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Do Very High Tax Rates Induce Bunching? Implications for the Design of Income-Contingent Loan Schemes

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ABSTRACT

We test whether very high marginal tax rates affect taxpayer behaviour, using a unique policy. Under the Higher Education Contribution Scheme – an income-related university loans scheme in Australia – former students with a debt face a sharp discontinuity. At the first repayment threshold they are required to repay a percentage of their entire income, resulting in an effective marginal tax rate that could be regarded as being as high as 76,000 percent. We formally model the taxpayer decision, and then use a sample of taxpayer returns provided to us by the tax office to investigate whether taxpayers bunch below the repayment threshold. We find a statistically significant degree of bunching below the threshold, but the effect is economically small. On net, we estimate that both the deadweight cost and the budgetary loss are less than A$1 million per year, a small fraction of the amount annually repaid through the Higher Education Contribution Scheme. The result has an important implication for the design of income contingent loans for higher education, such as those being introduced in the UK for tuition in September 2006. This is that it is possible to design arrangements in which the first income threshold of repayment is apparently high, but which are still able to deliver relatively high revenue streams in the early stages of income contingent policy reform without important tax payment avoidance consequences. Our findings also reinforce earlier research suggesting only minimal bunching around kink points in taxation schedules.

JEL Classification: H31, H52

Keywords: bunching, marginal tax rates, responses to taxation, income-related loans

1. Introduction

In many developed countries the taxation system is increasingly being used for purposes that were not envisaged a generation ago. Earned income tax credits, education credits and child credits are among the programs that have been introduced or expanded in many developed countries over recent years. In some nations the taxation system has also been used to collect non-custodial parent child support payments and to recover student loans.[1]

While the taxation system can be an efficient way of means-testing various benefits and payments, using it in this way may create high effective marginal tax rates at certain points in the income structure. In this paper, we address the question: to what extent do significant discontinuities in the tax schedule affect taxpayers' behaviour through their effect on disposable incomes?

To address this question we are fortunate to have at our disposable possibly the largest policy-induced distortion of this kind ever experienced in any country – the repayment threshold associated with the collection of Australia's income contingent charge for higher education tuition, known as the Higher Education Contribution Scheme (HECS). In the most recent year covered by our study, the disposable income of a person earning precisely the repayment threshold amount would be $760 lower than a person earning $1 per annum less than this repayment threshold. Although a precise modelling of the effect of this threshold depends on various parameters, one way of regarding this discontinuity is as a 76,000 percent marginal tax rate.

Relatively little research has focused on the impact of sharp discontinuities in the taxation schedule on behaviour. Most relevant to our analysis is the work of Saez (2002) who explores whether taxpayers bunch just below "kink points" in the US tax schedule. Using microdata from US tax returns over the period 1960-97, Saez finds evidence of bunching

[1] A system to collect non-custodial parent child support payments through the taxation system was introduced in Australia in 1987. Countries that use the tax system to recover student loans include Australia (1989), New Zealand (1991), Ethiopia (2002) and the United Kingdom (introduced in 1997 for income support and expanded considerably in 2005 to cover tuition). The governments of Thailand and Israel have recently passed legislation allowing their taxation systems to collect student loans in the near future.

at the first tax bracket, which for much of the period he analyses represents an increase in the effective marginal rate from zero to 15 per cent. He finds little evidence of bunching at other tax brackets, or around the Earned Income Tax Credit's various kink points. Other US studies find modest evidence of bunching. For example, Burtless and Moffitt (1984) and Friedberg (1998, 2000) find some bunching for elderly US workers who are working and receiving social security benefits; while Blundell (2001) and Blundell and Hoynes (2001) find some bunching just above the first eligibility threshold for the UK equivalent of the earned income tax credit.[2]

Our paper focuses on a kink point that is many orders of magnitude higher than any covered in previous studies. Using a sample of tax returns from young workers, we compare the distribution of taxpayers affected by the kink point (that is, with a HECS debt) with those not affected by the kink point (that is, without a HECS debt). To preview our findings, we observe a small but significant degree of bunching at the repayment threshold. The budgetary cost and the deadweight loss resulting from this substantial discontinuity in the taxation schedule appear to be relatively small. We conclude that even an extremely high marginal tax rate seems to have a surprisingly small impact on behaviour.

The remainder of this paper is structured as follows. Section 2 outlines the HECS system focusing on the nature and importance of the repayment threshold, and provides a conceptual discussion of some of the behavioural issues pertinent to calculations of effective marginal tax rates in the HECS context. In Section 3 we describe the data, explain our method for determining the extent of bunching, present the econometric results and offer some robustness checks. In Section 4 we examine the policy implications of the results, with respect to both budgetary and deadweight costs. The final section concludes with a discussion of the relevance of our findings for the design of

[2] In the Australian context the only other relevant study is Braithwaite and Ahmed (2005), who survey a sample of graduates concerning their attitudes to HECS and the taxation system. They find a positive correlation between an 8-item scale of attitudes towards HECS repayment and another 8-item scale of attitudes towards paying one's income tax. From this they conclude that the introduction of HECS has the potential to undermine confidence in the taxation system. If this conclusion is true an implication is that we should observe bunching below the HECS repayment threshold.

income contingent loan schemes and the relevance generally of very high effective marginal tax rates for government budgets and labour supply behaviour.

2. The Higher Education Contribution Scheme and Effective Marginal Tax Rates

2.1 Some Conceptual Issues Concerning Calculations of Effective Marginal Tax Rates

A major advantage of our exercise is that we are able to explore empirically the effects of an extraordinary high effective marginal tax rate, which is that associated with the repayment of Australia's income contingent charge for higher education. An important point is the recognition that there is a potentially significant difference for behaviour with respect to the repayment of an income contingent loan and that associated with high effective marginal tax rates resulting from the interaction of income tax payments and the withdrawal of social security (or earned income tax) benefits. In this section the importance of this difference, and its relevance for the calculation of effective marginal tax rates, is explained, and a model is presented with respect to the costs and benefits of repayment avoidance.

We conclude in this section that the HECS arrangements: when their implications for debtors are calculated properly, suggest extremely high, indeed unprecedented, costs for taxpayers from earning even small amounts above a particular income level; are an unusual, yet still highly relevant, basis for an exploration of the behavioural consequences of very high effective marginal tax rates; and, that there are important broad lessons to be learned from the tests of the effect of HECS on bunching. The modelling exercise sets the scene for the empirical analysis reported and interpreted in a policy context in sections 3 and 4 respectively.

2.2 HECS described

In 1989 the Australian government introduced the world's first income contingent charge system using the taxation system as the collection mechanism. It is well known that government intervention of some kind is necessary to solve the essential capital market problem associated with the provision of bank finance for human capital investment, and the issue can be traced as far back as Friedman (1955). However, a relatively recent literature (Barr, 1989; Barr, 2001; Chapman, 1997; Chapman and Ryan, 2005) promotes the use of income contingent collection mechanisms for student loans, in which the debt is repaid if and only when a former student is receiving a relatively high income. Thus if an individual experiences economic adversity in the future no loan repayments are required at that time, and this feature of income contingency provides the twin insurance benefits to borrowers of default protection and consumption smoothing (Chapman, forthcoming 2006).

HECS works as follows. Upon enrolment a higher education student faces the choice of paying the year's tuition charge up-front and receiving a 25 per cent discount, or contracting to pay later through the income tax system with repayments depending on the annual level of the debtor's personal income. The nominal value of the stock of an individual's debt is indexed to the Consumer Price Index, meaning that the real rate of interest on HECS debt once it is incurred is set at zero. The discount associated with the up-front payment implicitly means that there is in effect a real rate of interest on the debt, since those choosing to pay later begin with a higher level of real debt than those choosing to pay up-front.

With HECS no repayments are required until the former student receives a minimum annual income, which in the early 2000s was set at around $A25,000.[3] To ensure that the loan is repaid relatively quickly, the system is designed such that once a taxpayer's earnings exceeds the income threshold for repayment, she is required to pay a percentage

[3] At the current exchange rate this is about $US19,000. Our sample covers the tax years 2001-02, 2002-03 and 2003-4. In 2004-05, the repayment threshold was lifted to $35,001, but the sharp discontinuity still exists (indeed, it is now larger than in the years upon which we focus).

of her *entire* taxable income, not merely a percentage of the amount exceeding the threshold.[4] Consequently in 2003-04 (the most recent year covered in our study) a taxpayer with a HECS debt who earned over $25,348 was required to pay 3 percent of her total taxable income towards repayment of HECS debt, meaning that the disposable income of a person earning the threshold level of income would be $760 lower per annum than a person earning $1 per annum under this repayment threshold.[5]

To illustrate these relationships Figure 1 shows the effect of the repayment threshold for two taxpayers – one with a HECS debt, and one without. Over the range of the HECS threshold, a taxpayer without a HECS debt is subject to the marginal rate of income tax, which is 30 percent at the threshold.[6] By contrast, a taxpayer with a HECS debt experiences an actual decrease in disposable income at the repayment point, which is both very large and covers a substantial range. For example, in 2003-04 a taxpayer with a HECS debt must earn an additional $1135 in order to have the same disposable income as individuals earning just below the repayment threshold. This means that in 2003-04, a taxpayer with a HECS debt had the same current disposable income at $25,347 per annum as if she earned $26,482 per annum.

Using the traditional calculation of the impact of earning an additional dollar on disposable income at the threshold implies an effective marginal tax rate of 76,000 percent, an extraordinarily large figure for public policy analysis and debate in this area. To put this in context, the highest top marginal personal income tax rate among OECD

[4] There is a slight difference between general taxable income and the taxable income definition used for HECS purposes (which the ATO terms "repayment income"). Repayment income is equal to taxable income plus any deductions for reportable fringe benefits and net rental losses. For those workers in our empirical analysis (aged 21-30), we assume that these amounts are trivial, and therefore do not take them into account. It is unlikely that this assumption biases our results, since the ATO has merely removed two categories that taxpayers might have exploited to bring their taxable income below the threshold.

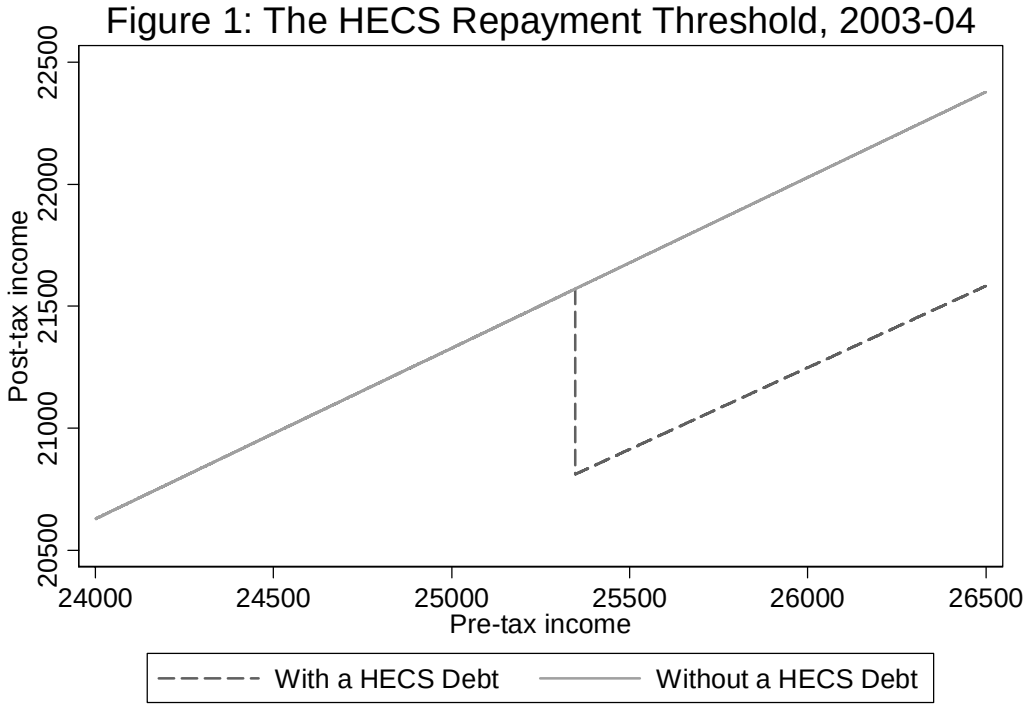
[5] The HECS system has several repayment rates, and the points at which they increase are often termed "repayment thresholds". For simplicity, throughout our paper we use the term "repayment threshold" to refer to the first repayment threshold.

[6] For simplicity, we ignore in this example the Medicare levy, which depends on the income of the taxpayer's spouse and the number of dependent children. For a single taxpayer with no dependent children, the Medicare levy would raise the marginal tax rate by 1.5 percent in the income range discussed in the example. The Medicare levy does not interact with HECS repayment provisions.

countries is 70 percent, while the maximum effective marginal tax rate due to benefit withdrawal is 100 percent.[7]

However, the next section explains that for various reasons there is quite a different way of interpreting the effective marginal tax rate of the HECS arrangements, and it is pointed out that the traditional calculation has the potential to exaggerate the effective marginal tax rate at the threshold. But even with a more informed set of calculations we conclude that a policy designed to collect obligations from citizens on the basis of a percentage of *total* income above a first threshold still has an extremely large impact on their contemporary disposable incomes. This is why the example is highly pertinent for an exploration of the behavioural and budget consequences of effective marginal tax rates.

Figure 1: The HECS Repayment Threshold, 2003-04



[7] Top tax rates are for 2004, from the OECD Tax Database, Table I.4 (www.oecd.org). Benefit withdrawal rates are for 2003, from Whiteford (2005, Table 6).

2.3 Understanding HECS effective marginal tax rates: loans still have to be repaid

In the above discussion we reported that treating the HECS repayment threshold in the same manner as one would normally calculate effective marginal tax rates results in a tax rate of approximately 76,000 percent. However, there is a different way of interpreting effective marginal tax rates in the context of HECS, for several reasons. A major issue is that the avoidance of a loan repayment in a particular period would generally mean that there is a deferral only of the obligation, not a one-off benefit. After all, for most debtors the total loan still has to be repaid in the future[8].

It is instructive to illustrate the importance of the deferral of the repayment of an income contingent loan in the context of the possible role of effective marginal tax rates in order to highlight the extent to which our application is useful. Consequently we now present a simple model designed to illustrate what the true effective marginal tax is for HECS.

The assumptions used for our illustration are based very approximately on the 2003-04 tuition arrangements for HECS. They are as follows:

(i) After graduating from university the individual has accumulated a total HECS debt of $4560;[9]

(ii) The debt has a real interest rate of zero, meaning that the nominal level of the debt is increased every year by the CPI;

(iii) The graduate is able to avoid having a taxable income above the income threshold of repayment for one year only;

(iv) The graduate expects to receive $25,348 in real terms per annum for the next seven years;

[8] Harding (1995) has estimated that around 80 per cent of HECS debtors will pay back in full, and about half of the remaining 20 per cent will repay at least half of their debt.

[9] This would be a typical debt for a former student with a three-year degree who had paid for one year of tuition up-front (thus not incurring a HECS debt for this year). While many students would have higher debts than this, the example is illustrative.

(v) The graduate is obligated to repay 3 per cent of $25,348 ($760) towards her HECS debt. Only in the 1st year can she potentially avoid this repayment. If she does so, that payment is moved to the 7th year;

(vi) The graduate has a discount rate of 5 per cent per year.

To illustrate the consequences for the avoidance of repayment of the HECS debt for effective marginal tax rate the present value of repayments (calculated at the point of graduation) for two scenarios can be compared. The first calculation involves the debtor not engaging in behaviour to avoid the repayment of her debt in the first period after graduation. In this case, the present value of the stream of repayments is given by the addition of the discounted costs of the debt from years 1 to 6 after graduation:

$$PV\ (1) = 760 + 760/(1.05) + \ldots + 760/(1.05)^5$$
$$= \$4050$$

The second calculation involves the debtor engaging in behaviour that results in her decreasing her taxable income in the first period from $25,348 per annum to $25,347 per annum, which means that she then has no HECS repayment obligations in the first period, and accordingly, a (highly discounted) additional HECS repayment in the 7th period after graduation. The present value of her HECS repayment obligations are thus given by the sum of the discounted costs of the debt from years 2 to 7 after graduation:

$$PV\ (2) = 0 + 760/(1.05) + \ldots + 760/(1.05)^6$$
$$= \$3857$$

The difference in the present value of the streams is $193, which means that the additional dollar earned for scenario (1) has the present value costs of $193, or an effective marginal tax rate of 19,300 per cent. While this is lower than the traditional calculation of 76,000, it still is very significantly higher than any other effective marginal tax rate calculations for other combinations of tax and welfare policies. It should be noted that the example assumes a particularly unusual case – in which the taxpayer's taxable

income is precisely at the HECS repayment threshold. The next section models formally the cost of avoidance in a broader framework.

2.4 Modelling the HECS repayment avoidance decision

What now follows is the modelling of the benefits and costs relevant to the individual's decision to avoid the repayment of HECS. It is further assumed that if the taxpayer avoids, avoidance occurs only for one year, being the year in which the debtor first would have crossed the first income threshold of repayment if he or she had not chosen to avoid.

Non-repayment of HECS for the period has a benefit and a cost. The benefit is that in the current period the debtor is able to transfer the obligation to the future, and exists because there is no real rate of interest on the debt and people have positive discount rates. This benefit can be expressed as the present value of the difference between what the debtor would pay without avoidance and what the debtor would pay given avoidance. Symbolically, let $NEHECS_i$ equal the present value of the cost of the non-avoidance of repayment by taxpayer i in period t and $EHECS_i$ = the present value of the cost of repayment of HECS given the avoidance of payment in period 1. The benefit is thus:

$$NEHECS_{it} - EHECS_{it} \qquad (1)$$

It is useful to break this down further, into the payment avoided in the first period (we will call this $HECSA_{i1}$) and the discounted value of the deferred payment once it is eventually made (we will call this $EHECSA_{it}$).

The value of the payment avoided in the first period is the product of the repayment rate r and taxable income before the avoidance strategy is used, TIBA. We assume that TIBA is a function of a vector of inherent characteristics Z (encompassing experience, education and ability) and a normally-distributed error term ε.

$$HECSA_{i1} = rTIBA(Z_{it},\varepsilon_{it}) \qquad (2)$$

In the example in Section 2.3, the taxpayer's income before avoidance was precisely the repayment threshold. Using the parameters for tax year 2003-04, we found that $HECS_{i1}$ = \$25,348*0.03 = \$760. Here we take account the possibility that the taxpayer's income is above the repayment threshold. This will increase both the benefits and costs to avoiding.

A way to consider $EHECSA_{it}$ is that it is a payment to be made eventually, the benefit to the debtor being that in period 1 the future obligation has the value of being discounted. Thus, where d is the personal rate of discount (which varies across individuals, but not across time), and n is the number of years it takes for the postponed debt to be paid:

$$EHECSA_{it} = HECSA_{1t}/ (1 + d_i)^n \quad (3)$$

The benefit of repayment avoidance is thus given by:

$$HECSA_{i1} – EHECSA_{it} \quad (4)$$

In the example set out in Section 2.3, d = 0.05, n = 6, $HECSA_1$ = 760 and consequently $EHECSA_{it}$ = \$567. Thus the benefit of avoidance ($HECSA_{i1}$ – $EHECSA_{it}$) was \$760-\$567=\$193.

Avoiding also has a cost. This takes the form of the debtor needing to find a mechanism or mechanisms to reduce taxable income below the threshold once it is expected that income would reach the threshold. There are several ways in which this might be done. The taxpayer might reduce his or her labour supply, might hire an accountant to find additional deductions, or might purchase deductible items.[10] For simplicity, these costs

[10] We assume that the cost of avoidance is net of income tax savings. For example, suppose an individual's pre-tax income is \$1000 above the threshold, the individual must pay an accountant \$500 to reduce their tax liability by that amount, and the regular income tax rate in this range is 30 percent. If the individual did not avoid, they would receive \$700 more than the threshold (\$1000 minus \$300 in regular income taxes). By avoiding, the individual must pay the accountant \$500, but he or she also saves \$300 in income taxes. So the net cost of avoiding is \$200. Thus a=200/1000=0.2. In the example in Section 2.3, the taxpayer's

are assumed to be proportional to the reduction in taxable income. We term the cost of avoidance a, and assume that it lies between 0 and 1, and is constant across taxpayers and over time.

Assuming that the taxpayer's income exceeds RT, the HECS repayment threshold in year t. Where TIBA>RT, we can model CA, the total cost of avoidance as:

$$CA_{it} = a[TIBA(Z_{it},\varepsilon_{it}) - RT_t] \quad (5)$$

With expressions for both the benefits and costs we are now able to show the conditions under which a debtor will choose to avoid.

Generally, repayment avoidance will occur when:

$$HECSA_{it} - EHECSA_{it} - CA_{it} > 0 \quad (6)$$

Substituting from equations (2), (3) and (5), a taxpayer will avoid if:

$$rTIBA_{it} - rTIBA_{it}/(1 + d_i)^n - a(TIBA_{it} - RT_t) > 0 \quad (7)$$

Thus, avoidance can be shown to more likely: the higher is r (since the benefit is higher for any given TIBA, given that $r>r/(1+d)^n$); the higher is d (since as d increases the less negative $r/(1+d)^n$ becomes; the higher is n (since this lowers the present value of the deferred repayment); and the lower is the per-dollar avoidance cost a; and the higher is RT (since aRT is always positive). The effect of TIBA on avoidance is in principle ambiguous. If $a>r-r/(1+d)^n$ then avoidance will be more likely the lower is TIBA, while if $a<r-r/(1+d)^n$ then avoidance will be more likely the higher is TIBA. In practice, we expect the former to hold in almost all cases, and thus avoidance to fall as TIBA rises.

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pre-avoidance taxable income was precisely the repayment threshold amount, so the amount of income tax saved was zero.

Many of these parameters are not observable in the available data, but the essence of equation (7) can be made operational with the information provided. The data are described and the econometric method are now considered.

3. Empirical Findings: How much bunching is there?

3.1 The data

In order to focus precisely on behaviour around the repayment threshold, it is necessary for us to use data that identify an individual's taxable income (total income minus deductions). For this reason, administrative data are preferable to survey data, since they allow us to pinpoint taxpayers who are very close to the threshold. We therefore obtained a representative sample of confidentialised tax returns from the Australian Tax Office (ATO). Australia does not have a standard sample of tax returns that are made available to researchers.[11] Therefore our data were extracted specifically for this project by the ATO. To our knowledge, this is the first time that the ATO has made taxpayer records available to economists.

The tax year in Australia runs from 1 July to 30 June, and all taxpayers file as single individuals (as in the United Kingdom). Our extract consists of 5000 taxpayers in each of the tax years 2001-02, 2002-03 and 2003-04. All respondents are aged between 21 and 30. Half of the respondents (2500 in each year) have an outstanding HECS debt, while half do not. Our total sample comprises 15,000 taxpayers. Our dataset contains information on taxable income, whether or not the person has an outstanding HECS debt (and the size of that debt), age, gender, and marital status.

This information allows us to construct what we call a "treatment group" (taxpayers with a HECS debt), and a "control group" (taxpayers without a HECS debt). Members of these groups are not completely distinct with respect to ever having had HECS obligations,

[11] Unlike, for example, the United States Individual Income Tax Public Use Sample, or the Canadian Longitudinal Administrative Databank (LAD).

since many of those in the control group may have a university degree gained after the introduction of HECS and could have paid their tuition up-front, while others might have graduated with a debt which has been paid in total by the time of the survey.

Crucial to our analysis is the HECS repayment threshold. This is the point at which taxpayers with a HECS debt become liable to repay 3 percent of their total earnings (not merely their earnings above the threshold), hence creating a sharp discontinuity. This threshold is $23,242 in 2001-02, $24,365 in 2002-03, and $25,348 in 2003-04. In each of these years, the marginal tax rate at the repayment threshold point (ie. the marginal tax rate paid by the control group) is 30 percent.

Table 1 presents summary statistics for the two groups. Members of the treatment group tend to have lower earnings than the control group, are more likely to be female, and less likely to be married. Note that for our purposes, it does not matter that the two groups are exactly the same – merely that their distribution around the kink point is similar.

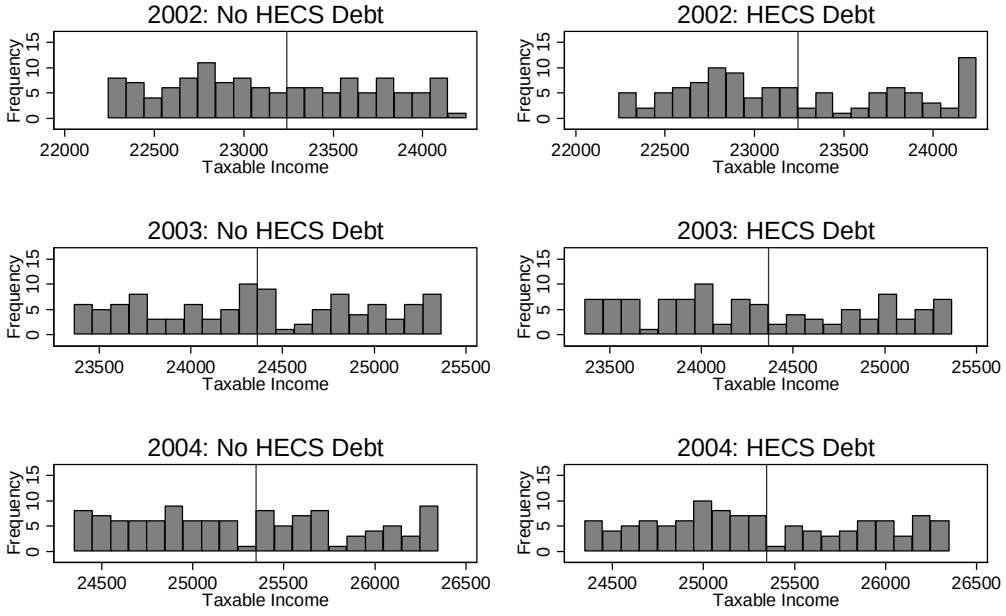
Table 1: Summary Statistics

	Control Group		**Treatment Group**	
	Mean	SD	Mean	SD
Taxable Income ($)	25743.39	17942.79	20239.42	25890.35
HECS Debt ($)	0	0	11578.91	7472.81
Age (years)	25.82	2.87	25.20	2.65
Female	0.44	0.49	0.59	0.49
Married	0.21	0.41	0.13	0.34

Note: Number of observations is 7500 for the control group, and 7500 for the treatment group. In each case, one-third of the observations are from the tax years 2001-02, 2002-03 and 2003-04.

Figure 2 shows the distribution of the two groups in the range of $1000 below to $1000 above the HECS repayment threshold. Given that we are focusing on a narrow range of earnings, we should not expect to see substantial differences in the distributions over such a narrow range. Although we do not observe substantial bunching, there are noticeable differences between the three panels on the left (control group) and the three panels on the right (the treatment group). While the control group are evenly distributed over the range, the treatment group are discernibly bunched below the HECS repayment threshold.

Figure 2: Taxable Income Distributions Within $1000 of the Repayment Threshold. Vertical line denotes repayment threshold



3.2 The method

To formally test for bunching, we pool taxpayers from the three years, and compare the proportion of taxpayers on either side of the repayment threshold for the treatment group and the control group. Where *Below Threshold* is an indicator variable denoting whether individual i in group j in year t is above or below the taxable threshold for that year, *HECS Debt* is an indicator variable denoting whether the individual has an outstanding HECS debt, Z is a vector of individual characteristics (gender, marital status and age), and δ are indicator variables for the different tax years used in this study, we estimate the following probit regression:

$$I^{\text{Below Threshold}}_{ijt} = \alpha + \beta I^{\text{HECS Debt}}_{ijt} + \gamma Z_{ijt} + \delta_t + \varepsilon_{ijt} \qquad (8)$$

In each case the sample is restricted to a given "window" around the HECS repayment threshold. In successive specifications, we expand this window from $200 to $1000.

Our approach relies on the assumption that in the absence of HECS, young adults with a HECS debt would have the same distribution around the repayment threshold as young adults without a HECS debt. By including demographic and time controls, we aim to take account of additional factors that might affect the shape of the earnings distribution around the repayment threshold.

This strategy allows us to discern the extent of bunching. If taxpayers in the treatment group do not attempt to reduce their taxable income so that they are below the repayment threshold, we should expect the distribution for the treatment and control groups to be identical, and hence $\beta=0$. If taxpayers in the treatment group "bunch", then we should expect $\beta>0$.

3.3 Results

Table 2 shows the results from this exercise. Panel A is shown without any demographic or time controls – and is akin to a comparison of the means for the dependent variable in the two groups. Panel B then includes a full set of controls: gender, marital status, interactions between gender and marital status, an indicator for age, and an indicator for the tax year.

Table 2: Formal Tests for Bunching

Dependent Variable: Indicator for Taxable Income Being Under the HECS Repayment Threshold

	(1)	(2)	(3)	(4)	(5)
	Panel A: Without controls				
Distance from threshold	±$200	±$400	±$600	±$800	±$1000
HECS Debt	**0.187****	**0.212*****	**0.139*****	**0.095****	**0.053**
	[0.087]	**[0.060]**	**[0.049]**	**[0.043]**	**[0.039]**
Observations	126	253	395	517	663
Pseudo R^2	0.026	0.034	0.015	0.007	0.002
Observed Probability	0.57	0.59	0.59	0.58	0.56
	Panel B: With controls				
HECS Debt	**0.206****	**0.251*****	**0.140*****	**0.094****	**0.046**
	[0.096]	**[0.065]**	**[0.052]**	**[0.046]**	**[0.041]**
Female	0.043	0.089	0.07	0.106**	0.087**
	[0.101]	[0.071]	[0.055]	[0.048]	[0.043]
Married	-0.08	-0.145	-0.086	0.008	0.021
	[0.279]	[0.185]	[0.126]	[0.110]	[0.090]
Female* Married	0.11	0.055	0.177	0.09	0.003
	[0.319]	[0.214]	[0.129]	[0.129]	[0.116]
Indicator for age?	Y	Y	Y	Y	Y
Indicator for tax year?	Y	Y	Y	Y	Y
Observations	126	253	395	517	663
Pseudo R^2	0.105	0.096	0.044	0.033	0.021
Observed Probability	0.57	0.59	0.59	0.58	0.56

Notes:

1. Data are drawn from a random sample of 15,000 taxpayers aged between 21 and 30 in tax years 2001-02, 2002-03 and 2003-04.
2. Distance from threshold is $|Income_{ijt}-Threshold_t|$.
3. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.
4. Coefficients are marginal probabilities from a probit model, with robust standard errors in brackets.

We observe statistically significant bunching behaviour by the treatment group, as compared with the control group. This is greatest within $400 of the threshold, where we observe bunching behaviour by 18-25 percent of the treatment group. When the window is expanded to ±$600, this effect attenuates, with 14 percent of the treatment group bunching. Expanding the window to ±$800, we observe only 9 percent of taxpayers

bunching. Finally, when the window is expanded to ±$1000, we do not observe any statistically significant bunching behaviour. Reassuringly, the results are similar both with and without the demographic and time controls.

Overall, these results suggest that within $800 of the repayment threshold, around 9 percent of those with a HECS debt are adjusting their income so as to bring themselves below the threshold. Of the 7500 taxpayers in our sample who have a HECS debt, 245 individuals (or 3.2 percent) have taxable income that is within $800 of the HECS repayment threshold. This suggests that 0.3 percent of all HECS debtors "bunch" in a given year. If we assume that bunching involves moving one's income from the midpoint of the upper range (+$400) to just below the repayment threshold, then the average person who bunches reduces their income by $400.

3.4 Robustness Checks

In essence, our results are based upon comparing the earnings distribution for individuals with a HECS debt with those without a HECS debt, around the repayment point. However, since having a HECS debt requires attending university, our treatment group has both more education and less experience than our control group. Even within the narrow window around the repayment threshold, it is possible that we will misinterpret these experience and earnings differences as evidence of bunching.

In this section, we present two robustness checks. First, since experience and education effects are likely to be stronger for younger workers, we split the sample into respondents aged 21-25, and respondents aged 26-30. Experience and education will still matter for the older group, but to a lesser extent than for the younger group. If we observe substantially less bunching in the older sample, we might worry that our results are driven by experience and education, rather than by the repayment threshold.

Table 3 shows the results of these specifications. Although statistical significance diminishes somewhat, we do not discern any substantial differences between the degree

of bunching observed in younger and older workers. Within $400 of the threshold, those with a HECS debt are around 20 percent more likely to be below the threshold, with the effect declining to approximately 10 percent once the window is widened to ±$800.

Table 3: Formal Tests for Bunching – Splitting Sample by Age
Dependent Variable: Indicator for Taxable Income Being Under the HECS Repayment Threshold

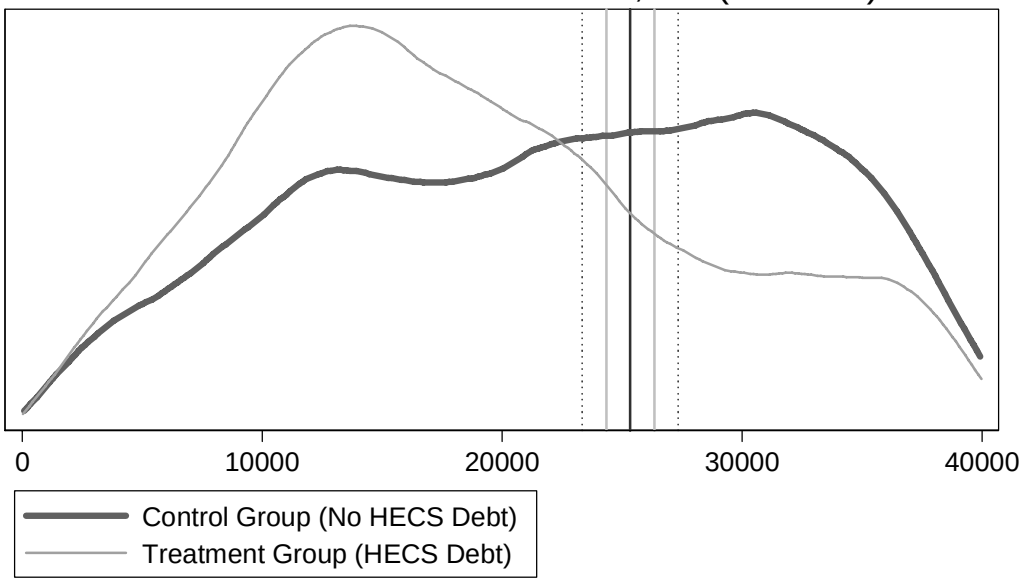
			Panel A: Aged 21-25		
	(1)	(2)	(3)	(4)	(5)
Distance from threshold	±$200	±$400	±$600	±$800	±$1000
HECS Debt	**0.212***	**0.258*****	**0.116**	**0.115***	**0.077**
	[0.125]	**[0.086]**	**[0.076]**	**[0.068]**	**[0.061]**
Controls?	Y	Y	Y	Y	Y
Observations	63	127	189	241	305
Pseudo R^2	0.053	0.102	0.041	0.029	0.016
Observed Probability	0.619	0.638	0.603	0.589	0.577
			Panel B: Aged 26-30		
HECS Debt	**0.15**	**0.230****	**0.163****	**0.078**	**0.025**
	[0.141]	**[0.094]**	**[0.073]**	**[0.063]**	**[0.055]**
Controls?	Y	Y	Y	Y	Y
Observations	61	126	206	276	358
Pseudo R^2	0.194	0.1	0.065	0.044	0.03
Observed Probability	0.525	0.54	0.578	0.569	0.545

Notes:
1. Data are drawn from a random sample of 15,000 taxpayers aged between 21 and 30 in tax years 2001-02, 2002-03 and 2003-04.
2. Distance from threshold is $|Income_{ijt}-Threshold_t|$.
3. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.
4. Coefficients are marginal probabilities from a probit model, with robust standard errors in brackets.
5. All specifications include the same controls as in Panel B of Table 2: female, married, female*married, an indicator for age, and an indicator for survey year.

However, one might still wish to take account of the overall shape of the earnings density function in the general vicinity of the repayment threshold. For example, if the earnings density function of the treatment group was upward sloping, while the earnings density function of the control group was downward sloping, we might mistakenly assume that taxpayers were bunching below the threshold.

To see why this problem might matter in practice, Figure 3 shows a kernel density function for the overall distribution of earnings for the control group (no HECS debt) and the treatment group (HECS debt) for the most recent year in our data. Whereas Figure 2 showed the density function only over the range from $1000 below the repayment threshold to $1000 above the repayment threshold, Figure 3 shows the density function from $0 to $40,000. As can be seen, the earnings density function of the treatment group is more left-skewed than the density function for the control group. Throughout the range $10,000 to $30,000, the density function of the control group is approximately uniform, while the density function of the treatment group is downwards-sloping. (Similar patterns can be observed in tax years 2001-02 and 2002-03.)

Figure 3: Kernel Density Plot of Taxable Income Distribution from $0-40,000 (2003-04)



Black line is repayment threshold. Gray lines denote area analyzed in Tables 2 & 3.
Table 4 includes a control for the ratio between dotted lines and gray lines.

A cautious reader might therefore worry that what we have termed bunching may be no more than an artefact of overall differences in the two density functions. In practice, we regard this as unlikely, since our main estimates in Table 2 attenuate as we move further from the tax repayment threshold. If our results had been driven primarily by the slope of

the earnings density function, and not by the HECS repayment threshold, we would not expect them to change as we moved further away from the threshold.

However, in order to take account of the possibility that our results are affected by the slope of the earnings density function, we perform a final robustness check. Here, we create a variable which denotes for the treatment and control group the ratio of taxpayers who are $2000-1000 below the threshold to the ratio of taxpayers that are between $1000-2000 above the threshold. In figure 3, this ratio is represented by the density function in the region between the dotted line and the grey line on the left side of the repayment threshold to the density function in the region between the dotted line and the grey line on the right side of the repayment threshold.

By creating this variable, we are able to take account of the general shape of the earnings distribution in the vicinity of the repayment threshold, and then test whether – holding this constant – the earnings distribution of HECS debtors is atypical when we focus in the region within $1000 of the repayment threshold. Note that this approach assumes that taxpayers who are more than $1000 above or below the repayment threshold do not bunch. To the extent that such bunching behaviour occurs, it will attenuate our estimates towards zero.

Where θ is the ratio of the number of taxpayers in the range $2000 to $1000 below the repayment threshold to the ratio of the number of taxpayers in the range $1000 to $2000 above the threshold for individuals in group j in year t, we estimate the equation:

$$I^{\text{Below Threshold}}_{ijt} = \alpha + \beta I^{\text{HECS Debt}}_{ijt} + \gamma Z_{ijt} + \delta_t + \theta_{jt} + \varepsilon_{ijt} \qquad (9)$$

Table 4: Formal Tests for Bunching – Controlling for Earnings Distribution
Dependent Variable: Indicator for Taxable Income Being Under the HECS Repayment Threshold

	(1)	(2)	(3)	(4)	(5)
Distance from threshold	±$200	±$400	±$600	±$800	±$1000
HECS Debt	**0.078**	**0.157**	**0.122**	**0.095**	**0.032**
	[0.151]	**[0.106]**	**[0.077]**	**[0.068]**	**[0.061]**
Ratio of number between {-$2000–$1000} to number between {+$1000–$2000}	0.565	0.38	0.078	-0.003	0.058
	[0.482]	[0.321]	[0.246]	[0.215]	[0.192]
Controls?	Y	Y	Y	Y	Y
Observations	126	253	395	517	663
Pseudo R^2	0.113	0.1	0.044	0.033	0.021
Observed Probability	0.571	0.589	0.59	0.578	0.56

Notes:
1. Data are drawn from a random sample of 15,000 taxpayers aged between 21 and 30 in tax years 2001-02, 2002-03 and 2003-04.
2. Distance from threshold is $|Income_{ijt}-Threshold_t|$.
3. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.
4. Coefficients are marginal probabilities from a probit model, with robust standard errors in brackets.
5. All specifications include the same controls as in Panel B of Table 2: female, married, female*married, an indicator for age, and an indicator for survey year.
6. *Ratio of number between {-$2000–$1000} to number between {+$1000–$2000}* is the fraction of taxpayers in a given year and treatment/control group that are between $2000-1000 below the repayment threshold to the fraction that are $1000-2000 above the threshold.

Table 4 shows the results of these specifications. Our results are no longer statistically significant at conventional levels (for the ±$400 and ±$600 specifications, our t-values are around 1.5). However, the magnitude of the estimated coefficients remain similar to those in previous tables, suggesting that our results are unlikely to be driven by differences in the earnings distributions of the treatment and control groups.

4. The Significance of the Results for Policy

4.1 Estimating the costs to the budget

A natural exercise at this point is to estimate the cost of this distortion to the budget. As a policy modelling exercise, one would preferably wish to compare the present manner in which HECS operates with some alternative policy. However, given the complexities

involved in estimating the distortions caused by HECS, we begin by simply focusing on the effect of the repayment threshold on government revenues. Readers should note that this budgetary cost must necessarily be compared with the costs of alternative schedules, which are unlikely to be zero.

To estimate the budgetary costs of HECS, we use two findings from Section 3:

(i) within $800 of the repayment threshold, 9 percent of those with a HECS debt adjust their income so as to bring themselves below the threshold; and

(ii) of the 7500 taxpayers in our sample who have a HECS debt, 245 individuals (or 3.2 percent) have taxable income that is within $800 of the HECS repayment threshold

Combining (i) and (ii), we conclude that 0.3 percent of all HECS debtors "bunch" in a given year. For simplicity, we refer to these individuals as "bunchers".

We also make the following three assumptions:

(iii) we assume that bunching involves moving one's income from the midpoint of the upper range (+$400) to just below the repayment threshold – therefore the average person who bunches reduces their income by $400; and

(iv) taxpayers only engage in bunching in their first year with a HECS debt; and

(v) the average duration of HECS debtors is six years, and all taxpayers who bunch repay their debt in six years.

Bunching therefore imposes two costs on the budget. First, since those who bunch reduce their taxable income by $400, the government loses the income tax that would have been paid on this income. Throughout the period covered by our study, the income tax rate around the HECS repayment threshold was 30 percent. Therefore the lost income tax per buncher is $120.

Second, bunching imposes a cost on the government because the taxpayer does not make a HECS repayment in that year. Instead, that HECS repayment is made in six years' time. The size of the repayment is equal to 3 percent of the taxpayer's pre-tax income before avoidance. If we assume that the income of the typical buncher is $400 above the repayment threshold, this amount is $709 in 2001-02, $743 in 2002-03, and $772 in 2003-04. Recall that HECS debts are indexed to the CPI – hence the cost to the budget is the real interest that would have been earned on this amount over the period of 6 years.

As in Section 2, TIBA denotes taxable income before avoidance, RT denotes the repayment threshold, r denotes the repayment rate, and n denotes the number of years remaining before the HECS loan is repaid. Additionally, we use τ to denote the income tax rate in the area of the repayment threshold, and g to denote the real rate of interest earned by the government. For simplicity, suppose that each person who bunches reduces their income to epsilon below the repayment threshold. The cost to the budget from each person who bunches (BC) is therefore the sum of the lost tax revenue and the deferral of the taxpayer's HECS debt.

$$BC = \tau(TIBA-RT) + rTIBA(1-(1+g)^{-n}) \qquad (10)$$

To calculate the total cost to the budget, we multiply BC (the cost per buncher) by the number of people who bunch. According to the ATO, in the most recent tax year, 644,107 people aged 21-30 had a HECS debt.[12] From assumptions (i) and (ii), we estimate that 0.3 percent of HECS debtors – or 1932 people – bunch in a given year.

What is the total amount of lost revenue from bunching? First, this depends on the lost tax revenue. Since the income tax rate in the vicinity of the repayment threshold is 30 percent, and using the assumption that each buncher reduces their income by $400, the lost tax revenue per buncher is $120 (or $231,840 in total). Second, the lost tax revenue depends on the government's real interest rate (g), and the period taken to repay (n).

[12] Note that although our most recent year of data is 2003-04, this figure is for the 2004-05 tax year. The ATO were unable to supply us with the comparable figure for the last year of our data. However, the figure is likely to have been similar in 2003-04, and our results are not sensitive to reasonable perturbations.

Table 5 presents estimates of the total lost revenue from bunching using two plausible real interest rates – 3 percent and 6 percent, and for four possible delay periods – 6 years, 10 years, 20 years and infinity. Note that these estimates are for the total budgetary cost, and include forgone tax revenue of $231,840. They are based on the assumption that the mean income of a person who bunches is $400 above the 2003-04 repayment threshold, which was $25,348.

Table 5: Estimating the Cost of Bunching to the Budget

	Real government interest rate	
Delay before repayment	**3 percent**	**6 percent**
6 years	$489,442	$699,504
10 years	$516,604	$931,824
20 years	$750,210	$1,322,692
Never repaid	$1,816,930	$1,816,930

Note: Assumes 1932 people bunching below the repayment threshold. Average amount of bunching is assumed to be $400. Calculations are based on the 2003-04 repayment threshold ($25,348) and repayment rate (3 percent). All specifications include the same amount for the loss of income taxation ($231,840), and differ only in their assessment of the budgetary cost of delayed repayment of the HECS liability.

Assuming that the debts are eventually repaid, the lost revenue associated with bunching is estimated to be relatively small, in the order of half to one-and-a-half million dollars. Even in the unlikely event that bunching led to the debts never being repaid, the cost to the government is still only $1.8 million. To put this in perspective, the value of the HECS debt repaid in this manner in 2003-04 was $640 million (ATO 2004, 50).[13] Thus even our highest estimates suggest that the budgetary loss arising from the design of the HECS repayment threshold is less than 1/300th of the annual amount repaid under the scheme.

4.2 Estimating the deadweight cost

Another relevant question to consider is the deadweight cost of the current design of the HECS scheme. Note that in estimating deadweight costs, we are not concerned with transfers between taxpayer and the government, but only the pre-tax earnings that are

[13] $640 million was the amount repaid in 2003-04 through what the ATO calls "compulsory repayment". The HECS scheme also allows for voluntary payments and up-front payments. Including these, total HECS payments in 2003-04 totaled $1,983 million (DEST 2005).

lost. While we do not have precise data on this point, we can place an upper bound on the deadweight loss. Again, assume that 1932 people bunch, and that the average buncher reduces his or her pre-tax income by $400. In this scenario, the deadweight cost of the sudden HECS repayment threshold is $772,800.

Relative to the total earnings of recent university graduates, this is a small deadweight cost. Moreover, the true deadweight loss may be less than this, since the figure of $772,800 assumes that the full reduction in taxable income takes place through a reduction in real earnings. However, it is also possible that at least part of the reduction in taxable income is more accurately regarded as a transfer from the government to the taxpayer than as a deadweight loss. For example, suppose that instead of reducing earnings, bunchers instead each purchased $400 of tax-deductible goods, which they valued at $200. In this instance, the deadweight loss of the HECS repayment threshold would be $386,400.

5. Conclusion

The use of income-related loans has proven an effective way of addressing credit constraints in Australia and elsewhere. However, a critical issue in the design of such programs is the repayment structure. In essence, there are practicable two ways of designing such systems: to set the repayment threshold at a low income level, but require repayment only to be on additional earnings above the threshold; or set the repayment threshold at a higher income level, but require repayment on a percentage of all earnings.

While the latter approach has the virtue of requiring no repayments on low-income earners, some have suggested that such a sharp discontinuity might create large budgetary and deadweight losses. Using a sample of taxpayers from Australia, we show that such concerns are unfounded. Close to the repayment threshold, we observe a degree of bunching by taxpayers that is statistically significant, but economically trivial. Overall, our calculations suggest that around 0.3 percent of all those with a HECS debt bunch below the repayment threshold. Plausible estimates of the loss to the budget and

deadweight loss are below $1,000,000 per year: a trivial amount relative to the size of the scheme and the earnings of new university graduates.

For designers of income contingent loans, our results suggest that a sharp discontinuity in the repayment threshold is not likely to be a substantial problem, and that the equity gains from such a design most likely outweigh any efficiency costs. For example, when considering reforms to income-contingent loans in the United Kingdom, a parliamentary committee recommended that the repayment threshold be raised to the level of average weekly earnings (then £24,500) (Education and Skills Committee 2003). The UK Government's response was that this was not feasible, since "doing so would both increase the overall cost of loans and the time over which graduates would repay them" (Secretary of State for Education and Skills 2003). Neither side appeared to acknowledge a third option – that the threshold could be raised to average earnings, but with repayments based on total income (rather than income above the threshold, as in the current system). Our results from Australia, upon which the UK income-contingent loans scheme has been modelled, suggests that such a reform in the UK might strike a better balance between equity and efficiency.

Our results also have implications for taxpayer behaviour in generic terms in that they reinforce earlier findings that have found very little bunching around kink points (Saez 2002). It is worth highlighting that the effect of the HECS repayment threshold is to create a marginal tax rate of several thousand percent – perhaps the highest marginal tax rate experienced anywhere in the world. Given that this sharp discontinuity does not induce a substantial degree of bunching, it should come as little surprise that there is minimal bunching at kink points in regular taxation schedules.

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