DISCUSSION PAPER SERIES

IZA DP No. 5626

Lifecycle Impact of Alternative Higher Education Finance Systems in Ireland

Darragh Flannery
Cathal O'Donoghue

April 2011

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Lifecycle Impact of Alternative Higher Education Finance Systems in Ireland

Darragh Flannery
University of Limerick,
REDP, Teagasc and NUI Galway

Cathal O'Donoghue
REDP, Teagasc
and IZA

Discussion Paper No. 5626
April 2011

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 5626
April 2011

ABSTRACT

Lifecycle Impact of Alternative Higher Education Finance Systems in Ireland

With increasing numbers of young people participating in higher education in Ireland and a heavy reliance of higher education institutions on state funding, the introduction of an alternative finance system for Ireland has been muted over the past number of years. However, no study has been conducted to gauge the potential impact of such measures. In this chapter we utilize a dynamic microsimulation model developed for Ireland to simulate the impact of both an income contingent loan system (ICL) and a graduate tax system from a fiscal and redistributional viewpoint and to analyze the repayment length under the former system. Our results suggest that an ICL system would is more equitable, while the graduate tax system would be a better alternative from a fiscal viewpoint. The results also illustrate the important of the interest rate attached to any future student loan system within Ireland from a fiscal viewpoint.

JEL Classification: I22, I28

Keywords: higher education financing, dynamic microsimulation, income contingent loan, graduate tax

Corresponding author:

Darragh Flannery
Department of Economics
University of Limerick
Limerick
Ireland
E-mail: darragh.flannery@ul.ie

1. Introduction

Over the past 15 years Ireland has experienced rapid growth in higher education participation, with student numbers increasing from 86,624 to 155,000 in the period 1994 to 2010 and expected to grow to 204,000 by 2018 (Department of Education and Science, 2010). Within Ireland, the vast majority of third level funding is provided by the state (85% for the year 2007, OECD 2010). Given the high private returns to education (Barrett et al, 2002) and the current difficult fiscal situation within Ireland, alternative forms of higher education financing have been suggested by the OECD (2006), the Department of Education and Science (2003) and the Hunt Report (2011). The aim of this paper is to utilize a dynamic microsimulation model for Ireland and explore the fiscal and redistributive implications of a number of alternative higher education finance structures, with varying assumptions regarding the parameters of these systems.

Since the mid 1990s there has been a general move by developed nations towards shifting the burden of higher education costs upon the student and away from the state. This is seen with table 1 below, where the OECD average state share of total expenditure on tertiary education over the period 1995-2007 falling from 86% to under 70%. The only exception is Ireland, where the public share has risen from 70% to 85%, due to the free tuition fees initiative for undergraduates introduced in 1996. Before this, the majority of undergraduate students had to pay tuition fees that were based upon the manner of course being pursued and institute attended. These fees were replaced with a much lower flat 'registration fee' which stood at €190 (IR£150) in 1996, and has risen to €1500 by 2010. The shortfall in revenue for third level institutions this created was filled by government finances and so a substantial shift towards reliance on state funding by these institutions was created.

Meeting the objective of increasing the percentage of the Irish labour force with a third level qualification from 33% in 2008 to 48% in 2020 (Future Skills Needs, 2007) will require significant extra resources. In addition participation in higher education participation is not equal, with higher socio-economic groups such as professional backgrounds having a disproportionate share of third level admissions relative (O'Connell et al, 2006). Clancy (1997 and 2001), using data on college entrants, highlighted that this pattern did not change with the introduction of the free fees scheme.

Both a graduate tax scheme and an income contingent loan system have been suggested as possible alternatives to the current free fees scheme with the *National Strategy for Higher Education to 2030*[1] (2011) recommending that the latter system be introduced in Ireland in the near future. In an international context, empirical work has been carried out most notably for the UK and Australia to gauge redistributive and fiscal implications of introducing such systems. To date, no study has been conducted that attempts to analyse the implications of an alternative higher education finance structure in an Irish context

[1] This is also commonly known as the Hunt report

In this paper we utilize a dynamic microsimulation model for Ireland and explore the fiscal and redistributive implications of a number of alternative higher education finance structures, with varying assumptions regarding the parameters of these systems. In the next section we will provide a brief overview of the economic theory behind the nature of funding for third level education and also analyze the various finance options available for higher education. We next investigate these options in an international context and explore their applicability in an Irish setting. We then briefly outline LIAM, the dynamic microsimulation model to be used. The methodology of simulating two higher education finance structures using LIAM follows. We then present our results and conclude.

2. Student Loan Options for Higher Education Finance

In understanding the impact of funding choice, the concepts of efficiency and equity are important considerations (Barr, 1993). In terms of efficiency, an examination of the private and social benefits and costs to higher education is relevant in relation to the balance between public and private funding. Graduates of higher education on average extract a significant private return as a result of higher lifecycle earnings and greater employment prospects[2]. Thus from an efficiency viewpoint, an individual should contribute towards the costs of this education. However, both society and the state may also derive benefits from more tertiary-education individuals due spillover externalities, higher taxes, lower unemployment and better social outcomes such as lower crime (McMahon, 2004). As a result, there is an efficiency justification for the state to subsidise the cost of participation.

The burden of who pays what amount from an efficiency viewpoint can be illustrated with figure 1. This shows different amounts of the marginal private benefit, the marginal social benefit and the marginal cost of education against various enrolment levels. The two benefit measures are downward sloping as the benefits of education are assumed to fall as enrolment levels rise, while the marginal cost of education rises as enrolment levels increase. Also, we note that in figure 1 the marginal social benefit is assumed to be outside the private benefit, this is due to the possible positive externalities education may induce.

Theory would suggest that the individual must pay up to the point where his/her marginal private benefit equals the marginal cost of education, however, this may lead to a socially inefficient level of education being taken on, show by point A in figure 1 and corresponding to enrolment level E1. For the socially optimum amount of education to be admitted, enrolment level E2, theory would suggest that the taxpayer should provide funds up to the point where the marginal cost of education equals the marginal social benefit. The optimal size of the subsidy provided by the state is given by the distance between P1 and P2, and will be dependent on the size of the relative private and social benefits to this education. However, the precise estimation of both private and social benefits to higher education is complicated, especially when the possible externality effects of tertiary education are taken into consideration (Psacharopoulos and Patrinos, 2004). This leads to a degree of uncertainty as to the

[2] For instance in an Irish context Barrett et al (2002) found that those with a diploma or degree could earn up to 80% more then an individual with just primary education complete. From an international perspective on the private return to education, see Psacharopoulos (1993), Card (1999) and Harmon at al (2002).

optimal level of government funding towards higher education but does suggest that students that extract a private benefit from higher education should bear some of the cost towards it. In an Irish context, it may be argued that this has not been the case due to the existence of free tuition fees for higher education and so inefficiencies may exist.

Inefficiencies may also arise due to market failure within education. Imperfect capital markets combined with uncertain future gains from higher education may entail that talented individuals pass all necessary tests to be admitted to third level education but may not be able to afford to pay any private charge on education, leading to enrolment inefficiencies. This market failure can affect the equity of access perpetuating income inequalities. If lower income groups are excluded from participating, the resulting differential lifecycle earnings will lead to wealth inequalities in a society persisting. Subsidies for higher education, by reducing the credit constraint faced by students may see more from lower incomes participate. However if subsidies do not overcome the disincentives faced by lower income groups, then they effectively become transfers to the rich. Thus as noted by Clancy (1997, 2001) and O'Connell (2006), the free tuition scheme because of the persistent socio-economic participation differentials, results in a net transfer to the top of the income distribution.

Student Loan Options

We now discuss alternative higher education financing options. To help achieve the goals of equity and efficiency and provide some private funding within higher education finance a wide range of finance options for higher education are available. While options such as grant schemes, education vouchers and tuition fee schemes exist within these options[3], in this paper the focus is upon two main instruments of income contingent based finance options, namely

- Income contingent loans (ICL) with risk sharing and
- Graduate taxes.

In this section we first outline the basic principles of a student loan system and then describe in detail both a graduate tax and risk sharing ICL system.

A student loan system attempts to reduce credit constraints associated with higher education participation and potentially reduces inequalities from state funding of higher education. Students generally receive a loan to cover the cost of their education with repayment made from labour market earnings, with the repayments ending once the loan has been repaid in full or upon retirement. There are two basic forms of student loans within this format with the main distinction between whether the level of debt and/or the level of repayments account for the income of the graduate. The type of student loan system that will take account for the graduate's income in some manner is known as an income contingent loan (ICL) system, while those that do not are known as mortgage style loans[4]. A number of variants of around these basic tenets

[3] Please see Greenway and Haynes (2004) for more details on education vouchers, grant allocations and tuition fees.
[4] See Johnstone (2005) for more details on the mortgage style student loans

exist with Chapman (2005) and Barr (1993) presenting a detailed discussion of these[5]. However, gauged in terms of the applicable in an Irish context, the proposals outlined previously in an Irish context (HEA, 2009; Department of Education, 2003; Hayes, 2009) and for parsimony, it was decided this paper will focus specifically upon the potential impact of a risk sharing ICL system and a graduate tax system in Ireland.

Income Contingency with Risk Sharing

A form of ICL that is typically associated with public financing is a risk sharing ICL. With this system graduates are obligated to repay a maximum amount in present value terms and entails that the size and frequency of repayments are linked to income levels, with no repayments after the individuals has cleared his/her own debt is cleared. Within this structure the costs of non payment are shared by the tax payer and the graduate. As the externalities involved with higher education benefit society as a whole, placing some of the financial burden on taxpayers does satisfy an efficiency argument. The graduate will face some burden of default (d) as generally the loan they receive will be augmented to reflect some probability of default; however, this will not vary as he/she goes through their lifecycle. Therefore the graduate will generally face repaying

$$Payment = (1 + D) \times t \quad (1)$$

Where D is the default probability across the cohort and t is the initial loan for tuition purposes and can be seen as MC-X, where MC is the marginal cost of the education and X is the value of the externalities involved with extra education. As noted earlier, the exact breakdown of the private/public contributions to this debt is difficult to estimate, however, if all of these parameters are set appropriately the government will receive the full tuition loan t. If they have not it could be the case that non-higher educated taxpayers pay more than they should[6], or they could see a revenue windfall, depending on the total level of debt each student is burdened with and the default rate. Although this system does generally entail some graduates will pay more than others in terms of total repayments, sharing the risk of an ICL with the taxpayer can help deal with problems of adverse selection and moral hazard that may arise with a risk pooling system. With the taxpayer and not the graduate meeting the default, there is no danger for the borrower if his/her future incomes rise. Therefore it is less likely for a high ability student to opt out of this system, and also graduates with higher incomes will less incentive to divert away from income benefits and higher paying jobs as the amount they repay is not linked to the income of others in the cohort (Chapman, 2005). There still may exist some issues of adverse selection with this system as those that expect high earnings may still opt out to avoid paying Dt from equation 1 above. The problem of adverse selection can be reduced through a mandatory system of ICL such as exists in Australia. Also as Chapman (2005) notes, the risk sharing is generally seen as being administered by the government, it would have the advantage of an efficient collection system through income taxation or social insurance schemes.

Various forms of income contingent loan systems have been introduced in Australia, New Zealand and the UK respectively over the past 25 years, and evidence would

[5] These include human capital contracts and an ICL system with risk pooling
[6] Measured against the benefits they enjoy from the externalities from higher education

suggest that each has had no little or no affect on the composition of those participating in higher education across social or income class in a positive or negative manner (Chapman, (2005) and Office for National Statistics, 2004). However, it could be suggested that they have successfully placed some of the financial burden of higher education upon the student, while removing some of the reliance on the state of tertiary education funding.

Graduate Taxes

Another income contingent instrument is a graduate tax system. This is similar to an ICL system in that students do not face an upfront charge when they enter higher education and so the credit constraint is removed; however, there is no loan aspect in the design. Instead, the graduate tax acts as a supplementary tax/compulsory payment on graduates throughout their working life. In its simplest form this system may obligate graduates to pay a fraction of their taxably income, in addition to income tax, to the government until they retire (Barr, 1993). Although such a system can be designed to incorporate an income contingent element (such as most income tax systems) the key difference with the ICL stems from the fact there is no cost recovery aspect to the graduate tax system with the likelihood that some individuals may end up paying more than the cost of their education under this system of graduate tax. A related point is that the amount graduates pay is invariant in costs between degrees. As the graduate tax continues throughout the working life of the graduate it could act in the same way income tax does and be a disincentive to work. Also with a graduate tax system, as Greenaway and Haynes (2004) note, if the graduate tax is not hypothecated, higher education institutions still reliant on state finance and the possible political obstacles that go with this. A graduate tax system does have advantages in that it could be efficiently collected through the income tax system and it has scope to raise considerably revenue for the government. However, as a graduate tax system has not been implemented anywhere in the world yet suggests that the inefficiencies caused by the problems outlined above poses questions about its viability.

Both the finance options outlined above provide various merits in terms of helping to place more of the financial burden upon the individual and away from the state, in removing the initial credit constraint an individual may face when deciding to enter higher education and increasing efficiency relative to a situation of free tuition fees. Also, gauged in terms of the applicable in an Irish context and the proposals outlined previously in an Irish context (HEA, 2011; HEA, 2009; Department of Education, 2003; Hayes, 2009), investigating the impact of a risk sharing ICL system and a graduate tax system in Ireland would appear a valuable exercise.

3. Methodology

Microsimulation in ex-ante higher education policy analysis

With the implementation of various forms of higher education finance options in different countries over the past 20 years, numerous studies have attempted to gauge their impact on a variety of issues, both from an ex-ante and ex-post perspective. Although we have mentioned a number of ex-post studies that provided evaluations in terms of accessibility in the previous section, the focus of the research conducted here is on the possible impact of various student loan systems from an ex-ante viewpoint.

In an international context, ex ante studies on higher education finance reform has relied mainly upon microsimulation techniques for their analysis.

Harding (1995) uses a dynamic microsimulation model of 4000 Australian individuals to report the repayment profiles of males and females under the Australian ICL system Higher Education Contribution Scheme (HECS) and also the AUSTUDY supplement income-contingent scheme intended to for student maintenance purposes. Within this study it is assumed that each individual completes four years of higher education and receives a tuition loan similar to that of a full time student undertaking a standard course. There is also the assumption that each student takes on the maximum amount of AUSTUDY loan possible. The results show that 96% of the total HECS debt owed by males to the government was paid by the time they reach retirement age, with 93% of AUSTUDY debt paid in full by males over the same time frame. These figures are lower for the female population with 77% and 71% of total debt due from the HECS and AUSTUDY respectively from females being recouped by the government. Harding concludes that the majority of students who do not fully pay off their debt do manage to pay off a substantial amount of it and so the scheme is not fiscally insecure from a government revenue point of view. Glennerster et al (1995) investigate the impact of an income contingent loan system and graduate tax system on the repayment patterns of British graduates using the LIFEMOD microsimulation model. They conclude that an ICL system is favourable over the two especially from an equity standpoint. Showing similar findings to the Australian study, women on average pay back less than men with a range of 84% to 22% of male graduates paying their loan in full depending on the assumptions surrounding earnings growth and the interest rate attached to the student loan. This compares with a range of 61% to 10% of females that fully pay off their again dependent on the assumptions surrounding the loan system. Goodman et al (2002) estimate the redistributional impact of the introduction of a graduate tax in the UK using the tax-benefit microsimulation model TAXBEN. The study is conducted with the aim of estimating the 'overnight' effect of the imposition of a graduate tax in the UK and concludes that it may present some progressive qualities by placing a greater burden on graduates from higher income deciles. Dearden at al (2007) use simulated lifetime earnings for graduates in England to analyse the distributional effects of changes to the higher education finance system in 2006. A number of assumptions are imposed such as each graduate has taken on three years of the maximum amount of debt allowed, both for tuition and maintenance[7]. Their results show that the reforms have a positive redistributional impact, reducing the cost of higher education for those at the lower income distribution.

Jacobs (2002) uses a similar methodology to simulate the lifecycle earnings of a sample of Dutch graduates at a micro level in examining the impact of a graduate tax or income contingent loan system. The study uses data containing information on variations in enrolment length and type of course pursued at the individual level in order to calculate the rate of graduate tax necessary to cover all state education expenditure in the Netherlands. The results show that a graduate tax scheme may exhibit a redistribution of income from males to females and/or from high earning graduates to low earning graduates. An income contingent loan system with risk sharing is also analysed under various assumptions regarding the repayment rates and the default risk to be levied on the student loans. The results show that repayment

[7] Note: the amount debt that can be incurred from maintenance is dependent on household income

periods averaged nearly 40 years under all assumptions and upwards of 50% of total debt remaining unpaid by retirement age which may raise questions to the fiscal security involved, if the state is assumed to be the lender is the scheme.

This paper utilizes the Lifecycle Income Analysis Model (LIAM), a dynamic microsimulation model for Ireland to investigate the potential impact of the introduction of an income contingent loan system or a graduate tax system within Ireland (O'Donoghue, 2010). The introduction of such a system would entail an income transfer from one period to another as individuals participating in higher education will have free access at point of entry but must pay back the cost over his/her lifecycle. To illustrate the potential impact of such a system over the lifecycle for Irish graduates, a dynamic microsimulation model is seen as an appropriate methodological tool. Given the important role of this microsimulation model in our estimations, we now provide a brief overview of the specific simulation processes carried out in forming LIAM.

The LIAM model ages a sample of the Irish population, based upon the Living in Ireland survey data (1994-2001) up to 2050. The life-cycle processes that are simulated include demographic processes such as mortality, fertility and marriage, education, labour market processes such as employment and unemployment and the simulation of incomes and interactions with the tax/benefit system at the individual level. It accounts for new individuals through simulated births and immigration and also allows for simulated death and emigration, consistent with official population projections (CSO, 1999). It thus maintains a representative sample of the population over time.

Labour market status, including whether in work, unemployed, retired, the type of employment if in work, earnings and other characteristics are also modelled in the LIAM framework using a mixture of econometric models such as logit models and standard OLS regressions. Education level, age and parental education level are all important determinants of probabilities these factors within the future life histories of these variables within LIAM (O'Donoghue, 2010).

The LIAM model also incorporates a static tax-benefit microsimulation model of the Irish tax-benefit system. Using the information provided by estimations on earnings and demographic status, the tax-benefit model serves to calculate disposable incomes, based on the parameters of the Irish tax-benefit system and amounts using actual values for the period 1994-2006.

The combination of the above processes provide a simulated future for the entire population within the Living in Ireland dataset up to 2050. The education level completed of an individual in LIAM is disaggregated across four main headings, primary, lower secondary, upper secondary and tertiary. No distinction is made between those that complete different forms of tertiary education, such as degrees or diplomas or whether they attend a university or institute of technology. LIAM does provide us with the lifecycle earnings streams and employment patterns of each individual in our population[8]. Table 2 below illustrates the education-earnings profile

[8] These earnings are scaled to 2000 prices with an assumption of the real earnings growth rate equaling the real discount rate of 2%, this follows the Irish government's present convention for discounting in public sector projects (Department of Finance, 2010).

of the population and shows the data following an expected path, with higher educated individuals earnings more over their lifetime, and also males earnings more then females. For the analysis in this paper it is the lifecycle of a particular cohort that is of interest. We identify those that have completed upper secondary education schooling and had completed tertiary education by the end of their 22nd year. We then track these individuals throughout their lifecycle until the point of retirement. As our simulated population runs from the years 2000 to 2050, this allows us to track the life cycle of eight cohorts of graduates until their point of retirement. Figure 2 presents a picture of the simulated total lifecycle earnings distribution for our sample discounted to year 2000[9]. A normal distribution plot within the figure illustrates the positively skewed nature of the earnings, providing comparison with similarly skewed earnings distribution studies on simulated graduate populations (Dearden et al, 2007). Figure 3 below presents the simulated average earnings for males and females graduates within LIAM throughout the lifecycle. The simulations suggest that earnings rise from around €15,000 for men and women to a peak of around €62,000 (€32,000) for males (females) at age 57 (56). It must be noted that these figures are in constant year 2000 prices. The drop in both male and female earnings seen in figure as the simulated population moves towards age 60 is due to a large proportion of individuals in the higher earnings distribution retiring as they reach age 60, while those in the lower end continue to work until age 65. As we are interested in analysing the impact of alternative higher education finance systems within this framework, we must now specify the exact parameter of the systems to be simulated.

Specification of ICL and Graduate Tax System within LIAM

In this section we describe in practice how the two alternative higher education finance structures are simulated within LIAM.

With the LIAM model disaggregating education level completed across four main headings this prohibits simulating different loan amounts to different individuals based upon course choice. It also prohibits looking at differences across part time or full time study. For the purposes of this analysis, these individuals were assumed to have completed 4 years of full time tertiary education between the ages of 19 and 22 inclusive, and in the context of an ICL system to have received, during each of those years' loans of €2500 per annum (in 2000 prices)[10]. Therefore, each graduate is assumed to incur a debt of €10000 by the end of his/her stay in higher education. We assume payment begins as soon as their graduate with no grace period. We also initially assume there is no interest rate on the loan, but the principle is scaled every year by the increase in inflation[11], in other words there is a zero real interest rate attached to the loan. We also assume that there is no scope for early repayment in the system and there is no system for tracking emigrants.

We investigate repayment of this simulated debt under two systems, the first of which is an income contingent loan system. We set the income threshold as the average

[9] Total lifecycle earnings for an individual is the sum of earnings from ages 22-65 with an assumption of 2% real growth in earnings per annum and a 2% real discount applied

[10] Although it is not of consequence for our analysis whether these loans go towards covering tuition fees or maintenance, we assume this is solely a loan for fees, with the current system for maintenance grants staying in place

[11] This is assumed to be 2% per annum as per current government projections, we then apply a real discount rate of 2% in obtaining the present value for the year 2000.

income of those working for pay in our population for any given year. Any individual whose taxable income is below this threshold in a given year does not have to repay any amount in that year[12]. This suggests an equitable income threshold as any graduate above this level can be said to be gaining some premium from higher education in the form of higher earnings. Individuals will pay 10% of any income earned above this threshold to service their loan. Also to incorporate more progressivity in the system, we also set a second threshold at 1.25 times the average income of those working for pay in our population for any given year. If an individual earns more than this they must pay 5% on any income earned above this second threshold as well as 10% on all income above the first (lower threshold)[13]. The assumption is also made that these amounts are blanket thresholds at the individual level, with no allowances for no. of children and and/or spouse income or parental income level. Repayment stops once the loan amount has been repaid in full or when retirement is reached.

This is in contrast to the graduate tax whereby repayments continue until the age of retirement regardless of how much is paid back with the result that high earnings may repay more than they have borrowed. In this paper we apply this graduate tax through the social insurance contributions system[14], with graduate forced to pay an additional 1% on their pay related social insurance (PRSI) contributions until they retire. This applies to all classes of PRSI and has a progressive element in its design as the more an individual earns, the more they pay. We assume that this follows all the other rule surrounding PRSI contributions such as the PRSI ceiling.

To incorporate these measures into LIAM we apply a tax/benefit microsimulation module upon the simulated future population of Ireland. This maps all taxes, social contributions and benefits incurred/received by our simulated population for the years 2000-2050. The introduction of the two finance systems outlined above is achieved by inserting them into the tax/benefit microsimulation module. This allows us to track at an individual level, the scope and scale of both systems mentioned above. As we do not have the tax/benefit rules for all future years, we initially vary the tax/benefit rules reflecting the real world from 2000-2006 for Ireland. We then hold the 2006 tax/benefit rules constant for the rest of the simulated future. As our input data from LIAM is in 2000 prices, earnings and any other income variables that influence tax/benefit situations are up rated to the corresponding tax/benefit year, before applying the tax/benefit module. The relevant variables for the all years beyond 2006 are up rated to the 2006 level and as they are subject to the 2006 tax/benefit rules. All output from this process are then converted back to 2000 prices.

4. Empirical Results

The results of simulating two alternative higher education finance systems for Ireland using the LIAM dynamic microsimulation model will be analyzed in terms of repayment patterns, redistributional issues and from a fiscal viewpoint. When analyzing these figures it is important to note that they are quite sensitive to changes

[12] This is similar to the design of the original Australian ICL system.

[13] While these repayment rates are chosen somewhat arbitrarily, they are based loosely upon the repayment rates that currently exist in the UK.

[14] A graduate tax system through PRSI contributions in Ireland has been put forward by the main opposition party at the time of writing.

in the assumptions surrounding the simulations. Changing the assumptions regarding the loan amount, earnings growth and repayment structures within our model may drive these results in a different direction, however we will provide an analysis based on the assumptions set out previously and also with varying assumptions surrounding the level of interest charged on the loans and the rate at which the graduate tax is levied[15].

ICL

For the ICL system simulated, table3 indicates that for males, 83% of graduates pay back their loan in full when a zero real interest rate is applied to the debt. We also see that there is a substantial gap across gender in terms of those who repay their debt in full with 74% of females doing so, compared to 91% of male graduates. These figures are slightly below that of the simulations presented by Harding (1995) for the Australian system. She finds that by the age of retirement, 96% of males and 77% of females have paid their tuition related loans. This may stem from the fact that the individuals in the Australian system pay a fraction of all taxable income after they reach a certain threshold, rather then just a fraction of income earned above this threshold. Our simulated repayment rates are above those found in Glennerster et al (1995) with respect to females as they find 62% of British females may repay back their loan in their simulated ICL system[16]. The male repayment rate of 84% they find is also below the findings of our simulations.

Males that do pay off their debt in full do so in an average of 13 years when the assumption of a zero real interest rate is applied, while females take 15 years on average. This is a similar repayment period to those in the Australian simulations where males and females take on average 12 and 15 years respectively. While for the UK Glennerster et al (1995) simulated 16 years and 22 years as the mean repayment period for males and females respectively. Dearden at al (2007) find that a variant of the UK system may bring down these figures for the UK, with the no. of years taken to repay the full debt at 13 and 17 years for males and females. Our repayment period may be undesirable from a policy perspective as this represents a considerable time for the government/university to wait for the full benefits of debt repayment to be fulfilled. In the context of males versus female repayment patterns our results are not surprising given the fact females earn less across the lifecycle, are more likely to leave the labour market and/or work part time than their male counterparts.

Another are of interest with regard to the simulated ICL system is the level of subsidy provided by the government due to assumptions of the cancellation of the debt upon retirement and the level of interest charged on the loan. This is measured in table 3 using the average net present value (NPV) of the repayments made by graduates compared to the initial loan of €10,000 the graduates receive. We can see the under the assumption of a zero real interest rate the average subsidy as a percentage of the

[15] Some sensitivity analysis on the assumed discount rate applied is also presented in appendix 1 of the paper but not discussed at length within the empirical results. The main point of note, as seen in table A1 of appendix A, is that increasing the real discount rate by 1% does not affect the length of repayment of the income contingent loan but does have a significant impact upon the net present value amount the student repays under the ICL system. With respect to the graduate tax system, a 1% change in the real discount rate does little to impact the amount repaid relative to the simulated loan.

[16] This is under the assumption of 3% real earnings growth and 0% real interest rate on the loan.

original loan amount is 62.7%. This figure arguably represents quite a generous subsidy towards the graduate and is a figure considerably higher than that estimated for the UK system by Dearden et al (2007). Barr (2005) and Barr and Falkingham (1996) argue that the interest subsidies to graduates within an ICL system from applying a zero real interest to the loan are particularly expensive, and given the government is the most likely source of ICL student loan system, this subsidy represents a large burden upon the taxpayer. The results presented in table 3 show that the ICL system simulated for Ireland here would seem to back up their findings.

Table 3 also provides an analysis of the same issues discussed above with the assumption of a 2% real interest rate applied to the loan provided. It is shown that the proportion of graduates that repay the percentage of borrowers that repay the debt in full drops to 73%, with relatively equal drops in the proportion of those repaying the debt in full across gender. However, the imposition of the higher real interest rate does not have a major impact upon the average length of repayment for those that do pay off the loan in full by retirement age. With regard to the average loan subsidy to graduates provided by the government, the imposition of a 2% real interest rate on the loan substantially reduces this relative to that seen with a zero real interest rate. Again comparing the NPV of average repayments to the initial €10,000 loan provided shows that the average subsidy as a percentage of this loan falls to 18.5%, down from the figure of over 60% seen previously with the zero real interest rate. This would seem to support the claims of Barr (2005) that the level of the interest rate applied on any ICL system is vital in terms of the expense imposed upon the taxpayer. Our result suggest that within the system simulated here, a interest rate on the debt that corresponds to real interest rate of 2% is extremely effective in reducing this subsidy, compared to a situation of zero real interest rates.

From a distributional point of view, we analyze the repayments patterns across deciles of the life cycle earnings distribution of graduates and across the two variants regarding the assumption of the interest rate charged upon the student loan. From table 4 below, we can see that as a result of the income contingent nature of the system, our simulated ICL system is seems to hold progressive qualities.

With a system of zero real interest rates, our results shows that 46% of those in the lowest lifecycle earnings decile end up paying back the full amount of their debt, compared to a figure of 100% of those in the highest income decile. We also see that the largest subsidy of the loan is also provided to those at the lower income deciles as they pay back the lowest amount on average (in NPV terms). However, it is also noticeable that the subsidy is quite large, even for those at the higher end of the graduate income distribution, standing at nearly 60% of the original loan amount.

When the assumption regarding the real interest rate charged upon the loan is varied the system would still seem to hold its progressive nature. Although the amount repaid increases and the level of subsidy granted towards those in the lowest income decile falls, the subsidy to the higher earning graduates falls to zero while there still remains a substantial subsidy to the graduates at the bottom of the income distribution.

An analysis of the ICL system simulated under both variants with respect to the level of interest rates suggests that the highest proportion of the loan that is not repaid comes from those that do not benefit from higher education through higher lifecycle

earnings. Therefore, it could be suggested that the system simulated here satisfies both the equity and efficiency arguments surrounding higher education as nobody faces an upfront charge when entering higher education under this system and those that do not see their lifecycle earnings benefit substantially from higher education do not pay substantially towards its cost.

Graduate tax

We have also simulated a graduate tax scheme for Ireland to be implemented through the social insurance system. As a graduate tax system does not involve any loan, we do not examine this in terms of repayment rates or length of repayments. Instead we investigate the yield of such a scheme relative to the ICL system seen before. We investigate this under two different graduate tax rates and also with varying simulated debt amounts due to variations in the real interest rate surrounding the ICL system outlined earlier.

From table 5a we see that a graduate tax system of an extra 1% on PRSI contributions would repay 146% of total borrowing under the assumption of a zero real interest rate on the debt. This is compared to just under 40% of all debt recovered from the ICL system under the same assumption. A graduate tax system involving an extra 2% of PRSI contributions would yield 287% of the total loan liability with the same interest rates involved.

When the interest rate applied to the graduate debt is varied the yield of various graduate tax rates also varies. This is seen with table 5b, where a 1% graduate tax scheme would yield only 60% of simulated debt with the assumption of a 2% real interest rate on student loans. The simple reason for this is that while the amount taken in from the graduate tax does not change, the simulated debt will be higher. When the graduate tax system involves an extra 2% on PRSI contributions with same interest rate, the yield is shown as 118% of simulated debt.

To gauge the implications of both graduate tax schemes against the original debt received by the graduate it is the results in table 5b that is of relevance. This provides the equivalent of estimating the yield of both graduate tax systems as a percentage of the original loan amount graduates get[17] and our results show that no government subsidy would be required under a 2% graduate tax scheme, while some substantial government subsidy would still exist under a 1% scheme.

We can also see from table 6 that with the exception of graduates from all income distributions pay more under the graduate tax system than the ICL but the majority of the burden falls on those that earn the most over their lifecycle. This gives rise to the situation where richer graduates repay more than they would have borrowed under an ICL scheme and hence contribute to the education costs of poorer students. Although this type of system does have its advantages in terms of the revenue generated, Glennester et al (1995) find a similar result and argue against this from an equity point of view. They suggest that cost of higher education for poorer students should not fall on the richer graduates but on the tax payer, similar to any other redistributive measure. They also suggest that as the revenue from a graduate tax system may go to

[17] This is due to the fact a 2% real interest rate attached to any student loan, combined with a 2% real discount rate will give the same NPV of the debt as the original amount borrowed.

the state and not directly to higher education institutions, the benefits of such a system may not be accrued to educational resources.

5. Conclusion

With increasing numbers of young people participating in higher education in Ireland and a heavy reliance of higher education institutions on state funding, the introduction of an alternative finance system for Ireland has been muted over the past number of years. However, no study has been conducted to gauge the potential impact of such measures. In this paper we utilize the dynamic microsimulation model LIAM to simulate the impact of both an income contingent loan system (ICL) and a graduate tax system from a fiscal and redistributional viewpoint and to analyze the repayment length under the former system. Under the ICL system we set a threshold based upon the average income of those working for pay in our population for any given year and find that 83% of graduates would pay back their loan in full by the age of retirement with a zero real interest rate attached to the repayments of students. This represents a slightly lower figure than studies conducted in Australia and is broadly in line with simulations conducted for the UK. We also find that the average subsidy provided to graduates by the zero real interest rate attached under this is quite generous and may be fiscally expensive. We also perform some sensitivity analysis with regard to the assumption surrounding the real interest rate attached to the loans involved and find that a 2% real interest rate may be more favourable from a fiscal viewpoint, while still holding progressive qualities. It must again be noted that these figures can be quite sensitive to changes in the various other assumptions underlying the ICL system we specifically simulated.

From a distributional point of view we see that under the ICL schemes with both a zero and 2% real interest rate, those from the lower deciles of the lifecycle earnings distribution pay the least, and so the system does exhibit some degree of progressivity. However, from a policy perspective the low amount of the total debt repaid may suggest that any ICL system to be introduced may benefit from having a positive real interest rate attached.

With the two variations of a graduate tax scheme simulated within the social insurance contributions of graduates we also find evidence of progressivity with those that earn the least over their lifecycle paying the least. However, our results also show that under the graduate tax scheme where an extra 1% is added to PRSI contributions, graduates on average pay back 1.45 times the amount they may have borrowed under an ICL system with a zero real interest rate. We again perform some sensitive tests here and find varying the extra percentage added to PRSI contributions as part of the graduate tax can vary this measure considerably. Our analysis suggests that a graduate tax scheme may have advantages over an ICL system in terms of the revenues it generates for the state, however, it does entail that richer graduates will pay for the education of poorer individuals. While we do not investigate the impacts of such systems upon participation rates, or the administrative costs of the alternative systems, this paper does provide the first step in measuring the possible impact of alternative higher education finance structures in Ireland. The LIAM model could be utilized in the future to simulate variants of the systems proposed here to attempt to find an optimal system from an equitable and efficiency viewpoint.

References

Barr, N., 2005. “Financing higher education: A universal model”, in *Financing Higher Education: Answers from the UK*, Routledge, Oxon and New York.

Barr, N. and J. Falkingham, 1996. “Repayment Rates for Student Loans: Some Sensitivity Tests, Welfare state programme, Discussion paper WSP/127, London School of Economics.

Barr, N., 1998. “Higher Education in Australia and Britain: What lessons?”, Australian Economic Review, vol. 31, No.2, June 1998, pp179-88.

Barr, N., 1993. “Alternative Funding Resources for Higher Education”, *Economic Journal*, vol. 103, No.418, May, pp718-28.

Barrett, A., J. FitzGerald, and B. Nolan (2002). "Earnings inequality, returns to education and immigration into Ireland." *Labour Economics* 9 (5), 2002.665-680

Card, D., 1999. “The Causal effect of Education on Earnings”, in Handbook of Labour Economics, Ashenfelter, O. and Card, D. (eds.), Elsevier, New York, pp.1802-1863.

Central Statistics Office Ireland, 1999, Population and Labour Force Projections, 2001-2031 Dublin: Stationery Office.

Chapman, Bruce, 2005. "Income Contingent Loans for Higher Education: International Reform," CEPR Discussion Papers 491, Centre for Economic Policy Research, Research School of Social Sciences, Australian National University

Clancy, P. (1997). “Higher Education in the Republic of Ireland: Participation and Performance”. *Higher Education Quarterly*, Vol. 51, 1. 86-106.

Clancy, P. (2001). College Entry in Focus: A Fourth National Survey of Access to Higher Education. Dublin: HEA

Dearden, L. Fitzsimons, E. Goodman, A. and Kaplan, G. (2007) “Higher Education Funding Reforms in England: The Distributional Effects and the Shifting Balance of Costs”. The Institute for Fiscal Studies Working Paper18/07.

De Butléir, (1993), Third Level Student Support', Report of the Advisory Committee on Third Level Student Support, Dublin, Government Publications.

Department of Education and Science. (2010). Projections of Full Time Enrolment At Primary, Secondary and Higher Level, 2009-2030. Government Publications, Dublin.

Department of Education and Science. (2003). Supporting Equity in Higher Education, Government Publications, Dublin.

Department of Finance, 2010, Project Discount and Inflation Rates. [Online], available at

http://www.finance.gov.ie/Viewtxt.asp?DocID=5387&StartDate=1+January+2010

[Accessed 17th December 2010].

Expert Group on Future Skills 5th Report. (2007). Tomorrow's Skills, Towards a National Skills Strategy, Dublin.

Flannery, D. and O'Donoghue, C. (2009) "The Determinants of Higher Education Participation in Ireland: A Micro Analysis", *The Economic and Social Review*, Vol. 40, No.1, pp 7-107.

Glennerster, H., J. Falkingham, and N. Barr. Education and the life cycle. In *The Dynamic of Welfare: The Welfare State and the Life Cycle*, edited by J. Falkingham and J. Hills. Wheatsheaf: Prentice-Hall/Harvester. 1995.

Goodman A., A. Leicester and H. Reed, 2002. "A Graduate Tax for the UK?", in IFS Green Budget, Dilnot, A. C. Emmerson and H. Simpson (eds), Institute for Fiscal Studies, London.

Greenway, D. and M. Haynes, 2004. "Funding Higher Education", in International Handbook on the Economics of Education, edited by G. Johnes and J. Johnes. Cheltenham: Edward Elgar Publishing Ltd. 2004.

Harding, A. (1995) "Financing higher education: an assessment of income-contingent loan options and repayment patterns over the life cycle", *Education Economics*, Vol. 3, pp. 173–203.

Harmon, C., Oosterbeek, H., and I. Walker, 2002. "The Returns to Education: A Review of the Evidence, Issues and Deficiencies in the Literature", Institute for the Study of Social Change working paper, 2002/03.

Hayes, B., 2009. *The Third Way, A Fine Gael Green Paper on Reform of Higher Education*, [Online] Available at: www.finegael/org/upload/file/3rdway.pdf [Accessed 26th February 2010].

Higher Education Authority, 2011. National Strategy for Higher Education to 2030- Report of the Strategy Group. Report to Minister for Education and Science Government Publications, Dublin.

Higher Education Authority, 2009. Policy Options for New Student Contributions in Higher Education, Report to Minister for Education and Science.

Jacobs, B., 2002. "An investigation of education finance reform: Graduate taxes and income contingent loans in the Netherlands", CPB Discussion Paper no. 9/2002.

Johnstone, D.B., 2005. "Higher Educational Accessibility and Financial viability: The Role of Student Loans", paper prepared for the World Report on Higher Education: The Financing of Universities II International Barcelona Conference on Higher Education, Global University Network for Innovation (GUNI) Barcelona, Spain, May 24-25 and November 28-30, 2005.

McMahon, W. W. 2004. “The social and external benefits of education”, in International Handbook on the Economics of Education, edited by G. Johnes and J. Johnes. Cheltenham: Edward Elgar Publishing Ltd. 2004.

O’Connell, P.J., Clancy, D. and McCoy, S. (2006). Who Went to College in 2004? A National Survey of New Entrants to Higher Education. Dublin: Higher Education Authority.

O’Donoghue, C., (2010) *Life-Cycle Income Analysis Modelling*. Lambert Academic Publishing.

O’Donoghue, C., Lennon, J. and Hynes, S. (2009), “The Life-Cycle Income Analysis Model (LIAM): A Study of a Flexible Dynamic Microsimulation Modelling Computing Framework”, *International Journal Of Microsimulation*, 2(1), 16-31.

OECD, 2010. Education at a Glance: OECD Indicators, Paris: OECD, Centre for Educational Research and Innovation.

OECD, 2006. Higher Education in Ireland, Reviews of National Policies for Education. OECD Publishing, Paris.

Psacharopoulos, G., and H. A. Patrinos (2004). “Human capital and rates of return” in International Handbook on the Economics of Education, edited by G. Johnes and J. Johnes. Cheltenham: Edward Elgar Publishing Ltd. 2004.

Pscharopoulos, G. (1993). “Returns to Investment in Education: A Global Update”, Education and Employment Policy Research Working Papers, The World Bank, 1067.

Vandenberghe, V. and Debande, O. (2007) “Deferred and Income-contingent Tuition Fees: An Empirical Assessment using Belgian, German and UK Data”, Education Economics, 15:4, 421 – 440

Vodopivec, M. "A Simulation of an Income Contingent Tuition Scheme in a Transition Economy." IZA Discussion Papers 1247, 2004.

Table 1: State proportion of total tertiary education expenditure across levels and selected countries for 1995 and 2007

Country	2007	1995
Ireland	85%	70%
UK	35.8%	72%
USA	31.6%	48%
Italy	69.9%	91%
Germany	84.7%	93%
Australia	44.3%	73%
OECD average	69.1%	86%

Source: OECD (2010)

Table2: Present Value of Total Gross Lifecycle Earnings (€) across Education level and Gender (all in year 2000 values)

Gender	Education level		
	Lower secondary	Upper secondary	Tertiary
Male	427,826	748,078	988,813
Female	155,901	340,624	658,120

Source: Author's Calculations LIAM

Note: Earnings are assumed to grow by 2% in real terms each year while a real discount rate of 2% is applied

Table 3: Repayment Patterns for Graduates by Gender under an Income Contingent Loan System for Ireland with Two Different Interest Rates (Debt of €10,000)

0% Real Interest Rate				
	% of Borrowers who Repay in Full	Average Repayment Period in Years	Average NPV of Repayments (€)	Average Subsidy as a % of loan
Females	74%	15.5	3,492	65%
Males	91%	14.2	3,962	60.3%
Total Average	83%	14.8	3,728	62.7%
2% Real Interest Rate				
Females	62%	16.1	7,308	26.9%
Males	85%	15.4	8,978	10.2%
Total Average	73%	15.7	8,146	18.5%

Source: Author's Calculations LIAM

Note: The average repayment period includes only those that had paid their loan in full

Note: The NPV of repayments are repayments discounted to the year of graduation of each graduate

Table 4: Repayment Patterns for Graduates by Decile of Graduate Lifecycle Earnings Distribution under an Income Contingent Loan System for Ireland with Varying Interest Rates (Debt of €10,000)

Decile	% of Borrowers who Repay in Full	Average Repayment Period in Years	Average NPV of Repayments (€)	Average Subsidy as a % of loan
Real Interest Rate = 0%				
1	46%	24.8	2,880	71.2%
2	50%	21.1	3,015	69.8%
3	82%	22.7	3,674	63.3%
4	84%	18.8	3,937	60.6%
5	84%	18.5	3,988	60.1%
6	92%	15.3	3,977	60.2%
7	93%	11.8	3,769	60.3%
8	100.0%	9.3	4,033	59.7%
9	100.0%	8.4	4,055	59.4%
10	100.0%	6.5	4,056	59.4%
Real Interest Rate = 2%				
1	25%	23.1	4,557	54.4%
2	31%	19.75	4,946	50.5%
3	61%	24.7	7,586	24.3%
4	72%	23.0	8,240	17.6%
5	76.0%	21.5	8,423	15.7%
6	85%	17.5	9,200	8.0%
7	88%	14.6	9,055	9.15%
8	100%	9.2	10,000	0.0%
9	100%	9.6	10,000	0.0%
10	100%	7.5	10,000	0.0%

Source: Author's Calculations LIAM

Note: The average repayment period includes only those that had paid their loan in full

Note: The NPV of repayments are repayments discounted to the year of graduation of each graduate

Table 5a: Graduate Tax revenue as per cent of Total Simulated Loan Liability with Zero Real Interest Rate

	Yield of 1% Graduate Tax	Yield of 2% Graduate Tax
Females	127.2	253.0
Males	163.8	322.4
Total Average	145.8	287.9

Source: Author's Calculations LIAM

Table 5b: Graduate Tax revenue as per cent of Total Simulated Loan Liability with 2% Real Interest Rate

	Yield of 1% Graduate Tax	Yield of 2% Graduate Tax
Females	52.3	104.0
Males	67.4	132.5
Total Average	60.0	118.3

Source: Author's Calculations LIAM

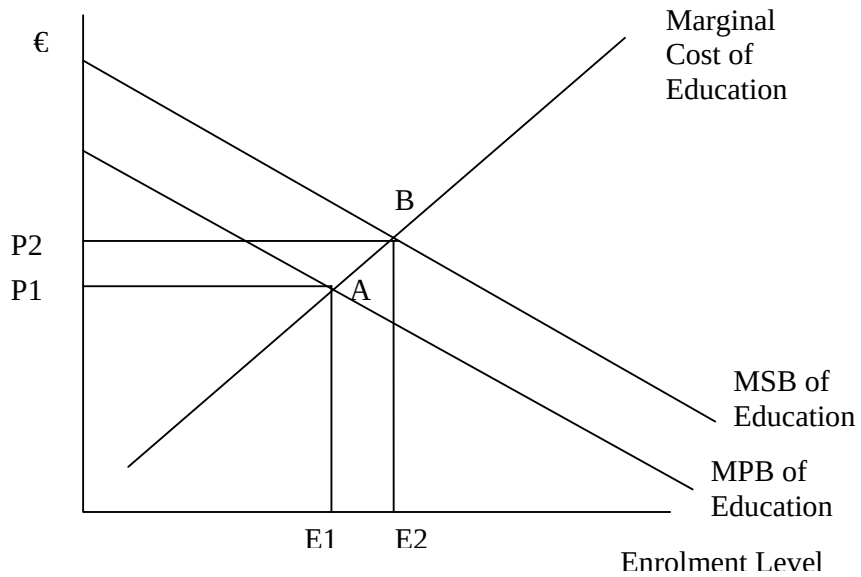
Table 6: Average Amount Paid by Graduates by Retirement Age under a Graduate Tax System of by Decile of Lifecycle Earnings Distribution and Varying Tax Rates

Decile of lifecycle earnings distribution	Average NPV of Repayments (€)
Graduate Tax Rate = 1%	
1	2,468
2	4,249
3	5,213
4	5,351
5	5,831
6	6,492
7	7,057
8	7,511
9	7,817
10	8,405
Graduate Tax Rate = 2%	
1	4,732
2	8,159
3	10,216
4	10,580
5	11,524
6	12,874
7	14,052
8	14,978
9	15,625
10	16,753

Source: Author's Calculations LIAM

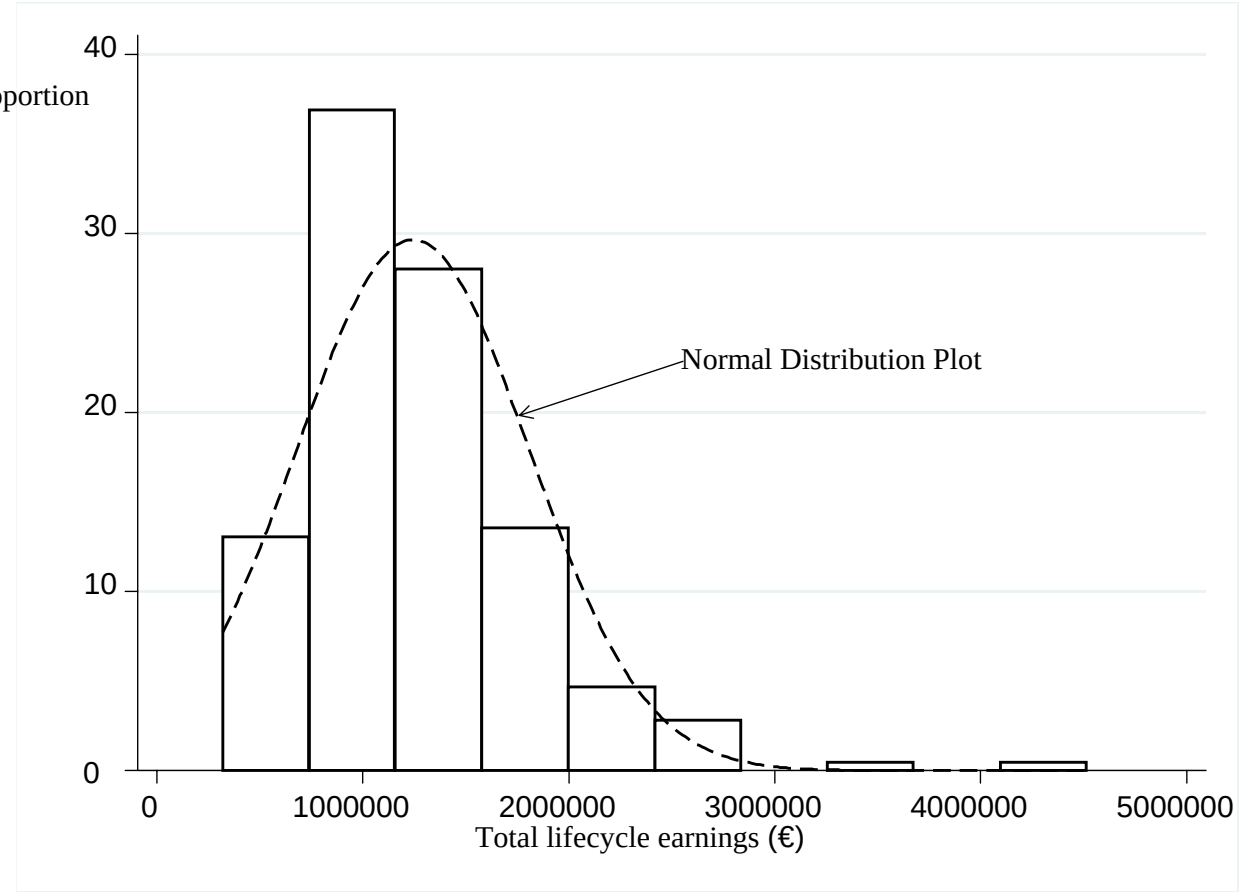
Note: The NPV of repayments are repayments discounted to the year of graduation of each graduate

Figure 1: Marginal Private and Social Benefits to Education versus the Marginal Cost of Education



Source: Adapted from Psacharopoulos and Patrinos (2004)

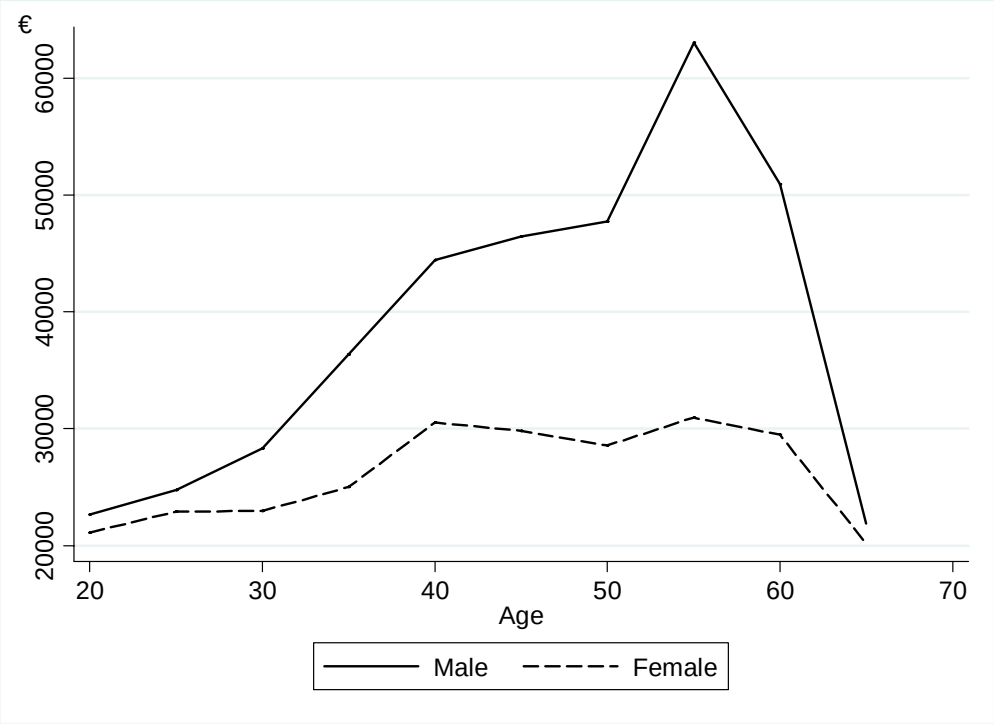
Figure 2: Simulated Present Value Lifecycle Earnings Distribution for Graduates within LIAM (All in year 2000 prices)



Source: Author's calculation LIAM

Note: Total lifecycle earnings for an individual is the sum of earnings from ages 22-65 with an assumption of 2% real growth in earnings per annum and a 2% real discount applied

Figure 3: Simulated Mean Annual Earnings for Male and Female Graduates within LIAM from ages 22-65 (All in year 2000 prices)



Source: Author's calculation LIAM
Note: Earnings are subject to the assumption of 2% real growth in earnings per annum and a 2% real discount applied

Appendix A: Sensitivity Analysis with respect to the discount rate - Repayment Patterns for Graduates by Gender under an Income Contingent

Table A1: Loan System for Ireland with Two Different Interest Rates and Real Discount Rate of 3% (Debt of €10,000)

	% of Borrowers who Repay in Full	Average Repayment Period in Years	Average NPV of Repayments (€)	Average Subsidy as a % of loan
0% Real Interest Rate				
Females	74%	15.65	2,303	77%
Males	91%	14.3	2,610	73.9%
Total Average	83%	14.8	2,457	75.4%
2% Real Interest Rate				
Females	60%	16.1	4,740	52.6%
Males	85%	15.4	5,814	41.9%
Total Average	73%	15.7	5,279	47.2%

Source: Author's Calculations LIAM

Note: The average repayment period includes only those that had paid their loan in full

Note: The NPV of repayments are repayments discounted to the year of graduation of each graduate

Table A2a: Graduate Tax as per cent of Total Simulated Loan Liability with Zero Real Interest Rate and Real Discount Rate of 3%

	Yield of 1% Graduate Tax	Yield of 2% Graduate Tax
Females	126.1	251.0
Males	162.4	319.7
Total Average	144.3	285.4

Source: Author's Calculations LIAM

Table A2b: Graduate Tax as per cent of Total Simulated Loan Liability with 2% Real Interest Rate and Real Discount Rate of 3%

	Yield of 1% Graduate Tax	Yield of 2% Graduate Tax
Females	52.3	104.0
Males	67.3	132.5
Total Average	60.0	118.3

Source: Author's Calculations LIAM