Retracing HECS: Its Definition and Fiscal Role

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RETHINKING HECS: ITS DEFINITION AND FISCAL ROLE

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SUMMARY

The Australian Higher Education Contribution Scheme (HECS) directly subsidizes tuition costs in public higher education in two ways. First, for many courses, students are required to pay less than half the full costs of their tuition. Second, students are permitted to borrow the required tuition charge from the Commonwealth, but they do not have to begin making payments until their income reaches a threshold level. While there is a substantial 25% discount and reward for prompt payment made at the time courses are undertaken, there is no additional real interest rate penalty for those who choose to extend their repayments beyond the time that the income threshold is reached.

On the other hand, the Commonwealth income tax system severely discriminates against that part of personal investment in human capital which requires outlays on tuition costs. This is because tuition costs are not deductible against the higher income deriving from expenditures on higher education. By contrast, other investment expenditures - on financial assets, plant and equipment, and research and development - are deductible against the taxable income which they create. Clearly, there is a tax-based case for some degree of subsidy of tuition fees in public (and private) higher education.

This article calculates the proportion of tuition costs which should be charged at the time the course is undertaken in order to compensate for this lack of deductibility. With an average tax rate of graduate income in the region of .25 to .3, it follows that the appropriate proportion of full costs which students should be required to pay “up front” is about 70 per cent: this is the proportion of fees which students would effectively pay if their fees were tax deductible, the Commonwealth effectively paying the remainder through granting a tax deduction.

This “tax neutral” HECS contribution is significantly more than students are presently required to pay. Presumably this is because the origins of HECS lie in a desire to encourage higher education on account of its presumed external benefits, and on account of capital market imperfections which make it difficult for poor families to fund it by borrowing on commercial terms. However because tuition costs are a relatively minor proportion of the total social costs of higher education, less than 10 per cent, fee subsidies are an inappropriate method of compensating for these problems.
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1. Introduction
Economists are increasingly interested in the role of education in economic growth, and in the impact of taxation and other fiscal incentives to education: for recent examples see Trostel (1993); Dupor et.al. (1996); Kaplow (1996); Steuerle (1996)]. The Australian Higher Education Contribution Scheme (HECS) represents a unique form of fiscal intervention in higher education. Its main feature, income contingent lending integrated with the income tax system, has attracted international interest.

The Scheme has three main features which have their origins in a desire to improve both equity and efficiency in higher education by overcoming alleged capital market imperfections and by compensating for the alleged "externalities" generated by higher education. First, and less remarkably, the Scheme provides a direct subsidy to consumers of higher education in that students at public universities are required to contribute less than the full average cost of their tuition. Second, the contribution is income contingent: not only may payments be made in installments after the liability is incurred, the first installment is not required until the graduate's earnings reach a benchmark level, the debt accruing at a zero real rate of interest. Third, HECS is integrated with income tax collections, debts being monitored and collected by the Australian Taxation Office.

Until the end of 1996, local students payed $1800 annual fees "up front" for all courses, regardless of cost of delivery, while $10000 was paid by foreign students. This $1800 compared with $2400 in constant dollars should local students choose to defer repayment until their earnings reached a benchmark level related to average weekly earnings, involving a discount of 25 per cent for "up front" payment.

As of 1997, a three band scheme was introduced, each band purporting to represent a different level of annual course delivery cost: $3300; $4700; and $5500, with the same 25 per cent discount for payment on enrolment applying to each band. Arts, Humanities, Social Studies/Behavioural Science, Visual/Performing Arts, Education and Nursing were placed in the lowest cost band 1; Mathematics, Computing, Other Health Sciences, Agriculture, Renewable Resources, Architecture, Science, Engineering, Business and Economics are in band 2; Legal Studies and Medical, Dental and Veterinary Sciences were placed in band 3.
[The anomaly in this scheme is Legal Studies, a low-cost of delivery course, which was placed in band 3 on the grounds that such graduates earn relatively high income]. The repayment threshold was made independent of average weekly earnings such that now graduates begin to repay the loan when their annual taxable income reaches $20700.

Judging from the heat of debate when changes to these rates were announced to apply from 1997, and from the changes which were based on a mixture of "ability to pay" and cost principles, there is clearly confusion as to what the HECS contribution should be. Equally confusing is the definition of the HECS requirement, which is to pay a specified real charge at an indefinite future time, meaning that the present value of the requirement is vague.

This paper seeks to shed light on these issues. It does so by redefining the HECS contribution and calculating the level which would put private investment in higher education on the same income tax footing as other investments. An incidental calculation is the HECS contribution that would be needed to capture significant external benefits generated by higher education.

The main motivation for this task is that, considerations of equity and capital market imperfections apart, some form of HECS is called for to compensate for the distortions imposed within an income tax system by the unique tax treatment of higher education - non deductibility of fees and income tax progression. [The effect of these features of the income tax system was recently analyzed for the U.S. by Dupor et. al. (1996)].

While income which is forgone by students and graduates is tax deductible in the sense that such income would be taxed, in assessing the taxable income of graduates there is no deduction from taxable income allowed for the cost of capital in the form of fees unless such higher education were required by the student's employer, which would be rare for the student population as a whole. By contrast, investments in financial assets and in plant and equipment are subject to a deferred deduction, in the sense that principal or capital outlay is deducted from gross receipts to assess taxable income in the year of receipt, while investment outlays on R and D enjoy a more favourable immediate deduction in advance of receipts.

Progressive income taxes create a second bias which is significant for all personal investment in human capital, including on-the-job training involving forgone income as opposed to mere "learning by doing" which does not. This bias is greater for full time higher education, which requires a greater investment of forgone income and tuition costs which normally pushes a taxpayer into a higher average tax bracket, even when the proportional rate of return is low. Stated somewhat dramatically, tax progression means that any given dollar of
expected income will be taxed at a higher rate when it is earned by someone with a sufficiently higher endowment of human capital. This is because that person also expects to earn additional income commensurate with investment in human capital, and will be subject to a higher average tax rate. For any given investment, this differential treatment applies in every year of full time work.

There are two reasons why this effect of tax progression is particularly severe on personal investment in human capital, including on-the-job training. First, the corporate tax rate is proportional. Second, most other personal investment does not involve forgone income, the exception being full time, professional investors who are likely to be on the top marginal tax rate. By contrast, those who invest in human capital are likely at the time of investing to be on low marginal tax rates.

The article evaluates the net effect of these personal income taxation arrangements on the demand for higher education, using a simple model of the higher education decision. The model is initially developed on the assumption that there are no capital market imperfections and equity considerations: the only imperfections are assumed to lie in the fiscal system itself and in the generation of externalities over the working life of the graduate. This approach allows a statement about the appropriate basic level of HECS, which provide a firm peg on which to hang subsequent considerations of market imperfections and equity in higher education, previously analysed by Brennan (1988) and Chapman (1988). However, as far as these issues are concerned, the helpful insight which emerges from the model is that, because costs of tuition are less than 7 per cent of total higher education costs and benefits to consumers and society, any fee subsidy system such as HECS has very small leverage in correcting distortions the effects of which persist over the working life of graduates. Such long term distortions include income tax progression as well as externalities.

The analysis proceeds in the following way. Section 2 analyses the determinants of the return from higher education which is required by prospective students, using a two period model of the personal higher education decision. Section 3 deals with the implications of non deductibility of tuition fees for this required return, and derives the "up front" and deferred HECS payments which compensate for non deductibility. Section 4 considers the impact of tax progression on the required return, and the appropriate HECS adjustment to compensate for tax progression. Each of these sections begins with a self contained summary of the results of the algebraic analysis which follows. Section 5 concludes.
2. What Determines the Return Which is Required from Higher Education, and How Significant are Tuition Fees in that Required Return?

2.1 Summary
This section analyses the determinants of the rate of return which prospective students require from investing in a course. This may be expressed as a required benefit-cost ratio - the ratio of the income which graduates require to undertake that course relative to the presumably lower income of high school graduates which they forgo by undertaking that course. It is shown that this required return depends on the importance of tuition fees relative to forgone income in the total costs of higher education, and on the rate at which students discount the future costs and returns from higher education: the greater the relative importance of tuition costs and the greater the discount rate, the higher will be the required return in terms of income foregone. It follows that a fee subsidy for consumers such as HECS, which reduces fee costs to students, lowers the required return and thus encourages investment in higher education.

It is also shown that, because tuition costs are incurred over a relatively short period compared to the benefits, with a discount rate of .03 these costs are less than 7 per cent of the costs and benefits of higher education which are assumed to flow over a working life of 40 years. Accordingly, any fee subsidy scheme such as HECS has limited ability to compensate for those distortions like tax progression and externalities which persist over the working life of graduates. It follows that its main contribution lies in maintaining equity and efficiency by overcoming distortions due to capital market imperfections and the non deductibility of fees, the effects of which are in direct proportion to the level of tuition costs.

2.2 The Model
These conclusions flow from a stylized model in which the working life of a new graduate from high school is divided into two periods. Period 1 comprises the n years required for full time higher education should this path be chosen, and Period 2 represents the decades spent in full time employment by university graduates and high school graduates alike. Of course, those who choose not to undertake full time higher education will be employed over Period 1 as well as 2. The length of Period 1 would be n = 4 years for a four year degree. The length of Period 2 is R-n years, where R is the number of years from high school graduation to the
The expected time of retirement, say 45 years for those who plan to retire in their early sixties. So Period 2 would consist of about 40 years in the case of a four year degree.

The capitalization factor for the cost and income flows of Period 1 is

\[ K_1 = \frac{(1 + i)^n - 1}{i(1 + i)^n} \]

\[ = 3.81 \ (3.72 \ (3.55) \text{ for } n = 4, \ i = .02 \ (.03) \ (.05). \] (1)

Corresponding to the relative length of these two periods, this factor is much less than that for Period 2 which is

\[ K_2 = \frac{(1 + i)^{(R-n)} - 1}{i(1 + i)^{(R-n)}} \]

\[ = 27.36 \ (23.1 \ (17.16) \text{ for } R-n = 40 \text{ and } i = .02, \ (.03) \ (.05). \] (2)

Higher education involves the annual loss of the yearly income \( Y_1 \) commanded by a high school graduate over Periods 1 and 2. The full (unsubsidized) costs of tuition, \( F \), also fall into Period 1. These are assumed to be a fraction, \( f \), of \( Y_1 \). So annual education costs in Period 1 comprising both income forgone and fees are \( Y_1(1 + f) \). Expressed as a cost annuity payable over \( n \) years, its present value is

\[ C_1 = K_1Y_1(1 + f). \] (3)

Likewise, the present value of the annuity of \( Y_1 \) which is forgone by the graduate for \( R-n \) years over Period 2 is

\[ C_2 = K_2Y_1/(1 + i)^n. \] (4)

The benefit of higher education is that it provides an annual income or benefit annuity of \( Y_2 \) in the second period for \( R-n \) years. By analogy with \( C_2 \), this has a present value of

\[ B_2 = K_2Y_2/(1 + i)^n. \] (5)
In equilibrium, when benefits match costs, the gain of $B_2$ is equal to the sum of the cost components $C_1$ and $C_2$. Then the ratio of the income of university graduates to that of high school graduates, $Y_2/Y_1$, is at the required level. Call this the required return ratio,

$$y^* = 1 + K(1 + f),$$

(6)

where $K$ is a composite capitalization factor

$$K = (1 + i)^n \frac{K_1}{K_2}$$

$$= \frac{[(1 + i)^n - 1](1 + i)^{R-n}}{[(1 + i)^{R-n} - 1]},$$

(7)

which has a constant value of $(.1507) (.18099) (.25119)$ for $i = .02 (.03) (.05)$, $n = 4$, and $R-n = 40$.

In the limiting case, where $R$ is infinity, and $K$ simplifies to $(1 + i)^n - 1$, the implicit annual discount rate corresponding to the required return ratio is simply

$$i^* = \left[\frac{(y^* + f)}{(1 + f)}\right]^{1/n} - 1.$$  (8)

For example, this has a value of $.0746$ for $y^* = 1.5$, $f = .5$, and $n = 4$: a required return ratio of 1.5 implies that students are discounting future costs and returns from higher education at a rate of 7.46 per cent per annum. Otherwise, when $R$ is less than infinity, the solution for $i^*$ is very complicated (and less than $.0746$ for $y^* = 1.5$) and that is why it is convenient to focus on $y^*$ rather than $i^*$.

As a rough check on the realism of the model, assume a discount rate of $.02 (.03) (.05)$, and that tuition costs are in the region of one half of forgone earnings. This assumption is based on first, an unskilled school leaver wage of $10 per hour or $20000 per annum and second, full tuition costs being in the region of $10000 as indicated by the charges on overseas students and by Brennan (1988, Table 1) [which is a revision of Throsby (1986, Table 1)], inflated by 1.36 which is the rise in academic salaries since 1987. Then the required return ratio (four year degree) would be $1.226 (1.271) (1.377)$.

These theoretical returns are only slightly lower than those indicated by current US data - the ratio of the average income of US college graduates (four year degree) to that of
high school graduates is in the region of 1.5 [Averett and Burton (1996)] - but it must be remembered that the model is so far free of any tax and capital market distortions which would raise the return required from education. Moreover, the actual return ratio will vary with the age and income profile of college and high school graduates in any given population. For Australia, Borland (1996, Table 2) calculates that in 1989/90 within the age group 15 to 24 years the ratio of graduate income to the income of those not having completed high school was 1.74 and 1.5 for males and females respectively.

The model implies that the relative importance of Period 1 and Period 2 costs in higher education is

\[ \frac{C_2}{C_1} = \frac{1}{(1 + f)K}, \]  

which is 4.4 (3.7) (2.7) for \( i = .02 (.03) (.05) \) and \( f = .5 \): Period 1 costs represent 18 (21) (27) per cent of total costs, of which tuition costs are assumed to be at most one third or 6 (7) (9) per cent. It follows that if the external benefits of higher education are no less than 6 (7) (9) per cent of the private benefits, the HECS contribution which would compensate for them by lowering the required rate of return is zero or negative. In other words, HECS has small leverage over distortions such as externalities and tax progression which persist over the working life of graduates. So, apart from compensating for non deductibility, its main justification would appear to lie in compensating for the capital market imperfections which inappropriately deter borrowing to pay fees.

3. The Impact of Non Deductibility of Fees on the Required Return Ratio and the Appropriate HECS

3.1 Summary

This section calculates the increase in the required return which results from taxing graduate income without allowing any deduction for the tuition fees required to qualify for that income. Because fees are a small proportion of total costs and benefits, the effect of non deductibility on the required return is small. For example, a tax rate in the region of .2 raises the required return by only about 2 per cent. So the HECS contribution which would compensate for this small distortion is a correspondingly small discount on full tuition costs. This conclusion does not depend on the assumptions of the model.
I define the HECS ratio as the proportion of the full costs of tuition which students are required to pay "up front". With a tax rate of $t - .2$ and immediately deductible fees, the net cost of fees to students would be $(1 - t) - .8$ in the dollar. Thus a HECS ratio of $(1 - t)$ or $.8$ of full fee costs is sufficient to simulate immediate tax deductibility. Because the duration of courses is short relative to working life, the "up front" HECS contribution which simulates a different tax regime which defers the deductibility of fees until the time of graduation is not significantly higher than this.

On the other hand, a HECS contribution which is itself deferred until a benchmark level of income is reached after graduation should have a significant loading in order to have the same present value as an "up front" contribution. The existing discount of 25 per cent for "up front" payment implies a loading of 33 per cent for delayed payment. The analysis shows that, at a discount rate of $.05 (.03) or less, the appropriate loading for payments which are deferred less than 4 years after graduation from a 4 year course is less than 31 (18) per cent. Hence a flat loading of 33 per cent which is paid within 4 years of graduation imposes an excessive charge on those who are excluded by family circumstances and lack of access to the capital market from "up front" payments. The first step in rectifying that situation is simply to express the HECS payment in terms of an "up front" requirement because this has an unambiguous present value. Presently, HECS is expressed as a deferred payment at an unspecified time, and the present value of the payment depends on when it is paid.

3.2 Inserting the Tax Regime and HECS into the Model

These conclusions are derived by introducing both income taxes and HECS into the analysis. First consider proportional income taxes at rate $t$, and make fees immediately deductible at this rate (as for R and D), so that the net cost of fees is $F(1 - t)$. Then all of the above annuities and their present values $C_1$, $C_2$, and $B_2$, are scaled down by $(1 - t)$, and the required return is unchanged by the proportional tax with immediate deductibility.

For comparison, consider the impact on the required return of fees being undeductible (subscript $u$), combined with a proportional tax on income. Because $F = fY_1$ is no longer deductible, the value of the post tax cost annuity in Period 1 increases from $(1 - t)(1 + f)Y_1$ to $(1 - t + f)Y_1$. This is an absolute increase of $tfY_1$ and a proportional increase of $tf/[1 - (1 - t)(1 + f)] = .0833$ for $t = .2$ and $f = .5$. And because the capitalization factor is unchanged, this is also the proportional increase in the present value of cost Annuity 1 given by $C_1$ in (3) which is now
\[ C_{1u} = K_1 Y_1 (1 - t + f). \]  

(10)

For example, with the present value of Period 1 costs representing 18 per cent of total costs, a rise in \( C_1 \) to \( C_{1u} \) of 8.3 per cent with a tax rate of .2 raises the total costs and the required return by less than 2 per cent.

Again solving for the required rate of return through \( (4) \), \( (5) \) and \( (10) \) gives

\[ y^*_{u} = 1 + K(1 - t + f)/(1 - t) > y^*. \]  

(11)

With \( K = .18099 \), \( f = .5 \), and a tax rate of .2 (.25) (.3), the required return ratio rises slightly from 1.271 to 1.294 (1.302) (1.310), which is a rise of 1.9 (2.5) (3.1) per cent.

Now consider the HECS contribution which would compensate for the rise in the required return ratio due to non deductibility of fees, by creating the outcome which would prevail under immediate deductibility. HECS is also non deductible, but students pay only \( x_1 F \) \( (x_1 < 1) \) "up front", instead of \( F \): \( x_1 \) is the HECS ratio.

Substituting \( x_1 f \) for \( f \) in \( (11) \), the required return under non deductible HECS (subscript h) is

\[ y^*_{h} = 1 + K(1 - t + x_1 f)/(1 - t). \]  

(12)

To calculate the value of the HECS ratio which compensates for non deductibility, by simulating immediate deductibility (subscript md), set \( (12) = (6) \), and solve for

\[ x_{1*md} = (1 - t). \]  

(13)

The simple explanation for this result is that a non deductible, immediately payable fee of \( xF \) has the same present value as an immediately deductible fee of \( F(1 - t) \) when \( x = (1 - t) \), and this is the case for all \( f, n \) and \( i \): this result does not depend on the assumed values of these variables.

Suppose, on the other hand, that it were desired to give the cost of higher education the same tax treatment as financial assets and plant and equipment with deductibility being
deferred until the receipt of income in Period 2 (subscript dd). Under this regime capital expenditures are carried forward for tax purposes without interest. Thus at the end of Period 1 the amount of accumulated fees paid is \( nF = nF_Y1 \) and the corresponding capital value at this time of the tax deduction is \( tnfY1 \), payable as an annuity over \( R-n \) years. The present value of this tax deduction is simply \( tnfY1/(1+i)^n \). So with deferred deductibility the present value of Period 1 costs becomes

\[
C_{1dd} = C_{1u} - tnfY1/(1+i)^n = K_Y1(1-t+f) - tnfY1/(1+i)^n. \tag{14}
\]

Equating the sum of \( C_{1dd} \) and the post tax value of \( C_2 \) [derived from (4)] to the post tax value of \( B_2 \) [derived from (5)] gives the required return ratio with deferred deductibility

\[
y^{*dd} = 1 + K + Kf\{1 - t\left[\frac{tn}{K_Y(1+i)^n}\right]/(1-t)\}. \tag{15}
\]

To find the HECS ratio which creates this outcome, set (15) = (12) and solve for

\[
x_{1*dd} = 1 - itn/[(1+i)^n - 1], \tag{16}
\]

which differs from \( x_{1*md} \) by \( t\{1 - in/[(1+i)^n - 1]\} \) which is very small; for example, only .01 for \( t = .2, n = 4 \) and \( i = .03 \).

Now consider the possibility of deferring payment of HECS until period 2. This possibility of deferring payment, at least until graduation at time \( n \), is an essential feature of the Scheme, which provides the option of repayments which are contingent on the earning of income at a benchmark level. This reduces the risk of borrowing for higher education. However, as events have demonstrated, there remains "sovereign risk", because the authorities can change the benchmark.

To allow for a period of on-the-job training beyond time \( n \), which may be required to reach the benchmark level of income at time \( n' \), \( n' > n \), note that annual fees are incurred until time \( n \), but the HECS payment may be deferred until time \( n \) or beyond to time \( n' \).
Let the HECS ratio for deferred payment be $x_2$, ($x_1 < x_2 < 1$). The problem is to find the value of $x_2$ which is equivalent in its impact on the required return ratio to the impact of $x_1$.

If students are billed each year a HECS liability of $x_2fY_1$, this will accumulate to $nx_2fY_1$ at year $n$. If paid at time $n'$, it has a present value of $nx_2fY_1/(1 + i)^n$. By contrast, the present value of a HECS "annuity" payable "up front" in each of $n$ years is $x_1fY_1K_1$. The value of $x_2/x_1$ which equates the present values of these two forms of HECS is

$$x_2/x_1^* = \frac{(1 + i)^n' - (1 + i)^{n'-n}}{in}.$$  \tag{17}

For $i = .03$ (.05) and $n = n' = 4$, $x_2/x_1^*$ is 1.046 (1.078): the appropriate loading for payment deferred to graduation at time $n = 4$ is 4.6 (7.8) per cent. For $n' = 8$, the loading is 17.7 (31) per cent. Such loadings make the return required from higher education independent of whether students are required to pay "up front" or at time $n'$. The loading, however, is not known in advance, because time $n'$ is unknown.

The other feature of HECS is the ability to defer repayment, at zero real interest, beyond the time $n'$ that the benchmark level of income is reached. Zero interest beyone time $n'$ is not fundamental to the Scheme, in that real interest could be charged, by the Commonwealth or commercially, for deferral beyond time $n'$ and this would still preserve the income contingency of HECS loans.

In any case, this feature of a zero real interest penalty for deferral cannot readily be integrated into the income tax system which recognises nominal, not real, interest: the Commonwealth would be charging nominal interest equal to the rate of inflation and giving an equal tax deduction, so net of tax, a negative real interest rate would be charged.

4. The Impact of Tax Progression on the Required Return

4.1 Summary

As noted in the Introduction, tax progression impacts through the entire working life of graduates. This is because $Y_1$, the income of a high school graduate, is effectively deductible throughout working life, Period 2, at a lower tax rate than the rate applying to $Y_2$, the income of a college graduate. Moreover, $Y_1$ forgone in Period 2 represents about 80 per cent of the total cost and benefit of higher education. Tuition costs, on the other hand, are only about 6
per cent of the income from higher education, so even a zero HECS cannot compensate for a significant degree of tax progression, whether or not it is desirable to do so.

On the other hand, HECS can easily compensate for a minor distortion associated with tax progression. This minor distortion arises in a tax regime which is almost ideal, in the sense that it offers immediate deductibility for fees, but tax rates are progressive, so that graduate income is taxed at a higher rate than the rate at which tuition costs are deductible. This distortion is more or less specific to investment in higher education requiring the outlay of fees. It can be simply removed with a HECS ratio which is equal to the fraction of tuition costs which students would pay, net of tax, if full fees were deductible at the same rate at which graduate income is taxed. In Australia this tax rate is in the region of .25, so the corresponding HECS ratio is .75.

4.2 Modelling Tax Progression

To formally analyse the role of tax progression in the model let $Y_1$ be taxed at an average and marginal rate of $t_1$, and let $Y_2$ be taxed at a marginal rate of $t_2 > t_1$, and at an average rate of $t_2$ such that $t_1 = t_1' < t_2 < t_2'$. Then, with immediate deductibility of fees (deductible against $Y_1$ at rate $t_1$), the net annual cost of fees is $F(1 - t_1) = f(1 - t_1)Y_1$, while net income forgone is $(1 - t_1)Y_1$, so that the cost annuities (3) and (4) are both reduced by a factor of $(1 - t_1)$. On the other hand, the benefit annuity in (5) which derives from $Y_2$ is reduced by a greater factor of $(1 - t_2)$ because $Y_2$ is taxed at a higher average rate $t_2$. So with immediate deductibility and tax progression (subscript mp), the required return ratio rises to

$$y^{*}_{mp} = y^{*}(1 - t_1)/(1 - t_2) > y^*,$$  \hspace{1cm} (18)

where the ratio of the bracketed terms measures the degree of tax progression.

The minor effect of tax progression - fees being deductible at a lower rate than the income deriving from those fees is taxed - is more or less restricted to formal higher education, which involves tuition costs, as opposed to on-the-job training. On the other hand, taxing income forgone at a lower rate than the income gained is common with that part of on-the-job training involving trainees forgoing income. It was noted earlier that for a discount rate of .03, Period 1 costs emerge from the model accounting for about 21 per cent of total higher education costs, of which tuition costs are assumed to be at most one third ($f = .5$). So
about 7 per cent of the costs of tax progression can be traced to its minor effect, and 93 per cent to the second.

The extent of progression in the Australian personal income tax system is described by the following (Medicare inclusive) marginal tax rates and thresholds: .215, $5401; .355, $20701; .485, $38001. These rates imply that the average tax rate (t1) rises from about .19 at average yearly unskilled youth earnings of, say, $25000 to t2 = .245 when the "average" graduate's yearly earnings exceed $25000 by a factor, say, of .5 ($37500), corresponding to a required return ratio of 1.5. For illustrative purpose this can be taken to imply a degree of tax progression 1.073, so that tax progression (combined with immediate deductibility) would raise the required return from higher education by 7.3 per cent, of which 7 per cent is due to the minor effect, which thus raises the required return by only .5 per cent. While the total impact of tax progression on the required return is significantly higher than that of non deductibility of fees in the absence of tax progression, which was shown to be around 2 per cent for proportional tax rates in the region of .2 to .25, the minor effect is much less than this.

The order of magnitude of the lump sum payment which would be required to compensate for the major effect of tax progression can be indicated in the following way. In the Australian case the average tax rate rises from a base of .19 at earnings of $25000. So for every .01 increase in the average tax rate beyond .19 which is suffered by the investor in human capital, the rise in the annual tax burden is $250. Applying the relevant annuity capitalization factor from (1), which is 23.1 (17.16) for i = .03 (.05), the present value of this burden is $5775 ($4290). Clearly, to fully compensate for tax progression involving a rise in the average tax rate by five points from .2 to .25 would require that prospective personal investors in human capital would have to be given a lump sum grant of over $20000, which goes far beyond a simple fee subsidy scheme such as HECS. Fortunately, it is not necessary to be more precise about the extent of Australian tax progression and the transfers needed to compensate for it because it is not specific to graduates from full time higher education.

In the case of the minor effect of tax progression, practical compensation means allowing a tax deduction for fees at the same rate as the average rate t2 at which the income from higher education is taxed, so that the present value of the net cost of fees per dollar of the present value of net income derived from fees -

\[ K(1 - t_2)fY_1/[K(1 - t_2)Y_2]/(1 + i)^n = KfY_1/Y_2 \] - is independent of tax rates.
To derive the required return under partial compensation for tax progression (subscript \( ptp \)), note that the present value of forgone income is \((1 - t_1) Y_1[K_1 + K_2/(1 + i)^n]\); the present value of net fees is \(K_1(1 - t_2)fY_1\); and the present value of graduate income is \(K_2(1 - t_2)Y_2/(1 + i)^n\). The required return then becomes

\[
y^*_ptp = (1 + K)(1 - t_1)/(1 - t_2) + fK. \tag{19}
\]

When this is simulated by non deductible HECS at rate \(x_1f\), the present value of net fees becomes \(K_1x_1fY_1\), and the HECS ratio which provides partial compensation for tax progression is simply

\[
x_{1*ptp} = (1 - t_2), \tag{20}
\]

where \(t_2\) is the average tax rate which is expected to be paid by graduates over their working lives.

This is the HECS ratio which simulates immediate deductibility of fees within a progressive tax system, correcting the distortion arising from the difference between the tax rates at which graduate income is taxed and at which fees would be deductible. Obviously, it is independent of discount rates, the relative importance of tuition fees, and the degree of tax progression.

Table 1, following, indicates that the mean income for those holders of bachelors degrees earning between $20000 and $70000 in 1991 was $39000. Allowing for inflation of salaries since that time, the Australian tax scales the average tax rate on incomes in the range $40000 to $50000 is between .25 and .28. This implies a HECS ratio of .75 to .72.
5. Conclusion
The most obvious deficiency of HECS is one which is easily rectified and that is its definition: HECS is defined in terms of a real burden at an unspecified time so its present value is ambiguous, depending on the time that the debt is paid. If HECS were defined in terms of a required "up front" payment, the loading for deferred payment could be determined in a way which did not unduly penalize those choosing, or being forced to choose, that option, this choice being fundamental to the Scheme.

Equally fundamentally, the Australian income tax system discriminates against that component of investment in human capital which generates taxable income, through its failure to allow tuition as a deduction against that taxable income, and through income tax progression. The Australian tax scales inserted into the model suggest that the first distortion would raise the return required of such investment by about 2 to 3 per cent. Whether the benchmark is immediate or deferred deductibility, HECS would fully compensate for non deductibility by charging a proportion of the full average costs of tuition, depending on the average tax rate of young high school graduates engaged in full time work. Data from the 1991 census suggest that this income was in the region of $25000 in current dollars, attracting an average tax rate of .2, so that the appropriate HECS ratio would be in the region of .8.

On the other hand, HECS is not an appropriate instrument to compensate for income tax progression for two reasons. First, HECS is restricted to the fee paying higher education sector, which accounts for only part of investment in human capital which suffers from tax progression. Second, it is essentially a scheme for subsidizing fees, and over 90 per cent of the distortion which is imposed by tax progression is unrelated to the tax treatment of fees. The relatively small distortion associated with the effect of tax progresssion on the value of the tax deduction for fees can be compensated by simply basing the HECS ratio on the average tax rate of graduates of fee paying institutions. The 1991 census of graduate incomes and the Australian tax scales imply an average tax rate on graduate income in the region of .25 to .3. This indicates an upper limit for the HECS ratio of something like .7. Based on average tuition costs [Brennan (1988, Table 1), inflated by 1.36, the rise in academic salaries since then], the 1997 HECS ratios are far below this level, .36 for band 1, .3 for band 2, and .43 for band 3.

As in the case of tax progression which has effects over graduates' working lives, HECS has very limited capacity to appropriately lower the return required from higher education in the face of externalities, because of the insignificance of tuition costs relative to
the life time private and social benefits of higher education. Accordingly, if HECS were to be used to compensate for externalities, it would be easy to justify a zero HECS ratio, because a subsidy of this magnitude would be required to capture external benefits amounting to as little as 6 per cent of the private benefits.

If there are in fact significant externalities beyond this level, they cannot be dealt with by HECS. However, given the presence of these externalities and the absence of other fiscal compensations for them, a zero HECS would be a second best. In a world where externalities were otherwise dealt with satisfactorily, the role of HECS would be simply to compensate for non deductibility, in which role its appropriate value is relatively high at .75, and for those capital market imperfections, yet to be quantified, which inappropriately deter borrowing from capital markets to finance investment in higher education.
References


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