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The Life-cycle Impact of Alternative Higher Education Finance Systems in Ireland

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Abstract: 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 utilise 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 analyse the repayment length under the former system. Our results suggest that an ICL system could be more equitable, while the graduate tax system could be a better alternative from a fiscal viewpoint. The results also illustrate the importance of the interest rate attached to any future student loan system within Ireland from a fiscal viewpoint.

I 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 per cent for the year 2007, OECD 2010). Given the high private returns to education (Barrett *et al.*,

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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 Higher Education Authority (2011). The aim of this paper is to utilise 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 in Table 1 below, where the OECD average State share of total expenditure on tertiary education over the period 1995-2007 fell from 86 per cent to under 70 per cent. The only exception is Ireland, where the public share has risen from 70 per cent to 85 per cent, 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 €1,500 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.

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).

Meeting the objective of increasing the percentage of the Irish labour force with a third level qualification from 33 per cent in 2008 to 48 per cent in 2020 (Future Skills Needs, 2007) will require significant extra resources. In addition, participation in higher education is not equal, with higher socio-economic groups such as professional backgrounds having a disproportionate

share of third level admissions. (O'Connell et al, 2006) and 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

In this paper we utilise 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 analyse 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.

II 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 life-cycle 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 to positive

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

[2] For instance in an Irish context Barrett *et al.* (2002) found that those with a diploma or degree could earn up to 80 per cent 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 *et al.* (2002).

externalities, higher taxes, lower unemployment and better social outcomes such as lower crime (McMahon, 2004). Also, with specific reference to externalities generated from higher education, Moretti (2004) shows evidence that higher numbers of third level graduates can positively impact on wages for those of lower education. As a result of these, there is an efficiency justification for the State to subsidise the cost of participation.

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 life-cycle 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 the lower incomes participate. These may take the shape of State funded policies such as means tested grants based upon parental income, a range of scholarship programmes aimed specifically at those from lower incomes or in the most extreme case, free higher education may be offered to the entire population. In addition, the method of financing influences the redistributive nature of the policy as does differentiation in access due to non-monetary reasons. Studies such as those from Dynarski (2003) and Carnerio and Heckman (2002) outline the potential importance of these subsides in helping overcome the credit constraint those with lower incomes may face when entering third level education. However, untargeted subsidies such as free third level to all may effectively become transfers to the rich if other barriers to entry by lower income groups to higher education exist[3] and are not overcome. Although Ireland does have a mean tested grant system in place to cover tuition fees and some maintenance costs for those with low income, Clancy (1997, 2001) and O'Connell (2006) note that the free tuition scheme in Ireland, because of the persistent socio-economic participation differentials, results in a net transfer to the top of the income distribution.

2.1 *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

[3] These may include a perceived low rate of return to higher education, high opportunity costs and/or family and cohort influences, see Flannery and O'Donoghue (2009) for a discussion of these in an Irish context.

education are available. While options such as grant schemes, education vouchers and tuition fee schemes exist within these options,[4] 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 of 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.[5] A number of variants around these basic tenets exist with Chapman (2005) and Barr (1993) presenting a detailed discussion of these.[6] However, gauged in terms of the proposals outlined previously (HEA, 2009; Department of Education, 2003; Hayes, 2009), the applicability in an Irish context, 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.

2.2 *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 individual has cleared his/her own debt. Within this structure the costs of non-payment are shared by the taxpayer and the graduate. As the externalities involved with higher education benefit society as a whole, placing some of the

[4] See Greenway and Haynes (2004) for more details on education vouchers, grant allocations and tuition fees.
[5] See Johnstone (2005) for more details on the mortgage style student loans.
[6] These include human capital contracts and an ICL system with risk pooling.

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 life cycle. Therefore, the graduate will generally face repaying

$$\text{Payment} = (1 + D) \times t \tag{1}$$

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 taxpayers without higher education pay more than they should,[7] 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 different forms of ICL systems. For example, an ICL with risk pooling is designed with a fixed total debt for members of particular cohorts, usually designated by student's year of enrolment. In this system, although each student may receive the same loan amount, as the debt is totalled across a cohort, some individuals may have to pay debts that are not paid for by others in their cohort. This is because repayments are adjusted ex post to take into account the repayment patterns of others in the cohort. This results in a transfer of the default risk of the loan to those with higher future incomes, who may end up repaying more than those with lower future incomes as repayments are based as a fraction of future incomes (Chapman, 2005). Therefore, as an ICL with risk sharing entails that the taxpayer and not the graduate will meet the default, there is no danger for the borrower if his/her future incomes rise. Therefore, it is unlikely that high ability students will opt out of this system, and also graduates with higher incomes will have less of an incentive to divert away from high 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

[7] Measured against the benefits they enjoy from the externalities from higher education.

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 with an ICL system generally introduced to complement an existing means tested grant scheme. Chapman (2005) notes that in Australia, evidence would 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, while the scheme resulted in eight billion Australian dollars[8] being raised during the period 1989-2001. Also, as the figures in Table 1 illustrate, it can be suggested that all these countries 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. With particular reference to the UK, who introduced an ICL with risk sharing system in 1997, we see the proportion of third level expenditure coming from the State fell from 70 per cent in1995 to 36 per cent by 2007. The UK has seen evidence similar to that of Australia with the introduction of the scheme seemingly having no effect on the composition of those participating in higher education across social or income class (UK Office for National Statistics, 2004).[9] Such evidence would seem to suggest that in an Irish context, the introduction of a similar scheme may have a limited impact upon the participation of those from lower incomes and help reduce the funding reliance of third level institutions on the State. However, while the initial system in the UK was designed with a flat, generic loan given to each graduate, recent reforms such as those in 2007 and currently being implemented as a result of the Browne report (2010) entail that graduates of different courses and institutions will face varying amount of debt. This will mean increased fees (and debt) for students (graduates) and thus increased revenue for third level institutions and so may prove fiscally beneficial. However, the effect upon student participation in the UK is unknown, with research by Dearden *et al.* (2007) suggesting that such reforms may increase participation levels by lower income groups if they are complemented with reform/implementation of a higher education grant system.

[8] This figure is in 2001 prices.

[9] It may be important to note that both these countries introduced these ICL schemes as complementary to existing subsidy schemes such as means tested grant schemes. The possible impact upon participation they would have had if such subsidies were removed with the introduction of the ICL systems is difficult to estimate, however, it may be reasonable to suggest that participation by those from lower socio-economic groups may suffer in such a case.

2.3 *Graduate Taxes*

Another income contingent instrument is a graduate tax system. While most income tax systems are progressive and so higher educated individuals with higher incomes will pay on average higher average tax rates, these systems do not differentiate horizontally, so individuals with the same income will pay (subject to other tax deductions) the same tax. A graduate tax recognises the differential public expenditure in relation to higher education. 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 taxable 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 would still be reliant on State finance and face 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 considerable revenue for the government. There are some administrative difficulties (albeit non-insurmountable) also in linking income tax systems to higher education systems, to define the potential tax base. Issues may arise also in terms of graduates who have spent all or part of their studies overseas. Another question may relate to whether the tax rate should differentiate between different length or costs of tertiary education. However, the fact that 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. The next section outlines the

methodology employed to simulate the implementation of these two systems within Ireland.

III METHODOLOGY

3.1 *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 have 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 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 per cent of the total HECS debt owed by males to the government was paid by the time they reach retirement age, with 93 per cent of AUSTUDY debt paid in full by males over the same time frame. These figures are lower for the female population with 77 per cent and 71 per cent 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 per cent to 22 per cent 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 per cent to 10

per cent of females that fully pay-off their debt, 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 *et 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.[10] 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 life-cycle 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 periods averaged nearly 40 years under all assumptions and upwards of 50 per cent of total debt remaining unpaid by retirement age which may raise questions about the fiscal security involved, if the State is assumed to be the lender in the scheme.

Other papers such as Vodopivec (2004), Vandenberghe and Debande (2007) and Migali (2010) do not explicitly employ microsimulation techniques in simulating the impact of alternative finance structures. The first study merges two datasets to simulate life-cycle earnings and employment patterns for Slovenian graduates based on the work histories of a separate adult cohort based upon gender, age and education level to help investigate the impact of an income contingent loan system on government revenues. This finds that an ICL system would be successful in recovering its outlays in Slovenia. The second paper mentioned also investigates an ICL system from a fiscal

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

viewpoint in three European countries. They use a cross section of earnings data from each country to simulate age earnings profiles of graduates to analyse the impact of a ICL system, again finding there is a significant fiscal impact from the repayments of graduates. Migali (2010) compares mortgage style student loan and ICL systems using a cross-sectional dataset of UK graduates, where life-cycle earnings are produced by assuming that the growth rate of graduate earnings throughout the life cycle follow a Brownian motion and conclude that an ICL system may be beneficial for those with lower earnings. However, unlike the studies utilising dynamic micro-simulation models these studies do not analyse the specific redistributional impacts and/or the length of time to repayment involved with alternative finance structures for higher education.

This paper utilises the Life-cycle 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 life cycle. To illustrate the potential impact of such a system over the life cycle 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 factors in determining 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. While the model does not explicitly incorporate the current economic crisis, as this period will form a relatively short part of an individual's life cycle, the qualitative conclusions between scenarios are robust. It must be remembered that in using microsimulation models for scenario analysis, we are not conducting forecasts, rather we utilise plausible distributions of lifetime earnings patterns and compare the impact of alternative financing mechanisms on this distribution, rather than forecasting the impact which is both beyond a methodology such as this and containing significant uncertainty.

The combination of the above processes provide a simulated future for the entire population within the *Living in Ireland Survey* 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 life-cycle earnings streams and employment patterns of each individual in our population.[11]

Table 2 below illustrates the education-earnings profile of the population and shows the data following an expected path, with higher educated individuals earning more over their lifetime, and also males earning more then females. For the analysis in this paper it is the life cycle of a particular cohort that is of interest. We identify those that have completed upper

Table 2: *Present Value of Total Gross Life-cycle 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 per cent in real terms each year while a real discount rate of 2 per cent is applied.

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

secondary schooling and had completed tertiary education by the end of their 22nd year. We then track these individuals throughout their life cycle 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 1 presents a picture of the simulated total life-cycle earnings distribution for our sample discounted to year 2000.[12] 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 2 below presents the simulated average earnings for males and females graduates within LIAM throughout the life cycle. 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.

3.2 *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.

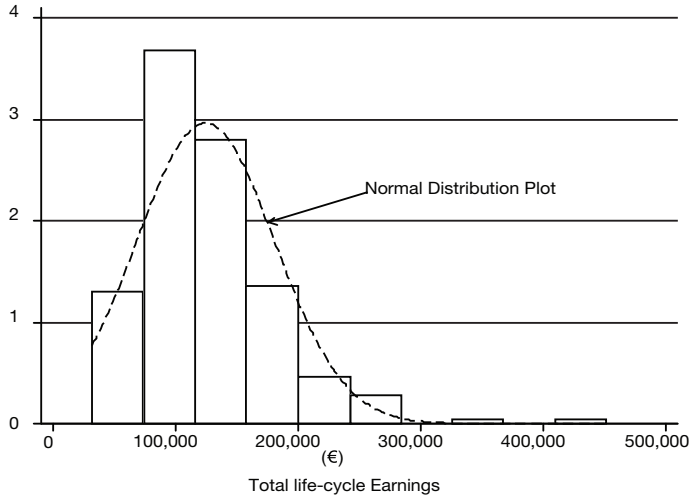
With the LIAM model disaggregating education level completed across four main headings, it prohibits simulating different loan amounts to different individuals based upon course choice. It also prohibits looking at differences across part-time or full-time study.[13] For the purposes of this analysis, 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 €2,500 per annum (in 2000 prices).[14] Therefore, each graduate is assumed to incur a debt of

[12] Total life-cycle earnings for an individual is the sum of earnings from ages 22-65 with an assumption of 2 per cent real growth in earnings per annum and a 2 per cent real discount applied.

[13] Ideally one would distinguish between the different levels of tertiary education, either across part-time/full time and/or across universities versus institutes of technology. However, the LIAM dataset used here was originally designed to solely investigate tax/benefit issues, hence the aggregated variables with regard to education. Work to undo this within the LIAM framework would be prolonged and was not considered for this article but may be considered for future work.

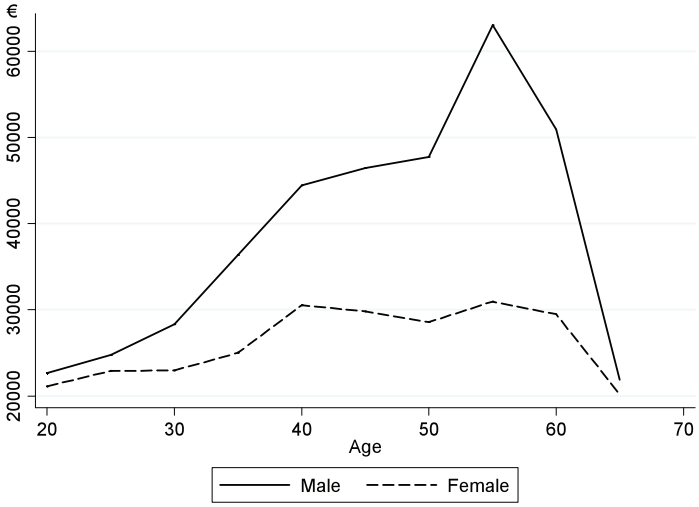
[14] Although it is not of consequence for our analysis whether these loans go towards covering tuition fees or maintenance, we assume this is solely a loan for fees, with the current system for maintenance grants staying in place.

Figure 1: *Simulated Present Value Life-cycle Earnings Distribution for Graduates Within LIAM (All in Year 2000 Prices)*



Source: Author's calculation LIAM.
Note: Total life-cycle earnings for an individual is the sum of earnings from ages 22-65 with an assumption of 2 per cent real growth in earnings per annum and a 2 per cent real discount applied.

Figure 2: *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 per cent real growth in earnings per annum and a 2 per cent real discount applied.

€10,000 by the end of his/her stay in higher education. We assume payment begins as soon as they 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,[15] 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 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.[16] 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 per cent 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 per cent on any income earned above this second threshold as well as 10 per cent on all income above the first (lower threshold).[17] The assumption is also made that these amounts are blanket thresholds at the individual level, with no allowances for number of children 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,[18] with graduates forced to pay an additional 1 per cent 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 rules surrounding PRSI contributions such as the PRSI ceiling.

[15] This is assumed to be 2 per cent per annum as per current government projections, we then apply a real discount rate of 2 per cent in obtaining the present value for the year 2000.
[16] This is similar to the design of the original Australian ICL system.
[17] While these repayment rates are chosen somewhat arbitrarily, they are based loosely upon the repayment rates that currently exist in the UK.
[18] A graduate tax system through PRSI contributions in Ireland has been put forward by the main opposition party at the time of writing.

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.

IV EMPIRICAL RESULTS

The results of simulating two alternative higher education finance systems for Ireland using the LIAM dynamic microsimulation model will be analysed in terms of repayment patterns, redistributional issues and from a fiscal viewpoint. When analysing these figures it is important to note that they are quite sensitive to changes 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.[19]

4.1 *ICL*

For the ICL system simulated, Table 3 indicates that for males, 82 per cent of graduates pay back their loan in full when a zero real interest rate is

[19] Some sensitivity analysis on the assumed discount rate applied is also presented in Appendix A 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 per cent 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 per cent change in the real discount rate does little to impact the amount repaid relative to the simulated loan.

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)*

	Percentage of Borrowers who Repay in Full %	*Average Repayment Period in Years*	*Average NPV of Repayments (€)*	*Average Subsidy as a Percentage of Loan* %
0% Real Interest Rate				
Females	74	15.9	5,904	41
Males	89	14.4	7,046	29.5
Total Average	82	15.0	6,477	35.2
2% Real Interest Rate				
Females	63	16.2	7,300	27.0
Males	85	15.4	8,976	10.2
Total Average	74	15.7	8,141	18.6

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.

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 per cent of females doing so, compared to 89 per cent 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 per cent of males and 77 per cent 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 per cent of British females may repay back their loan in their simulated ICL system.[20] The male repayment rate of 84 per cent 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 14 years when the assumption of a zero real interest rate is applied, while females take 16

[20] This is under the assumption of 3 per cent real earnings growth and 0 per cent real interest rate on the loan.

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 *et al.* (2007) find that a variant of the UK system may bring down these figures for the UK, with the number 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 generally earn less across the life cycle, are more likely to leave the labour market and/or work part time than their male counterparts.

Another area 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 that under the assumption of a zero real interest rate the average subsidy as a percentage of the original loan amount is 35 per cent. This figure arguably represents quite a generous subsidy towards the graduate and is a figure 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 some insight with an assumption of a 2 per cent real interest rate applied to the student loan provided. It is shown that the proportion of graduates that repay the debt in full drops to 74 per cent, 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 per cent 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 18.6 per cent, down from the figure

of over 35 per cent seen previously with the zero real interest rate.[21] 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 results suggest that within the system simulated here, an interest rate on the debt that corresponds to a real interest rate of 2 per cent is extremely effective in reducing this subsidy, compared to a situation of zero real interest rates.

From a distributional point of view, we analyse the repayment 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 seems to hold progressive qualities.

With a system of zero real interest rates, our results shows that 48 per cent of those in the lowest life-cycle earnings decile end up paying back the full amount of their debt, compared to a figure of 100 per cent 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 still exists for those at the higher end of the graduate income distribution, standing at nearly 12 per cent 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

[21] An intuitive example may help illustrate the sensitivity of the NPV of the amount repaid to the real interest rate. For simplicity, we assume that upon graduation an individual has €10,000 worth of debt that is owed to the State with a zero real interest rate. This person finds employment upon graduation and on average pays off €1,000 of his/her debt each year. After 10 years this individual will have cleared their debt, however the NPV of these repayments will only be €8,200 (with a real discount rate of 2 per cent as we assume above). So, in effect the State will receive €8,200 in return for €10,000 as they have not charged a real interest rate, thus providing an implicit 18 per cent subsidy to the graduate. On the other hand if the State had charged the debt with a 2 per cent real interest rate (upon the principal), after 10 years of similar annual repayments the individual would still owe the State €2,200 (or €1,800 in present value terms). The individual would continue repayments for roughly another 3 years. By this stage they will have paid back €13,000 in real terms but circa €10,000 in net present value terms, so the government will receive €10,000 back from the initial €10,000 debt in present value terms and the implicit subsidy from the real interest rate applied goes to 0.

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

	Decile Percentage of Borrowers who Repay in Full %	*Average Repayment Period in Years*	*Average NPV of Repayments (€)*	*Average Subsidy as a Percentage of Loan* %
Real Interest Rate = 0%				
1	48	25.5	3,725	62.7
2	48	20.0	3,971	60.3
3	78	22.5	5,445	45.5
4	87	19.9	6,070	36.8
5	84	19.2	6,249	37.5
6	92	16.0	6,944	30.5
7	88	12.52	7,888	20.1
8	100.0	8.1	7,775	22.2
9	100.0	8.8	8,457	15.5
10	100.0	6.8	8,778	12.2
Real Interest Rate = 2%				
1	29	23.0	4,545	54.5
2	31	19.75	4,935	50.6
3	61	24.7	7,579	24.3
4	72	23.0	8,230	17.7
5	76	21.5	8,415	15.8
6	85	17.6	9,195	8.0
7	88	14.6	9,051	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.

that is not repaid comes from those that do not benefit from higher education through higher life-cycle 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 life-cycle earnings benefit substantially from higher education do not pay substantially towards its cost.

4.2 *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 per cent on PRSI contributions would repay 135 per cent of total borrowing under the assumption of a zero real interest rate on the debt. This is compared to just under 65 per cent of all debt recovered from the ICL system under the same assumption. A graduate tax system involving an extra 2 per cent of PRSI contributions would yield 267 per cent 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 per cent graduate tax scheme would yield only 60 per cent of simulated

Table 5a: *Graduate Tax Revenue as a Percentage of Total Simulated Loan Liability with Zero Real Interest Rate*

	Yield of 1 Per Cent Graduate Tax	*Yield of 2 Per Cent Graduate Tax*
Females	118.6	236.0
Males	152.2	299.6
Total Average	135.4	267.9

Source: Author's calculations LIAM.

Table 5b: *Graduate Tax Revenue as a Percentage of Total Simulated Loan Liability with 2 Per Cent Real Interest Rate*

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

Source: Author's calculations LIAM.

debt with the assumption of a 2 per cent 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 per cent on PRSI contributions with the same interest rate, the yield is shown as 118 per cent 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 are 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[22] and our results show that no government subsidy would be required under a 2 per cent graduate tax scheme, while some substantial government subsidy would still exist under a 1 per cent scheme.

Comparing the results in Table 6 with Table 4, we see that with the exception of graduates in the bottom two income deciles within a 1 per cent graduate tax scheme, relative to a ICL system with a 2 per cent real interest rate, all income levels pay more under the graduate tax system than the ICL. However, the majority of the burden falls on those that earn the most over their life cycle. 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 taxpayer, similar to any other redistributive measure. They also suggest that as the revenue from a graduate tax system may go to the State and not directly to higher education institutions, the benefits of such a system may not be accrued to educational resources.

4.3 *Implications of Increasing Graduate Emigration*

With Ireland currently experiencing its worst economic crisis in recent history, labour market opportunities have tightened significantly. This is especially true for young people in Ireland, with unemployment rates of 26 per cent and 16.5 per cent for those aged 20-24 and 25-29 respectively (CSO, 2011). The weakness in the labour market has led to a rise in emigration from Ireland, particularly by those aged under 25. Third level graduates have formed a significant part of this increase with the latest figures (based upon

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

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

Decile of Life-cycle 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.

2008 graduates) showing that 10 per cent of new graduates are working abroad, with this figure expected to be higher for subsequent years (HEA, 2010). While the LIAM model used within our estimations does account for emigration, the assumptions surrounding the simulated emigration are based upon projections from the year 2001. While the projections incorporate a revision in terms of increased emigration, current emigration projections, especially for third level graduates, are higher. These changes could have an impact upon our estimates of repayment patterns by Irish graduates. To account for this possibility we simulate a significant rise in graduate emigration from Ireland within our model and observe the new pattern of repayments that occurs.

We first assume that 20 per cent of our sample emigrates upon graduation with this sub sample picked completely at random.[23] The impact upon income contingent loan repayment patterns is assumed to possibly follow two different paths. The first is where those that emigrate pay nothing back towards the debt they owe. The results of this are presented in Table 7a below for scenarios with zero and 2 per cent real interest rates respectively. If these results are compared to the original results presented in Table 3 we see that the simulated emigration has a significant effect on all aspects of repayment. The average proportion of graduates that repay their debt in full falls from 82 per cent to 65 per cent under a system of zero real interest rates while the average State subsidy rises from 35 per cent to 48 per cent with the same interest rate applied. Similar results are seen with respect to the ICL system with a 2 per cent real interest rate applied. Given that graduate emigration is expected to remain high in Ireland for the foreseeable future, our results would suggest that the introduction of an ICL system in Ireland must attempt to address the issue of repayment by graduates that leave the country.

The HEA (2009) have acknowledged the issue of graduate emigration within the design of an ICL system and point to countries such as the UK and Australia that employ mechanisms such as a requirement to notify the lending agency before emigration with an agreement of a new schedule for repayments and penalties if scheduled repayments are not met within their ICL systems. Therefore, if an ICL system is introduced in Ireland it is likely that some form of disincentive similar to these would have to be introduced to avoid zero repayment from graduate emigrants. We, therefore, also analyse the impact upon income contingent loan repayment patterns where repayment from emigrants does occur. As this is an ex ante study we rely on external statistics to estimate the probability of repayment by graduates that emigrate. This is achieved using figures from the UK that indicate that of those graduates that emigrate after completing third level college, an average 40 per cent are making repayments at any one time[24] (Student Loan, Company, 2011). Given this, we assume in our model that in any one period, 40 per cent of those randomly chosen to emigrate within our sample continue repayments on their debt to the same level as they would have living and working in Ireland. The

[23] The figure of 20 per cent is chosen somewhat arbitrarily as no official projections can be found. However, this was the rate of graduate emigration in Ireland in the late 1980s (Murray and Wickham, 1990), when overall emigration was previously at such high levels as those seen today and so may be seen as somewhat robust.

[24] This figure is based upon the average proportion of UK graduates that are overseas and making repayments on their student debt over the period 2000-2009. The rest of those overseas are either under the income threshold to begin repayments (42 per cent, or have fallen into arrears on their debt (18 per cent).

Table 7a: *Repayment Patterns for Graduates by Gender Under an Income Contingent Loan System for Ireland with Two Different Interest Rates and Simulated Graduate Emigration with No Repayment (Debt of €10,000)*

	Percentage of Borrowers Who Repay in Full (%)	*Average Repayment Period in Years*	*Average NPV of Repayments (€)*	*Average Subsidy as a Percentage of Loan (%)*
0% Real Interest Rate				
Females	60	15.1	4,889	51.1
Males	71	14.8	5,457	45.4
Total Average	65	14.9	5,179	48.2%
2% Real Interest Rate				
Females	50	16.6	5,901	41.0
Males	69	14.4	7,315	26.8
Total Average	60	15.3	6,611	33.9

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 7b: *Repayment Patterns for Graduates by Gender under an Income Contingent Loan System for Ireland with Two Different Interest Rates and Simulated Graduate Emigration with Some Repayment (Debt of €10,000)*

	Percentage of Borrowers Who Repay in Full (%)	*Average Repayment Period in Years*	*Average NPV of Repayments (€)*	*Average Subsidy as a Percentage of Loan (%)*
0% Real Interest Rate				
Females	66	16.2	5,328	46.7
Males	82	14.2	6,482	35.2
Total Average	75	15.1	5,907	40.1
2% Real Interest Rate				
Females	57	16.0	6,652	33.5
Males	77	15.4	8,167	18.3
Total Average	67	15.6	7,413	25.9

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.

results from these simulations are presented in Table 7b, again differentiated by levels of real interest rate. In comparing Tables 7a and 7b we see that the results indicate that incorporating some repayment from emigrants does significantly reduce the State subsidy relative to the situation of no repayment, the average State subsidy falls from 48 per cent to 40 per cent under a zero real interest rate system. However, when compared to the results of Table 3 we still find that emigration has a significant effect on the proportion of borrowers that pay their debt in full and the average State subsidy provided, suggesting that graduate emigration may still be a problem in terms of debt recovery if an ICL system is introduced in Ireland.

Table 8a: *Graduate Tax Revenue as a Percentage of Total Simulated Loan Liability with Zero Real Interest Rate and Simulated Graduate Emigration*

	Yield of 1 Per Cent Graduate Tax	*Yield of 2 Per Cent Graduate Tax*
Females	97.1	201.8
Males	119.9	243.3
Total Average	108.5	222.6

Source: Author's calculations LIAM.

Table 8b: *Graduate Tax Revenue as a Percentage of Total Simulated Loan Liability with 2 Per Cent Real Interest Rate and Simulated Graduate Emigration*

	Yield of 1 Per Cent Graduate Tax	*Yield of 2 Per Cent Graduate Tax*
Females	42.7	81.6
Males	55.2	1.09
Total Average	49.0	95.6

Source: Author's calculations LIAM.

For the impact of increased emigration upon the simulated graduate tax system, it is assumed that no repayment ever occurs from graduates that emigrate. This is due to the fact that the simulated graduate tax system in this study is designed to generate revenue through the Irish social insurance system and graduates that leave third level education under this system do so without any specific amount of debt to repay. The results of the simulated 20 per cent graduate emigration rate upon graduate tax revenue levels are presented in Tables 8a and 8b and are presented in a similar manner to Tables

5a and 5b, showing the yield of such a scheme relative to the ICL system, 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. We predictably find that graduate emigration has a negative and significant impact upon revenues generated from a graduate tax system. The results show that a 1 per cent graduate tax system now repays 108 per cent of total borrowing under the assumption of a zero real interest rate on the debt, compared with 135 per cent with lower emigration. Also, a graduate tax system involving an extra 2 per cent of PRSI contributions would now yield 222 per cent of the total loan liability compared with a figure of 267 per cent seen earlier with the same interest rates involved. Similar revenue falls are seen when the interest rate applied to the graduate debt is changed to 2 per cent. Despite the simulated graduate emigration forcing revenue downward, our results indicate that the graduate tax system still remains largely fiscally viable and attractive relative to an ICL system. However, as it is the graduates that are left in Ireland that are essentially paying for the education of those that leave the country, such a situation may bring about considerable moral hazard issues, leading to even greater graduate emigration, thus further reducing the potential revenue generated.

V 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 utilise 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 analyse 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 82 per cent 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 per cent 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 per cent real interest rate, those from the lower deciles of the life-cycle 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 life cycle paying the least. However, our results also show that under the graduate tax scheme where an extra 1 per cent is added to PRSI contributions, graduates on average pay back 1.35 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. We also investigate the potential impact of an increase in graduate emigration upon repayment patterns and find that State subsidies towards an ICL system may increase significantly under such circumstances, even with a mechanism in place to facilitate repayments from graduates overseas. Our results also indicate that our simulated graduate tax system may still be fiscally attractive with increased graduate emigration, but the unknown moral hazard effects may negate any strong policy conclusions to be made from this.

The progressive nature of both higher finance systems may entail that the removal of the current higher education finance system in Ireland and the introduction of either system discussed above may prove to be a type of redistributive policy tool. With both systems there is free point of entry to higher education and mechanisms in place to ensure that those that see the lowest return from that education pay the least for it. Under the current system, each individual pays the same regardless of future benefit received. When investigating the impact of non-cash transfers on income inequalities Callan *et al.* (2007) show the negative impact of State higher education transfers upon income inequality currently within Ireland. Under a system of ICL or graduate tax this may be reduced as those with the lowest income

would receive the greatest State transfer. However, the progressive nature of repayments within both systems may bring about an issue of moral hazard within graduates employment choices. With repayments in both systems dependent on work income, the introduction of both systems may act as a disincentive to work and also graduates may be more inclined to choose jobs with non-income benefits. This may be especially true if a graduate tax system is in place, as repayments are on-going throughout the life cycle and do not end with the debt repaid.

The paper does not investigate the impacts of such systems upon participation rates and administrative costs of the alternative systems. With the former, while evidence from the UK and Australia indicate no major impact upon participation rates with the introduction of an ICL system, research such as Hryshko, Luendo-Prado and Sorenson (2011) and Burdman (2005) suggests that individuals from more disadvantaged backgrounds are more likely to be financially risk adverse and thus may alter their education participation decision if a loan system is implemented. This could then worsen the negative distributional consequences of uneven participation from various socio-economic groups in higher education. With respect to administrative costs, Chapman (2005) notes that in countries that have adopted alternative higher education finance systems, the administrative costs have been inexpensive relative to potential revenue generated. Despite these constraints, 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 utilised in the future to simulate variants of the systems proposed here to attempt to find an optimal system from an equitable and efficiency viewpoint.

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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 Per Cent (Debt of €10,000)*

	Percentage of Borrowers Who Repay in Full %	*Average Repayment Period in Years*	*Average NPV of Repayments (€)*	*Average Subsidy as a Percentage of Loan* %
0% Real Interest Rate				
Females	74	15.9	5,109	49
Males	89	14.4	6,210	37.9
Total Average	82	15.0	5,662	43.4
2% Real Interest Rate				
Females	63	16.2	6,068	39.3
Males	85	15.4	7,661	23.4
Total Average	74	15.7	6,868	31.3

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 a Percentage of Total Simulated Loan Liability with Zero Real Interest Rate and Real Discount Rate of 3 Per Cent*

	Yield of 1 Per Cent Graduate Tax	*Yield of 2 Per Cent Graduate Tax*
Females	117.6	234.1
Males	151.0	297.3
Total Average	134.4	265.8

Source: Author's calculations LIAM.

Table A2b: *Graduate Tax as a Percentage of Total Simulated Loan Liability with 2 Per Cent Real Interest Rate and Real Discount Rate of 3 Per Cent*

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

Source: Author's Calculations LIAM.