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Grants or Loans? Theoretical Issues Regarding Access and Persistence in Postsecondary Education

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Abstract

Most economic investigations of access to education treat an investment in college or university as if it were a financial investment offering a particular expected rate of return. Since the average measured rates of return are quite favourable, other factors such as lack of information, contrary parental influence, or "debt aversion" must be invoked to explain the unwillingness of some qualified students from poorer backgrounds to borrow money and attend. However, a model that recognizes the hardship associated with low levels of expenditure suggests that, *ceteris paribus*, poorer students will actually need a higher measured rate of return before they will decide to attend. The result holds even when there is an efficient student loan system. This approach can provide some normative guidance for decisions about the choice of grants or loans as vehicles for student aid, and has positive implications about the effects of grants and loans on access and persistence.

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Introduction

For one who qualifies, a university education is perhaps the best investment a young person can make in her future. Estimates of the private return to a university degree in Canada and elsewhere regularly top 10%.[1] University graduates also benefit in non-financial ways. Apart from pure consumption value, which is difficult to quantify, they enjoy better health, (Kenkel 1991) and spend less time in jail (Lochner and Moretti 2001). All of this suggests that university students should be willing to pay the costs of this investment just as they would pay to invest in any other asset.

Nonetheless, postsecondary education throughout the world is supported through a complex array of private bursaries, government grants, and student loans, and access is restricted to those who are academically qualified. A strong case for public grants to those who pass an academic entry barrier is based on the idea that educating a talented subset of the population will have external benefits for all members of society. In this regard higher education is linked to participation in community affairs, the democratic process, and volunteer work (Bynner and Egerton 2000). As well, low skilled US workers earn higher wages if they live in cities that have a higher proportion of university graduates (Moretti 2004). This could be due to complementarities in production among workers (Johnson 1984). Finally, the effect of higher education on economic growth seems sure to be positive, although estimates are imprecise (Bassanini and Scarpenta 2001).

The externalities argument justifies a subsidy to all qualified students and as well, ceteris paribus, suggests that those students who are expected to generate the greatest external benefits should get the highest subsidies. This may provide a rationale for merit based scholarships, although in practice some of these scholarships go to students who would attend in any case.

There is another argument for grants that is based on achieving a neutral system of taxation (Carmichael 1999). Under a progressive income tax system the returns to a university education are taxed at a higher rate than the opportunity cost - i.e., the wages a

[1] See, for example, (Blondal, Field, and Giroard 2002).

potential student would earn if he did not attend university. This provides a rationale for grants, or other subsidies run through the tax system, but again it is those who stand to benefit the most (and thus eventually have the highest marginal tax rate) who should receive the highest subsidy. In fact, according to this argument, students who attend a university program that does not directly raise income should be taxed rather than subsidized, since the consumption benefits that flow from attendance are not taxed while the opportunity cost is taxed. The argument generally provides a rationale for greater government support for those programs that make students the most money after graduation - e.g. certain science and professional programs.

Other arguments for grants are based on considerations of equity. Many students feel that the financial hardships they endure during university make them deserving of direct public support in the form of grants and low tuition fees. Economists generally discount this argument, noting that those who qualify to attend university tend to come from richer than average families, are blessed with a greater ability to achieve at school, and will eventually take their place among the financially fortunate in society. There seems to be no reason based on equity for those who do not have the skills to benefit from attending university to be paying for those who do.

Grants that are targeted toward students from poorer families are also supported as a way to relax the liquidity constraints that may prevent qualified low income students from attending university.[2] However, even though these students come from poorer backgrounds, they are still blessed with academic ability and are likely do well after graduation. As a result, most economists argue that the student loan system is a more equitable tool for ensuring access for these students.[3]

There is also the problem that an increase in grants might make the overall level of

[2] Advocates sometimes make this argument to justify grants for all students, including those rich enough to face no liquidity constraint. This is a bad argument since the richer students will attend in any case.

[3] The equity argument does depend on the source of the grants. While grants to students from the general public may reduce equity, it is easier to justify grants that come from alumni donations or the higher tuition paid by richer students.

public support for university too high. The average rate of return to university may be substantial, but it will not be achieved by everyone who attends. There is some evidence that returns for students with marginal academic qualifications are much lower. One interesting study (Ockert 2003) examined a unique date set from Sweden. In 1982 college applicants were centrally ranked and admission was granted to those with the highest qualifications. There was a group of students at the bottom of the "acceptable" category who were considered equally qualified and who were randomly assigned admission to the fixed number of places remaining after all the higher ranking applicants were placed. Tuition was free. Ockert had information on the qualifications of each applicant and labor market histories up to 1996. In his sample the rate of return to an acceptance letter was actually negative – most marginal applicants would have earned more money had they not been admitted to university, even though the overall average rate of return was positive. However, many of the rejected students did attend university in subsequent years, so these data may partly reflect the option value of a compulsory "gap year" for some students. Obviously the issue of too much attendance can be addressed with academic entrance requirements, but an overly generous grant system that extends to academically marginal students may induce some students to attend when it is not in their own best interest to do so..

There are other arguments for targeted grants (Usher 2006) based on the fact that some students will have poor information about the benefits of education, or will come from a family background where education is not valued as much as it should be. In this case the ideal solution may be to deliver better information or to intervene directly in the family situation. However, given that these policies are difficult to deliver effectively, grants to poor students may be a "second best" instrument that may encourage attendance.

One way to organize these arguments is to note that the economic role of overall tuition subsidies and targeted grants is to ensure that the expected private rate of return faced by any student deciding to attend university reflects the true social return of sending him there. The role of a student loan program is to ensure that all qualified students have

access to the required funds, if needed, at a cost that reflects the true social cost of those funds. Academic screening is then used to prevent rich but under-qualified students from wasting their time. These are all "efficiency" arguments - i.e. the goal is to ensure that only those people for whom the net social benefit is positive will in fact choose to attend post-secondary education.

In this paper we will suggest another argument for grants - one based on equity. The argument depends on the fact that the decision to invest in a university education is not purely a financial decision - the kind that might be handled through an investment broker. Rather, it requires that one attend an institution for four years and adopt a lifestyle that one may not enjoy so much as the alternative. This is the source, we believe, of student concerns about "hardship". In particular, we will argue that the "hardship" of attending university will vary with income even when the financial rate of return does not.

Why should this matter? The answer requires us to define more precisely what the normative goal of "equal access to postsecondary education" might mean. When people differ in the benefits they will receive from education, this phrase does not mean that everyone should be educated to the same degree. One definition is based on the supply and demand analysis of human capital choice that forms the basis of Becker's theory of the distribution of income (Becker 1975). In this analysis the vertical height of the demand curve for education is given by the marginal rate of return achieved by a particular level of investment. For an individual, successively higher levels of investment eventually bring lower marginal rates of return. The supply curve is given by the marginal cost of the funds used to pay for the investment. Successively higher levels of investment require more money and require the individual to access successively more expensive pools of capital, from parental savings to borrowing, and so on. Educational choice is determined by the intersection of supply and demand.

Students will make an efficient choice when the height of their demand curve reflects the social rate of return to their investment. A natural definition of "equal access" in this framework is a situation where the marginal cost of the funds needed to attend university is

the same for every student - i.e., that the supply curves for each student are identical.[4] One could go further and ask that policies be designed to ensure that the marginal cost of funds be set equal to the social cost, and that students be able to borrow as much as they wish at this rate - i.e. to make the supply curve perfectly elastic. This is a goal that in principle could be achieved with a generous student loan system - i.e. without the use of grants.

The simple point we make in this paper is that even this ideal loan system will not be sufficient to provide equal access. If our model is correct there will be situations where two students face exactly the same private financial return to university and face the same marginal cost of funds. Nonetheless, as a matter of free choice one will go and the other will not. The reason is that while the net financial costs and benefits are the same for these two students, the net utility cost of attending university is higher for poorer students because they will be living closer to a subsistence level of consumption while in school. The overall personal or "psychic" rate of return - the one which determines behaviour - is not the same. This is an effect that works through the demand side of Becker's model. In a sense, what we argue is simply that education is a "normal" investment good. At the same price and the same rate of return, richer students will demand more. Importantly, access to a fully efficient loan system does not change this result.

So the normative issue, quite simply, is: "Is this fair?". Some might argue that university is not for everyone, and psychic costs are as real as any other, so that there is no normative issue. Rich people have access to more investments than poor people, just as they are able to consume more of every other good. Others may argue that university education, especially for those who have ability but are at the margin of attendance due to low family income levels, can be a life transforming event. The relative hardship a student experiences due entirely to her being born in a poorer family simply should not matter in the making of such an important decision. For those who take the latter position, evidence that "hardship" is a factor in educational decisions will provide a separate rationale for the use of grants to low income students in order to achieve equal access to education.[5]

[4] Becker, *op. cit.* p.123

[5] Canadians generally support the idea that access to health care should not depend on family income.

The idea is first developed in a theoretical model. We start with a simple case where the financial return is all that matters, and outline the standard argument in favour of loans over grants. We then modify the model in a very standard way to include notions of "hardship", and show that this generates an equity based argument for targeted grants based on family income. The model also generates some empirical implications about the role of family income on access to university and about the effect of loans on student effort and thus persistence. These implications are explored in a subsequent empirical section. A final section concludes the paper.

The Model

The simplest case

Our ideas will be developed in a simple two period framework. In the first period students attend university and in the second they work. We assume that a person who does not attend university and decides to work immediately will receive the amount w_1 in period 1 and w_2 in period 2. This person also has available a transfer from her family (or from personal savings) of the amount S. This transfer is received in the first period and can be used to offset the cost of going to university, although it is not assumed to be conditional on this. The individual may also receive a contingent subsidy S^* from her family only if she attends university. The student also receives net nonpecuniary benefits (or costs) of B_1 and B_2 in the respective periods if she attends university. These will be interpreted as "family background" influences. Note that family background may have separate influences on access and persistence. We ignore the effects of taxation.

It is worth taking a moment to consider what we might mean by the variables S and S^*. The hypothesis we explore in this paper is that family income will have an effect on access to university, independent of family background and independent (even) of direct financial support from parents. Consider two students with similar family backgrounds apart from income, and for whom the parents have offered the same level of contingent

This definition of "equal access" imposes the same normative condition on access to investments in post-secondary education.

support S^*. The first student is from a richer family and owns a car, has a wardrobe full of clothes, and is covered by her parents' dental plan, and may receive a monthly allowance. These benefits are hers *whether or not* she goes to university. The other has none of this. Even though these students have the same ability, face the same alternative wage and the same financial rate of return to university, the first may be more likely to attend. The second, even though she will experiences the same *decrease* in consumption levels to attend university, may experience more relative hardship than if she were to go to her alternative. Attending university might bring her close to a subsistence level of expenditure that could be quite difficult to endure.[6]

In what follows we will focus on the effects of S holding constant the level of S^* and family background. Returning to our model, if the individual attends university she pays the total amount T in period 1 and receives the benefit of a higher wage $w_2 + R$ in period 2, assuming she graduates. She will also gain the private nonpecunairy benefits B_1 and B_2 from attendance in each period. To address issues of persistence, we assume that graduation takes effort e and for simplicity assume that e is binary: $e \in \{0, 1\}$. The probability that a student graduates is given by $p \cdot e$, $p \in [0, 1]$. Effort therefore does not necessarily guarantee graduation, and comes at a cost $c \cdot e$. The student also has available a government grant G (so that tuition paid by the student is $(T - G)$) and a student loan program. If he borrows the amount L he will have to repay the amount $L(1 + r)$, where r is the interest rate. To keep things simple we will ignore issues of bankruptcy and require that all loans be repaid in the second period, regardless of whether the student graduates. The student also has a personal discount factor given by δ. In what follows we do not explore the impact of different discount factors across students, and will assume that $\delta = 1/(1 + r)$.

If, as is often assumed, the potential student is risk neutral and interested only in

[6] We assume that all students eventually go "off the payroll", in that they receive no parental support after they reach the age of graduation. This may be realistic in most cases, but our results do depend on it. If rich students expect to get unconditional access to a trust fund that will make them independently wealthy at age 25, the pecuniary incentive to attend university will be reduced, and our results do not hold.

financial returns, then he compares the overall return to university:

$$[L + G + S + S^* + B_1 - T - c \cdot e] + \delta \left[w_2 + (p \cdot e)(R + B_2) - \frac{L}{\delta} \right] \tag{1}$$

with the return to not attending:

$$[w_1 + S] + \delta [w_2] \tag{2}$$

where e^* solves

$$\max_{e \in \{0,1\}} \delta(p \cdot e)(R + B_2) - c \cdot e. \tag{3}$$

The student will put effort into her studies if

$$\delta p(R + B_2) \geq c. \tag{4}$$

We assume that $G + S^* + B_1 - T < w_1$, so that a student who does not plan to graduate will not attend university. In this case the student will attend university if the overall net return ((1) − (2)) is positive, i.e.:

$$[G + S^* + B_1 - T - w_1 - c] + \delta p(R + B_2) > 0 \tag{5}$$

The issue of access can be modelled here with the constraint that the student be able to afford a subsistence level of expenditure in the first period (where the benefits B_1 and the cost of effort are assumed to be nonpecuniary),

$$L + G + S + S^* - T \geq E^* \tag{6}$$

and issues of persistence can be examined by looking at the determinants of the probability of graduation. In this simple model it is immediate that the availability of neither grants nor loans will have any effect on student effort. Persistence[7] depends only on "forward looking" factors - the expected return to a degree $\delta(R + B_2)$ and the costs and benefits of study effort. As well, so long as loans of sufficient size are available to any student, then

[7] Clearly we are considering academic persistence only. In this paper we do not consider the decision to withdraw for financial reasons. In our framework it would be modeled as a subsequent attendance decision.

family wealth or personal savings (measured by the availability of the unconditional transfer S) will have no effect on access or persistence. Poorer students will take out larger loans, but the level of the loan does not appear in the attendance condition (5) or the effort decision (3).

This linear model, although it is clearly very restrictive, does guide the thinking of many economists. In particular, given that university students are (or will be) a privileged group relative to others of their generation, there is no strong equity based case for the provision of grants to students. Since grants are not needed to improve access and have no effect on persistence, the only arguments for grants are based on the possible external benefits to society of having some of its more able members receive higher education, or the beneficial effect they might have for tax neutrality. Given a government subsidy at this level, student loans are the best instrument for ensuring access - they provide access to those students who need the help, and for whom attendance is the right decision, at no cost to the rest of society. Students from rich and poor backgrounds will use the same rate of return criteria to decide whether or not to attend university.

Hardship

One of the unrealistic aspects of this linear model is the fact that a decision to attend university for four years is treated as if it were a decision to take the money and invest it in a financial instrument with a particular risk free expected rate of return. But a unique aspect of a university education is that it requires one to spend four years in a particular place, and adopt a particular lifestyle with relatively low levels of consumption expenditure. This aspect of the "cost" of an education is not captured by the model. For students from poorer backgrounds, university attendance may impose a level of personal and financial hardship that will not be the experience of richer students.

A simple way to model this is to assume individual welfare is given by a standard concave utility function $U(y)$ defined over consumption expenditure y.A particular example might be the Stone Geary form:

$$U(y) = \ln(y - E^*) \tag{7}$$

The subsistence constraint is now incorporated into individual welfare in what is perhaps a more realistic fashion. Living close to a subsistence level of expenditure is difficult, particularly in an environment where one's peers may be able to afford a more affluent lifestyle.[8] We do not need the specific Stone Geary form to get our results, however, so in what follows we simply assume $U(y)$ is concave.

With this change the choice problem facing a prospective student becomes more complex. The overall expected return to university becomes:

$$\begin{aligned} &U\left[L+G+S+S^{*}-T\right]+B_1-c\cdot e \\ &+\delta\left[(p\cdot e^{*})\left(U\left[w_2+R-\tfrac{L}{\delta}\right]+B_2\right)+(1-p\cdot e^{*})U\left[w_2-\tfrac{L}{\delta}\right]\right] \end{aligned} \tag{8}$$

while the return to not attending becomes:

$$U\left[w_1+S\right]+\delta U\left[w_2\right] \tag{9}$$

and e^{*} now solves:

$$\max_{e\in\{0,1\}}\ \delta\left[(p\cdot e)\left(U\left[w_2+R-\frac{L}{\delta}\right]+B_2\right)+(1-p\cdot e)U\left[w_2-\frac{L}{\delta}\right]\right]-c\cdot e. \tag{10}$$

It is immediate from the above program that the level of student loan may affect the level of study effort. A student will study if

$$\delta\left[\left(U\left[w_2+R-\frac{L}{\delta}\right]+B_2\right)-U\left[w_2-\frac{L}{\delta}\right]\right]\geq c. \tag{11}$$

Differentiation of the LHS of this expression with respect to L gives:

$$U'\left[w_2-\frac{L}{\delta}\right]-U'\left[w_2+R-\frac{L}{\delta}\right] \tag{12}$$

which is positive by the concavity of $U(y)$. A larger student loan will increase the utility penalty associated with the failure to graduate, and thus should increase student effort. Note that in the model so far, however, effort is binary and there is no reason for a student to attend if he does not anticipate providing effort. We will return to this issue later.

[8] "I've learned to appreciate every single thing I have and it's hard for me to see people here throwing away hundreds of dollars on clothes and parties and stuff. I just don't get it." (student at Queen's University, quoted in The Journal, Queen's University, Nov 30, 2006.

With no explicit subsistence constraint and no student loan program, a student will attend if:

$$U\left[G+S+S^{*}-T\right]+B_{1}-U\left[w_{1}+S\right]-c+\delta p\left[U\left[w_{2}+R\right]+B_{2}-U\left[w_{2}\right]\right]\geq 0 \tag{13}$$

Family support S, even though it is not contingent on attendance, now affects access to education. Differentiation of the LHS of this expression with respect to S gives:

$$U'\left[G+S+S^{*}-T\right]-U'\left[w_{1}+S\right] \tag{14}$$

If we assume that $G-T+S^{*}<w_{1}$, i.e. that students are not paid more by their parents to attend university that they would earn in their alternative job, then concavity of $U(y)$ indicates that an increase in unconditional family support will increase access. Put differently, in the absence of loans a poorer student needs a higher financial rate of return in order to attend. This result does not require a subsistence constraint.

Access to a student loan program does not change this result. Suppose first that all students have access to a loan program and that they borrow the optimal amount L^{*}. Then the attendance condition (13) becomes:

$$\begin{array}{c} U\left[G-T+S+S^{*}+L^{*}\right]+B_{1}-U\left[w_{1}+S\right]-c \\ +\delta p\left[U\left[w_{2}+R-\frac{L^{*}}{\delta}\right]+(1-p)U[w_{2}-\frac{L^{*}}{\delta}]-U\left[w_{2}\right]\right]\geq 0 \end{array} \tag{15}$$

Since loans are chosen to maximize the net return to attendance, it follows immediately from the envelope theorem that the effect of changes in family support on the return to attendance is unaffected by any induced changes in the level of loans. The relevant expression for the effect of changes in S on the return to attendance becomes:

$$U'\left[G+S+S^{*}-T+L^{*}\right]-U'\left[w_{1}+S\right]. \tag{16}$$

So long as the student does not borrow so much money that he is better off at school than he would be in his alternative this expression remains positive.[9] Note that the key to this

[9]Such might be the case if this student's net rate of return were very high and very certain, but of course this student would not be complaining of "hardship" at university.

result is simply that the level of loan be freely chosen, not that the student loan system have any particular efficiency properties. Nonetheless, even a fully efficient loan system will not ensure equal access.

In practice, of course, not everyone has access to the student loan program and there is a constraint on how much students can borrow based on their measured need. Assuming that the loan authority can observe S and S^*, this can be modelled with the condition:

$$L \leq K + T - (G + S + S^*) \tag{17}$$

where K is a positive "subsistence level" constant.

If we assume that the loan constraint is binding the attendance condition for a student who qualifies for a loan then becomes:

$$\begin{array}{c} U\left[K\right] + B_1 - U\left[w_1 + S\right] - c \\ +\delta\left[p\left(U\left[w_2 + R - \frac{L}{\delta}\right] + B_2\right) + (1-p)U[w_2 - \frac{L}{\delta}] - U\left[w_2\right]\right] \geq 0 \end{array} \tag{18}$$

Since a dollar increase in S leads to a dollar reduction in loans, the effect of an increase in S on the attendance condition is now

$$-U'\left[w_1 + S\right] + p\left[U'\left[w_2 + R - \frac{L}{\delta}\right] + (1-p)U'[w_2 - \frac{L}{\delta}]\right] \tag{19}$$

This expression cannot be signed in general. It is possible, for example, that access to the income smoothing effects of a larger student loan makes attendance more attractive for those who are able to borrow more. This will be the case if $w_2 > w_1$ and the allowable loan is relatively small. On the other hand, to the extent that the lending authority cannot observe S accurately, an increase in S may be met with a less than dollar for dollar reduction in the allowable loan, and the positive relationship between S and access might be preserved.

We can also explore the effects of changing some of the other observable exogenous variables on the attendance condition. In particular, the effect of the first period cost variables can be expected to be larger for students from poorer backgrounds. For example, the effect of an increase in the alternative wage w_1 on the attendance condition is simply

given by $-U'[w_1 + S]$, which given a concave utility function is clearly larger in absolute value for a student with lower family support. Note that this relationship holds even if the student faces a subsistence constraint. In a linear model, with or without a subsistence constraint, the effect of changes in the opportunity cost on the return to attendance is the same across family income levels.

The empirical implications of this section can be summarized as follows. With concave utility, measures of family income and wealth will affect access to university even when we hold constant ability, other family background variables and even holding constant the direct transfer a student will receive from his parents if he attends university. This relationship between family income and access, *ceteris paribus*, will be positive for those who are not eligible to receive a loan. For those who do receive a loan the effect will also be positive if they are not choosing to take out the maximum loan allowed. For those who are constrained by the loan system, the effect is indeterminate. In addition, the effects on access of changes in first period cost variables should be larger for students from poorer backgrounds.

The reason why loans do not provide equal access is that there remains a risk of not graduating, even when the student provides effort. While loans create "leverage", in that successful graduation will generate a high realized rate of return, they also increase risk. With concave utility, there is a substantial anticipated cost of having to pay off a loan in a bad state where income is low. This limits the benefit that taking out a loan can provide to the student. To achieve equity of access a further grant for low income students is required.

Persistence

Not every student who attends university will graduate and go on to earn the benefits that come with a university degree. In many cases the failure to graduate is due to sickness or other circumstances beyond anyone's control. Alternately, the initial decision to attend may have been in error due to imperfect information, or financial circumstances may change. In some cases, however, students just do not put in the effort to graduate, even though they have made the initial decision to attend. Some perspective on this last issue

can be gained in our model with the addition of some recent ideas from Behavioral Economics.[10]

Recent experimental and empirical work has given support to the idea that people may use hyperbolic rather than exponential discounting when making choices about the future. Under hyperbolic discounting the present period has special status, so that the discount rate between the current period and the future is higher than the rate between two future periods. For example, many of us might choose ten dollars right now over eleven dollars next month, but would choose eleven dollars ten years plus one month from now over ten dollars ten years from now. Under standard exponential discounting we would make the same choice in each case.

People who use hyperbolic discounting may also procrastinate - i.e. put off an unpleasant task until some time in the future. But when the planned time arrives, they once again delay. This is not unlike a prospective student who decides to go to university planning to work and graduate, but when the time comes does not put in the required effort.

Under the simplest version of hyperbolic discounting there are two discount factors - δ and β. The first, δ, is the standard exponential discount factor. The second is an additional factor that affects every period in the future relative to the present. When $\beta = 1$ we are in the classical framework. A high school graduate contemplating going to university or working in the future therefore compares the return to attending university:

$$\begin{aligned} &\beta(U\left[L+G+S+S^{*}-T\right]+B_{1}-c\cdot e \\ &+\delta\left[(p\cdot e^{*})\left(U\left[w_{2}+R-\tfrac{L}{\delta}\right]+B_{2}\right)+(1-p\cdot e^{*})U\left[w_{2}-\tfrac{L}{\delta}\right]\right]) \end{aligned} \tag{20}$$

with the return to not attending:

$$\beta(U\left[w_{1}+S\right]+\delta U\left[w_{2}\right]) \tag{21}$$

where e^{*} now solves:

$$\max_{e\in\{0,1\}}\beta\delta\left[(p\cdot e)\,U\left[w_{2}+R-\frac{L}{\delta}\right]+B_{2}+(1-p\cdot e)U\left[w_{2}-\frac{L}{\delta}\right]\right]-\beta c\cdot e \tag{22}$$

[10] This section draws from the MA thesis of Marcel Cormier (Cormier 2007)

Note that at the time the attendance decision is made both the costs and benefits of the effort decision are off in the future, so the benefits are discounted relative to the costs by the factor δ. Thus we get the same anticipated effort as in the previous case. In the absence of very large grants or parental support for attendance, every student who attends university will anticipate working and graduating.

However, once the student arrives at university the effort required to graduate must be provided in the present, while the benefits are still off in the future. The effort decision is then determined as:

$$\max_{e\in\{0,1\}} \beta\delta \left[(p\cdot e)\left(U\left[w_2+R-\frac{L}{\delta}\right]+B_2\right)+(1-p\cdot e)U\left[w_2-\frac{L}{\delta}\right]\right]-c\cdot e \qquad (23)$$

The future benefits of effort are discounted more heavily, and it follows that some students may decide to attend university but then fail to graduate because they do not put in the effort.

This analysis provides us with some insights into the empirical determinants of academic persistence. Clearly students with high perceived benefits are more likely to put in the effort to graduate. This can be proxied by high school grades or perhaps field of study. As well, as was foreshadowed in the simpler model above, a higher level of loans should be associated with a higher level of effort and thus a stronger likelihood of graduation.

Studying is also important in high school, of course, but most students in high school are living at home and still under the influence of teachers and parents who may help to provide discipline. When they arrive at university they are on their own for the first time, and have the opportunity to procrastinate.[11]

Empirical Tests

Our model has generated several predictions about the relationship between family income and loans on access and persistence. First of all, income will of course not be the

[11] Thus we might also expect, ceteris paribus, that students who attend a university while living at home or near their home may be more likely to graduate.

only factor affecting access. Family background variables that affect attitudes toward education will also have an impact. However, family income should affect access even when the data contain excellent controls for family background and even for the amount of financial support the student receives while at school. This relationship will be positive among students who are unconstrained in that they do not need a loan or are able to borrow as much as they like. The model makes no predictions about the relationship between income and access among students who are financially constrained, in that they would like to borrow more. A second prediction is that student loans should be associated with higher effort in university. A final prediction is that the elasticity of attendance with respect to cost variables should be larger (in absolute value) for students from lower income backgrounds, with or without the presence of a student loan system.

In this section we report the results of some empirical tests of these propositions. The one prediction we do not test directly is the final one, as our data do not exhibit much variation in cost variables. However, we note that this is an old issue in the Economics of Education literature.[12] Researchers such as (Hoenack 1971), (Bishop 1977), (McPherson and Schapiro 1991) and others have noted that changes in cost variables such as transportation costs, tuition fees and student aid all have a larger affect on access for students from lower income families. These older papers do not provide much in the way of a theoretical framework, but to the extent that they are concerned about the distribution of income, they tend to speak in terms of income rather than utility. Even though their (implicit) models are linear, this result is not surprising and could indicate simply that poorer students are more likely to face financial constraints that prevent them from attending university.

More interesting, perhaps, is the fact that changes in the alternative wage (Corazzini, Dugan, and Grabowski 1972) also have a greater effect on access for lower income students. Changes in the alternative wage do not alter the amount of money one needs to subsist at university, and in a linear model the net return to education is changed by the same

[12] We thank the MESA referees for these references.

amount for a rich or a poor student regardless of any subsistence constraint. In our concave model a change in the alternative wage has a greater effect on the net return for a poorer student. It might be expected, therefore, to have a greater effect on behaviour.

However, in a standard supply and demand model (Becker 1975) changes in the alternative wage simply create a vertical shift in the demand curve. If the demand curves are the same and if (as Becker assumes) poorer students face a more restrictive supply of educational funds (and if the demand curve has the right shape) then the same vertical shift in demand (as would happen under a linear model) can induce a larger response from poorer students. This implication will disappear if policy creates a situation where rich and poor face the same cost of educational funding - i.e. under a generous student loan system.

We note here simply that in our concave model, even in a system that provides unlimited and cheap access to educational loans, changes in the alternative wage will shift the demand for education by a larger amount for poorer students, and therefore will have a larger effect on the attendance decisions of poorer students. While we believe this does have normative implications for the use of targeted grants, it is not a prediction we are able to test directly.

The Data

We test the remaining propositions using two related datasets - the Youth in Transition Survey, Cohorts A and B (or "YITS-A" and "YITS-B"). The YITS-A initially interviewed a national, representative sample of 15-year old Canadians, their parents, and their high school administrators in 2000. There were then two follow-up surveys of the young people (only) in 2002 and 2004. In this latter cycle, the young people were 19-years of age, the point at which they would have been making at least their initial choices about entering post-secondary education. These data are extremely rich in background variables, including family income, parental education, and numerous sets of variables relating to the young person's high school experiences, attitudes, and parental behaviour at the time of the first interview when the person was age 15. Importantly, the parental income and

education measures are based on the response of the parents, and should be measured with some accuracy. We use this sample to estimate models of access to PSE which include the family income and parental education variables, as well as different combinations of the other variables as controls to get at the access-related propositions mentioned above – focussing on the effects of family income which are central to our analysis.

The YITS-B is similar to the YITS-A except that it started with a sample of individuals aged 18-20 in 2000, who were similarly followed up in 2002 and 2004. The data thus cover a later period in the young person's schooling experiences, but do not include the same wealth of background variables possessed by the YITS-A. We use these samples (all three cycles) to estimate models of persistence in post-secondary education and effort expended on school to get at the final propositions implied by the model.

The Access Models and Family Income Effects

The dependent variables used in our access models represent a bit of a turning of the usual set-up on its head. This is done in order to facilitate the investigation of the precise hypotheses being entertained. Whereas access models usually consist of using a logit or probit (or sometimes simply a linear probability model) where participating in post-secondary education takes the value of one and not participating is given a zero, here we turn those relationships around and, at least in the first case, accessing PSE is given a value of zero and non-access is given a value of one – thus simply reversing the nature of the usual relationships (e.g., higher parental income will be expected to have a negative rather than positive effect).

The reason for this approach is to allow us to study the effects of income (and the other variables included in the models) on the different reasons for non-participation – corresponding to the different implications of our model. We thus use a multinomial logit model set-up where 0 is participation in PSE, 1 is non-access and the individual cites a financial barrier as the reason for his or her non-participation (i.e., affordability is the issue), and 2 is non-access but the person does not cite a financial constraint as the reason for non-participation. (In the raw data, of those who did not attend post-secondary

education by the final survey, 18% of males and 27.3% of females cited financial barriers as the reason.)

We would thus expect family income to affect the financial constraint non-access outcome if the student financial aid system is not doing a complete job or there is otherwise some set of factors which generate such an income-financial barrier relationship. We would, however, also expect family income to affect the no financial constraint non-access outcome if income transfers also play a role in the participation decision, as developed in our model. Income might also operate through other channels (such as high school outcomes), but we believe the YITS-A dataset is sufficiently rich that such other effects are likely controlled for (e.g., we include grades, the PISA reading score, and other such possible mechanisms through which income could affect access indirectly in certain variants of the models), thus leaving us to at least tentatively conclude that we are in fact estimating "pure" or "direct" income effects.

The results of this estimation are shown in Tables 1 and 2. Table 1 shows the results of the simpler access ("0") versus non-access ("1") model, while Table 2 breaks the latter into those citing a financial barrier ("1") and those who say it was not a lack of financing that stood stand in the way of their participation in PSE ("2").

In each case, two sets of results are presented, one in which the "PSE" outcome includes both college and university students, and a second in which only university students are included among the participants and college students are excluded from the models. We actually focus on the latter specification because the literature has clearly established that university access is the more highly differentiated PSE outcome where family background and other effects matter more, and hence we expect to find sharper results with this model. Finally, each set of models is estimated with parental education first excluded and then included in order to show how much of the "raw" or "total" family income effects appear to in fact be parental education effects – and also to show the general magnitude of these other background effects, which can be generally interpreted as the "B" effects in our theoretical model. In all cases the models also include controls for sex,

province, family type, and visible minority and immigration status, although the results for these variables are not reported here.

The most interesting and general finding from Table 1 is that family income is indeed significantly related to non-participation in PSE. These income effects are significantly attenuated when parental education is added to the model (the second column in each set of results). Still, significant income effects remain. So, for example, when only the sharper university versus no PSE comparison is made (the left hand columns) the top two family income categories are associated with 11 and 21.9 percent lower probabilities of not participating in university when parental education is excluded, while these effects fall to a considerably lower, but still significant (and important) 4.8 and 9.3 percentage points when parental education is added. These results hold, if perhaps not quite as strongly, when college students are included and grouped with university students in the PSE participation group – as expected.

We then turn to what is perhaps the even more interesting proposition: that family income affects participation for both i) those who face financial barriers to their participation in PSE, which the student financial aid system is of course meant to rectify, and ii) those who are not financially constrained from going to PSE but do not participate anyway (for other reasons). The results reported in Table 2 show the effects of family income on each of these outcomes.

The results suggest, first, that the student financial aid system does indeed seem to be doing a good job in the sense that being constrained from going to PSE due to the financial barriers is only relatively weakly related to family income, with most of the income-related coefficients in the first equation ("Financial Barrier") not statistically significant, and those that are significant being relatively small in magnitude, especially once the parental education variables are added.

Family income is, however, in general significantly related to not going to PSE even when the person is not financially constrained from going (the "Financial situation not a barrier" equations). This is especially true, again, when the university option is isolated.

The implication of this finding is that the student financial aid system might need to go beyond pure "affordability" criteria if it wants to level the PSE access playing field for young people from lower income families.

Persistence, Effort, and Student Loans

Next we turn to the effects of having a student loan on the probability of leaving PSE or changing programs. In Table 3 we show the results of a persistence model in which the probability of advancing from one year of studies to the next is modelled (again) in a multinomial framework where the outcomes can be i) switching from one program to another, or ii) leaving PSE. The key variables of interest (and the only ones reported in the table) are those pertaining to the student's receipt of student financial aid: merit based scholarships, need based grants, or loans. The models are estimated separately for college and university students.

The models are estimated with different sets of other regressors, which (as indicated in the notes to the table) move from including only a single set of dummy variables indicating the year of the program ("duration" effects when the model is viewed as a hazard or duration model, which it can be), through a limited set of (exogenous) background variables which include province/region, gender, visible minority status, family type, and parental education, to a model where a full set of controls include not only high school grades and engagement, but also a comparable set of variables at the PSE level.

In this context, it is nevertheless difficult to know how to interpret the student financial aid variables generally, and the loan variable in particular, since these are likely to be picking up a range of other effects. Principal among these would be unobserved personal, institutional, and other effects (including those reflecting policy initiatives) that are related to both who qualifies for a loan and the persistence outcome. We therefore regard the results of these models as representing no more than a simple kind of descriptive analysis of the relevant correlations – albeit estimated in an econometric framework.

The most important result here is that the student loan variables are almost nowhere statistically significant, and where they are significant (in the later specifications for college

students), they are of the "wrong" sign – i.e., positive rather than negative. That is, whereas our model predicts that students with loans will, ceteris paribus, be less likely to drop out because they will want to complete their studies to move into the better jobs that will make it easier to repay their loans and provide a better standard of living while doing so, the empirical evidence points to no such effect, or a small effect in the opposite direction. Unfortunately, as these data are from the YITS-B survey, we have no way to control for parental income, which can be expected to be negatively correlated with student loans.

These difficulties with the data prompt us to conclude that the evidence is simply not very meaningful. A better test would be to come up with a more exogenous determinant of loans and use such an instrument to measure the causal effects of borrowing on persistence. An experimental framework would of course be an ideal way to approach the issue.

Finally, we turn to the effects of having a student loan on effort. This outcome is still prone to the sort of unobservable effects noted for the borrowing variable, but the problem may be less extreme. In particular, whereas a student's financial situation will likely directly affect both who qualifies for a loan and persistence behaviour there is less reason for the factors related to qualifying for and receiving a loan to also be directly related to effort. That said, we do not regard these results as necessarily strictly causal either, and take them to be no more than a preliminary set of estimates of a potentially interesting relationship.

Effort is measured as the number of hours spent on school work out of class, and is estimated using a Tobit framework since the endogenous variables is censored at zero (although a simple OLS approach generated very similar findings). The same different sets of controls are included as in the preceding persistence models, but again we report only the student financial aid variables.

The findings are in fact interesting, if only because the coefficients on the student loan variables conform to the predictions of the model. University students with loans spend, on average, in the range of .5 or .6 more hours per week (outside of class) on their school work

than do those without loans – and this on a mean value of around 10 hours per week. For college students, the effects are slightly smaller, in the range of .3 or .4 hours, but this would be expected in a context where mean hours are also lower, and the effects are still statistically significant. Note that the final regression includes measures of high school grades and engagement as well as university grades and engagement, and the effect of loans on effort is strongest in this regression. We may thus conclude that this first evidence is in fact consistent with the predictions of our model regarding student loans and student effort.

Conclusions

The general arguments in favour of public grants for the support of postsecondary education are well-known. The strongest argument is based on the belief that education for a relatively gifted subset of the population provides external benefits to all of society, and should be encouraged. This argument does not suggest that education should be free, however, since the personal benefits of higher education are substantial, so the incentive for good students to pursue higher education is already very high. Other arguments in favour of grants suggest that they help provide a neutral tax system, or may serve as a second best response to informational issues about the benefits of education that may be of particular importance for poorer students (Usher 2006). Further arguments for grants, or for education to be "free", are normally dismissed by economists as ideological statements about the appropriate role of the state in society (if they come from colleagues in academe) or as self serving calls for undeserved public transfers (if they come from students).[13] At this point, recognizing that university students are a group favoured by our market economy, most economists will argue that further support should come in the form of loans.

This paper has argued that family income will affect access to education through its effect on the personal rate of return to schooling. We can illustrate the main idea with reference to a pair of potential students who are identical in every respect but family income. Suppose that attendance at university for each will require a reduction in yearly

[13] No more self serving or undeserved, of course, than calls for government handouts that come from other segments of society.

expenditure of $5000.00 relative to the best alternative. Afterwards, as a graduate or non-graduate, each expects the same yearly income and other benefits. Our hypothesis is simply that a reduction in yearly expenditure from $10,000 to $5000 is a more daunting prospect than a reduction from $20,000.00 to $15,000.00. The level of hardship associated with very low levels of expenditure increases in a nonlinear fashion, and the first student therefore faces a higher personal cost of attending university. She will need a higher objective rate of return before she will decide to attend.

The idea has positive implications for the effect of income on access. In particular, even among students who declare themselves unconstrained by financial barriers, we would expect to see a positive relationship between family income and access to higher education. This relationship should survive the addition of any number of parental and family background variables. It is a pure income effect on behaviour. A second implication is that students with outstanding loans can be expected to work harder to graduate. Data from the YITS-A and YITS-B surveys provides support for these predictions. The model also predicts that the response of poorer students to changes in costs, including opportunity costs, will be larger for poorer students. This implication also has empirical support.

The idea also has normative implications for the design of programs to provide equal access to post-secondary education. In particular, a student loan program will have no effect on the empirical implications of the model - even an ideal loan system will not provide equal access. The problem is that having to take out a larger loan increases the leverage faced by a poorer student, and thus increases the riskiness of her investment. Equal access also requires that we provide grants to students from poorer backgrounds.

While not discussed here, there are many student support programs that essentially combine loans with targeted grants. Income contingent loan programs combine loans with public grants (i.e. debt forgiveness) to those students who end up earning less money over their lifetime. A graduate tax is like an income contingent loan system where the grants come from the more successful students, who end up paying more for their education than graduates who earn less money. These programs have advantages, but differ from the loan

/ grant programs discussed here in that the recipients of grants are those who experience lower personal lifetime income, rather than those whose parents are poor. Since the arguments here depend on the hardship caused by low parental income, they support the idea that grants should be given directly to those students whose parents are poor.

Finally, it is of course one thing to suggest that a grant be given, but quite another to suggest how large it should be. We are some way yet from addressing this second issue.

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Table 1 - Access Models: Simple Case of Participation Vs. Non-Participation

	University Only		College and University	
	1	2	1	2
Parental/guardian's Education (HS completed)				
Less than HS		0.1302***		0.1425***
		[0.0239]		[0.0254]
Some PSE		-0.0857***		-0.0751***
		[0.0277]		[0.0242]
Trade/College		-0.0906***		-0.0696***
		[0.0189]		[0.0169]
University-below BA degree		-0.2603***		-0.1781***
		[0.0330]		[0.0288]
University-BA		-0.3340***		-0.2286***
		[0.0195]		[0.0166]
University-Grad		-0.4127***		-0.2841***
		[0.0222]		[0.0198]
Other/unknown		0.2299**		0.3124**
		[0.1066]		[0.1383]
Parental Income Level ($50000 to $75000)				
Extremely low ($0-$5000)	0.0985	0.1021	0.0973	0.0874
	[0.0744]	[0.0721]	[0.0653]	[0.0653]
$5000 to $25000	0.1880***	0.0895***	0.1504***	0.0709***
	[0.0274]	[0.0286]	[0.0264]	[0.0262]
$25000 to $50000	0.1137***	0.0570***	0.0779***	0.0376**
	[0.0183]	[0.0180]	[0.0167]	[0.0165]
$75000 to $100000	-0.1096***	-0.0476***	-0.0789***	-0.0393**
	[0.0179]	[0.0171]	[0.0155]	[0.0154]
$100000 and up	-0.2178***	-0.0930***	-0.1574***	-0.0843***
	[0.0185]	[0.0201]	[0.0159]	[0.0175]

Average marginal effect shown. Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 2 - Access Models: Reasons for Non-Participation

	University Only				College and University			
	1		2		1		2	
	Financial barrier	Financial situation not a barrier	Financial barrier	Financial situation not a barrier	Financial barrier	Financial situation not a barrier	Financial barrier	Financial situation not a barrier
Parental/guardian's Education (HS completed)								
Less than HS			0.0265	0.1037***			0.0289	0.1136***
			[0.0247]	[0.0295]			[0.0188]	[0.0332]
Some PSE			-0.019	-0.0672*			-0.0174	-0.058
			[0.0188]	[0.0361]			[0.0136]	[0.0354]
Trade/College			-0.0119	-0.0789***			-0.0095	-0.0605**
			[0.0123]	[0.0236]			[0.0092]	[0.0236]
University-below BA degree			-0.0572***	-0.2033***			-0.0401***	-0.1384***
			[0.0182]	[0.0504]			[0.0143]	[0.0469]
University-BA			-0.0620***	-0.2722***			-0.0426***	-0.1863***
			[0.0099]	[0.0259]			[0.0079]	[0.0244]
University-Grad			-0.0918***	-0.3218***			-0.0663***	-0.2185***
			[0.0085]	[0.0365]			[0.0071]	[0.0346]
Other/unknown			-0.0831*	0.3187***			-0.0568	0.3774***
			[0.0473]	[0.1107]			[0.0360]	[0.1396]
Parental Income Level ($50000 to $75000)								
Extremely low ($0-$5000)	0.0723	0.024	0.0746	0.026	0.0637	0.0312	0.0628	0.0227
	[0.0536]	[0.0772]	[0.0542]	[0.0729]	[0.0428]	[0.0771]	[0.0424]	[0.0739]
$5000 to $25000	0.1045***	0.0813**	0.0824***	0.0049	0.0831***	0.0648*	0.0647***	0.0037
	[0.0256]	[0.0334]	[0.0243]	[0.0326]	[0.0202]	[0.0344]	[0.0190]	[0.0332]
$25000 to $50000	0.0616***	0.0497**	0.0506***	0.0041	0.0459***	0.0296	0.0384***	-0.0032
	[0.0132]	[0.0247]	[0.0127]	[0.0234]	[0.0102]	[0.0247]	[0.0098]	[0.0237]
$75000 to $100000	-0.0092	-0.1009***	0.0021	-0.0502**	-0.0055	-0.0739***	0.0019	-0.0417*
	[0.0095]	[0.0262]	[0.0099]	[0.0246]	[0.0075]	[0.0247]	[0.0078]	[0.0243]
$100000 and up	-0.0392***	-0.1785***	-0.0182*	-0.0747**	-0.0285***	-0.1289***	-0.0158**	-0.0685**
	[0.0079]	[0.0294]	[0.0095]	[0.0298]	[0.0064]	[0.0273]	[0.0073]	[0.0285]

Average marginal effect shown. Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 3 - Student Financial Aid and the Probability of Switching/Leaving PSE

College

	MNL (1)		MNL (2)		MNL (3)		MNL (4)		MNL (5)	
	Switcher	**Leave**	**Switcher**	**Leave**	**Switcher**	**Leave**	**Switcher**	**Leave**	**Switcher**	**Leave**
Scholarships	0.0171	-0.0450***	0.00138	-0.0422***	0.000632	-0.0274	0.00725	-0.0229	0.00685	-0.0181
	[0.019]	[0.015]	[0.016]	[0.016]	[0.017]	[0.017]	[0.017]	[0.016]	[0.016]	[0.015]
Grants	-0.0331*	-0.0326*	-0.00704	-0.0690***	-0.00742	-0.0645***	0.00381	-0.0573***	0.0048	-0.0559***
	[0.018]	[0.020]	[0.020]	[0.017]	[0.020]	[0.016]	[0.021]	[0.016]	[0.021]	[0.015]
Student Loans	-0.00602	0.0282*	-0.00604	0.0202	-0.00647	0.0245	-0.00471	0.0254*	-0.00281	0.0242*
	[0.013]	[0.015]	[0.013]	[0.016]	[0.013]	[0.015]	[0.012]	[0.014]	[0.012]	[0.013]
# of Observations	8442	8442	8442	8442	8422	8422	8422	8422	8422	8422

University

	MNL (1)		MNL (2)		MNL (3)		MNL (4)		MNL (5)	
	Switcher	**Leave**	**Switcher**	**Leave**	**Switcher**	**Leave**	**Switcher**	**Leave**	**Switcher**	**Leave**
Scholarships	-0.0285***	-0.0342***	-0.0340***	-0.0332***	-0.0256***	-0.0205**	-0.0200**	-0.0125	-0.0187*	-0.0125
	[0.0079]	[0.0082]	[0.0086]	[0.0086]	[0.0096]	[0.0095]	[0.010]	[0.0096]	[0.0099]	[0.0095]
Grants	0.00968	-0.00224	0.00893	-0.00622	0.0103	-0.00574	0.0132	-0.00293	0.0131	-0.00332
	[0.010]	[0.012]	[0.011]	[0.012]	[0.011]	[0.012]	[0.011]	[0.012]	[0.011]	[0.012]
Student Loans	-0.00177	0.00584	0.00222	0.00955	0.00194	0.00779	0.000354	0.00403	0.0021	0.00474
	[0.0089]	[0.0100]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.0099]	[0.010]	[0.0099]
# of Observations	11342	11342	11342	11342	11307	11307	11307	11307	11307	11307

Note: Only the results for the student financial aid variables included in the models are reported. The others variables are listed below.
MNL(1): Includes only the student financial aid variables and transition year variables.

MNL(2): Adds basic background variables, such as gender, visible minority status, region of schooling, family structure, and parental education.
MNL(3): Adds high school grade and high school engagement variables.

MNL(4): Adds PSE grade variables.

MNL(5): Adds PSE engagement variables.

Table 4 - Student Financial Aid and Hours Spent on School Work Outside of Class

College	Tobit (1)	Tobit (2)	Tobit (3)	Tobit (4)	Tobit (5)
Scholarships	1.263***	0.972***	0.486**	0.479**	0.533**
	[0.23]	[0.23]	[0.22]	[0.22]	[0.22]
Grants	0.357	0.255	0.11	0.036	0.0188
	[0.29]	[0.28]	[0.27]	[0.27]	[0.27]
Student Loans	0.400**	0.365**	0.255	0.256	0.228
	[0.18]	[0.18]	[0.18]	[0.18]	[0.18]
Constant	10.150908	8.9306622	8.8192717	9.0656924	9.5413583
# of Observations	7147	7147	7129	7129	7129

University	Tobit (1)	Tobit (2)	Tobit (3)	Tobit (4)	Tobit (5)
Scholarships	1.868***	1.893***	0.903***	0.678***	0.640***
	[0.22]	[0.22]	[0.22]	[0.23]	[0.22]
Grants	0.396	0.479*	0.394	0.358	0.281
	[0.27]	[0.27]	[0.26]	[0.26]	[0.25]
Student Loans	0.524**	0.447*	0.539**	0.642***	0.639***
	[0.25]	[0.26]	[0.25]	[0.25]	[0.24]
Constant	12.393008	12.326585	11.530606	11.497167	10.456201
# of Observations	5253	5253	5235	5235	5235