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The Impact of Higher Education
Finance on University Participation
in the UK

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Abstract: In this paper we estimate the separate impacts of upfront fees, grants and maintenance loans on UK higher education participation. We use the panel data element of Labour Force Survey data on the university participation decisions of 18 year olds, covering the period 1992-2007, which saw great variation in HE finance, most importantly the introduction of up-front tuition fees and the abolition of student maintenance grants in 1998 and major reforms of 2004 in which maintenance grants were re-instated and up-front fees were replaced with deferred fees of £3000. To test the robustness of the results, and to help deal with potential measurement error, we create a pseudo-panel of participation by UK region over time and test a number of specifications. Our findings show that the impact of upfront tuition fees in 1998 had a small negative impact on participation among high income groups, while the package of reforms introduced in 2006 had no impact on participation, largely because tuition fees were accompanied by large increases in loans and grants.

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1. Introduction

The subject of how to finance Higher Education (HE) has been high on the agenda of successive UK governments since the 1960s. The UK has moved from a situation where the taxpayer footed the entire bill for HE, to a system where HE participants contribute part of the cost. This so-called ‘cost-sharing’ has always been plagued with controversy, with fears that it would lower participation, particularly among youths from low income backgrounds.

The first most dramatic changes in UK student finances occurred as a result of the 1998 Teaching and Higher Education Act, whereby tuition fees were introduced for degree courses for the first time ever. Maintenance grants were reduced substantially and subsequently abolished and replaced by maintenance loans in 1999. Eight years later, in 2006, another substantial policy change occurred as a result of the 2004 Higher Education Act: the introduction of deferred fees, considerably higher than before, for all students, regardless of background. These so called “top-up” fees were completely offset by an accompanying fee loan to be repaid after graduation, and so represented a further major shift. Maintenance grants, which were re-introduced for the poorest students in 2004, were also significantly increased in 2006.

Perhaps unsurprisingly, advocates of widening participation opposed the introduction of tuition fees and the replacement of grants with loans, claiming that this would only serve to deter youths from lower income backgrounds from going to university. On the other hand, many economists argued that requiring students to contribute to their higher education costs was important for efficiency and equity reasons (Greenaway and Haynes, 2003; Goodman and Kaplan, 2003) and that the wage gains associated with a degree would mean youths would be unlikely to be put off by the increase in upfront costs.

However, despite years of debate and further major policy changes (for a summary, see Barr and Crawford, 2005), there remains little evidence on the extent to which support in the form of maintenance grants and loans encourage students towards higher education, or tuition fees dissuade them from it. This paper is the first UK study to provide evidence on the causal impact of tuition fees and support on university participation in the UK. It exploits the exogenous variation in HE funding policies induced by the major reforms mentioned above – along with some other variation occurring over time as a result of less-publicised policy choices – to estimate the effects. It uses the panel element of Labour Force Survey (LFS) data from 1992-2007 – a period of great variation in higher education finance, described more fully in section 3. The main result of the paper comes from a model in which we pool sixteen years of data on the (first-year – i.e. at age 18-19) university participation decisions of youths. During this period, upfront means-tested tuition fees were introduced, and upfront means-tested grants were abolished and then re-introduced. We exploit differences in parental income levels by region (measured in the year prior to possible university participation), which naturally give rise to variation in grants, loans and fees by region. Using this variation, we form a pseudo-panel of participation by region over time and apply standard panel data techniques to obtain estimates

of the impacts of grants and fees on participation. Since we suspect that participation decisions are impacted by anticipation effects arising from prior knowledge, we estimate a dynamic model including two lags of participation as dependent variables. Our results indicate that a £1,000 increase in fees results in a 4.4ppt decrease in university participation, while a £1,000 increase in loans results in a 3.2ppt increase in participation, and a £1,000 increase in grants results in a 2.1ppt increase in participation. These findings are comparable, but of a slightly lower magnitude to those reported in US literature.

Understanding the link between participation and HE finance is important from a financial perspective. Despite the increasing share of the financial burden being borne by students, UK government spending on the HE system continues to grow – in 2007, estimated spend was £918m on maintenance grants, £349m on student fee loans and £564 on maintenance loans, as well as a further £509m on loan administration.¹ But there is little evidence that these subsidies have any real impact on university attendance.

Separating out the effect of fees and grants is also important for policymakers going forward. Historically in the UK, HE policymakers have introduced packages of reforms, affecting both major elements of HE finance, grants and fees. However, if, as is likely, future policymakers adjust just one element of HE finance, then knowing how this may affect participation is of key importance. Previous related papers in the UK have focused on responses to a set of particular reforms, most notably the 1998 ones, rather than on the separate effects of the levels of fees and grants on participation over time. Blanden and Machin (2004) examine university participation rates by parental income before and after the 1998 reforms. They find that degree attainment became more closely linked to family income as participation in HE expanded between the 1980s and 1990s. However, they find no evidence that this gap in participation was related to the cost of HE. Evidence from a subsequent paper (Blanden and Machin, 2008) indicates that the link between degree participation and family income, while still strong, was static for those obtaining a degree between 1993-2003. Similar evidence of this nature comes from Galindo-Rueda et al (2004), who look at changes in university participation by parental income, over 1994-2001. Their results also highlight the large gap in participation by income background during the past decades, and they also conclude that this gap cannot be ascribed to the 1998 reforms.

Rather than examining participation responses to a particular set of reforms, we advance on these studies by untangling the separate impact of grants, loans and fees, and their direct relationship to HE participation. We accomplish this by constructing individuals' grant, loan and fee obligations (which can be calculated using each respondent's parental income data and the year they are eligible for university) and using variation in tuition fee, loan and grant policy over time through the changes in policy highlighted above, and across income group due to means-testing rules, for identification.

¹ All in 2007 prices. This does not represent the amount of money lent to students, but the future cost of subsidizing and writing off student loans issued in that year as well as management of the student loans stock (DfES departmental report 2007)

Closely related to our work is the sizeable body of US literature estimating the causal effects of grants and fees on HE participation. Kane (1994) exploits between- and within- state variation in US public spending on tuition fees to estimate the impact of tuition fee costs on university attendance. He finds that a \$1000 increase in tuition fees (\$1999) leads to a 3.7ppt decrease in attendance of black 18-19 year olds. Kane (1995) also finds evidence of reductions in HE participation as a result of increased fees. His fixed effects methodology implies a \$1000 increase in fees leading to a 2.4ppt decrease in participation.

Dynarksi (1999) exploits a policy change in 1982, whereby HE financial aid was withdrawn from children with a deceased, disabled or retired father. Using a difference-in-differences methodology to estimate the impact of aid on attendance, she finds that the effect of the reform is to reduce HE participation by 3.6 percentage points. Kane (1995) also looks at the impact of the Pell Grant aid system, but finds no impact on participation, while Sefton and Turner (2002) find a small impact of Pell Grant eligibility of 0.7 percentage points per \$1000 of aid (although of a restricted sample of mature students) in their fixed-effects estimation.

Hemelt and Marcotte (2008) point out that little research of this nature has been carried out in recent years, making their paper a useful update. Their fixed effects methodology utilises significant variation in tuition fees within institution. They find similar elasticities to Kane in the US.

The identification strategy used in Nielsen et al (2008) is very similar to ours. They exploit the combination of a kinked aid scheme and a reform of the student aid scheme to identify the effect of direct costs on college enrolment in Denmark. Though they find a significant positive effect of aid on enrolment, it is lower than previous studies at just over 1 ppt.

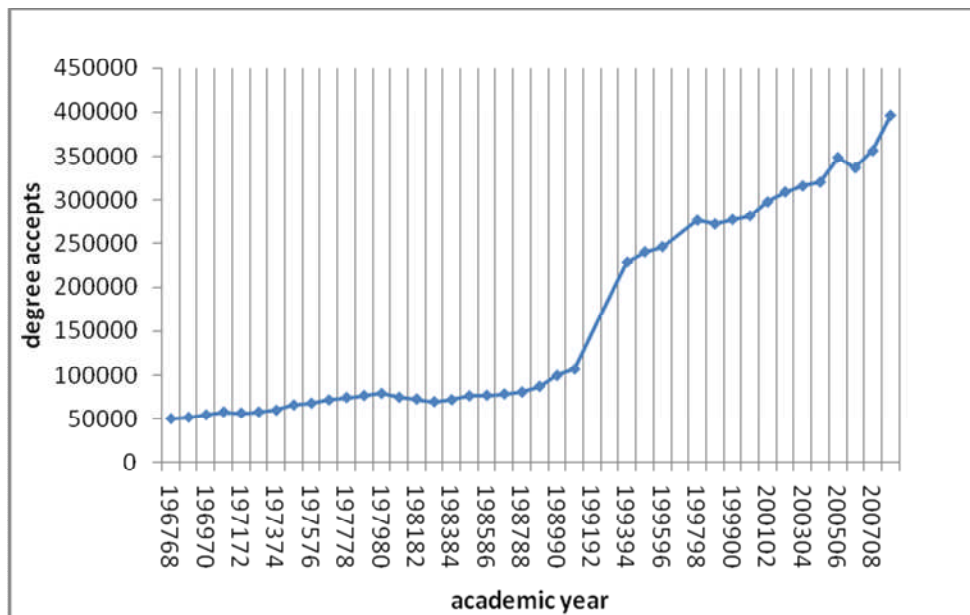
While these results relate to non-UK student aid and fee policies, the results all suggest that the levels of grants and fees set by the government play an important role in affecting HE participation decisions. Our paper consolidates this evidence even further in a different setting, the UK.

The paper proceeds as follows. In Section II, we provide more background on the HE finance reforms that took place in 1998 and in particular which types of students were most affected and how. Section III describes the data that we use in the analysis. Section IV describes our estimation strategy and 'pseudo panel' approach, while Section V presents the main findings of this analysis. Section VI concludes with implications of the results for UK higher education funding policy.

2. HE Finance in the UK, 1960 – 2009

The UK Higher Education sector has undergone a major expansion in recent decades. Student volumes have more than quadrupled, rising from around 100,000 full-time equivalent (FTE) students in the 1960s to just under 2 million by 2007.² Figure 1 illustrates the dramatic increases in entry to degree programs by academic year.

Figure 1: Degree Accepts (vol) by academic year (HESA)



This large increase in university entry and participation occurred intermittently. In the 1960s the recommendations from the Robbins Report³ (1963) resulted in a dramatic expansion of the sector as all colleges of technology were reclassified as universities, and 17 new universities were built. Further increases in participation occurred during the 1980s as the economy shifted towards the service sector and relative wages for graduates improved. The establishment of the GCSE in 1988 led to significant improvements in staying on rates, in turn encouraging more youths to enrol in university (Blanden et al, 2003). The reclassification of HE institutions in the early 1990s, in which polytechnics were given university status along with additional funding, led to a further increase in university places which were filled by rapidly growing demand.

However the large rises in participation were not matched with increases in university funding, so by 1997 the HE sector was in financial crisis: funding per FTE student had fallen to a historic

² All UK domiciled Higher Education students (HESA) .FTE student Full-time equivalent (FTE) data represents the institution's assessment of the full-time equivalence of the student instance during the reporting academic year. FTE data is based on the HESA session population, and includes writing-up students.

³ Officially known as “*Report of the Committee Appointed by the Prime Minister under the Chairmanship of Lord Robbins*”

low of £4,850⁴ (from £8,000⁵ per student at the end of the 1980s). The Dearing Report (2007)⁶ was commissioned by the government to recommend ways to tackle the funding crisis as well as look at the issue of widening participation; despite the increases in enrolment, the gap between rich and poor was still very wide in comparison to other developed countries (Barr and Crawford, 1998), and rather than narrowing, it was widening (Blanden et al, 2005).

The principal recommendation of the Dearing Report was to introduce upfront means-tested tuition fees of £1,200 in 1998. The reforms also abolished grants (not recommended by the Dearing Report), and replaced them with higher maintenance loans for eligible students. This latter reform was fully phased in by 1999 (Goodman and Kaplan, 2003, Barr, 2004).

So in 1998, for the first time ever in the UK, some students had to pay upfront fees to attend university. Importantly for our identification, fees were means-tested on the basis of parental income, thus inducing variation in fees for the period 1998 through 2005. We exploit this to estimate the impact of fees on participation in HE. The fee reform affected all but the poorest students - around 56% of students were eligible to pay at least part of the fee - and the nature of the means-testing is shown in Figure 2. Fees are a non-linear, discontinuous function of parental income, as shown in the formula below. We effectively use this variation in fees across income levels (induced by the non-linear, discontinuous means-testing of fees) to identify the effects of fees on HE participation.

$$F = \begin{cases} 0 & \text{if } Y_{i,t-1} < \text{£}21,475^7 \text{ OR } t < 1997 \\ 45 + (Y_{i,t-1} - 21,475)/9.5 & \text{if } (Y_{i,t-1} \geq \text{£}21,475 \text{ AND } Y_{i,t-1} < \text{£}32,000 \text{ AND } t > 1997) \\ \text{£}1,150 & \text{if } Y_{i,t-1} > \text{£}32,000 \text{ AND } t > 1997 \text{ \& } t < 2006 \end{cases}$$

We use this formula to predict the amount of fee a youth *would be* eligible for were (s)he to attend university the following year. In each year, a slightly different threshold is used.

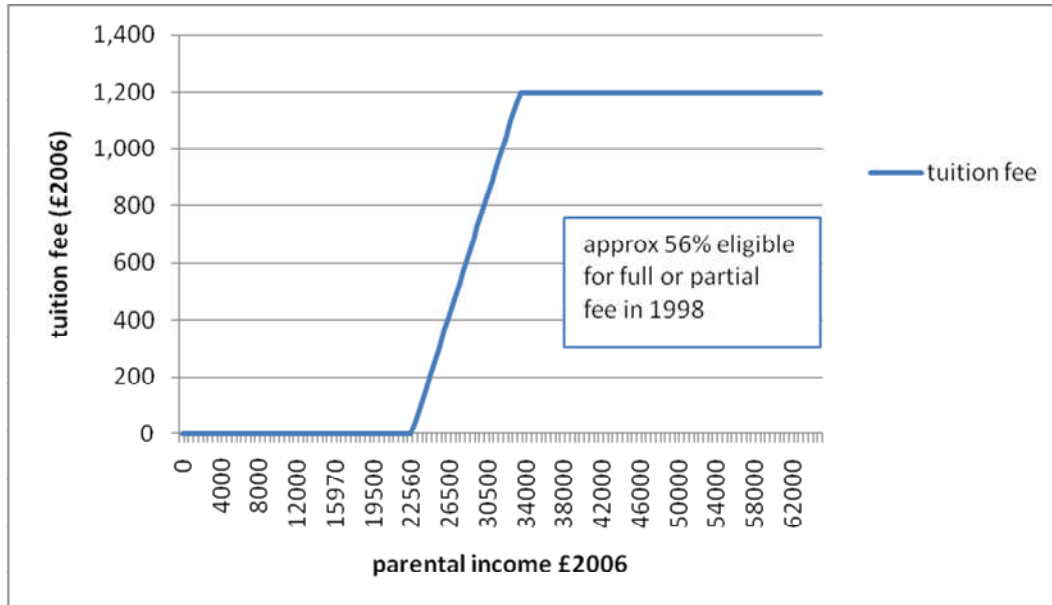
⁴ All figures that follow are in 2006 prices unless otherwise stated

⁵ Source: Carpentier, Institute of Education, University of London.

⁶ Formally known as “*The National Committee of Inquiry into Higher Education*”

⁷ Monetary amounts are in nominal prices for 2004/05, for illustration. Thresholds are updated annually with inflation.

Figure 2: Tuition Fee Obligation by Parental Income, 2004/05



In 1999, Scotland was granted devolution and in 2000 abolished tuition fees for all Scottish students. In 2001 grants were restored to Scottish students.

By 2004 UK participation had increased significantly, but the Government became again concerned that participation from the working class had not risen. It was also widely agreed that the student support package was still too small (Barr, 2004). A further concern was that UK universities were still under funded compared with the rest of the OECD, and hence lacking in quality (Greenaway and Haynes, 2003). The Government therefore began to look at ways to improve on the post-Dearing reforms.

This debate resulted in the 2004 Higher Education Act, in which upfront fees were abolished and replaced with a deferred fee, to be implemented in the 2006/07 academic year. In contrast with the set £1,200 fee, the new fee was to be variable up to £3,000 with the universities themselves to decide how much to charge each student (Dearden et al, 2004; 2008). Unlike the upfront fee, this fee was not means-tested. However, as we already observe a long history of tuition fee variation across income groups, plus the large increase in tuition fees occurring in 2006 for all groups, we are able to extend our model to include the 2006 reform in fees⁸.

A further important set of policy changes to occur over the observed time period involved maintenance grants. In 1998 maintenance grants were halved, and subsequently abolished in 1999. This affected all but the richest students – around 58% of those studying in 1999, and the means-testing is shown in the formula below. However, in the period before 1998 the real value

⁸ Note, the 2004 act did not apply to Scottish students, and following devolution in Wales in 2007, the Welsh government chose to retain the £1200 fee for Welsh domiciled students, providing them with an £1800 voucher to cover the additional fee cost.

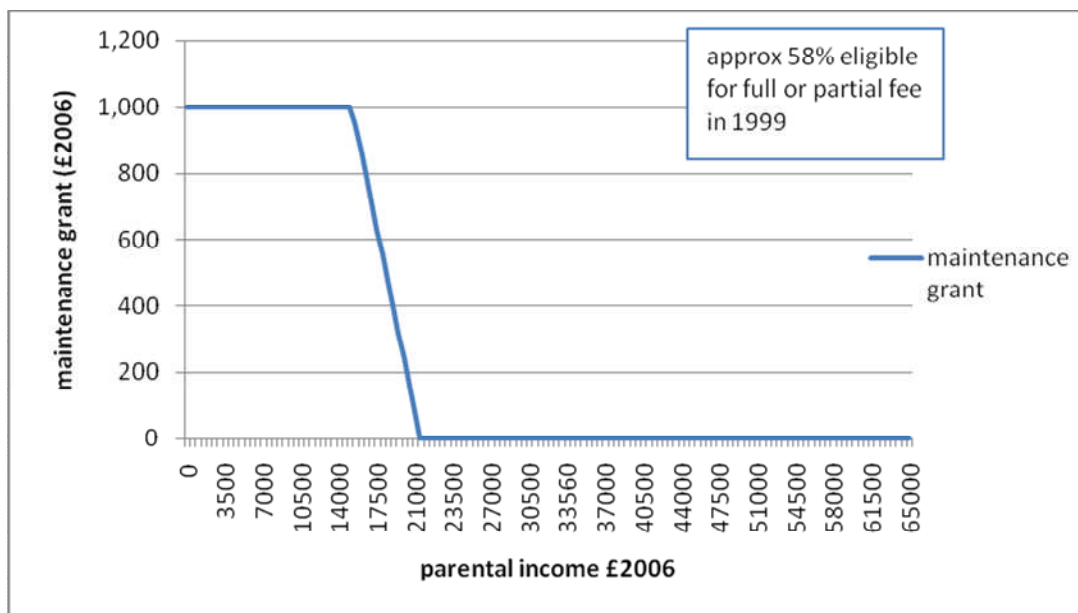
of grants had been eroding every year, since they were frozen in real terms. Also, maintenance grants were re-introduced in 2004 and then extended in 2006, generating even more variation in grants than in fees. We exploit these sources of variation to estimate the effect of grants on HE participation. The formula below shows the calculation for grants:

$$G = 1000 \text{ if } (Y_{i,t-1} < \pounds 15,200 \text{ AND } t > 2003 \text{ AND } t < 2006)^9$$

$$= 1000 - (Y_{i,t-1} - 15,200) / 6.3 \text{ if } Y_{i,t-1} \geq \pounds 15,200 \text{ AND } Y_{i,t-1} < \pounds 21,185 \text{ AND } t > 2003 \text{ AND } t < 2006$$

$$= 0 \text{ if } Y_{i,t-1} > \pounds 21,185 \text{ OR } (1998 < t < 2006)$$

Figure 3: Maintenance Grant Eligibility by Parental Income, 2004/05



During the time period of observation, there was also considerable variation in maintenance loan amounts. Maintenance loans rose throughout the 1990s as maintenance grants were reduced, and also were dramatically increased as a result of the 1998 reforms. At this point they also became partially means-tested. Obviously loans have a major impact on the up-front costs of going to university and will therefore be crucial in youths' participation decisions. We therefore also exploit these sources of variation to estimate the effect of loans on HE participation in a similar way as grants and fees. However, it should be noted that here we simply enter the upfront value of the loans, grants and fees that individuals are eligible for into the model and are agnostic about the extent to which people discount the future – i.e. how much individuals take account of the fact that maintenance and fee loans have to be repaid. The resulting coefficients should guide us to the extent to which discounting (and indeed loan and grant uptake) takes place. If students discount the future and/or take up of loans is less than 100% then we would expect the coefficient on loans to be smaller than that on grants and fees, since loans must be repaid at some point in the future. In practise, however, we would expect individuals to put less

⁹ See footnote 7.

emphasis on the fact that they have to repay income-contingent loans, since government loans of the type discussed here are heavily insured in that they are only repayable once the individual is earning over a certain amount, and only a small percentage of income must be repaid each month. These loans are therefore very different to other types of debt such as credit card debts that are not income-contingent.

Loans were also, obviously extended in 2006 as fee loans were introduced to cover the deferred fee of £3,000. We create a composite loan series which incorporates both fee and maintenance loans in order to be able to extend this series beyond 2005. Thus, we treat fee and maintenance loans as a single entity. We believe this is plausible since loans were extended in 1998 as upfront fees were brought in, and anecdotal evidence suggests that while there were no fee loans, individuals simply used their maintenance loan to pay for their fee (since the fee was upfront, it effectively reduced upfront benefits to those students who were eligible for it).

Table 1 summarises the variation in fees, loans and grants experienced over our time period of interest. Here we present variation by individual according to government means-testing categories themselves – those receiving “full support” are the lowest income students (i.e. those who are eligible for the maximum grant, when available). Such students by virtue of being from low income backgrounds are never eligible to pay a fee. Those receiving “partial support” are those the government entitles to some amount of grant (when available) which is less than the maximum, and obliges to pay some amount of fee (when there is one), which is again less than maximum. Finally, those categorised as “no support” never receive a grant, and are always obliged to pay the full fee whenever it is in place. Each group always receives a maintenance loan of varying size, and each group received a full £3000 fee loan from 2006 onwards. We will explore these policy groupings in more detail in Section 3.

Table 1: Average Grant, Fee and Loan Amounts by Year and Policy Group (£2006)

GRANTS		policy group		
Year		full support	partial support	no support
Percentage of participants	in each group ¹	32%	23%	27%
1997		1995	1316	0
1998		919	796	0
1999		0	0	0
2000		0	0	0
2001		0	0	0
2002		0	0	0
2003		0	0	0
2004		1041	102	0
2005		1005	98	0
2006		2700	1429	0
2007		2687	1398	0

FEES		policy group		
Year		full support	partial support	no support
Percentage of participants	in each group ¹			
1997		0	0	0
1998		0	647	1200
1999		0	684	1200
2000		0	672	1200
2001		0	575	1200
2002		0	607	1200
2003		0	572	1200
2004		0	556	1200
2005		0	599	1200
2006		3000	3000	3000
2007		3000	3000	3000

LOANS		policy group		
Year		full support	partial support	no support
Percentage of participants	in each group ¹			
1997		1632	1644	1682
1998		2849	2769	2715
1999		3470	3387	2715
2000		3515	3436	2737
2001		3505	3480	2738
2002		3490	3463	2722
2003		3474	3445	2691
2004		3455	3440	2745
2005		3414	3399	2654
2006		5551	5794	5853
2007		5514	5716	5895

¹ Average over 1997-2007; totals may not add to 100% due to those with unknown parental income.

As described in Table 1, in a similar vein to Hemelt and Marcotte (2008), we are considering fairly large increases in fees for some groups – for example from zero to £1200 in 1998 for the “no support” group, and from zero to £3000 in 2006 for the “full support” group. We observe anticipation effects in the data in 1997 and 2005 as youths learned of these changes early and

entered HE immediately, presumably to avoid the fee. We therefore use a dynamic specification to account for these anticipation effects. This will be fully described in Section 4.

3. Data

The objective of this paper is to estimate the impact of tuition fees and maintenance grants on university participation in the UK. To identify the effects, we use policy induced variation over time and across income levels, as will be further explained in section 4. As discussed in section 2, the main policy reforms occurred in 1998, whereby upfront fees were introduced and grants abolished, and in 2006 when deferred fees were introduced and maintenance grants were significantly increased. However, over the period since the early 1990s, grants had been eroding over time, so we also exploit this variation. Also, we exploit a reform in 2004 in which maintenance grants were re-introduced in England and Northern Ireland in 2004.

One of the first challenges we faced was in constructing the appropriate sample and the key variables of interest. Those entering university are always subject to the finance policy in place in their first year of entry and subsequent policy changes do not affect them. We therefore require information on the sample of youths eligible for *their first year of university* (i.e. at age 18/19). This is to ensure that we know the HE policy they are subjected to. We take these to be people who are of the appropriate ‘academic age’ for first year of university (as determined by precise date of birth)¹⁰, whatever their education background. This is a somewhat limited sample of university participants who can, obviously, be any age, but ensures that we have accurate information on the HE finance policy they were subject to at the time.

Along with this information, we also need to observe their parental income in order to calculate the amount of fees, loans and grants they *would be* eligible for were they to go to university. Note since we do not observe take-up of grants and loans, we model students’ behaviour based on what they are eligible for – i.e. ‘intention to treat’, which is more at the heart of policy makers’ concerns.

We found that the main issue is that few datasets observe people living at home in the year before they are eligible for university, along with their date of birth and their parents’ income, which is what is used to determine grant and fee levels. Moreover, datasets that successfully follow that specific individual into university or otherwise, a year later, are even harder to come by! After investigating three surveys -the British Household Panel Survey (BHPS), the Family Resources Survey (FRS) and the Labour Force Survey (LFS) –the LFS was the only one that fulfilled these criteria and contained adequate sample sizes to enable robust estimation. This is a quarterly survey in which detailed information is collected from 60,000 households every quarter. It has both cross-sectional and longitudinal elements – households are interviewed for 5 consecutive quarters and then removed from the panel and replaced. We use LFS data from 1992 through 2007 in all that follows.

¹⁰ For more information on the English school admissions entry criteria see <http://www.teachernet.gov.uk/management/atoz/c/compulsoryschoolage/>

We use this data set to create an accurate picture of university participation in the following way. Using the first wave of the survey, we use academic age information to assess whether the individual is eligible for university in the following year. If so, we obtain their parents' income data and use this to calculate their fee and grant levels. We then observe them in wave five a year later – the first year in which they are eligible for university – and can see whether they are a HE participant or not. If an individual has moved out of the home we only observe him/her if (s)he is in HE and living in a hall of residence. If (s)he is living in private accommodation (whether in HE, working or otherwise) we no longer observe him/her, as (s)he is no longer considered to be part of parents household. However, such individuals are included in the survey as independent households – we are therefore able to observe their university participation decisions but not their parental income (since the parents of those living independently are never interviewed and no questions are asked about an independent person's parental income). Fortunately, the proportion of such individuals is quite small, comprising around 11% of our sample. For these individuals, we estimate fee, loan and grant eligibility on the basis of their own characteristics, using the year of university eligibility for identification. The sensitivity of this approach is tested by excluding them from the model completely and the results are found to be similar (see Dearden et al 2010 for a detailed sensitivity analysis).

Another potential issue with our parental income data is that some individuals' parental incomes are observed only in the year in which they go to university, rather than the year before. This is true of all individuals in the LFS pre-1996, in which income information was only recorded in wave 5, as well as some individuals for whom the information is missing in wave 1 but not in wave 5. For these individuals, we impute their lagged parental income based on their current wave 5 income, adjusting for inflation. We test for robustness of this approach post-1996 by imputing lagged income in this way, for those whose income we observe in both waves, and measuring the correlation. We find the imputed and real incomes for wave 1 to be highly correlated, to the tune of 85%.

The sample of potential participants is divided into three groups based on their eligibility for different elements of the HE finance system, which is solely a function of parental income in the year prior to first year eligibility for university (i.e. at age 17-18 when ideally living at home). The groups are as described in Section 2, Table 1.

1. 'full' support: those whose parental incomes entitle them to the *most* generous support: eligible for a full grant (relevant pre-98, post-04) or fee exempt (relevant post-98 but pre-06); joint annual parental income \leq £17,000 in real prices.
2. 'no support': those whose parental incomes entitle them to the *least* generous support: not eligible for any grant (relevant pre-98 and post-05); eligible for full fees (relevant post-98); joint annual parental income of around £37,000 or more in real prices.
3. 'partial support': those in the middle - parental incomes render them eligible for support in between those of the previous two groups. Eligible for a partial grant (relevant pre-98 and post-

05); eligible to pay partial fees (relevant post-98); joint annual parental income of £17,000 - £37,000.

As discussed, a further important factor, is the level of maintenance and fee loan entitlement which was also changing over the period of time in question. All three groups are eligible for a loan of between £300 and £6,000 (2006 prices). As mentioned, a fourth 'missing' income group is also included in all models.

The reasoning for this policy categorisation is as follows:

(1) Each group is affected predominantly by only one element of the reforms in question, which makes it easier to draw conclusions based on their behaviour. Figures 2-4 illustrate this point – average eligibility for grant, fee and loan differs by both academic year and parental income. For example Figure 4 shows youths from the “full support” group. The chart shows the constant erosion of real grants throughout the 1990s until grants were finally abolished in 1999 and then restored in 2004, and extended in 2006. Individuals in this group are not eligible for fees during the period up to 2005, but then become eligible for fees in 2006. Loans are increased more or less in line with the erosion of grants (underlining the importance of controlling for loans) and then increase dramatically in 2006 as the fee loan is introduced. By contrast, figure 6 shows fee and aid eligibility for individuals from the “no support” group. These individuals are never eligible for grants, by definition, but are eligible for the full £1,200 fee introduced in 1998/99 and also experience increase a large increase in loans at this time, and a further large increase in 2006 as deferred fees are introduced. This illustrates the variation in policy arising as a result of means-testing, but is also useful for the purpose of identifying the impact of the reforms, since each distinct group clearly is affected in a different way – the low “full support” group by the abolition of grants, and the “no support” group by the introduction of fees.

(2) government/policy tends to focus on participation among groups of this nature

(3) this provides more variation in the data. These groups will hereon be referred to as 'full', 'partial' and 'no support'.

In the analysis that follows, the sample is restricted to youths in England, Wales and Northern Ireland since as previously mentioned Scotland experienced a significant departure from UK policy in 2000, and as part of this, introduced an endowment of £2289 per student, to be paid upon graduation. This renders the Scottish system very different to the English system, with no comparable series in the rest of the UK.

Note, a potential problem with these groupings is that the composition of each group may change over time, if for example, earnings growth fails to keep pace with the income thresholds for means-testing. This fiscal drag effect has resulted in an increasing proportion of individuals being categorised as “high income” because earnings have risen at a faster rate than means-testing thresholds. Thus individuals falling into our 3 groups are likely to be increasingly different over time. To test for this, we use propensity score matching to re-weight all individuals, so that

their characteristics are fixed over time, using the mid-point year of 1998 as our base. We then re-estimate all models using this weighting and find the results to be similar, suggesting this change in composition of groups is a minor issue.

Note also that while these groupings are based on lagged parental income (i.e. that observed the year before the youth is eligible for university), we also observe current parental income – that observed the year of university eligibility, and use this continuous measure in our set of controls.

Figure 4: Fee, Grant and Loan eligibility: Full support students

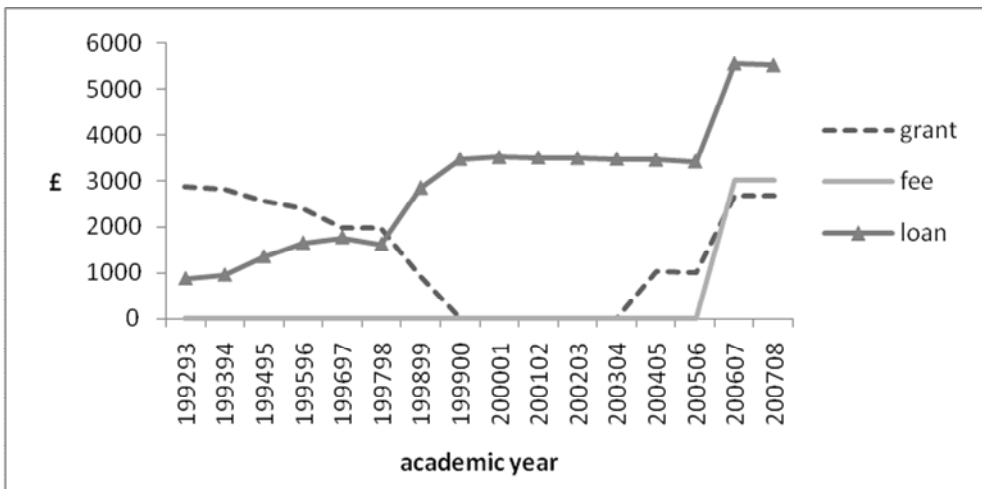


Figure 5: Fee, Grant and Loan eligibility: Partial support students

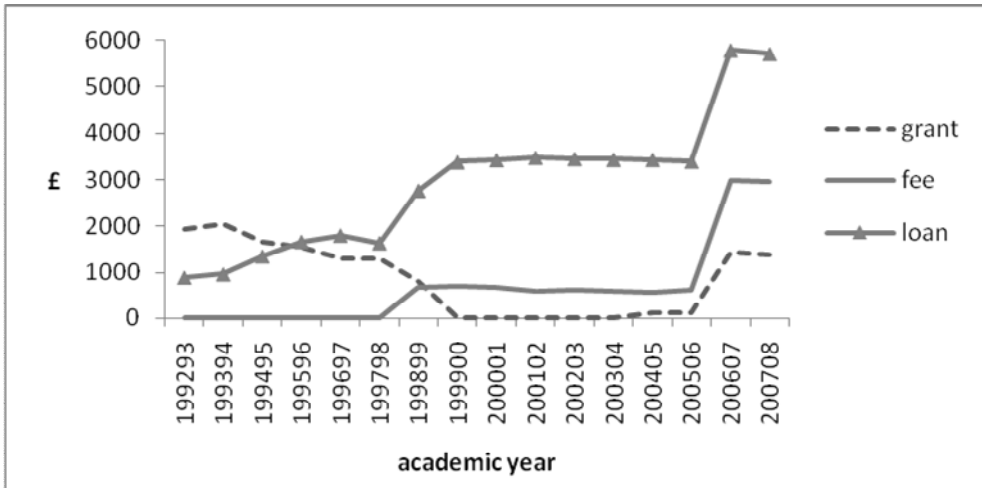
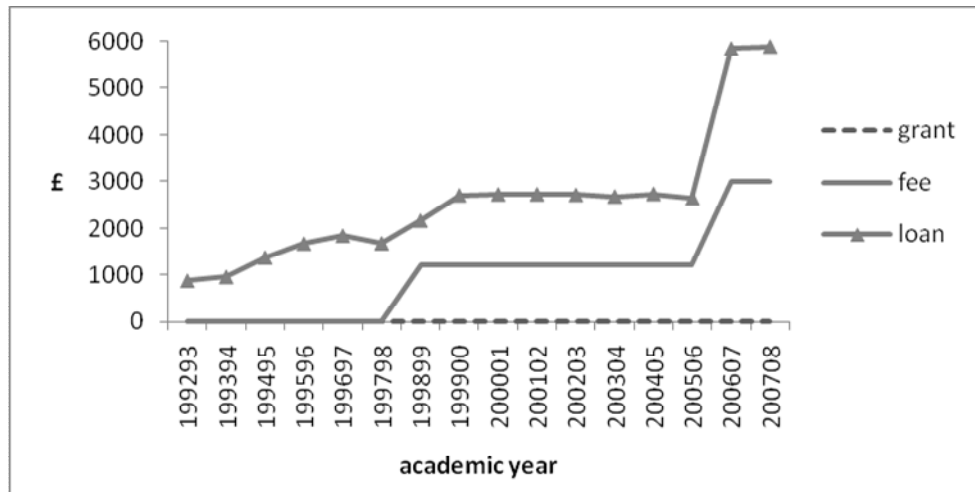


Figure 6: Fee, Grant and Loan eligibility: No support students

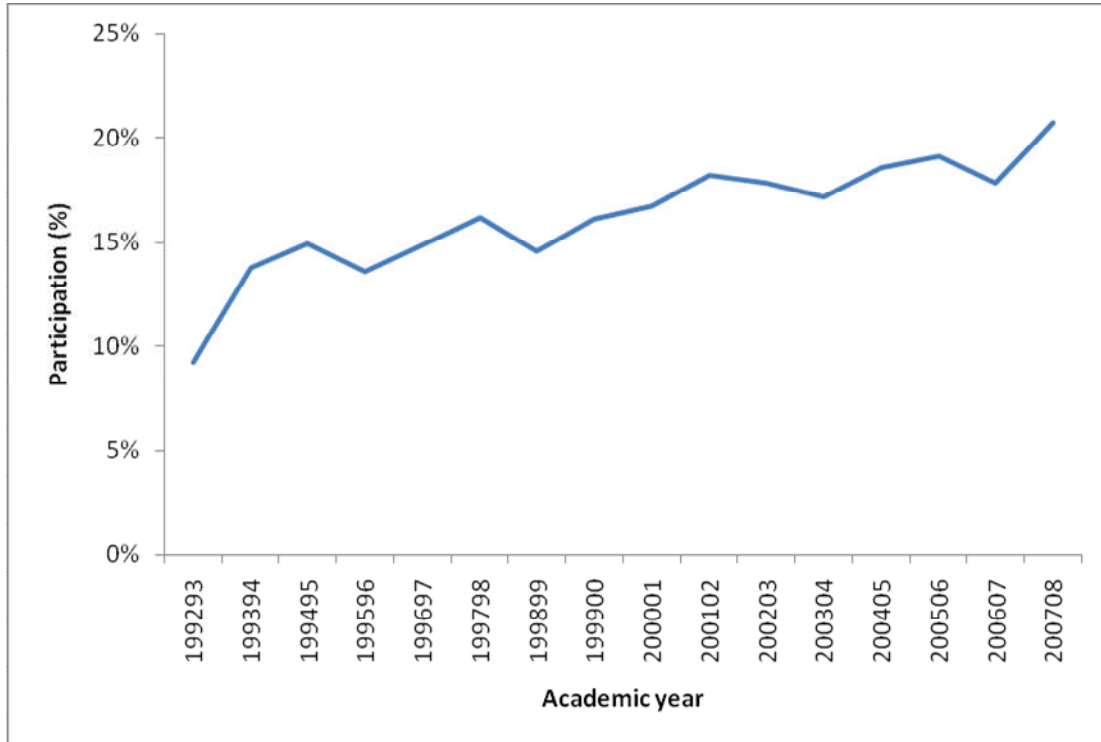


Our outcome variable is “studying for first degree” – as shown in Figure 7¹¹. As can be seen there are strong anticipation effects in the years before the introduction of upfront fees and deferred fees, with large rises in participation in 1997 and 2005, and subsequent dips in 1998 and 2006. We describe our method for controlling for these dips in Section 4. The significant increase in participation in 1992/93 academic year arising from the 1992 HE act is also somewhat apparent in this chart¹².

¹¹ There are two possible measures of participation in the LFS – “enrolled at university, college or polytechnic” or “currently studying for first degree”. The latter is chosen as the outcome variable since this is the least ambiguous – it is certain that all those in this category (and potential people eligible for university) will be subject to the same government policy on loans, grants and fees, whereas those in the former, broader definition may not be – finance can be different for students on college and polytechnic courses.

¹² In a sensitivity testing stage, all models are re-estimated excluding 1992/93, with little effect on the results.

Figure7: Degree participation over time (LFS): Youths at first year of university eligibility (age 18/19)



The average participation rate (over the period 1992-2007) of the sample is 16.3% though participation varies considerably by parental income, with only 12.2% of individuals from low income “full support” backgrounds studying for a degree, versus 30.7% from high income “no support” backgrounds.

Table 2 shows summary statistics and sample means, including the selection of control variables which will be used throughout the remainder of this analysis. These are ethnicity (a binary variable taking the value of one if the individual is white and zero otherwise)¹³, youth’s prior attainment (a binary variable taking the value of one if the youth has five or more good GCSEs and zero if the youth has less than five)¹⁴, parents education (this is available for each parent and is measured in 3 categories of attainment using the National Qualification Framework of both educational and vocational qualifications, current parental income (this is the sum of both parents’ annual income in the *current* year – i.e. when the youth is eligible for university at age 18-19) and region (using 18 regional dummies in total, representing the 16 major regions of

¹³ While a number of ethnic groupings are available in the LFS dataset, white represents the majority with the others spread throughout several smaller categories, so for simplicity a binary variable is created

¹⁴ A variable measuring number of A-levels is available in the LFS dataset, but only from 1993 onwards, and is limited in granularity to less than 1 or 1 or more, and to English, Welsh and Northern Irish students. Scottish students undertake Scottish Highers, which are one-year courses and so not comparable with A-levels. For these reasons GCSE or equivalent is chosen as a more robust measure of prior attainment.

England, and one each for Wales and Northern Ireland). Note that region represents the region of home domicile of the individual. This means that those living at home or in halls of residence will have their home domicile as their region, rather than the region of the institution they are attending. This is in fact preferable, since HE finance is dependent on country of domicile rather than location of institution. For example, English, Welsh and Northern Irish students studying in Scotland would still have to pay fees even though they were abolished for Scottish students, so knowing the location of their institution is irrelevant.

Thus, the final sample size, including those living away from home and not in halls of residence for whom parental income is imputed, but excluding those with missing parental income for other reasons, is 22,486 youths of age 18-19. The sample is evenly split between males and females, those with and without five good GCSEs and parental education types. Again it can be seen, unsurprisingly, that those with high parental incomes have very highly educated parents, and vice-versa.

Table 2: Summary Statistics (LFS, 1992-2007)¹

	all	parental income:				sex:	
		low	medium	high	missing	Male	female
% all sample	-	46.2	26.7	15.7	11.4	50.9	49.1
% participating	16.4	12.2	16.6	30.7	13.3	14.5	18.3
% non-participating	83.6	87.8	83.4	69.3	86.7	85.5	81.7
<i>Ethnicity</i>							
white (%)	85.8	81.7	90.4	92.6	81.8	85.7	85.9
non-white (%)	9.6	13.1	5.3	4.4	12.4	9.5	9.7
missing (%)	4.7	5.2	4.3	3.0	5.7	4.9	4.5
<i>youth's education</i>							
GCSEs >=5 (%)	50.0	44.7	53.4	72.5	32.4	45.5	54.3
GCSEs < 5 (%)	47.8	53.0	44.5	26.3	64.7	52.0	43.9
missing (%)	2.2	2.3	2.1	1.2	2.9	2.5	1.8
<i>parent's education²</i>							
NVQ level 4 + (%)	35.7	26.3	44.8	73.8	-	36.9	34.6
NVQ level 2 or 3 (%)	21.8	25.0	29.1	15.6	-	22.7	20.9
NVQ level <2 (%)	27.0	43.7	21.3	7.2	-	28.6	25.4
missing (%)	15.5	5.0	4.8	3.4	100.0	11.8	19.1
parental inc £	22210	6308	27941	57536	-	21807	22688
<i>Region</i>							
England (%)	88.6	86.6	89.9	92.3	89.9	88.7	88.6
Scotland (%)	-	-	-	-	-	-	-
Wales (%)	5.8	5.9	5.9	5.0	6.0	5.7	5.8
Northern Ireland (%)	5.6	7.6	4.2	2.7	4.9	5.5	5.7
sample size	26637	12322	7110	4175	3030	13562	13075

¹ Sample below is all those first year eligibles, with known parental incomes or, for those living independently, but of eligibility age, imputed parental incomes

² This is the education level of the more educated parent.

4. Estimation: A pseudo panel approach

In order to identify the effects of grants, loans and fees on HE participation, we estimate a model which has participation (as described in section 3) as the dependent variable, and with levels of fees, grants and loans for each individual, were (s)he to participate in HE as the explanatory variables of interest.

We also include a number of control variables in our specification. These include the policy group the individual belongs to (as defined in Section 3), current levels of parental income, and all other background factors listed in Table 2 above¹⁵.

After 1997, any observed variation in fees that a youth is eligible for is solely a result of parental income, as fees are a non-linear function of parental income. Pre 1998 and post 2004, any variation in grants across youths is also due to non-linear means-testing. Post 1997, loans are also a non-linear function of parental income. So the basic idea of the empirical strategy is to compare the outcome of young people who have similar characteristics (including parental income) but who are eligible for different fees/loans/grants due to the means-testing in the exogenous HE policy regimes. Our sample consists of a pooled series of cross sections over the years 1992 through 2007 (see section 3). The parameters of interest are fees, grants and loans¹⁶ We identify their effects from their non-linear relationship with income (see formulae in section 2). In essence, we are assuming that parental income has a smooth effect on participation: so, for instance the impact of fees is identified from the extent to which those who became eligible for the largest increase in fees responded differently from those who received smaller increases.

We also add a set of group-specific quadratic time trends. This is in order to allow for structural shifts in demand for HE over time, and for these shift to vary by group (family background). There is evidence of this in Blanden and Machin (2004). In essence we are assuming that our results are not being driven by a group-specific trend that is not already captured by the quadratic time trend.

One potential concern with this approach is measurement error. In particular we are concerned that our measure of income may be mis-measured. While grants, loans and fees are calculated using parental income, the LFS only has information on weekly earnings for those in employment, excluding the self-employed. Therefore, our income measure and in turn our imputed grant, loan and fee variables may also be measured with error. This is likely to be a

¹⁵ Note that we assume a perfectly elastic supply – i.e. that institutions are not subject to any supply constraints and will accept any students who wish to enrol.

¹⁶ The all-encompassing nature of the 1998 reforms precludes a difference-in-difference analysis, as there is no natural control group unaffected by the reforms. Note also that in 1999 Scottish devolution occurred and tuition fees were abolished for all students. However, as previously mentioned this was accompanied by a number of other reforms, including the re-introduction of grants, the introduction of the graduate endowment and the significant reduction of student maintenance loans.

problem that especially affects our partial support group since there is more variation in grant and fee eligibility in this category, and thus small amounts of measurement error could impact the calculated fee and grant amounts. Our full support and no support groups are less affected by this; incomes would need to be very poorly measured in order to calculate their fee/grant eligibility wrongly.

We adopt a pseudo-panel approach to help deal with the issue of measurement error.¹⁷ In a seminal paper, Deaton (1985) suggests the use of cohorts to estimate a fixed effects model from repeated cross-sections. Individuals sharing common characteristics, such as year of birth, are grouped into cohorts, after which the averages within these cohorts are treated as observations in a pseudo panel. This is the approach we adopt here. We define groups on the basis of region¹⁸, gender and policy group. So in practical terms, we aggregate HE participation by region, sex, level of parental education and time: for example, we take all males in policy group X in region r in 1992 and compute their average HE participation; we do exactly the same for females. This grouping is natural: as Verbeek (2007) discusses, cohorts should be defined as groups whose explanatory variables change differentially over time. This is certainly the case for a key explanatory variable in our model – GCSE results – which varies markedly over time by policy group, region and gender.

As discussed, our main reason for using this approach is to deal with potential measurement error. It helps in two ways. First, as it involves taking means within each period, this averaging process eliminates individual-level measurement error in the cross-section. Second, since each individual is observed only once, the measurement errors observed in one period will be for different individuals than the measurement errors observed in other periods (Antman and McKenzie, 2006). When the number of individuals per group is large, as is our case, the measurement error disappears.

Our choice of groups gives a balanced panel of 8 groups, in 18 regions, over 16 years, or 2304 cells in total.

To estimate the model, the averages within groups are treated as observations in a pseudo-panel to which standard techniques for panel data estimation are applied. So we treat the pseudo panel as if it were a genuine panel and apply conventional inference methods for panel data, including a static fixed effects model.

The fixed effects approach can be used to remove unobserved heterogeneity that is assumed fixed over time. This approach uses variation over time, within a specific group (which could be individuals, households, regions or any other type of group – so long as there are multiple groups or individuals, each of which can themselves be observed over time) to identify the

¹⁷ As university decision making is a one-off choice which occurs at a particular (school-leaving) age, a standard panel set-up is infeasible in our context.

¹⁸ Note, regions pertain to an individual's home rather than where they attend university. So those individuals whose normal residence is in England but who attend university in Scotland will be recorded in English regions. This is preferable, since grant and fee amounts are calculated according to home domicile.

impact of a specific variable or variables, removing unobserved heterogeneity arising from unobservables such as measurement error.

Finally, as previously stated we suspect anticipation effects in the data, arising from youths learning about future levels of fees in particular. This means that participation in year 1997, for example, is artificially high (as individuals who may have postponed university entrance instead enter university to avoid the fee introduction in 1998), and subsequently artificially low in 1998. To deal with this, we estimate the fixed effects model using a dynamic specification, meaning simply that we include lagged values of participation as dependent variables – unlike a static model which would not allow previous values of participation to impact current participation

5. Findings

5.1 Results from the pseudo-panel model

The findings presented are from the pseudo-panel approach using a dynamic specification. On account of unobserved heterogeneity arising from measurement error in the data, our preferred specification is the Fixed Effects model.

These results are displayed in Table 3 and in each case represent the probability of participating in a university degree course. Here, grants, fees, loans and parental income are expressed in real prices in £1,000's, so the coefficient on each shows the increase in the probability of participation caused by a £1,000 increase in the particular variable. Because of the dynamic nature of the model, these coefficients are expressed as short-run impacts (i.e. the immediate impact of the reform). The long-run impacts are more relevant for our analysis since they show the equilibrium impact of the reforms, but must be derived separately as shown below for fees.

$$lr_{fees} = \frac{\beta_{fees}}{1 - participation_{t-1} - participation_{t-2}}$$

Where lr_{fees} is the long run coefficient on fees, β_{fees} is the coefficient on fees, and $participation_{t-1}$, $participation_{t-2}$ represent the first and second lag of participation.

The long run impacts are shown in Table 3 below – and are very similar to the short-run impacts, indicating that fees, grants and loans have similar long and short run impacts – i.e. the impact of the reform does not diminish over time to any great extent.

The results imply that a £1000 increase in fees results in a 4.4 percentage point decrease in participation, whilst a £1000 increase in loans leads to a 3.2 percentage point increase in participation and £1000 increase in grants leads to a 2.1 percentage point increase in participation.

The coefficients on grants and fees are significant and their signs are as expected – upfront tuition fees have a significant negative effect on participation, whereas grants have significant positive impacts on participation. The coefficients are in-line with the findings of Dynarski (2004) and Kane (1995), as described in Section 1, bearing in mind inflation and exchange rates.

As previously mentioned, we do not make any assumptions about individuals' propensity to discount the future, as this is itself an empirical question. .

Our results indicate that a £1000 increase in loans or grants is not sufficient to counteract the impact of a £1000 increase in fees – the coefficient on fees is significantly higher than both loans and grants. This may be due to take-up. If grants were fully taken up, we would expect a similar but opposite signed coefficient to fees (since the former is money received, and the latter is

money to be taken away) but if take up of grants is lower than fees, (which is plausible since there are administrative costs associated with grant applications whereas everyone is eligible for fees) a lower coefficient on grants, as we find here, is plausible.

A further interesting result is that, while the coefficient on loans is higher than the coefficient on grants, further testing reveals that these coefficients are not significantly different from each other ($p=0.076$). This indicates that youths view these forms of support on equal terms and do not value loans any less despite the repayments involved (again, however, there may be different take-up rates of grants and loans which could affect this).

The set of explanatory variables is highly significant. Parental education and prior attainment are key drivers of participation, in line with widely accepted theory (Heckman and Carneiro, 2003; Gorard, 2006). In the case of parental education (for the LPM specification), a child whose father is educated to NVQ level 2-3 is 3.9 percentage points less likely to participate in university than a child with a father educated to NVQ level ≥ 4 (the omitted category), controlling for all other factors, including mother's education.

GCSE attainment has a strong positive impact on participation – an increase from less than 5 good GCSEs to 5 or more good GCSEs results in a 21 percentage point increase in the probability of attending university. Current parental income (also expressed in £1000s) also has a strong positive effect on probability of going to university, while whites are less likely than non-whites to go to university.

Table 3: Probability of Attending a University Degree Course given £1000 of grants and fees; Dynamic Regional Panel Model (Fixed Effects)

	(1)
Grant	0.024** (0.009)
Fee	-0.050*** (0.013)
Loan	0.0358** (0.011)
parental income	0.002** (0.001)
White	-0.131*** (0.034)
GCSE	0.205*** (0.024)
father, NVQ Level 2-3 ¹	-0.039 (0.028)
father, NVQ Level <2	-0.048* (0.027)
mother, NVQ Level 2-3	-0.036 (0.031)
mother, NVQ Level <2	-0.041 (0.027)
unemployment rate	0.010*** (0.003)
Constant	-0.202** (0.096)
Participation (t-1)	-0.071*** (0.023)
Participation (t-2)	-0.062*** (0.022)
Time trend (lin & n-lin)	Y
Observations	1831
R-squared	0.15

Table 4: Probability of Attending a University Degree Course given £1000 of grants and fees; Dynamic Regional Panel Models

	(1)
Grant	0.021** (0.009)
fee	-0.044*** (0.011)
Loan	0.032** (0.01)

It would be useful to identify the impact separately for low, medium and high income students, and in theory this could be accomplished by adding interactions of income group and eligible fee, grant and loan amounts. However, these are highly collinear – income group fully predicts fee and grant amount over long periods of time in the model. For example low income groups

have zero fees from 1992 – 2005 and full grants from 1992 – 1999, while high income groups have zero grants throughout the entire time period and full fees from 1998-2007. Therefore it is not possible to obtain robust results by adding interactions of this nature.

5.2 Estimating the impact of the 1998 and 2006 reforms

The aim of this next section is to contextualise the results of the preferred dynamic specification, by using the coefficients on grants and fees to estimate the impact of the 1998 and 2006 reforms. So, rather than just observe what happened to participation after the reforms the aim is to calculate the impact of introducing tuition fees and abolishing grants, compared to what *would* have happened had these reforms not taken place – i.e. in the case of the 1998 reforms, what would have happened had grants not been abolished and tuition fees not been introduced, and in the case of the 2006 reforms, what would have happened had deferred fees not been introduced and grants not increased.

In order to do this, it is necessary to create counterfactual values of grants, loans and fees assuming they had continued along the same trend as before the reforms. In order to do this grants, fees and loans are regressed on a time trend and the usual set of controls for each of the three income groups separately, thus creating estimates of the average value for each of grants, fees and loans, for each income group post 1998 and post 2006, had there been no reforms.

Tables 6 and 7 summarise the actual and counterfactual values for fees, grants and loans for 1998 and 2006.

Table 6: Average loans, grants and fees, pre and post 1998 reforms, and counterfactual (£s, 2006 prices)

	1992-1997 actual	1998-2003 Actual	1998-2003 counterfactual	Net impact of the reforms
Low income				
Grant	2455	0	1077	-1077
Fee	0	0	0	0
Loan	1382	3398	2492	906
Medium income				
Grant	1631	0	602	-602
Fee	0	620	0	620
Loan	1408	3338	2472	866
High income				
Grant	0	0	0	0
Fee	0	1200	0	1200
Loan	1461	2649	2541	108

Table 7: Average loans, grants and fees, pre and post 2006 reforms, and counterfactual (£s, 2006 prices)

	1998-2003 actual	2006 actual	2006 counterfactual	Net impact of the reforms
Low income				
Grant	0	2700	0	2700
Fee	0	3000	0	3000
Loan ¹	3500	5500	3500	2000
Medium income				
Grant	0	1400	0	1400
Fee	600	3000	600	2400
Loan ¹	3400	5800	3400	2400
High income				
Grant	0	0	0	0
Fee	1200	3000	1200	1800
Loan ¹	2600	5800	2600	3200

¹Includes fee and maintenance loan

Therefore, as a result of the 1998 reforms, low income groups therefore lost £1077 in grants – since grants were predicted to be at £1077 on average from 1998-2003; medium income groups lost £602 in grants and became eligible for £620 in fees, and high income groups became eligible for £1200 in fees. As discussed, students from all income groups experienced changes in loan amounts.

In the case of 2006, we are interested in the impacts of the 2006 package of reforms compared to the system before the HE finance bill – i.e. the system in 2003¹⁹. In fact, average values of fees, grants and loans were steady over the period 1998-2003 (except for inflationary increases), so the counterfactual is simply the values of loans grants and fees for 2003. Low income students gained £2700 from the generous re-instatement of grants, and also gained an additional £2000 in loans (this is made up of around a £1000 decrease in maintenance loans, and a £3000 increase in fee loans). This group also became eligible for a £3000 increase in fees as a result of the reforms. So in total, this group were £1700 better off. Medium income students also received large increases in grants and fees, and also benefitted from the fee loan increase, while high income students experienced the smallest increase in fees – an £1800 increase from £1200 to £3000 – and also gained from a loan increase.

The next step, then, is to use these values in conjunction with the coefficients from the preferred model in Section 4 to calculate participation rates after 1998 and 2006 – imagining the reforms had not taken place and grants, loans and fees took their counterfactual values. The generated participation rates are then compared with the participation rates predicted by the model using the real levels of grants, loans and fees after 1998 and 2006, and the difference is estimated.

¹⁹ Alternatively, we could compare the 2006 system to the 2004 or 2005 systems, however since maintenance grants were brought back in in 2004 as part of the reforms, we consider 2003 to be the “pre-reform” system.

Since the dynamic model was the preferred model after selection, the results are presented for this model. However, as mentioned, there may be dynamics at play in university demand, so the coefficients from the dynamic model are also used in the estimation.

The “policy on – policy off” effect is estimated for each income group for the dynamic specifications, in Table 8 below.

Table 8: Decomposing the effect of the policy change: Predicted effect on average participation rates over 1998-2003

	(1) Predicted effect of reforms	(2) Marginal effect of grant change	(3) Marginal effect of fee change	(4) Marginal effect of loan change
Impact of 1998 reforms				
low income	0.006	-0.023*	-	0.029*
medium income	-0.013	-0.013*	-0.027**	0.027*
high income	-0.050**	-	-0.054**	0.003*
Impact of 2006 reforms				
low income	-0.009	0.057*	-0.132**	0.057*
medium income	-0.003	0.030*	-0.107**	0.074*
high income	0.020	-	-0.079**	0.100*

Robust standard errors in parentheses * significant at 5%; ** significant at 1%

The decompositions in Table 8 above paint an interesting picture about the separate effects of the reforms experienced by each income group for the two sets of reforms.

Column 1 shows the overall impact of the reforms, while columns 2-4 show the overall impact is decomposed, illustrating the marginal effects of the changes in HE finance.

For the 1998 reforms, for low income students, the decrease in grants they experienced as a result of the reforms had a significant negative impact – abolishing grants resulted in participation being 2.3 percentage points lower than it would have been, as described in Column 2. This itself is a striking result, since no other UK study has been able to quantify the effects of the abolition of grants in 1998-1999. However, going on to look at Column 4, low income students also experienced an increase in loans over the same period, and this appears to have had a positive effect on participation, which offset the decrease in grants. The net result is that there is no significant change in participation for low income students. A similar story is apparent for medium income students; the decrease in grants and increase in fees both have a significant negative impact, while the increase in loans has a positive impact. The net result is no significant impact on participation.

High income students, while enduring no loss in grants, experienced the biggest increase in fees as a result of the 1998 reforms. The impact of the £1200 increase was that participation for this group was 5.4 percentage points lower than it would have been (according to the FE specification) had the reforms not taken place. Again, this is a striking result, and the main driver

of the overall reduction in participation of 5.0 percentage points (again using the FE specification) compared to what would have been.

In summary then, the increased costs of university participation imposed in 1998/99, while reducing participation of high income groups, did not appear to sacrifice the goal of widening participation of low income groups.

In the case of the 2006 reforms, there was no overall change in participation for any of the groups. For the low income group, the large increase in grants and fee loans was sufficient to outweigh the impact of the £3000 deferred fee introduction, so that the net result was no significant change in participation (the coefficient of -0.09 is not significant). The same is true for medium and high income students though in each case the separate components of loans, grants and fees are themselves significant.

6. Conclusions

In this paper we have estimated the impact of tuition fees, loans and grants on HE participation using two identification strategies. The use of pseudo-panel techniques meant that the suspected estimation problems – namely measurement error in the explanatory variables and unobserved heterogeneity – could be dealt with using well-established methods such as fixed effects, since observations were then observed in more than one time period.

Our main finding is that a £1,000 increase in upfront tuition fees *reduces* degree participation by 4.4 percentage points, while a £1,000 increase in loans *increases* participation by 3.2 percentage points and an increase in maintenance grants increases participation by 2.1 percentage points (though after further testing we find that the impact of loans is not significantly different from the impact of grants). These results are in line with, but of a slightly lower magnitude, than those estimated in the US in a number of studies such as Kane (1995), Dynarski (1999) and Helemt and Marcotte (2008).

These results are highly relevant for policy makers, who ought to be aware of the negative impact of upfront fees – i.e. those not covered by a fee loan – and the positive impact of aid on participation. Maintenance grants can potentially be used to offset the negative influence of fee increases, given their opposing influences on participation. Policy makers should also be aware of particularly vulnerable groups when setting levels of fees and grants, and may need to target specific groups with more generous aid to counteract any increases in tuition fees.

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