, to studying away from home. Furthermore, if students dropped out before the end of December in the 1st year of enrolment they could have their accumulated debt written off. Insofar as students are aware of this rule then we should see an increase in the hazard of drop out during the first 3-4 months of study.

Only full time students are considered since the dropout behaviour of part time students is very different - part time students have a higher propensity to drop out, possibly because of work or family reasons. Students who have been registered for 6 years or more are excluded. We also exclude students who register for an undergraduate course but who have a prior postgraduate qualification. These could have been data errors and where they are not, then they are likely to be ineligible for student loans. Students aged 36 years or more are excluded from the analysis. We exclude non-EU international students since they are subject to different fee regimes and are not covered by the reforms discussed in the Introduction. Students studying in Wales are excluded because the policy reform started 1 year after that in England, that is, in 2007, and students studying in Scottish universities are also excluded because of the different fee regime. In sum, we keep 'Home' students studying in English universities. Finally, using the students home postcode we map on to the student data a time series of unemployment rate data at the TTWA level. These data refer to total monthly unemployed claimants aged 18 years old and over for the period 2004-2010.[8] Our final data set refers to over 1.8 million students.

To perform a duration analysis we need additional assumptions and restrictions. The survival time to dropout is clearly discrete, since the event of interest can happen on any day of the year. The time students become at risk of dropping out coincides with the start of the observation period. Censoring occurs at the end of the first academic year, which we assume to be the 31st of August. We also restrict the enrolment period to a twelve month time period and so the maximum length of our observation period is therefore 365 days. We further divide the duration in days into 12 periods of equal length i.e. 'monthly' intervals.

Table 2, Panel A, reports the actual dropout rates by year (cohort) and gender. It is clear that, on average, the dropout rate has remained fairly constant at around 8 per cent of the student population up to 2008 when the drop out rate began to fall. Indeed, by 2010 the dropout rate was almost 2/3 of the rate of 2004. Comparing the pre- and post-reform periods, the drop out rate was around 1.4 percentage points lower in the post-reform period. Panel A also shows that there are differences in drop out behaviour between male and female students - in the post-reform period the dropout rate for males falls slightly more (on average 1.6pp), compared to the pre-reform period, than for females (on average 1.3pp), but the absolute dropout rate for males is still higher than females in the post-reform period.

also the baseline hazards in Figure 2.

[8] We also mapped youth unemployment rates (16-24 year olds) at the travel-to-work area level as a sensitivity test.

Panel B disaggregates the dropout rate by the socio-economic background of the students' parents, where their occupation is collapsed into one of three groups - high, middle and low socio-economic groups.[9] These groups roughly correspond to high, middle and low income groups. What is clear from Panel B is that all groups exhibit a similar percentage point decline in the dropout rate following the policy reform, even though there is still a clear ranking of dropout rates by socio-economic group for each year. The decrease in the dropout rate for the low income group is slightly higher from 2008, following the onset of recession, although this group still has the highest absolute dropout rate when compared with the middle and high income groups in the same period. The differences in drop out rates between income groups are between 1-2 percentage points. Taken together these findings do not suggest any major difference in student behaviour between income groups.

In Panel B we also report, for each income group, the percentage of students enrolled each year, computed on the total number of enrolled over the period 2004-2010. We observe a small decline (around 1 percent) in enrolments, for each income group, in 2006 when the policy reform was introduced. We also note an increase in participation in HE for all three income groups during, and immediately after, the recession. Over the entire period under investigation, we observe a small increase in participation in HE for students from poorer socio-economic background, which implies that there has not been a substantial compositional change in the student body induced either by the policy reform or the Great Recession, however, we must be cautious because our socio-economic groups are highly aggregated.

The dropout rate for the broad type of university attended, classified here by the membership of various 'mission groups' is shown in Panel C. It is worth noting that UK HE is highly stratified and several 'mission' groups have emerged. The Russell Group of universities tend to be research intensive, are generally bigger in terms of student numbers and typically have a strong science base. Examples include Oxford, Cambridge, Imperial and UCL. The 1994 Group, which disbanded in 2013, focused on teaching and research and include universities such as, Lancaster and Sussex. Post-1992 universities which converted from polytechnic or college of higher education status are essentially teaching focused, and these make up the majority of our 'Other' category.[10] Not surprisingly, the type of students who attend universities in each of the mission groups vary in terms of prior educational attainment (A level scores) and socio-economic background, the greatest overlap occurring between Russell and the 1994 Groups of Universities. It is important to allow for university type when trying to estimate the effect of the 2006 policy reform on dropout behaviour. We note that drop out rates are always higher in the 'Other' group of universities and lowest for Russell group universities (see Panel C). Nevertheless, the decrease in the dropout rate in the post-reform and recession period is greatest for the 'Other' group of universities (i.e. 1.8pp) and changes marginally for the 1994 Group of universities.

Finally, Table B1, Appendix B, provides some descriptive statistics for the covariates used in our econometric analysis.

4 Econometric Methodology

Our interest is in the impact of the policy reform and recession on the incidence of, and time to, drop out in the first year of study. Given this, let M be the time in months to dropout, which can

[9]The high income group includes students whose parents have managerial and professional occupations. The middle income group includes students with parents in intermediate and technical occupations, small employers and self-employed. The low income groups includes student with parents in routine occupations and unemployed.

[10]This group of universities also includes some pre-1992 universities. Note that we also allow mission group membership to be time varying since some universities shifted from the 1994 Group to the Russell Group.

take integer values $m = 1, \ldots, M$ and consider a sample of N students ($i = 1, \ldots, N$). Define y_{im} as a dummy variable taking values 0 for all the periods a student i is enrolled at university and is censored at time M, and coded 1 in the period m when dropout occurs.

The conditional probability of dropping out for student i at period m, given that event has not yet occurred, is the discrete-time hazard

$$h_{im} = P[M_i = m | M > m - 1, \mathbf{x_{im}}] \tag{1}$$

where $\mathbf{x_{im}}$ is a vector of observed explanatory variables, which can be time-variant or time-invariant.

Following **?** we expand the data to enable us to estimate discrete-time non-parametric hazard models. More precisely, we reorganize our pooled cross-sectional data in order to have multiple rows of observations for each individual student with as many rows as the periods at risk. Our final dataset has the format of an unbalanced panel. The likelihood for binary regression models based on the expanded dataset corresponds to the likelihood for the discrete-time hazard, and the predicted hazards are maximum likelihood estimates. We define the likelihood contribution for a student i who is censored at time M as the probability

$$P[M_i > m] = \prod_{m=1}^{M} (1 - h_{im}) \tag{2}$$

The likelihood contribution of a student who drops out in period M is

$$P[M_i = m] = h_{iM} \prod_{m=1}^{M-1} (1 - h_{im}) = \frac{h_{iM}}{1 - h_{iM}} \prod_{m=1}^{M} (1 - h_{im}) \tag{3}$$

From Equations (2) and (4) the corresponding log-likelihood is

$$logL = \sum_{i=1}^{N} \sum_{m=1}^{M} y_{im} \, log(\frac{h_{im}}{1 - h_{im}}) + \sum_{i=1}^{N} \sum_{m=1}^{M} log(1 - h_{im}) \tag{4}$$

We next specify now the form of the hazard function. The most common method for modelling covariate effects for continuous-time hazard data assumes proportionality.[11] As demonstrated by **?** the discrete-time counterpart of the proportional hazards model is the complementary log-log hazard rate.

$$c \log\log(h_{im}) = \log(-\log(1 - h_{im})) = \mathbf{x_{im}}\beta + f(m) \tag{5}$$

where $f(m)$ is the baseline hazard. In our model we use a piecewise-constant function by including dummy variables for each period. Thus, within each monthly interval the duration dependence is assumed constant. In our base analysis we estimate the following semi-parametric, discrete-time, hazard model

$$h_{imt} = 1 - \exp(-\exp(\mathbf{d_{im}}\alpha + \theta_1 R_t + \theta_2 U_{it}^w + \theta_3 R_t \times U_{it}^w + \mathbf{x_{im}}\beta)) \tag{6}$$

where $\mathbf{d}$ are the duration variables for the baseline hazard, w are the local labour markets, or more specifically TTWAs[12] where student i is domiciled before enrolling at a university. U is the unemployment rate in the corresponding TTWA in the month of August before the start of academic year t. R is the policy reform dummy, such that:

[11] This implies that the covariates act proportionally on the underlying hazard function.

[12] TTWAs are self-contained local labour markets, where by definition at least 70% of the population live and work in the area. TTWA boundaries are non-overlapping, are contiguous and cover the whole of the UK.

$$R_t = \begin{cases} 1, & \text{if t} <= 2005 \\ 0, & \text{if t} >= 2006 \end{cases}$$

θ_3 is the coefficient of the interaction between policy reform and unemployment rate. It measures the variation in the conditional probability of drop out after the reform for different rates of unemployment in the TTWAs.

In our analysis, we generalize this model to account for any unobserved individual-specific effects. Ignoring unobserved heterogeneity can generate misleading inference due to inconsistent parameter estimators (**?**). In Equation (6) we therefore include a random intercept η_i, which is assumed to be uncorrelated with the vector of covariates, $\mathbf{x_{im}}$ (**?**).

$$h_{imt} = 1 - \exp(-\exp(\mathbf{d_{im}}\alpha + \theta_1 R_t + \theta_2 U_{it}^w + \theta_3 R_t \times U_{it}^w + \mathbf{x_{im}}\beta + \eta_i)) \tag{7}$$

This new specification requires an assumption on the the distribution of the unobservable individual-specific error term. **?** have provided Monte Carlo evidence that a misspecification of the random effect distribution does not bias either the duration dependence or the covariates included in the model.[13] We assume in all our estimations that the random intercept is normally distributed and constant over each time interval.

4.1 Identifying the effect of the recession

In order to distinguish a simple before-after estimator (like the one shown in Equation 7) and isolate the effect of the recession, we adopt a difference-in-differences approach combined with the duration modelling. Recall that we exploit the spatial and temporal variation in unemployment rates in the local labour market. Thus we know for each student the monthly variation of the unemployment rate in their local labour market.

The main effect of the recession is an increase in the unemployment rate, and we know that this happens in a spatially uneven way. This is well established in the spatial economics literature, and arises for a whole variety of reasons to do with differences in local aggregate demand and aggregate supply conditions. In order to undertake a repeated cross-section DiD analysis we need to identify 4 groups of students, that is, a treated and a control group observed before and after the treatment. We assume that the "treatment" is the severity of the recession defined as an increase of the unemployment rate above the national average in a given local labour market. Thus we will distinguish areas particularly hard hit by the recession from areas where there has been a relatively small variation in the local unemployment rate.[14]

In practice, we compute the average variation in the unemployment rate ($\bar{\delta}$) between all TTWAs observed for 2 periods, before and after the recession. We include in the treated group all students domiciled in those TTWAs with a variation in unemployment rate higher than the average variation for the same 2 periods ($\delta^T > \bar{\delta}$). Ideally, the control group should include students in TTWAs where the variation in the unemployment rate is zero (and hence completely unaffected by the recession). However, in practice, it is almost impossible to identify such a control group, therefore, we include students in TTWAs where the variation in the unemployment rate was stable around the average for the same two periods ($\delta^C \approx \bar{\delta}$).

[13] They also show more generally that discrete-time hazard models are robust to different forms of misspecification of the unobserved heterogeneity.

[14] This approach is close in spirit to **?** and **?** who study the effects of child care reforms on maternal employment and children outcomes, in Norway and Germany, respectively. They exploit spatial and temporal variation in child care coverage, and include in the treatment and control groups municipalities with an increase of the coverage above and below the median, respectively.

To exclusively identify the effect of the severity of the recession on dropout we need to focus on the years 2007 and 2009. These years are chosen for the following reasons: 2007 is prior to the 2008 recession and following the 2006 policy reform. Indeed, from 2007 onwards, students are only subject to the ICL system and to the increased fee regime. The year 2009 is just after the recession.

We therefore estimate the following semi-parametric, discrete-time, hazard model:

$$h_{mt} = 1 - \exp(-\exp(\mathbf{d_m}\alpha + \gamma_1 Y_t + \gamma_2 Tr + \gamma_3 Tr \times Y_t + \mathbf{x_m}\beta)) \tag{8}$$

where t is the academic year, $m = 1, \ldots, M$ time in months to dropout,

$$Y_t = \begin{cases} 1, & \text{if t} = 2009 \\ 0, & \text{if t} = 2007 \end{cases}$$

$$Tr = \begin{cases} 1, & \text{if a student is in a treated TTWA} \\ 0, & \text{if a student is in a control TTWA} \end{cases}$$

γ_1 is a year effect for all the students in all the TTWAs across the country, and corresponds to the naive before-after recession estimator. γ_2 captures the effect of the recession on the risk of dropout for students domiciled in a TTWA hit by relatively large increase in unemployment when compared to TTWAs where the unemployment remained relatively stable. γ_3 is the difference-in-differences estimate which should identify the Average Treatment on the Treated (ATT) effect of the severity of the recession on the risk of dropout, for students enrolling at university in 2009 and domiciled in TTWAs that suffered a relatively larger increase in unemployment.

To ensure that we have more homogenous comparison groups, and to better proxy the severity of the recession, we have re-classified the TTWAs observed in 2007 into 'high' and 'low' unemployment areas, and in each area we have defined the treated and control groups, as explained above.[15] Therefore, we estimate Equation 8 separately for 'high' and 'low' unemployment areas. Appendix A provides a more detailed description of how we determined the treatment and control TTWAs for high and low unemployment areas.

4.2 Indirect effect of the higher education reform

In the Introduction, we discussed the fact that to properly identify the effect of the policy reform on dropout we need to observe the participation decisions of students at the end of secondary school, in order to control for a potential endogeneity bias. This may arise, for instance, if students from lower income groups are reluctant to enter university because of the prospect of higher debt following the tuition fee reform. This in turn changes the composition of the student body, essentially reducing the group of students at risk of drop out. However, with our data we cannot evaluate students decisions, since we can only observe students that are already enrolled at university. Hence, a causal effect of the policy reform cannot be estimated. Nonetheless, in our analysis we can provide a conditional and indirect effect of the reform. This is derived by evaluating the treatment effect of the severity of unemployment on two partially overlapping sub-periods, where the only difference is assumed to be the introduction of the policy reform.

To obtain our estimate of the reform effect we adopt the same econometric approach explained in Section 4.1 and we estimate Equation 8 restricting our analysis to the years 2005 and 2009. 2005 is the year prior to the policy reform and precedes the recession, whereas 2009 is after the

[15] For example, in the high unemployment areas the treatment group includes students living in TTWAs where the variation in the unemployment rate before and after the recession is above the average variation in all 'high' unemployment areas, $\delta^T_{high} > \bar{\delta}_{high}$.

reform and is post-recession. In this context, the coefficient γ_3 in Equation 8 should pick up the effect on dropout for students coming from TTWAs hit by a relatively large increase in the unemployment rate and enrolled at the university in 2009 under the new ICL repayment system. The coefficient γ_1 should measure a total time effect between 2005 and 2009. Summing up the coefficients γ_1 and γ_3 should give an estimate of a cumulative effect on dropout, which includes the change in the tuition fee regime and the recession. We then compute the sum of γ_1 and γ_3 using the estimates previously obtained from the estimation of Equation 8 for the period 2007-2009. The latter effect, as shown above, should then only include a cumulative recession effect. We compute the difference $(\gamma_1 + \gamma_3)^{(05-09)} - (\gamma_1 + \gamma_3)^{(07-09)}$, and we interpret it as an illustrative measure of the conditional reform effect on dropout, assuming that any other change in students decision has remained constant over the period 2005-2009.

4.3 Evaluation of Treatment and Control groups

Note that the DiD analysis relies on one important assumption, that is the presence of a common trend in dropout rates between the treated and the control group in the counterfactual situation of no treatment. This assumption cannot be formally tested, however we report in Figure 1 the variation in the dropout rates for students living in the TTWAs included in our analysis and enrolled between 2004 and 2010. We show the 'high' and 'low' unemployment cases, separately, and we note that in both the treated and the control groups there is no significant variation in dropout rates from 2005 to 2007. However, we do observe a negative and significant variation after the recession in 2008. This evidence provides some confidence that the common trends assumption holds.

Table 3, Panel A, shows the number of TTWAs for each of the two time periods for high unemployment areas; Panel B reports the equivalent information for low unemployment areas. In each case we have a reasonably large number of TTWAs which is reassuring since it implies that our findings can be generalised. Furthermore, we have checked the selected TTWAs to ensure that they are not highly spatially concentrated in terms of the treated and control groups. For instance, are all high unemployment areas in the north of England and low unemployment areas in the south? Inspection of the data suggests that this is not the case with TTWAs in each of the selected treatment and control groups coming from across England.[16] We have also checked our choice of monthly unemployment rates and these are highly serially correlated as are the annual rates shown in Table 4. This implies that our findings are not likely to be sensitive to the choice of monthly or annual unemployment rate.

Panels A and B, in Table 3 also show the average dropout rates for high and low unemployment areas, disaggregated for treatment and control group. Focusing on Panel A, the dropout rates decrease on average by around 1pp between 2005 and 2009, and between 2007 and 2009. We have computed the raw difference-in-differences, and for 2005 and 2009 this is reported in the final row of the Panel and shows that for males the risk of dropout declined by a very small amount (-0.005) but increased slightly for females (0.008).[17] These raw effects should capture the recession effect confounded by the reform effect. Repeating the exercise for the post-reform/recession period (2007-09) shows that the dropout rate increased more for males than for females. These estimates should instead reflect only the recession effect. Differencing the two sub-periods leaves the possible biasing effect of the reform on the recession effect. This indirect reform effect suggests that the reduction in the risk of dropout for males was quite substantial (-3.5pp) which compares with a

[16] A list of TTWAs for the low/high by treated/control groups is available on request.

[17] Note that these differences are not strictly comparable to our estimates below because they are simply means whereas the estimates from the econometric analysis are derived from a duration model and then converted to odds ratios.

small positive effect for females.

The effects for high unemployment areas are larger than the equivalent effects for low unemployment areas, which is to be expected. In sum, the raw data suggests that we do observe differences in the effects of the recession (and policy reform) for high and low unemployment areas, as well as for males and females. Whether these effects persist once we control for covariates and unobserved heterogeneity remains to be seen.

5 Results

5.1 Base Model - The effect of the policy reform and recession on the incidence and timing of dropping out

In Table 5 we report the results of our base model estimated immediately before and after the policy reform. We include a full set of covariates together with the unemployment rate, reform and interaction effect variables for all students in all TTWAs. We only report models with unobserved heterogeneity (Equation 7), since the results for the homogenous models are almost identical.[18]

The estimated effects on most of the covariates are signed appropriately and consistent with the existing literature. There are very few differences in the estimated effects for males and females, exceptions being the estimates for mature students and students from the Asian sub-group which suggest that females are less likely to drop out; for males the effects are positive. For both males and females, students with higher levels of prior attainment have a lower risk of drop out, however, females with a vocational qualification (NVQ level 4 qualification) are more likely to drop out. Male students studying creative subjects are less likely to drop out whereas in all other subjects the effects are positively signed.

Turning now to the variables of particular interest in this paper, we can see that the log odds ratios suggest that for males the tuition fee reform increased the risk of drop out by 19 percent, whereas for females the effect is positive but statistically insignificant. Similarly, students from TTWAs with higher unemployment rates were more likely to drop out, although again the effects are statistically insignificant for females. Also note that the effect of the unemployment rate is lower in this model than the effect of the policy reform. However, for male students the interaction effect between the unemployment rate and policy reform is negative and statistically significant, suggesting that in the post-reform period students from areas of higher unemployment were less likely to drop out; the effect for females is statistically insignificant. In sum we observe different responses to the reform and the recession by male and female students which may reflect differences in their attitudes to debt or differences in labour market expectations.

To investigate further the effect of the policy reform and recession on the timing of the dropout decision we have re-estimated our models for the pre- and post-reform periods. Figure 2 plots the estimated baseline hazards for the heterogeneous models, pre- and post-reform and for females and males, respectively. There is very little difference between the estimated hazards in these two models. What is interesting, however, is that the hazard of exit from university increases slightly in the first three periods of study and then flattens off until period 8 from which it begins to increase again for the post-reform/recession period, which is followed by a further increase in the hazard in period 11. Thus, although students could avoid the accumulation of debt if they leave university before December (i.e. by period 3) of the first semester, the policy reform and recession do not appear to have substantially affected the timing of the dropout decision by first year undergraduate

[18] We also include the p-value of the likelihood ratio test of the hypothesis of zero unobserved heterogeneity. Unobserved heterogeneity does not appear to be an issue in these models.

students.

5.2 Preferred model - A difference-in-differences approach

In this section, we present estimates from a DiD approach where we identify the causal effect of the Great Recession on dropout behaviour. Recall that the treatment is a measure of the severity of the recession measured in terms of its effect on local unemployment rates. To estimate the recession effect, we consider the year when it started, late 2007, and the year 2009 (post-reform and post-recession) as the post-treatment period. We also seek to obtain the conditional effect of the policy reform. As explained in Section 4.2, holding everything else constant, the difference between the cumulative estimated effect of the year dummy and interaction effect for 2005-2009 minus the same cumulative effect for 2007-2009, should provide a conditional effect of the policy reform.

As mentioned above, more homogeneous comparison groups are obtained by separating students according to whether they come from high or low unemployment local labor markets. Table 6 reports the main results of this analysis for male and females students, separately. We only discuss the odds ratios.

Table 6, Panel A, shows the results for high unemployment TTWAs. We only focus on column two and column four, which report the estimates for the period 2007-2009. The year dummy (Year), which reflects the change in the drop out rate between 2007 and 2009, shows that for males the drop out rate decreased by around 24 percent for the whole period. For females, the effect is much larger with a 31 percent reduction in the risk of drop out for the two time periods. The treatment dummy (T) shows that in those TTWAs where unemployment was high and increased relatively more (i.e. the treated group) there was a 8 and 15 percent rise in the drop out rate when compared to the control group, for males and females respectively. These increases are both statistically significant. The variable, Year×Treated, is the DiD estimate, and this is the causal effect of the recession. The drop out rate in treated areas in 2009 compared to 2007 increased by around 10-15 percent, and the effect is larger for males than for females by around 5pp. Looking at the indirect effect of the reform, for males we find a reduction in the drop out rate by around 2 percent whereas for females it increased the drop out by 2.5 percent. Clearly these effects are much smaller than those for the recession.

A different story emerges when looking at columns two and four, in Panel B, for the low unemployment areas. For students in these localities the treatment dummy and the interaction effect variables are not statistically significant as one might expect. However, the indirect effect of the policy reform suggests a statistically significant reduction in the dropout rate for treated students, by 10 percent for males and 8 percent for females, when compared to their control group counterparts.

This set of results is consistent with the view that students from high unemployment areas, who witness relatively large increases in unemployment, are risk averse and drop out early because they see poor labour market prospects, coupled with potentially smaller future wage returns (*recession effect*). The tuition fee reform had a reinforcing effect for females which could be interpreted as a debt aversion response in addition to the potentially worsening family financial circumstances. In contrast, for males the tuition fee reform has reduced the risk of drop out. Male students are possibly less debt averse and see the supply of liquidity provided by the ICL system as a means by which they can focus on their studies and exert extra effort as a consequence. This effect is sufficiently strong to counter the recession effect.

In low unemployment areas, the recession had no effect, perhaps because students expectations about future labour market prospects were unchanged, whereas the policy reform led to greater

effort and hence a lower drop out rate.[19]

Table 7 repeats the analysis but this time we disaggregate by socio-economic group, since it could be argued that our earlier results simply reflect the effect of spatial sorting of students from high and low income groups into high and low unemployment areas. We focus on the interaction effect for the 2007-09 period (the recession effect) and the indirect reform effect. Our findings suggest that for high unemployment areas the treated groups experienced an almost identical effect on their risk of drop out regardless of whether they were high or low income - the recession increased their risk of drop out by about 15 percent (Panel A). This finding is similar in magnitude to those found in Table 6. Differences do emerge, however, between high and low income groups in terms of the indirect reform effect. For students from wealthy family background, the tuition fee reform had no noticeable effect on the risk of drop out whereas for students from low income groups the risk of drop out decreases by around 4 percent. These students may see university as a way out of their 'home' labour market circumstances and are willing to invest in their future through further study. As such they are not debt averse and see the liquidity provided by the ICL as an opportunity for a better future.

For low unemployment areas once again there was no statistically significant effect of the recession (Panel B). In contrast, for treated students from poor family backgrounds the risk of drop out increases by 10 percent compared to their control group. They behave very differently to their high income counterparts facing similar labour market prospects and also when compared to low income students in high unemployment areas. Since the recession has no effect, we conclude that students from low income groups living in low unemployment areas are more interested in exploiting the immediate returns in their local labor markets, therefore they may see the prospect of additional debt from the higher education system as a burden.

Students from the high income treated group in low unemployment areas are 13 percent less likely to dropout when compared to the control group; they do not have immediate needs to go to work thus they are not debt averse and stay on.

In Table 8 we report the findings for university mission groups where we compare our estimated effects for the so-called Russell Group with more teaching focused universities, most of which are modern universities. Recall that students from Russell Group universities are less likely to drop out when compared with students from the 'Other' group of universities. Panel A shows that the recession had a substantial effect on the risk of drop out for students from research intensive universities (i.e. increasing this by 41 percent), compared to their control group, whereas the effect for teaching intensive universities was a modest 7 percent increase, again compared to their control group. Since there is sorting of students on the basis of academic ability between the two types of universities, it is plausible that more highly qualified Russell Group university students from areas of high and rising unemployment see their labour market prospects post-graduation as being bleak and take their chances in the labour market and drop out of university. Students from teaching intensive universities see the acquisition of a degree as a worthwhile investment helping to boost their employment prospects post-graduation.

[19]We also conducted a sensitivity check where we use the youth unemployment rate to define the treatment and control groups. The results of this analysis showed that the recession had no effect on dropout rates whereas the policy reform had much larger effects when compared to the analysis in Table 6. We believe these results to be less plausible because, as we argued above, students are more likely to respond to aggregate labour market conditions than they are to the conditions in the youth labour market. Unemployed 16-24 year olds are more likely to be less skilled and less educated, and so university students will not see their circumstances as reflecting the labour market opportunities they may face regardless of whether they graduate or drop out. These results are available upon request.

Panel B shows that the effect for Russell Group universities is even larger (i.e. a 96 percent increase in the risk of drop out) in low unemployment areas, which is to be expected because employment prospects are presumably much better. However, there is no recession effect for students from teaching universities.

The indirect reform effect significantly counteracts the recession effect for students from research intensive universities reducing the risk of drop out by 21 percent in high unemployment areas, and 42 percent in low unemployment areas. So we can conclude that students from Russell Group universities are not debt averse, and being on average higher ability students prefer to exploit the liquidity provided by an ICL to improve their future labour market prospects.

For students from teaching intensive universities in high unemployment areas, the reform effect increases the probability of drop out, presumably because these students perceive the prospect of additional debt as a further burden. In contrast, there is almost no effect of the reform for students from low unemployment localities studying at teaching intensive universities.

6 Conclusion

In this paper we investigate the effects of the so-called Great Recession, and indirectly the university tuition reforms introduced in 2006, on the risk of students dropping out of HE in the UK. We develop an approach to separately estimate these two effects, and to do so we use HESA data on first year students who enrolled at a university between 2004-2010. Duration modelling techniques are combined with a difference-in-differences approach, because the hazard of dropping out of university is likely to be non-monotonic. The financial crisis and the onset of severe recession has led to a reduction in job opportunities for graduates. In our modelling, we take advantage of differences in the initial conditions in local labour markets which students faced, exploiting the fact that unemployment either increased or remained relatively stable. This variation allows us to define a treatment group, which includes students from areas severely hit by the recession, and a control group, which includes students from areas where the effect of the recession was relatively mild. To ensure more homogenous comparison groups we have also separated 'high' and 'low' unemployment areas. We are able to identify the causal effect of the Great Recession by focusing on the years before after and the recession in the post-policy reform period. The effect of the policy reform is at best conditional on student participation and is derived indirectly.

Base model estimates suggest that the policy reform increased the risk of drop out by 19 percent for males but with no effect for females. These estimates are at best descriptive since there is no attempt to disentangle the recession effect from the reform effect. However, these models do allow us to show that the hazard of drop out is not constant, tending to increase towards the end of the first year of study. When we adopt a difference-in-differences approach, our estimates show that in high unemployment areas the effect of the recession on drop out behaviour was positive, statistically significant, and substantial (10-15 percent) with some differences between male and female students. The policy reform counteracted the recession effect for males, with a 2 percent reduction in the risk of drop out, whereas for females the effect was positive and so reinforced the recession effect. In contrast, and as expected, for students from low unemployment areas, the recession had no effect but the policy reform reduced the drop out rate by between 8-10 percent.

We interpret the reduction in drop out rate as reflecting, on average, a lack of debt aversion amongst students who use the liquidity provided by the ICL system to focus on their studies regardless of their current 'home' labor market conditions. For example, students from poorer backgrounds from high unemployment areas tend to drop out less. However, in those models where the effect of the reform is negative and statistically significant then we argue that these students

face increased uncertainty about future labour market prospects and are debt averse. For example, this is likely to be the case for students who are enrolled in research focused universities, since the effect of the reform reduces the risk of drop out regardless of the level of, and change in, their 'home' unemployment rate.

The evidence presented in this paper has implications for current tuition fee policy and practice. From a policy perspective it is clear that the 2006 reform had an effect on student drop out behaviour, but the magnitude and sign of this effect depends on local labour market conditions. It is likely that the 2012 reform, which increased fees further (to GBP 6,000-9,000) may have had a more substantial effect because the perceived level of perceived debt accumulation is so much greater. Moreover, these effects are likely to vary by the socio-economic background of the student, and the type of university attended. In terms of the implications for practice, it is important that universities do all they can to support students from poorer social backgrounds through scholarships and bursaries to mitigate the effects of debt aversion, monitor and counsel against poor attendance at classes because this is often correlated with dropping out, and also continue to improve the academic and extra-curricular experience for students to give them a competitive edge in the labour market.

A The choice of treatment and control TTWAs

To construct the different treatment and control groups for the period 2005-2009, we first observe the mean unemployment rate in August 2005 (i.e. in the pre-treatment and pre-recession period) in each TTWA. We then observe the variation in the unemployment rate in the same TTWA between August 2005 and August 2009. Ideally, the control group should include TTWAs where the variation in the unemployment rate is zero (and hence completely unaffected by the crisis) whereas the treated group of TTWAs should show a positive variation.

To make the comparison groups more homogenous we re-classify the TTWAs as 'high' unemployment areas if their unemployment rate in the first period of observation is below the average unemployment of all TTWAs, whereas 'low' unemployment areas include all the remaining TTWAs.

Therefore, for the 'high' unemployment areas we include in the treated group students living in those TTWAs whose increase in their unemployment rate between 2005 and 2009 is greater than 1 standard deviation of the average variation between all TTWAs in England for the same period. Similarly, for the control group we include students from TTWAs where the variation in the unemployment rate was between -0.5 and +0.5 of a standard deviation around the average variation for the period 2005-2009. The TTWAs in the control group therefore exhibit relatively static unemployment rates around the mean.

For 'low' unemployment areas we include in the treated group students from those TTWAs with an increase in the unemployment rate between 2005 and 2009 of 0.5 of a standard deviation above the mean variation rate for the same period, whereas for the control group we include students from TTWAs whose rate is 1 standard deviation below the mean variation.

This methodology ensures that we have reasonably balanced numbers of TTWAs in the treated and control groups for high and low unemployment areas in the 2005-2009 period. We adopt the same strategy to define the treatment and control groups for the period 2005-2007.

Figure 1: Assessing the common trend assumption: 2004-2010

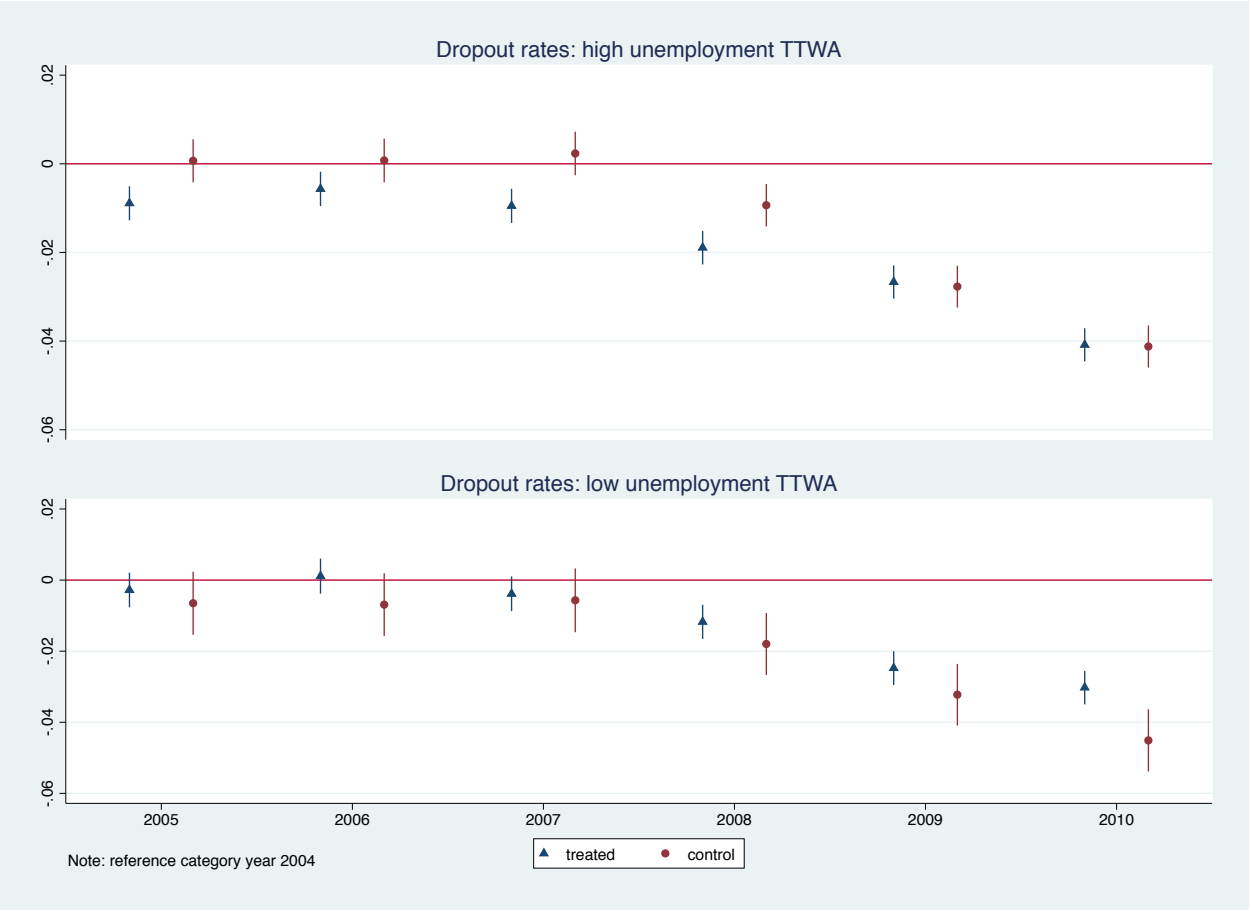

Figure 2: Estimated hazard functions before and after the Policy Reform

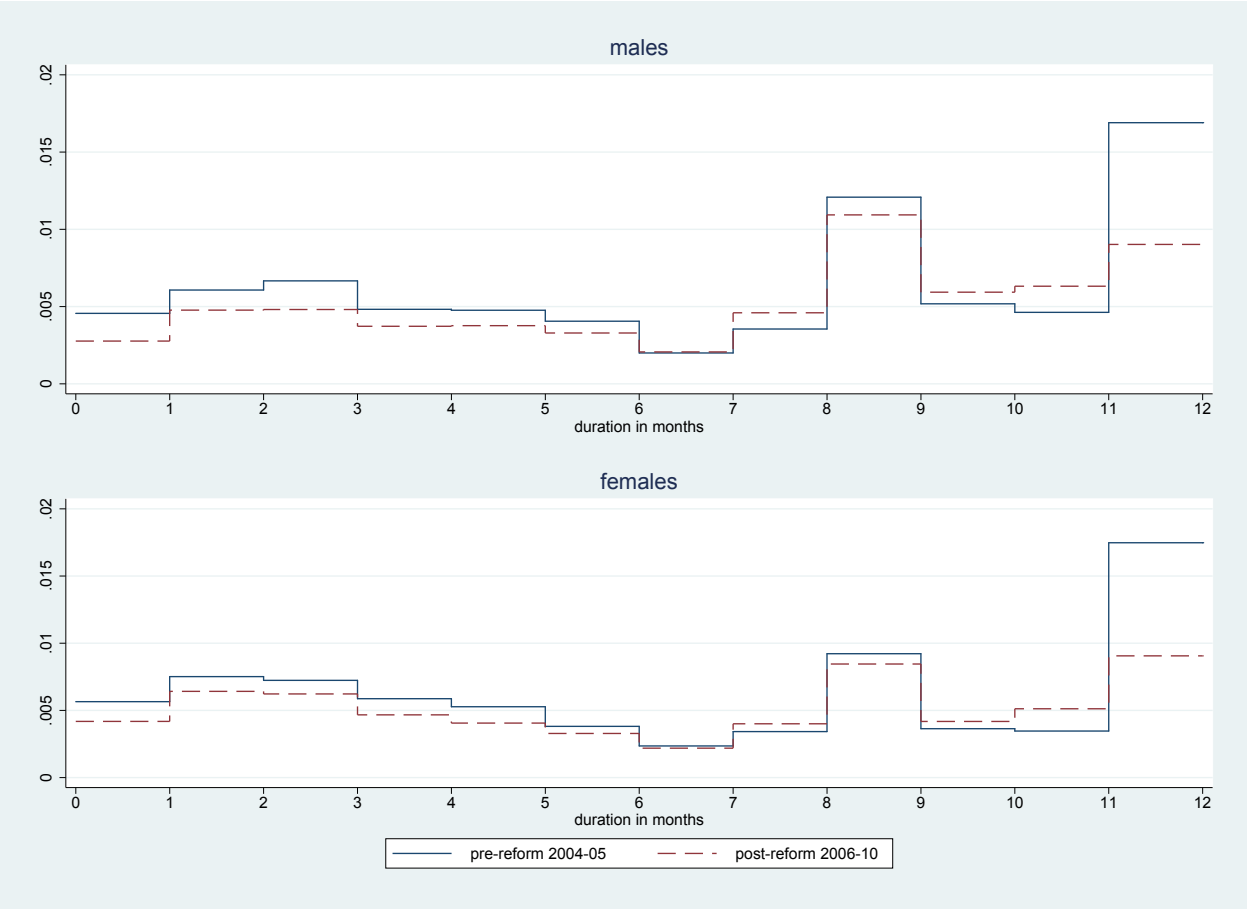

Table 1: The evolution of student financial support in the UK

	2003	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*
tuition fees	1125	1150	1175	3000	3070	3145	3225
Loans							
tuition fee loan:							
			students entering prior 2006/07				
number loans	na	na	na	158	99	32	5.6
			students entering from 2006/07				
number loans	na	na	na	234	455	666	780
maintenance loan:							
number eligible	840	874	897	905	928	963	1004
number loans	682	693	719	728	746	772	820
Borrowers above threshold (No.)	53.7	63.2	74.6	86.8	96.5	109.6	128.1
Grants							
tuition fee grant:							
number full grants	321	327	315	190	102	32	6.5
number partial grants	109	100	92	59	31	9	1.3
maintenance grant:							
full	na	na	na	98	180	155	99
partial	na	na	na	68	122	98	54
HE grants:							
full	na	83	160	127	77	24	5.2
partial	na	19	36	28	17	5	1

Source: Student Loans Company. Tuition fees are in GBP, other figures are in thousands.

na= not applicable.

Table 2: Analysis of dropout rates by year and characteristics

Panel A: Full sample and by gender

	pre-reform			*post-reform*			
	2004	2005	2006	2007	2008	2009	2010
All	0.089	0.086	0.089	0.087	0.077	0.065	0.054
N	281323	297762	287597	297016	317255	334538	339156
Males	0.097	0.093	0.094	0.092	0.082	0.072	0.061
N	126727	133390	128394	132229	141510	150028	152182
Females	0.084	0.081	0.084	0.084	0.073	0.060	0.049
N	154596	164372	159203	164787	175745	184510	186974

Panel B: Dropout rates by socio-economic background

	2004	2005	2006	2007	2008	2009	2010
High income	0.069	0.069	0.075	0.072	0.064	0.055	0.045
N	117176	113443	105606	109835	111375	122211	125536
%*	0.146	0.141	0.131	0.136	0.138	0.152	0.156
Middle income	0.082	0.081	0.083	0.083	0.073	0.065	0.055
N	54202	54676	51159	52732	56273	60423	60291
%	0.139	0.140	0.131	0.135	0.144	0.155	0.155
Low income	0.098	0.095	0.100	0.102	0.088	0.079	0.069
N	33739	36292	35101	37818	46075	42933	46391
%	0.121	0.130	0.126	0.136	0.166	0.154	0.167

Panel C: Dropout rates by type of university

	2004	2005	2006	2007	2008	2009	2010
Russell group	0.052	0.046	0.049	0.046	0.040	0.028	0.021
N	64463	64801	66064	68349	71074	71182	71144
1994 group	0.072	0.064	0.075	0.074	0.062	0.052	0.044
N	32776	33037	34960	37496	39914	40114	40818
Others	0.110	0.106	0.107	0.107	0.094	0.080	0.067
N	172751	188862	180060	184395	199481	216376	220765

First year entrants only.

*Annual percentage of students enrolled over the 2004-2010 period.

Table 3: Dropout rates by high and low of unemployment areas

Panel A: Dropout rate in high unemployment areas

group	*year*	*males*	*females*	*TWA*	*year*	*males*	*females*	*TWA*
Treated	2005	0.110	0.093	29	2007	0.101	0.099	37
Treated	2009	0.099	0.079	29	2009	0.105	0.081	37
Control	2005	0.098	0.100	26	2007	0.104	0.087	31
Control	2009	0.092	0.078	26	2009	0.078	0.067	31

DiD: 2005/09		*DiD: 2007/09*		*Difference (2005/09)−(2007/09)*	
Males	*Females*	*Males*	*Females*	*Males*	*Females*
-0.005	0.008	0.03	0.002	-0.035	0.006

Panel B: Dropout rate in low unemployment areas

group	*year*	*males*	*females*	*TWA*	*year*	*males*	*females*	*TWA*
Treated	2005	0.085	0.084	25	2007	0.092	0.094	23
Treated	2009	0.073	0.063	25	2009	0.084	0.070	23
Control	2005	0.090	0.087	34	2007	0.105	0.088	32
Control	2009	0.065	0.067	34	2009	0.068	0.066	32

DiD: 2005/09		*DiD: 2007/09*		*Difference (2005/09)−(2007/09)*	
Males	*Females*	*Males*	*Females*	*Males*	*Females*
0.013	-0.001	0.029	-0.002	-0.016	0.001

Note: sample of 1st year entrants in English universities.

Table 4: Correlations between unemployment rates

	Aug05	Aug06	Aug07	Aug08	Aug09	Aug10	Aug11
Aug05	1						
Aug06	0.970***	1					
Aug07	0.943***	0.972***	1				
Aug08	0.925***	0.953***	0.976***	1			
Aug09	0.840***	0.873***	0.903***	0.950***	1		
Aug10	0.894***	0.899***	0.910***	0.946***	0.960***	1	
Aug11	0.896***	0.906***	0.917***	0.955***	0.960***	0.985***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Estimates of the determinants of dropout behavior - 2005 vs 2006

	Males Heterogenous	*Females Heterogenous*
Policy Reform	0.172***	0.048
	(0.054)	(0.049)
log odds ratio	1.188***	1.050
unemployment rate	0.081***	0.015
	(0.015)	(0.014)
log odds ratio	1.084***	1.015
Ref×unemp	-0.042**	0.013
	(0.021)	(0.019)
log odds ratio	0.959**	1.013
Country of origin		
Scotland	-0.070	-0.197
	(0.138)	(0.136)
Wales	0.151**	0.171***
	(0.060)	(0.052)
N.Ireland	0.251***	0.219***
	(0.081)	(0.071)
Socio-economic background		
Middle income family	0.010	-0.008
	(0.026)	(0.023)
Low income family	0.100***	0.090***
	(0.030)	(0.026)
Ethnic background		
Black	0.112**	-0.128***
	(0.048)	(0.047)
Asian	0.120***	-0.210***
	(0.029)	(0.031)
Other/Unknown	0.179***	0.072**
	(0.036)	(0.036)
Prior Attainment / school		
1st quartile	-0.156***	0.030
	(0.037)	(0.036)
2nd quartile	-0.387***	-0.210***
	(0.040)	(0.038)
3rd quartile	-0.696***	-0.450***
	(0.044)	(0.040)
4th quartile	-1.197***	-0.803***
	(0.051)	(0.045)
NVQ Level 4	-0.031	0.082*
	(0.042)	(0.043)
Privately funded school	0.008	-0.082**
	(0.034)	(0.035)
Other school type	0.172***	0.169***
	(0.030)	(0.029)
Mature student	0.020	-0.133***
	(0.032)	(0.033)
Type of University		
1994 group	0.216***	0.113***
	(0.037)	(0.035)
Other universities	0.408***	0.306***
	(0.033)	(0.029)
Subject of study		
physical sciences	0.151***	0.084**
	(0.030)	(0.038)
social sciences	0.082***	0.162***
	(0.031)	(0.026)
humanities	0.021	0.120***
	(0.031)	(0.023)
creative sciences	-0.151***	0.040
	(0.034)	(0.028)
N×m	1634255	2073482
LogL	-64320.49	-79426.31
$\chi^2_{p-value}$	0.035	0.041

First year entrants only, in English universities.
$\chi^2_{p-value}$ of LR test of model with Normal distributed heterogeneity against model without controlling for heterogeneity.
Base category subject: medical sciences.

Table 6: Effect of the reform and the recession (2007-09) by low and high of unemployment areas

Panel A: High Unemployment areas				
	Males		*Females*	
	2005-2009	*2007-2009*	*2005-2009*	*2007-2009*
Year	-0.232***	-0.271***	-0.367***	-0.363***
	(0.058)	(0.035)	(0.053)	(0.033)
log odds ratio	0.793***	0.763***	0.693***	0.695***
Treated	0.104**	0.077**	-0.031	0.144***
	(0.051)	(0.037)	(0.047)	(0.034)
log odds ratio	1.109**	1.080**	0.969	1.155***
Year×Treated	0.079	0.140***	0.128*	0.100**
	(0.071)	(0.052)	(0.065)	(0.048)
log odds ratio	1.083	1.151***	1.137*	1.105**
N	478302	854045	631771	1113439
LogL	-20522.57	-34235.67	-24919.72	-40844.98
Indirect Reform Effect[a]				
	Males		*Females*	
(2005-09)-(2007-09)	-0.022***		0.025***	
	0.000		0.000	
log odds	0.978***		1.025***	

Panel B: Low Unemployment areas				
	Males		*Females*	
	2005-2009	*2007-2009*	*2005-2009*	*2007-2009*
Year	-0.370***	-0.302***	-0.342***	-0.333***
	(0.109)	(0.110)	(0.096)	(0.105)
log odds ratio	0.691***	0.739***	0.710***	0.717***
Treated	-0.121	-0.117	-0.040	0.050
	(0.086)	(0.099)	(0.075)	(0.089)
log odds ratio	0.886	0.889	0.960	1.051
Year×Treated	0.137	0.177	-0.005	0.066
	(0.125)	(0.140)	(0.111)	(0.128)
log odds ratio	1.147	1.194	0.995	1.068
N	230087	143691	293667	184169
LogL	-7869.29	-5137.06	-10333.81	-6716.25
Indirect Reform Effect[a]				
	Males		*Females*	
(2005-09)-(2007-09)	-0.108***		-0.080***	
	0.001		0.001	
log odds ratio	0.898***		0.923***	

First year entrants only in English universities.
All models contain the same control variables as in the base model.
Recession effect columns 2 and 4.
[a] $(\text{Year+Interaction})_{2005/09} - (\text{Year+Interaction})_{2007/09}$

Table 7: Effect of the reform and the recession (2007-09) by low and high of unemployment areas and by socio-economic status

Panel A: High Unemployment TWA				
	High Income		*Low Income*	
	2005-2009	*2007-2009*	*2005-2009*	*2007-2009*
Year	-0.272***	-0.378***	-0.317***	-0.276***
	(0.068)	(0.041)	(0.094)	(0.060)
log odds ratio	0.762***	0.685***	0.729***	0.759***
Treated	0.107*	0.155***	-0.008	0.111*
	(0.059)	(0.042)	(0.083)	(0.061)
log odds ratio	1.113*	1.168***	0.992	1.118*
Year×Treated	0.039	0.142**	0.150	0.152*
	(0.082)	(0.059)	(0.113)	(0.085)
log odds ratio	1.040	1.153**	1.161	1.164*
N	470076	855768	177240	291657
LogL	-16456.11	-27292.22	-8087.26	-12602.95
Indirect Reform Effect[a]				
	High Income		*Low Income*	
(2005-09)-(2007-09)	0.003***		-0.043***	
	0.000		0.001	
log odds	1.003***		0.958***	
Panel B: Low Unemployment TWA				
	High Income		*Low Income*	
	2005-2009	*2007-2009*	*2005-2009*	*2007-2009*
Year	-0.597***	-0.356***	-0.050	-0.386**
	(0.118)	(0.130)	(0.182)	(0.173)
log odds ratio	0.551***	0.700***	0.952	0.680**
Treated	-0.147*	0.109	0.018	-0.214
	(0.089)	(0.109)	(0.153)	(0.157)
log odds ratio	0.863*	1.115	1.018	0.807
Year×Treated	0.186	0.084	-0.262	-0.026
	(0.134)	(0.157)	(0.214)	(0.226)
log odds ratio	1.204	1.088	0.769	0.974
N	246254	155270	68892	43186
LogL	-7509.06	-4765.87	-2714.933	-1898.547
Indirect Reform Effect[a]				
	High Income		*Low Income*	
(2005-09)-(2007-09)	-0.139***		0.100***	
	0.001		0.003	
log odds ratio	0.870***		1.105***	

First year entrants only in English universities.
All models contain the same control variables as in the base model.
Recession effect columns 2 and 4.
[a] $(\text{Year+Interaction})_{2005/09} - (\text{Year+Interaction})_{2007/09}$

Table 8: Effect of the reform and the recession (2007-09) by low and high of unemployment areas and by university type

Panel A: High Unemployment areas				
	Russell Group		*Other Universities*	
	2005-2009	*2007-2009*	*2005-2009*	*2007-2009*
Year	-0.206*	-0.492***	-0.341***	-0.271***
	(0.119)	(0.076)	(0.044)	(0.027)
log odds ratio	0.814*	0.612***	0.711***	0.763***
Treated	0.393***	0.218***	-0.044	0.112***
	(0.103)	(0.070)	(0.038)	(0.029)
log odds ratio	1.482***	1.244***	0.957	1.118***
Year×Treated	-0.179	0.342***	0.189***	0.070*
	(0.139)	(0.105)	(0.053)	(0.040)
log odds ratio	0.836	1.407***	1.208***	1.072*
N	273176	493071	738081	1222385
LogL	-6951.399	-10085.93	-35227.63	-57309.13
Indirect Reform Effect[a]				
	Russell Group		*Other Universities*	
(2005-09)-(2007-09)	-0.235***		0.048***	
	0.001		0.001	
log odds	0.791***		1.050***	

Panel B: Low Unemployment areas				
	Russell Group		*Other Universities*	
	2005-2009	*2007-2009*	*2005-2009*	*2007-2009*
Year	-0.779***	-0.679**	-0.342***	-0.317***
	(0.264)	(0.271)	(0.076)	(0.081)
log odds ratio	0.459***	0.507**	0.710***	0.728***
Treated	0.257	-0.095	-0.147**	-0.038
	(0.167)	(0.181)	(0.063)	(0.070)
log odds ratio	1.293	0.910	0.863**	0.962
Year×Treated	0.236	0.673**	0.100	0.072
	(0.293)	(0.305)	(0.090)	(0.097)
log odds ratio	1.266	1.961**	1.105	1.075
N	118873	105326	339784	260336
LogL	-2405.378	-2198.228	-14105.53	-11505.18
Indirect Reform Effect[a]				
	Russell Group		*Other Universities*	
(2005-09)-(2007-09)	-0.537***		0.004***	
	0.002		0.001	
log odds ratio	0.584***		1.004***	

First year entrants only in English universities.
All models contain the same control variables as in the base model.
Recession effect columns 2 and 4.
[a] $(\text{Year+Interaction})_{2005/09} - (\text{Year+Interaction})_{2007/09}$

Table B1: Descriptive Statistics - Sample proportions

	Mean	*Std. Dev.*
male	0.442	0.497
English	0.956	0.205
Scottish	0.005	0.074
Welsh	0.02	0.139
Northern Ireland	0.01	0.098
EU24	0.009	0.097
White	0.753	0.432
Black	0.06	0.237
Asian	0.114	0.317
Other/Unknown	0.064	0.246
Non UK	0.009	0.097
high income family	0.415	0.493
middle income family	0.2	0.4
low income family	0.147	0.354
Level 2 and below	0.068	0.251
NVQ Level 4	0.059	0.236
1st quartile tariff score	0.252	0.434
2nd quartile tariff score	0.206	0.405
3rd quartile tariff score	0.212	0.409
4th quartile tariff score	0.203	0.402
State-funded school or college	0.792	0.406
Privately funded school	0.106	0.308
mature	0.147	0.354
Rusell group	0.223	0.416
1994 Group	0.144	0.351
Other universities	0.633	0.482
Medical sciences	0.224	0.417
Physical sciences	0.154	0.361
Social sciences	0.204	0.403
Humanities	0.268	0.443
Creative sciences	0.151	0.358