

**CAN YOU
AFFORD
THAT STUDENT LOAN?**

***HOW TO AVOID
EXCESSIVE STUDENT LOAN
INDEBTEDNESS***

EDWARD D. DUVALL

CAN YOU AFFORD THAT STUDENT LOAN?

How To Avoid Excessive Student Loan Indebtedness

Also by Edward D. Duvall

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Fremont Valley Books, 2011

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Edward D. Duvall

Fremont Valley Books, LLC
Gilbert, AZ

8 Dec 2011

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ISBN: 978-0-9845773-1-6
LCCN: 2011943372

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Published by Fremont Valley Books, LLC
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In memory of Dad
"Good advice never dies"

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Introduction

I started working with my father in the family business at age 13. Dad was in the wholesale grocery business at the time, and he had worked every other aspect of that business as well over the years. He had started when he was 10, making deliveries from Tom's delicatessen at the corner of North Ogden St. and East Lovejoy Ave. to the neighborhood families. When we worked together, he often found a way to give me the same lecture. I can still recall after all these years as if it were yesterday, my father's admonitions to "Get an education; it's the one thing the government can't take away from you". Sometimes he would hold out his hands and say, "See these? These are what I have to work with. Get an education so you can work with your head and not your hands. Don't be a jackass like me". He especially desired that I find a way to avoid his line of work: "The grocery business is good in one respect. You'll always have work because people have to eat. Otherwise, it's a job for a moron". Finally, there was the historical version: "I hated school. I couldn't wait to get out. Now I wish I could go back. You should stay in school. Don't be a dumbbell like your old man".

He was old-school, as they say, determined to use his influence as best he could to encourage me to be the first in the family to go to college. He had that attitude because, like all good parents, he wanted me to have opportunities that he did not have. For me, his comments turned out to be very good advice. I was fortunate that jobs were readily available, and I was able to work my way through college. I only had to borrow a small amount of money to complete my education. But that was back in the 1970's, when tuition and fees were much lower in relative terms than they are now. I learned a good trade (electrical and optical engineering), and have maintained steady employment for 32 years. My career choice and the fact I had limited debt upon graduation made my education pay off in economic terms. But in these modern times, it is more difficult for young people to make the right decision about whether borrowing to pay for an

education makes economic sense, simply because of the large increases in costs. This little book is designed to help make that determination.

But it will be a purely economic analysis. I will not attempt to rate the “value” of one career choice over another. After all, in the long run, it is better to work a job one enjoys even if it means less money than to endure a high-paying job that one hates. This book will help answer two central questions. First, if you borrow a certain amount of money at a certain interest rate, will the resulting career path provide sufficient income to repay the loan without being squeezed for cash every month? Secondly, if a certain type of job requiring the education pays a certain amount, and student loan money is available at a certain interest rate, how much can you afford to borrow? I mean of course, being able to repay the loan and still afford to move out of Mom and Dad's basement.

1.1 Student Loan Basics

But before we get too far afield in “working the numbers”, let's stop for a moment and review the general nature of borrowing for an education, commonly known by the euphemism, “student loans”. The “student loan” system is a federal program, subject to certain minimum requirements, such as financial need, citizenship or definite legal non-citizen status, a Social Security Number, and a few others. As in all federal programs, it is administered through the usual bureaucratic process, all of which is explained in several publications available from the U. S. Department of Education [1, 2]. They contain a great deal of practical information (as far as they go) and are certainly worth reading.

There are two types of federal student loans: Perkins Loans and Stafford Loans. The Perkins Loan has the following features:

- a. The loan is issued by the school which the student is attending.
- b. The interest is fixed at 5%.
- c. All loans are subject to a determination of financial need.
- d. The maximum repayment period is 10 years.
- e. The loan is repaid to the school.
- f. They are available to students who are attending at least half-time.

All Stafford loans have these features:

- a. The loan is issued by the U. S. Department of Education.
- b. The interest rates change from year to year, but the rate for any given loan is fixed (i.e., the rates are not variable).
- c. The loan is repaid to the U. S. Department of Education.

Additionally, there are two types of Stafford Loans: subsidized and unsubsidized. In the subsidized case, the U. S. Department of Education pays the interest on the loan while the stu-

dent is enrolled in school, and repayment does not begin until after a certain grace period. The grace period begins after graduation or after withdrawal from school. The interest covered by the government is not charged to the student. For students enrolled in an undergraduate program (i.e., to obtain an Associate, Bachelor's, or other certificate), the interest rate for loans taken out between 1 Jul 2011 and 1 Jul 2012 is fixed at 3.4%; for loans after 1 Jul 2012, the interest is fixed at 6.8% per year. In future years, the interest rate will be adjusted per a formula based on 90-day Treasury notes. For all graduate students (seeking a Master's, PhD, or other post-Bachelor's work), the current interest rate (until 1 Jul 2012), regardless of loan date, is fixed at 6.8%. In every subsidized loan, the student must demonstrate financial need (which is why the interest is forgiven while the student is obtaining the education). Generally, the loan repayment period is between 10 and 25 years, although the exact duration is subject to negotiation.

An unsubsidized Stafford Loan operates a little differently. First, there is no need to demonstrate financial need; they are available to all students. Secondly, the interest rate for all loans is 6.8%. Third, the borrower must pay interest on the loan starting from the loan date (same as a car loan or mortgage), although the interest payments may generally be deferred until after graduation or withdrawal from school. This delay on repayment of interest is known as a "deferment"; it is almost always granted while the student is in school. Post-graduation deferments are also generally granted to students who are called up for full-time military duty, are unable to find work (3 year maximum), and certain other hardship conditions.

With all deferments, the interest that was supposed to be paid starting from the loan date is simply added onto the total loan amount (principal); this is known as "capitalization". This feature is a very important consideration as will be shown in the worked examples, as these deferments can cause the total principal to increase dramatically.

There are maximum borrowing limits for both Perkins and Stafford Loans. Generally, a Perkins Loan is limited to \$5500 per year for undergraduates and \$8000 per year for graduate students, although the exact values depend on many other factors. Stafford Loan limits are a little more complicated, as they also depend on whether a student is "independent", meaning they are not declared as dependents on someone else's tax return. For "independent" undergraduate students, the total loan amount for all loans combined is \$57,500, of which no more than \$23,000 can be subsidized by the Department of Education. For "dependent" undergraduate students, the corresponding values are \$31,000 and \$23,000 respectively. For undergraduates, the rules are actually a little more complicated than represented here. The maximum loan amounts are also regulated by your undergraduate status, i.e., the loan amounts are different for freshmen, sophomore, junior and senior standing. For graduate students, whether "independent" or not, the total loan amount for all loans is \$138,500, of which no more than \$65,500 can be of the subsidized type. All Stafford Loans are also subject to a 1% origination fee.

1.2 Repayment Conditions

The required start of repayment depends both on the type of loan and on a definition of “student status”. For both types of loans, “student status” ends either upon graduation or dropping below a half-time student (that is, being enrolled in courses whose total credit hours amounts to less than half the credit hours of a full-time student). When “student status” ends, a grace period begins; after the grace period, repayment must begin. For Perkins Loans, the grace period is 9 months; for all Stafford Loans, the grace period is 6 months. It should be noted however, that the grace period is extended for any student on active military duty.

As mentioned above, student loans are generally repaid over periods ranging from 10 to 25 years. However, the minimum repayment is \$50 per month. Interest paid on student loans is deductible from income taxes, but the deduction is limited to \$2500 per tax year.

1.3 Summary

The federal student loan program is fairly complicated, and it is advisable to research the details carefully before committing to the program. This chapter has summarized some of the basic rules. These will be revisited in the worked examples in Chapter 4 where the effects of the various rules will be made clear. Suffice to say, one has to be careful about how the arrangements are made and exactly what type of loan is being contemplated in order to determine the true affordability.

1.4 References

1. U. S. Department of Education, Federal Student Aid, Student Experience Group, *Funding Education Beyond High School: The Guide to Federal Student Aid, 2011-2012*, Washington D.C., 2010. It is available free at www.edpubs.gov.
2. U. S. Department of Education, Federal Student Aid, Student Experience Group, *Your Federal Student Loans: Learn the Basics and Manage Your Debt*, Washington D. C., 2010. It is available free at www.edpubs.gov.

2

The Benefits and Risks of Student Loans

This chapter contains a review of the inherent advantages and disadvantages of student loans. Not all of these will apply to everyone, but it is best to give them careful consideration to see if they may apply to you.

2.1 Benefits

The first benefit of a student loan is the fact that it allows those who could not otherwise afford an education to obtain one. An education is a valuable commodity; it is in effect an investment in yourself, the only thing you are guaranteed to possess for the rest of your life. Obtaining a college education is a worthwhile investment in most cases compared to ending education at high school. Numerous published studies show that a person with a Bachelor's degree will earn about 1.8 times as much over their working life as someone with only a high-school education; for a Master's degree, the ratio is about two; for a Ph.D., is about 2.8. An education offering this kind of potential increase in your earning power is a good economic investment, but only if the field of study leads to careers that are in high demand. Also, people with college degrees usually enjoy less frequent and shorter periods of unemployment. Unfortunately, this is difficult to quantify; it tends to run in cycles and is highly dependent on the type of degree one has.

The second benefit is that paying tuition with a student loan frees up some time for studying that would otherwise be devoted to earning money to cover current expenses. Working full-time while attending school is not necessarily a bad thing (having done it for ten years), but it can be stressful. All work and no play makes Jack a dull boy, as they say. If we keep in mind that the student loan is best thought of as a means to finance an investment, it is pretty obvious that the student loan ideally should be taken out only to cover tuition, fees, books, lab materials and other such direct costs. In other words, a student's day-to-day living expenses are not an in-

vestment per se; they are expenses that would have to be paid whether he attends school or not. Therefore, if I may offer some advice here, it is best to work part-time while attending school in order to defray some or most of your living expenses (rent, groceries, etc.); use the student loan money to finance the economically beneficial investment, the education itself.

The third related benefit is that the repayment of student loans can usually be deferred until after graduation. The problem here is that doing so is not always free. In reality, interest is always due from the start of the loan. But, if the loan is “subsidized”, then the U. S. Department of Education pays that interest while the student is in school, and the student never has to repay that. On the other hand, if the loan is “unsubsidized”, the interest is again due from the date of the loan, but is deferred until after graduation or withdrawal from school. In this case, as mentioned previously, the interest is not forgiven; it is simply added onto the loan amount. This is more important than it might seem at first, and will be covered in the worked examples. But, it may be worth considering, because it does free the student from having to begin repayment while still in school.

The fourth benefit of a student loan is the most obvious one: it may be the only way that some students could possibly afford to pursue an education.

Last, taking out a student loan and making payments on it is a convenient way to build a credit score. That is a true fact, but it is a poor reason to take out the loan; it simply happens to have that characteristic.

It is always better to pay off a student loan early. Doing so makes room for savings, investments, or other worthwhile debts (such as buying a house or starting a business). In other words, the amount of interest payments that you can avoid by paying it off early is money in your pocket that you can use for other important expenses.

2.2 Risks

Now we get to the major risk elements in taking out a student loan. Some of them are purely personal, for which no analysis can be helpful; some are related to the state of the economy in general, for which there is no predictive method. There are some that instill a healthy dose of caution into a student loan decision (which is good in and of itself), and others that are amenable to direct numerical evaluation. All of them are reviewed briefly, but the last category is the one of primary interest in this book.

The first important risk to consider is whether or not jobs will be available in your field after graduation. There are some types of work for which jobs will likely be available over the long term, such as nursing, pharmacology, legal work, and medicine. At the other end, it will be difficult most of the time to find work as a museum curator specializing in Tang Dynasty artwork. Even for those occupations that typically experience high demand, the state of the economy may be such that there is a surplus of experienced talent looking for work at the time you

are graduating. There is no general prescription for evaluating this situation; one either selects the occupation that is most attractive regardless of the number of opportunities, or chooses one that is expected to have a reasonable demand.

The second major risk is the fact that you, the student, are going to be liable for repayment of the student loan. There was in past decades a considerable amount of fraud on the part of students, in which they would take out student loans and avoid payment by declaring bankruptcy. The government has wisely taken steps to end this abuse (which amounted to nothing more than robbing the taxpayer), and has made it nearly impossible for a student loan to be discharged as part of a bankruptcy proceeding. Therefore, if you are considering a student loan, keep in mind that there is virtually no practical way out of the debt except for death or permanent disability.

The next risk to consider is the type of school you plan to attend. There are some who claim that certain schools are more interested in signing up students for financial aid and student loans than they are in providing an education. Critics sometimes accuse the "for profit" colleges and some types of trade schools of engaging in this practice, which amounts to taking a commission for originating the student loan or arranging financial aid and doing little else for the student. The best way to protect yourself from these situations are to only attend schools and colleges that meet the following requirements: a) are accredited by a public evaluation committee; b) have a good reputation for educating students; and c) are willing to provide statistics on how many of their graduates find work in their chosen fields, excluding those who already had jobs in the field before commencing their studies.

Let's consider the student loan program from the viewpoint of a college, university, or trade school staff member, whether they be an administrator, admissions officer, or financial advisor. As employees of the school, it is clear that their jobs exist only because the school exists; the school exists only because the student body exists. Their future prosperity depends upon a steady and preferably increasing number of students. Therefore, they have every incentive to assist you, the prospective student, to gain admission to the school and guide you in obtaining any financial assistance. They are of course obligated to inform you of the costs of student loans, but keep in mind it is not their responsibility to ensure that the loan is economically viable for you. Their obligation ends at what is good for them and the school; whether such a loan is good or bad for you is simply not their problem. It is your problem, and it is your duty to make sure you don't borrow too much, or borrow at too high an interest rate. A student who borrows too much presents no inconvenience to the school. The school receives the payments for tuition, fees, room and board, and whatever else is required, and that is about all the school employees need to care about. But you need to perform due diligence to ensure that the loan indebtedness makes economic sense; that is, that the education received represents a good return on the investment you have chosen to make in yourself.

There are some who criticize the student loan system as an excuse for schools to raise tuition and other fees simply because they realize that students have access to student loans. In

other words, these critics claim that the availability of “easy money” in the form of student loans induces schools to raise education prices faster than they otherwise would. There appears to be some validity for this assertion, given that tuition costs and fees have increased more rapidly over the past twenty years than nearly every other type of expense. I am not going to venture an opinion on the merits of this claim on the grounds that it really doesn't matter: an education costs what it costs, and the real question at hand is whether the benefit received justifies that cost.

Do not allow yourself to become like the members of Congress who have neither the backbone nor the imagination to ensure that the nation's revenue and expenditures come approximately into balance. Politicians always ensure that there are provisions in the laws by which none of them will ever be held responsible for their bad actions. You, however, have no such protection. As mentioned earlier, if you borrow too much in the form of a student loan, you will not be able to escape the debt simply by declaring bankruptcy. You will not be able to send the bill to someone else, and you will not be able to leave it for your grandchildren to pay. If you borrow too much, you may find yourself trapped for many years in a destructive cycle of debt.

The “bottom line”, so to speak, is that one should only take out student loans if all of the following are true: a) there is no other practical option to obtain the funds necessary to complete the education; b) the education provides a reasonable probability of a tangible benefit, that is, an increase in one's income over the long term as opposed to not obtaining the education; c) there is a reasonable probability that a sufficient number of jobs will exist in the chosen career field in locations where you desire to live; and d) the repayment schedule does not impose an undue hardship on the long-term cash flow. The last of these lends itself to a straightforward analysis, which is considered next.

3

How to Determine the Affordability of a Student Loan

Having dispensed with the generalities of characteristics, risks, and benefits of a student loan in the first two chapters, we now come in this chapter to the cold, hard economic question: is it actually affordable? First, this chapter begins with an overview of how one's income should normally be segregated by category of expense. Secondly, a student debt nomograph is described as a method of determining affordability in general. It first considers the fraction of net income that normally is safe to allocate to repayment of debt. It also includes starting salaries of common occupations, standard principal and interest curves, and tax factors to complete the system. This chapter lays the groundwork for several worked examples in chapter 4 that will demonstrate the utility of the system.

3.1 General Rules for Allocation of Income

Many experienced personal finance analysts have come up with some general guidelines for the management and allocation of personal income. While there are no hard-and-fast rules, and recognizing that there will always be some dispute about the exact ratios, most personal finance experts agree that one's expenses relative to income should conform approximately to the following guidelines. In what follows, "net income" is what you have left over after payroll and income taxes. Sales taxes are not explicitly accounted for here; they are assumed to be included in the following assigned percentages. The common categories and their recommended limits are approximately:

- a. Personal debt repayment, including student loans and credit cards of all types, but excluding mortgage and car payments, should consume not more than 15% of net income.

- b. Housing costs, including mortgage principal and interest, home maintenance, rent, real estate taxes, homeowners or renters insurance, and utilities, should consume not more than 30% of net income.
- c. Transportation costs, including fuel, maintenance, car payment, and car insurance, should consume not more than 15% of net income.
- d. Groceries, clothing, and other personal expenses should consume not more than 20% of net income.
- e. At least 10% of net income should be allocated to long-term savings (401K or IRAs for retirement plus other non-retirement investments such as mutual funds and money markets).
- e. All the other intangibles (such as entertainment, medical costs, life insurance, health insurance, and charity) should consume not more than 10% of net income.

The important point to take away from these figures is that all personal debt repayment, excluding a mortgage and a car payment, should not exceed approximately 15% of net income after taxes. That includes, as mentioned above, the repayment of student loans as well as credit cards, personal debts, and department store charges. For planning purposes, it is wise to relegate student loan repayments to not more than 5 to 7% of net income, as this will leave room for the purchase of furniture, computers, accessories, and all the other miscellaneous items we consider so necessary in the modern household.

3.2 Starting Salaries for Common Occupations

In order to determine if the education is truly worthwhile from an economic standpoint, it is necessary to consider what the income from a career in a chosen field of study will be. Keep in mind that although one's salary will increase over time, it is essential to evaluate student loan repayment capability relative to the starting salary; after all, the student must begin repayment within 6 or 9 months after school ends, depending on the type of loan. Figures 3.2-1 through 3.2-19 contain an estimate of annual starting salaries for a wide range of occupations as they are likely to prevail in the year 2015. The source data for all these Figures was obtained from the U. S. Department of Labor [1]. The starting salary values shown here were derived by taking the 10th percentile data from the Department of Labor tables, scaling them for inflation between now and 2015 at 3% per year, and then rounding to the nearest \$500. The job titles have mostly been retained from the original Department of Labor statistics. Also shown is a multiplier (called the M Factor) to indicate the factor by which the starting salary is to be multiplied to obtain the median salary, which would prevail after about 15 years of experience. The higher the multiplier, the faster the salary will increase with experience. The M factors were derived by dividing the median salary by the tenth percentile salary as shown in the Department of Labor

data. As seen in Figures 3.2-1 through 3.2-19, most career choices indicate an M factor multiplier between 1.5 and 1.7, meaning that after 15 years of experience in the field, the salary then prevailing will be 50 to 70% higher than the starting salary. Some occupations have higher multipliers; this simply indicates professions that are held in high esteem (such as surgeons, lawyers, financial analysts) or those that are somewhat more dangerous (power line repairmen). The Figures do not show all the job categories in the Department of Labor data, and you should go to the referenced website to search for any not listed here. It is important to pay careful attention to these salary numbers because they come from a reliable source and are typical figures for all the regions of the country. Some high-cost areas will reflect higher starting salaries; but keep in mind that you will also have correspondingly higher expenses in those areas, and these are still useful as a general guide.

Category	Job Title	Starting	M Factor
Agricultural	Food Scientists and Technologists	40,000	1.75
	Soil and Plant Scientists	40,000	1.67
Biological	Biochemists and Biophysicists	50,500	1.84
	Epidemiologists	49,500	1.49
	Microbiologists	46,000	1.68
	Biological Scientists, All Other	45,500	1.76
	Zoologists and Wildlife Biologists	42,000	1.61
	Animal Scientists	38,000	1.71
Conservation	Conservation Scientists	42,000	1.65
	Foresters	42,000	1.53

Figure 3.2-1: Biological Sciences

Category	Job Title	Starting	M Factor
Management	Advertising and Promotions Managers	48,500	2.02
	Marketing Managers	67,500	1.95
	Public Relations and Fundraising Managers	58,000	1.85
	Food Service Managers	35,500	1.58
	Lodging Managers	34,500	1.59
Business Administration	Wholesale and Retail Buyers, Except Farm Products	34,000	1.71
	Human Resources, Training, and Labor Relations	34,000	1.81
	Compensation, Benefits, and Job Analysis Specialists	41,500	1.60
	Market Research Analysts and Marketing Specialists	39,000	1.82
	Business Operations Specialists, All Other	39,500	1.85
Finance	Budget Analysts	52,500	1.52
	Credit Analysts	42,000	1.64
	Financial Analysts	52,000	1.67
	Personal Financial Advisors	38,000	1.98
	Loan Officers	36,000	1.83
Accounting & Tax	Tax Examiners and Collectors, and Revenue Agents	34,500	1.67
	Tax Preparers	21,500	1.69
	Accountants and Auditors	45,500	1.58

Figure 3.2-2: Business, Management, Accounting, Financial

Category	Job Title	Starting	M Factor
Computer Sciences	Computer Systems Analysts	56,500	1.61
	Computer Programmers	48,000	1.75
	Software Developers, Applications	63,500	1.61
	Software Developers, Systems Software	71,500	1.54
	Database Administrators	48,500	1.77
	Computer Support Specialists	33,000	1.63
IT	Network and Computer Systems Administrators	49,500	1.63
	Information Security Analysts and Web Developers	50,500	1.75
Math	Mathematicians	62,000	1.88
	Statisticians	45,500	1.86

Figure 3.2-3: Computer Systems, Software, and Information Technologies

Category	Job Title	Starting	M Factor
Post-Secondary Teachers	Architecture	49,000	1.76
	Agricultural Sciences	48,500	1.88
	Anthropology and Archeology	48,500	1.78
	Area, Ethnic, and Cultural Studies	42,000	1.89
	Art, Drama, and Music	39,000	1.87
	Atmospheric, Earth, Marine, and Space Sciences	51,500	1.88
	Biological Science	47,000	1.80
	Business	40,500	2.13
	Chemistry	48,000	1.72
	Communications	39,000	1.80
	Computer Science	42,500	1.94
	Criminal Justice and Law Enforcement	39,000	1.78
	Economics	48,000	2.02
	Education	38,000	1.82
	English Language and Literature	38,500	1.84
	Environmental Science	43,000	1.94
	Engineering	53,500	1.96
	Foreign Language and Literature	39,500	1.75
	Forestry and Conservation Science	51,000	1.80
	Geography	45,000	1.73
	Health Specialties	47,000	2.11
	History	39,000	1.94
	Home Economics	37,500	2.02
	Law	38,500	2.86
	Library Science	47,000	1.55
	Mathematical Science	41,000	1.87
	Nursing	45,000	1.61
	Philosophy and Religion	39,000	1.87
	Physics	50,500	1.80
	Political Science	42,000	1.96
	Psychology	42,000	1.88
	Recreation and Fitness Studies	33,500	2.00
Social Sciences	49,000	1.75	
Social Work	41,500	1.77	
Sociology	41,500	1.83	
Vocational Education	32,500	1.73	
Assistant	Graduate Teaching Assistants	20,500	1.88

Figure 3.2-4: Education, Post-Secondary

Category	Job Title	Starting	M Factor
Elementary & Middle	Preschool Teachers, Except Special Education	20,000	1.49
	Kindergarten Teachers, Except Special Education	37,000	1.54
	Elementary School Teachers, Except Special Education	40,000	1.50
	Middle School Teachers, Except Special and Technical	41,000	1.48
	Career/Technical Education Teachers, Middle School	41,000	1.48
Secondary	Secondary School Teachers, Except Special and Technical	41,000	1.52
	Career/Technical Education Teachers, Secondary School	42,500	1.50
Special	Special Education, Preschool through Elementary School	40,500	1.51
	Special Education, Middle School	42,500	1.47
	Special Education, Secondary School	43,000	1.50

Figure 3.2-5: Education, Elementary, Secondary, and Special

Category	Job Title	Starting	M Factor
Architects	General (except Naval & Landscape)	50,000	1.69
	Landscape	43,000	1.68
	Naval	50,500	1.85
Engineering	Aerospace	71,000	1.61
	Agricultural	49,500	1.68
	Biomedical	58,000	1.64
	Chemical	66,000	1.60
	Civil	59,000	1.53
	Computer Hardware	72,000	1.61
	Electrical	63,000	1.56
	Electronics, Except Computer	67,500	1.56
	Environmental	57,500	1.61
	Health and Safety, except Mining	53,500	1.66
	Industrial	58,000	1.53
	Materials	60,500	1.61
	Mechanical	59,000	1.55
	Mining, Mining Safety, and Geological	57,500	1.69
	Nuclear	78,500	1.49
Petroleum	74,500	1.80	

Figure 3.2-6: Engineering and Architecture

Category	Job Title	Starting	M Factor
Drafting	Electrical and Electronics	40,000	1.56
	All Other	33,500	1.57
Engineering Technicians	Aerospace and Operations	40,500	1.68
	Avionics	43,000	1.42
	Civil	34,000	1.59
	Electrical and Electronics	40,000	1.64
	Electro-Mechanical	36,500	1.58
	Environmental	33,000	1.55
	Industrial	37,000	1.53
	Mechanical	37,500	1.57
	Surveying and Mapping	27,500	1.62
	All Other	36,500	1.86
Installation & Repair	Telecommunications Equipment	36,500	1.76
	Electrical and Electronics, Transportation	38,000	1.50
	Commercial and Industrial Equipment	38,000	1.59
	Powerhouse, Substation, and Relay	53,000	1.45
	Surveyors	36,000	1.78

Figure 3.2-7: Engineering Support and Technicians

Category	Job Title	Starting	M Factor
Art	Art Directors	50,000	1.88
	Fine Artists, Including Painters, Sculptors, and Illustrators	22,500	2.34
	Multimedia Artists and Animators	39,500	1.73
Design	Fashion Designers	38,000	1.99
	Floral Designers	20,000	1.39
	Graphic Designers	30,500	1.66
	Interior Designers	31,000	1.75
Performance	Choreographers	22,000	2.03
	Music Directors and Composers	25,500	2.12
	Radio and Television Announcers	19,500	1.62
	Reporters and Correspondents	23,500	1.73
Literary	Public Relations Specialists	35,500	1.70
	Editors	34,000	1.78
	Technical Writers	43,500	1.70
	Writers and Authors	33,500	1.94
Translator	Interpreters and Translators	27,000	1.89

Figure 3.2-8: Fine Arts and Literary

Category	Job Title	Starting	M Factor
Dentistry	Dentists, General	83,500	1.98
	Oral and Maxillofacial Surgeons	114,500	>2.5
	Orthodontists	85,000	>2.5
	Prosthodontists	48,500	2.86
Pharmacy	Pharmacists	96,000	1.36
General	Chiropractors	38,000	2.08
	Family and General Practitioners	101,500	1.89
Specialties	Internists, General	102,500	>2.5
	Obstetricians and Gynecologists	118,500	>2.5
	Optometrists	58,000	1.91
	Pediatricians, General	101,000	1.80
	Podiatrists	57,500	2.35
Surgery	Psychiatrists	76,500	2.51
	Anesthesiologists	141,000	>2.5
	Surgeons	135,500	>2.5
Assistants & Nursing	Physicians and Surgeons, All Other	62,500	>2.5
	Physician Assistants	67,000	1.50
	Nursing Aides, Orderlies, and Attendants	21,000	1.35
	Licensed Practical and Licensed Vocational Nurses	35,000	1.36
	Registered Nurses	51,500	1.46

Figure 3.2-9: Health Specialists, Surgeons, Nursing

Category	Job Title	Starting	M Factor
Practice	Lawyers	63,500	2.08
	Paralegals and Legal Assistants	34,500	1.58
Legal Records	Court Reporters	30,000	1.86
	Title Examiners, Abstractors, and Searchers	28,500	1.59

Figure 3.2-10: Legal

Category	Job Title	Starting	M Factor
Mechanics	Aircraft Mechanics and Service Technicians	39,500	1.59
	Automotive Body and Related Repairers	27,000	1.66
	Bus and Truck Mechanics and Diesel Engine Specialists	31,000	1.54
	Mobile Heavy Equipment Mechanics, Except Engines	34,500	1.51
Electrical	Computer Numerically Controlled Machine Tool Programmers	35,000	1.52
	Electrical Power-Line Installers and Repairers	39,500	1.72
	Electricians	34,500	1.64
	Electronic Equipment Installers and Repairers, Motor Vehicles	22,500	1.47
Industrial	Farm Equipment Mechanics and Service Technicians	26,000	1.52
	Heating, Air Conditioning, and Refrigeration Mechanics	31,000	1.61
	Machinists	28,000	1.60
	Plumbers, Pipefitters, and Steamfitters	32,000	1.69
	Roofers	26,000	1.55
	Sheet Metal Workers	29,500	1.67
	Structural Iron and Steel Workers	31,000	1.69
	Telecommunications Line Installers and Repairers	31,500	1.89
	Tool and Die Makers	37,500	1.47
Welders, Cutters, Solderers, and Brazers	28,000	1.48	

Figure 3.2-11: Mechanical and Industrial Trades

Category	Job Title	Starting	M Factor
Therapists	Occupational	57,000	1.48
	Physical	62,500	1.42
	Radiation	59,500	1.47
	Occupational Assistants	38,500	1.54
	Occupational Aides	20,500	1.57
	Massage	21,000	1.94
	Physical Assistants	36,500	1.60
	Physical Aides	20,000	1.37
Medical Technologists	Health Diagnosing and Treating Practitioners, All Other	45,000	1.80
	Dental Hygienists	52,500	1.52
	Surgical Technologists	33,000	1.42
	Opticians, Dispensing	24,500	1.56
	Orthotists and Prosthetists	39,500	1.93
	Dental Assistants	26,500	1.48
	Medical Assistants	24,500	1.39
	Medical Equipment Preparers	24,000	1.44
Lab	Medical Transcriptionists	25,500	1.50
	Dental Laboratory Technicians	24,500	1.68
	Medical Appliance Technicians	27,500	1.52

Figure 3.2-12: Medical Technology and Therapists

Category	Job Title	Starting	M Factor
	Chefs and Head Cooks	27,000	1.75
	Funeral Directors, Morticians, and Undertakers	35,000	1.82
Beauty	Barbers	20,000	1.41
	Hairdressers, Hairstylists, and Cosmetologists	19,000	1.39
Sales	Securities, Commodities, and Financial Services Sales Agents	36,500	2.24
	Sales Representatives, Technical and Scientific Products	43,000	2.01
	Sales Representatives, Wholesale and Manufacturing	31,500	1.94
Secretarial	Legal Secretaries	31,000	1.58
	Medical Secretaries	25,000	1.44
	Secretaries and Administrative, General	23,000	1.57
Veterinary	Veterinarians	58,500	1.64

Figure 3.2-13: Miscellaneous, Sales, Secretarial, Veterinarian

Category	Job Title	Starting	M Factor
Natural Sciences	Astronomers	57,000	1.79
	Physicists	69,000	1.81
	Atmospheric and Space Scientists	52,500	1.95
	Chemists	46,000	1.74
	Materials Scientists	53,500	1.85
	Environmental Scientists and Specialists, Including Health	44,000	1.63
	Geoscientists, Except Hydrologists and Geographers	51,500	1.88
	Hydrologists	56,500	1.57
	Geographers	49,500	1.71
Liberal Sciences	Clinical, Counseling, and School Psychologists	45,500	1.71
	Economists	56,500	1.85
	Industrial-Organizational Psychologists	57,500	1.77
	Sociologists	51,500	1.64
	Urban and Regional Planners	47,000	1.56
	Anthropologists and Archeologists	36,500	1.73
	Historians	31,000	2.03
	Librarians	39,500	1.62
	Library Technicians	21,000	1.66
Political Scientists	57,000	2.20	

Figure 3.2-14: Natural and Liberal Sciences

Category	Job Title	Starting	M Factor
Fire	Firefighters	27,000	1.96
Police & Corrections	Correctional Officers and Jailers	30,500	1.50
	Detectives and Criminal Investigators	45,500	1.77
	Police and Sheriff's Patrol Officers	37,000	1.69

Figure 3.2-15: Public Services

Category	Job Title	Starting	M Factor
Counseling	Substance Abuse and Behavioral Disorder Counselors	29,000	1.54
	Educational, Guidance, School, and Vocational Counselors	37,000	1.69
	Marriage and Family Therapists	28,000	1.92
	Mental Health Counselors	28,000	1.58
	Rehabilitation Counselors	24,500	1.56
	Counselors, All Other	27,500	1.77
Social Work	Child, Family, and School Social Workers	30,500	1.54
	Healthcare Social Workers	34,500	1.60
	Mental Health and Substance Abuse Social Workers	29,500	1.53
	Social Workers, All Other	34,500	1.76
	Probation Officers and Correctional Treatment Specialists	36,000	1.53
Religious	Clergy	28,500	1.82

Figure 3.2-16: Social Work, Counseling, Clergy

Category	Job Title	Starting	M Factor
Scientific	Biological Technicians	29,000	1.57
	Chemical Technicians	30,500	1.62
	Geological and Petroleum Technicians	35,000	1.80
	Nuclear Technicians	47,500	1.68
	Social Science Research Assistants	25,000	1.74
	Environmental Science and Protection Technicians	31,000	1.56
	Forensic Science Technicians	38,500	1.57
	Forest and Conservation Technicians	29,000	1.34
Health	Medical and Clinical Laboratory Technologists	45,500	1.45
	Medical and Clinical Laboratory Technicians	28,500	1.50
	Dietetic Technicians	21,000	1.51
	Pharmacy Technicians	23,000	1.43
	Veterinary Technologists and Technicians	24,000	1.45

Figure 3.2-17: Technicians, Non-Engineering

Category	Job Title	Starting	M Factor
Air	Air Traffic Controllers	63,500	1.98
	Airline Pilots, Copilots, and Flight Engineers	64,500	1.88
	Commercial Pilots	41,000	1.94
Overland	Heavy and Tractor-Trailer Truck Drivers	29,000	1.53
	Light Truck or Delivery Services Drivers	21,000	1.61

Figure 3.2-18: Transportation

Category	Job Title	Starting	M Factor
Utilities, Power Plant Operations, Nuclear	Gas Plant Operators	45,500	1.48
	Chemical Equipment Operators and Tenders	33,500	1.57
	Chemical Plant and System Operators	42,500	1.53
	Nuclear Power Reactor Operators	68,000	1.30
	Petroleum Pump System Operators, Refinery Operators	44,000	1.60
	Plant and System Operators, All Other	37,000	1.64
	Power Plant Operators	47,500	1.55
	Stationary Engineers and Boiler Operators	38,000	1.60
	Water and Wastewater Treatment Plant and System Operators	29,000	1.64

Figure 3.2-19: Utilities

3.3 Derivation of the Student Loan Nomograph

A nomograph is a graphical means to determine approximate relations between complex quantities. Although they are out of fashion now that fast computational techniques are available to everyone, they remain a valuable shorthand method to obtain quick approximate answers, especially when there are many variables to be considered. They also have the important attribute of giving the user the ability to see the interaction among all the variables involved. In our case, we have six variables to consider: a) the amount borrowed per the student loan; b) interest rates; c) term of repayment; d) fraction of income necessary for (comfortable) repayment; e) gross income; and f) marginal tax rates (from which is determined net income).

The student loan nomograph simply links all these factors together in a series of four charts, which may be traced in any direction to obtain the answers to several classes of questions

on the subject. Four basic charts are arranged and linked together by equating the x-axis of one with the x-axis of another, and likewise for any two y-axes. The basic student loan nomograph is shown on Figure 3.3-1. The curves in the upper-left chart show the relation between interest rates and the amortization of each \$1000 borrowed as a function of repayment duration. These are standard relations that can be obtained from any table of fixed-rate amortization schedules. Only three interest rates are shown here: 3.4%, 5%, and 6.8%, which are the rates imposed by Congress during the last modification of the student loan program. As mentioned earlier, these will likely change in the future, depending on a formula related to 90-day Treasury notes. Suppose a student wishes to pay off his loan in 10 years, and the interest rate on his loan is 6.8%. The chart in the upper left of Figure 3.3-1 indicates that the monthly amortization of such a loan is about \$11 per month per \$1000 borrowed, as shown by the dashed directing line.

The chart in the upper right of Figure 3.3-1 relates amortization per \$1000 on the y-axis to the monthly payment due as a function of the amount borrowed. In the example shown, the amount borrowed is indicated by the parametric lines running from lower left to upper right. The amount of the monthly payment is found on the x-axis. This is nothing more than a simple way to show the multiplication of the amount borrowed times the amortization to get the monthly payment. For example, if the loan terms produce a monthly amortization of \$11 on the y-axis, and the student borrows \$30,000, the monthly payment will be about \$340 per month, as shown by the intersection of the directing line on the x-axis. Note that the \$30,000 is not shown on its own line; but is interpolated halfway between the \$20,000 and \$40,000 lines.

The chart on the lower-right in Figure 3.3-1 relates the monthly payment owed to net income as a function of the fraction of income that should be allocated to repayment of debt. Recall from Section 3.1 that total personal debt repayment, including student loans, should be limited to not more than 15% of net income. It is also a good idea to limit the student loan portion to not more than about 7% or so in order to allow for other debts. Here, if the monthly payment due is about \$340, and the student wishes to limit the repayment of the student loan to 9% of his net income, his net income must be about \$46,000 as indicated by the intersection of the directing line with the y-axis.

Last, the chart on the lower left of Figure 3.3-1 shows the relation between gross income and net income as a function of federal income tax filing status. Here, the marginal tax rates for tax year 2011 are used, and the 7.65% (combined) Social Security and Medicare payroll tax has been included as well. As an example, if the student is single with no dependents, and the required net income is \$46,000, then his required gross income to net \$58,000 as shown by the intersection of the directing line with the x-axis. This is the desired answer: if the required income is less than the starting salary income per the Figures in Section 3.2, then the student loan is affordable; if not, then the student loan is possibly a bad idea economically. If this student graduates with a degree in Economics and finds work in that field, this student loan is a reasonable transaction, since his starting salary will be somewhere around \$57,000 per Figure 3.2-14. How-

ever, it would be a very bad idea to enter into this \$30,000 student loan and expect to repay it under these conditions if the student obtains a degree in History, with an expected starting salary of \$31,000 per Figure 3.2-14.

Of course, there are other options: the student with a degree in History could repay the loan over twenty years, which would result in a monthly amortization just under \$8 per \$1000 borrowed, leading to a monthly payment of about \$220. If the student was willing to expend 12% of his net income on the student loan repayment, his annual net income would have to be about \$26,000; and if he were single, his required gross income would have to be \$30,000; close to the expected starting salary for an historian.

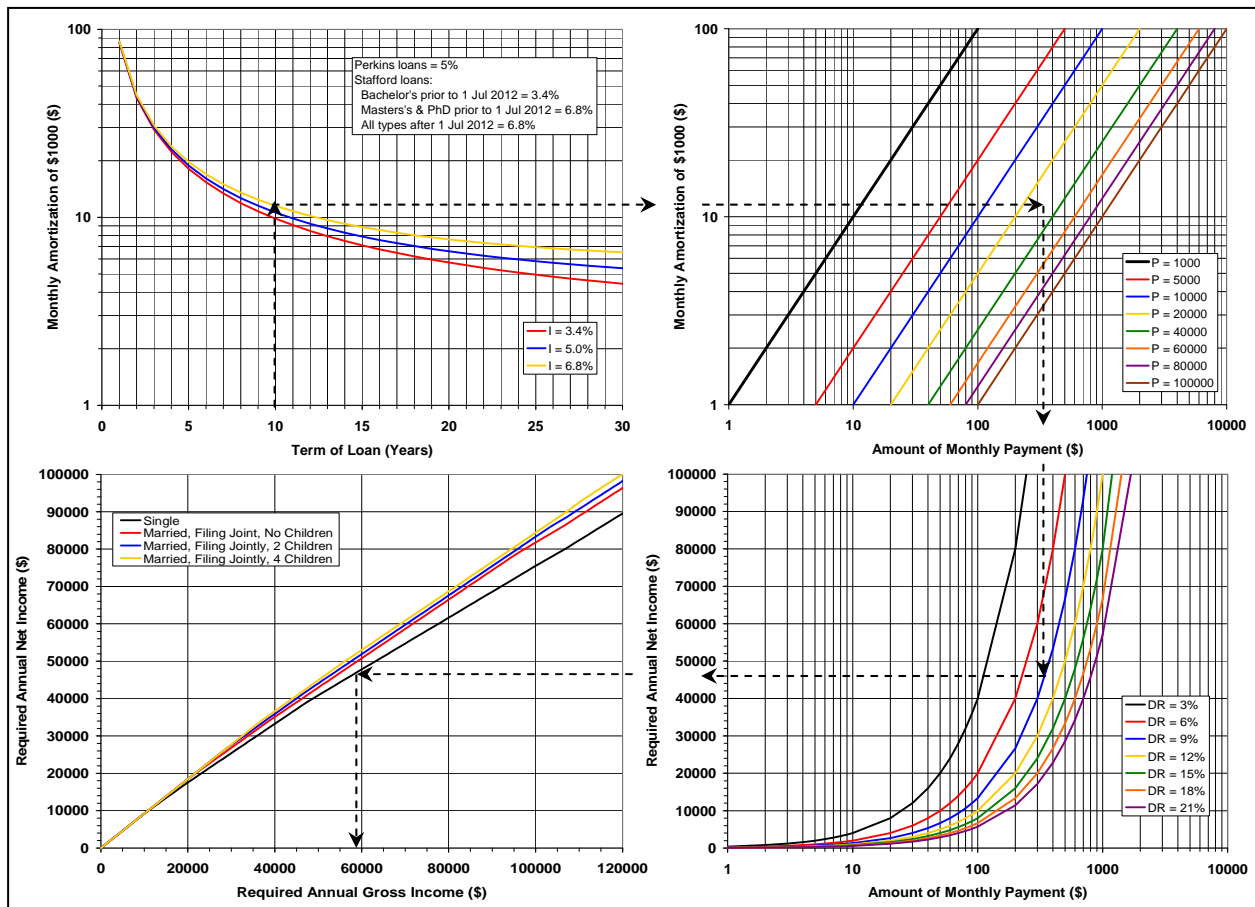


Figure 3.3-1: Student Loan Nomograph Example

Hopefully, this example shows the utility of the nomographic approach: quick approximate answers that cover most of the important issues. It is easy to see that choosing between a degree in Economics over a degree in History amounts to the difference between a \$340 per month payment for 10 years, but which is only 9% of net income, or a \$220 payment for 20 years, representing 12% of net income. The disparities are even greater when deciding, for example, between the medical professions and choreography.

There are some assumptions embedded in the nomograph. First, it is assumed that the interest rates are fixed for the term of any given loan, consistent with the rules laid out by Congress. It is conceivable that a particular student may have more than one loan at differing rates. If so, the nomograph is still valid; all that is required is to calculate the answer for each rate and add the results together. Secondly, it is assumed that the primary objective is to determine affordability just after graduation when repayment must begin. In other words, an answer obtained at the lower-left chart should be compared to the entry-level income at the chosen profession; this is important because the interest continues to be added onto the principal if repayment does not begin as scheduled. Third, it does not include the allowed \$2500 income tax deduction for student loan interest; if you consider the curves on the lower left of the nomograph in Figure 3.2-1, you will see that it makes only a very small difference. Fourth, the lower-left chart of the nomograph assumes that the taxpayer will take the standard deduction; thus implicitly assuming that the initial repayment will begin without a large mortgage interest deduction. If the student has a mortgage deduction, the results of the lower left chart will be somewhat conservative. But keep in mind that one also incurs the expenses of maintenance when buying a house.

Each of the four charts on the nomograph are independent, meaning that the construction of one of the charts does not depend on the results from another. This means that the nomograph has the convenient property that it may be worked in any direction, or it can start at any interior point and work in both directions. This is a useful property because a large number of questions can be answered from any known set of data, as will be shown in Chapter 4.

Aristotle once wrote that “The mark of an educated mind is to be content with an approximation”. The main benefit of the nomograph is that it provides the whole picture of debt, repayment, interest, terms, etc. all in one place; but it does sacrifice a little in accuracy (because it involves drawing lines on a set of curves). The nomograph will not provide answers to the penny, but if done carefully, the dollar accuracy of this system (i.e., the income and monthly payments) is about 2 or 3% , which is good enough to determine if a loan for an education is a good idea or not. The example quoted above showed a monthly payment of about \$340 read from the nomograph; the actual value for these assumptions would be \$345.24, which represents an error of about 1.5%.

There is one other item that requires our attention, which is the subject of deferment of repayment. As mentioned earlier, deferring repayment is a common practice, and the amounts which would normally be repaid from the date of the loan are simply added onto the principal. The amount that is added depends on several factors, including the interest rate, intended repayment term, and the amount borrowed. This problem is simplified somewhat in the interest of obtaining a suitable approximation by making the following assumptions: a) the student will borrow for either 2 or 4 years; a) the amount borrowed in each year is the same; and c) the interest rate remains fixed over the entire period of borrowing. Clearly, it is unlikely that each of these will be true in every case. However, it is a reasonable place to start from a planning standpoint.

First, it is a simple matter to assume that the cost of tuition, fees, etc. will increase a little by one's senior year over what they are in freshmen year (a reasonable estimate is 5% per year). Secondly, although the interest rates on student loans will fluctuate a little depending on 90-day Treasuries, they are not likely to jump radically from year to year. With these assumptions in mind, Figures 3.3-2 and 3.3-3 have been derived to show the increase in principal that will occur if repayment is deferred until after graduation. Figure 3.3-2 applies to a student borrowing the same amount (P_a) in each of four years, and Figure 3.3-3 applies to students borrowing an equal amount (P_a) in each of two years.

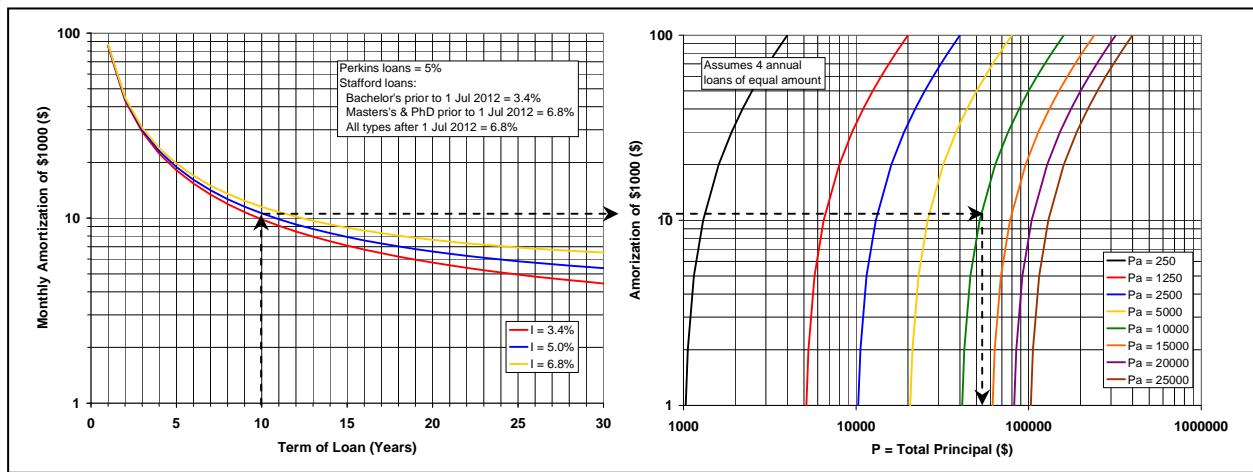


Figure 3.3-2: Growth of Principal (Capitalization) Due to Deferral, Four Year Case

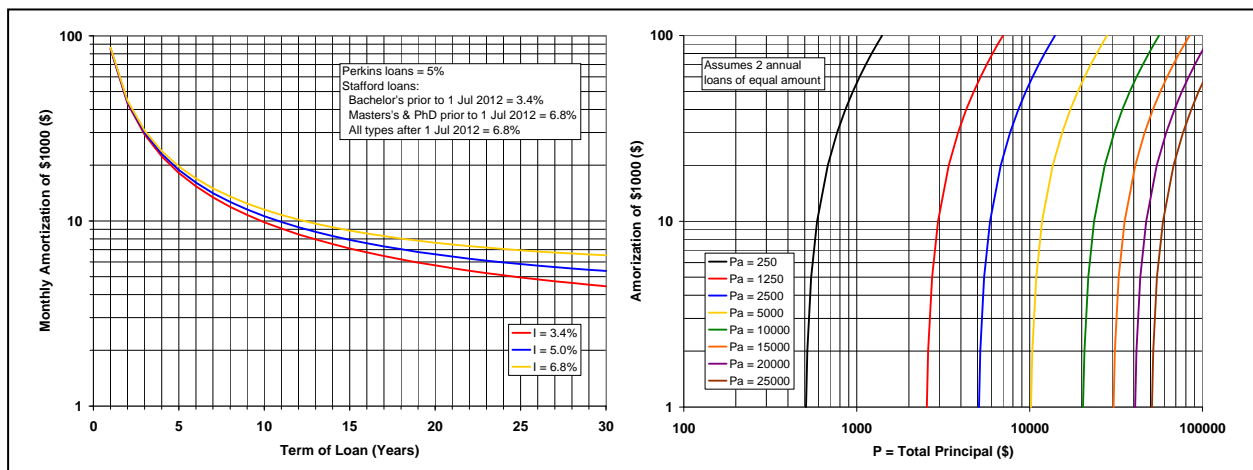


Figure 3.3-3: Growth of Principal (Capitalization) Due to Deferral, Two Year Case

Figure 3.3-2 contains directing lines that illustrate the following example. Suppose a student plans to pursue a four-year degree by borrowing \$10,000 per year, and would like to repay the loan in 10 years after graduation. Suppose further that the interest rate is 5%. The directing line on the left side of Figure 3.3-2 shows the amortization per \$1,000 for 5% over ten years. It is extended to the right side, and intersects the parameterization of amount borrowed per year

(\$10,000). Dropping down to the x-axis on the right side, it is seen that the total principal resulting at the end of the four years is about \$53,000 (a big difference from the \$40,000 that was actually borrowed). This is the total value that should be used in the upper-right chart of the standard nomograph (i.e., Figure 3.2-1).

With this basic data about expected starting salaries and the student loan nomograph, we are now prepared to look at some worked examples to show how the system may be used to answer a wide variety of questions related to the affordability of student loans.

3.4 References

1. U. S. Department of Labor, Bureau of Labor Statistics, Salary Tables for May 2010, "National Cross-Industry Estimates", available at http://www.bls.gov/oes/oes_dl.htm

4

Worked Examples

This chapter contains several worked examples that illustrate how to determine overall affordability of a student loan when considering all the relevant factors. These examples should cover most of the normal situations.

4.1 Amy

Scenario: Amy estimates that her total debt at graduation will be \$18,000 in Perkins Loans at 5% interest. Her parents will make the payments on the Perkins Loans while she is in school, but the repayment afterward will be her responsibility. Amy intends to obtain a degree in Finance. She does not want to stretch herself too thin on her starting salary, and plans to devote no more than 10% of her net starting salary to student loan repayments. This is a sensible approach, as she knows she will have other financial obligations. The maximum repayment term on a Perkins Loan is ten years from graduation. Will she be able to comfortably pay it off sooner than that? She expects that she will be single when the loan repayment starts.

Answer: The best way to answer this question is to work the nomograph counter-clockwise from total income in the lower left chart to the upper-left as shown on Figure 4.1-1. With a degree in Finance, Amy should expect an approximate starting salary of \$52,000 per Figure 3.3-2. The directing line on the lower left chart indicates that a \$52,000 gross income for a single person leads to a net income of about \$42,000 as shown on the y-axis of the lower right chart. The directing line continues to the right, where it stops about one-third of the way between the blue and yellow percentage repayment lines in the lower right chart. That is the correct point because 10%, which is the fraction Amy wishes to devote to repayment, is one-third of the way between 9% (the blue line) and 12% (the yellow line). The directing line proceeds upward; note that it crosses the x-axis of the upper right chart at a monthly payment of about \$340. Because we are doing the nomograph backwards (so to speak), this \$340 per month indicates

what Amy can afford, given the assumptions about gross income and 10% devoted to debt repayment. The directing line continues upward until it reaches a point partway between a total principal of 15,000 and 20,000; again we are interpolating between the two values at \$18,000, which is Amy's total debt at graduation.

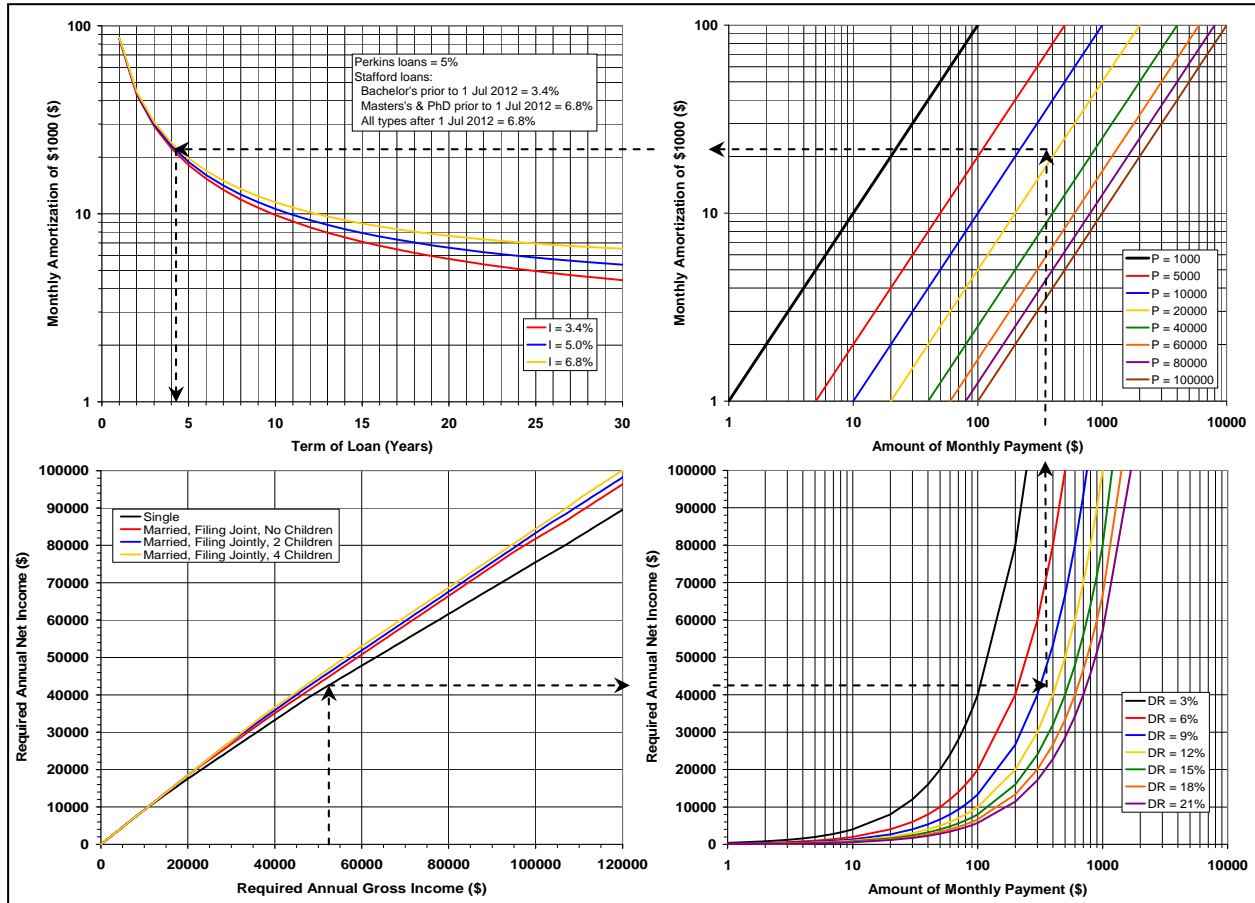


Figure 4.1-1: Nomograph Solution for Amy

The directing line then moves to the left, passing the amortization per \$1000 of about \$21 per month for loans at 5%, and it intersects the 5% line in the upper left chart at about 4.2 years. So, the conclusion is that this is a very wise strategy on Amy's part; although she has ten years to pay it, she will be able to do so comfortably in less than five years. The reason, of course, is that the student loan principal is fairly small compared to her starting salary.

4.2 Bill

Scenario: Bill qualifies for financial assistance and is therefore able to obtain subsidized Stafford Loans. He intends to pursue a four-year program in the field of graphic design starting in the fall of 2012. He estimates that he will need to borrow \$5,000 per year, and he is counted as a dependent on his parents' tax return. After graduation, he expects to find work as a graphic

designer, move out on his own, and desires to limit his repayment period to 5 years. Is this a viable plan?

Answer: As a "dependent" student, the maximum he can borrow is \$23,000 in subsidized form. Since he will only borrow \$20,000 total, he can obtain all of it subsidized and deferred until after graduation. Since it is subsidized, the U. S. Department of Education pays the interest while he is attending school, so, upon graduation, he will owe \$20,000 at 6.8% interest. From Figure 3.2-8, Bill can expect an annual starting salary of around \$30,500. The nomograph on Figure 4.2-1 shows Bill's case.

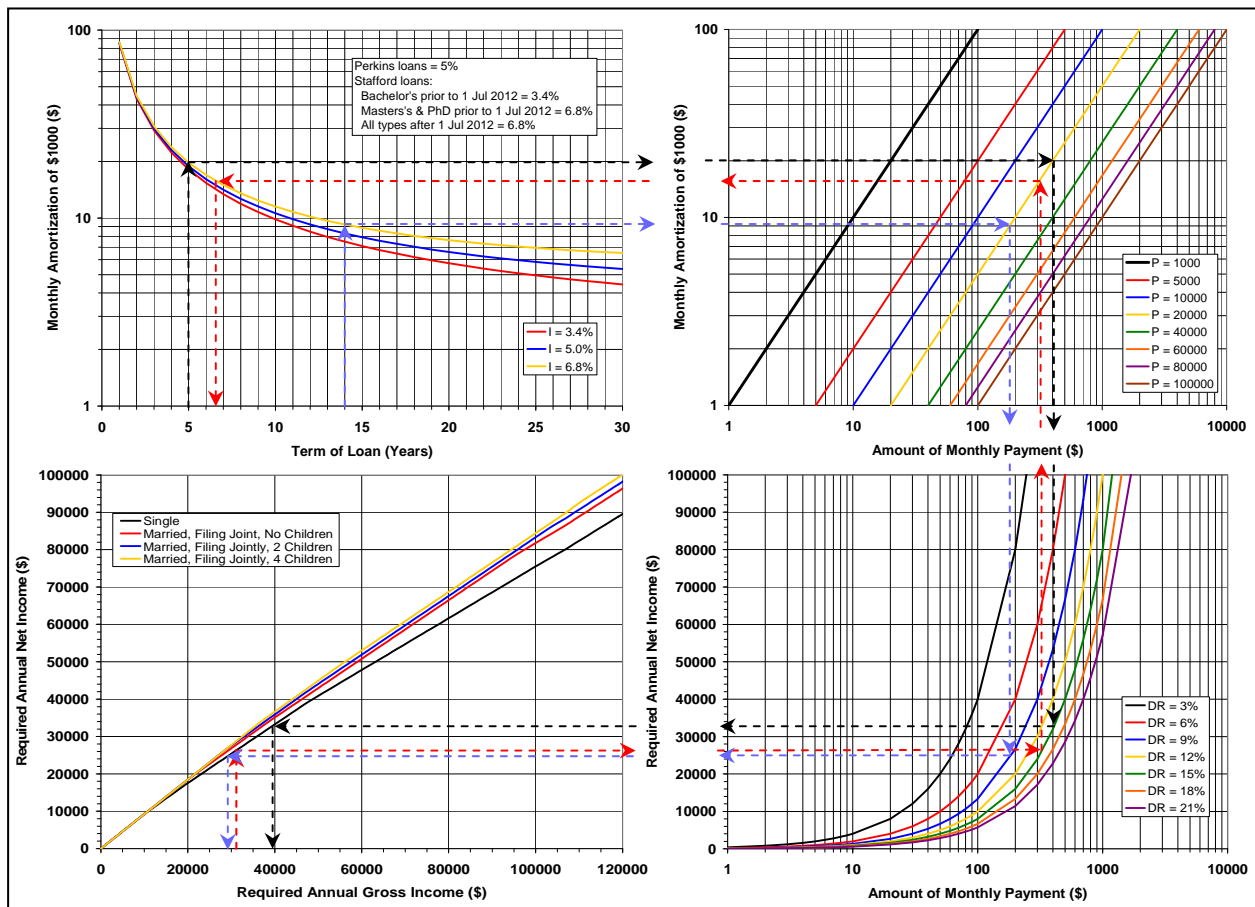


Figure 4.2-1: Nomograph Solution for Bill

Consider first the black dashed directing line, which starts at upper left, and extends to the upper right based on the intersection of Bill's desired 5-year payback term and the 6.8% interest rate. It extends to the right, intersects the \$20,000 principal that Bill will owe, and extends down to show that his monthly payment will be about \$400. That doesn't sound too bad at first, but consider what happens when the black directing line is extended to the lower right, and intersects the 15% debt repayment ratio. Recall, 15% is the recommended limit for the fraction of net income that is to be devoted to personal debt repayment as discussed in Chapter 3. The directing

line then extends to the left and the resulting required net income to support his repayment is about \$32,000; extending further to the lower left chart, assuming Bill remains single, we see that the required gross income is about \$40,000. This exceeds by a considerable amount what Bill can reasonably expect in the way of a starting salary. We conclude that Bill's initial plan is not viable.

To see what Bill's viable options are, we can work the nomograph backwards starting on the lower left chart with the red directing line. It starts at Bill's expected starting salary, \$30,500, goes up to his net income curve for a single person, extends to the right indicating a net income of about \$26,000. Suppose Bill still is interested in paying it off as soon as possible, and chooses the maximum debt repayment ratio of 15%. The red directing line intersects the 15% ratio line, transfers up to a monthly payment of about \$310. Extending up to the \$20,000 total debt figure, then left to the amortization chart in the upper left, we see that the directing line intersects the 6.8% interest rate line and drops down to a repayment period of about 6.5 years. This represents the fastest viable repayment, assuming the starting salary. However, this is probably a bad idea for Bill for one important reason. Just starting out, he is likely to have other personal debts, such as furniture for his apartment, and the 15% allocated to the student loan is too much of a burden. It is likely he will always have a severe cash-flow problem.

Let's see if there is a suitable solution here. Let's reduce the debt repayment fraction to somewhere around a more comfortable 9% in the lower right chart. Looking up, that would equate to a monthly payment of about \$190 and an annual amortization of about \$9.00 per thousand as shown on the left side of the upper right chart. If we look for a suitable repayment term matching these requirements, we see in the upper left chart that 14 years seems about right. Starting there per the blue directing line, we find the monthly payment on \$20,000 at 6.8% over 14 years to be about \$190. If that is to represent 9% of net income, his required gross income is a little less than \$30,000. That represents a reasonable solution to Bill's case, leaving him some margin for other debts as he begins his career. To summarize, the recommendation for Bill is: allocate not more than 9% for debt repayment, allow a monthly payment of about \$200 or so, and plan on a repayment term of about 14 years. Referring back to Figure 3.2-8, it is seen that Bill's chosen field has an M factor of 1.66; hence he should expect to be earning about \$50,500 in ten years or so, and the monthly payment on the student loan will be easily affordable by that time. Meanwhile, he will have enough cash flow to get by during his first few years in the workforce.

4.3 Cindy

Scenario: Cindy qualifies for subsidized Stafford Loans. She intends to borrow enough money to pay for tuition, books, and fees for a two-year program at a local community college. She intends to obtain an Associates degree in Electronics, and plans to work as a telecommunica-

tions installer after graduation. She is single and will live with her parents while attending school and work part-time to pay her other living expenses. She is determined to pay off her loan in five years, and desires to limit the monthly student loan payment to 6% of her net income. The question is: how much can she afford to borrow under these constraints?

Answer: Cindy’s interest rate will be fixed at 6.8% since she qualifies for a Stafford Loan. Because it is subsidized, she will not be required to make payments while she is in school because the Department of Education will absorb it. This is a case where the nomograph can be worked in two opposite directions to arrive at the desired answer. It will be worked clockwise from the upper left, beginning with Cindy’s desire to pay off the loan in five years; it will also be worked counterclockwise from the lower left starting at Cindy’s expected starting salary. The two sets of lines will meet in the upper right chart to show how much she can afford to borrow.

Figure 4.3-1 shows the solution. In the upper left chart, the blue directing line begins at the desired five-year repayment point, and moves up to intersect with the 6.8% interest rate, in which it is seen that the monthly amortization is about \$20 per \$1000 borrowed. It then moves across to the upper right chart and continues through it.

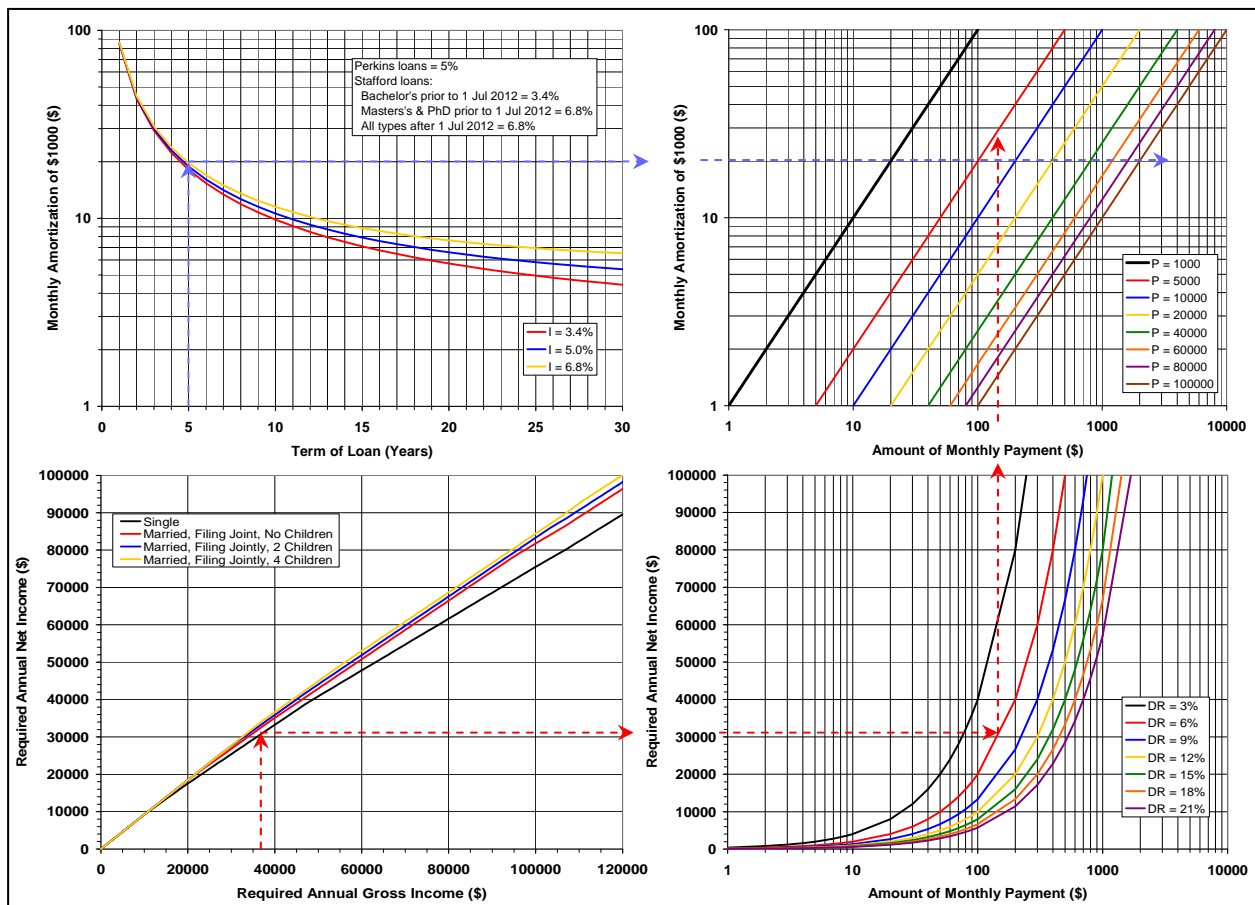


Figure 4.3-1: Nomograph Solution for Cindy

Meanwhile, from Figure 3.2-7, it is seen that Cindy can expect a starting salary of \$36,500 as a communications equipment installer. Starting the red directing line on the lower left chart at \$36,500 gross income and moving up to the “single-filer” tax line, we find that her net income will be just less than \$32,000. The red directing line continues to the right until it intersects the 6% debt repayment line, then moves up toward the upper right chart. As it crosses the x-axis of the upper right chart, it is seen that Cindy will be able to afford about \$140 per month. The red directing line continues upward until it intersects the blue directing line coming from the other direction. It is easy to see that the two directing lines intersect at a point that equates to about \$7,500 in total principal on the student loans. Since Cindy is pursuing a two-year degree, she can afford to borrow half that much per year, or \$3,750 per year. The obvious conclusion is that Cindy is wise to limit her total debt obligation in this way, although she could afford to borrow more if she was willing to devote a greater portion of her net income every month to paying off the student loan. But Cindy is too smart for that.

4.4 Dave

Scenario: Dave intends to become an aerospace engineer. His goal is to finish up his senior year as an undergraduate and then obtain a Ph.D. from a prestigious aeronautical school and go to work designing airframes (he has four years of school yet to go). He will be able to get a job teaching undergraduates part-time at the University. That salary will cover most of his living expenses, and he therefore does not qualify for subsidized loans. So, he plans to borrow \$20,000 to pay the tuition at the university for each of four years, and intends to defer repayment until after graduation. Can Dave afford to implement this plan?

Answer: Per Figure 3.2-6, Dave can expect an annual starting salary of about \$71,000 as an aerospace engineer. Since he is deferring repayment until after graduation, the interest that would normally be due while he is in school will accrue and be added onto the principal. In order to examine his total indebtedness upon graduation, it is necessary to first calculate the growth of principal over four years. The interest on Stafford loans after 2012 is fixed at 6.8%. For planning purposes, it is helpful to examine several options with regard to the repayment terms to find the best solution. Therefore, there are four sets of directing lines shown on the growth-of-principal nomograph per Figure 4.4-1. There is a solution shown for 10, 20, and 30 years repayment schedules. As seen here, if he borrows \$20,000 per year, he will end up with different total principal amounts depending on his desired repayment term.

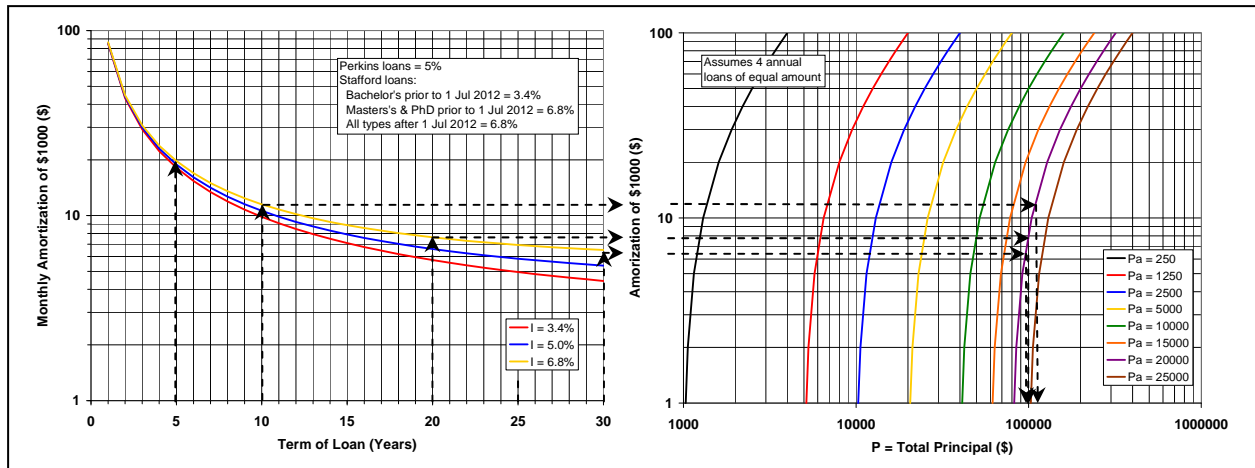


Figure 4.4-1: Growth of Principal for Dave

The total principal amounts are as follows. If he plans to repay the loans in 10 years, the total principal due will be about \$107,000; for 20 years, is about \$99,000; and for 30 years is about \$95,000. The general nomograph on Figure 4.4-2 shows whether or not this is affordable.

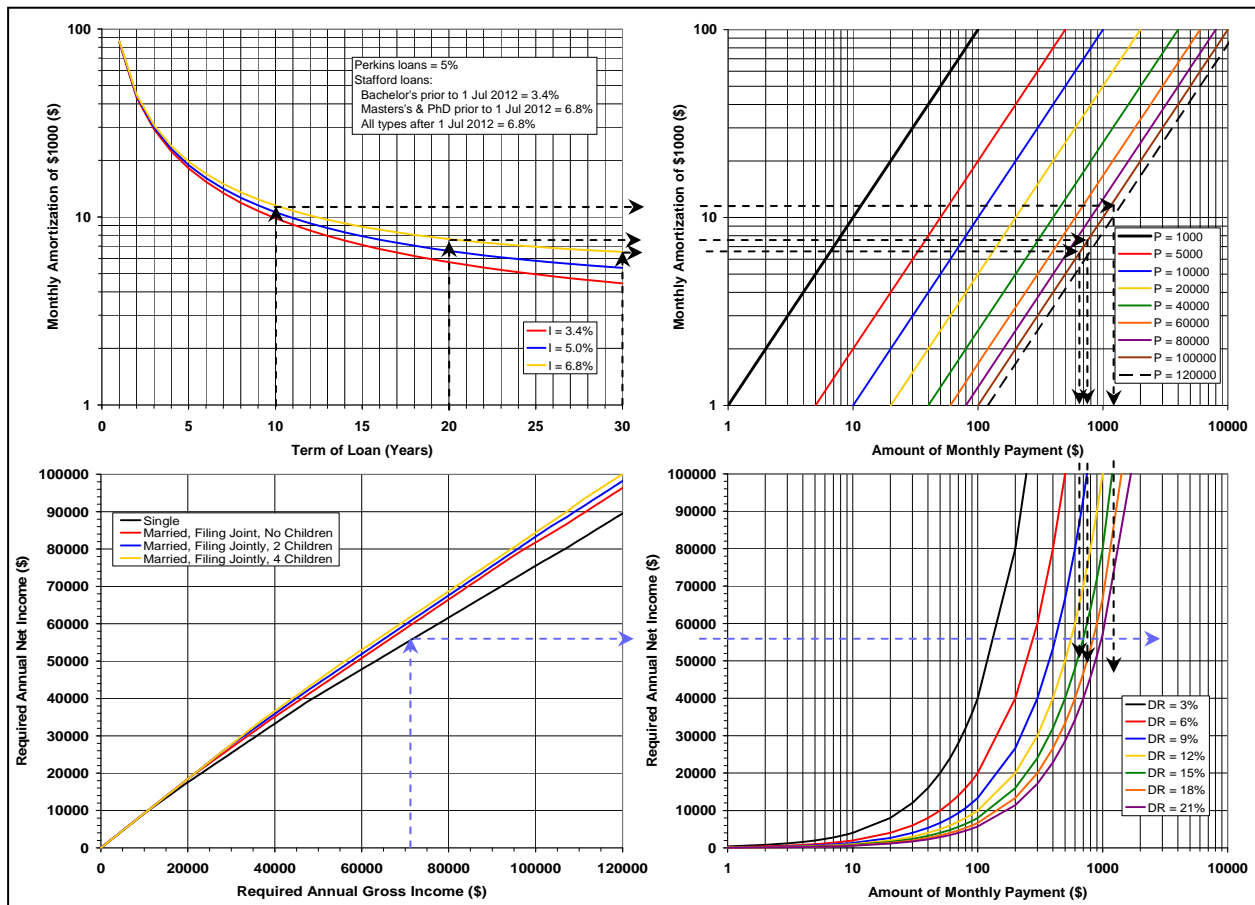


Figure 4.4-2: Nomograph Solution for Dave

The best way to answer this question is to determine for each term what the required fraction of income must be devoted to repaying the student loan; that is, work from both directions and end up on the lower right chart. The upper left chart shows the three candidate terms; they are brought over to the upper right chart and intersect the corresponding total principal values from the growth-of-principal chart above. The corresponding monthly payments are shown on the x-axis of the upper right chart: for 10 years, is about \$1,200; for 20 years, is about \$750; and for 30 years, is about \$610. These payment values are extended down to the lower right chart. Working the nomograph from the other direction, it is seen from the lower left chart that an annual salary of \$71,000 leads to a net annual income of about \$56,000 per the blue directing line. Extending the directing line to the right chart and finding where they intersect the monthly payment values indicates how affordable this plan is.

For a 10-year repayment schedule, the fraction of net income that must be devoted to the student loan is well in excess of the highest line shown here (it is actually 26%); for 20 years, is about 15%, and for 30 years is about 12%. So, the 10-year idea is completely impractical. The 20 and 30 year plans are nominally affordable, but do not leave much room for other expenses, at least until his salary increases with time. The M-factor for aerospace engineering per Figure 3.2-6 is 1.61; so after 10 to 15 years, Dave can expect to be earning about \$115,000. The student loan will be much more affordable then. Meanwhile, Dave will be strapped for cash every month. Overall, borrowing this much for an engineering degree, regardless of repayment term, is a bad idea. A Ph.D. in aerospace engineering is certainly a valuable commodity, but it is simply not worth a \$100,000 debt liability to obtain it. Dave should find some other means to obtain his education. The lower right chart on Figure 4.4-2 indicates that he could comfortably afford a monthly loan payment of \$300 to \$400 (representing 6% to 9% of net income). Tracing back to the upper right chart will show to what extent he needs to control his overall debt, depending on how long he wants to stretch out the repayment. For a 30 year term, his total debt should be limited to between \$45,000 and \$60,000; for 20 years, to between \$40,000 and \$55,000; and for 10 years, to between \$18,000 and \$30,000.

4.5 Erica

Scenario: Erica, a single person, has a combination of student loans at varying terms and interest rates. She went to school on and off for several years, and is now about to graduate with a Master's degree. She has borrowed the following amounts: a) \$7,000 on a Perkins Loan at 5% on a five-year term; b) \$5,000 on a subsidized Stafford Loan from 2009 at 3.4% on a 10 year term; and c) a \$10,000 on a subsidized Stafford Loan at 6.8% (which she borrowed as a graduate student) on a 15 year term. The issue is: if she obtains a job paying \$42,000, should she seek to renegotiate the repayment durations to improve her cash flow?

Answer: Because the nomograph is designed to solve problem with fixed interest rates, it is necessary to solve the nomograph three times, once for each interest rate, to find the monthly payment for each loan. These are then added together in order to determine overall affordability. Figure 4.5-1 shows the solution. The three black directing lines start on the upper left chart at the 5, 10, and 15 years terms, intersect the interest rates per the respective loan terms, and move across to the upper right chart. There they intersect with the corresponding loan amounts and transfer down to the monthly payments. As seen here, the approximate monthly payments are as follows: a) \$120 for the Perkins Loan; b) \$50 for the earlier (3.4%) Stafford Loan; and c) \$90 for the later (6.8%) Stafford Loan. The approximate total for all three is \$260 per month (the exact total is \$257.90).

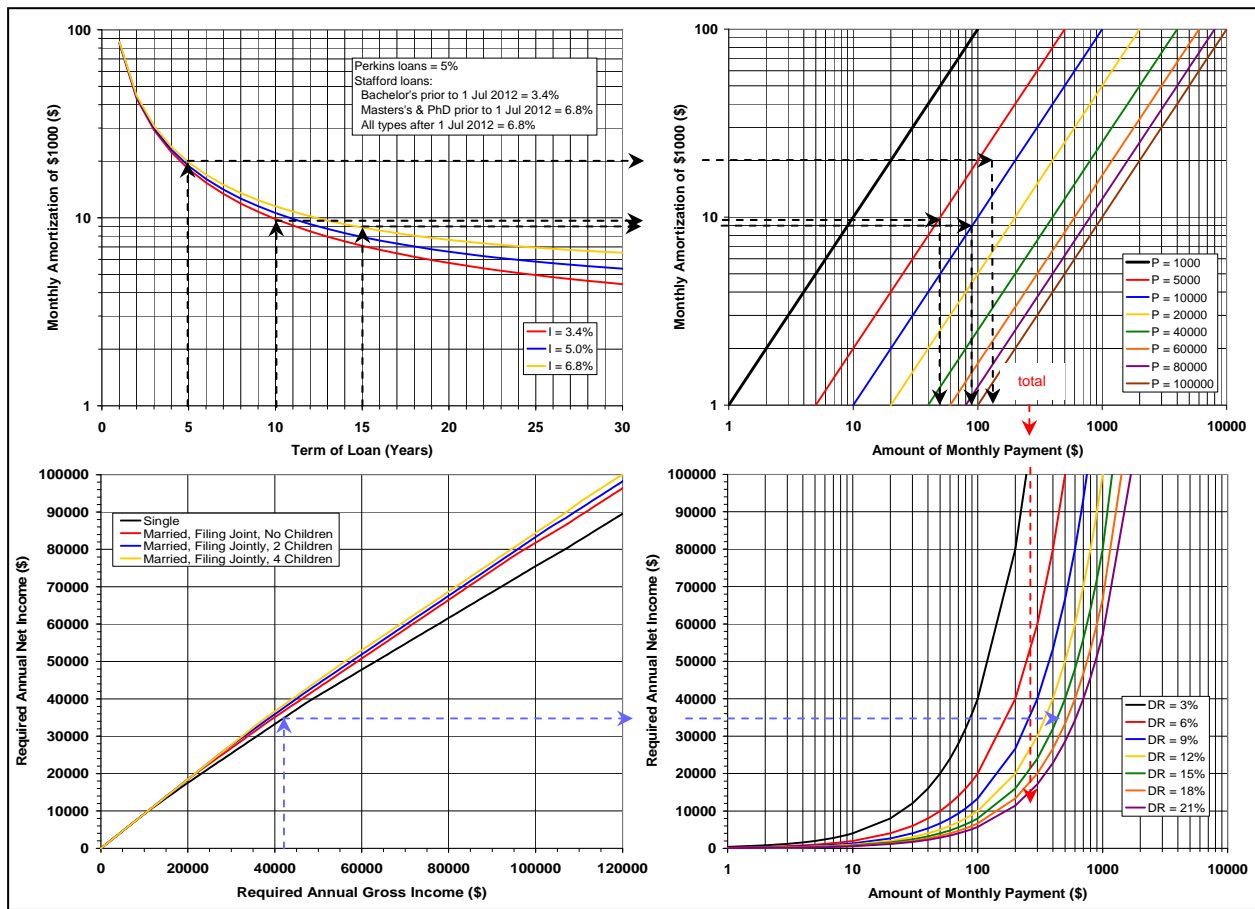


Figure 4.5-1: Nomograph Solution for Erica

A new directing line in red is started on the x-axis of the upper right chart to designate the total monthly payment, \$260. It continues through to the lower right chart. Meanwhile, a blue directing line is started on the lower left chart at the \$42,000 starting salary; it transfers to the right from the single taxpayer line showing a net income of about \$35,000. It continues over to the lower right chart. The fraction of net income that must be devoted to student loan repayment

is indicated by the crossing point of the blue and red directing lines; in this case, they cross right at about 9%. So, Erica's situation is not too bad; she probably can afford this payment without too much trouble if she controls her other personal debts. But what if Erica did have a cash flow problem? What renegotiation objective would offer the biggest advantage? It is pretty obvious from the curves that the greatest benefit would be achieved by stretching out the Perkins Loan to the full ten-year maximum. The monthly amortization on it would then be about \$11 (actually \$10.60), and her monthly payment on the \$7,000 loan would be reduced from the present \$120 to about \$75 (actually \$74.20). Her total would then be reduced from \$260 to \$215 (actually \$212.10).

4.6 Summary

Hopefully the preceding examples are sufficient to show how to evaluate the affordability of a student loan. Although it is approximate to within a few percent, the great strength of the student loan nomograph is that you can see the big picture of how interest rates, term, amount borrowed, debt repayment burden, taxes, and gross income all interact. In Amy's case, we started with gross income and found a suitable repayment term that would not cause a monthly cash flow problem. In Bill's case, we found that modifying the loan term would provide sufficient margin to allow for comfortable repayment. In Cindy's case, we started with a desire to limit the term of repayment, and using her expected starting salary, found out how much she could afford to borrow. In Dave's case, we found that he was borrowing way too much to finance the degree he was seeking, and used the available data to determine what his practical borrowing limits should be. Finally, in Erica's case, we found how to use the nomograph to find the results for several loans, and at the same time, determined what fraction of her income would be required for repayment, and the best strategy for modifying those if it were necessary.

5

Conclusion

We have now come to the end of our analysis. Hopefully this presentation was clear enough to allow you to see how all the factors involved in the student loan program must be considered before committing to the obligations. It is exceedingly important to do some advance planning, especially in light of the potentially large amounts involved, in order to avoid an unpleasant financial situation just as your career is starting. There is nothing worse than finding oneself under a mountain of debt without a clear path forward. If done correctly, the nomographic system presented here should allow you to see and avoid the pitfalls of taking on too much debt, or in what amounts to the same thing, taking on a reasonable debt on the wrong terms.

5.1 Some Final Remarks

Getting the education you want is certainly a laudable goal. For many people like me, without looks, talent, or connections, it was about the only way to move up in the world. It is important to remember that you, the aspiring student, must be careful that you do not get roped into bad financial arrangements. Unfortunately, that is too easy these days, as everyone wants to sell you a fast easy fix for a near-term lack of money, without the inconvenience (to them) of having to any obligation to you if the repayment proves too difficult later. That is especially the case with student loans, since only the student is put at risk, not the government or the educational institution. Hopefully, this little book will prove to be useful for those who are wary of financial entanglements, or who are not familiar with the risks at all.

When you enter into a student loan arrangement, you are likely to receive some financial counseling and advice from school administrators or loan officers. That is all well and good, but don't get focused on the near-term minutia. Check their numbers against this nomograph and make sure all the ground rules and assumptions are accurately included. This should lessen the probability of finding yourself in a cash squeeze after graduation.

5.2 Extra Nomograph Templates

It is obvious from the worked examples that the nomograph curves are a little hard to work with owing to the format of this book. Blank nomograph and principal growth templates in a larger size (using the full 8.5 x 11” format) are available free at <http://fremontvalleybooks.com> and <http://edduvall.com>. These may be downloaded, distributed, and reproduced without limitation.

Thanks for reading. If you have any comments or suggestions, please email me at: eduvall@fremontvalleybooks.com