Student Loans:
An Analysis of Income Contingent Loan Repayment Plans

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1. Introduction

In a world of globalization and emerging markets, higher education has been recognized as important to build human capital and improve the economy's productivity. However, investing in human capital is costly. Individuals often incur debt in order to invest in the future. This cost burden may discourage people from investing in education, even though the investment would be economically valuable to both the individual and the economy. Policy toward student loans should ensure an equitable allocation of resources to promote equal access and sustainable growth within the educational sector. The benefits of education are apparent: education increases productivity on average yielding higher earnings in the future. Education in Canada also plays a role in socializing youth and informing the public by maintaining a progressive society. At higher levels, education transmits political and cultural norms which re-establish modern democracy with an improved electorate.[1] From a public policy perspective education is one of the most essential investments in society. Technological progress and endogenous growth theory[i] validate educations' importance.[2]

However, investment in education is atypical. Lack of collateral and uncertain rates of return create many difficulties in realizing the value of human capital investment. Recently, Canada has undergone scrutiny for its policies toward postsecondary education. Rising tuition fees coupled with government cutbacks has diminished equal access and created a system in need of restructuring. Canada's student loan program demands revision; the current structure needs to better adapt to the changes in postsecondary

[1] Rosen (pg. 265)
[2] Romer (pg 136)

education. Student funding policies need to function more efficiently in order to fully realize the benefits education possesses for both the economy and its educated workers.

The analysis put forth here explores the issues of student finance in Canada and seeks to provide superior alternatives to Canada's student loan policy. Conceptualizing the need for student loans as well as identifying present problems will aid in evaluating practical policy. Specifically, the evaluation will focus on the current structure of loan repayment in Canada, and will investigate the merits of income-contingent loan repayment plans (ICLRP's). ICLRP's work to alleviate risk and uncertainty in the decision to invest in higher education by insisting that repayment plans be contingent on future earnings. Post-education income of the borrower is then the only relevant income.[3] The intrinsic insurance elements of ICLRP's tend to encourage the low income population to invest in education, but may induce problems of moral hazard and adverse selection[ii].[4] Another area of concern in student finance is asymmetric information. Governments have imperfect knowledge of the investor's ability to succeed in loan repayment. The problem of insufficient collateral and an uncertain rate of return also create complications in financing.

The degree to which governments have to cover the cost of defaulted loans is one indication of repayment success. Canada's traditional 'mortgage-type' loan system has been criticized for possessing exorbitantly high interest rates which lead to high default rates.[5] These high interest rates create high monthly payments, which become unmanageable for the borrower and cause them to default on their repayment. A high

[3] West 1993 (pg. 11)
[4] Guillemette (pg 2)
[5] Thomas (pg. 2)

repayment obligation only contributes to loan default. High interest rates discourage investment and overall educational attainment suffers. Implementing equity and efficiency measures can be used to evaluate the impacts of these contrasting loan repayment schedules, and provide insight on attaining optimal policy design.

I use a utility maximizing simulation model to analyze the affects student loan policy has on different groups in society. The two variables used to define the different groups in the population are skill and wealth. Acting as parameters, skill and wealth can be used to help to evaluate the equity and efficiency concerns of the corresponding loan structures. Liquidity constraints, repayment schedules and present value equations are other elements examined in detail. The measure of relative risk aversion in the simulation model investigates how each policy affects different types of risk-averse investors. The model is designed to evaluate the accessibility impacts of traditional mortgage-type loans and income-contingent loans. Loan default is important in policy evaluation, but is not the emphasis of this analysis. Accessibility is the focal point of the discussion; the issue of default is apparent and could be accounted for in the model, but is only considered in brief. The results from the simulation show that both policies influence participation differently. Income contingent loans are preferred over fixed mortgage-type loans when the investment is more risky. Analyzing the differences in skill suggest that low skilled individuals prefer the income contingent loan, where as the high skilled tend to favour the contemporary loan scheme. As a variable, wealth most significantly affects high skilled poor individuals. The utility maximizing results of each group in the population are interpreted in a detailed analysis of the model, followings it's development.

The analysis of this paper will attempt to illustrate how the relationship between education and economics influences student financing and public policy decisions. A good understanding or this relationship is crucial to realizing the implications of student loan structures. Recognizing the relationship between education and economics is vital to the significance of this analysis.

Following the introduction, *section two* reviews the conceptual issues of student finance. Uncertain rates of return and lack of collateral create the need for student loan policy as well as demand for alternative financing. The attributes of fixed mortgage-type loans and flexible income-contingent loans are also outlined in this section.

Section three presents the simulation model used for analysis. This section describes the construction of the model: including the definition of parameters, underlying assumptions, and overall design. The predictive power of the model comes from clearly understanding its function and design.

Section four organizes and interprets the results obtained from the simulation model. Relative risk aversion is used to aid in policy comparison. When risk aversion equals zero, a benchmark example is used to define the efficiency standard for analysis. A sensitivity analysis is conducted to observe the effect that the parameters have on the model. The accessibility impacts of the contrasting loan policies are also evaluated in this section.

Section five highlights ICLRP experience abroad in an attempt to link theory with practice. Australia, the United States, and New Zealand are a few countries that have implemented some form of an income-contingent student loan structure. The mixed nature of evidence found from ICLRP experience proves that income contingent loan

structures are not the Holy Grail of student financing, but may possess some positive qualities.

Section six summarizes what was found from the study. This section discusses the analysis in its entirety, and offers concluding remarks, including the implications such an analysis should have on student finance policy planning in the future.

Comprised these sections seek to provide superior public policy alternatives toward student finance, in hopes to make it more accessible and ensure an increasingly productive market force, in turn strengthening the Canadian economy.

2. Key Concepts and Evidence

In a report titled *On the Edge: Securing a Sustainable Future for Higher Education,* the Organization for Economic Cooperation and Development (OECD) have identified key global challenges to educational investment. Rapid growth in enrolment and research activity, declining state funding, unsustainably low levels of infrastructure investment, and greater competition were all recognized as issues of international concern.[6] The increasing reliance on specialization and skill acquisition in a knowledge-based economy has only furthered the need for educational investment. Higher education offers great rewards in the form of personal, cultural and economic benefits, as well as in the form of an increased income advantage over non-graduates.[7] Investment in higher education also generates external benefits above and beyond those accrued by the student. These externalities refer to the social benefits – political, cultural and economic.[8] When students choose to invest in higher education they do not account for these externalities. This creates underinvestment and a loss of efficiency in post secondary investment.[9] In order to maintain an optimal level of investment, government subsidies are needed to compensate for the loss of efficiency. Financing the cost of higher education is problematic because the investment is risky and the borrower lacks sufficient collateral for the loan. The government must then uphold accessibility by ensuring that all prospective students can borrow to cover the private cost of education.[10]

Canada's student financing programs have been characterized as being costly and inefficient. High tuition fees have shifted the cost-burden to the student, making the

[6] Alaire & Duff (pg. 554)
[7] Guillemette (pg. 2)
[8] Ibid.
[9] Ibid.
[10] Guillemette (pg. 2)

investment in education more costly for the individual investor. Other things equal, the increase in cost to the individual investor as yet to be compensated for with adequate improvements in student assistance and financial aid programs. While the cost of investment has increased, incentives to invest have not been equally matched by government initiatives. Investing in education is now not only increasingly costly, but also risky. High variability and uncertainty in post graduate income creates a reluctance to invest, especially for those most in need of assistance. An uncertain rate of return on investment and lack of collateral for student loans create a disconnection between both the lender and borrower of the loan. Students need money to invest in postsecondary education but not all students are willing to assume this burdensome debt. Financing institutions may be reticent to loan to students if they (or their families) cannot provide necessary collateral and their ability to repay their loans in the future remains uncertain.[11] Thus, risk and problems of default cause lender resistance and perpetuates the barriers of investment. Without government provision in student finance, there would be inefficient investment in postsecondary education, and access would be limited. Therefore, to serve both efficiency and equity goals, governments often operate student loan systems.[12] It is these efficiency and equity goals that are the focus of this discussion.

A Canadian solution to this lending problem involves government-assisted bank loans to students with low to moderate family incomes.[13] This is summarized by Yvan Guillemette: "the government guarantees loans to students on the assumption that the financial return on the postsecondary education will allow them to reimburse the loans."[14]

[11] Finnie 2005 (pg 476)
[12] Finnie 2005 (pg 476)
[13] Guillemette (pg 3)
[14] Ibid.

The traditional mortgage-type loan system in Canada uses fixed repayment rates, government-assisted bank loans and has limited insurance devices to minimize loan default. The problem of defaulting grows large, especially where governments involve banks and special departments of quasi-public institutions for managing the borrowers.[15] Quasi-public institutions complicate the collection of repayments, and lack adequate enforcing mechanisms needed to combat loan default.

Chart 1
Loan status of 1994-95 consolidations as of September 2003

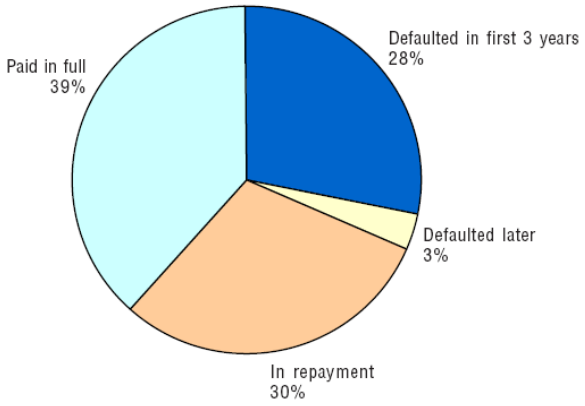

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Chart 1 is taken from a study, *Factors Affecting Loan Repayment,* conducted by Statistics Canada and summarizes the loan status of the 128,000 students who consolidated their student debt after graduating in the year 1994-95. These loans are assumed to take on the typical ten year repayment term. The pie graph illustrates the distribution of loan repayment in 2003 (nine years after consolidation) and indicates that 39% of student debtors had repaid their loans in full, 30% were still making payments, and most importantly to an analysis of the problems of Canada's current loan repayment scheme,

[15] West 1993 (pg. 1)
[16] Kapsalis (pg.8)

that the remaining 31% of student debts were considered to be in default[iii]. The graph also shows that 28% of loan default occurs within the first three months. Loan default rates have been high in Canada in the past and are a continual reminder that the system needs improvement.

An alternative financing approach that can solve some of these discrepancies is one that subsidizes high risk investors by making loan repayments dependent on future income. Income-Contingent Loan Repayment Plans or (ICLRP) can be used to reduce risk and uncertainty in the decision to invest in higher education. The practical and theoretical aspects of ICLRP will be the focus of the following discussion, and the qualities of such a system will be investigated.

2.1 Income Contingent Loan Repayment Plans (ICLRP's)

The inception of the ICLRP scheme is rooted in the pioneering works of the neo-liberal economist Milton Friedman. In a 1955 paper *The Government and Education* Freidman proposed income-contingent lending as a way to inspire capable individuals to invest in training and higher education.[17] The proposal addressed the concern that individuals with the ability and desire to succeed in a profession may decide not to invest due to financial barriers.[18] The reluctance of the individual to assume risk and the reluctance of the lender to loan are the two aspects that contribute most to the difficulties in financing post secondary education. Friedman's solution was to use the increased earning power of graduates to finance university education investment; loan repayment

[17] Thomas (pg.1)
[18] Ibid.

would then be a specified fraction of future earnings.[19] The flexibility in loan repayment under ICLRP allows compensation to be 'smoothed-out' over long periods of time, while simultaneously adjusting to changes in income. E.G. West states that this is contrary to the current program, which is a mortgage type of loan, requiring fixed payments at fixed and relatively short intervals, a feature that he agrees could result in many students to default.[20] Differences in program design can be more easily understood and better evaluated once the basic problems associated with student finance are reviewed. The number of students demanding higher education and student assistance has grown substantially since Friedman first conceptualized ICLRP. However understanding the essence of ICLRP is fundamental to conceiving the evolution of ICLRP and how it is perceived today. Friedman's proposals were mainly theoretical until the early 1970s when countries such Australia, New Zealand, the United States, and the United Kingdom attempted to put the theory into practice.[21] Prior to examining any of the early practical applications of income-contingent lending, one should examine the basic structure of such financing schemes.

To understand the functions of an ICLRP financing system, several variables require attention. In a 1994 discussion, Terrance Thomas concisely outlines seven significant variables of income-contingent loan structures. These variables may change with specific program design, but collectively work to create the essence of any ICLRP construct. The following factors identified by Thomas are used to identify the elemental differences between the traditional mortgage-type loan scheme and the income-contingent design.

[19] Ibid. (pg.1)
[20] West 1993 (pg.1)
[21] Thomas (pg.1)

1. The amount of the loan (L)

The size of the loan itself is a crucial variable. In the last 15 years tuition fees for post-secondary education have increased substantially in most Canadian provinces — more than doubling in real terms on average and rising even more in graduate and professional programs.[22] The trend towards rising tuition fees has resulted in students having to bear more of the cost when investing in post-secondary education. This increased individual cost burden has not been coupled with increased financial aid or governmental assistance. Student aid programs have not justly paralleled the recent increases in tuition. Such tuition increases will only affect educational choice if government loan programs overcome imperfections in capital markets caused by asymmetric information.[iv][23] This issue of imperfect capital markets and asymmetric information is problematic for loan policy, because of the uncertain rate of return on investment. No party involved has 'perfect knowledge' of investment outcomes, which results in decisions being made with imperfect information. This is economically inefficient in principle, and having increased education costs only exacerbates this imperfection.

Rising tuition fees have increased the direct cost of investment, but in terms of repayment seem to contribute little to the inability to repay the loan. A study conducted in 2001 by Statistics Canada makes use of significant results found by the National Graduate Survey (NGS), and outlines factors that affect loan repayment.[24] Table 1 organizes these findings.

[22] Alaire and Duff (pg. 1)
[23] Rosen (pg. 274)
[24] Situ (pg. 4)

Table 1: *Basic statistics of debtors who consolidated their debt in 1994-95* [25]

Calendar year	Number of debtors	Percentage of debtors (%)	Total debt at consolidation ($)	Principal owed at default ($)	Average own income (1995-1997) (Current $)
Defaulted during the first three years	36,300	28	6,800	6,500	13,800
Defaulted later	4,000	3	7,000	5,100	19,100
In repayment	37,900	30	7,400	n/a	24,000
Paid in full	49,300	39	6,500	n/a	24,200
All 1994-95 consolidations	127,600	100	6,900	5,400	21,000

The study observes a group of borrowers who consolidated loans in 1994-95, and tracks repayment transactions of this specific cohort. In brief, the consolidation process under the mortgage-type loan is as follows: the borrower of the loan strikes a repayment contract after graduation which sets the monthly repayment rate and repayment term. In Canada there is a six month grace period before payments need to be made, but after that the borrower is responsible for fulfilling the repayment contract. The process of consolidation is the point at which all borrowed money is integrated into an overall repayment contract. One can see that the difference in average indebtedness between those who defaulted during the first three years ($6,800) and those who paid off their loan in full ($6,500) was not significantly different.[26] The small variation between the debt of those who defaulted and those who repaid in full suggests that the amount of indebtedness has minimal effect on the ability of students to repay their loan.[27] By contrast, the last column of Table 1 shows significant differences in income between

[25] Kapsalis (pg. 9)
[26] Ibid.
[27] Ibid.

those who defaulted and the rest of the borrowing population. The average own-income over the period 1995-97 in current dollars was $13,800 for those who defaulted in the first three years and $24,200 for those who paid off their loan in full.[28] Table 1 suggests that the post-graduate income of students is a much more important factor than the size of the loan in terms of repayment success.

The size of the loan is an even less significant of a factor in ICLRPs. ICLRP's do not require complex eligibility regimes. One advantage of ICLRP design is that it does not rely heavily on parental contribution to determine various levels of assistance. The ICLRP structure systematically shifts the liability and collateral for loan from parental income to the borrower's ability to succeed post-graduation, comparable to buying a stock in oneself. This is positive because it reconciles the issue of reticent financing institutions that are reluctant to loan to students when they (or their families) cannot provide necessary collateral, while their ability to repay their loans in the future is uncertain.[29] Loan size is not irrelevant all together since it appears to possess minor influences on factors that affect loan repayment. However the evidence is mixed, suggesting that the affect depends on the implementation of the ICLRP design.

2. The interest rate on the loan (r)

High interest rates on student loans are one reason why most students opt not to borrow. High interest rates along with large principal only make the decision to invest less appealing. Determining the 'correct' rate of interest is a difficult task. Policymakers must find the rate that is needed to discount expected future earnings, but this is troublesome since asymmetric information between the borrower and lender of the loan

[28] Ibid.
[29] Finnie 2005 (pg 476)

can create an inoperative market.[30] The interest rate supply curve for loans is so high that it fails to intersect with any point on the demand curve. This is not an imperfect, but rather an inoperative market. The 'true' height of the supply curve is the key concern.[31]

A quick simulation of loan repayment can illustrate the basic challenges of student financing. With help from a loan calculation kit provided by Statistics Canada, one can start to understand how loan repayments work. Canada Student Loans carry a maximum fixed interest rate of the prime rate + 5%, or a maximum floating rate of the prime rate + 2.5%. A "fixed rate" is a stable rate of interest that is applied throughout the duration of the repayment term. For example if the prime rate is 6% then the fixed rate is 11% (6% +5%). A "floating rate" is a rate of interest that fluctuates over time. If the borrower consolidates their loan with a floating rate, the rate of interest applied will change throughout the repayment term. For example if the prime rate is 6% then the floating rate would be 8.5% (6% + 2.5%). The prime rate is also a variable rate of interest that is expressed as a percentage each year. The prime rate is the lowest interest rate set by the lender; it is used as a reference point for the interest rates that are set on all other loans. This actual choice of interest rate is sometimes referred to as the 'student-rate'. It is established when the loans' terms and agreements are consolidated. Interest rates vary from province to province, but one can use the formula below to approximate monthly payments under Canada's current student loan program:

$$Monthly\ Payment\ M = \frac{P \times I}{1 - (1 + I)^{-N}}$$

[30] West 1988 (pg. 86)
[31] Ibid (pg 86)

where P =	Loan Principal
N =	number of months over which the loan is amortized
I =	monthly interest rate in decimal form (i.e., r/ (12*100)). For example, an annual interest rate of r= 10% means that I = 10/1200 = 0.0083333.

As an example, consider monthly payments to repay a loan of $20,000 over 10 years, given both the fixed and floating rates discussed:

Fixed

Student loan principal	P = $20,000
Prime Rate	pR = 6%
Annual interest rate	r = 11% (fixed = prime + 5%)
Repayment period	= 10 years. Number of repayment periods N = 10 years*12 months = 120 – 6month grace = 114 months

$$Monthly\ Payment\ (M) = \left(\frac{20{,}000 \times 0.009167}{1 - (1 + 0.009167)^{-114}} \right) = \$283.52$$

In summary, when opting for a fixed interest rate, the borrower is responsible for paying $283.52 a month for 114 months. The total amount repaid is $32,321, and therefore total interest paid on a $20,000 loan over 10 years is $12,321, that is more than half of the principal amount borrowed.

In contrast the floating rate alternative applied with the same prime rate equates monthly payments to $256.29. In this example, the gamble of the floating rate has paid off. The total amount repaid under the floating rate of interest is $29,217, and accrues a

total interest of $9,217. Deciding the rate of interest to be repaid on student loans is a major contributor in defining loan repayment. One can stabilize monthly payments with a fixed rate, or can gamble with the variable floating rate.

Calculating repayment and interest rates under ICLRP is less obvious because these rates are continually adjusting to income changes, interest rates and inflation.[32] The monthly payment can be adjusted annually, based on factors such as interest rates, annual income and family size.[33] Having the payments adjust to inflation would entail a subsidy equal to the real rate of interest.[34v] If the payments were adjusted by an interest rate, a specific 'student-rate' would also have to be set for each cohort. The rate could be either the same as, or higher than the rate paid on funds borrowed to finance the program.[35] The Canadian Council of Ontario Universities suggest that: "since there would normally be a gap of at least five percentage points between the rate at which the fund could borrow and the rate on personal loans, [that] there is a significant range within which the fund could charge a rate greater than its borrowing rate yet offer a rate that would be less than the rate available to student borrowers at other lending institutions."[36] Recognizing the differences in interest rates between the mortgage-style loan and income-contingent style is fundamental to analyzing the two repayment schemes.

[32] Council (pg. 8)
[33] Ibid.
[34] Ibid.
[35] Ibid.
[36] Ibid.

3. When interest starts to accrue

Another issue that needs clarification in repayment policy is the point at which interest starts to accrue. Unlike the traditional loan plans, the ICLRP interest rate would be applied from the time of borrowing rather than waiting until after graduation.[37] In principle, an ICLRP system could be either entirely unsubsidized or subsidized so that borrowers repay less than the full principal and interest.[38] An unsubsidized system would have interest accrue as soon as the loan is issued, and interest rates would have to be high enough to compensate any aggregate shortfall in repayment.[39] Comparing interest rates and the length of accrued interest, is also fundamental to evaluating alternative means of financing. The previous findings from the Statistics Canada Survey as summarized in Table 1, show that loan default is more likely to occur soon after graduation. The matching principle[vi] suggests that it takes time before the borrower finds their 'right' job. This is not as significant a factor with ICLRPs because the repayment rate is contingent on earnings. With ICLRPs, the borrower is not penalized for having to take 'x' amount of time to find the 'right' job. They will not be obligated to pay a fixed payment like they would under the mortgage-type loan structure.

4. The proportion of income (X % of income per year for each $1,000 of student loan)

The proportion of income put towards loan repayment is one variable that widely differs between the two loan policies. The relationship between borrowers and lenders under ICLRP is as follows: borrowers will either have future earnings below, above or at

[37] Ibid.
[38] Finnie 1996 (pg.65)
[39] Finnie 1996 (pg. 65)

the average earnings; thus, those who are more successful pay for those who are less successful.[40] Proposals often include a cutoff income level (for example two-thirds of the average industrial earnings) below which an individual would pay nothing.[41] Calculating the income cut-off point is also a crucial aspect to ICLRPs. This is important because it sets the standard at which the "unsuccessful" investor does not have to pay anything; this entirely eliminates the issue of default. The repayment structure of the ICLRP design follows the ability to pay principle[42]: those able to pay do and those who are not able to pay do not. Instead of having eligibility and assessment requirements for repayment forgiveness as fixed-mortgage type loans, the ICLRP attacks the root of the problem – uncertain future earnings. The main factor that dictates the success and failure in a loan repayment system is loan default. The current structure within Canada offers three main options that help to alleviate the burden of unmanageable fixed monthly payments after consolidation.

A) Change the Terms and Conditions – the immediate alteration that can be made to lower monthly payments is to extend the repayment term 10 to 15years, thus lowering monthly payments by stretching payment over a longer period.[43] One can infer what this does to accumulated interest; it only postpones repayment while allowing the principal to accrue more interest. This is a simple technique to help with monthly payments, but is not a favourable end result for the borrower.

[40] Ibid. (pg.65)
[41] Ibid. (pg. 67)
[42] Ability to pay principle -
[43] Guillemette (pg. 12)

B) Interest Relief – the purpose of interest relief is to combat unmanageable monthly payments. One can apply for interest relief in six month sections for up to a maximum 30 months or 54 months depending on whether or not the term was increased to 15 years and the student had completed their studies within 5 years.[44] If qualified for interest relief the borrower need not pay anything for six months, and the accrued interest is paid for by the government. This is a useful tool in helping with monthly repayment, but is a limited solution due to its heavy reliance on the assessment of who needs relief and its limited availability to others who do not qualify.

C) Debt reduction – is the last chance to help borrowers who face long-term financial hardship. Debt reduction lowers the outstanding loan principal. If eligible the borrower can receive up to three debt reductions: first $4,300 for the first reduction, and $2,200 for the subsequent reductions.[45] The payee must indicate long term financial hardship in order to qualify for these extreme measures, as well as have been out of school for 5 years or more, and have obtained interest relief for 30 months prior, in order to be eligible for debt reduction.[46] This is helpful, but again limited in its design. The insurance mechanisms undoubtedly help in extreme cases, but the usefulness of having repayment contingent on income is only reiterated in the fact that the need for these mechanisms are eliminated in ICLRPs all together.

[44] Ibid.
[45] Ontario Student Assistance Program, April, 2007. Available at www.osap.gov.on.ca
[46] Ibid.

5. Amortization Period

This is an aspect of student financing that is of significant concern. Is a lengthened repayment term beneficiary? The Canadian Federation of Students strongly appose long repayment periods and suggest that ICLRP does not solve the problem as it only extends repayment. The Federation also notes that successful borrowers simply get to pay off the loan fast with little interest, while the less successful repay longer and with more accumulated interest.[47] The federation also states that ICLRP would effectively disfavor women, because women that leave the workforce due to pregnancy would have low incomes and prolonged debt.[48] The fear that students might hesitate to take on a repayment 'burden' lasting long periods of time is relevant. However, the main distinction between an ICLRP and a fixed debt plan needs to be reiterated: fixed-debt obligations require fixed payments at fixed intervals, whereas contingent repayment systems allow for low or irregular payments in reaction to low or irregular incomes.[49] The way in which the current system alleviates problems of repayment is simply a more convoluted way of extending repayment responsibilities. The income-contingent structures are timely because they use the ability to pay principle to promote efficiency within its design. The number of years over which a loan is paid is obviously a determining factor of any loan policy, in examining the effects the two loan structures have on repayment terms we recognize that that flexible nature of the income-contingent structure certainly facilitates a timelier repayment schedule.

[47] Ibid.
[48] Conlon (pg.9)
[49] Council (pg. 2)

6. Income stream of those who have taken out the loan

If governments had perfect knowledge they could observe the variable income streams of those who take out loans as well as identify who in the population needs assistance. Governments could then also consider the incomes of those who default on loan repayment; if people graduating from sociology are more susceptible to default, then student loan policy should be informed so action can be taken. However, governments cannot do these things; asymmetric information among other things prevent the government from having perfect knowledge. Regardless, these issues need to be acknowledged.

Currently, the Canada Students Loan Program (CSLP) is the "principle vehicle for delivering federal financial assistance to postsecondary students in Canada."[50] The function of CSLP can be understood from reading the programs mission statement:

> The mission of the Canada Student Loans Program (CSLP) is to promote accessibility to post-secondary education for students with a demonstrated financial need by lowering financial barriers through the provision of loans and grants, and to ensure Canadians have an opportunity to develop the knowledge and skills to participate in the economy and society.[51]

A review of the CSLP and its function is vital to understanding the conceptual issues of the current framework. Table 2 organizes the results of a study conducted by Statistics Canada and outlines the distribution of CSLP debt by the size of debt.

[50] Finnie 1996 (pg. 9)
[51] Human Resources and Social Development Canada, March 7, 2007. Available at www.hrsdc.ca

Table 2: *Distribution of CSLP debt, by size of debt, 1994-1995* [52]

CSLP debt at consolidation	Number of debtors	Percentage distribution
Less than $5,000	60,3000	47
$5,000 to $9,999	40,100	31
$10,000 to $14,999	17,800	14
$15,000 to $19,999	6,500	5
$20,000 and over	2,900	2
All debtors	127,600	100

Table 2 indicates that in 1994, 78% of the CSLP debt was distributed amongst students with debt of $9,999 or less. This illustrates that the majority of investors are borrowing similar amounts of money. The proportion of debt suggests that the income stream of those taking out the loan is similar.

A more likely source of income at this time in the student's life may be their parents, thus the current system relies heavily on parental income in determining eligibility. This is problematic because not all parents are financial independent contribute to their children's schooling. ICLRPs rely less on parental income and place more of the pressure on the individual's ability to repay. Table 3 identifies those who require student assistance in order to be able to participate in higher education under the current loan policy.

Table 3: *Postsecondary Participation Rates by Parental Income, 2001* [53]

Parental Income	In college	In university	In any postsecondary education
Less than $25,000	29.4	19.5	48.9
$25,000 to $50,000	36.5	23.3	59.8
$50,001 to $75,000	38.2	25.0	63.2
$75,001 to $100,000	38.1	38.2	76.3
Over $100,000	31.8	45.6	77.4
Overall	35.4	30.0	65.4

One can see that participation rates reflect high parental income; it is the less advantaged investors that need the assistance. Policy must therefore target the participation of the low

[52] Kapsalis (pg. 10)
[53] Guillemette (pg. 11)

socioeconomic individuals because loan policy does not influence the participation of the wealthier, who will participate regardless since they have the resources needed to fund the investment. An efficient post secondary design is not one that admits only the rich, but rather one that facilitates fair accessibility for all prospective investors. Ability to succeed should dictate whether or not someone attends university, not how wealthy their parents are. Evaluating the accessibility impacts of the corresponding loan structures will compare how each repayment structure encourages different types of investors.

7. Average present value of income stream over the life of the loan (PV).

The essence of Human Capital Theory[vii] is that investments made in human capital improve productivity and therefore earnings.[54] Students are then required to accurately assess the expected costs and benefits of educational investment. Cost - Benefit analysis dictates whether or not postsecondary investment is economically worthwhile, that is if the benefits exceed costs then the investment is worthwhile, otherwise it is not. The decision to invest in human capital can be illustrated mathematically. Present value equations mathematically portray the evaluation of the costs and benefits of investment. The benefits of higher earnings in the future, however, have costs that incur in the present. Direct costs such as tuition, books and living expenses are easily accounted for because they are explicit monetary costs. Indirect costs are implicit because they account for the opportunity forgone by investing one's time and money into the education process. Determining educational rates of return involves the application of present value functions. Evaluating any investment involves application of

[54] Rosen (pg. 245)

present value formulas. The present value is the discounted value of a future sum or stream of cash flows.[55] Rosen describes these functions as follows:

$$PV(H)=\frac{Y_{18}^{H}}{(1+r)^{0}}+\frac{Y_{19}^{H}}{(1+r)^{1}}+\ldots+\frac{Y_{T}^{H}}{(1+r)^{T-18}}=\sum_{t=0}^{T-18}\frac{Y_{t+18}^{H}}{(1+r)^{t}}$$

The following equation describes the present value of education for someone graduating high school. This individual has T-18 working years left. If they decide not to invest in university, they earn $\left(Y^{H}\right)$ for the remainder of their working life. Now, if they decide to invest in education they earn nothing for four years and incur costs(D), but earn a higher income$\left(Y^{U}\right)$. The cost (D) is incurred by the individual as long as they are attending school. The cost which is represented by a negative sign represents the direct and indirect costs of educational investment.

$$PV(U)=-\frac{D_{18}}{(1+r)^{0}}+-\frac{D_{19}}{(1+r)^{1}}+\ldots+\frac{Y_{22}^{U}}{(1+r)^{4}}+\ldots+\frac{Y_{T}^{U}}{(1+r)^{T-18}}=\sum_{t=0}^{T-18}\frac{Y_{t+18}^{U}-D_{t+18}}{(1+r)^{t}}$$

The present value of the costs and benefits of schooling are more simply stated as:

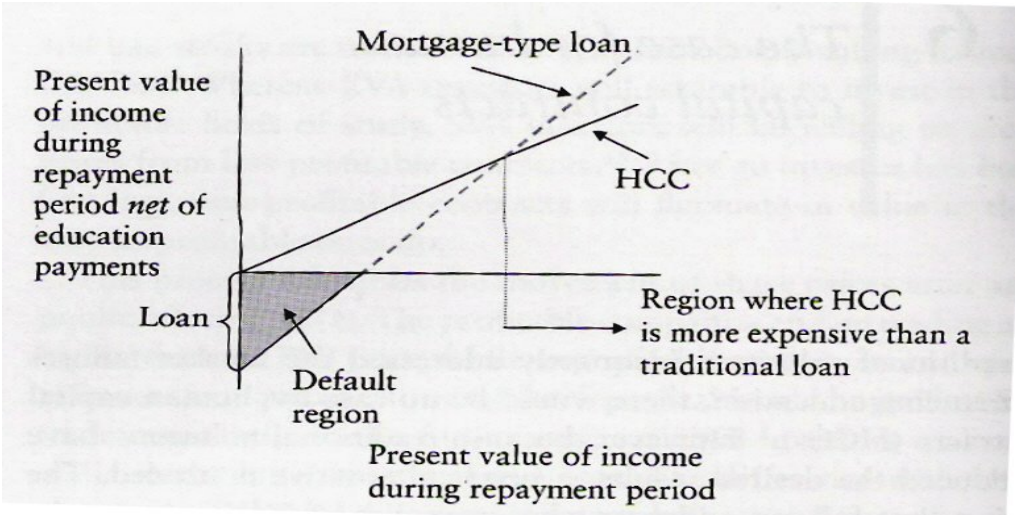
$$PV(B)=\sum_{t=4}^{T}\frac{Y_{18+t}^{U}-Y_{18+t}^{C}}{(1+r)^{t}} \qquad PV(C)=\sum_{t=0}^{3}\frac{Y_{18+t}^{H}+D_{t+18}}{(1+r)^{t}}$$

Education's expected earnings (Y) is related to the income differential and t is used to indicate various time periods t= 1,2,3… all the way to time 'T'. The income differential is the difference between the incomes earned by a university graduate versus someone with less educational attainment.[56] A university graduate can expect differential earnings equal to the sum of the present values across 'T' time periods. If the present values and expected earnings are known, then the internal rate of return (i) can be found. The

[55] Benjamin (pg. 248)
[56] West 1988 (pg 57)

internal rate of return on educational investment is the expected internalized rate of return on investment. It includes all costs incurred in the current year, and can be found by setting PV= i the internal rate of return (IRR). Costs of education (D_t) are usually spread over 3 or 4 years. Using this equation we proceed to search for the IRR which sets PV=0, and can be calculated implicitly.[57] The return stream of educational investment is calculated using the above formulas. Costs are calculated by including forgone earnings during the training period as well as direct costs (i.e. tuition and books). According to Benjamin, Gunderson and Riddell, the difference in present values of the returns and cost streams measure the proceeds of such investments by young scholars.[58]

As previously mentioned, the rationale for student loans and public support rests mainly on the market failure argument concerning externalities[viii]. In *Investing in Human Capital* (2004, 73) Palacios graphically depicts the present value implications of the various designs and shows how ICLRP reduces risk.



The dashed line represents the present value of students' net earnings (total earnings minus education payments) under the traditional loan. The solid line represents

[57] Ibid.
[58] Benjamin (pg 245)

the (NPV) of net earnings under an ICLRP type design. Differences should be noted between the two present value lines. Since ICLRPs represent a percentage of income, net earnings will never be negative, represented by the shaded area. Net earnings are zero when income is zero (since payments are zero) and increase proportionally with income. Also, the slope of the two lines indicate that the ICLRP present value line is flatter than the mortgage type. Therefore, under ICLRP, increases in earnings do not translate to equal increases in net earnings because payments increase proportionally as earnings increase. Net earnings will grow but at a slower rate.[59] This flatter line also illustrates that net earnings are less sensitive to total earnings under ICLRP as compared to the steeper mortgage loan line.[60] Also note the point where the two lines intersect. This point is where the student is indifferent between the two plans and is referred to as 'break-even' earnings. At each side of this point the present value of education is equal to the individuals' future expectation of lifetime income. Here, earners expecting high incomes would prefer the mortgage-style and earners expecting low incomes would prefer ICLRP.[61]

This breakeven point is defined for the average present value of future income over the total group of borrowers (or over a subset of the total, such as all those who borrowed or began repayment in a particular year)[62]. For the individual borrower, the breakeven point is once again where the present value of the future income stream is such that the borrower is indifferent. Risk makes forecasting future income streams a problem for both the lender and the borrower. This alleviation of risk is then appealing especially

[59] Ibid. (pg. 245)
[60] Ibid.
[61] Ibid.
[62] Thomas (pg. 3)

to risk-averse investors, therefore making ICLRP a relevant alternative for students with insufficient resources. Risk averse individuals are the least likely to invest due to high risk in investment. If educational investment is risky, poor people should want to acquire less of it according to DARA (decreasing absolute risk aversion). DARA correlates high risk investment with high levels of wealth. This also implies that individuals from poorer backgrounds are less willing to acquire education because it is a risky asset.

With fixed-debt schemes, the borrower bears the risk and is responsible for full payment of the loan regardless of post graduate income. Although most students manage to successfully repay their loan, there are still many students reluctant to borrow in fear of assuming unmanageable debt. This is not economically beneficial to Canadian society because skill and talent that could be used to increase the economy's productivity remains untapped due to financial barriers.

These seven variables, as defined by Thomas, help to identify the different features of the mortgage-type loan and income-contingent type loan. Understanding these elemental differences in policy design is imperative to the development of the model. Through comparing and contrasting the features of both designs, one can evaluate the effectiveness of each in terms of efficiency and equity goals.

3. Model

Student loan policy is of particular interest in the area of student finance, because equal access and participation are central to the program's ability to deliver the assistance to those who need it. The theoretical implications of the mortgage-type and ICLRP type loan structures have been reviewed, next an economic model can be used for simulation to aid in structure comparison. Comparing the loan schedules in a basic economic model will help simplify the complexities of investment in human capital.

I use a simple economic model to investigate the impact of ICLRP on the individual's decision to invest in higher education. The model is designed to answer the question as to whether or not ICLRP's improve accessibility for able but risk averse students, and also seeks to determine if ICLRP's facilitate a more efficient and equitable student loan structure in comparison to the conventional mortgage type loan. Realizing the interconnectedness of education, income, students and the government is essential to the development of the variables used in the model. The model compares traditional fixed mortgage-type loans with flexible income-contingent loans and assesses their respective ability to improve participation and accessibility. Efficiency and equity issues are the focus of the analysis. Default issues are mainly excluded from the model, although the issue of loan default is recognized as being important to policy evaluation. Model extensions could be constructed to include such issues as loan default. These additions can be attended to later in the analysis, efficiency and equity consequences are the primary concern.

An application of basic economic principles can illustrate how significant variables affect the decision to invest in human capital. The argument will begin with the

outline of the model and proceed with an analysis that will evaluate the relative effects each type of student loan policy has on different types of individuals.

3.1 Construction of the Model

The foundation of the model is built on the underlying assumption that *diverse economic agents receive different levels of utility in the consumption of post secondary investment*. The main determinants in defining the agents in this model are wealth and skill. For a straightforward example, there are high and low levels of both family wealth and skill that make four combinations of prospective investors in education: high skilled rich **(HR)**, high skilled poor **(HP)**, low skilled rich **(LR)** and low skilled poor **(LP)**. The model then applies a three period horizon to analyze the possible utilities of various consumption choices. These choices include: deciding whether or not to invest in higher education at all, deciding whether or not to take out a student loan, and finally deciding which 'type' of loan structure is preferred by what 'type' of individual. I will now elaborate on how the variables were defined and their function within the model.

Wealth and skill are two variables fundamental to this particular design. All individuals possess the same utility function for the consumption of education, it is the constraining effects of wealth and skill that influences the decision to invest as well as the overall success of loan repayment. The degree of this influence is to be determined, but one must initially understand that together these two variables characterize specific individuals of the population: the high skilled, the low skilled, the rich and the poor.

Individual *wealth* (A) – is defined here as the parental contribution toward financing the investment. I assume two levels: (A_R) and (A_P) such that $(A_R > A_P)$. Wealth is the financial resources the individual has when originally deciding to invest in higher education. In the case of (A_P) these resources could amount to zero. If (A_P) were to equal zero the individual would then certainly require external assistance to help cover the cost of investment. Previously it was observed that parental contribution or wealth is an important factor in assessing a student's need for financial assistance, this is why wealth is a major function in the simulation.

The variable *skill* is defined as the individual's 'natural earning power'. The demand for education and postsecondary investment hinges on one main benefit – increased human capital yields higher earnings in the future through increased productivity. Current investments are made in human capital to improve future productivity and earnings.[63] However we have also observed that this is an average measure, and that there is high individual variance in income possibilities. This is why one must consider their expected ability to successfully repay for school before actually investing in it, or more importantly before taking out a student loan to finance their education. Skill translates to the individual's ability to earn income in the present and the future; productivity could be attributed to many factors: commitment, work ethic, and learning ability could all affect one's potential earnings. In this model skill represents the individual's chance of earning high or low incomes given educational investment. Like wealth there are two types of skill: high skill and low skill. High skilled individuals have

[63] Rosen (pg. 245)

a high probability (P_H) of earning high incomes; low skilled individuals have a lower probability (P_L) of earning high incomes. (P_{HG}) is the probability of a high skilled person getting a 'good-job; (P_{HB}) *or* $(1 - P_{HG})$ conversely represents the probability of a high skilled person getting a 'bad-job'. Good or bad jobs represent income, a good job earns (Y_G) income and a bad job earns (Y_B) income, such that $(Y_G > Y_B)$. The same applies for the low skilled person, noting that $(P_{HG} > P_{LG})$. If the prospective agent decides not to invest in education their income opportunities are constrained by their level of skill. Without investment in education a high skilled person earns (Y_H), and a low skilled person earns (Y_L) such that $(Y_H > Y_L)$ and that $(Y_G > Y_H\ ,\ Y_B > Y_L)$. Conceptualizing the relationship between wealth, skill, education and income will be easier once these variables are assigned numbers.

We reviewed the four types of agents **HR**, **HP**, **LR**, and **LP** and identified that they all possess different combinations of wealth and skill. We must now create the timeline of the basic educational investment decision, as well as the expected utilities of these individuals. The model consists of three time periods. Every agent lives for these three periods. Each individual has the same utility function over consumption only, the lifetime utility function is: $U = u(C_1) + \beta u(C_2) + \beta^2 u(C_3)$

where: u = *per period utility of consumption, and* β = *discount factor*

Per period utility is defined as: $u(c) = \frac{c^{1-\rho}}{1-\rho}$

This utility function *u(c)* is a constant relative risk aversion (CRRA) utility function, and is typical for assessing the aspects of risk and uncertainty in this particular investment decision.

$$-\frac{u''(c)}{u'(c)} \times (c) = CRRA = \rho = measure\ of\ relative\ risk\ aversion$$

The variable rho (ρ) is the measure of relative risk aversion, this parameter plays key role in setting the 'normative' conditions for the model. When $(\rho = 0)$ the simulation equates each type of individual's present value of lifetime consumption. This is useful because we know that the rates of return of post secondary investment on average are high, but have high individual variance, therefore discouraging risk averse individuals from investing. We can then see how certain people react (especially risk averse types) to changes in parameters and loan policy. With these specifications in mind we can observe the investment decision and the affect these choices have on the agent's utilities across these three time periods.

- 1st stage **(t=1)** – Here the individual faces three alternatives: 1) decide not to invest in school, 2) decide to invest in school but without the help of a student loan, 3) decide to invest in school with the help of a student loan. Each decision made has a specific outcome for each type of individual. If the individual chooses not to work they receive either (Y_H) *or* (Y_L), if they choose to get educated, they do not work and receive a different utility from consuming $(A_R - e)$ *or* $(A_P - e)$ in t=1. For example, the high skilled agent receives (Y_H) if deciding to

immediately enter the workforce, or has the probability (P_{HG}) of earning (Y_G)in later periods if deciding to invest in education. The low skilled agent receives (Y_L) if deciding to immediately enter the workforce, or has the probability (P_{LG}) of earning (Y_G)if deciding to invest in education. While the decision to invest in education is made, the individual must also consider whether or not they require a student loan to finance their investment. This is where the comparative analysis begins, once we assess who opts for a student loan we can introduce the repayment schedules of both the mortgage type and ICLRP type to see which one is preferred, and by what type of person. If the individual chooses to use a student loan they will be granted a loan (L)in t=1 that will just cover education expense (e) such that$(e = L)$ for both ICLRP and mortgage-type loans. Then, first period consumption will only include wealth $(A_R \text{ or } A_P)$because$(L - e = 0)$. Therefore, the decisions made in the first period set precedent because they affect the consumption for the future periods. If one chooses not to go to school they can earn (Y_H) or (Y_L) for each of the remaining time periods depending on skill, if one chooses to go to school they must then evaluate how they will finance the cost of their decision. Wealth and skill continue to be a major factor in shaping the individual's investment decision.

- 2nd stage **(t=2)** – Represents the time period directly after graduation. The probability of getting a good job is included as well as loan repayment if necessary. If the individual decided not to invest in education they will continue

to receive either (Y_H) or (Y_L) for t=2 and t=3 (the remaining time periods). Recall that if the student invests in education without a loan, first period consumption is constrained to wealth minus education expense $(A_R - e)$ *or* $(A_P - e)$ and the person will have no future repayment obligations. Inherent skill will influence the probability of the individual getting a good or bad job after graduation, and therefore determine the individual's income for the remainder of time either (Y_G) *or* (Y_B). Repayment rate (r) must also be considered because the individual will assume repayment (r_2) in period t=2 and (r_3) in period t=3, therefore $(C_2 = Y_G - r_2)$ *or* $(C_2 = Y_B - r_2)$. This stage is important because this is where the individual starts to earn income, and is essentially where the rate of return on investment is realized.

- 3rd stage **(t=3)** – is the final time period where all income is earned and all repayments must be fulfilled. If the individual decided not to invest in education they will continue to receive either (Y_H) or (Y_L). If they decided to invest without a student loan they will earn either (Y_G) or (Y_B), in absence of loam repayments the individual keeps all income earned. If they decided to invest with the help of student assistance they are obligated to pay (r_3) in t=3. The ability to repay the loan is directly related to income earned.

The consumption path of the agent's investment decisions are organized in appendix 1. The tables are the 'decision matrix' for each agent, and help to visually identify the consumption choices of each individual throughout the three time periods.

Now that we understand the purpose of including the attributes of wealth and skill we can examine the additional parameters of the model, and observe how they influence the consumption paths of each investor. Wealth and skill are only a few parameters defined within the model, I will now review some of the other essential variables used in this utility optimization problem.

3.2 Parameters

The subsequent section outlines other variables used in the model and states the underlying assumptions. The following discussion defines the 'benchmark' values that are assigned to these parameters. Further application will examine the dynamics of these variables; however, an initial reference point is needed for comparison.

Rho (ρ) as discussed represents the measure of relative risk aversion. This evaluates how various agents behave with varying levels of uncertainty. Increases in uncertainty raises expected marginal utility for a given value of expected consumption; therefore risk averse investors are less likely to take on a 'fair' gamble. Thus, an increase in uncertainty raises the incentive to save, therefore discouraging investment in education. Risk neutral students will choose the amount of education that maximizes the expected net present value of lifetime earnings. Risk averse students will place more weight on expected benefits and costs that are certain as apposed to those that are

uncertain. Rho is set to zero to create the 'benchmark' standard for the model. The model then introduces the affect of risk and uncertainty in the decision to invest in education, and identifies how this influences the individual decision. Increasing the parameter rho is the how the model examines the affects of risk aversion.

Beta (β) is the discount factor of the model, which is often used in financial modeling to represent how an investor discounts future cash flows. For example $1 tomorrow may equal $0.95 today due to the time value of money. Inflation is a factor closely related to the time value of money. For simplicity inflation is omitted from determining the consumption beta in the model. In the economy money can lose a percentage of its purchasing power every year that is why money is valued more in the future than in the current period. The capital asset pricing model (CAPM) determines that the coefficient from regression of an assets return on consumption growth is evaluated by the consumption (β).[64] The risk free rate is the rate of return of investing in risk-free assets, beta (β) is the measure of sensitivity to market changes, and the equity market risk premium is the rate of return on investment that investors require above that of the risk free rate. The discount factor is the number by which a future cash flow (future earnings) to be received at time't', must be multiplied in order to obtain the current present value of investment. This variable includes the time value of money, and determines the present value of future cash flows discounting them using the appropriate cost of capital. This is necessary because cash flows in different time periods cannot be directly compared; most people prefer money now as apposed to later, due to opportunity

[64] Romer (pg. 368)

cost and risk that accumulates over time. This is related to the previous discussion of present value functions and internal rate of return on investment.

Education expense - (e) refers to the explicit monetary costs of investing in postsecondary education. Tuition, textbooks, and living expenses are all included because they hold specific monetary value. This measure does not include the indirect cost of forgone opportunity. Education expense is an important variable within the model because we have already noted that the changing environment of postsecondary education has increased the individual cost-burden of investment. This is of particular interest because loan policy must adapt to these increased costs. We can then observe how these changes in education costs, affect an individual's preference toward various loan programs. The factor (e) is directly related to the size of the loan(L), since the model assumes that the size of the loan (L) be exactly the cost of education(e), $(e = L)$. This abstracts for a one set of inefficiencies of student needs-assessment programs, by assuming that whoever wants a loan can get one in full. By granting a loan in the full amount of the cost of investment we can also bypass the issues of loan size. Wealth $\left(A_R \text{ and } A_P\right)$ is also related to education expense, since the agent's wealth represents the resources available to fund the investment without financial assistance.

The *market interest rate* (R) is used in the model to represent the opportunity cost of investment, and is defined using beta (β) the discounted time value of money.

$$\left(R = \frac{1-\beta}{\beta}\right)$$

Interest rates (R) are used in finance models to account for the opportunity costs of borrowing money. The market interest rate (R) evaluates how borrowed money could otherwise have been invested, and acts as a standard for the investment decision. This variable is also included in loan repayment because borrowed money accrues interest in addition to the principle amount. In this model (R) takes on a simple form, and does not include the factor of inflation, it functions to provide the basis of a stable investment, much like investment in government treasury bonds. This is critical because governments must also evaluate how funds spent on loans could otherwise be allocated.

Sigma (σ) represents the proportion of high and low skilled individuals in the population. The government is unable to distinguish between these various types of investors which creates problems in policy design. Therefore we must examine the affects of changes in the skill distribution of the population. Sigma (σ) is also used in defining the ICLRP repayment rate because it takes the average probabilities of repayment outcomes dependent on an individual's skill.

Income streams have previously been discussed in the decision process of investment. The variable (Y) symbolizes income and takes on many forms in the model:

- (Y_G) = high income job that could be achieved after investing in education
- (Y_B) = the low income job that could be achieved after investing in education
- (Y_H) = the income a high skilled individual earns if they choose not to invest in higher education.

- (Y_L) = the income a low skilled individual earns if they choose not to invest in higher education.

Income streams are defined in the model as the opportunities that different types of individuals have to earn various levels of income depending on their skill and investment choice.

Loan repayments are characterized by loan type, and take on the variable (r). Defining (r) is crucial to comparing loan schemes because the main difference between loan schedules is their repayment obligations. Prior to this we have reviewed the repayment scheme under the traditional mortgage-type loan, and have realized that these obligations are essentially fixed, and have been defined simply in this model as:

$$r = \frac{e(1+R)^2}{2}$$

Thus, repayments are distributed equally over the two time periods, while continuing to assume $(e = L)$. The ICLPR type is dependent on future earnings and is the main focus of program comparison. ICLRP repayment rate is defined in the model as:

$$r^l = \frac{e(1+R)^2}{2\sigma\left(P_{HG} \times Y_G + P_{HB} \times Y_B\right) + 2(1-\sigma)\left(P_{LG} \times Y_G + P_{LB} \times Y_B\right)}$$

This ICLRP rate considers variable skill, probable income streams, and applies an average repayment rate for all agents in the population. The repayment rate applied for the ICLRP structure is a percentage of the income earned. Therefore the more the individual earns the more they have to repay. A key factor in determining the repayment rate for any ICLRP system is the income cut-off point or otherwise known as the

threshold level of repayment. This model does not establish a repayment threshold, it simply assumes that each individual repay the required average percentage of their income earned.

Since the remaining parameters have been discussed; the assumptions of the model can be now be stated. These assumptions help to simplify the utility maximization and develop the overall mechanics of the model.

3.3 Underlying Assumptions:

1) The decision to invest in higher education is only made in t=1.
2) If you choose to go to school your parents give you (A_R) *or* (A_P), depending on wealth. Note: (A_P) equal zero is possible, but not always.
3) The direct cost or expense of education is (e) (explicit monetary costs: tuition, textbooks, living expenses) and is equal to the size of the loan(L), if taken.
4) If you go to school you cannot work, all your time is devoted to education.
5) (Y_G) and (Y_B) can only be achieved if the individual invests in education.
6) (Y_H) and (Y_L) are skill-dependent incomes earned if and only if one decides NOT to invest in education.
7) Once an individual's income $(Y)$is determined it does not change, the individual earns that income stream for the remainder of their life.
8) Loan Structures:

Mortgage-Type – payments are fixed, borrower must pay back (r_2) in period 2 and (r_3) in period 3, regardless of earnings.

ICLRP- repayments are contingent on income (r_2) and (r_3) are dependent on future earnings(Y). A standardized ICLRP repayment rate $\left(r^I\right)$ is used.

9) Interest rate (r) is determined in t=2 when the rate of return on investment is realized and income is earned.

The layout of the argument requires that the mechanics of the model be reviewed first; an analysis can commence having now outlined the construction of the models parameters and underlying assumptions. The analysis of the model interprets the results obtained from executing this simulation model.

4. ANALYSIS OF MODEL

Thus far we have reviewed the conceptual issues of student financing, explored the qualities of two types of financing schemes, and developed a simulation model. The ICLRP design has been contrasted with the conventional mortgage-type loan structure. Assessing the conceptual issues of student finance has permitted the development of an informed simulation model. The analysis of the model further investigates the advantages and disadvantages of the corresponding loan schedules. Assigning the parameters values allows the analysis to interpret the utility maximizing results for each agent, given these specific conditions. 'Normative' measures are used to function as a benchmark for the design. Focus is attended to the risk-aversion affects as it continues to be the primary objective in evaluating the efficiency and equity impacts of the two loan structures. Tables and outputs are organized in the appendix for aesthetic purpose and are referred to throughout the analysis.

To recall, the model setups with four prospective investors, these agents possess the same CRRA utility function, but differ in wealth and skill. The model examines how various levels of wealth and skill influence the agent's decision to invest in education. I want to analyze who benefits from what type of loan structure, and infer from that, what policy facilitates a more accessible and equitable student loan structure. The analysis starts by outlining the normative aspects of student policy. This determines the optimal results given risk-free investment, and analyzes the influences policy has in detracting from this preferred state. Efficiency is achieved by setting risk aversion to zero. One can then observe how consumption choices change with increases in uncertainty. A sensitivity analysis is used to evaluate the effect all parameters have how on the

investment decision. The following seeks to objectively and systematically analyze the results found from comparing mortgage-type loans and ICLRP loans with the simulation model.

Normative measures are implemented to produce the standard to which the results are compared. This method is often used in economics and policy analysis to allow the investigator to recognize - what should happen? before examining - what actually happens?

4.1 Benchmark Example

The benchmark example is used to define the efficiency standard for the model. Appendix 2 - represents the point of reference for all comparisons, it assigns the parameters their benchmark values. The most important to note is (ρ=0), this implies a risk-free linear demand function, due to perfect expectation of lifetime income. At this point the agent chooses to maximize consumption of lifetime income without the aspects of uncertainty and liquidity constraints. The model numerically equates how each agent optimizes their utility over consumption given these conditions. The outputs indicate what the agent chooses, for simplicity; the discussion refers only to the maximizing choice as apposed to the specific value of utility.

When the parameters are set to these values each individual optimizes their utility and decides their preferred consumption path. The parameters set are assigned in relation to each other, the actual value is not a matter of importance; it is the 'relative-ness' of the parameters which is observed. Given the linear utility $(u(x) = x)$ each individual would maximize utility considering expected lifetime income only. Setting $\left(A_P > e\right)$ initially

removes the wealth constraint for the poor individuals and gives all agents a chance to invest in education without financial assistance. Without uncertainty and liquidity constraints every agent rationally decides to invest in education; in order to benefit from the high rate of return and increased earning capacity. The model efficiently assumes that given these standardized parameters each agent chooses to invest in education at t=1. This is determined before any loan structures are included into the equation. Assuming that everyone should invest in education abstracts the structural inefficiency of having someone invest in school who should not. Segmenting the decision process is executed easily within the program, and is useful because it allows one to observe how decisions are made before and after introducing certain variables. One can identify how these decisions change when the parameters are introduced.

Once loan structures are established we can determine what type of individual prefers loans? As well as who prefers what type of repayment structure? Appendix 3 organizes the utility maximizing choice for each agent at various risk levels before and after loan systems are included. When relative risk aversion is equal to zero, every agent chooses to invest in education. When loan structures are included only the low skilled individuals opt for financial assistance. In fact, the low skilled individuals don't opt for the traditional loan program at all, it is only when the ICLRP design enters the process that their decision changes. This result is attributed to the fact that the ICLRP structure insures the less skilled rather than compensating for the risk of the poor agents in the population. It is possible that the insuring aspects of risk pooling in this ICLRP design create problems of adverse selection. The asymmetry of information between borrowers and lenders contributes to the inefficiency of the ICLRP structure. For example, each

borrower knows better how likely they are to succeed based on their individual skill, on the other hand the lender of the loan has limited access to this information. Implementing insurance mechanisms into the loan structure make it more appealing for less successful essentially creating what is called a 'market for lemons'.[Y] The problems of adverse selection and asymmetric information are key determinants in evaluating the efficiency and equity impacts of the corresponding loan systems, these issues will continue to central to the analysis.

When wealth is greater than education expense for both the rich and poor types, it contributes less to the individual's decision for a loan than skill. The probability of earning high incomes dominates the decision to invest in education with or without a student loan. We know that not all people can afford to go to school, and that not all individuals possess the same ability to succeed. In an attempting to promote efficiency in its design loan policy should target the high skilled poor agents more so than the low skilled investors. When relaxing the assumption that all agents should go to school one can understand how the ICLRP design allows the 'bad' risks to crowd-out the 'good' risks. The effects of risk pooling and risk shifting in ICLRP policy must be carefully reviewed when analyzing the efficiency and equity concerns of student financing schemes.

After defining the benchmark standard the model evaluates how the different loan structures affect diverse types of risk-averse investors. This is achieved by evaluating away from the benchmark example, and incorporating risk and uncertainty in the investment decision. When increasing (ρ) within the model we can observe how all agents maximize utility given an increased level of risk.

When $(\rho = 2)$ all agents choose to invest in education with the help of a student loan. The traditional loan is preferred over no loan, but it is the ICLRP structure that is preferred by all. This indicates that the ICLRP structure is more appealing to all types of investors with an increased level of risk. This supports the idea that ICLRP's facilitate a preferable loan structure given high levels of risk. When the model accounts for risk in the investment decision each agent 'safely' secures consumption by investing with a student loan. Each investor would be willing to pay money (interest on loan) to avoid the risk of investing without a student loan. This is the typical behavior of a risk-averse investor. However, one might assume that the agents' who are more risk-averse are the ones who should opt for a student loan. Not necessarily all agents should avoid the risk, especially those who possess the skill and wealth to invest (HR). For the high-skilled rich agents the expected payoff of investment is most certainly in their favour. Increasing the level of risk aversion to two shows how the different types of individuals behave with increased levels of uncertainty. At this level of risk all agents prefer the insuring nature of an ICLRP design over the fixed traditional mortgage-type loan.

When $(\rho = 4)$ the model observes a key change in the high skilled poor agent's decision to invest, now HP optimizes utility by choosing to work in t=1. With increased risk the high skilled poor agent prefers to earn (Y_H) for their lifetime, instead of taking on the gamble to earn (Y_G) in later periods. This is an interesting result, because it is these types of individuals that policy would prefer to entice. Structural efficiency would

suggest that the high skilled poor agents are the ones that should invest, because it is these agents that are more likely to succeed, but do not invest because of financial barriers. At this risk level the remaining agents decide to invest in education, with the help of a student loan, all prefer the ICLRP design. The ICLRP structure is preferred over the traditional loan policy given uncertainty, but does not necessarily improve accessibility for high skilled poor individuals.

When $(\rho = 8)$ the simulation model observes the same results, HP still opts for (Y_H) income, and the rest all prefer the ICLRP type program. This level of risk is extreme and is only examined in brief to attest the results found from the more sensitive levels of risk aversion.

Including risk into the simulation produces key results. The measure of relative risk aversion in the model indicates that the ICLRP design encourages low skilled participants rather than financially constrained investors. This is an extremely important result because it contests Friedman's original idea that ICLRP's increase the participation of able and poor students. The ICLRP design in the model does reflect a less risky repayment scheme in comparison to the mortgage loan, but does so by subsidizing the unsuccessful investors. It is this effect that deters high skilled poor individuals from investment. These agents would rather work than have to compensate for the less successful. This is inefficient, because we know the optimal choice for the high skilled poor individual is to invest in education. We can see that measure of relative risk aversion is useful in setting the efficiency standard, and provides the analysis with its most

explanatory results. Analyzing the effects of the other parameters in the model can identify additional factors that contribute to inefficiencies in the two loan policies.

4.2 Sensitivity Analysis

Economic modeling and scientific inquiry often requires that certain factors be held constant while others are free for observation. *Ceteris-Paribus* is a Latin phrase meaning all things remaining equal. This is a concept that is applied extensively to the economic observation of this model. The dynamics are organized in appendix 4; the sensitivity analysis interprets what has been found for each significant variable. Appendix 4 is coded specifically to indicate each agent's investment choice: NS – no school, SNO – school no loan, SLOT – school traditional loan, SLOI – school income-contingent loan. One should understand that the model introduces these options successively and that the income contingent choice is included last. For example anytime (SLOT, SLOI) is found in the appendix this means that the agent originally preferred the traditional loan but eventually opted for the income-contingent loan once is was inputted into the decision process. Therefore when SLOI follows a comma this means that the income-contingent loan structure has changed the agent's initial decision. Understanding the organization of the appendix is vital to interpreting the results of the sensitivity analysis.

The sensitivity analysis changes each variable in the models design, assigning the variables values above and below their benchmark assignment. While holding all other factors constant, the model observes how fluctuations in parameters change each agent's decision to invest. The sensitivity analysis is conducted using the different levels of risk

aversion as discussed previously. The analysis continues to assess the efficiency and equity consequences of the two loan repayment structures.

$(\rho = 0)$

When highlighting the results from appendix 4 we can see how changes in the parameters values influence each agent's decision to invest. At this risk level, every agent competently chooses to invest in school. The low skilled agents choose to do so with an income-contingent loan (SLOI), the high skilled agents invest without a student loan (SNO). When the values of the parameters are changed at this risk level the sensitivity analysis observes minimal changes in the agent's decision to invest.

The low skilled poor (LP) agent only changes its investment decision when $(A_P = 100)$. When $(A_P = 100)$ LP does not have enough resources to cover the costs of education, but ensuring positive consumption in the first period leads LP to prefer to invest in school without a student loan (SNO). This is an interesting result, because given $(\rho = 0)$ and insufficient wealth, LP maximizes more of its utility from no loan at all. This change helps to evaluate the effect wealth has on the decision to invest in education. For the low skilled poor agent decreases in wealth make loan policy unappealing even given a low consumption in period 1. This could mean that when $(\rho = 0)$ and $(A_P = 100)$ that first period consumption is valued just enough to make sure that LP desires education but is not willing to assume the debt to finance the investment.

The low skilled rich (LR) individual never changes its resultant consumption choice; the only change is observed when $(\beta = 0.99)$. Here, LR considers school with no loan SNO, but ultimately prefers an ICLRP type loan. Remember that beta is the discount

factor used to define the market interest rate (R), as well as the repayment rates for both structures. When $(\beta = 0.99)$ this means that the agent values tomorrow more than today, but also indicates that as beta increases the market interest rate decreases making it cheaper to borrow today. This is why the LR considers school with no loan, because having money in the future is valued more than it is today. However the contrasting effect of a lower interest rate makes borrowing with an income-contingent loan more appealing. The change in the discount factor is not enough to actually change LR's investment decision it enters only as a preliminary thought in the decision process.

The high skilled rich agent (HR) also never changes its consumption choice. No change in the parameters cause HR to change its decision to invest in school without a student loan. This is a good indication because it shows that given $(\rho = 0)$ that the HR chooses to invest in school regardless. This shows that models parameters have accurately accounted for the benefits of higher education. The HR agent is important, because it is least risk-averse agent in the population. HR possesses both the wealth and skill needed to succeed in the education process. Loan policy should do little to affect the high skilled rich individuals. It is a good sign that these individuals a not easily affected by changes in the parameters given risk-free investrment in the model.

The high skilled poor agent (HP) is the most sensitive to change at this level of risk aversion. Two parameters influence HP's investment decision. When $(\beta = 0.99)$ HP prefers the traditional loan (SLOT). This is the first time in the model that any agent has actually opted for the contemporary loan structure. This was also found for the low skilled poor agent, but was not the end result. This indicates that poor individuals are

more readily affected by changes in the discount factor of the model. When $(\beta = 0.99)$ this lowers the interest rate and makes borrowing cheaper this is why LP opts for a loan. This effect also increases the value of future income and makes education more valuable. The fact that HP doesn't opt for an ICLRP loan further illustrates the disincentive risk pooling creates for the high skilled investors. The other parameter that changes HP's investment decision is when $(Y_G = 300)$. When $(Y_G = 300)$ the rewards from educational investment are not enough to entice the high skilled poor agent to invest. The high skilled poor agent prefers to work (NS) than to take on the risk and debt attributed to educational investment. This points out that as future income opportunities decrease the HP agent is more likely not to go to school than any other agent.

The sensitivity analysis continues to examine the parameters of the model for the various levels of risk. As risk increases all agents become more sensitive to change, it is at these increased levels of risk that the model produces its most interpretive results.

$(\rho = 2)$

All agents choose to invest in school with an income-contingent loan (SLOI). This is constructive for program comparison because it continues to show that the ICLRP structure is preferred by all types of agents given increases in risk aversion. We can now analyze how changes in the parameters affect the individual's investment decision with an increased level of risk.

The low skilled rich (LR) individual does not change its resultant consumption choice when risk is increased. The traditional loan policy (SLOT) is considered, but is

never chosen. The increase in risk has generally made student loans more appealing, but it is the ICLRP repayment rate that is always favoured by the low skilled rich agent. The sensitivity analysis has limited influence on the low skilled rich agent's decision to invest. No changes in the parameters directly affect the investment decision of the low skilled rich agent.

Comparing the results of the low skilled rich and the low skilled poor agents will summarize the effect wealth has on low skilled agents. The low skilled poor (LP) agent's decision to invest is altered by an increase in education expense. When $(e = 200)$ LP decides to invest in education without a student loan (SNO). The increase in education expense deters LP from investing with a loan because the costs exceed the benefits. The poor agent is now credit constrained and would need to take out a loan. The amount of the loan has also increased since (e=L). Therefore loan repayments also increase. This is the main reason why the poor agent decides not to invest with a student loan. This agent is less likely to succeed and lacks the sufficient resources needed to finance the investment. Thus, with risk and increased education cost the gamble becomes more risky for the low skilled poor individual. This helps to show how wealth influences agents of the same skill set. When the low skilled poor agents invest without a student loan as education expense increases this indicates that the loan structures do not sufficiently compensate for the poor agents in the population. LP would prefer to starve first period consumption in an attempt to entirely avoid loan repayment. This result has efficiency and equity implications. Having a low skilled individual invest in school without a student loan might be efficient because the cost of a less successful investment is borne entirely by the individual. However the effect of wealth creates equity issues, the low

skilled rich individual still opts for the ICLRP loan. If the low skilled rich opts for a loan then so should the low skilled poor. At this risk level the ICLRP design continues to favour not only low skilled individuals but the rich ones as well. The impact education expense has on the other agents will determine the overall effect of the cost of investment. Education expense is the only parameter that changes the low skilled poor agent's decision to invest. Some parameters introduce alternatives, but never actually change the final decision. When $(Y_G = 300)$ and $(Y_L = 190)$ the low skilled poor agent considers no school (NS), but still decides to invest in education with an ICLRP loan. Changing the variation in income opportunities directly affects the rate of return on investment. When the income opportunities change so does the pay off of investment, that is when $(Y_G = 300)$ and $(Y_L = 190)$ that the low skilled agents consider not going to school. Contrasting the results for the low skilled rich and low skilled poor show how the differences in wealth effect the investment decision. Keeping these results in mind, we can continue to examine the effects the parameters have on the high skilled agents.

Appendix 4 illustrates that it is the high skilled agents who are most sensitive to change when $(\rho = 2)$. The low skilled investors favour insurance in policy design because they lack the ability to succeed. The high skilled individuals have better options because of their capabilities, and as a result are more easily persuaded by changes in the parameters. The following organizes the results of the sensitivity analysis for the high skilled rich and high skilled poor agents given a risk level equal to two.

At this level of risk the high skilled agents' decision to invest is influenced by most variables. It is observed that the probability of success affects the consumption

choice of both high skilled types. When $(PH_G = 0.9)$ both the high skilled agents prefer the traditional loan over the ICLRP loan, this is also true when $(PL_G = 0.2)$. Therefore when the probability of getting a good job increases for the high skilled individual they maximize utility by investing with a traditional type loan. Conversely, as the probability of getting a good job decreases for the low skilled agents the traditional loan becomes more appealing to the high skilled investors. The high skilled agents prefer the traditional loan given these changes because risk pooling in the ICLRP structure creates disincentive for high skilled agents to invest. Widening the gap of income probabilities in the model illustrates how the high skilled investors dislike having to subsidize the less skilled investors in the population. This investment preference of high skilled agent's is also observed when changing the distribution of skill within the population. When $(\sigma = 0.2)$ the proportion of high skilled investors decreases. With this change the high skilled agents prefer the traditional loan, supporting the idea that high skilled agents prefer not to be pooled with low skilled investors. The issue of risk pooling in the ICLRP design continues to be problematic for the high skilled agents, especially when the probability of success is widened between the agents. Alternative income streams have a similar effect on both the high skilled agents. When $(Y_H = 300)$ the utility received from not investing in school is greatest for the high skilled agents. They choose not to invest because the relative rate of return is not high enough to overcome the benefits earned from a high skilled job immediately following high school. Uncertainties in the investment decision also cause the high skilled investors to avoid risk by not investing in education at all. This is certainly not an efficient result because loan policy is deterring the agents from what they should optimally decide, as set by the benchmark. The education system should

encourage the high skilled agents as apposed to insuring the less skilled. Examining the other income streams continue to show how income opportunities influence the high skilled agents' decision to invest. When $\left(Y_B = 300\right)$ each high skilled agent opts for the traditional loan, increasing the income earned from a bad job decreases the overall effect of failure in the model. Making $\left(Y_B = 300\right)$ increases the demand for education because the result of failure is not as harsh. The high skilled agents prefer the traditional loan over the ICLRP loan because the risk of getting a bad job is not as severe, therefore they do not demand the insuring aspects of the ICLRP design. So far the following changes in the parameters have affected both the high skilled agents the same. Next we can observe the differences in consumption choices to evaluate the effect of wealth.

A difference between the high skilled rich and high skilled poor decision is found when changing the income stream of a good job. When $\left(Y_G = 300\right)$ HR decides to invest in education with the traditional loan (SLOT), where as HP decides not to invest in education at all (NS). When there is a difference in consumption choice between two agents with the same skill we can deduce from that the effect is a result of wealth. Decreasing the income earned from a good job, decreases the rate of return of investing in education. This decrease is enough to deter HP from investment entirely, and only changes the loan preference of HR. Here the level of wealth determines the value of investment. HR agents are more apt to invest because they do not have as much to lose as the HP agents. Wealth affects the high skilled poor agent more than the high skilled rich agent. When $\left(A_P = 100\right)$ HP decides not to invest in education because of the wealth constraint. Neither loan policy sufficiently entices HP to borrow even though we know

that the efficient choice is to invest in education. This inefficiency is confirmed when observing the results obtained from the sensitivity analysis given a level of risk aversion equal to four.

When $(\rho = 4)$ the model observes a major change in the consumption choice of the high skilled poor (HP) individual. It is at this point of risk aversion that HP chooses not to invest in education. Here, the analysis confidently asserts its interpretations, and proves that neither student loan structure provides the incentives needed to promote an efficient and equitable student loan structure. Applying increased levels of risk have helped identify how these contrasting loan structures impact the accessibility of risk-averse investors. The model continually observes that the ICLRP structure is more favourable than the traditional loan structure given high levels of risk. What has also been found is that the ICLRP design limits participation of the high skilled poor investors. The results from this sensitivity analysis attest the inefficiency claims made throughout the analysis.

In summary, the following sensitivity analysis demonstrates the many problems governments face when assessing the factors that affect student finance. Asymmetric information makes forecasting difficult. The insuring elements of the ICLRP design have positive and negative effects. The question is to what degree should the high skilled agents subsidize the unsuccessful investors? How can post-secondary education opportunities be equalized for low income and other disadvantaged groups in society? Reviewing ICLRP experiences connects theory with practice, and provides insight on how governments implement income-contingent structures in an attempt to improve accessibility. A brief overview of ICLRP experience illustrates the successes and failures

of income-contingent loan schemes. The mixed nature of evidence shows that ICLRP programs are not perfect, and that ICLRP's success is dependent on many variables.

5. ICLRP Experience

International ICLRP implementations in countries like Australia, United States, and New Zealand are useful tools in relating theory and practice. The following will highlight the challenges faced by a few pioneering ICLRP programs.

5.1 Australia (HECCS)

Australia was one the founding nations to implement an ICLRP structure. Throughout the 1970's Australia's education system withstood radical changes in policy design; tuition fees were at one point eliminated entirely in an attempt to improve minority participation.[65] Then in 1989 the Labor Party brought back substantial tuition fees in combination with the nation's first ICLRP program under the Higher Education Contribution Scheme (HECS).[66] The HECS design has changed international perspectives on student financing, and has been at the forefront of the student loan debate. HECS and its ICLRP fundamentals were created in direct response to the governmental duty of reducing financial barriers that prevent the economically disadvantaged from participating in higher education.[67] Tuition fees were set at a flat rate of A$1,800 per student independent of institution or course of study.[68] These tuition fees could be paid in two ways, upfront - where there was a considerable discount of 15% - 25%, or all payments could be deferred to after graduation where payment would be contingent on income. The process of loan repayment collection was monitored by the

[65] Alaire and Duff (pg. 563)
[66] Ibid.
[67] Chapman (pg.741)
[68] Ibid.

Australian tax system, and in 1989, the accumulated HECS debt of 15 year loans was to be repaid at the following rates[69]:

1% of taxable income between $22,000 and $24,999,

2% of taxable income between $25,000 and $34,999, and

3% of taxable income of $35,000 or more.

The cut-off income for repayment was $22,000. For earnings below this level the payment would equal zero. These categories were to be indexed by inflation each year to adjust to the changes in the cost of living; so the nominal amount to be paid each year would increase, but no interest would accrue.[70]

Since then the HECS system has endured many changes. The most prominent were made in 1997 and 2005. Alterations in 1997 included a ranking of tuition fees that was dependent on field of study replacing the standard flat rate.[71] The tuition levels were as follows:

1) Arts, Humanities – A$3,768

2) Engineering, Business – A$5,367

3) Medicine, Law – A$6,238

This set of reforms made in 1997 have been criticized for improving access to less-able students from wealthier backgrounds perpetuating class inequality in the elite

[69] Thomas. (pg. 7)
[70] Ibid.
[71] Alaire and Duff (pg. 563)

professions.[72] This precisely validates what has been continually observed throughout the analysis. The model accurately portrayed ICLRP's affect on low skilled rich individuals. The inefficiencies of income-contingent lending found in the model are supported by the Australian experience. Income-contingent charging systems have the potential to protect the access of the disadvantaged.[73] We also know that ICLRP's possess the potential to dissuade valuable investors. In 1999, the Australian Department of Education conducted a study to observe changes in accessibility and socioeconomic representation. The study vaguely concluded that: while students from low socioeconomic backgrounds are underrepresented in higher education institutions this is a long term concern which has not worsened as a result of the implementation of HECS.[74] Reviewing the evidence of the Australian experience has validated the quality of the model and reinforced the interpretations of the analysis.

5.2 US (The Yale TPO project)

An ICLRP design was first introduced in the United States around the 1970's. Yale is the most well known, although Duke had also begun a similar loan program around the same time. In 1971-72, Yale offered students the Tuition Postponement Option (TPO) this allowed for loan repayment to be related to future income. The TPO program, which ran from 1972 to 1978, was not a success.[75] Under the TPO project in 1972, Yale undergraduates could borrow up to $1,150, and any increases in university charges were to be added to these limits in subsequent years. Repayment would be

[72] Ibid. (pg.564)
[73] Ibid (Pg.566)
[74] Ibid
[75] Thomas (pg. 4)

4/10ths of 1% of their annual income for every $1,000 of deferred tuition.[76] Repayment term was to be a maximum of 35 years, although the actual repayment period was expected to be much shorter.[77] In brief an official at Yale summarized that: the program required a large amount of start-up capital because of the long period of repayment, and that the program was complex to administer because of the need for annual determination of income, heavy counseling and extended repayment.[78] The intentions of the TPO experiment were valiant, however after short inspection it was realized that the program lacked the organization needed to succeed. The TPO program was originally designed to break even, and not to produce profit. It was also found that the possibility of having to contribute to participants in the income-contingent scheme meant that some potential participants in the scheme would have preferred the existing plan.[79] This result supports what was discussed earlier for break-even investment between the mortgage-type loan and the income-contingent type loan. The TPO experiment faded to black in the academic year, 1977-78.[80] Evaluating the success of the ICLRP plan used at Yale University has supported the analysis and proved that theory does not always hold in practice.

5.3 New Zealand (SLS)

Another ICLRP structure worth considering is the program that New Zealand installed in 1992. The Student Loan Scheme (SLS) allows for income-contingent repayment. With SLS the repayment rate is 10% of income given certain threshold levels; since there is a positive threshold level, the actual percentage of total income contributing

[76] Ibid. (pg.4)
[77] Ibid.
[78] Ibid.
[79] Ibid.
[80] Ibid.

to the loan increases proportionally with income.[81] Thomas identifies the four income levels, with the percentage of total income going to repayment in parentheses: $15,000 (1.6%), $20,000 (3.7%), $40,000 (6.8%) and $60,000 (7.9%).[82] Thomas also calculates an example using the average wage of $30,000; the repayment at this level would take 5.8% of total income.[83] The SLS program has been characterized as an administrative success, and studies suggests that underrepresented groups (Maori and Pasifika peoples) are increasing participation under the SLS in both relative and absolute terms.[84] A primary advantage of this ICLRP type is that means test is shifted from the students' parents to the students themselves as graduates. This overcomes much of the inequity for which the current assistance plans have been criticized. Another advantage is the systems ability to reduce risk and deal with variability in post graduate outcomes. Such a program can be viewed as an arrangement whereby a given generation finances a significant portion of its own postsecondary education rather than relying on parental support, political willingness or taxability of the proceeding generation.[85] The success of New Zealand's SLS emphasizes the positive aspects of income-contingent repayment and reaffirms the potential ICLRP's have in creating more accessible student loan structures.

This prospective look at ICLRP experience across the globe has provided the evidence needed to support the results of the analysis. The variety of outcomes indicates that success is dependent on the approach. The mix of results observed by Australia, United States and New Zealand may be the contributing factor as to why Canada has not yet adopted an ICLRP structure.

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[81] Thomas (pg. 8)
[82] Ibid.
[83] Ibid.
[84] Ibid.
[85] Council (pg. 2)

6. DISCUSSION AND CONCLUSION

The following sections have facilitated a thorough examination of two student loan repayment policies. In an attempt to avoid repetition I briefly summarize the results of the analysis in a concluding discussion.

Investment in higher education is a priority for public policy, because the benefits of education accrue not only the individual but society as a whole. Education plays a major role in societal progression as well as economic growth. Student finance is of particular concern because of its effect on accessibility. The preceding analysis has examined the issues of accessibility, and outlined the efficiency and equity impacts of traditional mortgage-type loans and income-contingent type loans.

Income-contingent loans use the ability to pay principle to reduce risk in investment as well as determine loan repayment. Fixed mortgage-type loans possess limited insuring mechanisms; loan repayments are defined regardless of post investment income. Therefore the ICLRP design facilitates a less risky investment, and has the potential of improving the participation of risk-averse investors.

A simulation model was constructed to evaluate the influences the two policies have on accessibility. The analysis found that the ICLRP was preferred over the mortgage-type, given high levels of risk; this suggests that loan policy could benefit from an income-contingent design. However, it was also observed that the ICLRP structure tended to favour the low skilled individuals as apposed to the financially constrained investors. Adverse selection and moral hazard are recognized as problematic in the ICLRP design. It is these inefficiencies that have most likely mitigated the prospect of income-contingent lending in Canada.

Reviewing ICLRP experience identifies that the success of the program is dependent on the approach. Canada could reorganize student assistance plans to benefit from the rewards of an income-contingent approach. Experience suggests that the administrative success of an ICLRP system ultimately relies on the efficiency of the government's tax system. Canada is well known for its effective income tax system, therefore making them a strong candidate for the implementation of income-contingent financing.

Canada should adopt some form of income-contingent financing in the future to ensure accessibility. This analysis provides the information needed to facilitate efficient and equitable policy choices. It has been my suggestion that the government of Canada reform its current loan structure, in an attempt to promote equal participation in post secondary investment. Providing the necessary incentives to invest in education should be the primary goal of student loan policy. Making loan repayments contingent on income is one attempt to solve the problems of student finance. Policymakers must continue to search for innovative ways to fund the investment of education. Let this analysis lead the way to a healthier and prosperous student loan policy in Canada for years to come.

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Appendices

(Appendix 1)

HR

Get Education				No Education
If get a Loan (L)		If do not get a Loan		N/A
(t=1) $(C_1 = A_R)$ Assume $(e = L)$		$(C_1 = A_R - e)$		$(C_1 = Y_H)$ determined by skill
Yes: (P_H)	No: $(1 - P_H)$	Yes: (P_H)	No: $(1 - P_H)$	irrelevant
(t=2) $(C_2 = Y_G - r_2)$	$(C_2 = Y_B - r_2)$	$(C_2 = Y_G)$	$(C_2 = Y_B)$	$(C_2 = Y_H)$
(t=3) $(C_3 = Y_G - r_3)$	$(C_3 = Y_B - r_3)$	$(C_3 = Y_G)$	$(C_3 = Y_B)$	$(C_3 = Y_H)$

HP

Get Education				No Education
If get a Loan (L)		If do not get a Loan		N/A
(t=1) $(C_1 = A_P \geq 0)$ Assume $(e = L)$		$(C_1 = A_P - e)$		$(C_1 = Y_H)$ determined by skill
Yes: (P_H)	No: $(1 - P_H)$	Yes: (P_H)	No: $(1 - P_H)$	irrelevant
(t=2) $(C_2 = Y_G - r_2)$	$(C_2 = Y_B - r_2)$	$(C_2 = Y_G)$	$(C_2 = Y_B)$	$(C_2 = Y_H)$
(t=3) $(C_3 = Y_G - r_3)$	$(C_3 = Y_B - r_3)$	$(C_3 = Y_G)$	$(C_3 = Y_B)$	$(C_3 = Y_H)$

LR

Get Education				No Education
If get a Loan (L)		If do not get a Loan		N/A
(t=1) $(C_1 = A_R)$ Assume $(e = L)$		$(C_1 = A_R - e)$		$(C_1 = Y_L)$ determined by skill
Yes: (P_L)	No: $(1 - P_L)$	Yes: (P_L)	No: $(1 - P_L)$	irrelevant
(t=2) $(C_2 = Y_G - r_2)$	$(C_2 = Y_B - r_2)$	$(C_2 = Y_G)$	$(C_2 = Y_B)$	$(C_2 = Y_L)$
(t=3) $(C_3 = Y_G - r_3)$	$(C_3 = Y_B - r_3)$	$(C_3 = Y_G)$	$(C_3 = Y_B)$	$(C_3 = Y_L)$

LP

Get Education				No Education
If get a Loan (L)		If do not get a Loan		N/A
(t=1) $(C_1 = A_P \geq 0)$ Assume $(e = L)$		$(C_1 = A_P - e)$		$(C_1 = Y_L)$ determined by skill
Yes: (P_L)	No: $(1 - P_L)$	Yes: (P_L)	No: $(1 - P_L)$	irrelevant
(t=2) $(C_2 = Y_G - r_2)$	$(C_2 = Y_B - r_2)$	$(C_2 = Y_G)$	$(C_2 = Y_B)$	$(C_2 = Y_L)$
(t=3) $(C_3 = Y_G - r_3)$	$(C_3 = Y_B - r_3)$	$(C_3 = Y_G)$	$(C_3 = Y_B)$	$(C_3 = Y_L)$

(APPENDIX 2) – Variables appear as they are defined in the maple program

Variable	Value	Description
pHGood	=0.7	The probability of a high skilled person earning Ygood
pHBad (1 – pHGood)	=0.3	The probability of a high skilled person earning Ybad
pLGood	=0.4	The probability of a low skilled person earning Ygood
pLBad (1- pLGood)	=0.6	The probability of a low skilled person earning Ybad
Beta (β)	=0.96	Discount Factor of future cash flows (Y)
Rho (ρ)	=0*	Measure of relative risk aversion, *Perfect expectation – risk free
E	=*150	Direct Costs of Education
R	=0.416667	The market interest rate $[(1 - \beta)/\beta]$
Sigma (σ) σ	=0.5	Proportion of high and low skill people in the population
Ygood	=400	Income earned from getting a 'good' job
Ybad	=250	Income earned from getting a 'bad' job
Yhigh	=200	The income a high skilled person earns when deciding NOT to invest in education
Ylow	=140	The income a low skilled person earns when deciding NOT to invest in education
A_rich	=210	The wealth of a 'rich' person
A_poor	=*160	The wealth of a 'poor' person, in the benchmark example (*A_rich > A_poor > e)

(APPEDIX 3) – Utility Optimization 'Normative Measures'

Representative Agent ***(rho=0)**	Consumption Choice (Without Loans included)	Why?	Consumption Choice (With Loans included)	Why?
High Skilled Rich (HR)	**School**	- utility received from school is greater than any other option	**School – no loan**	- individual still chooses to invest in school, but without the help of either loan system
High Skilled Poor (HP)	**School**	- utility received from school is greater than any other option	**School - no loan**	- individual still chooses to invest in school, but without the help of either loan system
Low Skilled Rich (LR)	**School**	- utility received from School is greater than any other option	**School – ICLRP loan**	- utility received from investment in School with a Loan is highest, ICLRP is preferred over traditional loan type
Low Skilled Poor (LP)	**School**	- utility received from school is greater than any other option	**School – ICLRP loan**	- utility received from investment in School with a Loan is highest, ICLRP is preferred over traditional loan type

Representative Agent ***(rho=2)**	Consumption Choice (Without Loans included)	Why?	Consumption Choice (With Loans included)	Why?
High Skilled Rich (HR)	**School**	- utility received from Ygood is worth the risk.	**School – traditional loan, then ICLRP is preferred**	- HR invests in school, with loan. Traditional is preferred over no loan, but ICLRP is more preferred
High Skilled Poor (HP)	**School**	- utility received from Ygood is worth the risk.	**School – traditional loan, then ICLRP is preferred**	- HP invests in school, with loan. Traditional is preferred over no loan, but ICLRP is more preferred
Low Skilled Rich (LR)	**School**	- utility received from Ygood is worth the risk.	**School – traditional loan, then ICLRP is preferred**	- LR invests in school, with loan. Traditional is preferred over no loan, but ICLRP is more preferred
Low Skilled Poor (LP)	**School**	- utility received from	**School – traditional loan,**	- LP invests in school, with loan. Traditional

		Ygood is worth the risk.	**then ICLRP is preferred**	is preferred over no loan, but ICLRP is more preferred

Representative Agent ***(rho=4)**	Consumption Choice (Without Loans included)	Why?	Consumption Choice (With Loans included)	Why?
High Skilled Rich (HR)	**School**	- utility received from school is greater than any other option	**School – traditional loan, then ICLRP**	- HR still chooses to invest in school, with the help of a loan. ICLRP is preferred
*High Skilled Poor (HP)	***No School**	- utility received from Yhigh not investing in school is greater than any other option	***No School**	- individual still chooses not to invest in school, earning Ygood is not worth the risk for HP
Low Skilled Rich (LR)	**School**	- utility received from School is greater than any other option	**School – traditional loan, then ICLRP**	- utility received from investment in School with a Loan is highest, ICLRP is preferred over traditional loan type
Low Skilled Poor (LP)	**School**	- utility received from school is greater than any other option	**School – traditional loan, then ICLRP**	- utility received from investment in School with a Loan is highest, ICLRP is preferred over traditional loan type

(APPENDIX 4) - coded (NS, SNO, SLOT, SLOI) *Benchmark

RHO=0*	**(HP)**	**(HR)**	**(LP)**	**(LR)**
E=150	SNO	SNO	SLOI	SLOI
200	SNO	SNO	SLOI	SLOI
100	SNO	SNO	SLOI	SLOI
pHGood=0.7	SNO	SNO	SLOI	SLOI
0.9	SNO	SNO	SLOI	SLOI
0.5	SNO	SNO	SLOI	SLOI
pLGood=0.4	SNO	SNO	SLOI	SLOI
0.6	SNO	SNO	SLOI	SLOI
0.2	SNO	SNO	SLOI	SLOI
Beta (β) =0.96, R=0.0416667	SNO	SNO	SLOI	SLOI
0.99	**SLOT**	SNO	**SLOT**,SLOI	**SNO,SLOI**
0.90	SNO	SNO	SLOI	SLOI
Sigma (σ) =0.5	SNO	SNO	SLOI	SLOI
0.8	SNO	SNO	SLOI	SLOI
0.2	SNO	SNO	SLOI	SLOI
Ygood=400	SNO	SNO	SLOI	SLOI
500	SNO	SNO	SLOI	SLOI
300	**NS**	SNO	SLOI	SLOI
Ybad=250	SNO	SNO	SLOI	SLOI
300	SNO	SNO	SLOI	SLOI
200	SNO	SNO	SLOI	SLOI
Yhigh=200	SNO	SNO	SLOI	SLOI
300	SNO	SNO	SLOI	SLOI
150	SNO	SNO	SLOI	SLOI
Ylow=140	SNO	SNO	SLOI	SLOI
190	SNO	SNO	SLOI	SLOI
50	SNO	SNO	SLOI	SLOI
A_rich=210	SNO	SNO	SLOI	SLOI
270	SNO	SNO	SLOI	SLOI
160	SNO	SNO	SLOI	SLOI
A_poor=160	SNO	SNO	SLOI	SLOI
210	SNO	SNO	SLOI	SLOI
100	SNO	SNO	**SNO**	SLOI

*BENCHMARK

RHO=2	**(HP)**	**(HR)**	**(LP)**	**(LR)**
E=150	SLOI	SLOI	SLOI	SLOI
200	**NS**	**SLOT**, SLOI	**SNO**	**SLOT,**SLOI
100	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
pHGood=0.7	SLOI	SLOI	SLOI	SLOI
0.9	**SLOT**	**SLOT**	**SLOT**,SLOI	**SLOT**,SLOI
0.5	**NS**	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
pLGood=0.4	SLOI	SLOI	SLOI	SLOI
0.6	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT,**SLOI
0.2	**SLOT**	**SLOT**	**SLOT**,SLOI	**SLOT**,SLOI
Beta (β) =0.96, R=0.0416667	SLOI	SLOI	SLOI	SLOI
0.99	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
0.90	**SLOT,**SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
Sigma (σ) =0.5	SLOI	SLOI	SLOI	SLOI
0.8	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
0.2	**SLOT**	**SLOT**	**SLOT**,SLOI	**SLOT**,SLOI
Ygood=400	SLOI	SLOI	SLOI	SLOI
500	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
300	**NS**	**SLOT**	**NS**, SLOI	**SLOT**,SLOI
Ybad=250	SLOI	SLOI	SLOI	SLOI
300	**SLOT**	**SLOT**	**SLOT**,SLOI	**SLOT**,SLOI
200	**NS**	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
Yhigh=200	SLOI	SLOI	SLOI	SLOI
300	**NS**	**NS**	**SLOT**,SLOI	**SLOT**,SLOI
150	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
Ylow=140	SLOI	SLOI	SLOI	SLOI
190	**SLOT**,SLOI	**SLOT**,SLOI	**NS**,SLOI	**SLOT**,SLOI
50	**SLOT,**SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
A_rich=210	SLOI	SLOI	SLOI	SLOI
270	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
160	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
A_poor=160	SLOI	SLOI	SLOI	SLOI
210	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI
100	**NS**	**SLOT**,SLOI	**SLOT**,SLOI	**SLOT**,SLOI

RHO=4	**(HP)**	**(HR)**	**(LP)**	**(LR)**
E=150	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
200	**SNO**	SLOT,SLOI	**SNO**	SLOT,SLOI
100	**SLOT,SLOI**	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
pHGood=0.7	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.9	**SLOT,SLOI**	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.5	**SNO**	SLOT,SLOI	SLOT,SLOI	SLOI,SLOI
pLGood=0.4	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.6	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.2	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
Beta (β) =0.96, R=0.0416667	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.99	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.90	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
Sigma (σ) =0.5	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.8	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
0.2	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
Ygood=400	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
500	NS,**SLOI**	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
300	NS	**SLOT**	SLOT,SLOI	SLOT,SLOI
Ybad=250	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
300	**SLOT,SLOI**	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
200	SNO	**SNO**,SLOI	SLOT,SLOI	SLOT,SLOI
Yhigh=200	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
300	**SNO**	**SNO**	SLOT,SLOI	SLOT,SLOI
150	**SLOT,SLOI**	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
Ylow=140	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
190	NS	SLOT,SLOI	**NS**	SLOI,SLOI
50	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
A_rich=210	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
270	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
160	NS	**NS**	SLOT,SLOI	SLOT,SLOI
A_poor=160	NS	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
210	**SLOT,SLOI**	SLOT,SLOI	SLOT,SLOI	SLOT,SLOI
100	**SNO**	SLOT,SLOI	**SNO**	SLOT,SLOI

Endnotes

[i] Endogenous growth theory gives crucial importance to the production of new technologies and investment in human capital as defined by Romer.
[ii] Moral hazard refers to a situation in which individuals can influence their risk of suffering a loss from which they have obtained insurance coverage. Adverse selection refers to a situation in which the insurer cannot observe the true risk involved in insuring the insuree, but the insuree knows it well. Both impose a difficulty on developing insurance contracts such as implicit contracts.
[iii] Here default means that repayment had been in arrears for three months or longer.
[iv] Asymmetric information is described by Benjamin, Gunderson and Riddell in "Labour Market Economics" as a situation in which both parties to a contract do not have the same information as far as work effort, production costs, or firm profit is concerned; there is often a disincentive to reveal full information to the other party.
[v] The real rate of interest is the actual or nominal interest rate for three-month treasury bills less the inflation rate.
[vi] Benjamin, Gunderson and Riddell outline matching in "Labour Market Economics". The matching principle contends that there is a process by which workers search for employment and are paired with firms offering jobs, occurring in an environment of imperfect information.
[vii] Human Capital Theory is a theory of the act of investment in human resources in the form of training and education with a view on raising the productivity of an individual. For a full explanation of Human Capital Theory see Rosen, H.S., B. Dahlby, R.S. Smith, & P, Boothe, "Public Finance in Canada".
[viii] Externalities are said to exist when the self-interested action of one person indirectly affects the utility of another person or group.
[ix] A market for lemons explained by George Akerlof is created when the pressure of competition causes quality to deteriorate to such low levels that the market may fail to exist.