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Milton Friedman and the finance of higher education

Book section
(Accepted version)

Chapter 23

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February 2014

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Author bio

Nicholas Barr is Professor of Public Economics at the London School of Economics and the author of numerous books and articles including *The Economics of the Welfare State* (5th edn, 2012), *Financing Higher Education: Answers from the UK* (with Iain Crawford) (2005), and *Reforming Pensions: Principles and Policy Choices* (with Peter Diamond) (2008). Alongside his academic work is wide-ranging involvement in policy, including spells at the World Bank and the International Monetary Fund, and as a member of the World Economic Forum's Global Agenda Councils on Demographic Shifts and on Ageing Society. A range of academic and policy writing can be found on http://econ.lse.ac.uk/staff/nb.

Abstract

Friedman and Kuznets (1945) posed the puzzle that the return to investment in human capital was higher than to physical capital. They hypothesised a distortion causing under-investment in human capital and made brief mention of the idea that individuals might sell 'shares' in their future income to finance their investment in human capital. Friedman (1955) explored the idea in more detail, setting out the first worked out proposal for income-contingent repayments. After discussion of today's context, successive sections of this chapter discuss the nature of Friedman's idea, assess its impact on policy, and set out a view to the future, including future design options and potential theoretical work.

Keywords: equity finance, loan finance, higher education finance, student loans, income-contingent repayments, interest subsidies, debt aversion, credit constraints, prior-attainment constraint, imperfect information

Milton Friedman's writing about education is best known for his writing about vouchers for school education. Less well-known but, I will argue, more important is his work setting out the logic of student loans with income-contingent repayments, i.e. repayments in the form of *x*% of the borrower's subsequent earnings rather than a fixed amount of $X per month. This chapter explains how that mechanism, though peripheral when first proposed in 1945 and more fully in 1955, has a central role in the finance of tertiary education, an astonishing impact from what (as far as I can tell) are Friedman's only pieces of writing about education.[3]

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[1] This chapter draws on writing and discussions with many co-authors over the years, including Mark Blaug, Iain Crawford, Howard Glennerster and Neil Shephard.

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[3] The material in Friedman (1955) is repeated in Friedman 1962 and Friedman and Friedman 1980.

Section 1 establishes the context in today's terms. Section 2 sets out Friedman's central ideas about financing tertiary education. Section 3 discusses the impact of those ideas to date; section 4 considers future design options and theoretical research.

1 Today's context

It is sometimes useful to think of human capital as of two sorts. 'Basic' human capital includes the ability to walk, talk, co-operate and do manual work. Most people have this type of human capital though some, for example with physical disabilities, may lack some of them. A second type of human capital derives from more explicit investment in skills, from literacy and numeracy through to advanced skills.

HUMAN CAPITAL: MORE IMPORTANT THAN EVER. The starting point is the argument that the second type of human capital has become increasingly important over the years. There are at least two strategic sets of reasons – technological advance and demographic change – why this is so.

Technological advance is a key driver. Though it can reduce the need for skills (more user-friendly computers), technological advance has increased the demand for skilled workers. The evidence (e.g. Autor et al., 2003) points to skill-biased technical change (i.e. new technologies that favour more skilled workers) being an important part of the explanation.

Second, change is increasingly rapid, so that knowledge goes out of date more quickly. Thus skills need to be updated and to be flexible enough to adapt to changing technology. Put another way, investment in broad, flexible skills offers a hedge against technological dynamism. Specific skills may become redundant, but education and training should give people general skills, saving the resources that would otherwise be necessary for retraining labour whose skills had become outdated or supporting workers socially excluded by technical advance.

A separate argument is that widening and deepening human capital should be seen not only as investment, but also as insurance against being overtaken by countries with greater investment in skills.

These changes explain the movement into the 'information age', meaning a need for education and training that is (a) larger than previously, (b) more diverse, and (c) repeated, since people will require periodic retraining.

Demographic change creates a second argument for spending on education. The rising proportion of older people in many countries has already created upward pressure on age-related spending, including pensions, medical care and long-term care. A central response (Barr and Diamond,2008, Ch. 4) is to adopt policies aimed at increasing output sufficiently to meet the combined expectations of workers and pensioners. If the problem is that workers are becoming relatively more scarce, part of the efficient response is to increase labour productivity. Demographic change is thus an argument for additional investment in both physical and human capital.

PRIMARY AND SECONDARY EDUCATION. Friedman (1955) proposed that school education should be privately produced in a competitive regime, financed at least in part by public subsidy. Specifically,

> 'Governments could require a minimum level of education which they could finance by giving parents vouchers redeemable for a specified maximum sum per child per year if spent on "approved" educational services. Parents would then be free to spend this sum and any additional sum on purchasing educational services from an "approved" institution of their own choice. The educational services could be rendered by private enterprises operated for profit, or by non-profit institutions of various kinds. The role of the government would be limited to assuring that the schools met certain minimum standards… (Friedman 1955, p. 127, quotes in original).

There is a large literature on vouchers for school education (see Abdukadiroglu et al. 2011, Bohlmark and Lindahl 2008, and for a survey, Bettinger 2011). The influence of choice and competition on school performance is equivocal. The 2012 PISA results (OECD 2013, p. 5) show that the top-performing school systems include some countries (e.g. Finland) with publicly-organised, publicly-financed school arrangements, and others, notably in Asia, with more competitive systems. Thus, it can be argued, vouchers have been part of the story but have not changed change the nature of the debate.

TERTIARY EDUCATION. In contrast, Friedman's work on the finance of tertiary education, though with a slower-burning fuse than vouchers, has been transformational. Higher education is no longer only a consumption good enjoyed by an intellectual elite but an important element in national economic performance. Thus it is no accident that the numbers in higher education have increased in all advanced countries. However, policy faces a railroad crash between the financial demands of a mass, high-quality tertiary system and the constraints imposed by competing demands on public funds, including school education, pensions, and medical spending.

Thus two solutions disappear:

- A tax-financed system of high-quality mass tertiary education is ruled out by macroeconomic constraints;
- A return to a small, elite system is ruled out by skill-biased technical change – the world in which a small, tax-financed system of tertiary education made sense has gone.

The solution must include a significant element of private finance to supplement public finance. More specifically, there are three sets of reasons for cost sharing between the taxpayer and the individual beneficiary.

- The railroad crash has already been mentioned. Cost sharing, from that perspective, is an element in containing public spending.
- In microeconomic terms, the argument is that higher education creates external benefits, justifying continuing taxpayer subsidy, but also substantial private benefits on average, both in monetary terms but also in the form of job satisfaction and the like. Cost sharing, from that perspective, is an element in efficient pricing.
- There is also an equity argument. 'Free' is just another work for 'someone else pays'. Given the extent to which students from better-off backgrounds are over-represented in higher education, taxpayer finance is generally regressive. Cost sharing, from that perspective, can be argued to contribute to social justice.

The argument for cost-sharing, however, raises two central concerns.

- Students are credit constrained, and so cannot afford to make a significant contribution while they are students. The solution is a loan to provide consumption smoothing. Thus tertiary education is free to the student; it is the graduate (i.e. the student's older self) who makes the contribution.
- Investments in human capital are risky, so efficient consumption smoothing needs to be complemented by an element of insurance.

The latter element is the heart of Friedman's insight. As explained below, today's solutions have a direct lineage from Friedman's writing 70 years ago.

OBJECTIVES. The desirability of different arrangements should be assessed against the policy objectives they are intended to promote. Higher education matters, as always, for the transmission of knowledge and skills, the promotion of core values and the pursuit of knowledge for its own sake. In contrast with former times, however, it matters also for national economic performance and for individual life chances. This is a new element.

Thus higher education policy should focus on three sets of objectives.

- Improving the quality of teaching and research matters for reasons that require little discussion.
- Widening participation in higher education by students from disadvantaged backgrounds is widely agreed as an equity objective. The objective can be justified also on efficiency grounds – countries cannot afford to waste talent.
- A third objective, size, is a direct response to skill-biased technical change. As discussed, an elite system is no longer a sensible option.

2 The ideas

2.1 Equity finance: Friedman's insights

Access to capital can be organized in different ways.

- With equity finance, the firm pays a periodic dividend to shareholders which continues for the lifetime of the firm.
- Conventional loan finance (for example, home loans or bank overdrafts): for a given size of loan and given interest rate, a conventional loan has a fixed duration and fixed

monthly repayments. The endogenous variable is the fraction of income which repayments absorb. The risk to the borrower is that repayments will be a high fraction of income when income is low.

- Income-contingent loan finance: in this approach, repayments take the form of *x* per cent of the borrower's subsequent income until the loan plus interest has been repaid. Thus the fraction of income which repayments absorb is fixed; the endogenous variables are the size of the monthly repayment and hence the duration of the loan.

AN AMBIGUITY TO AVOID. Since much of the discussion in this chapter is about income-contingent repayments, it is important to identify an ambiguity. For a given size of loan, 'income-contingent' is used in the literature in two different ways.

- Repayments contingent on lifetime income: thus people who earn more over their lifetime repay more in present-value terms. At its simplest, this is equity finance, sometimes also referred to as a graduate tax.
- The present value of repayments is independent of lifetime income. In the simplest case, this is a model of loan finance in which repayments stop when the borrower has repaid 100 per cent of the loan in present value terms. Under this definition, except for the lifetime poor, income contingency affects the time path of repayments but not the total.

Either definition is valid, but a common problem is the failure to be explicit about which is being used.

WHAT IS DIFFERENT ABOUT LOANS FOR HUMAN CAPITAL? There are two reasons why markets for home loans have tended to work well: the building provides physical collateral; and buildings do not have behavioural responses – a house cannot choose to develop a leak or to collapse. In contrast, loans to finance human capital face two sets of constraints, relating to (a) the lack of physical collateral and (b) the potential for behavioural responses coupled with asymmetric information.

Lack of physical collateral. People with fairly low incomes will borrow to buy a house, so why not to buy a degree? Apart from any tax advantages, when someone buys a house (a) he knows what he is buying, since he has lived in a house all his life, (b) the house is unlikely to fall down, (c) over most periods the value of the house is likely to go up, and

(d) if the borrower's income falls unexpectedly, he can generally sell the house to repay the loan (the physical collateral point).

In contrast, when someone borrows to finance investment in human capital:

- He may be imperfectly informed about his aptitudes for achievement in tertiary education and about labour market outcomes; both problems are likely to be more acute for someone from a family with no graduates.
- There is a high risk (or at least a perceived high risk, which again is higher for people with no previous university experience in their family) of failing the degree.
- Though the average private return to a degree is positive, there is considerable variation around it.
- There is no security for the loan. Thus if the borrower's income falls unexpectedly, there is no option to sell the degree to repay the loan.

For all four reasons, borrowing to buy a degree is more risky from the borrower's perspective than borrowing to buy a house. As a result, borrowing will be inefficiently low, hence so will investment in human capital. The latter outcome, Friedman argues, is an important explanation of why returns to human capital are higher than to physical capital. The deterrent applies to all students, but particularly to those from poorer backgrounds who tend to be less well informed and less able to absorb financial risk.

Asymmetric information. Behavioural responses include the potential for adverse selection: if I take out a loan, I may know whether I want to become an accountant or an actor, but can conceal that fact from the lender. In addition, there are sources of moral hazard, including working less hard, analogous to the sharecropper problem.

The lack of physical collateral makes loans to finance human capital risky both to the borrower and the lender; and asymmetric information further increases the risk to the lender.

FRIEDMAN'S INSIGHTS. Friedman and Kuznets (1945) studied the income structure in accounting, dentistry, engineering, law and medicine between 1929 and 1936. A central finding was that the return on human capital was higher than on physical capital. They cite

Walsh (1935) as making a similar finding.[4] Having explored and ruled out other explanations, the only hypothesis left standing was that there were capital market imperfections, particularly the risk to borrower and lender of an unsecured loan. Friedman and Kuznets set out in a footnote what, at the time was a deeply radical notion – that individuals sell 'shares' in their future income as a way of financing investment in their human capital. It is worth quoting the footnote in full.

> 'The argument may be put in [terms of]… an analogy that at first blush may seem fantastic. Investment in professional training will not necessarily be pushed to the margin because earning power is seldom explicitly treated as an asset to be capitalized and sold to others by the issuance of 'stock'. An individual will rarely sell a fixed proportion of his future income to an investor (i.e., he will rarely sell 'stock' in himself), though he may borrow money, obligating himself to repay the principal and to pay interest at a rate that ordinarily cannot exceed a legally stipulated maximum (i.e., he may sell 'bonds'). Under such conditions, an investor who loaned money to a prospective professional man could at most get back his capital and the interest on it; he could never realize a 'capital gain', But he could, and frequently would, suffer a 'capital loss', since, despite the average profitability of professional training, professional incomes differ greatly so that many individuals fare poorly and would be unable even to repay the principal. For this reason, it would be profitable for an investor to finance the professional training of individuals with no resources other than their expected future incomes only at a rate of interest that would be sufficiently high to provide for capital losses as well as for the usual interest charges. Such a rate of interest would probably exceed the expected return from investment in training even though the latter were well above the market rate of interest. On the other hand, if individuals sold 'stock' in themselves, i.e., obligated themselves to pay a fixed proportion of future earnings, investors could 'diversify' their holdings and balance capital appreciations against capital losses. The purchase of such 'stock' would be profitable so long as the expected return on investment in training exceeded the market rate of interest. Such investments would be similar to others involving a large

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[4] 'The following article ... considers schooling alone (not all education), and schooling of a particular kind -- that which trains a man for a professional career. It attempts to determine whether money spent in acquiring such training is, in a strict sense, a capital investment made in a profit-seeking equalizing market, in response to the same motives which lead to the creation of factories, machinery, and the like' (Walsh, 1935, pp. 255-6).

element of risk, a type of investment usually financed by stocks rather than bonds' (Friedman and Kuznets, 1945, p. 90).

Friedman (1955) explored that idea in more detail and applied it not only to professional training but to higher education generally.

'[I]n a non-slave state, the individual embodying the investment cannot be bought and sold. But even if he could, the security would not be comparable. The productivity of…physical capital does not ... depend on the cooperativeness of the original borrower. The productivity of the human capital quite obviously does…A loan to finance the training of an individual who has no security to offer other than his future earnings is therefore a much less attractive proposition than a loan to finance, say, the erection of a building' (Friedman, 1955, p.137).

That analysis was prescient, incorporating both the lack of physical collateral and (though the concept was not at the time known as such) the point about asymmetric information.

Having diagnosed the problem, Friedman went on to offer a prescription:

'The device adopted to meet the corresponding problem for other risky investments is 'equity investment plus limited liability on the part of shareholders. The counterpart for education would be to 'buy' a share in an individual's earning prospects: to advance him the funds needed to finance his training on condition that he agree to pay the lender a specified fraction of his future earnings' (*ibid*., p.138).

On that basis he advocates loans from government, in return for which

'The individual would agree in return to pay to the government in each future year x per cent of his earnings in excess of y dollars for each $1,000 that he gets in this way. This payment could easily be combined with payment of income tax and so involve a minimum of additional administrative expense' (*ibid*., p. 140).

Thus in Friedman's proposal income-contingency is applied to lifetime income. The government is taking an equity stake in the earnings of each graduate.

A DIFFERENT APPROACH LEADING TO THE SAME POLICY.   A different approach starts from a predisposition towards free, tax-financed education and abandons that model only because of its regressiveness in the case of higher education. Glennerster et al. (1968, p. 26) point out that:

> 'in the United Kingdom, higher education is now financed as a social service. Nearly all the costs are borne out of general taxation . . . But it differs radically from other social services. It is reserved for a small and highly selected group . . . It is exceptionally expensive . . . [And] education confers benefits which reveal themselves in the form of higher earnings. A graduate tax would enable the community to recover the value of the resources devoted to higher education from those who have themselves derived such substantial benefit from it.'

EQUITY FINANCE. Friedman's analysis comes from the political right and from the benefit principle. The analysis of Glennerster et al. comes from the political left and the ability-to-pay principle. The end point is the same: a graduate tax, whereby recipients of higher education pay a tax in addition to income tax. The amount a graduate repays is related to his or her lifetime earnings. Thus equity finance can be justified in terms both of the benefit principle and the ability-to-pay principle, a result which helps to explain the intuitive appeal of the income-contingent approach.

2.2 Loan finance

A different strand in the literature considered loan finance. In the simplest design, a borrower repays 100 per cent of the loan in present value terms. Except for someone with low lifetime income, the present value of repayments is independent of lifetime income.

Early proposals included evidence to the UK Robbins Report (1963) by Peacock and Wiseman (1962) and Prest (1962) recommending loans with income-contingent repayments. Blaug (1966) made a similar proposal. Robbins (1980) was later to regret that the Report made no recommendation about loans.

By the second half of the 1980s, as higher education systems in most OECD countries expanded and started to strain public budgets, the income-contingent approach bubbled back to the surface (for a survey, see Barr 1991). Discussion of loans with income-contingent

repayments in the UK included a White Paper (UK Department of Education and Science 1988),[5] Farmer and Barrell (1982), Barnes and Barr (1988) and Barr (1989).[6] US writing included Reischauer (1989). Proposals in Australia included the Wran Report (1988); see also Chapman (1988). In New Zealand, the Hawke Report was published in 1988.

CHARACTERISTICS OF A WELL-DESIGNED LOAN. Three features stand out.

- To provide consumption smoothing the loan should be large enough to cover tuition fees and realistic living costs, making tertiary education free at the point of use. Student loans are a device to assist consumption smoothing. If students face an intertemporal budget constraint that incorporates an efficient interest rate (discussed below), there is no reason for rationing loans, for example, via an income test. This is not an argument for unlimited loans, but for loans large enough to cover realistic costs.

- Given the riskiness of the investment, conventional loans lead to inefficiently low levels of investment for the reasons Friedman identified. Thus consumption smoothing needs to be complemented by insurance. Income-contingent repayments protect a person with low current income. It is also possible to provide insurance against low lifetime income by forgiving any loan that has not been repaid after 25 or 30 years.

- To provide efficient consumption smoothing and insurance, the loss on the portfolio should be limited to borrowers with low lifetime income. To that end, the interest rate should be based on the cost of finance. The centrality of the interest rate and the problems which arise from an inappropriate choice are taken up in section 3.2, below.

3 Impact: The story to date

3.1 Learning from success

Over the past 15 years various countries have introduced income-contingent student loan systems. The system introduced in Australia in 1989 covered a contribution to tuition charges

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[5] Option D was a loan with income-contingent repayments.

[6] Most of the UK work came from the London School of Economics (LSE). Lionel Robbins, Alan Peacock, Jack Wiseman, Mark Blaug and Howard Glennerster were all at the LSE in the 1960s, and Alan Prest was shortly to join. In the 1980s, John Barnes, Iain Crawford and I were all at LSE; so was Mervyn King, who was the first to suggest that loan repayments should be organised as an add-on to national insurance contributions.

which were fixed by the central government (for a review see Chapman and Tan 2009). In 1993, New Zealand introduced a system which covered tuition fees (which were set by universities) and living costs (for a review, see Larocque 2009). The UK introduced income-contingent loans in 1998 to cover living costs, and extended the system in 2006 to cover variable tuition fees (for a review, see Barr 2012*b*). Hungary introduced income-contingent loans in 2001 (for a review, see Berlinger 2009).

Though that list is far from exhaustive, the experience in those countries provides proof of concept, though also a series of potential pitfalls discussed in the next section.

A FLEXIBLE MECHANISM. The system can be implemented in different ways.

In a fully income-contingent system, repayments are a fraction of the borrower's earnings or income, collected weekly or monthly as a payroll deduction alongside income tax. Thus loan repayments instantly and automatically adjust to changes in a person's earnings. This system, as in Australia, New Zealand and the UK, is the best provided (and the proviso is crucial) that the country has the institutional capacity to implement it effectively.

In a lagged system, loan repayments are based on the borrower's last tax return. The arrangement faces problems where a person's income falls sharply, making it is necessary to have a supplementary non-automatic adjustment mechanism. This type of system, broadly that in Hungary, is less demanding administratively than the pure system.

A mixed system has conventional fixed repayments as the default, with income-contingent repayments for borrowers with income below a threshold. In the Netherlands, after a 2-year grace period, repayments are calculated so that the loan is repaid in fixed monthly instalments over 15 years like a conventional loan. However, a person whose total income is below a threshold can request a lower repayment and for very low incomes, repayment is zero. This process has to be repeated each year. The hybrid approach is less administratively demanding than the pure system because it is necessary to base repayments on individual income only for borrowers with low income, not all borrowers.

A COST-EFFECTIVE SYSTEM: NEW ZEALAND BETWEEN 1993 AND 2000. The system included fees set by universities, student loans with income-contingent repayments, and a real interest rate charged from the moment the loan was drawn down.

- Size: the loan was large enough to cover fees and living costs.

- The default interest rate: official estimates in the late 1990s suggested that a cohort risk premium of 2 per cent would cover the loss on low earners. The interest charge on loans was 1 per cent above the government's cost of borrowing, so that the cohort of borrowers covered half of the loss, taxpayers the other half, introducing an element of social insurance into the system, a topic taken up in more detail in the next section.

- Targeted interest subsidies: if a graduate's salary was so low that repayments did not cover that year's interest, the outstanding balance was adjusted so that his or her real debt did not increase.

- Fiscal parsimony: official estimates in the late 1990s suggested that about 89 per cent of total lending to students would be repaid in present-value terms.

In sum, the system was highly cost-efficient, and protected low earners.

PRIVATE FINANCE: HUNGARY. The system in Hungary was designed to conform with the three characteristics of good design discussed earlier. However, the need for the budget to comply with the Stability and Growth Pact created an additional design constraint, ruling out public finance. But privately-financed loans are problematical because under international statistical rules, if loans include a government guarantee to private lenders, the scheme counts as public spending (Barr 2001, Ch. 14; Berlinger 2009). The Hungarian design was the first to propose a solution, by combining a cost-of-finance element in the interest rate with a cohort risk premium. Though privately-financed student loans are not new, the combination of private finance with income-contingent repayments was novel and attracted considerable interest.

WIDENING PARTICIPATION. The Australian system, introduced in 1989, offers the longest historical record. The evidence (e.g. Chapman and Ryan 2005) shows an increase in overall participation and finds, superimposed on that trend, that women's participation grew more strongly than men's, and that the system did not discourage participation by people in the lowest socioeconomic groups. The UK experience offers powerful evidence (Barr 2012*b*) that income-contingent loans as part of a strategic package acts to widen participation.

3.2 Learning from mistakes

Though income-contingent systems have had considerable success, they also demonstrate a wide range of errors: ignoring behavioural effects, mispricing risk, choosing the wrong policy instrument, neglecting politics, and bad contract design.

IGNORING BEHAVIOURAL EFFECTS: THE YALE EXPERIMENT A famous early example of an income-contingent system was the Yale loan scheme (see Nerlove 1975). Students borrowed from Yale University, with repayments of a fraction of their subsequent income. The scheme was designed so that the cohort as a whole would repay, with higher-earning members of the cohort meeting the shortfall of lower-earning members. With hindsight, the flaw in the Yale arrangement was its 'last man standing' design: high-earning graduates were supposed to continue to repay until the cohort as a whole had repaid. Thus some graduates would have repaid many multiples of what they had borrowed, creating resistance to the scheme.

The solution to this problem, discussed further below, is to place a cap on overpayment by any individual graduate, for example, nobody would repay more than 120 per cent in present-value terms of what he or she had borrowed.

MISPRICING RISK: BLANKET INTEREST SUBSIDIES. The interest rate in a loan system may be too low either through a grace period during student days and/or through an interest rate below the cost of finance throughout the duration of the loan. The high cost and bad targeting of interest subsidies is shown internationally by Shen and Ziderman (2009).

In a system with (a) income-contingent repayments and (b) forgiveness after (say) 25 years, interest subsidies are pernicious. The intuition of interest subsidies is clear but mistaken. With conventional loans a subsidy helps first-time house buyers by reducing monthly repayments and so might be sensible policy. Income-contingent repayments turn the argument upside down: if a person's repayment is x% of her earnings, a lower interest rate has no effect on monthly repayments, but instead shortens the repayment period.

Charging an interest rate below the cost of finance creates a blanket interest subsidy. In a well-designed income-contingent system that subsidy is inimical to all the core objectives of quality, access and size.

Cost. The interest subsidy is expensive in fiscal terms. In the UK in the early 2000s about one-third of total lending was not repaid just because of the interest subsidy. There are at least three reasons why the high cost should not be surprising:

- The subsidy applies to all borrowers for the whole loan and for the entire duration of the loan. Thus not even the best-off graduates repay in full.

- The duration of repayments is long; this is desirable, since it is efficient if the length of a loan is related to the life of the asset, hence 3-year car loans but 25-year home loans. But with an interest subsidy, the longer the loan, the more costly the subsidy.

- Borrowers face an incentive to arbitrage: students who do not need the money nevertheless borrow as much as they can and save the money, making a profit on the interest rate.[7]

These high costs lead to further ill effects.

Impediments to quality and size. Student support is often politically more sensitive than spending on universities themselves. Within a given budget, the cost of the interest subsidy crowds out finance for teaching and research, putting quality at risk. More dramatically, the costs of the interest subsidy may lead to university places being rationed, as in England in the years after 2010.

Impediments to access. Because loans are expensive, they are rationed in size or number. They may not cover tuition fees, or may cover only part of living costs; or they may exclude some groups, for example, part-time and postgraduate students, and students in non-university tertiary education. The effect is most likely to harm students from poor backgrounds, who may not have access to family support.

Regressive. Interest subsidies do not help students (graduates make repayments, not students). They help low-earning graduates only slightly: people with low earnings make low

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[7] This is not conjecture. '[T]he current policy of writing off interest on loans for … students while they are studying … has made it possible for learners to borrow money and invest it for private gain (arbitrage). Consequently .. this policy should be discontinued – or that, as a minimum, the incentives for arbitrage should be removed.' (New Zealand Tertiary Education Advisory Commission, 2001, p. 14).

repayments; and if earnings remain low over the long term, unpaid debt is forgiven.[8] Interest subsidies do not help high-earning graduates with low earnings early in their career: with income-contingent loans, their monthly repayments will be low; the interest rate affects only the duration of the loan. Thus the major beneficiaries are successful professionals in mid-career, whose loan repayments are switched off (say) after 10 years rather than after (say) 12 years with a higher interest rate. This is not the group that the policy was intended to help.

Barr and Johnston (2013) quantify these various ill-effects for the system in England.

MISPRICING RISK: UPFRONT DISCOUNTS. The system introduced in Australia in 1989 allowed students to pay the tuition charge (I will use an illustrative number of $6,000) either upfront at a 25 per cent discount or deferred.

- Upfront payment: the student arrives at the university and hands over a cheque for $4,500 (i.e. $6,000 minus 25 per cent discount).

- Deferred payment: the student arrives at the university and signs a piece of paper. The loans administration sends the university a cheque for $4,500 (thus the university is indifferent between upfront and deferred payments). The student agrees to make income-contingent repayments after graduation until he/she has repaid $6,000 in real terms.

Under this arrangement, a borrower repays $6,000 in real terms, i.e. $1,500 more than the fee of $4,500 which the government has paid on his/her behalf. Thus (a) there is a positive real interest charge, but (b) in the form of a lump sum – $1,500. The marginal interest rate thereafter is a zero real rate, i.e. the real outstanding debt never increases.

The lump-sum nature of the interest charge is inefficient. First, though the $1,500 surcharge may cover the interest *on average*, it has none of the *marginal* incentive effects of a positive real interest rate. The implicit interest rate is arbitrary both across individuals and over time. Second, a lump-sum charge may create adverse selection – people who expect to be high earners pay upfront, leaving the government scheme with the bad risks.

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[8] In the UK, a person's outstanding loan balance is forgiven after 30 years.

A separate problem concerns loans to cover living costs. In the case of fees, it is possible to present the arrangement as a discount because it mimics an arrangement which is common in other areas. But a charge of $6,000 to provide a loan of $4,500 paid in cash to cover living costs will be seen not as a discount but as a surcharge. It is easy to imagine the newspaper headlines: 'Government acts as loan shark ...'. Thus in practice the $1,500 is likely to be eroded, and over time eliminated because of its high visibility, leading to a system with a zero real interest rate, with all the problems set out earlier.

A discount for upfront payments may be defensible for small tuition charges (hence the resulting distortion is small), given the advantages of the arrangement in terms of political presentation. But the arrangement is a bad one where tuition charges are substantial and diverse, and infeasible for loans to cover living costs.

CHOOSING THE WRONG POLICY INSTRUMENT: USING LOANS TO WIDEN PARTICIPATION. Interest subsidies are an example of the broader problem of confusing instruments and objectives. It is important to restrict the loss on the loan portfolio to borrowers with low lifetime earnings not out of a purist adherence to the idea of a loan but because leaky loan systems prevent the achievement of core objectives of higher education policy including the quality and size of the system.

The twin objectives of efficient consumption smoothing and widening participation require two instruments: a fiscally parsimonious loan and policies aimed directly at widening participation.

The error in using loans for distributional purposes is discussed in Barr (2012*b*, pp. 487-490). There are two sets of impediments to participation.

- Liquidity constraints arise because higher education is expensive and students generally do not have the necessary resources, nor, frequently, do their families. A well-designed student loans system is the primary instrument for addressing these constraints.

- Constraints with earlier roots are more intractable. A central constraint is a lack of prior attainment. The flawed argument is that people from poor backgrounds do not go to university because they are debt averse; thus, it is argued, money intended to

widen participation should be spent on scholarships for university students. The argument that the evidence supports is that people from poor backgrounds do not go to university mainly because of low attainment in school, and that if that problem is fixed are just as likely to go to university as people from better-off backgrounds. Thus money intended to widen participation should be focussed on raising school grades, preventing drop out, and improving information. The error, in short, is to attribute to the liquidity constraint behaviour that is determined mainly by the attainment constraint.

Interest subsidies are one manifestation of confusion between instruments and objectives, but loan repayments can be too generous in other ways. England illustrates the point. Until 2012, the interest rate on student loans was the inflation rate, i.e. a zero real rate, leading to the problems discussed earlier. Reforms in 2012 rectified that problem but reintroduced it in a different guise by making the loan repayment formula more generous.[9] Since the purpose of income-contingency is to provide insurance, the threshold at which repayments start should be high enough and the repayment rate low enough not to deter efficient borrowing. On the other hand, if the threshold is too high and/or the repayment rate too low, many borrowers will not repay in full. If the loan system runs at a significant loss, the ill-effects are the same (and for the same reason) as those of a blanket interest subsidy: (a) inefficient consumption smoothing, (b) badly-targeted redistribution and, by undermining the repayment performance of the loan system, also (c) a cap on student numbers (i.e. a shortage of university places), and/or (d) a decline in university funding, compromising quality.

The main reason for raising the repayment threshold in England in 2012 was political − to give an appearance of progressivity. In reality, the beneficiaries are those graduates who do not fully repay, but who would do so in a well-designed system; the losers are those, typically from disadvantaged backgrounds, who are excluded from the system because places are rationed. Thus the 2012 reform benefits insiders at the expense of outsiders. Indexing the threshold to earnings locks in this regressive pattern.

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[9] Until 2012, borrowers repaid 9% of their earnings above £15,000 per year; in 2012, the formula became 9% of earnings above £21,000, with the threshold indexed to changes in earnings.

In sum, loans are generally an ineffective instrument for addressing constraints with earlier roots, so that it is mostly mistaken to tinker with loan design for that purpose. Loans should be fiscally parsimonious both to provide effective consumption smoothing and to avoid crowding out the policies which really widen participation.

NEGLECTING POLITICS: THE SAD CASE OF NEW ZEALAND. Though the design of the system in New Zealand in the 1990s, described earlier, was as close to ideal as anyone has managed, mistakes were made. First, reform was to some extent big-bang: student loans were new, and fees, though not new, were fully liberalised. Second, though the system included targeted interest subsidies for low earners, there was insufficient explanation. Third, the politics of reform were not well handled. The government failed to explain how the system worked and did not continue to campaign for it. As a result, populist political pressures and an unexpected election victory by the opposition in 1999 led to the introduction of interest subsidies.

Reform in 2000 introduced a zero *nominal* interest rate while a student was at university and froze the real interest rate charged after graduation at below its previous rate. The impact of these changes was considerable. Estimates suggested that repayments would fall from 89 per cent of total lending to 77 per cent (New Zealand Ministry of Education 2002, p. 7). The change was so expensive precisely because the subsidy to students while still at university applied to all students.

The New Zealand experience suggests two important lesson. First, seemingly small adjustments can be very expensive. Second, the politics of reform matter. Ideally, the loan system should be designed to guard against short-term political opportunism – for example a requirement to publish an independent audit of the system each year.

BAD CONTRACT DESIGN. The importance of the loan contract is often overlooked. International mobility is high and likely to increase, raising questions about collecting repayments from borrowers who emigrate. In the systems in Australia and New Zealand repayment is coupled with the liability to submit an Australian/New Zealand tax return. Emigrants do not have to file a domestic tax return and hence have no liability to repay, a costly mistake since migration is significant, and particularly because both countries have an interest subsidy. In contrast, the UK contract specifies income-contingent repayments while

the borrower has UK taxable income, but requires repayment in other forms where someone works elsewhere.

4 A view to the future

4.1 Refining interest subsidies

Earlier arguments about the choice of interest rate suggest three conclusions. The rate of interest on an unsecured individual loan, such as credit cards is too high, given the objective of facilitating optimal investment in human capital. Second, an interest rate below the cost of finance (for example, a zero real rate) is too low. Third, borrowers with a good career should repay in full in present-value terms. The minimum interest rate that brings about this result is the cost of finance, e.g. the interest rate on long-term government bonds. To that rate can be added a cohort risk premium which covers at least part of the non-repayment by low-earning borrowers. The effect is to give borrowers access to finance at the cohort risk rate rather than the considerably higher individual risk rate.

The cost of finance is the appropriate starting point in a unified national system with income-contingent repayments and forgiveness of any outstanding loan after (say) 25 years. However, in any system with a positive real interest rate, the outstanding debt of someone with low or no earnings will rise, and perhaps rise rapidly. With forgiveness after 25 years spiralling debt would not be a problem for a rational individual. In practice, however, rising debt causes sleepless nights and hence political problems, as in New Zealand during the 1990s. Though *blanket* interest subsidies have serious ill-effects, is it good politics to have *targeted* interest subsidies.

A SIMPLE TARGETED INTEREST SUBSIDY. The simplest way to prevent real debt rising is to charge the cost of finance (with or without an additional cohort risk premium) from the time that the borrower draws down the loan and to charge that rate during the student's time at university to avoid the adverse effects of a grace period. That interest rate should continue once the student has left university except that in any year when his/her earnings are so low that income-contingent repayments do not cover that year's interest, the real outstanding loan balance in that year is frozen. This was the system in New Zealand in the 1990s. Alongside its policy advantages, the arrangement is administratively simple since it does not require the loans administration to gather any additional information.

In policy terms, the advantages are considerable:

- Because loans have income-contingent repayments, an increase in the interest rate for the generality of graduates has no effect on anyone's monthly repayment.

- The process gives genuine assistance to low earners.

- The policy is easy to explain: the interest rate on student loans is normally the government's cost of borrowing, but with subsidies to protect low earners: people who are unemployed, taking a career break, or with low earnings pay a zero real interest rate; and any loan that has not been repaid after (say) 25 years is forgiven.

INTEREST SUBSIDIES BASED ON LIFETIME INCOME. In the simple arrangement just described, a person receives an interest subsidy when earnings are low even if he or she goes on to have high earnings. A more sophisticated approach is to give conditional interest subsidies as just described, but to claw back those subsidies if the borrower goes on to have high earnings. In this approach the only borrowers who do not repay in full are those with low lifetime earnings.

OTHER SUBSIDIES. Targeted subsidies could be applied more broadly, for example to people caring for young children or elderly dependants. More radically, government could signal its support for caring activities by writing off (say) 5 per cent of the person's outstanding debt each year. There could be a similar arrangement for occupations such as nurses and teachers.

4.2 Mixing equity finance and loan finance

In the pure case of equity finance, a percentage of income is repaid for life (or up to retirement age), hence high earners repay multiples of their initial investment. At the other end of the spectrum is a simple income-contingent loan, where nobody repays more than he or she borrowed in present value terms, and losses are picked up by the taxpayer. This is the pure case of loan finance.

The two approaches can be combined. Supposing, for example, that the loss in a loan system is 20 per cent. It would be possible to design a graduate tax in which the cohort as a whole repays what it has borrowed. Or, there could be a loan scheme with an interest rate

equal to the cost of finance plus a cohort risk premium such that, ex-ante, the cohort repays 100 per cent.

ARGUMENTS AGAINST PURE EQUITY FINANCE. A pure graduate tax lasts for life, or until retirement, or for a fixed duration such as 25 years, and is problematical for several reasons.

It is public money, ruling out net private finance until cumulative repayments by graduates outweigh cumulative upfront outgoings.

Funding is closed-ended. With a graduate tax, the government controls the funding envelope. If fees go up but at the same time public spending on higher education declines, total university income stays unchanged; all that happens is a change in the balance between public and private finance. The 1989 reforms in Australia were introduced to address a funding crisis. At the time the government promised that there would be no offsetting decline in public spending. That was true in the early years, but over time, as fee income increased tax finance fell back. By 2000, the system was back in crisis. For the same reason, the introduction of fees in England in 1998 did not bring in any extra money.[10]

The root problem is not political mendacity but of establishing the counter-factual. If a country has a three-year planning cycle for public spending it is possible to verify that taxpayer support does not fall in those years; but beyond the planning period the issue is whether public spending is the same as it would have been had tuition fees not been introduced – an unanswerable question.

Incentives to quality are muted. Public finance plus closed-ended funding mutes the competitive incentives facing universities, and hence forgoes incentives conducive to improved quality.

A closed-economy model. Consider a graduate tax in the UK. If repayments are part of a person's income tax liability, they apply only to people with UK taxable income, thus exempting students from other EU countries who study in the UK but then work elsewhere,

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[10] This was predicted—see Barr and Crawford (1998, p. 78).

and UK graduates who work abroad. Unless the graduate tax is small (in which case it does not bring in much additional income) it will create incentives to emigrate.

Politically problematical. Though it sounds like a good idea, a graduate tax would be politically difficult. If the tax is compulsory, it causes what might be called 'the Mick Jagger problem'. In a graduate tax regime, Mick Jagger, once a student at the London School of Economics, would finance a good part of UK higher education. Compulsion, as well as encouraging emigration, will come under political attack from the right, as violating individual freedom, risking the long-term stability of the system (this was the central design problem in the Yale scheme). On the other hand, if people can opt out, the problem is one of adverse selection – the rich would pay upfront, reducing the redistributive capacity of the system and provoking attack from the political left.

ARGUMENTS AGAINST A PURE INCOME-CONTINGENT LOAN FINANCE. Consider a loan with an interest rate equal to the government's cost of finance, with income-contingent repayments and forgiveness after 25 years. That arrangement makes a loss on graduates with low lifetime earnings. That loss can be thought of either as insurance to support efficient consumption smoothing or as well-targeted redistributive spending. Either is a deliberate design feature. However, the loss has to fall somewhere. If it all falls on the taxpayer, the government might respond (as in the UK between 2010 and 2014) by restricting the number of university places. Thus there is no argument of principle against a pure loan scheme, but a potential argument of practice if the fiscal cost of loans restricts the supply of places.

Given the arguments against both the pure equity approach (in which the resulting loss is paid by the cohort of borrowers) and the pure loan approach (where the loss is paid by taxpayers), an intermediate arrangement might do better. The question for policy is who should cover the loss: taxpayers, the cohort of graduates, universities, or a combination?

TAXPAYERS. Systems in many countries, including Australia, New Zealand and the UK, are run by government, and losses covered from taxation. The same is true in the very different system in the USA. If the losses are small government might cover them from taxation. On the other hand, a country facing tight fiscal constraints might want to cover the loss at least partly from other sources.

THE COHORT OF BORROWERS. The loss on the loan portfolio could be covered, wholly or in part, by the cohort of graduates in one of two ways.

A *cohort risk premium* added to the government's cost of finance, e.g. two per cent above the long-term government bond rate, to cover the average loss on the cohort of borrowers. The higher interest rate has no effect on a graduate's monthly repayments but extends the duration of repayments. The system in Hungary is of this type (see Berlinger 2009).

A *repayment extension*. In this mechanism, the base interest rate is the cost of finance; insurance is by continuing repayments for (say) an extra year after the borrower has repaid his/her loan, subject to (a) forgiveness after 25-years and (b) a cap on repayments by any individual of (say) 120 per cent of what he or she has borrowed. For a given repayment extension, the interest rate is the endogenous variable, with higher earners paying a higher implicit interest rate. Barr (2010) explores the properties of this mechanism.

Financing the loss through the cohort of graduates has the following characteristics.

- Higher-earning borrowers pay at least part of the loss on low-earning borrowers. On a national basis, there will be a cross-subsidy from the graduates of elite universities to those of local universities.

- The system has two instruments – the cost of finance and a risk premium – to pursue the twin objectives of consumption smoothing and insurance.

- The system can accommodate macroeconomic turbulence: a downturn will slow repayments, but an interest rate that incorporates the cost of finance plus insurance through a cohort risk premium or repayment extension largely covers the cost of loans by extending the duration of repayments.

- The system can accommodate larger loans, for example to cover an increase in fees. A person with a larger loan will repay for longer, but the combination of cost of finance element and insurance element covers the cost of loans.

- Low earners are unaffected by either of the previous two points: changes in the interest rate have no effect on monthly repayments, protecting people with low

monthly income; and people with low lifetime income are protected by forgiveness after 25 years.

- The purpose of the risk premium or repayment extension is explicit. It represents an insurance premium where – as in any insurance system – the premiums of the 'lucky' (higher earners) cover the losses of the 'unlucky'. If the objective is a loan system which is self-financing, the premium should cover the entire non-repayment by low earners. Alternatively, the premium could cover some of the loss and the taxpayer the rest, as in New Zealand in the 1990s.

A design of this sort simultaneously protects low earners and, through redistribution within the graduate cohort, is largely self-financing. The design can be interpreted in different ways:

- As a loan with mandatory insurance.

- As a loan which achieves a 100 per cent repayment rate, making it plausible to increase the size of loans to cover higher fees and/or to extend the system to part-time and postgraduate students, and to other students in tertiary education.

- As a redistributive system, with additional repayments by higher earners covering some or all of the non-repayment by lower earners.

- As a form of social insurance with a solidarity element within the graduate cohort (note that pensions redistribute from a person's younger to her older self; loans, analogously, redistribute from a person's older to her younger self – thus the social insurance analogy is apt).

- As capped equity finance. [11]

Though the mechanism has powerful advantages, it cannot be pushed too far. If the losses are high, hence the risk premium large, there is a risk of adverse selection or, as in the Yale scheme, eventual breakdown. This point adds emphasis to the importance of designing the loan so that most graduates repay in full, thus containing the losses which the insurance element needs to cover. A second concern is that the mechanism gives all universities an

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[11] Islamic law does not allow interest payments. But it is possible to buy a house in ways compatible with Islamic law by making monthly rental payments for an agreed duration, after which ownership of the house is transferred to the occupant. Formulating student loans as a capped graduate tax provides an analogous solution.

incentive to charge higher fees, since neither the university nor its low-earning graduates face the resulting losses.[12] Thus a cohort risk premium may be only part of the story.

UNIVERSITIES. In this approach (Barr and Shephard 2010, paras 29-31) each university pays an insurance premium to match the predicted loss on the borrowing of its students. Note that the marginal loss on loans rises with the size of the loan, so higher fees disproportionately increase the loss on loans. University-specific insurance has the advantage of providing a countervailing pressure to the incentive to raise fees which can arise with a cohort risk premium.

In sum, an optimal package might cover losses from a mix of taxpayer, the cohort of graduates, and universities.

4.3 Individual contracts

HUMAN CAPITAL CONTRACTS. Palacios (2003) brings together the equity approach and the loan approach through the idea of a human capital contract, in which a person obtains the finance for higher education by selling the right to x% of his/her earnings for n years, i.e. a form of equity finance. That contract could be supplemented by a second contract in which the student buys a human capital option, which insures the graduate against overpaying if he/she turns out to be a high earner. The combination of human capital contract and human capital option is an income-contingent loan.

The core of the idea is two-fold. First, it allows individualised contracts in place of a unitary national system, thus, it is argued, improving efficiency because of the resulting market signals. Second, by allowing individual contracts, the approach opens the potential for privately-financed loans. Del Rey (2012), along similar lines, draws on the literature on medical insurance for insights into ways of giving students choice about the contract they take out. In this approach, the insurance element in the loan is based not on average cohort risk but on perceptions of individual riskiness and differences in risk-aversion across individuals.

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[12] The reforms in England in 2012 (Barr 2012*b*) create exactly such an incentive. This was both predictable and predicted (Barr and Shephard 2010, para. 22). Smith and Smith (2010), in a marvellously entertaining article, illustrate the point by considering a degree with high fees targeted at old-age pensioners, none of whom (because of their age) were likely to repay more than a fraction of the borrowing.

Attempts to individualise loans need to be considered in the context of the broader literature. Analytical tractability requires simplifying assumptions, including (a) no non-financial returns to higher education, choices based on (b) full information and (c) rational behaviour, and (d) non-altruistic utility functions, i.e. a first-best economy. Though exploration of individualised contracts provides analytical advances, the application to policy design needs to accommodate second-best arguments, some of which are discussed below.

ARE MARKET SIGNALS EFFICIENT? Palacios (2003) argues that it would be possible to get a loan on better terms for a more expensive degree with better earnings outcomes than for a cheaper degree with poorer outcomes. That prediction is almost certainly correct but it does not follow that the resulting price of the loan leads to the efficient subject mix in higher education. Even where the borrower is well-informed, the price of the loan is based only on private benefits, taking no account of any external benefits.

BOUNDED RATIONALITY. The case for human capital contracts rests on the assumption that agents are well-informed. Though that is, for the most part, the right assumption for higher education *per se*, that argument does not apply to complex, long-term financial contracts.

Behavioural economics is improving our understanding of why people faced with choices that are too complex frequently make no choice. Such behaviour is evident in the markets for pensions, particularly in systems where people are required to make a choice from competing pension providers. In Sweden, despite considerable public education in the late 1990s when the system of funded individual accounts was launched, by 2011, over 98 per cent of new entrants to the labour force made no choice and thus ended up in the default fund, with little evidence that people moved away from the default fund when older and with larger account balances (Barr and Diamond 2008, section 9.3; Barr 2013, Table 4). Thus a well-designed default is considerably more important than would be the case if the simple model of rational choice were fully accurate.

RISK SHARING, UNCERTAINTY AND MISSING MARKETS. Risk sharing lies at the heart of loan design. As with pensions, a central issue is how risks should be shared, and in particular, where the costs of losses should fall. Conventional debt adds to risk. Income-contingent debt adds to marginal tax rates. It does so wholly with pure equity finance, though less so in a design where repayments eventually stop (though no modelling has been done on this aspect).

The second-best optimisation problem concerns (a) the extent of risk to which borrowers are exposed and (b) where the risks of the loss on the portfolio fall.

In considering these issues, I continue to find Frank Knight's (1921) distinction between risk and uncertainty useful.[13] With risk, the probability distribution of outcomes is known or can be estimated with a reasonably small variance; with uncertainty, the risk cannot be quantified well. Breaking a leg is risk; different future rates of inflation are an uncertainty.

A borrower's future earnings should be analysed as an uncertainty: neither side of the market knows the true probability distribution of outcomes. In addition, student loans create problems of asymmetric information, since the student has private information about his/her future career intentions.

Uncertainty leads to missing markets and in, this context, to missing insurance markets. In contrast, a complete set of markets would include insurance against all possible future contingencies. Diamond's (1967) pioneering paper explored economies with missing insurance markets, creating deviations from optimality which government intervention might be able to improve. A central part of his argument is that governments also face uncertainty. Thus the right comparison is between imperfect market outcomes and imperfect government intervention.[14]

None of these points argue against more sophisticated design of student loans, but they do suggest caution about translating theory into practice. This line of argument leads naturally to the observation that as a practical matter it is difficult to get even a simple, well-designed loan into play and then to preserve the integrity of its strategic design. The economics of higher education finance is relatively straightforward – it is the politics which is problematical.

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[13] Not all economists accept the importance of the distinction. For a recent assertion that risk and uncertainty have very different implications, see Bronk (2009, especially pp. 214-16).

[14] For more recent discussion, see the theorem in Geanakoplos and Polemarchakis (1986) and the text by Magill and Quinzii (1996).

5 Conclusion

What has happened to the radical 1945 proposal that an individual should sell 'shares' in himself as a way of financing investment in skills?

The specific mechanism, equity finance (also known as a graduate tax), it can be argued, is more useful (a) the more homogeneous the system of tertiary education, (b) the greater the taxpayer share in its cost, hence the smaller the graduate tax needs to be, and (c) the smaller the dispersion in the distribution of income. These are a much better approximation of tertiary education in the 25 years after the Second World War than in the last 25 years. In the more recent period, systems of tertiary education have become larger, more complex and more diverse. Second, there is pressure to increase graduate contributions both because of diminishing taxpayer finance and because of the rising relative costs of tertiary education. Third, income disparities in many countries have increased.

For all these reasons, it can be argued that equity finance made sense in 1945, but that some version of loan finance is a better fit to tertiary education in today's world.

That said, the difference between the two approaches should not be exaggerated. There is a convergence between:

- An income-contingent loan available equally to everyone; and

- A universal grant financed through a graduate contribution that is income-related and time-limited. The time limit could be retirement (i.e. equity finance) or when the loan has been exactly repaid (loan finance) or an intermediate design.

Friedman's great contribution is not the specific mechanism of equity finance, but the power and flexibility of the income-contingent idea.

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