Higher Education and Technological Disruption: Purpose, Structure and Financing

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Part I – Higher Education, Ireland and the Income Contingent Loan Debate

The Irish education system appears to be in the midst of the state of *verschränkung* observed by Schrödinger (1935), namely, the system can be described as both alive and dead at the same time. One cannot simply look inside the "sealed box" of the education system to observe the true financial health of the individual entities, but one can observe that there is an astonishing level of debt through international lending sources such as the European Investment Bank (EIB). Multiple expansion projects are underway throughout the sector, designed to add capacity for the expected cohort of students that will enter the system in the forthcoming years while building towards the recommended investment of at least €1 billion recommended by Peter Cassells and associated expert group. This situation provides signs of life within the sector.
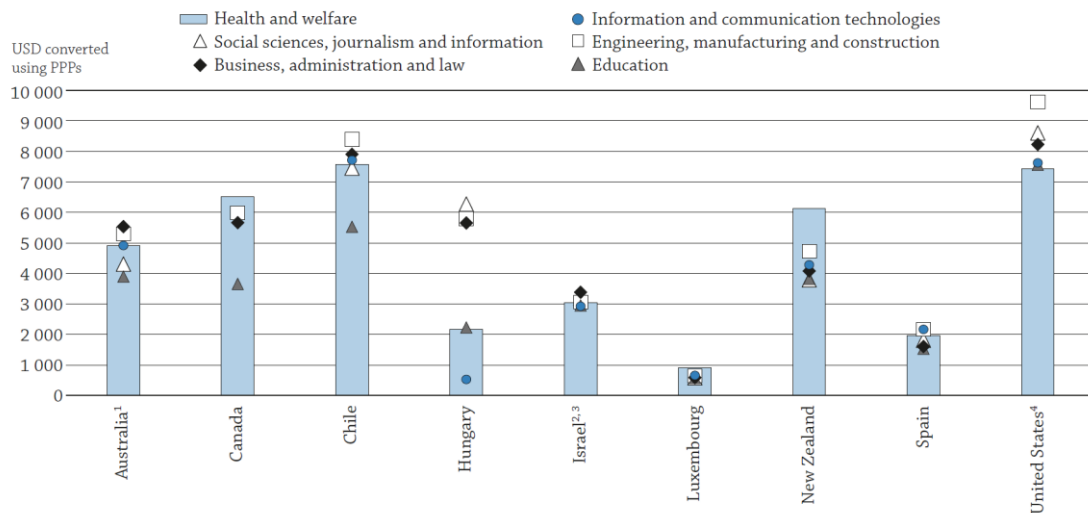
It is important to place this situation in context. If you look at the major higher education systems you have a cost problem. The most apparent challenge exists in the United States, where fee increases have become the focus of much debate recently. The 2007-2012 Global Financial Crisis focused attention on large, seemingly low risk, pools of debt. Outside of the mortgage market, that triggered the Crisis in mid-2007, the next largest semi-private pool of debt is in the area of student loans obtained to pay for university education.
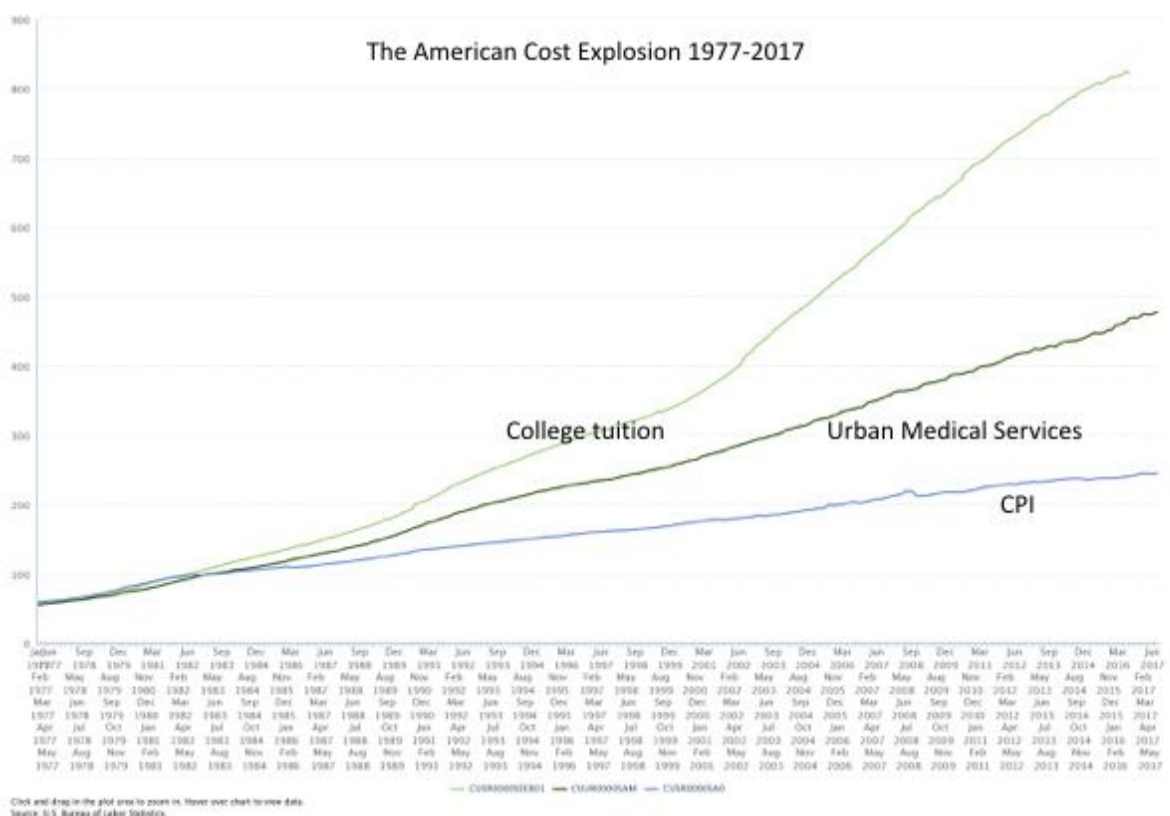
Source: BLS.

Figure B5.2. Average tuition fees charged by public institutions at bachelor's or equivalent level for selected fields of study (2015/16)
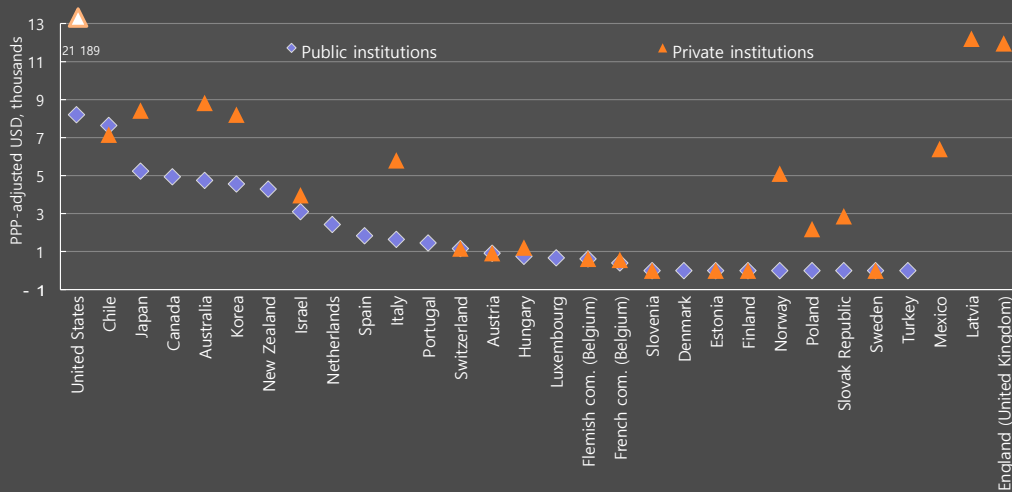
Average annual tuition fees charged to full-time national students, converted into USD using PPPs for GDP

Legend:
- Health and welfare
- Information and communication technologies
- △ Social sciences, journalism and information
- □ Engineering, manufacturing and construction
- ◆ Business, administration and law
- ▲ Education

USD converted using PPPs

Countries (x-axis): Australia[1], Canada, Chile, Hungary, Israel[2,3], Luxembourg, New Zealand, Spain, United States[4]

High tuition fees are characteristic of tertiary education in many countries

Figure B5.1

Tuition fees charged by public and private institutions at bachelor's or equivalent level (2015/16)

PPP-adjusted USD, thousands

21 189

◆ Public institutions   ▲ Private institutions

Countries (x-axis): United States, Chile, Japan, Canada, Australia, Korea, New Zealand, Israel, Netherlands, Spain, Italy, Portugal, Switzerland, Austria, Hungary, Luxembourg, Flemish com. (Belgium), French com. (Belgium), Slovenia, Denmark, Estonia, Finland, Norway, Poland, Slovak Republic, Sweden, Turkey, Mexico, Latvia, England (United Kingdom)

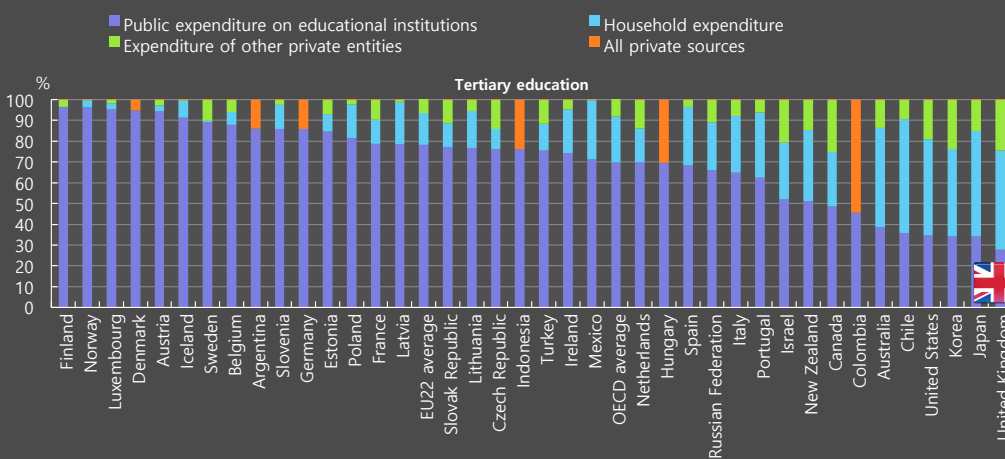## Private expenditure on tertiary education increased

Change in private expenditure on tertiary educational institutions, 2010 = 100 (2005 and 2014)
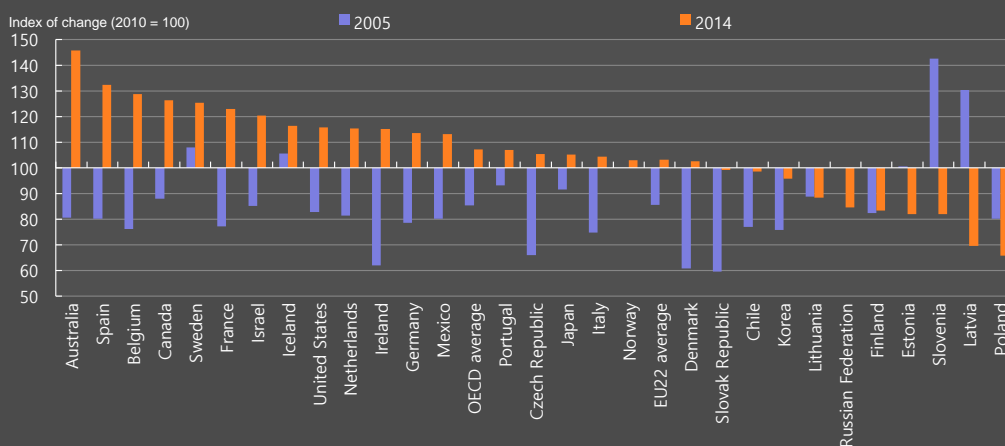
And now funds 30% of total expenditure on tertiary institutions on average across OECD countries

Figure B3.2

Distribution of public and private expenditure on educational institutions (2014)

In the US the current debts stands at $1.45 trillion, encompassing 44 million borrowers. Average debt in 2016 for a graduate was $37,172. In the UK the figure is around £100bn and averages around £32,220 per graduate, this for a system that has only existed since 1998. Simultaneously higher education institutions are subject to external pressures to facilitate wider national industrial and employment policies. In this context, the concerns of the Irish policymaking community and higher education management are apparent.
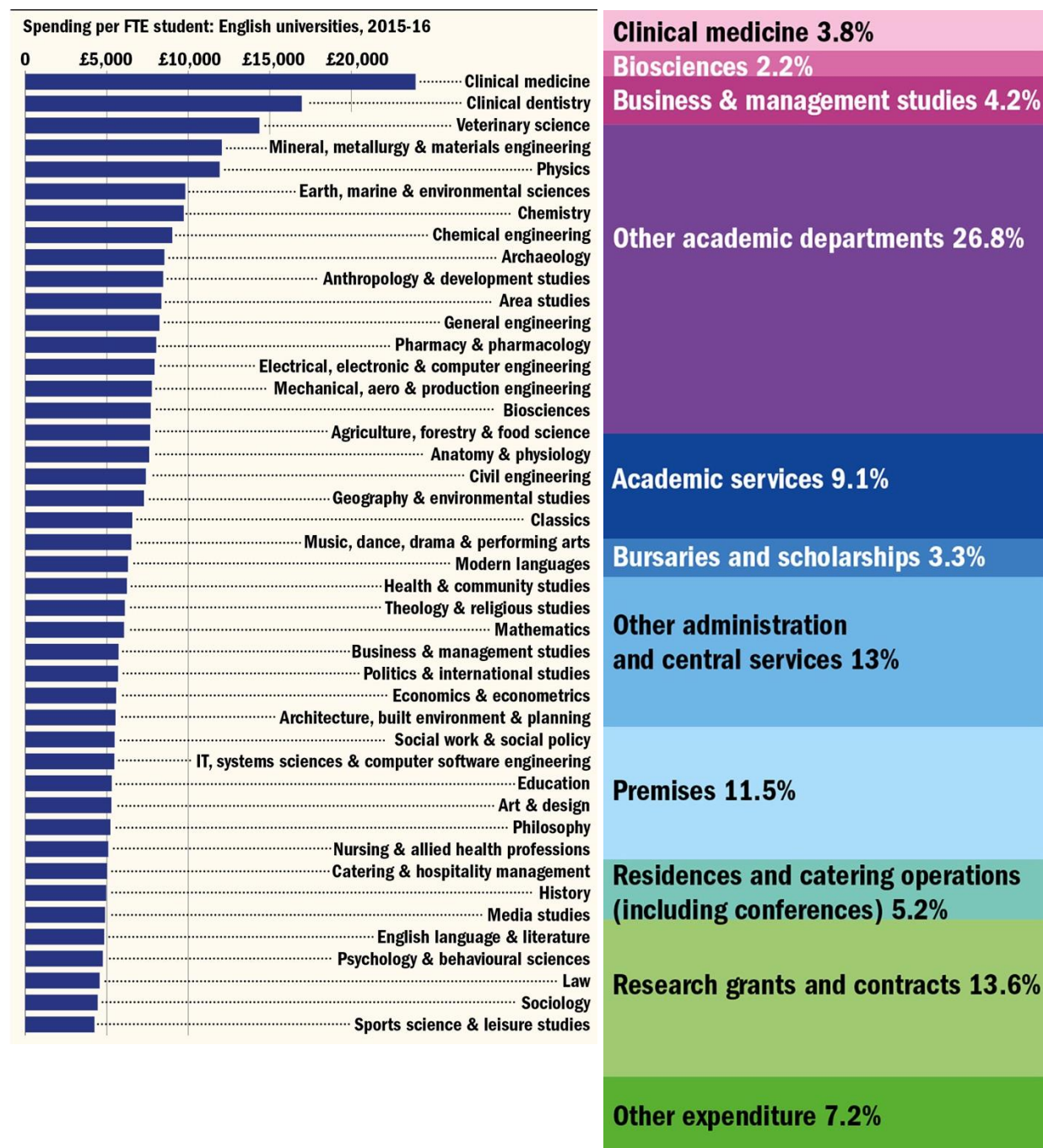
As the *Times Higher Education* highlights:

> The most expensive subjects to teach do still receive some top-up funding from the Higher Education Funding Council for England: £10,000 per student for medicine, dentistry and veterinary science; £1,500 for lab-based science courses and £250 for "intermediate-cost subjects" (although in reality the final amounts are scaled according to Hefce's budget). These bands also include subjects seen as important for workforce training like nursing or midwifery.

However, as an Institute for Fiscal Studies report found earlier this year, even though they receive no extra funding, other courses disproportionately benefited from the increase in fees to £9,000 because they are so much cheaper to provide.

It is this realisation that is driving much of the current row over funding and one possibility is that the government moves to a system of variable fees based on course cost and potentially other factors such as graduate earnings. (Baker, Simon. Subject cost data add fuel to England's variable fees debate. 5 October 2015. https://www.timeshighereducation.com/news/subject-cost-data-add-fuel-englands-variable-fees-debate)

The following two figures highlight the extent to which cross subsidization underlies the higher education system's operations.

Source: https://www.timeshighereducation.com/news/subject-cost-data-add-fuel-englands-variable-fees-debate)

This is all taking place while the UK follows the US into using more casual labour to support the higher education sector. According to the *New York Times* the academic labour force in 1975 was made up of 55% adjunct lecturers. In 2017, it is 70% with them making on average $1,000 per college credit, or $3,000 per course, per semester.[1] While the cost of higher education increases, it is simultaneously being met by a set of procedures to reduce labour costs.

Ireland, in this context has different concerns about the present and future. While American demographics highlight that the "traditional" coming-of-age student (18-24) will decline over the coming decades, Ireland's demographics mean that the traditional undergraduate population expansion will continue unabated. On the 27th of September 2017, Dr Rónán Ó'Dubhghail, Vice-President of UCC announced a €350 million expansion of the Cork university, which was quite an impressive milestone. Within the same radio interview, there was a stark warning issued of the importance that the recommendations of the Expert Group on Future Funding for Higher Education were followed, presenting evidence of the dark, suffocating threat that is most certainly directly in the path of progress within the entire education system. "Build it and they will come" is not the foundation upon which most great projects should be based, but population dynamics dictate the necessity for expansion. UCC have shown excellent foresight with their plan by playing the demographic dividend that is almost unique to Ireland amongst the advanced economies.
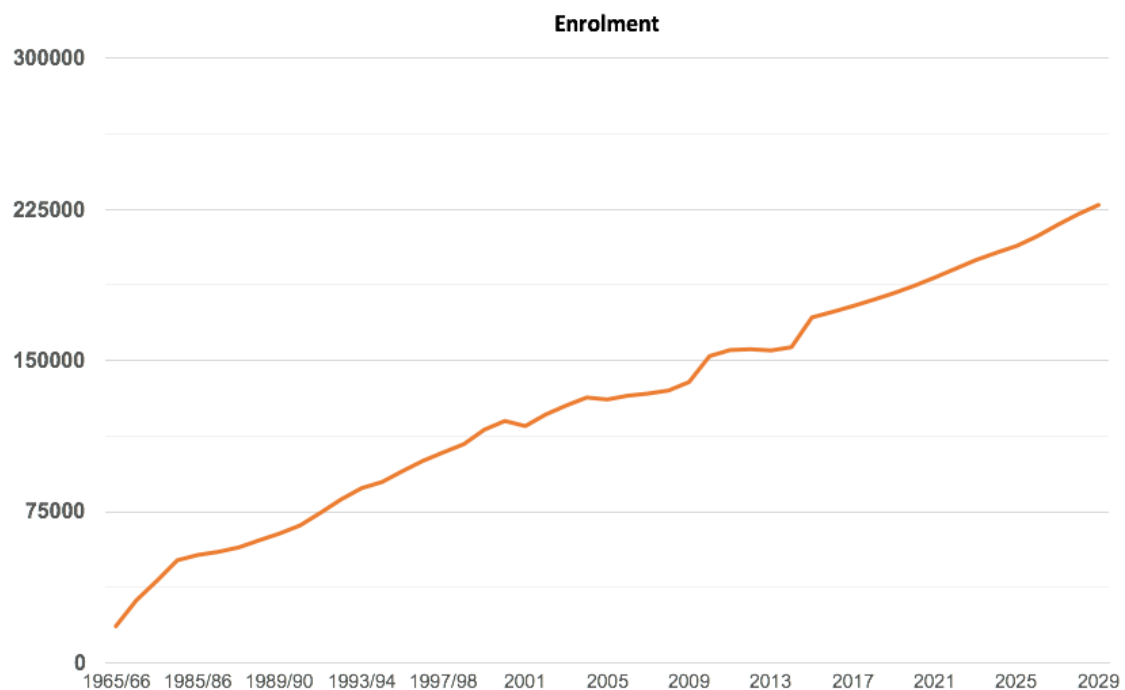
Source: HEA & Authors' Calculations.

However, how will students be able to afford to attend?

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[1] Gross, Neil. "Professors Behaving Badly." *New York Times.* 30 September 2017. https://www.nytimes.com/2017/09/30/opinion/sunday/adjunct-professors-politics.html

Through the multiple stakeholder interviews with ministers, departmental officials, respresentative bodies and political party spokespersons on education we have undertaken in preparation for presentations and research based upon the area of university financing there were some very straightforward anecdotal statements put forward to us: 1) there is not enough money to fund the system; 2) government will not accept paying for this shortfall; 3) companies may help but were somewhat discouraged by perceived wastage within the sector, however the will not cover the complete shortfall; 4) students will not accept paying for the shortfall, primarily due to the accommodation problems that they now face; 5) the grant is not a financial source that is available to use and shall be maintained at all costs; 6) this argument as a whole is politically nuclear; 7) the position within European legislation and financial regulations is exceptionally unclear; 8) universities must expand to accommodate a growing population; 9) we need more international students; and finally 10) something must be done to help. Enter the income contingent loan (ICL) argument.

Working previously on financial analyses of the banking sector, we were approached, along with others, by a key HEI stakeholder and by IOTI (now THEA) and asked to investigate the plausibility of the ICL structure proposed by the Cassells Report (issued in mid-2016 but ICLs were under discussion since early 2015) and promoted by Prof Bruce Chapman of Australia and a team of researchers located at the London Institute of Fiscal Studies and more locally. The application of ICLs in Australia and . Our findings fell firmly in opposition to their proposed ICL solution, leading to our appearance before the Oireachtas Committee on Higher Education in May 2017.

What is evident several months after this debate began, is that the pro-ICL cohort had not, to that point in time, been actively challenged. The ICL model exhibits exceptional vulnerability when placed outside of a particular institutional context. The Office of Budgetary Responsibility in the UK has highlighted the problems of student loans in their July 2017 *Fiscal Risks Report* which is work extensively quoting:

> 7.19 But PSNFL is not always a good guide. This is particularly true for student loans, which are recorded as assets at their nominal value even though a significant proportion will be written off rather than repaid. The true value of these loans will therefore be less than the value recorded in PSNFL (but of course more than the zero recorded in PSND, since student loans are not liquid assets). Student loans assets are recorded in departmental accounts and the WGA at a value that reflects expected future write-offs.
>
> …
>
> 7.25 The Government provides funds to support higher education, both through grants – including to universities for teaching – and subsidised loans to students. UK loans outstanding reached £100.5 billion by the end of 2016-17 (5.1 per cent of GDP), mostly relating to England. These have increased by more than 150 per cent since 2010-11, reflecting both more loans (the number of students with loans has increased by about 40 per cent since 2010-11) 3 and much bigger loans (thanks to the decision to increase the maximum from £3,375 in 2011-12 to £9,000 in 2012-13, matching the increase in university tuition fees). Loans issued in other parts of the UK have risen at a slower pace.

Chart 7.6: Student loans outstanding in the UK

Source: Student Loans Company, ONS, OBR
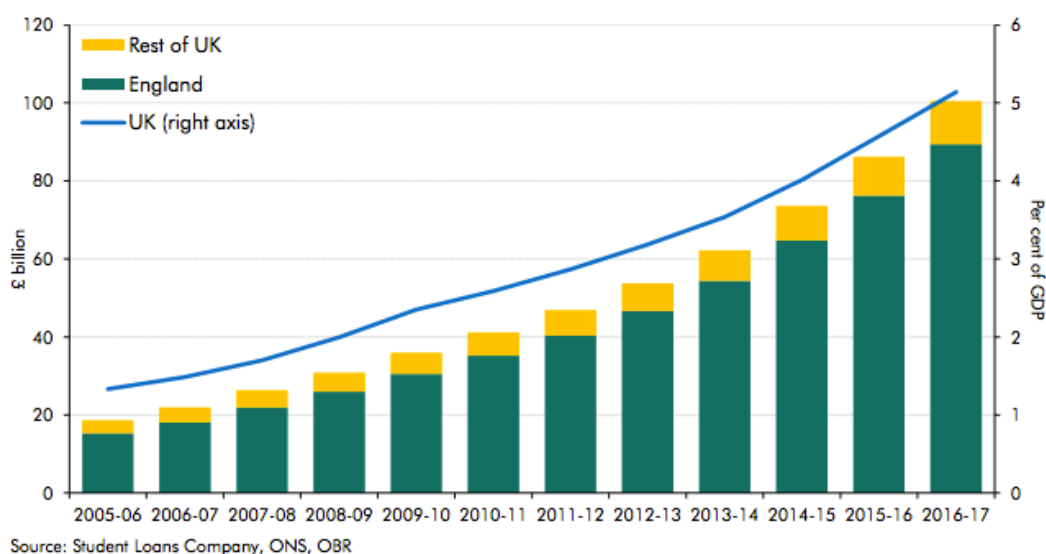
Source: OBR Fiscal Risks Report July 2017, p. 225.

7.26 Our March 2017 forecast assumes that student loans raise the net cash requirement and net debt relative to net borrowing in each year of the forecast. On average, net cash outlays – i.e. new loans issued less repayments received – add 0.8 per cent of GDP a year to net debt. The key risks around this forecast include: • Student numbers: Higher student numbers would increase current outlays and future repayments and write-offs. We forecast student numbers based on demographic assumptions that are adjusted for expected trends in entry rates. These are themselves determined by trends in application and acceptance rates. There are uncertainties around all these assumptions. Some are specific to Brexit – the last Government confirmed that existing EU students and those starting courses in 2016-17 and 2017- 18 would continue to be eligible for loans and home fee status for the duration of their courses.4 It also confirmed that research councils would continue to fund postgraduate students from the EU whose courses start in 2017-18. Our forecast does not include any assumptions about changes to policy on eligibility or funding in 2018-19 or subsequent years. Brexit effects may already be showing up, with applicants from the EU to study at UK universities in 2017-18 down by 6 per cent on the previous year.5 Over the medium term, it is outlays that are most sensitive to changes in student

numbers, as repayments and write-offs would only be affected over much longer horizons. All else equal, an increase/decrease of 10,000 in the number of students would increase/decrease outlays by around £135 million in 2017-18, rising to £400 million in 2021-22 (in line with the assumed path of average loans per student). • Economic drivers: Our forecast is also sensitive to assumptions about RPI and RPIX inflation, Bank Rate and earnings growth. Tuition fees and student support are uprated in line with RPIX inflation, affecting the average loan outlay per borrower; repayments are linked to earnings growth; interest payments are linked to RPI inflation and Bank Rate for pre-2012 loans and RPI inflation and earnings growth for post-2012 loans. • Student loans sales: risks relating to the sale of parts of the pre-2012 student loans book are discussed in paragraph 7.34. Risks to fiscal sustainability

7.27 In our 2017 FSR, we estimated that student loans would increase PSND by a peak of 11.1 per cent of GDP in the late-2030s before falling to 9.3 per cent by 2066-67. On the PSNFL measure, these figures would be closer to zero, since it includes student loan assets at face value. A better measure of the risks to fiscal sustainability posed by issuing large volumes of student loans is the cost of writing off principal and interest not repaid. This relates to the value of loans issued and the proportion written off. There are uncertainties around both.

7.28 In terms of our long-term projection for the amount of student loans outstanding, Annex B of our 2014 FSR highlighted three key sources of uncertainty:

• Future fees: our central projection assumes that the average tuition fee and maintenance loan rises with earnings rather than inflation. (In the long term, inflationuprating would steadily reduce university income relative to the size of the economy.) If fee loans were to rise with inflation, we would expect the impact on PSND from student loans to peak at a lower proportion of GDP and then to tail off more quickly.

• Student numbers: our central projection is sensitive to ONS population projections and the share of teenagers in the population. Under the 'young age structure' variant, the addition to PSND as a proportion of GDP would be greater than in the central projection in the mid-2040s, then declining only gradually thereafter. Under an 'old age structure' variant, we would expect the impact to decline more quickly.

• Graduate income volatility: our projection assumes that fees, loans and thresholds increase with earnings in the long term. The distribution of earnings is also important as repayments are due only if incomes are above the repayment threshold. The interest charged is also linked to a graduate's earnings. A greater spread of earnings would see student loans add more to PSND as a proportion of GDP.

7.29 The proportion of student loans that will eventually be written off depends on many factors, including the repayment conditions and graduates' future incomes. Currently there is an income-contingent repayment threshold, below which no repayments are made, and unpaid amounts will be written off after 30 years. Write-offs affect PSNB when they happen and PSND indirectly through any future repayments foregone. We project these to remain relatively small up to the mid-2040s, but then to increase to around 0.3 per cent of GDP as graduates under the post-2012 system start to have any outstanding loans written-off.

7.30 The overall impact on sustainability is determined by the cash paid out less cash received (the size of the subsidy), plus the interest paid on debt issued to finance the loans. The government estimates the size of the subsidy (the Resource Accounting and Budgeting (RAB) charge), the percentage of total outlays not covered by the discounted flow of projected future repayments. This was estimated at 45 per cent in the former Department for Business, Innovation and Skills 2014-15 accounts, but revised down to 20 to 25 per cent a year later. This was largely due to using a lower discount rate, which increased the present value of future repayments. If the RAB charge were calculated as the discounted value of write-offs, a lower discount rate would have raised it. Financial asset sales

7.31 Our March 2017 forecast included the ongoing sale and rundown of UKAR mortgage assets, the sale of the remaining stake in Lloyds Banking Group (since completed) and the sale of £12 billion of the pre-2012 student loans book.

7.32 Asset sales are only included in our forecasts when their size and timing are sufficiently certain. This means there will often be risks to the forecast from asset sales that are planned but not yet sufficiently firm to include in our central forecast. For example, uncertainty over timing and legal issues meant that we did not include the sale of the Green Investment Bank (GIB) in our last forecast, but this has subsequently been confirmed. The GIB was valued at £2.3 billion, split between £1.7 billion of sale proceeds (that will reduce PSND immediately) and £0.6 billion of outstanding commitments being passed to the buyer (which will reduce PSND over time). Our forecast does not include any further sales from the Government's holding of RBS shares (valued at £19.7 billion at the time of our March forecast).

7.33 Differences between past forecasts and outturns illustrate some of the potential risks. The timing of sales can be sensitive to market conditions and government policy. For example, the first tranche of student loan sales has been pushed back several times since the intention to sell was first announced in Autumn Statement 2013. We first included planned sales of RBS shares

in our July 2015 forecast, but only a single tranche was sold before the Government halted further sales pending resolution of uncertainty over legacy issues. There is also uncertainty over the amount that will be raised from such sales. For example, the auction of 4G spectrum licences in 2013 raised £2.3 billion, well below the £3.5 billion we had factored into our December 2012 forecast.

7.34 Key risks to the financial asset sales that feature in our central forecast include: • Student loan sales: These remain subject to market conditions and a final value-formoney assessment. Our March forecast assumed that the first sale would be completed in early 2017-18 and a second by the end of that year. These timings are likely to have been affected by the early general election. Selling the loan book affects the flow of cash to the Exchequer, with more recorded upfront as sales proceeds and less in future years, as repayments flow to the private sector instead. In effect this crystallises losses on the loans sold – the level of debt is permanently higher relative to no loans having been issued, because sale prices will reflect the interest rate and writeoff subsidies implicit in the loans. • UKAR asset sales and rundown: our forecast includes assumptions about the pace at which assets run down as mortgages are repaid and not replaced. The timing and scale of repayments are uncertain. UKAR's asset sales can be large. Its most recent sale, factored into our March forecast, raised £11.8 billion as part of a sales programme that we expect to be sufficient to repay a £15.7 billion debt to the FSCS. A further £5 billion of sale proceeds are included in our forecast for 2018-19. All major asset sales are subject to risks around market conditions that could affect whether they go ahead and, if they do, whether they raise as much as expected. UKAR has a strong track record on both timing and scale. 7.35 So, there are both upside and downside risks to our forecasts. The largest downside risk is probably further delays to student loans sales, while the biggest upside would be renewed sales of RBS shares. With the exception of the large stake in RBS, the Government has largely exited its post-crisis financial sector holdings, so the size and likelihood of asset-sale risks has probably fallen in recent years. When considering all asset sales of this type, it is important to remember that selling an asset for a fair market price does not improve fiscal sustainability in any meaningful way. It simply swaps one asset (a long-run flow of receipts) for another (a one-off upfront sum). This is more apparent when viewing such sales through the PSNFL or WGA metrics than when using PSND, in which all sales reduce debt.[2]

As the OBR has highlighted the ICL solution stocks up a series of intertemporal downside risks that require inflation and relatively high real economic growth to solve. The simple fact that ICLs are the only solution seriously presented by the Cassells Report and its advocates has allowed alternatives to be ignored. The only alternative presented has been a straw man, that it the government simply offer "free" education. Given the existing fiscal space this is simply not an option at this point in time.

The impasse is quite simple. There is no singular panacea to solve the education funding crises that we face. The solutions will be multifaceted, they will moderately costly relative to the recent past and they will make everyone unhappy: students, parents/taxpayers, university presidents. In the basic requirements of political economy, this violates Lincoln's dictum of political survival: "You can please some of the people some of the time, all of the people some of the time, some of the people all of the time, but you can never please all of the people all of the time." In other words, lasting and effective solutions are necessary but politically too costly to implement, so much like tax reform in the US, it will be left to another generation to solve.

The main argument of the ICL solution is based on the fact "that it works in Australia". While such an example was useful, the economic conditions of Australia are somewhat unique. Ireland is not Australia, on a social, economic or cultural level, resulting in a very different set of political economy options.

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[2] OBR. *Fiscal Risks Report.* July 2017. pp. 222-8.
http://cdn.budgetresponsibility.org.uk/July_2017_Fiscal_risks.pdf

Evidence is accumulating that ICLs are presenting problems in many of the countries where they have been implemented. The United Kingdom and New Zealand present primary examples. Our research found that the Irish education sector is most akin to that found in New Zealand in size and the Irish economy has many of the same features. This is not unsurprising since Ireland and New Zealand are part of the same Science Foundation Ireland defined consortium of small advanced economies along with Denmark, Finland, Israel and Singapore. We should be taking the New Zealand experience more seriously than that other ICL countries. Further, they share similar emigration dynamics to that of Ireland which we observe to be far greater an issue to the ICL model than admitted previously in official reports.

The arguments are very simple. Proponents of ICLs observe the system as efficient, access-promoting and a rapid solution to the university financing problem. Opponents observe ICLs as another formulation of a quango, reliant on the characteristics of a Ponzi scheme and transitioning further pain towards the exchequer and future generations through the inter-generational liability transfers that exist, further exacerbated by the unique population dynamics that exist in Ireland, namely our susceptibility to international financial shocks in a small, open-economy and our consistently high levels of emigration, especially during economic downturns.

Some proponent methodologies utilise data that was sourced prior to the international financial crises of 2007. There are no methodologies that use data in the period post-crisis, which we have presented in our analysis. However, we accept that expected salary growth is based upon many unique circumstances that cannot be modelled due to data unavailability. Data limitations from official sources in Ireland have resulted in the use of alternatives that provide wage information to the private sector.

It is important to note that wages are influenced by the course and discipline completed, with some evidence denoting the university attended as a significant driver. We are currently awaiting a unique and exciting dataset which will help us to attempt to solve the wage trend argument. Further research is vital based upon the courses that we offer within the Irish education system. It was evident from our prior analysis that some universities presented "higher earning potential" disciplines and streams than others. It was clear that a tailored solution may in fact be more prudent than that of a singular system-wide solution. We expect to complete this task in the forthcoming three months.

We are hampered somewhat by the existence of several key risks that directly influence any potential university funding system. In prior research we have considered the role that several threatening events can have upon any university financing system. These include, but are not exclusively limited to: 1) Interest rates; 2) Inflation; 3) Emigration; 4) Political instability and methodology restructuring; 5) Financial crises; 6) Salary reductions and poor graduate salaries; 7) Falling education standards in Irish universities; 8) Reliance on international students for funding; 9) Reduced access; and 10) Fraud.

We proceed by presenting our prior results and then developing upon a novel solution that may be deemed more appropriate when considering the broad number of stakeholders that must be satisfied.

Based on our research and evidence from Ireland and from countries that have implemented an ICL, our view is that ICLs would be a risky course of action for Ireland. It has the potential to create large contingent liabilities for the Exchequer. It would modify the significant social planning objectives that have been worked out over time between government and the higher education institutions. It would not rectify the resource per student issue without abandoning fiscal prudence and cannot solve the €5.5bn capital expenditure deficit. The Government would need to propose substantial legislative changes to solve issues of financial accounting in Higher Education Institutions, the creation of an arm's length loan company and loan recovery. Many of the decisions lie in the hands of the political system since they are related to role of the higher education system in social planning. Those decisions set the parameters.

Our findings here support that 61.5% of the loans would be estimated to be junk status, therefore 38.5% are investment grade. 21.2% of the loans based upon the estimated data are found to be in the lower spectrum of junk status, denoted as either highly speculative or possessing extreme default risk. The estimated window of effectiveness for an ICL in Ireland are:

· Default rates below 15%;

- A minimum payment cap of €2,250 per year;

- An interest rate of 7-8% over the baseline sovereign;

- In a perfect conditions environment, the model is running somewhere in the 25-30% success zone with perfect conditions, which will mean GDP growth rates of around 4-5% per annum.

- An EIB loan of €500M per annum will be insufficient - this model will need to be a structured Special Purpose Vehicle (SPV) generating in the region of €7 billon of net losses until year 18.

- To generate a profitable year for the ICL structure within a decade, students would be subject to an interest rate of 10% on their loans or be subject to a default rate of 0%.

- While the interest rate is paramount to the system working, it has a damaging impact on inequality since it will place those within the €25-35,000 income band into a debt-spiral.

There are ways of making this ICL system functional for certain levels and courses. However, for the vast majority of undergraduates entering the system and ICL will not be effective and will place a great burden on the Exchequer.

At the end of the day higher education has to be paid for and there are only three options: the student, firms or the Exchequer. In all circumstances it is about revenue and not debt, as debts ultimately have to be repaid by revenues generated from income, profits or taxes.

The economic rationale for subsidising higher education, and education generally, is related to the idea of human capital and economic growth. Education is beneficial to the economy since it can generate improved human capital, which when applied, increases productivity. Productivity is what drives economic growth and improved material welfare. First is that the education system has both public and private returns and as a student progresses through the education system those returns come to be dominated by private returns. This has been established empirically. Education is also beneficial to society. For instance, work performed in the United States by Prof Walter McMahon of the University of Illinois and recent work by the Growing Up In Ireland project highlights that there are distinct public benefits for educating people up to the end of a primary degree, especially for the primary caregiver of children.

The value of higher education is clear. The State's investment in higher education needs to increase under some form for it to be sustainable in the years to come. Publicly funded higher education could be achieved through directed exchequer funding. At present the system costs approximately €1.5bn to the Exchequer. To bring up funding levels to the high point (€12,158 per student) and cover the €367m in capital expenditure per annum the Exchequer would need to supply €2.2bn, growing with demographics towards €4bn. To "patch" the system the NTF Levy remedy outlined by Minister Bruton can be applied, though this is distortionary and leaves out 25% of the labour force. At present no solution offered brings back resources to mid-2000s levels or solves the capital expenditure problem. Alternatives exist. Students can pay higher fees. Costs can be reduced in various ways: course lengths can be reduced or more "unbundling" of the education product can take place. A ready solution is to "shrink the system" by reducing student numbers and/or institutions. An alternative is to move towards a model with an objective of 50% of the undergraduate student body being made up of non-EU fee paying students. This has been an unspoken but clearly practical approach taken in some of the leading universities in Scotland. In all circumstances this would necessitate significant political investment in the process.

The position taken by Ireland in the mid-1990s and continued by many Continental European jurisdictions is seen by the economics profession as a misallocation of resources since public subsidies could be better spent towards assisting the truly disadvantaged. The welfare comparisons are made using higher education markets that are actually markets where supply, demand, budget constraints and prices all function to transfer information to buyers and sellers. In other words not dirigisme. Where such a market exists courses charge fees in line with their economic costs, students decide what courses and institutions to apply for on the basis of entry criteria and price and where enrolment numbers and the depth of diversity of income streams determines the behaviour of higher education institutions. In such

a model subsidies are attached to truly public goods, such as non-commercial research, and encouraging certain course choices, such as STEM. In a system with fixed prices, fixed or near-fixed student numbers and limited alternative income streams, the behaviour of higher education institutions can become detrimental from a welfare point of view.

In practice this is reflected in the HEA funding model. It has encouraged institutions to solve their financial problems via increased enrolment. The long standing solution in higher education management is to develop a model of internal cross subsidisation between low cost and high cost programmes. In optimal conditions this is directly subsidised by the Exchequer and a differential price still remains. In Ireland this does not exist and results in large welfare losses as general arts and business studies subjects subvent other most expensive courses. This is clear from the IUA Full Economic Cost data. The drawback, from the point of view of the ICL system is that those persons also have the lowest probability of repayment. What in effect happens is that these students provide a subsidy to the medical, chemistry and computer science graduates, who already receive subsidised education via the low cost of entry. In the Irish system the full appreciation of the price and income elasticities of demand for higher education are not known since the higher education system does not operate as a normal market, with only the CAO points calculations reflecting an element of course and institution supply and demand. There are large welfare losses built into the higher education system that would need to be addressed if an alternative financing model were to be investigated.

Income contingent loans are a very effective way of distributing the repayment burden of higher education theoretically. They ensure that the loan holder doesn't have to pay and excessive amount of their income on an annual basis and could go as far as to result in no need for payment whatsoever in times of personal economic hardship. In technical terms – the repayment burden can be made light. While this system has many advantages, it does have limitations. It is not designed to solve a financial crisis. The HEA has published a report in 2016 highlighting the real and immediate financial crisis facing the IOT sector. The universities face similar financial challenges and have turned to low-cost borrowing from the European Investment Bank to solve immediate capital expenditure problems. While this is permissible under HEA regulations it would be irresponsible not to consider that both the borrowers and the lenders labour under the implicit assumption that universities are too-big-to-fail and seek a government bailout if a crisis were to emerge.

Regardless of the logic and merits of the EU Fiscal Rules, they are now part of the Irish policymaking process. There are requirements about Ireland returning to a 60% debt-to-GDP level (advised to 45% by the Central Bank and Fiscal Advisory Council) and that all new expenditures are met with continuous new revenues. Under EU definitions, education is not an investment. The EU and the IMF are keenly aware of the potential for "contingent liabilities" to undermine the public finances are seek to ensure that governments avoid them in future. That means that any special purpose vehicle needs to be stand-alone from the Exchequer. Accordingly, risk must be held by the private entity and the rate of return must equal the average cost of funds to the State. This would place the minimum nominal interest rate at 3.3%, roughly in line with the UK Treasury Green Book 3.5% VFM baseline figure. This approach to sustainable interest rates aligns with the recommendations by the New Zealand Productivity Commission in their March 2017 report *New Models of Tertiary Education* which was tasked with finding solutions to their ongoing ICL problems. Time horizons need to be taken into account as recent work by the IMF highlights that advanced economies reflect a fiscal cycle of approximately 18 years and that within the timeframe of an ICL loan that an Exchequer and a population may experience a full fiscal cycle, complete with fiscal retrenchment. The OECD and IMF have taken the view that this has added more importance of obeying fiscal rules and embracing a cautious approach to policy that may impact the Exchequer into the future and can be evaluated by fiscal stress tests.

We would like to quote here from Professors Bruce Johnstone & Pamela Marcucci:

Income contingent loans, such as those modelled after the Australian Higher Education Contribution Scheme (HECS) would seem to work well when

- a government, by downplaying (or not mentioning at all) the politically treacherous concept of tuition fees, is able to get an element of cost-sharing that it would likely be politically unable to implement were it to advocate openly event for the relatively modest, deferred tuition fees that such plans generally call for;

- a government, by stressing the deferred obligation of the student, is in a financial position to forego the potential of more up-front tuition and to minimize the role of parents (even affluent ones) as an important partner in sharing the costs of instruction;

- a state does not currently need even the students' deferred revenue, but is able to tax or borrow sufficiently to keep the universities open and the students fed and housed, and to accept payment only in the future – in essence becoming the lender – with a limited ability to tap private capital markets; and

- the majority of student borrowers (that is, students who become obligated to future income contingent payments) will have a single employer that will pay them a periodic and relatively regular salary and that is also sufficiently large, sophisticated, and legally compliant enough so it can be counted upon to take the correct amount out of the borrower's paycheck, year in and year out.

Conversely, income contingent loans would seem to be less applicable when

- nongovernmental revenue is needed immediately, making parental contributions to tuition (even with some discounting and excluding amounts from low-income families) an important sources of necessary revenue supplementation;

- the scarcity of government revenue precludes the government from being the sole lender, thus placing a premium on student loans that have some (albeit discounted) value in the private capital market;

- many graduates (borrowers) are likely to hold multiple short-term jobs, to be employed in the informal economic sector where records are most unreliable, or to be emigrating; and

- there is no tradition of voluntary, reliable self-reporting of income, and state systems for monitoring and verifying income – for the purpose of income-tax withholding or pension or social security contributions – are non-existent or unreliable. (Johnstone & Marcucci, 2010: 178-9).

What we discovered in our research is that approximately 50% of graduates will be unable to pay the full net present value of the income contingent loan over a 20 year time horizon. Our modelling shows that we can be assured of repayment in only 31% of graduates. Our estimations are based on post-crisis wage data from private sector sources and the public sector wage scales. By way of background to the largest employer in the State is the State with 294,000 staff and 39% of GDP. The multinational sector as a whole employs 187,000 people according to the IDA. We currently have a workforce of 2.2m. Approximately 16% of graduates leave the country within 6 months of completing their degrees. In the case of Trinity College that can be in excess of 20% depending on the course observed. The New Zealand and UK experience has illustrated how difficult it is to obtain payments from those overseas, with New Zealand taking recourse to the criminal justice system and arresting ICL defaulters upon re-entry to the country.

We have attempted in our modelling, as far as possible, to make the ICL work for Ireland. Given a certain profile of institutions, courses, ICL size, ICL contract entry points and interest rates an ICL in Ireland may work but a blanket system will not. In our model we have left the existing grant system unchanged. This is due to the obvious political challenges but also due to the potential increase in ICL principal if a UK-style ICL reform of the grant is explored. We break down our ICL loan holders into ventiles based on earning potential. That is determined by course, points, institution, and gender. We use evidence from the Georgetown University Center on Education and the Workforce to inform our calculations on employment earnings by university course. We then take a standard model of default and apply it to
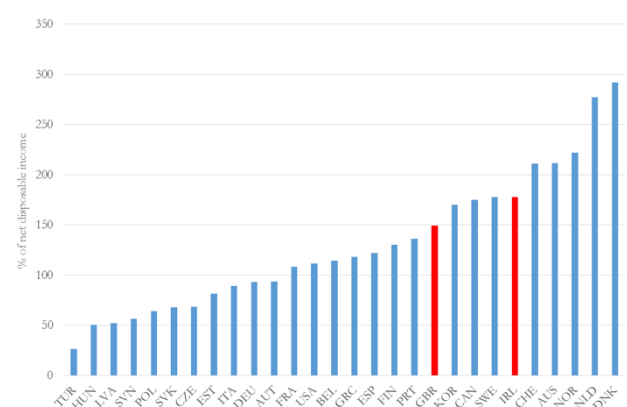
graduates. Once salaries reach the income contingent level of €25,000, we assume a similar system to that of the UK. The estimated percentages used are slightly above UK estimates to offer the best opportunity of Irish ICL success. Therefore, we estimate the methodologies upon the estimate of 10% of after-tax income being repaid to the ICL system upon an interest rate of 1.5% (estimate of RPI) on income over €25,000 and 3.5% on income over €45,000. The current 2017 Irish tax rates are imposed and held constant for this methodology.

While previous university wage analysis in Ireland has focused upon productivity as a driver of career earnings, it appears that ICL proponents have missed three key points: 1) Ireland has significantly lower real wages than that of the Celtic Tiger era, reflecting a global trend; 2) Ireland has higher taxation levels than many international counterparts; and 3) Ireland's graduates have continuously emigrated for higher wages and perceived better opportunities abroad. These are not the shared characteristics that a country seeking an ICL structure should possess. Ireland is quite similar in nature to New Zealand and economically to the UK. In mid-2016, the Financial Times (4 July) reported that after a dramatic increase in university fees in the UK, student loan debt rose by £12.6 billion to £86.2 billion in the period 2015-2016. It is estimated that graduates who now pay fees of £9,000 a year are estimated to leave university with an average of £44,000 of debt which has substantially increased upon the level of £16,200 of the cohort who graduated in 2011. In fact, it is widely reported that an expected decrease in UK household debt was entirely mitigated by this increase in student debt, where the Institute for Fiscal Studies modelled that about 70% of students who left university in 2015 are expected to never finish repaying their loans, instead making repayments for 30 years before then having to have the unpaid loan written off. In Figure 1, we observe that the implementation of ICLs in the UK has had a direct effect upon household debt when compared to disposable income. We must continue to reiterate that Ireland already possesses a significantly higher rate of household debt than the UK, therefore offering little tolerance to increases of the same nature or magnitude generated by potential student debt. This new era of the UK ICL model now manifests new issues within the context of student ability to obtain a mortgage and other loan-types. In fact, this increased ICL payment may now generate future real economic issues in the form of the housing market for example, which is quite simply defined as contagion risk, a form of economic shock which Ireland has sadly experienced in recent years.

Figure 1: UK household debt compared to disposable income (2016 estimates) and Household debt as a proportion of net disposable income (2015 estimates)
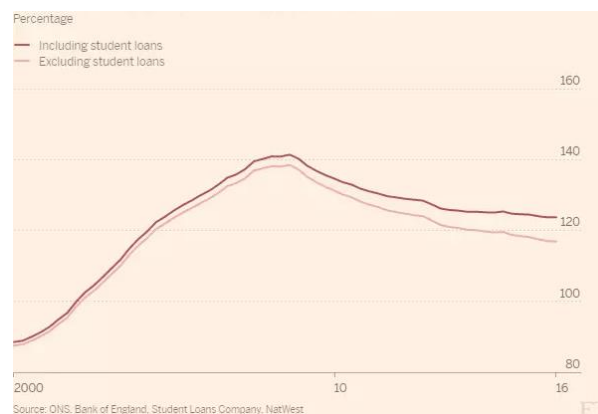

Source: The Financial Times, 4 July 2016   *Source: The World Bank*

To model the distribution of earnings in detail, we estimate the relationship between expected time passed within a graduate's career and their expected after-tax earnings at that point (holding Irish tax rates constant at Q1 2017 levels). The models are then estimated upon gross earnings ventiles which have been pre-estimated during the data analysis to separate the education facilities analysed, incorporating the expected gender gap discount (estimated based upon the Morgan McKinley 2016 report statistics, which

found an average differential of 20% in Ireland) and education facility premium as necessitated. All resulting cohorts are then combined within the database, denoted by the level of education currently being undertaken. The resulting simulated overall 20 year earning profiles are presented in Figure 2, providing the basis of the analysis of the ICL system if imposed upon the 2014/15 cohort of graduates as a baseline estimate of the current Irish educational and economic conditions in Figure 3.

The methodology is based upon analysis of the available pre-crisis datasets to identify the correlations between age and wages using re-centred influence functions, which have been enhanced through the additional support from searching available Irish job vacancy websites, consultation with recruitment companies, student bodies, university career advice services and publicly available current starting wage estimates (in the public sector for example) to estimate current graduate wage estimates. The trends in wage growth are further determined through analysis of publicly available job advertisements seeking at least 1, 2, 5 and 10 years of experience to aid extrapolation of current wage trends, building upon the analysis of age and wages. We also built upon the HEA provided data of the 2014/15 cohort of higher education students denominated by gender and ISCED field of study. Through analysis of the courses at each university, under the guidance of a range of information provided within university course advertisements, national education advisory sources and further aided by the Georgetown University "Economic Value of College Majors" (2015), we identified the most likely positions associated with each ISCED field of study, from which we could allocate a 20-year earnings estimate, as calculated through analysis with the RIF-OLS methodology which are then presented based upon the education ventiles that were estimated. The assumption that all graduates could complete 20 years of employment was made, therefore the methodology focuses upon earnings from the start of their career. The 20 year models are presented due to our forecasts based on the most likely period of debt securitisation, which is tactic commonly used in other jurisdictions such as the UK. 10 and 30-years estimates are further analysed with the short-term model limiting the potential for repayment for multiple ventiles and the long-term model offering little improvement in the ability to repay for those in lower estimated salary ventiles (as income growth is overshadowed by accruing interest payments). Upon these forecasts, an expected loss methodology was implemented to denote the calculated performance of the wage cohorts based upon varying forecasts of Irish wage growth within the twenty-year period. We then build our ICL model upon these forecasts applying similar repayment thresholds and interest repayment categories as those found in the UK ICL system. Prior versions of our methodology incorporated students in receipt of the grant payment and less accurate assumptions of wage profiles, however in this analysis we have focused solely upon the non-grant recipients and have incorporated an advanced dataset. The model is adjusted for estimated graduate emigration and incompletion rates as provided from multiple sources including individual universities and HEA.

Figure 2: Range-based estimated career earnings upon graduation by ventile (all student groups)
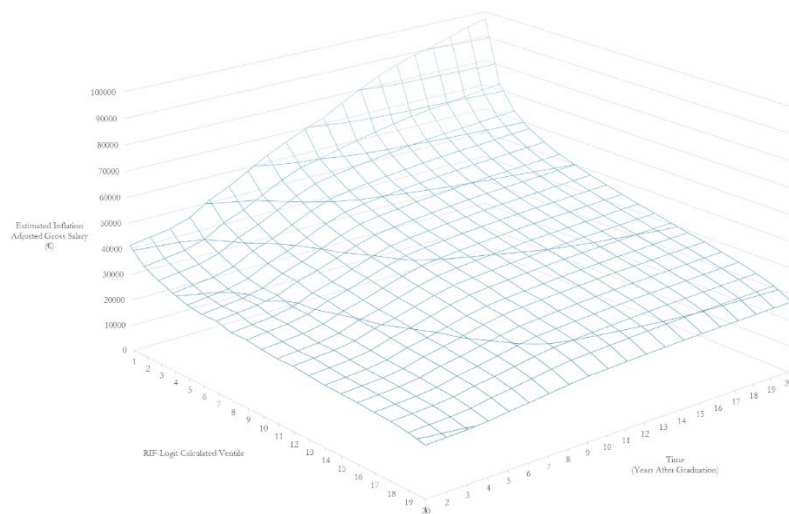
Note: The highest earners are denoted in ventile 1, the lowest earners in ventile 20. Salary estimates are adjusted for a modest inflation rate of 1% throughout the twenty year period. The above figure is based upon the combined sample, including segregation of gender, educational facility attended and level of education obtained. Source: Author's Calculations

The expected loss in Figure 3 is calculated as a function of the graduating estimate of €18,000 owed (which is calculated as €3,000 for 4 undergraduate years in university and €6,000 for one postgraduate year, therefore applying fees only) upon ICL repayment under the conditions of the UK ICL system (Additional and reduced repayment burdens were considered and will be presented in a forthcoming draft along with estimated probability of default methodologies and re-developed stress testing). We therefore measure the barrier upon which interest repayments plateau or increase in comparison to wage growth, thus eliminating the probability of repayment. 35.4% of students are placed in cohorts 10 through 12, however the estimated 20 year expected loss rates are found to be 14.1%, 19.4% and 24.1% respectively. This level of expected loss upon the average graduate salary base, when considered supplementary to the existing grant subsidy provided by the Irish state, portrays evidence that this system possesses a high probability of subsidy provision being significantly above 30%. Further repayment risks are located within our high emigration rates (similar to the problem found in New Zealand's ICL system) and those who dropout of their selected programmes after receiving ICL funding (as per 2017 HEA estimates which are found to be approximately 15% in first year programmes as analysed in the 2013/14 cohort of Irish university students).

Figure 3: Range-based estimated career earnings upon graduation by ventile
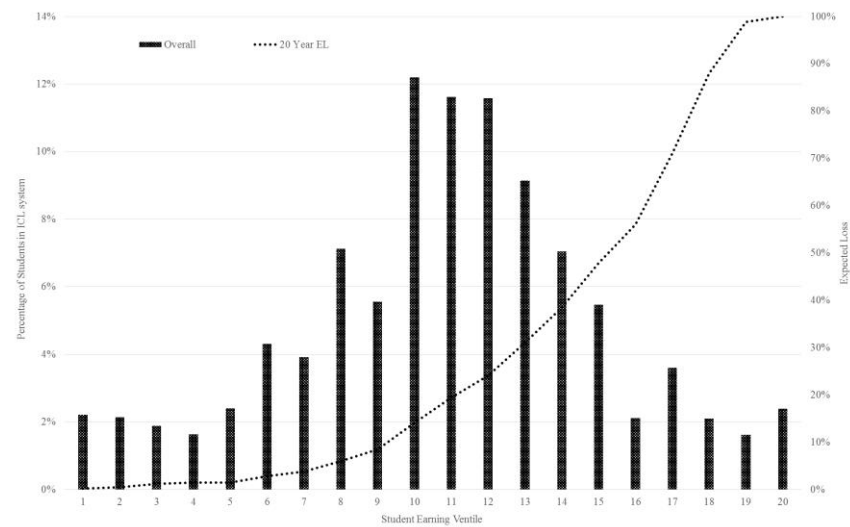
Source: Author's Calculations (2017)

We must also point out that although some may consider our estimates of the lower ventiles to be rather excessively negative, we point to one simplistic robustness check in the form of EU-SILC data based upon the estimated deprivation rate and at risk of poverty measures in Ireland. Within this context, in Figure 4 we can clearly observe the increases in both measures that have occurred since 2009. This has been widely explained due to the rise in unemployment levels, particularly youth unemployment, combined with the period of wage cuts that followed in the aftermath of the economic crisis. Figure 4 also serves as a good example of the dangers that are inherent in such a system if a crisis of the scale just witnessed in this state should re-occur. It should also be noted that graduates in fields such as engineering and quantitative finance, which are considered to be in high-earning ventiles (2-6), suffered significant unemployment during this period. This serves as a simplistic example that all students, no matter how high their career earning rates are perceived to be are at risk of unemployment as a consequence of economic conditions. It is estimated based on 2015 data that approximately 10% of third level degree (or higher) students are categorised as deprived, with approximately 6% at risk of poverty. Further, third-level students with lower than degree status present evidence of approximately 16% being categorised as deprived and over 9% at risk of poverty.

Figure 4: At risk of poverty rate in Ireland (2004-2015, Top Figure) and Deprivation Rate in Ireland (2004-2015, Bottom Figure)
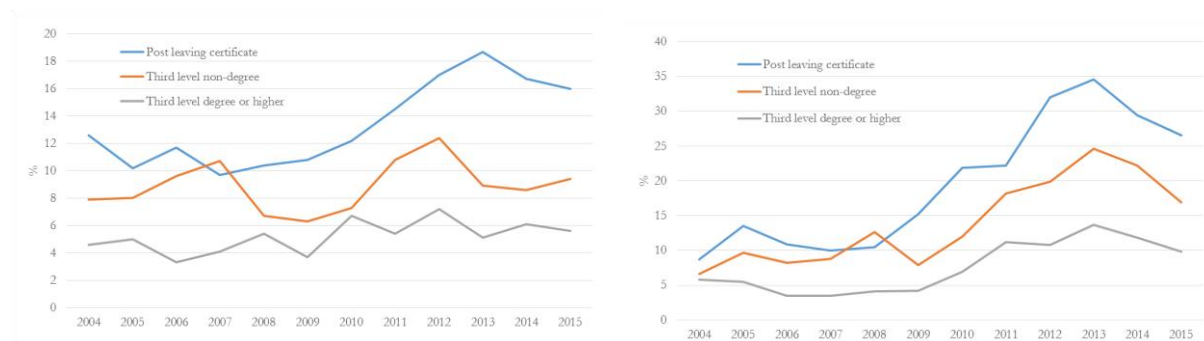
Source: EU-SILC (2016)

There is also evidence within the data to suggest that there exists a functional ICL system for postgraduate education across most educational facilities. This appears based on these preliminary estimates to merit further investigation and worthy debate. Due to the salary premiums evidenced across most ventiles within the Irish education system, our analysis shows that a majority of postgraduate salaries as in Figure 5, are categorised in ventiles 1 through 10, accounting for 73.1% of the postgraduate population.

Figure 5: Range-based estimated career earnings upon graduation denoted by undergraduate and postgraduate

*Undergraduate*   *Postgraduate*
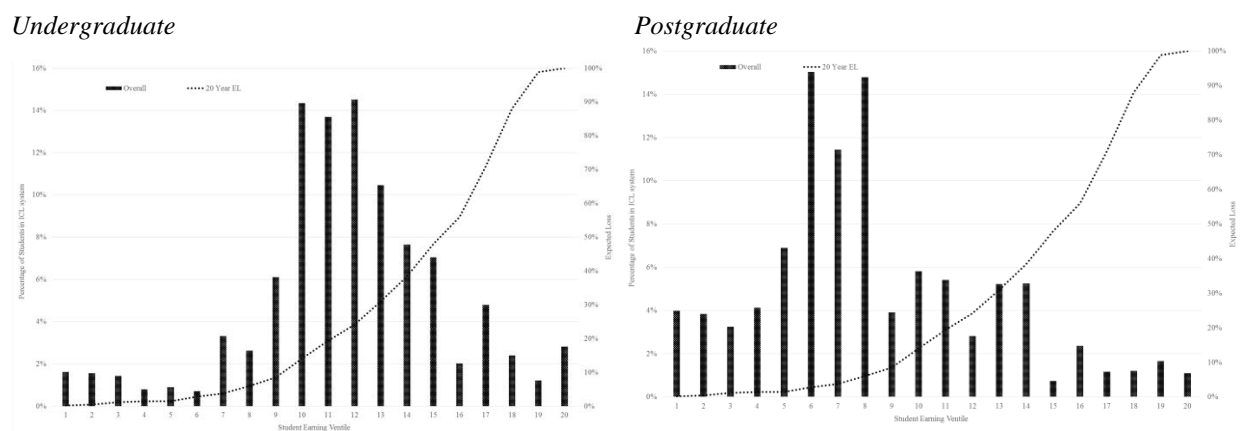
Source: Author's Calculations (2017)

The ICL system's modelled profit and loss (P&L) is then presented in Figure 6. As we can observe within the first 20 years of the ICL system's existence, we calculate that ventiles 1 through 5 will achieve breakeven. This indicates that after assuming the projected expected losses combined with assumptions of Irish graduate emigration, we are relatively confident that these cohorts of high-earning students will repay their loans. However, as we move further down through the ventiles, we begin to observe the estimated losses that are accrued by the lowest earners. The lowest ventiles in the system do not present the largest loss due to the relatively fewer students that are positioned in this category. The largest number of students are located at ventile 11 through 14 which generate the most substantial estimated losses. Should we repeat the same analysis for 30 years into the future, the net profits of the ICL system are estimated to increase, yet the probability of high expected losses for those in lower ventiles remain. However, the additional risks that increase from sources such as illness and death would then start to

become significant factors, which merits further investigation. In our methodology, we find that the 20-year expected loss is the most effective manner to quantify these risks as should the student not have repaid their loan at this point, there is a significant probability that they would never do so. Further, this is the most likely period of debt securitisation and sale. In Figure 6, we also observe the estimated profit and loss of this ICL system. We estimate, that outside the grants paid by the government each year, this ICL system would have to absorb annual payments of between €600 and €700 million each year for the first seven years. However, we do find that the system would reach a breakeven point between year 17 and year 18, where it would return a profit after reaching an estimated running loss of €7.1 billion. We must state that these calculations are completed under the assumption that the economy continues to grow unaffected between the start-up of the ICL and the break-even point. This is a highly unlikely scenario, particularly as a shock such as that experienced in the recent economic collapse would render the ICL system in immediate danger due to two significant side-effects: 1) issues raising necessary capital; and 2) student non-repayment due to a host of reasons such as unemployment and wage reductions.

Figure 6: Twenty-year profit and loss assumptions by ventile for the baseline ICL system and annual profit and loss assumptions for the baseline ICL system
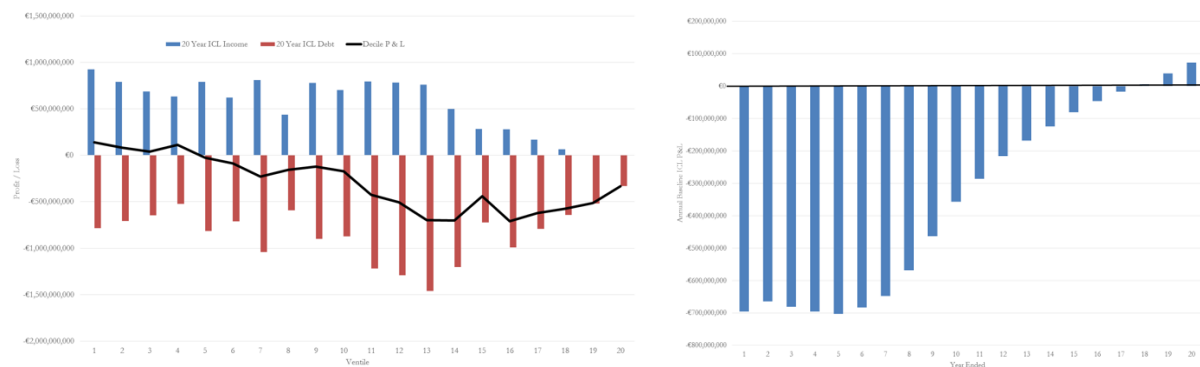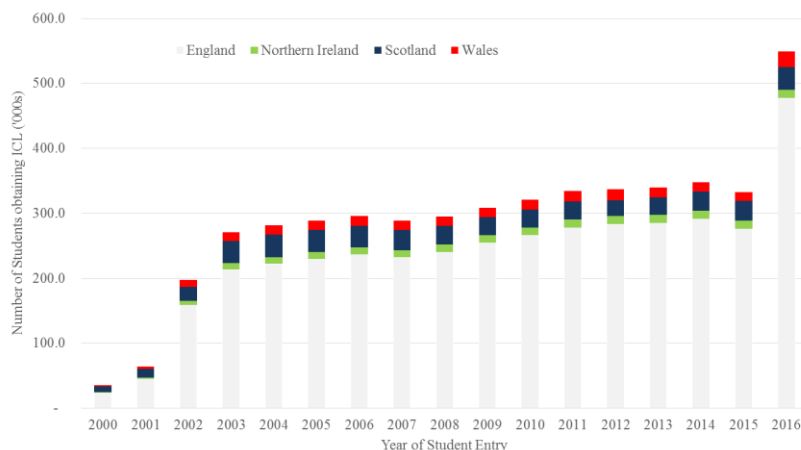

Source: Author's Calculations (2017)

Focusing on international comparisons, Figure 7 represents the growth in the number of student numbers availing of the UK system, presenting evidence of a large increase in English student funding in 2016. Between 2015 and 2016, the number of English students obtaining ICLs increased from approximately 276,000 to 477,000. While this growth is not observed in Northern Ireland or Scotland, the number of Welsh students receiving ICLs increased from approximately 13,000 to over 24,000.

In Table 1, we observe the repayment statistics for students that have received ICL funding per graduating cohort between 2000 and 2016. While the SLC provide data for each of the four systems individually, we have compiled the data to observe the complete system. We can observe that over fifteen years on from the 2000 graduating cohort, only 48% of this money has been repaid, noting that there were only 35,615 students within the total annual cohort. Of this, only 18.6% are above the repayment threshold. We must note that after thirteen years, 25.2% of the 2003 group (the first to contain over 250,000 students) are currently not repaying their ICL, combining the reasons provided due to unemployment and being under the salary threshold. The 2004 and 2005 groups represent 24.9% non-performance, while this figure grows substantially as we investigate more recent cohorts.

Figure 7: Number of students obtaining ICL funding in the UK (2000-2016)

600.0

England ■ Northern Ireland ■ Scotland ■ Wales

500.0

400.0

300.0

200.0

100.0

Number of Students obtaining ICL ('000s)

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

Year of Student Entry

Source: The Student Loans Company (SLC)

Table 1: Student repayment statistics in the UK ICL system (as of March 2016)

|		Domestic								Emigrated/International					
	Loan Repaid	Loan Cancelled	Above Threshold	Below Threshold	ST Unemp	LT Unemp	Incomplete Paperwork	Status leading to non-payment	Above Threshold (Paying)	Above Threshold (Defaulted)	Below Threshold	In Arrears	Further information sought (missing)	Totals ('000s)
2000	48.0%	2.6%	18.6%	14.3%	1.3%	6.3%	0.0%	6.4%	0.2%	0.2%	0.3%	0.0%	1.3%	35.615
2001	43.5%	2.6%	22.7%	15.4%	1.5%	6.2%	0.0%	5.7%	0.2%	0.3%	0.3%	0.1%	1.2%	63.727
2002	44.9%	1.9%	25.5%	13.9%	1.3%	5.2%	0.0%	4.5%	0.5%	0.4%	0.5%	0.1%	1.1%	197.836
2003	42.5%	1.5%	29.2%	13.2%	1.4%	4.9%	0.1%	4.2%	0.6%	0.5%	0.6%	0.1%	1.2%	271.159
2004	39.3%	1.2%	32.6%	13.2%	1.4%	4.9%	0.1%	4.0%	0.7%	0.5%	0.7%	0.1%	1.1%	281.206
2005	35.0%	1.0%	36.7%	13.4%	1.6%	4.9%	0.1%	4.0%	0.8%	0.5%	0.7%	0.1%	1.1%	288.998
2006	30.4%	0.8%	40.7%	13.7%	1.7%	5.0%	0.1%	4.1%	0.9%	0.6%	0.7%	0.1%	1.2%	296.311
2007	25.2%	0.7%	45.4%	13.8%	1.9%	5.3%	0.1%	3.9%	1.0%	0.6%	0.8%	0.1%	1.1%	289.074
2008	21.1%	0.5%	48.6%	14.3%	2.1%	5.4%	0.2%	3.8%	1.1%	0.6%	0.9%	0.3%	1.0%	295.384
2009	15.7%	0.4%	52.2%	15.6%	2.4%	5.6%	0.2%	3.8%	1.2%	0.6%	1.0%	0.3%	0.9%	308.506
2010	10.1%	0.3%	54.9%	17.3%	2.7%	6.1%	0.3%	3.8%	1.3%	0.7%	1.2%	0.4%	0.8%	321.137
2011	7.4%	0.3%	54.6%	19.4%	3.0%	6.2%	0.5%	3.8%	1.4%	0.6%	1.5%	0.5%	0.8%	334.034
2012	5.4%	0.2%	53.7%	21.8%	3.2%	6.5%	0.8%	3.8%	1.2%	0.6%	1.6%	0.5%	0.7%	336.762
2013	3.2%	0.2%	52.1%	24.4%	3.6%	6.9%	1.2%	4.0%	1.0%	0.4%	1.8%	0.5%	0.7%	340.103
2014	1.9%	0.1%	46.9%	28.8%	4.1%	7.2%	2.5%	4.3%	0.7%	0.3%	1.8%	0.4%	0.8%	347.590
2015	1.3%	0.1%	5.9%	6.8%	4.8%	8.0%	64.7%	4.5%	0.5%	0.1%	1.9%	0.4%	0.9%	332.394
2016	1.2%	0.1%	0.1%	0.2%	6.3%	7.5%	69.2%	11.0%	0.1%	0.0%	1.0%	0.0%	3.2%	549.189

Source: The Student Loans Company (SLC)
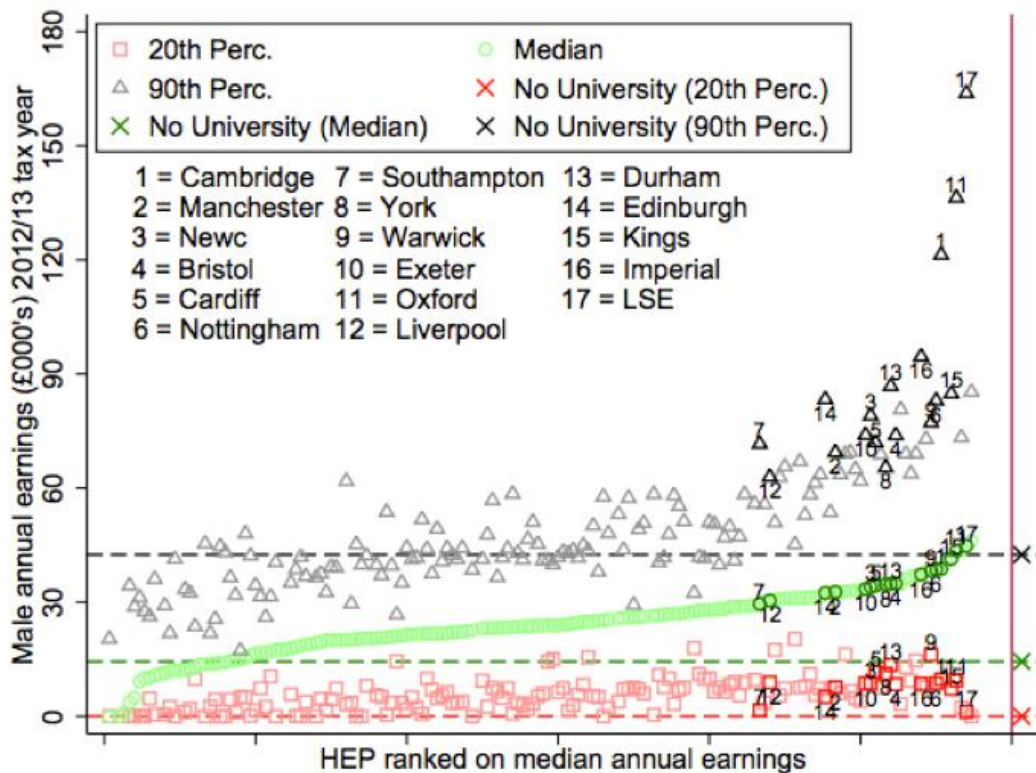
Figure 11: Unconditional male 20th, 50th and 90th percentile earnings for the 1999 cohort in 2012/13 for HEPs ranked on their graduates' 2012/13 median earnings. There are 168 different institutions included, and one "other" institution which include several hundred institutions that issue only a handful of loans. Note: The log scale is not used here. Zeros are included.

In Table 2 we find that overseas borrowers are predominantly more likely to be more long-term overdue, with domestically residing graduates presenting evidence of being overdue by under 12 months within the New Zealand ICL system. It is important to reiterate the scale of the levels of debt that is portrayed in these tables, with overdue overseas debt accounting for $982.6 million and domestic overdue debt accounting for $91.2 million. The NZ ICL system has been identified to contain major issues that have been linked to fraud and emigration. It was reported in December 2016 that after a crackdown on student loan borrowers identified 57,000 NZ students living in Australia where two-thirds were in default. In October, a new information-sharing agreement between Australia and New Zealand came into force to identify such issues. Tertiary Education, Skills and Employment Minister Steven Joyce stated that identified borrowers have a combined loan balance of $1.2 billion. There have also been reports of arrests of returning indebted citizens linked to hard-line powers introduced in March 2014. This has started a worrying trend of criminalising those who are unable to keep up with payments of their ICLs. Further, NZ citizens living outside the state that have defaulted on their ICLs are now being "monitored" for arrest should they wish to return home.

Table 2: Age of NZ overdue repayments by location as of 30 June 2016

Age of overdue repayments	New Zealand-based borrowers		Overseas-based borrowers	
30 June 2016	$m	%	$m	%
0-1 month	$5.3	5.9%	$3.9	0.4%
2-3 months	$12.9	14.1%	$155.8	15.9%
4-6 months	$3.9	4.3%	$5.3	0.5%
7-12 months	$4.1	4.5%	$7.9	0.8%
1-2 years	$13.5	14.8%	$153.3	15.6%
2-5 years	$20.0	22.0%	$310.7	31.6%
>5 years	$31.4	34.5%	$345.7	35.2%
Total	$91.2	100.0%	$982.6	100.0%

Source: New Zealand Student Loan Scheme Annual Report (2016)

But can we just repackage and sell the risk to financial markets? Yes, we can. However, financial markets process the inherent information associated with these portfolios and allocate a "fair value". For further information on this policy, we should consult those in the United Kingdom ICL system who have spent significant time and effort attempting to sell "loan books". In fact, the UK ICL system is selling the 2002-2006 loan book in early-2017, which had a face-value of approximately £4 billion. The final value of this sale has yet to be announced, however it is most likely going to include a substantial discount. This attributable discount may present a direct cost to the Exchequer, which in the Irish context would be a further subsidy to that already in place, namely the grant. Students who have had their loans securitised and sold are not affected, however HRM and the ICL system continues to operate the recuperation facilities on behalf of the new book owners. In late 2013, it was widely reported that a company called Erudio Student Loans was named as the successful bidder upon the 1990-1998 loan book which was estimated to be worth £890 million. It sold for £160 million, a discount of approximately 82%. This neutralised the loan book up to 1998, enshrining the risk of repayments from this cohort as an issue for those that purchased the loan book. There are numerous cohorts of society whose incomes will sadly never make it to the point where the ICL repayments will start, therefore generating this discount.

In order for this system to be sustainable and not an excess burden upon the Exchequer, it would need to be an attractive prospect for securitisation. This technique has been used in the UK, with limited success, to generate liquidity. In the UK the successful sale of one particular older loan books valued at £2bn but required a £750m subvention from the Treasury to entice willing investors. In the Irish context we have estimated a baseline credit rating of each ventile based on the calculated information using the 20 year expected loss model. From this analysis, we can observe the estimated market perception of each student loan ventile, observed in this brief sub-analysis as an individual portfolio. However, it is most likely that utilisation of this tactic would most likely sell the entire period of loans for an "x-year" time-period.

Table 3: Expected loss comparisons to international tranches of estimates

ICL Ventile	% of Students	Est. 20 year expected loss	Theoretical Credit Rating Grade
1	4.5%	0.1%	Investment
2	4.1%	0.3%	Investment
3	3.8%	0.7%	Investment
4	3.0%	0.9%	Investment
5	4.4%	1.3%	Investment
6	4.1%	2.2%	Investment
7	5.8%	3.1%	Investment
8	3.5%	5.6%	Investment
9	5.3%	8.0%	Investment
10	5.4%	14.0%	Junk
11	6.9%	19.4%	Junk
12	7.8%	24.1%	Junk
13	8.4%	31.0%	Junk
14	7.0%	38.4%	Junk
15	4.7%	44.9%	Junk
16	6.3%	55.9%	Junk
17	5.2%	71.5%	Junk
18	4.1%	88.1%	Junk
19	3.4%	98.8%	Junk
20	2.3%	100.0%	Junk

We also observe that 61.5% of the loans would be estimated to be junk status, therefore 38.5% are investment grade. 21.2% of the loans based upon the estimated data are found to be in the lower spectrum of junk status, denoted as either speculative or possessing extreme default risk (ventiles 13 through 20). Based on our analysis, we estimate that the window of effectiveness for an ICL in Ireland are:

- Default rates below 15%;

- A minimum payment cap of €2,250 per year;

- An interest rate of 7-8% over the baseline sovereign;

- In a perfect conditions environment, the model is running somewhere in the 25-30% success zone with perfect conditions, which will mean GDP growth rates of around 4-5% per annum.

- An EIB loan of €500M per annum will be insufficient - this model will need to be a structured Special Purpose Vehicle (SPV) generating in the region of €7 billon of net losses until year 18.

- To generate a profitable year for the ICL structure within a decade, students would be subject to an interest rate of 10% on their loans or be subject to a default rate of 0%.

- While the interest rate is paramount to the system working, it has a damaging impact on inequality since it will place those within the €25-35,000 income band into a debt-spiral.

There are ways of making this ICL system functional. One can begin by focusing on HEIs with low levels of grant recipients and high points and high earning potential courses. By expanding the ICL to postgraduates it will capture more high earners. The signing of the ICL contract in year 2 of the student's education will eliminate most drop-out students, which constitute a large default risk (which is also a valid option). A much higher interest rate would be required and recourse to the criminalisation of non-

compliance with the regulations of the ICL, most importantly for those that emigrate will be necessary. In short, the main purpose of the ICL will be cost recovery in order to prevent it from becoming a large liability for the Exchequer. Issues of equity and social policy will by necessity become secondary.

There are a few basic background issues we would like to highlight about the Irish higher education system and the labour market in general. Seamus McGuinness of the ESRI has recently published work on education-labour market mismatch and has highlighted Ireland's very high figure, 33%, when compared to the rest of Europe. This has been further reinforced by a report on the UK's education-labour market mismatch by the UK's Chartered Instituted of Personnel and Development, an association of 140,000 HR professionals. This echoed much of Baroness Wolf's *Remaking tertiary education: can we create a system that is fair and fit for purpose?* (2016) report. The earning potential of graduates, when highlighted as part of the general change in the labour share of national income is less than optimistic, with the labour share of income remaining flat since the 1970s and weak productivity growth. This has been highlighted by Prof. Robert Gordon and by the IMF in their latest World Economic Outlook. The Irish case is highlighted in Figure 8. In addition, we know that services economies suffer from low productivity and Baulmol's cost disease which translates into flat or very modest wage growth.
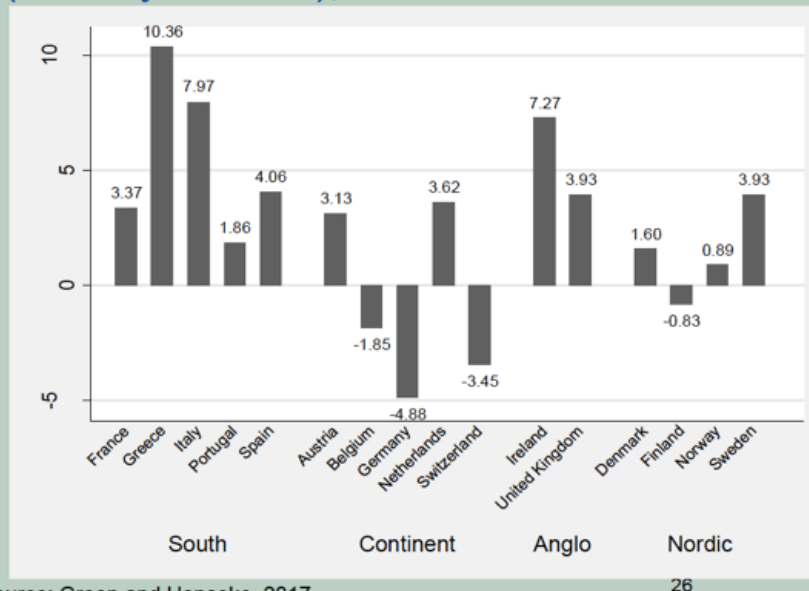

Graduate underemployment across the OECD, 2011

Source: Adapted from Green and Henseke (2016).
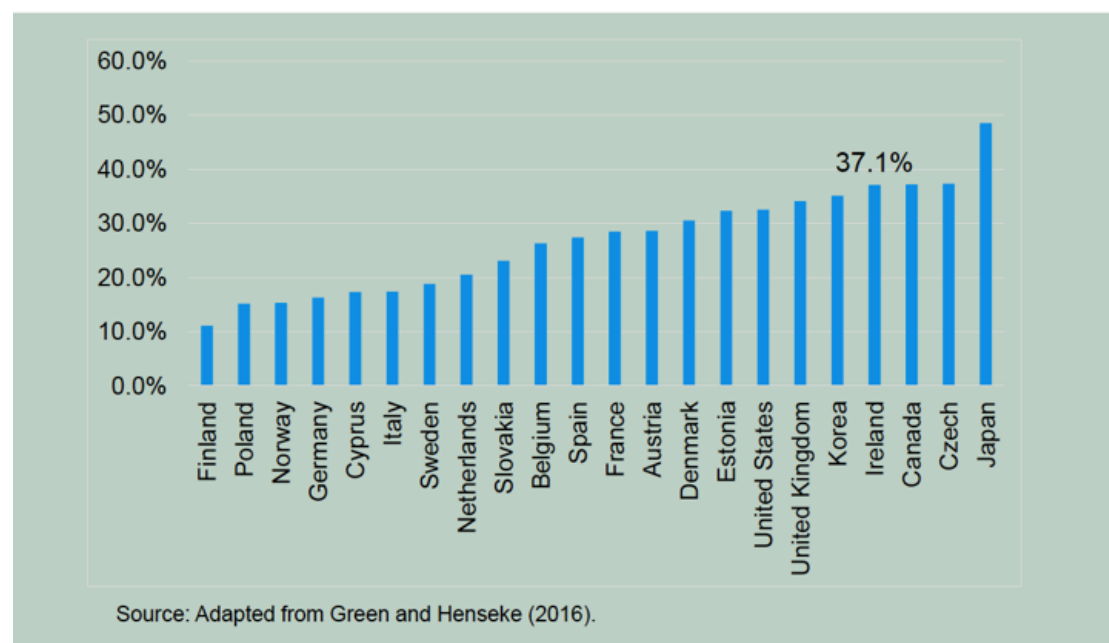
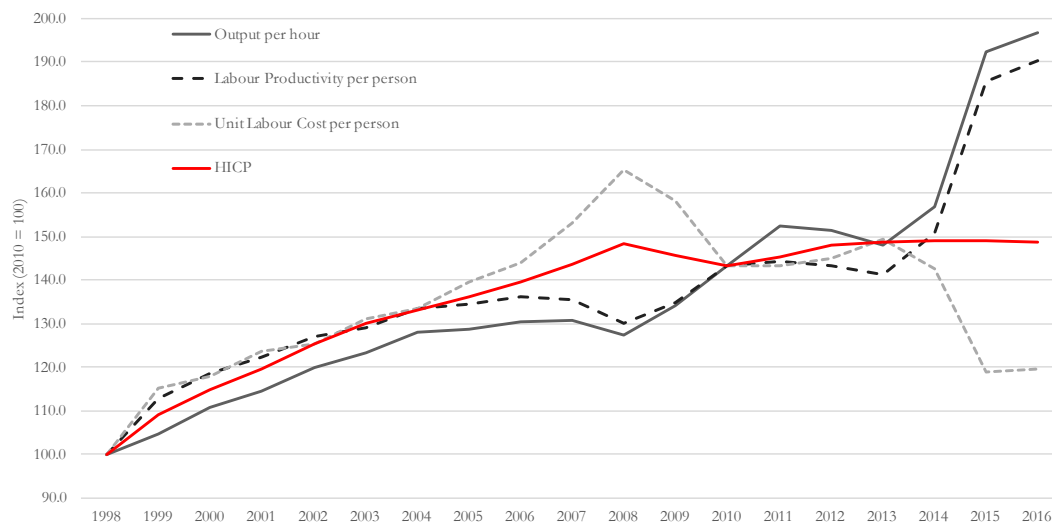Change in the proportion of employed graduates in medium-skilled or low-skilled jobs, (25-29 year olds), 2004-2015

Source: Green and Henseke, 2017

Figure 8: The disconnect between output per hour, productivity and unit labour costs

*Source: OECD, Eurostat, Authors' Calculations.*

Ultimately there is another dimension. Traditional undergraduate higher education is a large sunk cost investment, i.e. an irrecoverable cost in time, effort and money. There are deep information asymmetries on the part of the student with respect to the educational product and the labour market. In the US, there

is strong evidence that even when students overcome these asymmetries (60% don't) they overestimate their salaries by 13%. This is part of the rationale for an ICL. It is also part of the reason why in a changing economy and labour market, where large and well-educated precariats exist and as highlighted by MIT's Daron Acemoglu, there is empirical evidence that robotics are eating away at jobs and wages.

Based on our research, the evidence shows that ICLs would be a risky course of action for Ireland. It has the potential to create large contingent liabilities for the Exchequer. It would modify the significant social planning objectives that have been worked out over time between government and the higher education institutions. It would not rectify the resource per student issue without abandoning fiscal prudence and cannot solve the €5.5bn capital expenditure deficit. The Government would need to propose substantial legislative changes to solve issues of financial accounting in HEIs, the creation of an arm's length loan company and loan recovery. These conclusions are based upon evidence but indicate that further investigation is warranted based upon evidence from Ireland as well as multiple jurisdictions that have and do not have ICLs. Many of the decisions lie in the hands of political system since they are related to role of the higher education system in social planning. Those decisions set the parameters. At the end of the day higher education has to be paid for and there are only three options: the student, firms or the Exchequer. In all circumstances it is about revenue and not debt, as debts ultimately have to be repaid by revenues generated from income, profits or taxes.

Part II – The Wider Context

This leads us to the wider economic context within which the higher education discussion is taking place. The fiscal space is limited and the Irish fiscal policy results in a limited operating window when compared with other OECD countries.
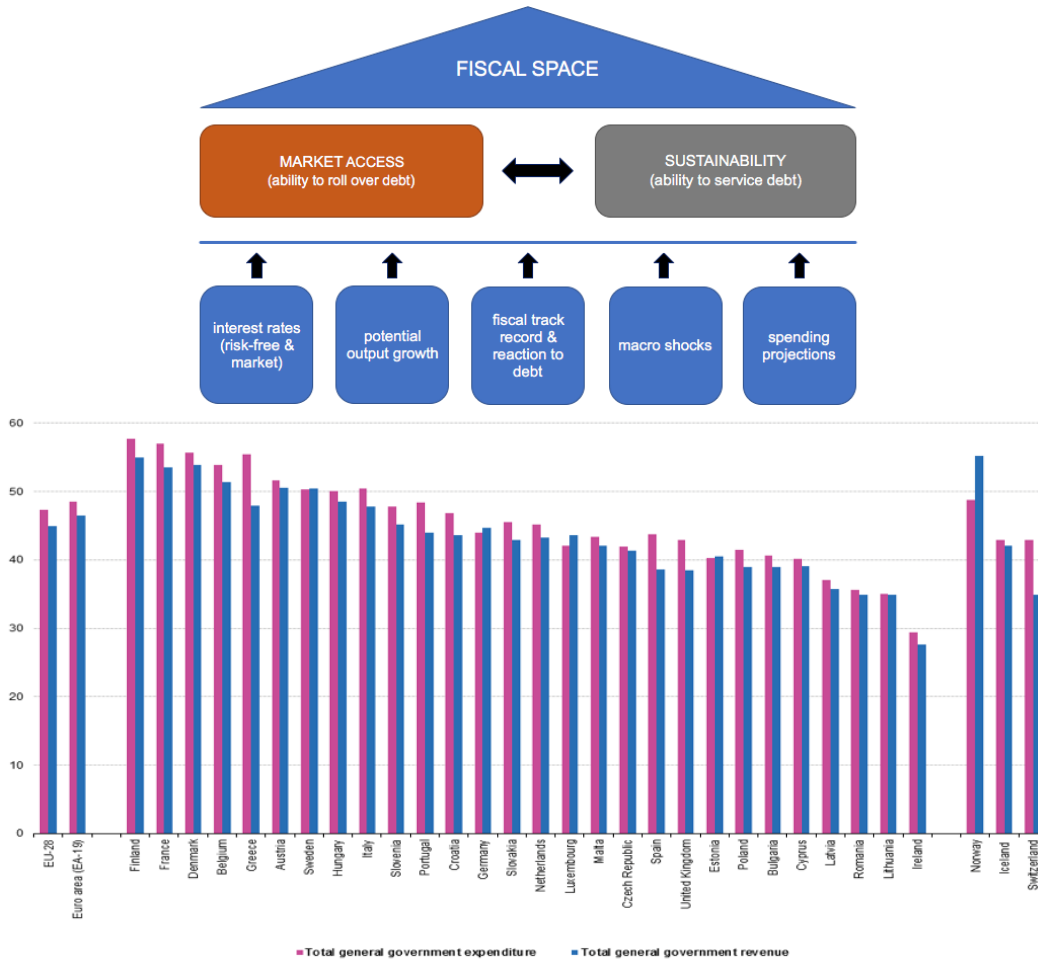
Note. Data extracted on 21.10.2016. Data ranked in descending order according to the average of total revenue and expenditure.
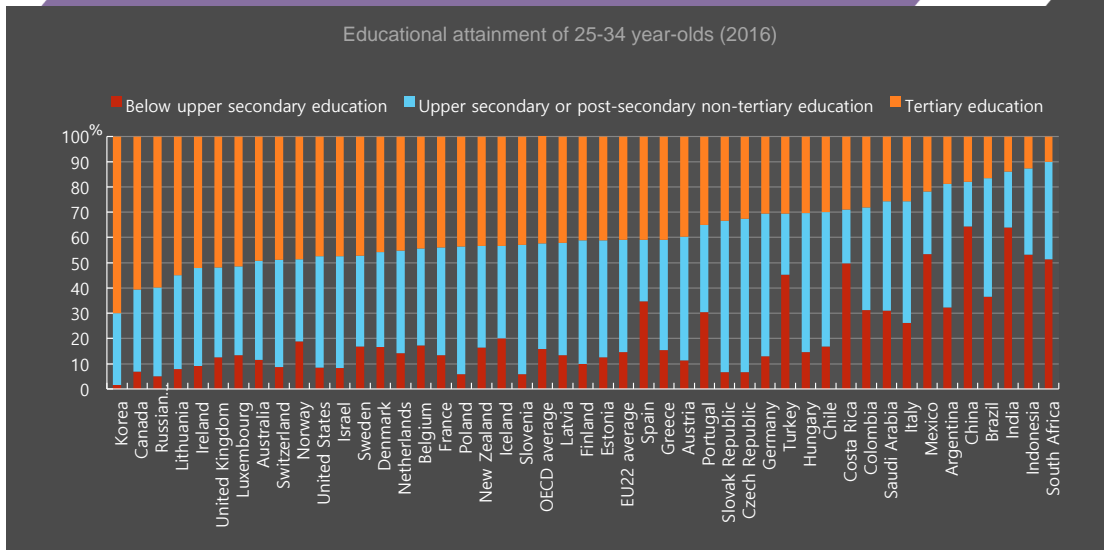*Source:* Eurostat (online data code: gov_10a_main)
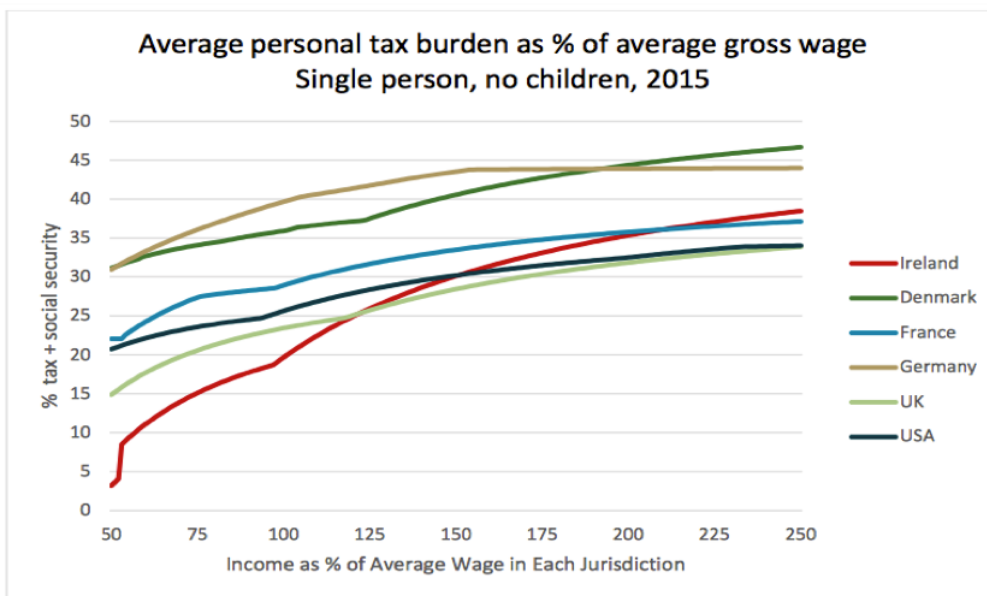
Data Source: OECD Taxing Wages 2015-2016

It is important to note that higher education is becoming an international norm but also decidedly utilitarian.
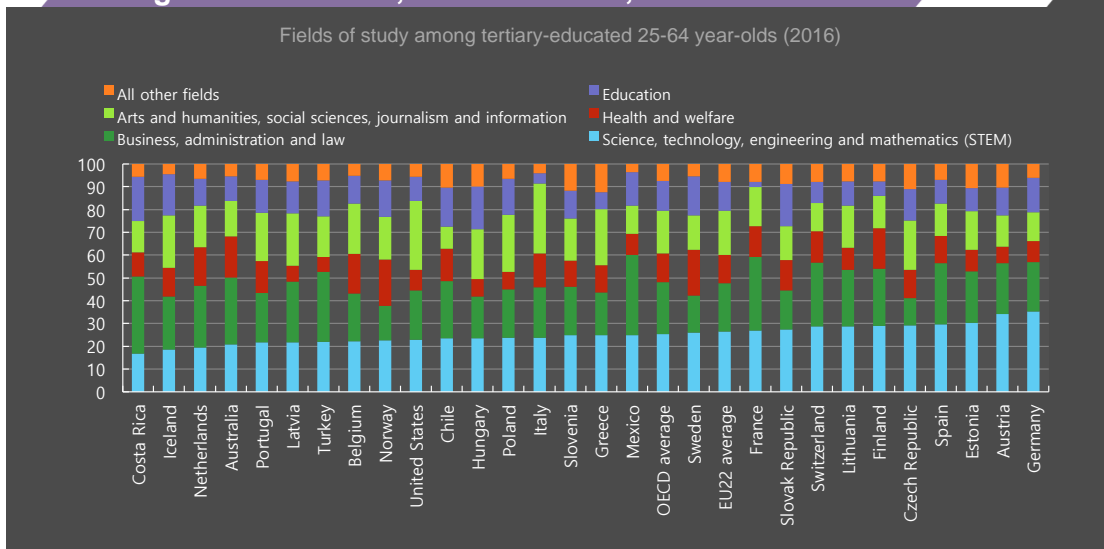
## Tertiary education is becoming the norm

Educational attainment of 25-34 year-olds (2016)

The largest share of tertiary-educated adults hold a degree in business, administration, and law

Fields of study among tertiary-educated 25-64 year-olds (2016)

Productivity and the labour share of wealth in the economy indicate a series of worrying trends for a very long time. It is not globalization, it's primarily technology!

Chart 1. US share of labour income has been declining
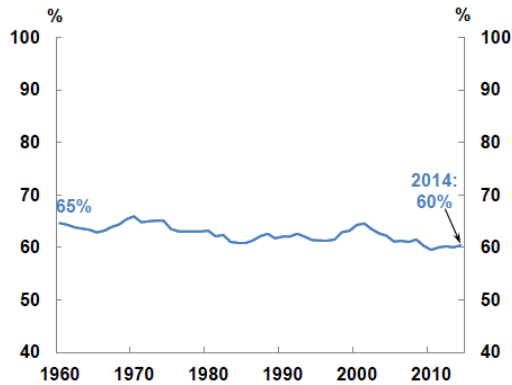
Source: Penn World Table 9.0.

Chart 2. Impact of globalisation and technology on decline in share of labour income in AEs and EMEs (1993 – 2014)
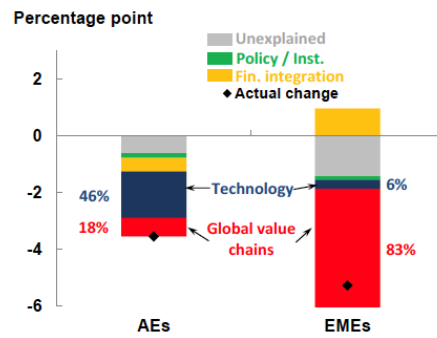
Source: IMF WEO (April 2017).

Figure 8: U.S. Productivity Growth, 1973-2016Q1 (with period averages)
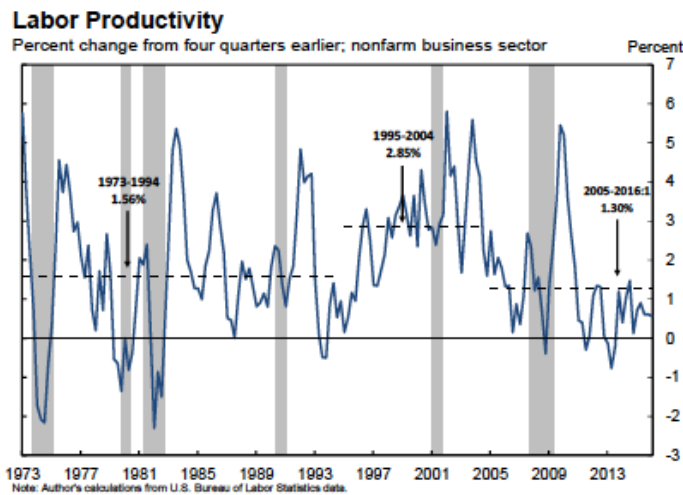
Valletta, 2017 NBER WP 22935

And the concern now is that the technology-productivity conveyor belt has shut down, resulting in lower overall growth and the potential for the economy to become more unequal as rent-seeking activities become a more effective method of enrichment.

Figure 1: Aggregate Data on Growth and Research Effort
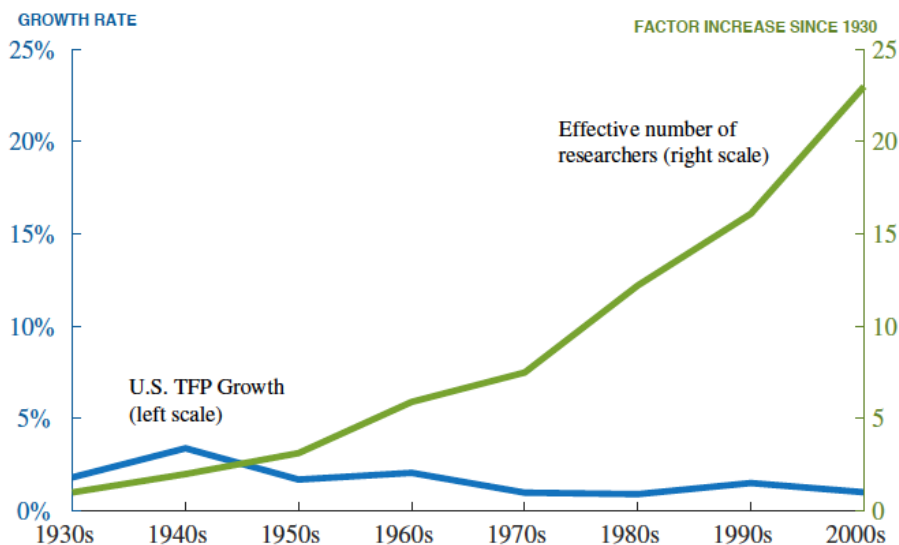
Note: The idea output measure is TFP growth, by decade (and for 2000-2014 for the latest observation). For the years since 1950, this measure is the BLS Private Business Sector multifactor productivity growth series, adding back in the contributions from R&D and IPP. For the 1930s and 1940s, we use the measure from Robert Gordon (2016). The i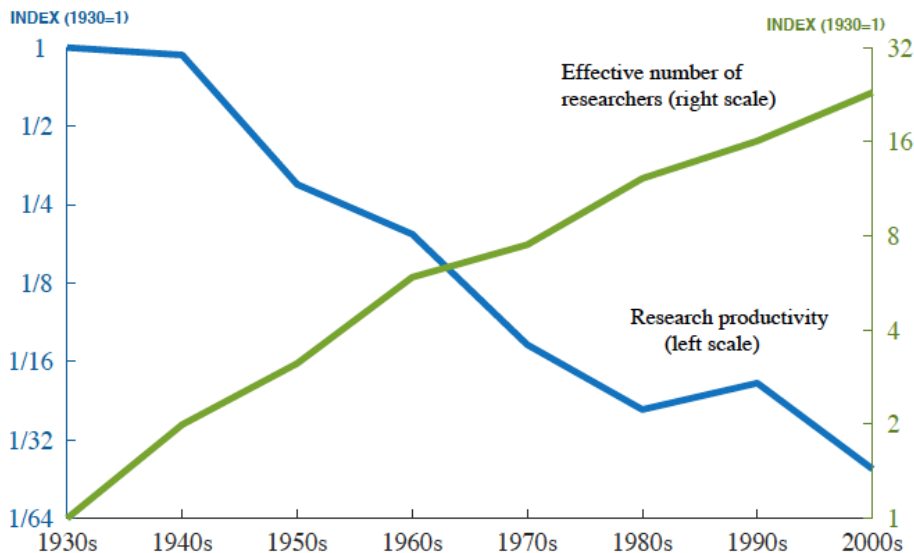dea input measure is gross domestic investment in intellectual property products from the National Income and Product Accounts, deflated by a measure of the nominal wage for high-skilled workers.

Figure 2: Aggregate Evidence on Research Productivity

Note: Research productivity is the ratio of idea output, measured as TFP growth, to research effort. See notes to Figure 1 and the online data appendix. Both research productivity and research effort are normalized to the value of 1 in the 1930s.

Figure 15: Compustat Distributions, Sales Revenue (4 Decades)
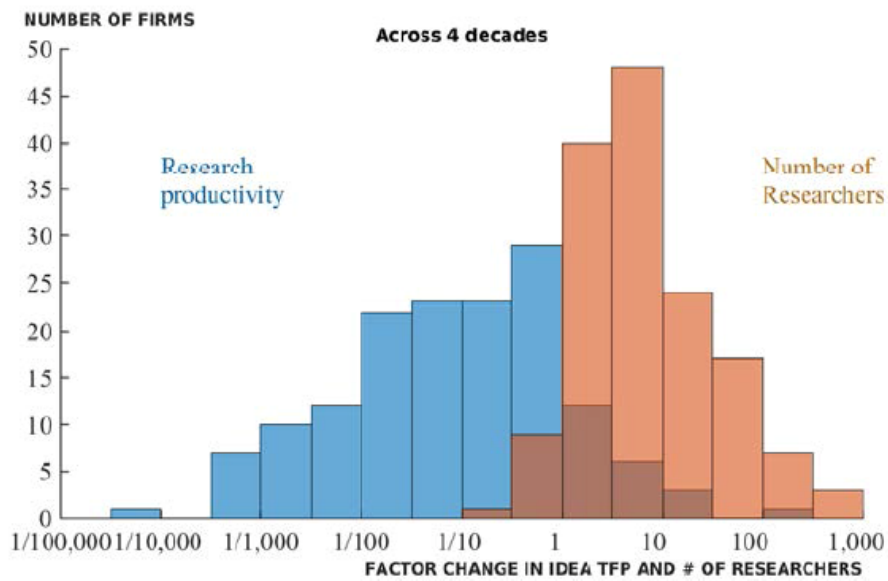
Note: Based on 149 firms. 14.8% of firms have increasing research productivity. 4.7% firms in this sample have research productivity that is roughly constant, defined as a growth rate whose absolute value is less than 1% per year.

Source: Are Ideas Getting Harder to Find? Nicholas Bloom, Charles I. Jones, John Van Reenen, and Michael Webb. NBER Working Paper No. 23782. September 2017

The impact of inequality is being seen in all the advanced economies. This creates real political economy challenges, where earnings growth by the majority of the population has been stagnate or slightly declining since the 1970s. Higher education can be a solution to this problem or begin the process of reinforcing this inequality.

Figure 4. Change in real income between 1988 and 2008 at various percentiles of global income distribution (calculated in 2005 international dollars)
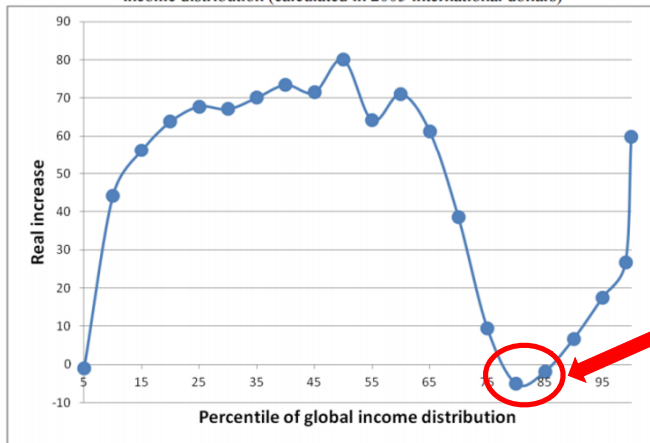
Note: The vertical axis shows the percentage change in real income, measured in constant international dollars. The horizontal axis shows the percentile position in the global income distribution. The percentile positions run from 5 to 95, in increments of five, while the top 5% are divided into two groups: the top 1%, and those between 95th and 99th percentiles.
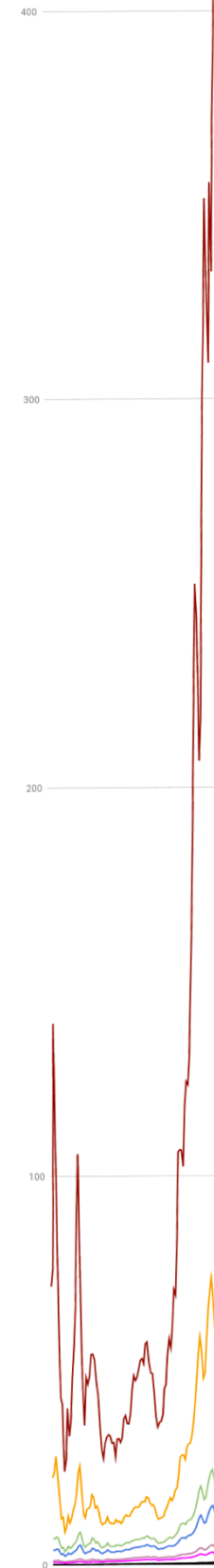
Political economy matters. As can be seen here, the tastes and preferences of countries can be very different, even if they share common linguistic and legal backgrounds.
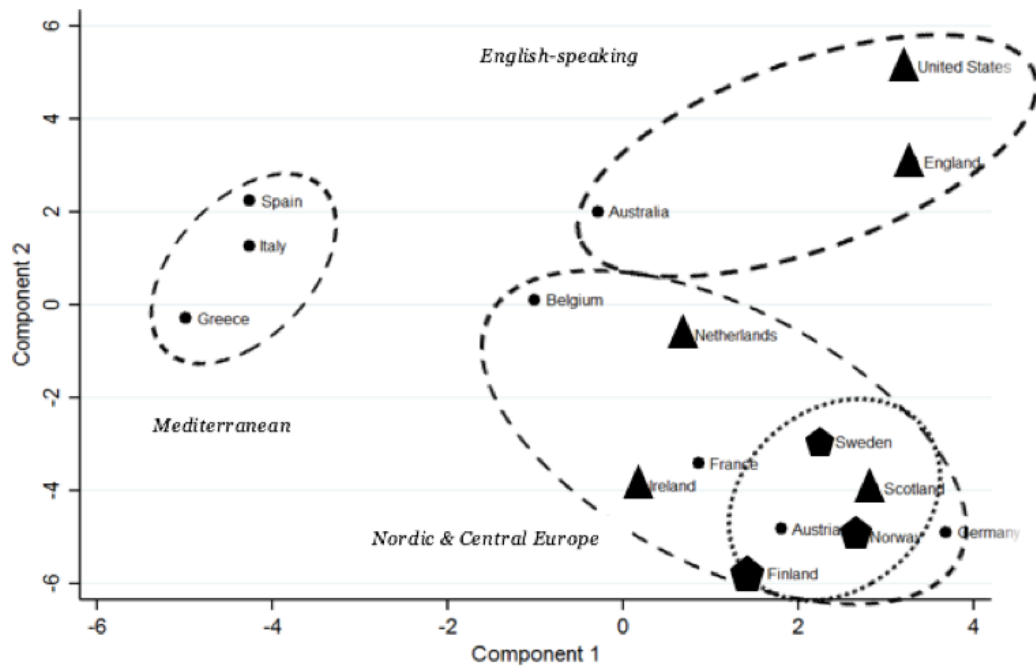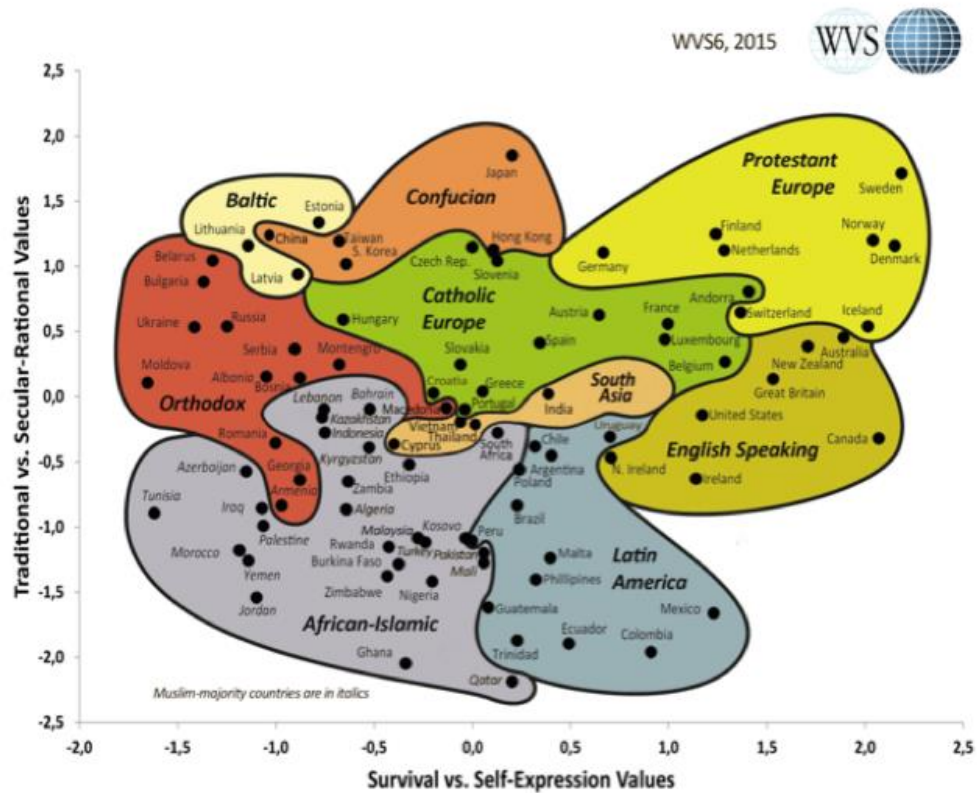
Rankings and the Visibility of Quality Outcomes in the European Higher Education Area – An anatomy of mission creep.

Higher education, as a sector, not to put too fine a point on it, is deeply confused. The provocativeness of this statement relates to directly to why this conference was convened by the Commission. The EU, along with Ireland, launched a new system of higher education analysis called U-Multirank. It has approximately 30 (and potentially increasing) indicators across five broad areas. Yes, those are a lot of data points for a given institution. Though the conference was generally convinced of the project required more data points it already conceded that providing the necessary information to make U-Multirank work was going to be a daunting task. Let's look at the areas:

http://www.umultirank.org/fileadmin/content_uploads/UMR_Dublin_Conference_Jan2013.pdf

Rankings and the Problems of Universities

Some of these comments are distilled from a piece of work I had done with some TCD colleagues about four years ago. You can read it here.

The basic problem with these types of rankings is that they amplify as opposed to diminish the intense conflicts rooted in higher education. These conflicts result in the misallocation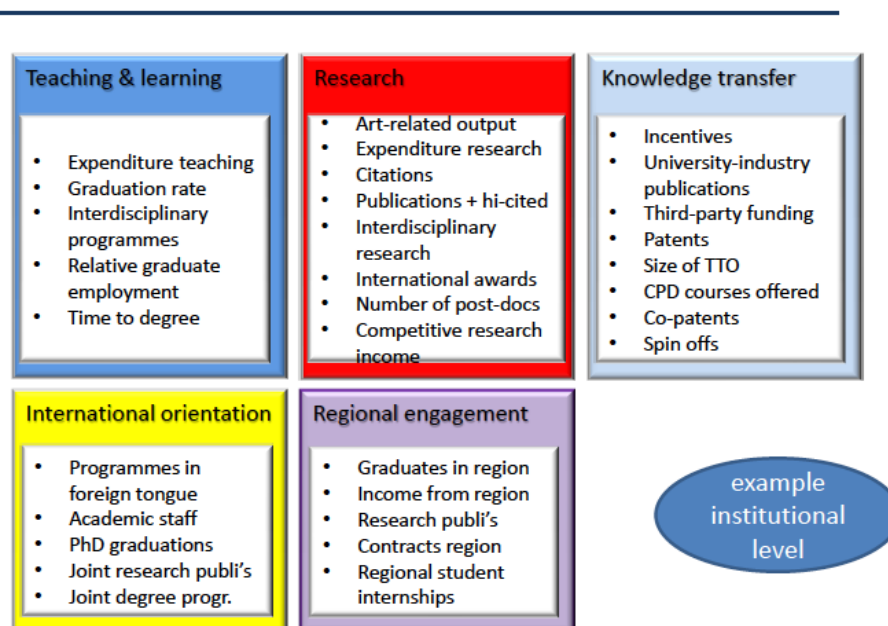 of resources and a general confusion of mission. This is commonly referred to as "mission creep" in other sectors but is perfectly acceptable, even encouraged, in higher education. Higher education is supposed to supply teaching, research, "knowledge transfer", soft power projection and local engagement with the socio-economic community of their home region. Removing the jargon for a minute lets look at what that means:

1. Teach undergraduate students
2. Teach postgraduate students
3. Mentor post-docoral staff/students
4. Provide a place for studying and learning
5. Provide a place for people to engage in unsupervised activities but within a "safe" framework
6. Provide guidance and learning opportunities for students that are not from the usual backgrounds (i.e. not 18 and middle class)
7. Provide "world class research"

8. Engage with local industry
9. Engage with the local community
10. Create a space for culture and social engagement
11. Make graduates more employable
12. Generate "knowledge" suitable for the "knowledge economy"
13. Create the next Google (sooner rather than later)
14. Facilitate the social and economic policy of the state
15. Align with the aims, purposes and obligations of the various disciplines contained represented within a higher education institution
16. Provide and educational/developmental experience
17. Engage with professions such as law, medicine and engineering
18. Comply with the regulations and stipulations of the funder/board of trustees/state
19. Be provided at the greatest efficiency and at least cost possible
20. Be sufficiently prestigious so as to be attractive to students, pride-inducing to alumni and boast-inducing to politicians

This is by no means an exhaustive list of aims but I think that you have the idea. Universities have a lot of directions to go in and typically parents, students and the state would like them to excel at all these objectives. The issue is that a financially distressed university begins to behave in perverse ways. *The Economics of University Behaviour* presents the economics behind the university. Universities aim to maximize prestige. This is a function of their inability to properly engage in market clearing since for non-market reasons they engage in active "rationing" of places based on entrance criteria, not on an equilibrium based on supply, demand and prices. Restricted supply and prices disconnected from the actual costs of the institution assist in this prestige-seeking model. Harold Bowen's *Investment in Learning,* William Bowen's *Economics of Major Private Universities* and Ron Ehrenberg's *Governing Academia* all present very useful economic models on how education establishments behave. One of the results is how quickly perverse decisions become acceptable as a result of "fact-based policy" typically formulated from naïve models fed by poor data. Courses are shut down or over expanded. Institutions enter an environment where their social marginal benefit function converges upon their marginal benefit (private) function. Also, second order effects become more prevalent with an increased "balkanization" of departments and courses and academic/financial units entering into "arms races" or "predatory" behaviour against other internal and external units. Both of these effects were identified and discussed at the conference.

The economics of universities means that they don't behave terribly well under "market" principles. This is mostly due to the fact that policymakers many times ignore immediate incentives and almost always ignore second-order (i.e. knock-on) effects. Higher education (all education levels to be honest) is poorly suited to the naïve application of such principles since they do not operate in complete markets. Student places are rationed and granted on a non-market basis. Prices, i.e. fees, are not market determined but largely driven by exogenous factors, such as a government grant or fee limitation. The market itself is riddled with massive information failures due to the presence of asymmetric information that is inherent to education and similar experience goods. Education, and higher education in particular, are not just equal in action to commodities or luxury goods. A degree in economics cannot be understood as being as market determined or as transparent as washing-up liquid or a digital camera.

The conference tried to address the problems of multiple missions by saying that a healthy ecosystem of institutions is necessary to ensure that the entire structure of higher education tries to fulfil these different roles but there is a deeper issue here.

Higher education has changed substantially over the past 60 years. The first wave of expansion has been found to be financially unsustainable. Looking at US manpower texts from the 1960s will illustrate a world where the staff was very well paid (even as graduate students), student numbers were increasing and plant was new. Fast forward to today and many of those staff have now retired on unsustainable defined-benefit pensions (a topic for another blog post), most staff now are adjunct staff and not well paid and the physical plant is now antiquated or trapped in a vicious cycle of high-speed depreciation. The higher education sector, like much of the education sector, has become of new solution to many of the economy's ills. "If we are smarter we will get the jobs." "If we have the best education system we will invent new ways of doing business." The "smart economy" and the "knowledge economy" mantras are well known to Irish readers. Declan Jordan of UCC and Colm McCarthy of UCD have written about the "faith based policy" related to research and development in Ireland. Though Ireland has had a

particularly poor record, such policies are not entirely successful elsewhere. The conclusion of part of the conference was essentially that "education is good for you" much like the old Guinness ads purporting that "Guinness is good for you" while being greeted by a smiling toucan.

While I agree that education is an aim in itself and very good for the individual and society as a whole most people arrive at university to get a degree to get a job. It is what their parents have come to expect. It is what they expect. It is also what the economists have told them would happen. Human capital theory (a blog post dedicated to this topic will follow) and the endogenous growth model drive much of the thinking on how education, innovation, economic growth and jobs all link together. The work by Theodore Schultz, Gary Becker, Edmund Phelps, Robert Lucas, Paul Romer, Charles I. Jones and Philippe Aghion has created this intellectual framework and it has had a profound policy impact. Interestingly, we now justify education financing by economic growth. It was not long ago, in the 1940s and 50s that we justified education on the grounds of national security. The famous Vannevar Bush book *Modern Arms and Free Men,* a text that followed from his report outlining the rationale for the National Science Foundation in the US on the grounds of military preparedness, was a clear statement of the justification of education using many of the same subjects (STEM – Science, Technology, Engineering & Mathematics) and examples (marketplace/battleground ready applicable innovations) we have become used to seeing today stated in the economic idiom.

The main problem with this approach is that we have fairly clear empirical evidence that something is wrong with the model. With Europe arguably the most highly educated [used advisedly] population it has ever has been in the history of the continent in gross terms and percentage of population there is something missing. That something is employment, most especially youth unemployment in Italy, Spain, Portugal, France and Greece.

The *New York Times* has written a series of articles on how the well-educated youth of Europe have little or no prospects. Read their dispatches about Italy and about France and see a story where education does not transcend macroeconomic mismanagement. The *New York Times* also raised some serious questions about the "smart" or "knowledge economy" and what that means for jobs over the medium to long term. The series entitled "The iEconomy" has presented some eye-opening reportage on the present and the near future. The implicit contract that existed between these graduates (and their parents) when they entered higher education was that the expense and effort would be rewarded with access to employment and employment that was superior in remuneration and job satisfaction than what would be found without such an investment in human capital. That contract, especially now during the Eurozone Crisis has been effectively ruled null and void. The unrest and disquiet has burst forth throughout Europe and the Middle East driven by unemployed young people that feel their elders have sold them a pig-in-a-poke. If education is supposed to "deliver the goods" and then fails where does it go next. We don't need it fight the Cold War anymore. It's economic magic seems somewhat sapped. What is the purpose of all these ivy-covered professors inside ivy-covered walls?

This is where we get to rankings. Rankings are a function of the above discussion. Higher education is expensive. Higher education suffers from imperfect information between providers, purchasers and recipients. Higher education has performed some spectacular own-goals. This has fostered a sense of distrust and that the "black box" needs to be better understood and *managed*.

The advent of the higher education rankings with a global outlook caused a bit of a stir about a decade ago. At first nobody seemed to know what to make of them but they were sure they had to be important. The American audience was not overwhelming concerned at first since rankings have existed for a long time in the form of the US News and World Report Best Colleges report. The Shanghai Jiao Tong University Rankings, the Times Higher Education Supplement Rankings and the QS World University Rankings all jolted the sleepy policy space that was higher education when burst onto the scene in 2003. The impact in Ireland was clear – how do we create "world-class universities" and quickly. At the very heart of this response was the fear that Europe was in decline, economically and intellectually relative to the United States. More locally there was a profound case of "Harvard envy" just as Harvard was beginning to question its own management policy.

On a pan-European level what followed is now seen as an arms race within countries and between countries. Ellen Hazelkorn has worked on university rankings and the development of the European Higher Education Area. This policy aimed to create an "ecosystem" of universities with diverse missions

and aims but were sufficiently transparent and integrated that students would be mobile across borders. The Bologna Process and now the Europe 2020 policy programme aim to create a single market for higher education in Europe and its surrounding countries. The ultimate aim is to pool resources in a fashion that attracts non-EU students and facilitates world-class research. U-Multirank, the child of U-Map, is there to provide the necessary transparency to allow this European Higher Education Area to become evident to non-experts.

At the core of this system are a series of graphics. Students and statisticians working to a broad framework provided by the Commission have driven the process. Academics have been largely side-lined in the process, something unions have objected to now and in the past. The Irish Presidency launched U-Multirank and is very attached to what it can deliver. There has been an agreement that the project would be continuity between the Irish Presidency and those of Lithuania and Greece, resulting in the project being fostered as a priority for the next 18 months. The main objection thus far has been about cost. This is by no means a simple or costless exercise and the representatives of the education ministries and rectors' offices were actively performing the mental arithmetic and equating it with their respective capitals unpleasant fiscal arithmetic.

The Research Assessment Exercise/Research Excellence Framework and National Student Survey did provide a framework for measuring regional and external engagement by universities but with nearly 50 sub-indicators.

The Commission policy constantly sought the quantification of unquantifiables and the construction of proxies wherever possible. These was little mention of the effects beyond the European Higher Education Area project of these metrics but it is clear that what gets measured gets managed. The mantra of evidence-based policy was clearly at work but while many aspects of this approach are to be lauded judgment is important as well. Judgment and trust are important to a functional education system. The Finns, renowned for their high quality of primary and secondary education systems, place little faith in metrics but in rigorous advanced training. Judgment, used to be a large part of policy, largely due to the *ad hoc* nature of government. This is a topic that Nassim Taleb discusses in his new book *Antifragile* and the classic study of aesthetics by Trinity College alumnus Edmund Burke *A Philosophical Enquiry in the Sublime and Beautiful*. The most famous example of proper judgment articulated in the face of the unquantifiable was at the US Supreme Court in *Jacobellis v. Ohio* (1964) 378 U.S. 184 where Mr. Justice Potter Stewart famously stated that in response to the threshold for obscenity "But I know it when I see it". In education, as in many areas, sometimes *prima facie* analysis tells us more than we are willing to admit.

Higher education metrics designed along the lines of U-Multirank are already being used for management purposes in Norway, where 23 indicators have been used to create "petal diagrams" to track on an institutional level the performance of Norwegian institutions. This form of data visualization is also used by U-Map and will be incorporated into U-Multirank. Here is an example of such a diagram:

40

Universitetet i Bergen

Kilde: DBH - dbh.nsd.uib.no
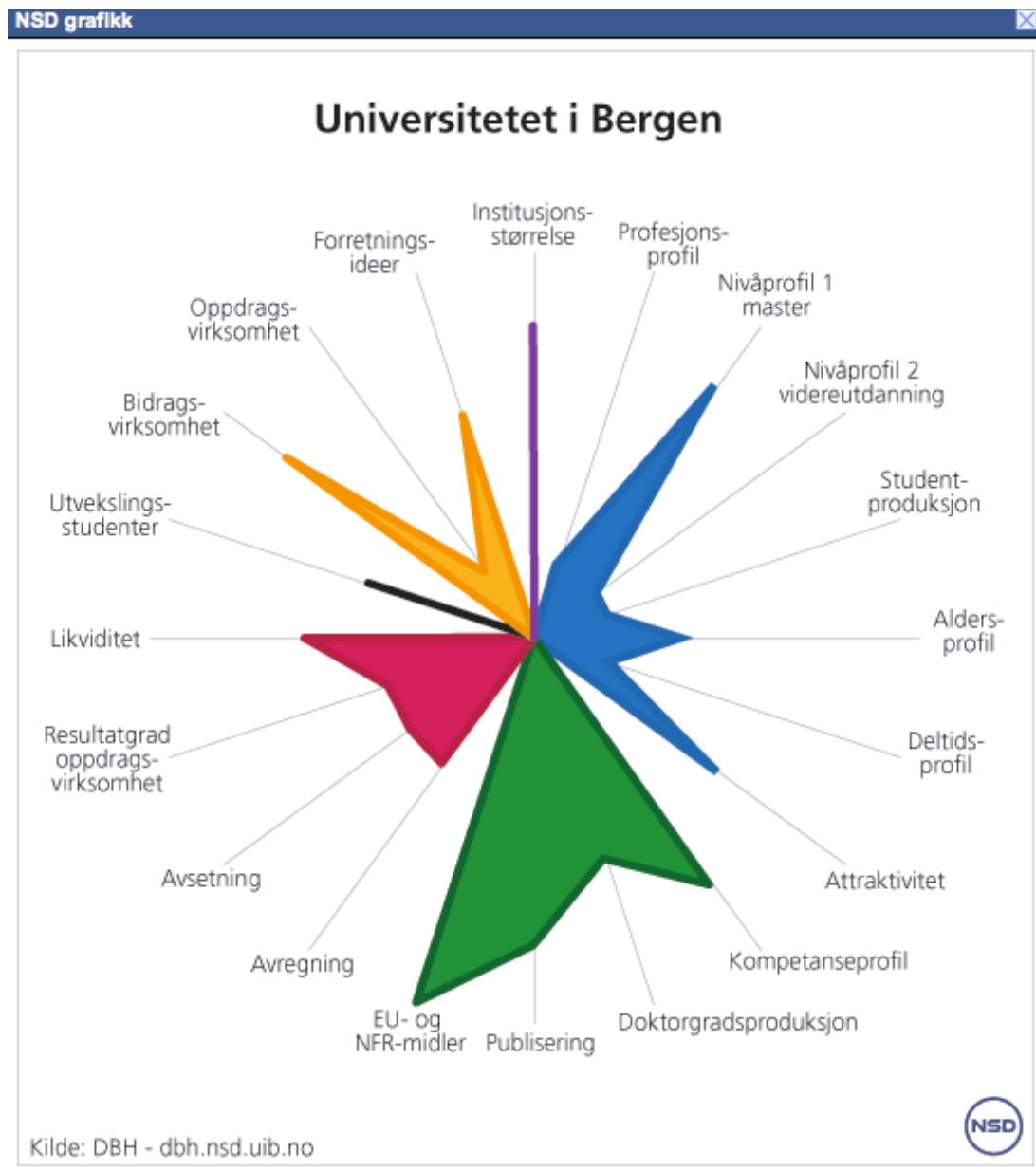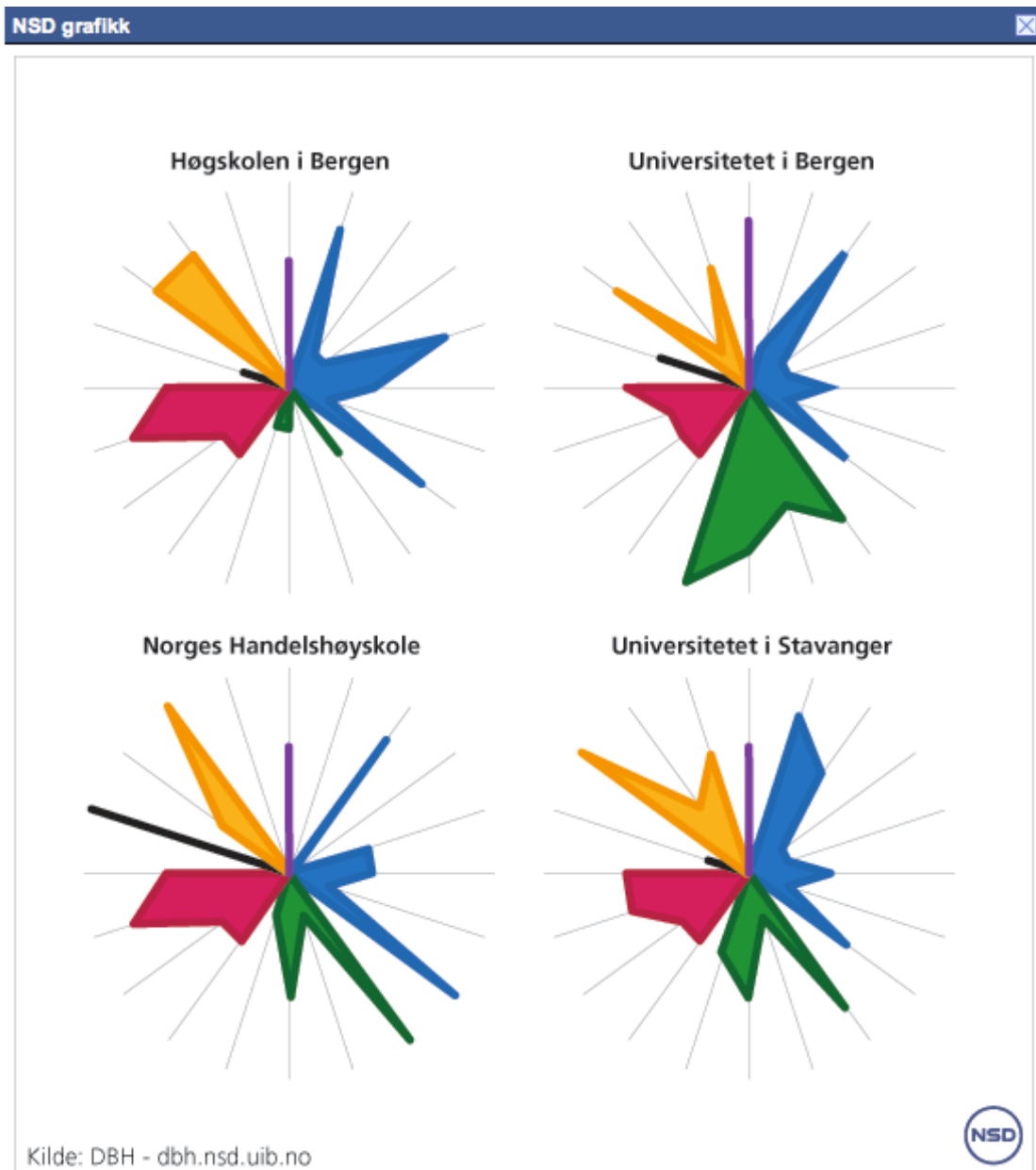
Beyond the basic response of "they look pretty" these diagrams of very difficult to interpret. Here is a comparison produced in a very good paper on the statistical problems of petal diagrams:
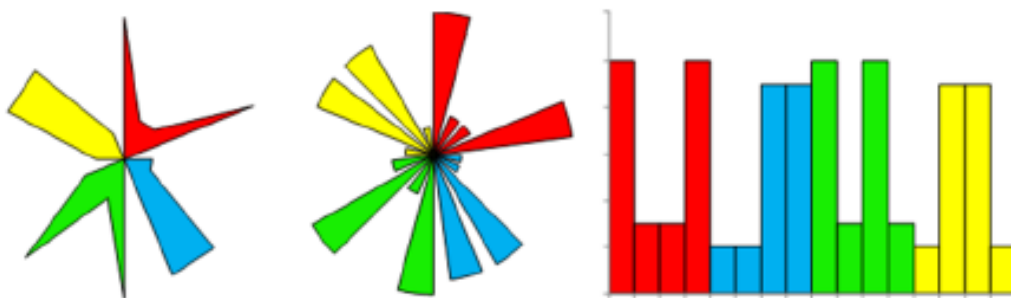
Figure 11: Comparison of a petal graph, a sunburst graph and a traditional Cartesian bar graph using the same set of parameters as in Figure 2.

It is clear that without due care and in the hands of statistical novices (last indication was that there were no statisticians in Leinster House) this system of metrics can be used to justify policy actions that were not evidence-based but where graphs and numbers become a proxy for persuasion and rational debate. It is clear that such indicators could effectively become the core of a university management system operated locally or at the ministry of education.

This leads us into the world of Key Performance Indicators. "KPIs" in the jargon, are considered crucial to the creation of an effective "business intelligence" system for a firm. U-Multirank provides a homogenous (relatively, it still relies on reporting by universities) multi-country overview of the performance of universities. The local ministry can benchmark against many different indicators and then mange the sector and individual institutions. This is a powerful tool, especially if funding is scarce and enacting government priorities is important. While no official stated a link between U-Multirank or even the Norwegian system being used in a coercive fashion one would have to be naïve not to see its apparent application. In many ways this is just the latest in many fads in higher education. Robert Birnbaum's *Management Fads in Higher Education: Where they come from, what they do and why they fail* looks at the unhappy history of transferring business management models in the higher education sector. Given the fined-grained nature of these indicators it is not difficult to see how individual staff members. The EU Knowledge Triangle already is being used in different ways to drive not just institution and sector policy but also individual workloads.

An example:
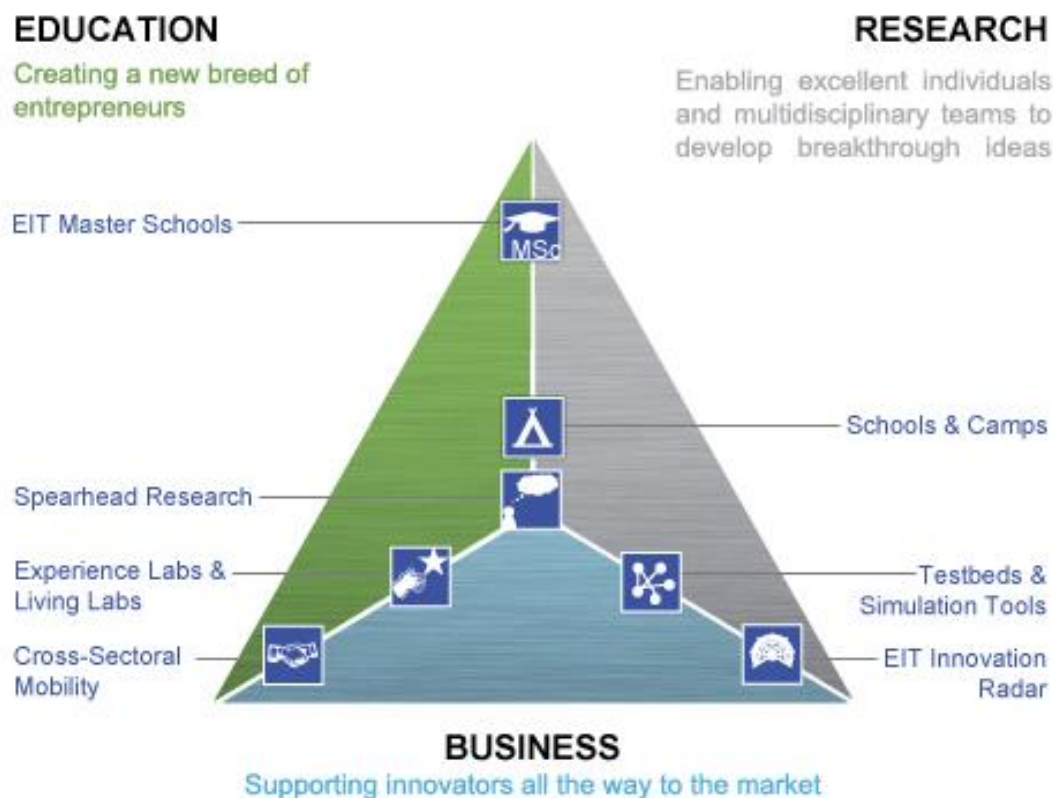
Then look at a UK university workload model diagram based on the idea of how the 18 hours a week standard contract is designed to operate in future:
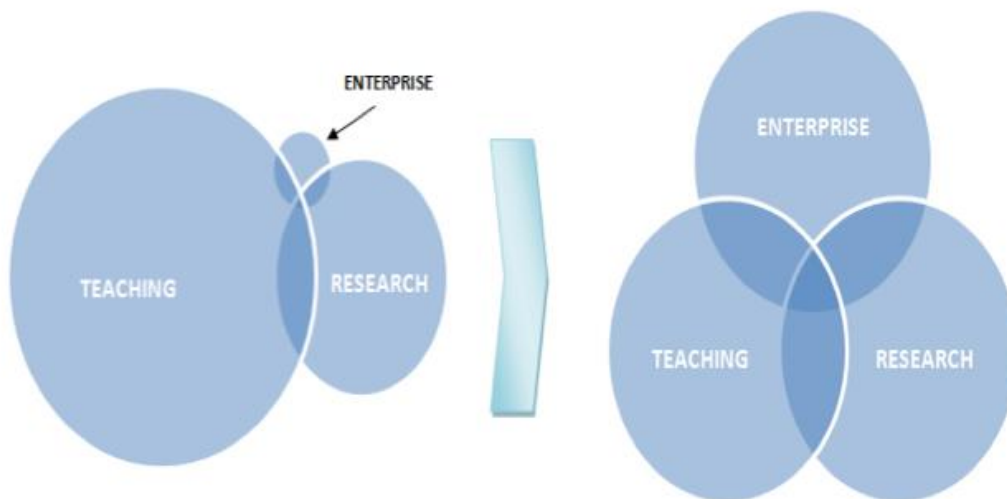
If what is measured gets managed then we are looking at not just sectors and institutions but also individuals being managed to the metrics created by these ranking and transparency systems. These systems are then highly sensitive to political will. The mercurial nature of British education policy at all levels and its reliance on metrics shows the danger of such an approach. Academics currently being poached between institutions in the name of the REF, the destruction of languages in secondary schools due to league tables and poor mathematics driven by a combination of factors but largely an extensive politicization of education that goes unmentioned. Even *Yes, Prime Minister* produced a whole episode to the sorry state of British education a quarter of a century ago with Sir Humphrey declaring: "When there is a Labour government, the Education Department says comprehensives abolish the class system. When there's a Tory government, they say it's the cheapest way to provide mass education. To Labour, we explain that selective education is divisive and to the Tories we explain that it is expensive. That way, we have a happy relationship with the NUT and we educate our own children privately." Things have not improved much since.

So given that mission creep and increasing costs have almost been built into the measurement process of higher education, what can be done to make higher education affordable and mission-focused?

Part III - An alternative education financing model

Alternative Funding – The Idea

What is the structure of this model? It is informed by the educational presentation by John Heywood, who draws on technological education and the philosophy of Alfred North Whitehead on the stages of education. The idea is to allow the creation of an educational structure that allows for lifelong learning.

The structure is as follows: 8 triggers. Triggers 1-3 are expected to be used, with the majority only using triggers 1 and 2. Trigger 3 will be used by less than 1/4 of school leavers. Triger 4 will be used by around 10%. Beyond trigger 4 will be expected to be relatively rare.

At present, most advanced economies offer some form of a child tax expenditure or a direct cash transfer to parents. In our model, we change this from a model of tax expenditures or cash transfers to a lump sum bullet payment to each child in the state. This would be around €36,000. This would be placed in a growing asset at 2%, which result in a total endowment by age 20 of approximately €57,000. Alternatively, a CPI-linked endowment payment can be made at age 20 that equals approximately €57,000. This endowment represents an accounting measure, with allocation of the endowment done by voucher or EFT directly to a state certified educational provider or education accommodation provider. The size of the endowment is sufficient to ensure that specialisation at levels 1 and 2 can be fully accommodated by the endowment.

Students that appear to have potential in high human capital industry can be sponsored at stages 2 and 3 through the firm paying their education insurance premium. Medical students can have the Department of Health sponsor their education insurance.

Students can redirect their endowments towards paying the education insurance premium. That payment can be topped-up via external sources (i.e. out-of-pocket) or through an employer payment, similar to employer-sponsored health insurance perquisites common in many large firms. Students that become unemployed will have their education insurance paid by the Department of Social Protection.

The education insurance structure will be operational from age 20 to age 65.

Students can choose what level of education insurance they wish to purchase and vary this over time subject to number of specialisation strikes and the human capital intensity of their sector. High human capital sectors and firms will seek high premiums and pay those for access to education. Those with low human capital intensity can use a lower premium.

The initial endowment, for many, will not be exhausted, even with the support of the premium being used by some for all or some of their working lives as it is expected that employers will play a large role in supporting premiums. That initial endowment can be made inheritable or transferable upon death of the incumbent holder as named asset upon payment of a very large additional fee. In most circumstances, the initial endowment will revert to the education insurance company upon the death of the incumbent, thereby assisting in solvency.

From age 65 until death the endowment, if not exhausted, can be redesigned, for a fee, as an additional retirement annuity. The same conditions on this annuity as existed for the education endowment apply. All education after 63 will be provided via direct out-of-pocket payments to the educational establishment, with the endowment going into a period of suspension until the death of the incumbent unless the annuity or intergenerational options are purchased by the endowment holder.

Education is from ages 1-20 provided 100% by the state. Upper secondary and the first 2 years of undergrad are redesigned to dovetail into each other.

More precise education (i.e. a BA, BSc) takes place in specialization 1. Advanced technical education in specialization, such as fully accredited engineering degrees takes place in stage 2. Medical and legal education (MD, JD, BL) takes place in stage 3 and so forth outward. The stages are designed to be discreet units so the application of barrier option can be used to go up or down the national qualifications framework.

Specialization units can be paid from the endowment and/or education insurance. Think of it as being like a car accident, the more people you hit the more you pay in insurance. At the outset, the insurance instrument is community rated, only those that go to 3 and up get a big increase. Those that trigger 5 experience a step function in their premium.

Insurance premium cost per annum runs from 170 to 3800. Again, you want to be a doctor, you pay a bit more and your premium remains high. You want to do classics you can pay out of your endowment and 170 per annum for when you do that basic accountancy course to improve your labour market outcomes.

The core idea is that people, as much as possible, should never see money being given or taken away from them.

The child benefit is financed partly by taxation and partly by a Perpetual (Consol in UK parlance, similar to a Cinderella bond in Wall Street jargon). That gets you an interest rate of 1.5%. The Insurance company is centrally owned by the state or is like Fannie Mae or the USAA. The insurer will pay a dividend ever so often.

How is that done? You have people paying premiums from the endowment, paying premiums from their employer in the same way as health insurance, self-employed paying out of pocket top-ups and unemployment insurance/social welfare paying for the unemployed. To get high paying premiums, those with high scores at age 20 are allowed to enter a "draft round" with employers, where salaries are offered with high premium packages of education insurance on the basis that (a) the student will need it and (b) the student will have a high return on investment (ROI) as a human capital asset. This builds up positive cash flow.

Reinsurance will be provided by a government entity (e.g. NTMA in Ireland) in order to keep costs low. In addition, as stated above, the endowment is designed as a tontine reverting to the state (insurance company) upon death. You have to pay a very large fee to make it inheritable. Alternatively, you can use it to supplement the old age pension as an annuity endowment. Again, the initial endowment reverts to the insurance company upon death.

A very powerful regulator will have to be co-designed with the education insurance company. The regulator for the Dutch health insurance system would be a good model to based such a regulator upon.

Cost: €10,000 - 12,000 Avg. p.a.			Cost: €15,000 - €25,000 p.a.		Cost: €35,000 - €60,000 Avg. p.a.						Cost: €5,000 Avg. p.a.

Pre-Primary (Early Years) Education | Primary Education | Lower Secondary (Jr. Cert), Legal obligation to 16 y/o | Upper Secondary & Associate's Degree (Licentiate) General Education — VEC | Technicians & Technologists Apprenticeships | Initial Specialization (BA, BSc) | Advanced Specialization (1) (MA, MSc, BL, MD, JD) | Advanced Specialization (2) (MBA, etc) | Advanced Specialization (3) | Advanced Specialization (4) | Advanced Specialization (5) | Advanced Specialization (6) | Advanced Specialization (7) | Retirement/Old Age Transitional Education or Community Engagement

Education System: Publicly Financed (100%): Ages 4 to Age 20

Lifelong Learning Education System: Insurance/Annuity Financed Age 20 to Age 63.

Recreational Education System: Privately Financed Age 64 to Age 90.

64-68/72/74   Pensioner 68-90

Remaining Funds in Annuity Transferred to OAP unless Intergenerational option purchased. [OAP supplement paid out from 75. IG option accounts held in escrow until death of initial owner. Value of IG a/c subject to inheritance tax.] Otherwise all excess funds at point of death revert to the State.

20-24 Years of Age Education Options: Exit, VEC (mixed financing), Drawdown for IS, AS(1). Finance Insurance Premium via Income or Annuity.

Initial Drawdown on Annuity (Barrier Option)

Initial Drawdown on Annuity (Barrier Option) Exhausted or Accruing Intergenerational Option Purchase Remains Open

Legal obligation to secure "education insurance".
Options: Earning under €25,000 government subsidy at €170 rate.
Rate relates to income and trigger actions with step function after trigger 4.
(Guideline Annual Premium: €170-€3,800)

Insurance Instrument

Barrier Option Triggered Insurance Instrument Covers Education Action (Premium Rises)

Barrier Option Triggered Insurance Instrument Covers Education Action (Premium Rises)

Barrier Option Triggered Insurance Instrument Covers Education Action (Premium Rises Substantially)

Barrier Option Triggered Insurance Instrument Covers Education Action (Premium Rises Substantially)

Barrier Option Triggered Insurance Instrument Covers Education Action (Premium Rises Substantially)

Tontine Annuity [Mazarine Venetian Arsenal Model] [Intergenerational allocation allowed if large premium paid. Otherwise the annuity dies with holder and reverts to the State.]

€36,000 Child Education Allowance (Endowment) [€150 p.m. for 20 years] = €53,705 after 2% continuous compounding for 20 years

Transfers

Government Subsidy

Transfers

FIRM: Private Sector Actor (Payment of Education Premium Part of Compensation Package) [e.g. US Healthcare, Irish VHI Group Plans] Firms with HIGHER Probability to use pay higher premiums.

Payment

INDIVIDUAL: Private Sector Actor (Like Car Insurance)

Payment

Perpetual Bond (coupon 1.5%)

D/Fin Pot of Money

Exchequer Funds

NTMA (Underwriter)

Ed Insure Ed Regulator

Dividend

Pay from Endowment

Pay from Endowment

Payout to

Payout to

Payment to Ed Insure

Individual Vouchers

Uni/Accommodation

Employer

Top-up/Draw-down

Self-Employed

Job

Tax

Tax

DSP/SOLAS Pay Premium

SOLAS

Unemployed

Alternative Funding - Financial Engineering

Within any structure that could potentially finance the third level education system, there necessitates some fundamental and radical changes to produce a viable probability of success. The next two figures present the proposed education system from entry to exit. We are focused on three key areas: 1) providing adequate resources to remunerate the education sector for the provision of education for each student on an annual basis; 2) providing a system that generates a safe, equity and burden sharing system that promotes access and education to all areas of the Irish economy; and 3) providing a system that cannot export shocks to the broad Irish economy while attempting to hedge any systematic risk that may be exposed. There are SIX key areas of risk that we must discuss in the broad and narrow explanations of the system's design. Further, we must state that we aim to facilitate the existence of the Irish state education grant in its current form when designing this system.

Figure 9: Proposed Life-long Learning Education System
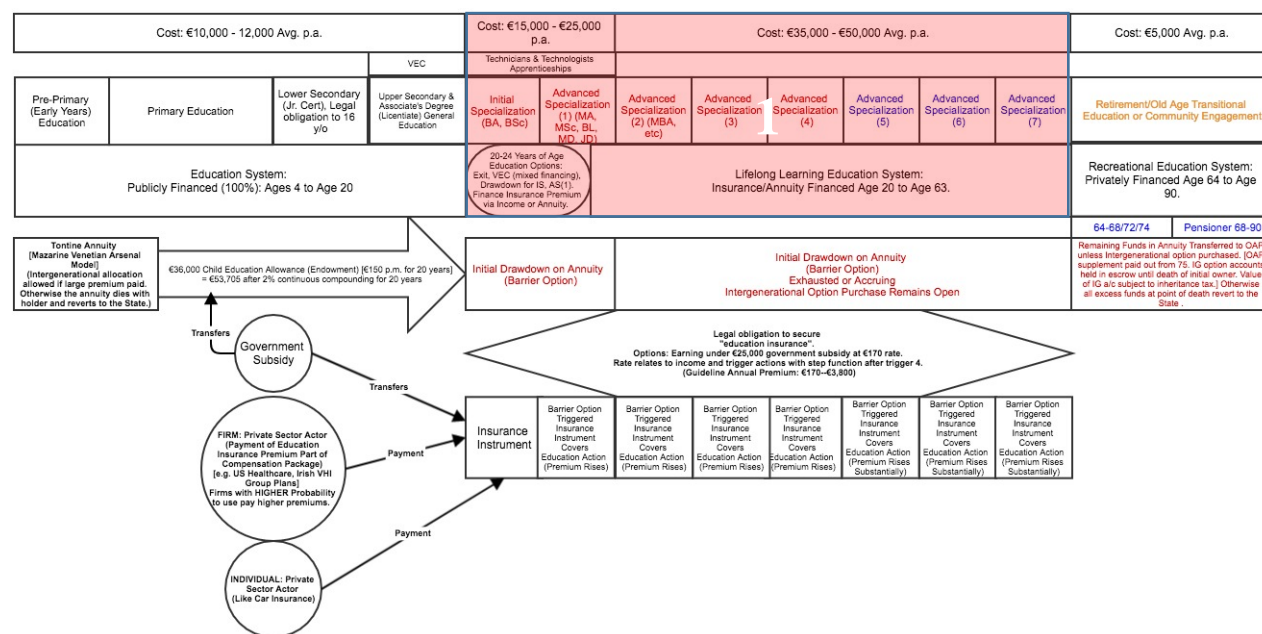
In Figure 9, we attempt to source the availability of eight trigger points that can be utilised by an Irish student within the Irish (or other national) education system.

As outlined in the section above, a large part of the process of education is designed to work between the state provided primary and secondary education and the first two years of higher education and the subsequent specialisations. The endowment is aimed to be sufficient to provide support for most students completing higher education to EU Bologna Process Cycle 1, or what is commonly referred to as the Bachelor's Degree.

It is entirely possible, that with certain criteria established and under strict governance, that this system can be made available to European students but on the basis of their paying a high rate of education insurance since they will not be allocated an endowment by the Irish state. If their home country operates such an endowment model it can be allocated in the same fashion as the Irish endowment.

After the completion of upper secondary and leaving certificate education, the student will enter into the Irish third-level system, either through a degree, diploma or certificate programme, or indeed a technician and technologies apprenticeship. Apprenticeships constitute a different track since they are connected to a shared cost of education, with part of the education cost being borne by the endowment and the wage payment to the apprentice being provided by the employer that the student is apprenticed to during the apprenticeship process. As apprenticeships are typically more expensive to provide compared to a normal BA degree, it would be likely that the student's endowment would be heavily drawn down and would need to begin topping-up insurance payment early in their career as a tradesman. Again this can be partly or completely addressed via wage supplementing insurance perquisites.

This initial phase will ideally be reshaped to direct students from upper secondary to a 2-year associate's degree programme, all of which will remain under public payment. "Senior" university for BA studies will be part of the initial specialisation supported by the education endowment. This will then lead to an advanced specialisation, which is proposed to cost between €10,000 and €25,000 per student per annum dependent upon the student's choice of specialism. It is then expected that the student will enter the workplace and enter the second stage of the Lifelong Learning Education System (LLES). At this point, the specialisms and programmes are selected based upon the necessitated skill and talent deficiencies of both the company and the student/employee. Therefore, the design of this system can add a multitude of added benefits including flexibility and specialisation of talent, which will provide a sought niche for perspective companies and companies that are already based in Ireland. Further, our young talent will benefit from the co-existence of work-experience and education simultaneously as programmes can be re-designed to facilitate part-time learning. There will be three proposed sources of financing towards the upskilling of each student: 1) a government subsidy that exists similar to that found in the Irish education system; 2) the private sector company (Government Sponsored Entity or GSE) that has employed the student and is deemed responsible for their development; and 3) the private sector insurance-style (GSE) payment that has been paid both on behalf of and by the student throughout their life to the point in which they are seeking to add further educational development. It is expected within our proposed model that the majority of strike-points would be utilised before the age of 30, therefore our selected methodology must represent this fact.

One of the key proposed financial products that can be used to represent the nature of our model is that of barrier options. At each strike point in area 1 above, it is envisaged that this would be similar to the strike point being met. Once the next phase of education is over, the student then returns to full-time employment and continues to pay an education insurance premium. The premium will continue to be paid during education, just as health insurance is still paid while sick and will apply from the age of 20, drawing initially on the endowment and subsequently on alternative sources.

This will be paid until it reaches such a value that the hypothetical option 'strikes' and the next stage of education is available. At the initial stages of 1 and 2 these will be very low option strikes. Strikes become progressively higher, reflecting the need for higher return on investment to recuperate the sunk costs of human capital investment. Should an employee pay into the system at a minimum level and be unable to accumulate the necessary funding for their barrier option to strike, they could seek aid from their employer, SOLAS/Social Protection or increase their premium payment, either continuously or with a lump sum, which could be provided in a third-party deal contingent on academic performance and the proposed salary benefits that may be available due to added education. Specialised education will reflect the premium levels of the students. Advanced and specialised Level 9 or 10 work will reflect very high premium payments. Level 6, 7 and 8 will reflect lower payments. For example, a classics graduate in small firm employment that is paying their premium at a low level either personally or via endowment can take a simple level 7 accounting course via the accounting technicians body. A medical doctor pursuing an MBA would have had to had paid a high premium, either directly out-of-pocket or via the remuneration contract with the hospital to avail of this expensive human capital investment and will be subject to a higher premium in the future due to multiple triggers.

A barrier option is a type of option whose payoff depends on whether or not the underlying asset has reached or exceeded a predetermined price. A barrier option can be a knock-out, meaning it can expire worthless if the underlying exceeds a certain price, limiting profits for the holder but limiting losses for the writer. It can also be a knock-in, meaning it has no value until the underlying reaches a certain price. Barrier options are considered a type of exotic option because they are more complex than basic American or European options. Barrier options are also considered a type of path-dependent option because their value fluctuates as the underlying's value changes during the option's contract term. In other words, a barrier option's payoff is based on the underlying asset's price path. Barrier options are typically classified as either knock-in or knock-out.

A knock-In option is a type of barrier option that only comes into existence when the price of the underlying security reaches a specified barrier at any point in time during the option's life. Once a barrier is knocked in, or comes into existence, the option will not cease to exist until the option expires. Knock-in options may be classified as up-and-in or down-and-in. In an up-and-in barrier option, the option only comes into existence if the price of the underlying asset rises above the pre-specified barrier, which is set above the initial asset price. Conversely, a down-and-in barrier option only comes into existence when the underlying asset price moves below a pre-determined barrier that is set below the initial asset price.

Contrary to knock-in barrier options, knock-out barrier options cease to exist if the underlying asset reaches a barrier during the life of the option. Knock-out barrier options may be classified as up-and-out or down-and-out. An up-and-out option ceases to exist when the underlying security moves above a barrier that is set above the initial security price, while a down-and-out option ceases to exist when the underlying asset moves below a barrier that is set below the initial asset price. If an underlying asset reaches the barrier at any time during the option's life, the option is knocked out, or terminated, and will come back into existence.

Barrier options are sometimes accompanied by a *rebate*, which is a payoff to the option holder in case of a barrier event. Rebates can either be paid at the time of the event or at expiration.
- A *discrete barrier* is one for which the barrier event is considered at discrete times, rather than the normal *continuous barrier* case.
- A *Parisian option* is a barrier option where the barrier condition applies only once the price of the underlying instrument has spent at least a given period of time on the wrong side of the barrier.
- A *turbo warrant* is a barrier option namely a knock out call that is initially in the money and with the barrier at the same level as the strike.

Barrier options can have either American, Bermudan or European exercise style.

The student is observed to be purchasing the barrier option to be utilised when the value of their investment has reached a certain threshold, whether it be through their own investment, the aid of a third-party or indeed direct provision of capital through an employer. The funding system is said to be writing the barrier option. It is important to stress that the payments will be same for all participants, however, those entering professions with substantially higher levels of salary will be expected to contribute more through the provision of higher university fees.
The proposed education financing system would mirror that of an up-and-in barrier option. This quite simply refers to a financial product that will provide a payment to students, who would be observed as buying an up-and-in call option on their future level of education. The lifelong learning financing system is said to be writing the option, or providing the up-and-out put option. This payment system would be taken from that described in Figures ## and ## mirroring that of the proposed education financing system.

Funding for such a system would be proposed to be sourced from exchequer funding, annual insurance payments from students who seek to avail of the education financing system and a perpetual bond guaranteed by the state. In Figure

10, we present a hypothetical system in which the barrier on a stock price underlier is breached. On the LHS, the underlier is not breached, therefore, there is no payoff. However, on the RHS, the barrier is breached, therefore there is a payoff. It is proposed that the total unit funding for each student should be considered in the same manner to the below underlier, and should it breach a pre-selected barrier level, the student would have the ability to enter the education system while the insurance-style payment system covers their costs.

Figure 10: An example of a barrier option being breached
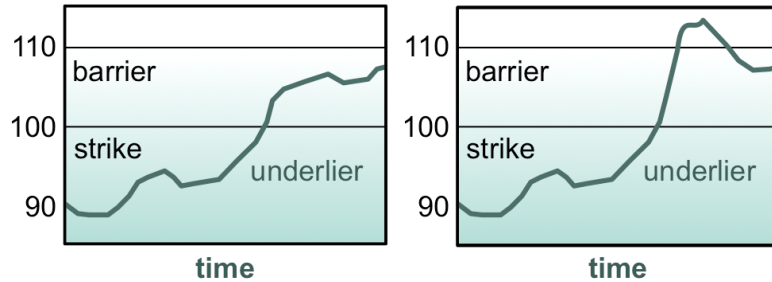
While we review the relationships between the proposed financing system, we can however obtain guidance from the existing relationships between barrier options and underlying financial market products. There are closed-form solutions for pricing European-style barrier options.

A number of different types of barrier options regularly trade in the over-the-counter market. They are attractive to some market participants because they are less expensive than the corresponding regular options. These barrier options can be classified as either knock-out options or knock-in options. A knock-out option ceases to exist when the underlying asset price reaches a certain barrier; a knock-in option comes into existence only when the underlying asset price reaches a barrier. These formulas are best described as:

$$c = S_0 e^{-qT} N(d_1) - K e^{-rT} N(d_2)$$
$$p = K e^{-rT} N(-d_2) - S_0 e^{-qT} N(-d_1) \quad \text{where}$$

$$d_1 = \frac{ln\left(\frac{S_0}{K}\right) + \left(\frac{r - q + \sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{ln\left(\frac{S_0}{K}\right) + \left(\frac{r - q - \sigma^2}{2}\right)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

An up-and-out call is a regular call option that ceases to exist if the asset price reaches a barrier level, H, that is higher than the current asset price. An up-and-in call is a regular call option that comes into existence only if the barrier is reached. When H is less than or equal to K, the value of the up-and-out call, c_{uo}, is zero and the value of the up-and-in call, c_{ui}, is c. When H is greater than K,

$$c_{ui} = S_0 N(x_1)e^{-qT} - K e^{-rT} N\left(x_1 - \sigma\sqrt{T}\right) - S_0 e^{-qT} \left(\frac{H}{S_0}\right)^{2\lambda} [N(-y) - N(-y_1)] + K e^{-rT} \left(\frac{H}{S_0}\right)^{2\lambda - 2} [N(-y + \sigma\sqrt{T}) - N\left(-y_1 + \sigma\sqrt{T}\right)]$$

and

$$c_{uo} = c - c_{ui}$$

Put barrier options are defined similarly to call barrier options. An up-and-out put is a put option that ceases to exist when a barrier, H, that is greater than the current asset price is reached. An up-and-in put is a put that comes into existence only if the barrier is reached. When the barrier, H, is greater or equal to the strike price, K, their prices are:

$$p_{uo} = -S_0 N(x_1) e^{-qT} + K e^{-rT} N(-y) + K e^{-rT} \left(\frac{H}{S_0}\right)^{2\lambda-2} N\left(-y_1 + \sigma\sqrt{T}\right)$$

and

$$p_{uo} = p - p_{ui}$$

Barrier options often have quite different properties from regular options. For example, sometimes vega is negative. Consider an up-and-out call option when the asset price is close to the barrier level. As volatility increases, the probability that the barrier will be hit increases. As a result, a volatility increase can cause the price of the barrier option to decrease in these circumstances. One disadvantage of the barrier options we have considered so far is that a ''spike'' in the asset price can cause the option to be knocked in or out. An alternative structure is a Parisian option, where the asset price has to be above or below the barrier for a period of time for the option to be knocked in or out. For example, a down-and-out Parisian put option with a strike price equal to 90% of the initial asset price and a barrier at 75% of the initial asset price might specify that the option is knocked out if the asset price is below the barrier for 50 days. The confirmation might specify that the 50 days are a ''continuous period of 50 days'' or ''any 50 days during the option's life.'' Parisian options are more difficult to value than regular barrier options.

Figure 11: Value, Delta and Gamma of a sample up-and-in call option with strike of 100 and barrier of 120
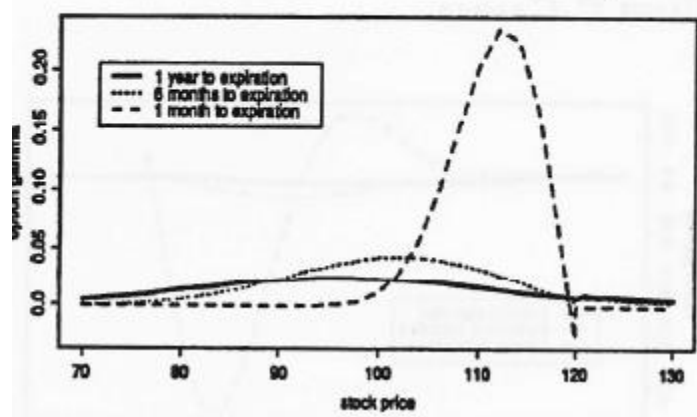
PANEL A. VALUE
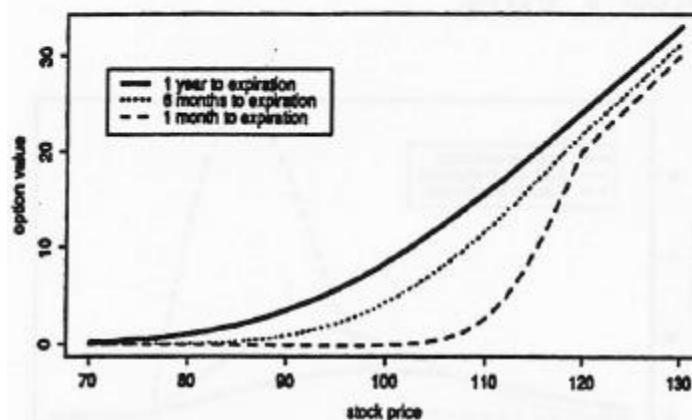
PANEL B. DELTA
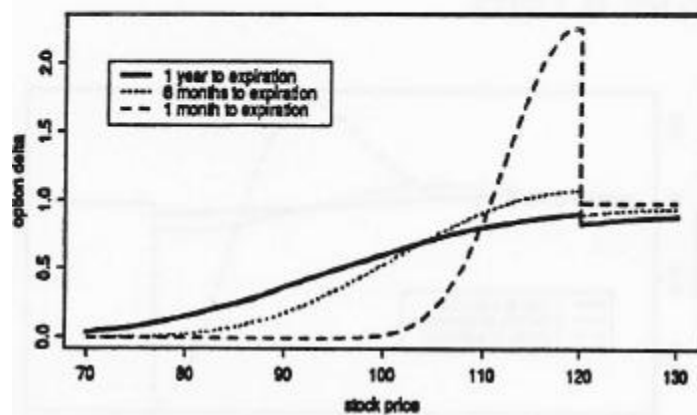
PANEL C. GAMMA

When clarifying the loop of financing throughout our proposed financing model, we have attempted to use the lowest possible risk financial market products while leveraging upon the existence of agencies that already exist in Ireland. While simplistic in nature, there are five further key areas of risk that are prevalent within the proposed system. To facilitate the available capital to allow students to "strike", the education insurance system must underwrite a large government supported bond (with the government acting as a guarantor). This is represented in area 2. While long-term bonds are preferable, in this system, and proposed time to expiry will create a "pinch-point" with the capacity to expose the system to collapse at the point of repayment. Should the system become self-sufficient at any point in the future, it would be proposed that the outstanding debt of this bond would be reduced as a priority. It would be recommended that the system be underwritten through the use of a perpetual bond.

A perpetual bond is a fixed income security with no maturity date[3]. One major drawback to these types of bonds is that they are not redeemable. Given this drawback, the major benefit of them is that they pay a steady stream of interest payments forever. A perpetual bond is also known as a "consol" or a "perp". With perpetual bonds, the agreed-upon period over which interest will be paid is "forever", as perpetual bonds live up to their name and pay interest in perpetuity. In this respect, perpetual bonds function much like dividend-paying stocks or certain preferred securities. Just as the owner of the stock receives a dividend payment as long as the stock is held, the perpetual bond owner receives an interest payment as long as the bond is held. Perpetual bonds have a long history. The British government is often credited with creating the first one way back in the 18th century. While they are not anywhere near as popular as the more familiar Treasury bonds and municipal bonds, perpetual bonds continue to be issued today.

Looking ahead, an argument can be made that issuing perpetual bonds would be an attractive proposition for indebted global governments. To fiscal conservatives, the idea of issuing any debt doesn't sound good, and debt that never ends would be positively unfathomable, but perpetual bonds have a certain appeal during troubled times. At its most basic, issuing perpetual bonds would permit a fiscally challenged government to raise money without ever needing to pay it back. Several factors support this approach. The first is that interest rates are extraordinarily low for longer-term debt. The second is that once inflation is factored into the equation, investors are actually losing money on the loans they make to the government. For example, when the interest rate the investors receive is 0.5% and inflation is at 1%, the result is an inflation adjusted interest rate of return for the investors of -0.5%. In dollars and cents, this means that when investors get their money back from the government, its buying power will be diminished. Think of it like this: the investor loaned the government $100. A year later, the investment's value is $100.50 courtesy of the 0.5% interest rate. But because inflation is running at 1%, it now takes $101 to purchase the same basket of goods that cost just $100 one year ago. Unfortunately, the investors have only $100.50. The rate of return on their investment failed to keep pace with rising inflation.

Since over time inflation is expected to increase, lending out money today at a hypothetical 4% interest rate will seem like a bargain to government bean counters in the future when inflation hits 5%. Of course, most perpetual bonds are issued with call provisions that permit the issuer to make repayment after a designated period has passed. So the "perpetual" part of the package is often by choice, rather than by mandate, and can be eliminated should the issuer have the cash on hand to repay the loan.

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[3] In 2014, the UK government repaid consols that were first written during the 1700s. "The UK government is to repay part of the nation's first world war debt – 100 years since the start of the war. As Europe marks the centenary of the Great War, the Treasury said it would pay off £218m from a 4% consolidated loan next February, as part of a redemption of bonds stretching as far back as the 18th century. They also relate to the South Sea Bubble crisis of 1720, the Napoleonic and Crimean wars and the Irish potato famine. Almost £2bn of first world war debt remains, and the government said it was looking into the practicalities of repaying it in full. The "4% consols" were issued in 1927 by Winston Churchill, then chancellor, to refinance national war bonds originating from the first world war. The government's Debt Management Office (DMO) estimates that the nation has paid £1.26bn in interest on these bonds since 1927." Source: https://www.theguardian.com/business/2014/oct/31/uk-first-world-war-bonds-redeemed

Perpetual bonds are of interest to investors because they offer steady, predictable sources of income. The payments take place on a set schedule, and some even come with a "step up" feature that increases the interest payment at a predetermined point in the future. In technical terms, this is referred to as a "growing perpetuity". For example, a perpetual bond may increase its yield by 1% at the end of 10 years. Similarly, it may offer periodic interest rate increases. Paying close attention to any step-up provisions is an important part of comparison shopping for investors looking for perpetual bonds. A growing perpetuity can be good for your pocketbook. A variety of risks are associated with perpetual bonds. Perhaps the most notable is that a perpetual period is a long time to carry on credit risk. As time passes, bond issuers, including both governments and corporations, can get into financial trouble and even fail. Perpetual bonds may also be subject to call risk, which means that the issuer can recall them. Another significant risk associated with time is that general interest rates may rise as the years pass. If rates rise significantly, the interest rate paid by a perpetual bond may be much lower than the prevailing interest rate, meaning investors could earn more money by holding a different bond. In such a scenario, the perpetual bond would need to be sold on the open market, at which time it may be worth less than the purchase price as investors discount their offers based on the interest rate differential.

These types of bonds exist within a small niche of the bond market. This is mainly due to the fact that there are very few entities that are safe enough for investors to invest in a bond where the principal will never be repaid. Some of the notable perpetual bonds in existence are those that were issued by the British Treasury for World War 1 and the South Sea Bubble of 1720. Some in the U.S. believe it would be more efficient for the government to issue perpetual bonds, which may help it avoid the refinancing costs associated with bond issues that have maturity dates.

Figure 12: Potential Financing Structure for the Proposed Life-long Learning Education System
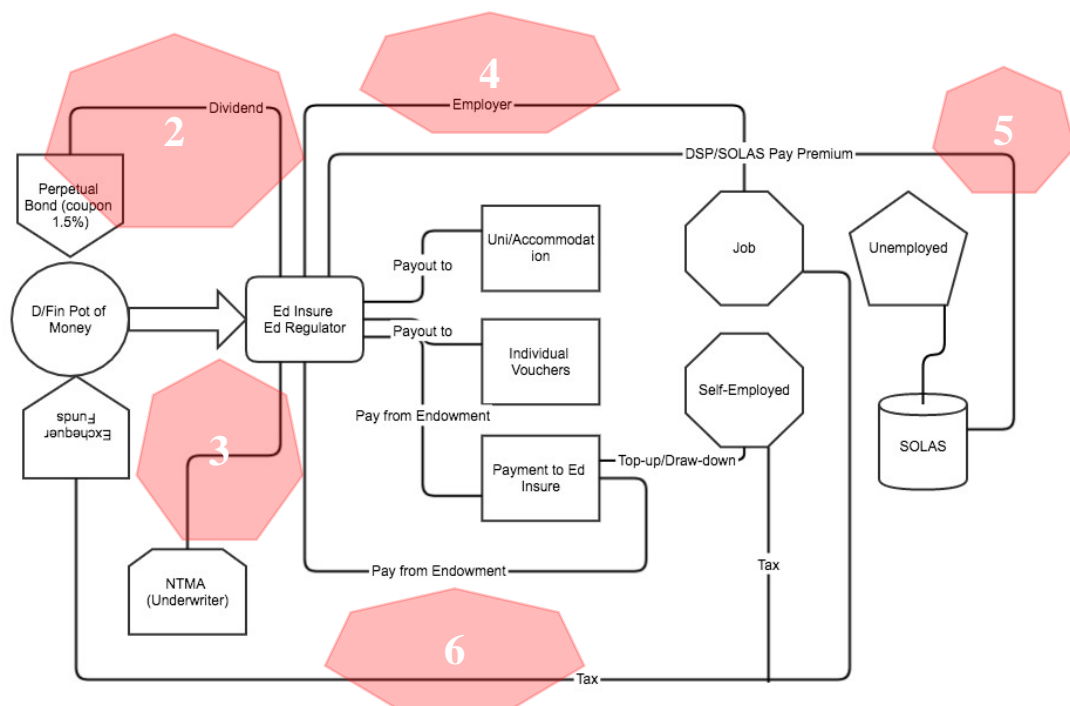
Since perpetual bond payments are similar to stock dividend payments, as they both offer some sort of return for an indefinite period of time, it is logical that they would be priced the same way. The price of a perpetual bond is therefore the fixed interest payment, or coupon amount, divided by some constant discount rate, which represents the speed at which money loses value over time (partly due to inflation). The discount rate denominator reduces the real value of the nominally fixed coupon amounts over time, eventually making this value equal zero. As such, perpetual bonds,

even though they pay interest forever, can be assigned a finite value, which in turn represents their price. The formula for the present value of a perpetual bond is simply:

$$Present\ value = D\ /\ r;$$

where D represents the periodic coupon payment of the bond and r represents the discount rate applied to the bond.

Area 3 represents the presence of an underwriting government agency that shall be remunerated for their services and expertise in the provision of the insurance-style products. The NTMA would be observed as a key proposed partner in this regard. The rationale for this proposition is simple, the NTMA have a wealth of experience raising large amounts of capital through bond issues, they possess a substantial portfolio of assets and government wealth that may be useful in the underwriting requirements for any financial produce designed to aid the creation of this education model and finally, they are deemed to be an acceptable financial vehicle under European and international financial rules and regulations albeit that their use is denoted as to provide stabilisation of the banking sector. Due to the forthcoming issues in financing the education system, the NTMA may indeed have a role to play in further economic stabilisation.

In Figure 12, risk areas 4, 5 and 6 are related to broad systematic risk contained within the Irish economy, but the control of such risk is paramount to a viable probability of success for this finance model. As we have witnessed in the recent economic collapse, unemployment and broad economic conditions will reduce the net payments to the central fund from which this financing system draws upon. Should economic conditions deteriorate during the lifecycle of the system, as one could prudently expect they will, finance will be sourced from bond issuance. During positive economic conditions, this central fund must be replenished to relieve pressure upon the bond refinancing. The bond issuance is used to generate the financing capital to provide financing to those that take part in the scheme within the first twenty years.

To clarify how this differs to other proposed and existing methodologies, the option financing methodology shares the cost burden of education equally, that will be prepaid through existing finance sources and could prove to be self-sustaining should appropriate investment strategies be fully utilised. Current grant structures can remain in place, while education can theoretically be provided without the payment of fees. A broad, state-guaranteed bond issuance is used to generate system finance. This is also the first proposal that incorporates all elements of the Irish education system. It is theoretically plausible that all skilled professional trading shall be incorporated in such a scheme, with repayment capacity made available to the self-employed. Through efficient planning, those unfortunately unemployed can be separated into talent pools to efficiently retrain themselves in areas that are identified as consisting of skill shortages within the state. The key areas of risk to the system exist with that of fraudulent behaviour, non-agreement from professional bodies and companies within the state, government instability and financial crises. These areas of risk are no different to any other system created in a similar nature. As the proposed insurance pool is prepaid prior to the student's selected education, emigration is not a problem. However, the use of future strikes would be proposed to be determinant upon the provision of taxation benefits to the Irish state.

We will set out to theoretically model the proposed financing system within the coming months.