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

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Under the Higher Education Contribution Scheme graduates face a sharp discontinuity in their taxable incomes. At the first repayment threshold, they are required to pay a percentage of their entire income to reduce their debts. This results in an extremely high effective marginal tax rate. Using a sample of taxpayer returns we 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. The result has important implications for the design of income contingent university loan schemes.

I 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 child support payments from non-custodial parents 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 article we address the question: to what extent do significant discontinuities in the tax schedule affect taxpayers' behaviour through their effect on disposable incomes?

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[1] A system to collect child support payments from non-custodial parents through the taxation system was introduced in Australia in 1987. Countries that use the tax system to recover higher education student loans include Australia (1989), New Zealand (1991), Ethiopia (2002), Hungary (2003), Thailand (2006) and the UK (introduced in 1997 for income support and expanded considerably in 2005 to also cover tuition). The governments of Colombia, Malaysia, Israel and other countries are seriously considering using their taxation systems to collect student loans in the near future.

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To this end, we are fortunate to have at our disposal possibly the largest policy-induced discontinuity 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 that of a person earning $1 per annum less than this repayment threshold, but the discontinuity is much lower since the debt will typically still be repaid. On one set of assumptions, including that the individual expects to pay off his or her debt in 6 years, the present value of deferring repayment by keeping one's income below the threshold is around $200 (see Appendix I for details).[2]

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 (2008) which explores whether taxpayers bunch just below 'kink points' in the US tax schedule. Using microdata from US tax returns over the period 1960–1997, Saez finds evidence of bunching at the first tax bracket, which for much of the period of the study represents an increase in the effective marginal tax 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 (2002) and Blundell and Hoynes (2004) find some bunching just above the first eligibility threshold for the UK earned income tax credit.[3]

Our article 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, but the budgetary cost and the lost pretax earnings resulting from this substantial discontinuity in the taxation schedule appear to be relatively small. We conclude that even an extremely high effective marginal tax rate seems to have a surprisingly small impact on behaviour.

The remainder of this article is structured as follows. Section II 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 III we describe the data, explain our method for determining the extent of bunching, present the econometric results and offer some robustness checks. In Section IV we examine the policy implications of the results, with respect to both budgetary impacts and lower pretax earnings. The final section concludes with a discussion of the relevance of our findings for the design of income contingent loan schemes and the general relevance of very high effective marginal tax rates for government budgets and labour supply behaviour.

II The Higher Education Contribution Scheme and Effective Marginal Tax Rates

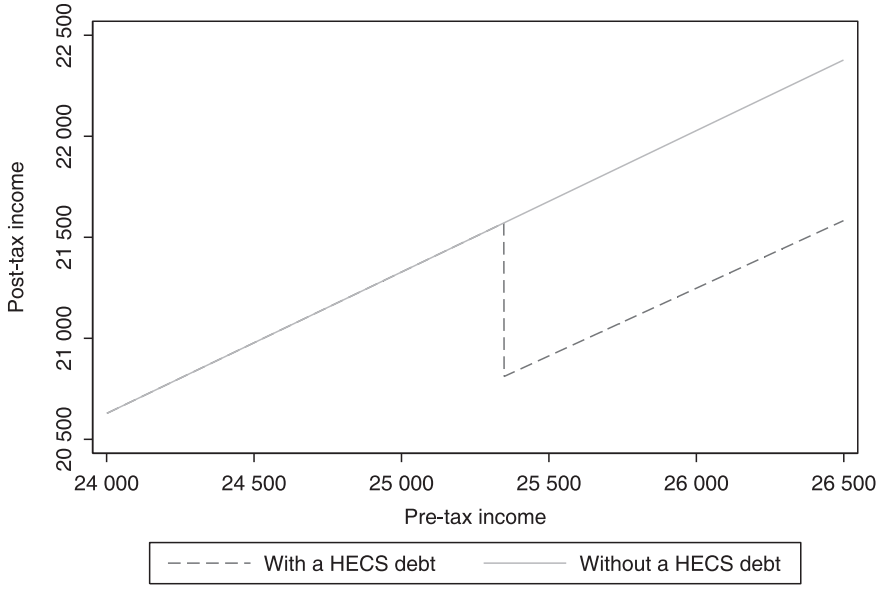
(i) Some Conceptual Issues Concerning Calculations of Effective Marginal Tax Rates

A major advantage of our exercise is that we are able to empirically explore the effects of an extraordinarily high effective marginal tax rate, which is that associated with the repayment of Australia's income contingent charge for higher education. However, there is a potentially significant difference in this context between the repayment of an income contingent loan and the payment of taxes (or receipt of benefits). In this section we discuss the structure of HECS and the way one might calculate effective marginal tax rates in relation to a loan payment. Our analysis indicates that even when one takes account of the fact that loans still have to be repaid, the HECS discontinuity imposes extremely high, indeed unprecedented, costs for taxpayers from earning small amounts above a particular income level. This

[2] The assumption of a 6-year repayment period is based on estimates from Chapman (2006).

[3] 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, then an implication is that we should observe bunching below the HECS repayment threshold. For a critique, see Chapman (2006, 83–4).

FIGURE 1
The HECS Repayment Threshold, 2003–2004



suggests that there are important broad lessons to be learned from testing the impact of HECS on bunching behaviour.

(ii) HECS Described

In 1989 the Australian government introduced the world's first income contingent charge system using the taxation system as the collection mechanism. A detailed description of HECS may be found in Chapman (2006), but for present purposes, it is sufficient to sketch the main features of the system. Upon enrolment, a higher education student faces the choice of paying the year's tuition charge up-front and receiving a 20 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.

No repayments are required until the former student receives a minimum annual income, which in the period that we study was set at around $25 000. To ensure that the loan is repaid relatively quickly, the system is designed such that a taxpayer whose earnings exceed the income threshold for repayment, is required to pay a percentage of his or her *entire* taxable income, not merely a percentage of the amount exceeding the threshold.[4] In 2003–2004 (the most recent year covered in our study) a taxpayer with a HECS debt who earned over $25 348 was required to pay 3 per cent of total taxable income towards repayment of the debt. This means that the disposable income of a person earning the threshold level of income would be $760 lower per annum than that of 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

[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 claimed deductions for reportable fringe benefits and net rental losses. For the 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 article we use the term 'repayment threshold' to refer to the first repayment threshold. (The other thresholds generate smaller discontinuities than the first threshold, and we find no evidence that taxpayers with HECS debts bunch at those points.)

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 per cent 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 2003–2004 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 2003–2004, a taxpayer with a HECS debt had the same current disposable income at $25 347 per annum as if he or she earned $26 482 per annum.

Using the traditional (and in this case, incorrect) calculation of the impact of earning an additional dollar on disposable income at the threshold implies an effective marginal tax rate of 76 000 per cent, an extraordinarily large figure for public policy analysis and debate in this area. To put this in context, the highest marginal personal income tax rate among OECD countries is 70 per cent, while the maximum effective marginal tax rate due to benefit withdrawal among OECD countries is around 100 per cent.[7]

(iii) Understanding HECS Effective Marginal Tax Rates: Loans Still Have to Be Repaid

In contradistinction to the above, 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 only a deferral 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 estimate the value of deferring the repayment of an income contingent loan, so that we may compare it with the value of avoiding the payment of income taxes. In Appendix I we present an illustrative numerical simulation, suggesting that for one plausible set of parameters, the net present value of keeping one's income below the threshold for one year is $193. While this is considerably smaller than the $760 that would hold if the threshold was a tax rate rather than a loan repayment rate, it nonetheless suggests that a taxpayer who is close to the threshold will gain a non-trivial amount from 'bunching'.

In Chapman and Leigh (2008; Appendix II), we also formally model the benefits and costs of repayment. The benefits take the form of deferring the repayment of a debt that is indexed to inflation, but does not accrue interest. The costs take the form of the debtor (taxpayer) 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, hire an accountant to find additional deductions or purchase deductible items.

Our model suggests that avoidance is more likely the higher is the repayment rate, the higher is the taxpayer's individual discount rate, the higher is the number of years it takes for the postponed debt to be paid, the lower is the per-dollar avoidance cost, the higher is the repayment threshold and (in most cases) the higher is the taxpayer's income before avoidance is attempted. Although we cannot observe all of these parameters in our empirical analysis, it is useful to bear them in mind nonetheless.

III Empirical Findings: How Much Bunching Is There?

(i) The Data

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 ATO. At the time of writing, the ATO did not make a standard sample of tax returns available to researchers (although such a sample has since been created). Our data were therefore extracted specifically for this project by the ATO.

The tax year in Australia runs from 1 July to 30 June, and all taxpayers file as single individuals.

[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 per cent in the income range discussed in the example. The Medicare levy does not interact with HECS repayment provisions.

[7] Top tax rates are for 2004, from the OECD Tax Database, Table 1.4 (http://www.oecd.org). Benefit withdrawal rates are for 2003, from Whiteford (2006; table 6).

[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 debts.

TABLE 1
Summary Statistics

	Control group		Treatment group	
	Mean	Standard deviation	Mean	Standard deviation
Panel A: All taxpayers in extract				
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
Panel B: Taxpayers within $1000 of repayment threshold				
Taxable income ($)	24228.72	1054.91	24301.86	1043.66
HECS debt ($)	0	0	11207.54	6752.43
Age (years)	25.59	2.74	25.97	2.29
Female	0.42	0.49	0.60	0.49
Married	0.17	0.38	0.10	0.31

Note: In Panel A, the number of observations is 7500 for the control group, and 7500 for the treatment group. In Panel B, the number of observations is 348 for the control group, and 315 for the treatment group.

Our extract consists of 5000 taxpayers in each of the three tax years 2001–2002, 2002–2003 and 2003–2004, and respondents are aged between 21 and 30, the age range in which we expected to find a high proportion of HECS debtors. Half of the respondents (2500 in each year) have an outstanding HECS debt, while half do not. Our total potential sample comprises 15 000 taxpayers (though because we focus on those close to the repayment threshold, we will only use several hundred taxpayers in our regressions). The data extract contains information on total taxable income, whether or not the person has an outstanding HECS debt (and the size of that debt), age, sex and marital status.

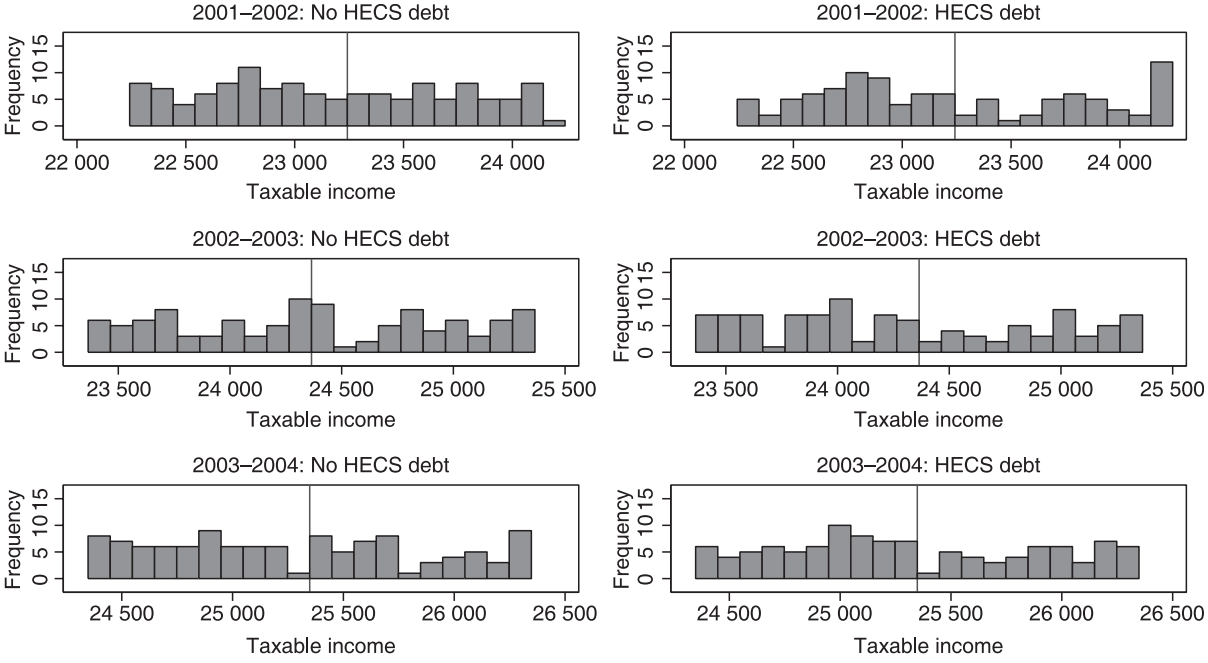
This information allows us to construct what we call a 'treatment group' (taxpayers with a HECS debt) and a 'control group' (taxpayers without a HECS debt). Members of these groups are not completely distinct with respect to ever having had HECS obligations, since a proportion of those in the control group may have gained a university degree and paid their tuition up-front, while others might have graduated with a HECS debt which has been fully repaid.

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 per cent of their total earnings (not merely 3 per cent of their earnings above the threshold), hence creating a sharp discontinuity. This threshold is $23 242 in 2001–2002, $24 365 in 2002–2003 and $25 348 in 2003–2004. In each of these years, the marginal income tax rate at the repayment threshold point (that is, the marginal tax rate paid by the control group) is 30 per cent.

Table 1 presents summary statistics for the two groups. In Panel A, we show summary statistics for the full sample of 15 000 taxpayers, while in Panel B, we show summary statistics only for those within $1000 of the repayment threshold. In Panel A, members of the treatment group tend to have lower earnings than the control group. In both Panels A and B, members of the treatment 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 there are enough data points around the kink.

Figure 2 shows the distribution of the two groups in the range of $1000 below to $1000 above the HECS repayment threshold. 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 (treatment group). Although those in the control group are evenly distributed over the range, those in the treatment group are

FIGURE 2
Taxable Income Distributions within $1000 of the Repayment Threshold



Note: Vertical line denotes repayment threshold.

discernibly bunched below the HECS repayment threshold.[9]

(ii) 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 $Below\ Threshold_{ijt}$ is an indicator variable denoting whether individual i in group j in year t is above or below the taxable threshold for that year, $HECS\ Debt_{ijt}$ is an indicator variable denoting whether the individual has an outstanding HECS debt, Z is a vector of individual characteristics (sex, marital status and age) and δ are indicator variables for the different tax years used in this study, we estimate the following probit regression:

$$I^{\text{Below Threshold}_{ijt}} = \beta I^{\text{HECS Debt}_{ijt}} + \gamma Z_{ijt} + \delta_t + \varepsilon_{ijt}. \quad (1)$$

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.[10]

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

[9] In the bottom left panel of Figure 2 (2003–2004 tax year, No HECS debt), there is an apparent drop in the number of observations in the region $25 248–25 348 (i.e. just below the HECS repayment threshold). We do not have any obvious explanations for this pattern in the data.

[10] If taxpayers could precisely control their earnings, then many bunchers would have incomes $1 below the repayment threshold. However, to take account of the fact that taxable incomes may be 'lumpy', we define the 'below threshold' distance as being at least $200, and expand it symmetrically with the 'above threshold' distance. Another approach would be to fix the distance below the threshold, and only vary the distance above the threshold. Doing so produces very similar results.

TABLE 2
Formal Tests for Bunching

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
Panel A: Without controls					
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	0.571	0.589	0.590	0.578	0.560
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	0.110	0.055	0.177	0.09	0.003
	[0.319]	[0.214]	[0.129]	[0.129]	[0.116]
Indicator for age?	Yes	Yes	Yes	Yes	Yes
Indicator for tax year?	Yes	Yes	Yes	Yes	Yes
Observations	126	253	395	517	663
Pseudo R^2	0.105	0.096	0.044	0.033	0.021
Observed probability	0.571	0.589	0.590	0.578	0.560

Notes: Distance from threshold is $|\text{Income}_{ijt} - \text{Threshold}_t|$. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. Coefficients are marginal probabilities from a probit model, with robust standard errors in brackets.

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 $\beta > 0$.

(iii) 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.

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 per cent of the treatment group. When the window is expanded to ±$600, this effect attenuates, with 14 per cent of the treatment group bunching. Expanding the window to ±$800, we observe only 9 per cent 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 per cent of those with a HECS debt are adjusting their incomes 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 per cent) have taxable incomes that are within $800 of the HECS repayment threshold. These data taken together imply that 0.3 per cent 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 his or her income by $400.

TABLE 3
Formal Tests for Bunching – Splitting the Sample by Age

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
Panel A: aged 21–25					
HECS debt	0.212*	0.258***	0.116	0.115*	0.077
	[0.125]	[0.086]	[0.076]	[0.068]	[0.061]
Controls?	Yes	Yes	Yes	Yes	Yes
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?	Yes	Yes	Yes	Yes	Yes
Observations	61	126	206	276	358
Pseudo R^2	0.194	0.100	0.065	0.044	0.03
Observed probability	0.525	0.540	0.578	0.569	0.545

Notes: Distance from threshold is $|\ \text{Income}_{ijt} - \text{Threshold}_t\ |$. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. Coefficients are marginal probabilities from a probit model, with robust standard errors in brackets. 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.

What explains the relatively small degree of bunching that we observe in our data (around 1 in 300 HECS debtors per year)? In our view, the factor that is most important is that very few HECS debtors have incomes that are close enough to the repayment threshold to make avoidance worthwhile. Further, it may be that HECS debtors are uncertain about their incomes during the year, and are therefore not able to precisely manipulate their incomes to fall below the threshold. Other taxpayers may be unaware of the repayment threshold, and it is also plausible that some avoidance techniques have a high ongoing cost. For example, a taxpayer in a full-time job would be unlikely to forego a $200 salary rise in order to stay below the threshold in a given year, if the effect was that he or she would also have a salary that was $200 lower the following year and even beyond.

(iv) Robustness Checks

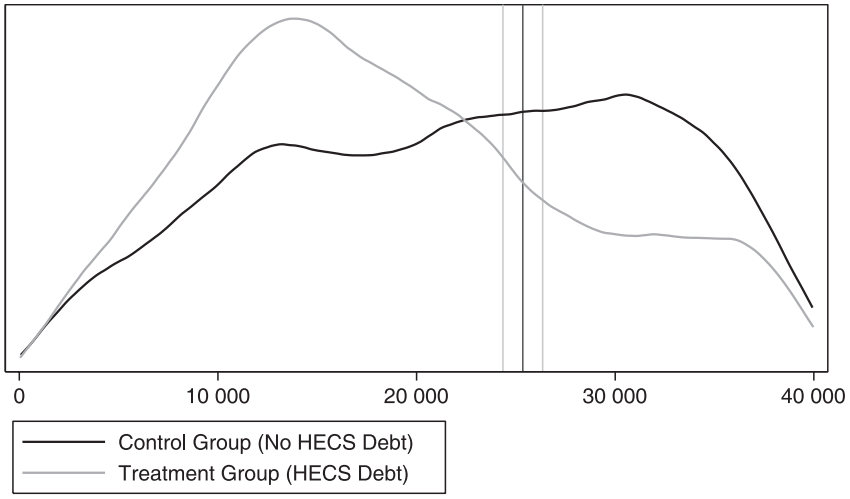
In essence, our results are based upon comparing the earnings distribution for individuals with a HECS debt to those without a HECS debt, around the repayment point. However, since having a HECS debt requires attending university, our treatment group has both more education and less experience than our 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 per cent more likely to be below the threshold, with the effect declining to approximately 10 per cent once the window is widened to ±$800.

However, one might still wish to take account of the overall shape of the earnings density function

FIGURE 3
Kernel Density Plot of Taxable Income Distribution from $0 to 40 000 (2003–2004)



Note: Vertical black line is repayment threshold. Vertical grey lines denote area analysed in Tables 2 and 3.

in the general vicinity of the repayment threshold. For example, if the earnings density function of the treatment group was downward-sloping, while the earnings density function of the control group was upward-sloping, we might mistakenly assume that HECS debtors 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 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 downward-sloping (similar patterns can be observed in tax years 2001–2002 and 2002–2003).

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 the predicted gradient of the income distribution in the range around the repayment threshold. We do this in two ways: first, by using the ratio of the number of taxpayers who are $2500–1500 below the threshold to the ratio of taxpayers that are between $1500–2500 above the threshold; and second, by fitting a quadratic to the entire density function from $0 to $40 000.

By creating the 'predicted gradient' 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 on the region within $1000 of the repayment threshold. Such an empirical strategy is similar to regression discontinuity, since it is identified from the sharp break at the repayment threshold. Note that the first approach assumes that taxpayers who are more than $1500 above or below the repayment threshold do not bunch. To the extent that such bunching behaviour occurs above or below $1500, it will attenuate our estimates towards zero.

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
Panel A: Prediction using gradient in nearby region					
HECS debt	0.343	0.220	0.331	−0.031	0.265
	[0.764]	[0.569]	[0.405]	[0.387]	[0.320]
Predicted gradient	−0.222	0.050	−0.303	0.190	−0.339
	[1.277]	[0.904]	[0.666]	[0.578]	[0.511]
Controls?	Yes	Yes	Yes	Yes	Yes
Observations	126	253	395	517	663
Pseudo R^2	0.105	0.096	0.045	0.034	0.021
Observed probability	0.571	0.589	0.59	0.578	0.56
Panel B: Prediction using entire earnings distribution					
HECS debt	0.197	0.293	0.074	0.140	−0.033
	[0.292]	[0.202]	[0.158]	[0.136]	[0.124]
Predicted gradient	0.034	−0.167	0.248	−0.170	0.286
	[1.063]	[0.752]	[0.559]	[0.483]	[0.426]
Controls?	Yes	Yes	Yes	Yes	Yes
Observations	126	253	395	517	663
Pseudo R^2	0.105	0.096	0.045	0.034	0.021
Observed probability	0.571	0.589	0.59	0.578	0.56

Notes: Distance from threshold is $|\text{Income}_{ijt} - \text{Threshold}_t|$. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. Coefficients are marginal probabilities from a probit model, with robust standard errors in brackets. 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.

Where h_{jt} is the predicted gradient of the income distribution for individuals in group j in year t, we estimate the equation:

$$I^{\text{Below Threshold}_{ijt}} = \beta I^{\text{HECS Debt}_{ijt}} + \gamma Z_{ijt} + \delta_t + \theta_{jt} + \varepsilon_{ijt}. \quad (2)$$

Table 4 shows the results of these specifications. Our results are no longer statistically significant at conventional levels, and in two of the 10 specifications the effect of the HECS debt is negative rather than positive. However, most of the estimated coefficients remain similar in magnitude 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.

IV The Significance of the Results for Policy

(i) 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 effects of this aspect of 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 III:

1 within $800 of the repayment threshold, 9 per cent of those with a HECS debt adjust their incomes so as to bring themselves below the threshold; and
2 of the 7500 taxpayers in our sample who have a HECS debt, 245 individuals (or 3.2 per cent) have taxable incomes that are within $800 of the HECS repayment threshold.

Combining **1** and **2**, we conclude that 0.3 per cent of all HECS debtors 'bunch' in a given year. For simplicity, we refer to these individuals as 'bunchers'.

TABLE 5
Estimating the Cost of Bunching to the Budget

	Real government interest rate (or real social discount rate)	
Delay before repayment	3%	6%
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: We assume 1932 people bunching below the repayment threshold. The average amount of bunching is assumed to be $400. Calculations are based on the 2003–2004 repayment threshold ($25 348) and repayment rate (3%). 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.

We also make the following three assumptions:

3 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 his or her income by $400;
4 taxpayers only engage in bunching in their first year with a HECS debt; and
5 the average duration of HECS debts is 6 years, and all taxpayers who bunch repay their debt in 6 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 per cent. 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 6 years' time. The size of the repayment is equal to 3 per cent of the taxpayer's pretax income before avoidance. If we assume that the income of the typical buncher is $400 above the repayment threshold, this amount is $709 in 2001–2002, $743 in 2002–2003 and $772 in 2003–2004. 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, or the debt discounted at the social discount rate.

The nominal cost to the budget is therefore the sum of the lost tax revenue and the deferral of the taxpayer's HECS debt, multiplied by the number of people who bunch (see Chapman and Leigh, 2008; Appendix II for a more formal treatment). According to the ATO, in the most recent tax year, 644 107 people aged 21–30 had a HECS debt.[11] From assumptions **1** and **2**, we estimate that 1932 people (0.3 per cent of HECS debtors) bunch in a given year.

What is the revenue cost from bunching in real terms? First, this depends on the lost tax revenue. Since the income tax rate in the vicinity of the repayment threshold is 30 per cent, and using the assumption that each buncher reduces his or her 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 (or the real social discount rate), and the period taken to repay. Table 5 presents estimates of the total lost revenue from bunching, using two plausible real interest rates – 3 and 6 per cent; and four possible delay periods – 6 years, 10 years, 20 years and infinity. Note that these estimates are for the total budgetary cost and include the 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 2003–2004 repayment threshold, which was $25 348.

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

[11] Note that although our most recent year of data is 2003–2004, this figure is for the 2004–2005 tax year. The ATO was 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 2003–2004, and our results are not sensitive to reasonable perturbations.

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 2003–2004 was $640 million (ATO, 2004; 50).[12] 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.

(ii) Estimating the Impact on Pretax Earnings

Another relevant question to consider is the reduction in pretax earnings caused by this particular discontinuity in the HECS repayment schedule.[13] Note that in carrying out this exercise, we are not concerned with transfers between taxpayers and the government, only with the pretax earnings that are lost. While we do not have precise data on this point, we can place an upper bound on the lost earnings. Again, assume that 1932 people bunch, and that the average buncher reduces his or her pretax income by $400. In this scenario, the reduction in pretax earnings related to the sudden HECS repayment threshold is $772 800.

Relative to the total earnings of recent university graduates, this is a small amount. Moreover, the true quantum of lost earnings 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 reduction in economic activity. For example, suppose that instead of reducing earnings, bunchers each purchased $400 of tax-deductible goods, which they valued at $200. In this instance, the amount of economic activity lost as a consequence of the HECS repayment threshold would be $386 400.

V Conclusion

Income contingent loans seem to be an effective way of addressing credit constraints for investment in human capital in Australia, and perhaps elsewhere. However, a critical issue in the design of such programs is the repayment structure. There are two practical 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 total 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 earnings 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 per cent of all those with a HECS debt bunch below the repayment threshold. Plausible estimates of the loss to the budget and the reduction in pretax earnings are below $1 million per year: a small amount relative to the size of the scheme and annual HECS repayments which are currently around $1.2 billion.

The changes to the HECS collection parameters that took effect from 1 July 2004 are worthy of some attention. In terms of our exercise, the two important changes were: raising the first repayment threshold from $25 348 to $35 001, and raising the first repayment rate from 3 to 4 per cent. Over subsequent years, the first threshold has been increased to approximately keep pace with average earnings, and was $41 595 in 2008–2009. In combination, these changes mean that the discontinuity at the first repayment threshold is now considerably higher than in the period that we analyse (1 July 2001–30 June 2004). At the same time, assuming that the income distribution in Figure 3 shifted rightwards by several thousand dollars over a 5-year period, that would suggest that there are probably fewer individuals with a HECS debt who have incomes around the first threshold.

Since these two factors (a sharper discontinuity, but a higher threshold) most likely work in opposite directions, it is difficult to be confident about the overall effects of the new discontinuity. However, even if the policy changes have increased the effect of the HECS discontinuity, the consequences are unlikely to be large in economic terms. Even assuming that the behavioural effects in recent years are twice as large as those that we have

[12] $640 million was the amount repaid in 2003–2004 through what the ATO calls 'compulsory repayment'. The HECS scheme also allows for voluntary payments and up-front payments. Including these, HECS payments in 2003–2004 totalled $1983 million (DEST, 2005).

[13] Of course, other features of the HECS system will have an impact on pretax earnings. Our goal here is only to focus on one aspect: the sharp discontinuity in the repayment schedule.

estimated for 2001–2004 (a very strong assumption), the resulting economic burden remains negligible.

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.[14] Our results also have implications for taxpayer behaviour in generic terms in that they reinforce earlier findings which have found very little bunching around kink points (Saez, 2008). It is worth highlighting that the effect of the HECS repayment threshold is to create an extremely high effective marginal tax rate – perhaps the highest 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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[14] 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 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 another option – that the threshold could be raised to average earnings, but with repayments based on ctotal income (rather than income above the threshold, as in the current system). Our results from Australia, upon which the UK income contingent loan scheme has been modelled, suggests that such a reform in the UK might strike a better balance between equity and efficiency.

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Appendix I

A Numerical Example of the HECS Repayment Decision

The assumptions used for our illustration are based very approximately on the 2003–2004 tuition arrangements for HECS (and chosen to simplify the numerical calculations). They are as follows:

1 After graduating from university, the individual has accumulated a total HECS debt of $4560;[15]
2 The debt has a real interest rate of zero, meaning that the nominal level of the debt is increased every year by the CPI;

[15] This would be a typical debt for a former student with a 3-year degree who had paid for 1 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.

3 The graduate is able to avoid having a taxable income above the income threshold of repayment for one year only;[16]
4 The graduate expects to receive $25 348 in real terms per annum for the next 7 years;
5 The graduate is obligated to repay 3 per cent of $25 348 ($760) towards her HECS debt. Only in the first year can she potentially avoid this repayment. If she does so, the avoided HECS repayment is effectively then transferred to the seventh year; and
6 The graduate has a (real) discount rate of 5 per cent per year.

To illustrate the consequences for the avoidance of repayment of the HECS debt for the 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 (V) is given by the addition of the discounted costs of the debt from years 1 to 6 after graduation:

$$V(1) = 760 + 760/(1.05) + \ldots + 760/(1.05)^5 = \$4050 \quad \text{(A1)}$$

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 seventh 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:

$$V(2) = 0 + 760/(1.05) + \ldots + 760/(1.05)^6 = \$3857 \quad \text{(A2)}$$

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, which 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. It should also be acknowledged that the calculation has been done using a change in income of only $1, and this explains in part the large size of the illustration (an interesting feature of the discontinuity is that incrementing income by $0.01 or $100 would give a result that was 100 times larger or smaller than incrementing income by $1).

[16] This assumption seems reasonable, since it is well known that university graduates experience relatively steep age-earnings profiles during their initial decade in the labour force.

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