

# A Feasibility Analysis of "Pay It Forward" Tuition Scheme

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# Team #3 Ostrichia Project Report

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### **ETM 535: Advanced Engineering Economics**

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### **1 Executive Summary**

College education for students has become more of a "degree with debt" than to a "path forward" for higher education in the U.S. Soaring tuition fees with a downhill in student aids from universities due to state budget cuts have left students in a dilemma of graduating with debts or not enrolling in colleges at all.

However, in an effort to make college education more affordable lawmakers in Oregon voted for a proposal, the idea of which was initiated by a couple of students in 2012 in their capstone project. This is known as "Pay it forward" that allows students not to pay their tuition during study period but in 25 years by repaying a percentage of their income after getting employed.

The present study evaluates the feasibility of the proposal for students in the Engineering School of Portland State University (PSU) as a case. Net Present Value (NPV) approach and Monte Carlo Simulation have been used to give an insight to students and investors to make their respective decisions on "Pay it forward". Data on tuition of resident and non-resident engineering students in PSU, inflation rate, initial salary for engineering students and salary increasing rates have been collected from reliable government data sources, necessary assumptions have been considered and Anderson-daring test with an significance level of 0.05 is used to find the mean and standard deviations of parameters that follow normal distributions. The MARR range is set at 2.89% to 5.53% assuming it to be less than the sum of GDP and inflation rate with pertinent explanations. The NPV calculation by expected cash flow shows that investment for a resident student has an expected financial gain of \$8,672, while the investment for a non-resident student has an expected financial loss of \$3077. Monte Carlo simulation shows that the probability of financial gain of investment from a resident student is 99% while that from a non-resident student is 10.4% i.e. the probability of loss is 89.6%. The break even contribution rate of salary is found at 2.4199% for resident students and 3.2058% for non-resident students. The trial calculation by Monte Carlo Simulation found the salary contribution rate for resident students to be 2.34% and for non-resident students to be 3.40% with the probability of 50% financial gain for break- even which means about half of the students are providing financial gain and the other half are providing financial loss.

The study concludes that the "Pay it forward" scheme is feasible for resident students but not for non-resident students if they pay at 3% of their salary as return of tuition for 24 years.

### **2** Introduction

In Oregon, lawmakers voted to study a proposal to transform how students pay tuition and fees at public colleges. Instead of getting a tuition bill upfront, students would pay a percentage of their income to the state for 25 years after graduation. The idea's supporters envision a sort of reverse Social Security: Students benefit early in life, then "Pay it forward" for the next generation. (Libby A. Nelson, 2013)

The idea of "Pay it forward" has spread quickly as concern grows about college affordability and student debt. Currently, more than half of students at public four-year colleges take out student loans, borrowing an average of about \$25,000 before graduation. The policy makers of Oregon and the students are eager to investigate the feasibility of the proposed scheme. If the scheme is piloted, the students will have another option of paying for their tuition.

This paper intends to provide a feasibility analysis to the proposed "Pay it forward" tuition scheme in Oregon based on the tuition and salary of the engineering students in Portland State University (PSU) and expected salary of US engineers in the future.

### 2.1 Current Financial Situation of College Students in America

The number of American students in graduate studies is declining and a few reasons for this delinquency are increasing burden of debt and decreasing opportunity of getting financial assistance due to federal budget cuts. Higher education in U.S. is expensive compared to many European and Asian countries around the world.

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The Council of Graduate Schools, an organization for institutions of higher education in the United States and Canada, reported that the number of American students enrolled in master's and doctoral programs declined by 1.7% from the fall of 2010 to fall 2011 based on an annual survey of American graduate schools. The report suspected that increasing debt burden from their undergraduate years could be a reason for students not willing to continue their education. Besides, state budget cuts also took its toll as public institutions reduce aid for graduate students while tuition kept on soaring incessantly.

The situation of students in America changed significantly over the past years. The tuition increased dramatically, so does the student loan. With the economy sours in the US, the prospection for the wage of college graduates is dime, the risk of unemployment after graduation from university has been growing compared with years earlier.

#### **Increasing Tuition**

First of all, students have to pay much more tuition currently than before. The tuition of colleges in America increased more than 900% since 1978(Cooper, 2011). This dramatic increase in tuition is due to the reduced support from the government. The president of PSU, Wim Wiewel, mentioned that the cost of higher education shifts from the state to the students at the Portland State of Mind Event, "From Debt to Degree."

"While total financial resources for higher education have been rising, there has been a significant shift in the share of resources coming from tuition and fees and a decline in the share coming from state appropriations".(Berger & Kostal, 2002). "Our simulations of policy options illustrate the difficulty of maintaining enrollment levels in the face of tuition increases" (Berger & Kostal, 2002).

#### **Increased Amount of Loans**

In order to pay these increased tuition fees, many students have no any other option than to take out a loan. The student loan debt is now higher than 1 trillion dollar, which is higher than housing and credit card debts(Louis, 2013) . Mark Kantrowitz pointed out that the average student debts for a Bachelor's candidate is about \$30,000.

#### Lower Wages and Unemployment

Many students, who are going to college, believe that they will get a well-paid job after graduation. However, the last economic crises caused the salaries to stagnate or even to decrease. In addition, the unemployment rate increased as well.

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### 2.2 "Pay it forward" Tuition Scheme

In 2012, a couple of students came up with a new idea about paying their tuition during their capstone project. They called their proposal "Pay it forward". The information in this section is based on their report SEDR (2012). Students, who would subscribe to this model, would not have to pay their tuition costs during the time they are studying. As soon as they go working, they have to pay 3% of their income for 24 years.

The goal of this concept is to make college more affordable for the low-income students. Furthermore, this scheme would help to decrease the debt burden of students.

Reducing the risks of failure to repay the student loan perceived, the "Pay it forward" approach would improve the accessibly of higher education especially by students from low-income families.

However, the proposal presented by the PSU students also has some significant shortcomings. First of all, the scheme does not take into consideration the impact on tuition inflation. In addition, they do not suggest how the start-up costs for the program can be funded.

When presenting the "Pay it forward" approach to students and university leaders, many practical problems appear. For example, it is unclear how out-of-state and international students can be included into the scheme. A major doubt is also that the students with future high-income jobs will not participate in this model; instead, they would stick on borrowing from the student loan. The "Pay it forward" scheme only considers the tuition costs. However, students will still have to borrow money for other costs such as books and accommodation.

### **3 Literature Review**

#### **Trends in Student Loans**

Student loan was not very popular in U.S till 1950s. Although the first loan program was adopted by Harvard University in 1840, the financial aid industry grew from 1966 with the creation of National Association of Student Financial Aid Administrators (NASFAA). ("The History of Student Loan Interest," 2013)

The GI bill which was enacted in 1944 allowed benefits only to Vietnam veterans to pursue education. But that initiated the prospect of getting educational loans for civilians as well (The GI BILL's History Born of Controversy: The GI Bill of Rights United States Department of Veteran Affairs, http://www.gibill.va.gov/Benefits/history\_timeline/index.html) Department of education was created in 1867, when it was concerned with establishing effective school system. But now DoE has the third largest discretionary budget behind Department of Defense and Department of Health. DoE earns \$120 billion in new loans annually. The loans generate tax deductible interests. (Deduct This: The History of Student Loan Interest, Forbes, http://www.forbes.com, 6/13/2011).

The Federal Students Aid (FSA) gives aid to students basically in three methods:

- -Gift aids in the form of grants, i.e., money that does not have to be repaid
- -Self-help aid in the form of work study, job earnings
- -Loans, money that must be paid back at cost of interest

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The Direct Loan Program offers several choices to borrowers to repay their loans and switch from one plan to other based on their needs. (Federal Student Aid, http://www.direct.ed.gov/about.html). Federal education loans are available either through the William D. Ford Federal Direct Loan Program, called "Direct Loans," or the Federal Family Education Loan Program (FFEL or FFELP). The FFEL Program is sometimes referred to as the federally-guaranteed student loan program.

#### **Interest Rates**

Congress sets the maximum interest rates in both the FFEL and Direct Loan programs. The interest rate on the Stafford Loan is identical in both programs. The interest rate on the PLUS loan, however, is 8.5% in the FFEL program and 7.9% in the Direct Loan program. The Higher Education Reconciliation Act of 2005 increased the interest rate in the FFEL program from 7.9% to 8.5% effective July 1, 2006 but did not implement a similar increase in the Direct Loan program. (Direct Loans vs. the FFEL Program, FinAid Page, LLC, 2013).

According to Berger and Kostal (2002), there is a "significant shift in the share of resources coming from tuition and fees and a decline in the share coming from state appropriations....Changes in the financing of higher education in the 1990s have gradually shifted the burden of paying from the state to the individual". In other words, the students have to pay more and more money while the state cuts his expenses for higher education. As stated by Breneman (1997) "state support for public higher education fell from 14% of total state budgets to 12.5% during the first half of the 1990s ". This tendency will have an effect on the enrollment of students in the higher education programs of the US. The simulation conducted by Berger and Kostal (2002) "illustrate the difficulty of maintaining enrollment levels in the face of tuition increases". There is a clear relationship which shows "as tuition increases the enrollment rate decreases" (Berger and Kostal, 2002). On the other hand, "foregone earnings, prices of private alternatives, income, and the unemployment rate have much smaller effects" (Berger and Kostal, 2002).

Heller (1999) developed a model which allows more detailed insights on the effects of student enrollment in the higher education programs in America. As he denotes, "for all races, enrollment rates are related to community college tuition prices, state grant spending, and unemployment rates." Furthermore, Heller analyzed this effect and gives numerical insight into the impacts of the increase in the tuition fees. "For

example, a \$1,000 increase in community college prices is associated with an overall drop in enrollment rates of 2.08 percentage points. Similarly, an increase in grant spending of \$100 per 18-24-year-old in the state is related to an enrollment rate increase of 1.26 percentage points".

### **4 Research Problems**

We take the students in engineering school of Portland State University as an example to evaluate the feasibility of this scheme. The "Pay it forward" scheme allows the students to waive their payment for tuition when they are getting the education, instead, after they take the classes for 4 years and graduate, usually it will take them 1 year to find a proper position in the job market, and then they must pay 3% of the salary for 24 years to cover the expenses for their 4-year higher education.

We consider the "pay it forward" scheme as an investment/payback project to pay the tuition for each university students, therefore, an economic feasibility analysis is desired by the policy makers in order to understand the cash flow and investment return of this innovative scheme to pay tuition. The analysis should be objective and it is to give the insights for the students and the investors in order to make decisions about whether to take the option of "pay it forward". The investors could be the government, the banks or any funding organization, who would like to invest in the tuition and take the payback from the students' future salary. This study is focusing on the feasibility of the investment mainly from the perspective of investors. The research problems in this paper can be described as follows:

#### The Evaluation of Feasibility by Net Present Value

Given the inflation rate, salary increase rate and starting salary, if the Minimum Acceptable Rate of Return (MARR) and the tuition of four years in the Engineering School of Portland State University, the Net Present Value (NPV) could be calculated. If the NPV is greater than 0, then the project is worthy of investment.

#### The Monte Carlo Simulation of the Problem

Suppose there are 10000 students in 2013 taking advantage of the "pay it forward" scheme to pay their tuitions for the 4 year higher education in the Engineering School of Portland State University and their initial salary and salary increase rate are predicted to be random but obey the normal distribution. If the NPVs aggregating the cash flows of the majority of the students are greater than 0, then the scheme is beneficial to the investors. On the other hand, if the majority of the students' NPVs are less than 0 then the scheme will make the investors loss money.

To be clarified, the gain of the investor would be the loss of the students if the expected rate of return of the students is the same as the investor's. However, this is not true given the fact that the graduates with higher education are much more productive than an under educated one. For the students, the investment of tuition is combined with the effort in studying which will pay them back in the future. The Appendix 1 shows the differences in annual earnings of adults with different education levels. So it is obvious that the expected rate of return of education is regarded much higher than the minimum accepted rate of return (MARR) of the investors, "Pay it forward" scheme and student loan both allow the students with low income to have access to the higher education that changes their future substantially. The difference in the expected rate of return of students and investors makes the "Pay it forward" scheme a win-win policy.

### **5 Methodology**

#### The NPV method

NPV is a central tool in discounted cash flow analysis and is a standard method for using the time value of money to appraise long-term projects. NPV is used for capital budgeting and widely used throughout economics, finance, and accounting. NPV can be described as the "difference amount" between the sums of discounted: cash inflows and cash outflows. It compares the present value of money today to the present value of money in the future, taking inflation and returns into account. ("Net Present Value," 2013)

#### **Monte Carlo Simulation**

Monte Carlo Simulation, or Monte Carlo experiment is a broad class of computational algorithms that rely on repeated random sampling to obtain numerical results; i.e., by running simulations many times over in order to calculate those same probabilities heuristically. ("Monte Carlo Method," 2013)

### **6 Data Collection**

#### Tuition

Tuition of the Maseeh School of Engineering and Computer Science is listed as Appendix 1. The sum of the tuition are listed as Table 1.

Year	Resident	Non-Resident
1	(\$9,091)	(\$25, 248)
2	(\$9,091)	(\$9,091)
3	(\$9,091)	(\$9,091)
4	(\$7, 197)	(\$7, 197)

Table 1. Tuition of Enginneering School of PSU in 2013

#### **Processing Fee**

The "pay it forward" scheme is inherently a legal contract between the students and the investors, the contract needs some cost of maintaining and the transaction cost should be considered. So we assume that a processing fee for the whole process should be charged to the students. The Processing fee will cover the cost of the following: -Initiation of a legal contract, \$500.

-Tracking the income of the students in the 25 five years of making money for \$20 per year, subtotaling in \$500.

-The accounting and payment of tuition of the students, \$5 per quarter with 16 quarters in 4 years, subtotaling in \$80.

-The accounting and payment of a specific percentage of the student's salary to the investor's account, \$3.2 per time with 288 times (288 months in 24 years), subtotaling in about \$920.

The estimation of the processing fee is \$2,000 in total.

#### **Inflation Rate**

According to the historical data of inflation rate in the US from 1982 to 2012, in the past 25 years, and through the Anderson-daring test with a significance level of 0.05, the inflation rate is obeying the normal distribution with an average value of 2.89% and standard deviation of 1.15%.

#### **Initial Salary**

A new salary survey from the National Association of Colleges and Employers (NACE) shows that engineering majors dominate the list of college degrees that pay the highest salaries to new college graduates, as shown in Table 2.

Table 2. The Annual Salary of Different Engineering Majors

Major	Annual Salary
Computer Engineering	\$70,400
Chemical Engineering	\$66,400
Computer Science	\$64,400
Aerospace/Aeronautical/Astronautical Engineering	\$64,000
Mechanical Engineering	\$62,900
Electrical/Electronics and Communications Engineering	\$62,300
Civil Engineering	\$57,600
Construction Science/Management	\$56,600
Information Sciences and Systems	\$56,100

The nine categories of engineering major's initial annual salary are obeying the normal distribution with an average of \$62,300 and standard deviation of \$4784, according to the Anderson-daring test with a significance level of 0.05.

#### **Salary Increasing Rate**

It is hard to find the increasing rate of annual salary for the engineers in the US. However, we can find some comparable clue from the national average wage indexing series. According to the Social Security Administration website ("National Average Wage Index," 2013). The National average wage indexing series from 1988 to 2012 is shown in Appendix 3.

The Anderson-daring test with a significance level of 0.05 shows that the salary increasing rate of the US people is obeying the normal distribution with an average of 3.51% and a standard deviation of 1.80%. This number doesn't take the growing experience of engineers into consideration. So according to the conservative subjective evaluation, it is assumed that the average salary increase rate could be improved to 5% with the same standard deviation (1.80%).

#### Minimum Acceptable Rate of Return (MARR)

The MARR of the investor is dependent on the risk of the investment, the expected return period and the investors' expectation, etc.. There are two basic benchmarking values for the MARR adopted: the inflation rate and the sum of inflation rate and Gross Domestic Production (GDP) growth rate.

The inflation rate i% is marking that one needs the money at the nth year of M(1+i%)^n to buy the same goods at the beginning of the 1st year. The inflation rate is the bottom line of MARR for most investors, i. e., MARR>=i%. Gross domestic product (GDP) is the market value of all officially recognized final goods and services

produced within a country in a given period of time. The GDP calculated has excluded the influence of inflation. The GDP growth rate, g%, is presenting the average increase in ability of producing of a specific country per year.(Barnes, 2013)

The loan interest of an investment is diversified by the objectives. For the "Pay it forward" scheme, the investment of tuition is not intensively for profit in nature. Its return is mainly based on the return of capital compared with the labor and entrepreneurship concerned. The risk of the investment is relatively low, since we suppose the investment is supported by the government, and the return of salary of individual students will be under the scrutinizing of the federal and state government. So it could be supposed that the MARR<(i%+g%).

As shown in Appendix 3, the GDP growth rate of the US from 1998 to 2013 is obeying the normal distribution with an average of 2.64% and standard deviation of 1.81% based on the Anderson-daring test with a significance level of 0.05.

The expected MARR range could be set as [2.89%, 5.53%].

We choose to compare the MARR of the tuition investment with the long term mortgage interest rate with 30 year returning period. They are similar in the lower risk involved, the mortgage is pledged by the value of the house, whereas, the return of the specific percentage of annual salary is guaranteed by the government tax statement. The return periods of mortgage and tuition investment are similar too. The payback period in the "pay it forward" scheme is expected to be 25 years, whereas, some students might be continuing with their study to get the graduate degree. Some female students might have several years to take care of kids before they get a job. Since they are similar in many aspects, the MARR of the tuition investment could be set in the light of the mortgage interest rate roughly. The average rate for a 30-year fixed mortgage was 4.29 % in Nov. 27th, 2013. (Gopal, 2013). The MARR is simply chosen the same as the 30-year fixed mortgage rate, 4.29%.

Comparing with the interest rate of student loan in the US according to Appendix 5, the MARR is higher than the undergraduate student loan interest but lower than the student loan for graduate, professional students, parents.

### 7 Analysis and Results

According to the analysis as shown in Appendix 4 and 5 the result shows that because the tuition of resident student is cheaper than a non-resident student, the "Pay it forward" is feasible for the resident student and not feasible for non-residents student. In here, the non-resident student is not including international students. Usually, a non-resident student only pay tuition with non-resident rate for one year, the second year, they would apply for the residency in Oregon and only pay tuition with resident rate in the following years.

In Appendix 4, the NPV calculated by the expected cash flow shows that the investment for a resident student has an expected financial gain of \$8,672, while the investment for a non resident student has an expected financial loss of \$3077.

In Appendix 5, the Monte Carlo simulation shows that the probability of financial gain of investment to a resident student is 99%, meanwhile, the probability of financial gain of investment to a non-resident student

The feasibility of "Pay it forward" scheme is suitable for resident student but not feasible for non-resident students.

Furthermore, we tried to find out that if the contribution rate of the salary of resident students is 2.4199%, the contribution rate of the salary of non-resident students is 3.2058%, the expected NPVs of the investors would both be 0, which makes both types of investment breakeven.

With the Monte Carlo simulation, the trial calculation shows that if the salary contribution rate of resident students is 2.34%, the salary contribution rate of non-resident students is 3.40%, then the probability of financial gain is about 50%, which means these contribution rates are breakeven, that is, about half of the students are providing financial gain and the other half are providing financial loss.

### 8 Survey

A survey among the undergraduate students is conducted to get their opinions, feedback, choice and what exactly they think about "Pay It forward".

#### Interview

The interviews with 10 undergraduate students are conducted and their opinions are recorded. After talking to a bunch of students, a mixed feedback is obtained, some is in agreement while some criticizing, and few were just neutral. The scheme of "Pay it forward" is popular, as many students have heard about the Oregon organizations talking about it in their seminars and presentations.

Majority of the students are in favor of the model, and their thoughts gives more insights to this category of students. As it was pointed out by one of the student, it will make it easier for him to complete his schooling without any stress of worrying about the financial part, as for now he is trying to take one course each term and working part-time shifts to earn enough to finance his studies and living. He will not be able to complete his engineering in four years as many of them are able to do, which will delay his chances of getting a good job by the time he graduates, building an immense level of pressure on him to just have a degree. This highlights how costly the current educational system is and with the increasing inflation rates, no one knows to what level the cost will rise. While interacting with a Wal-Mart employee we found out, that he was working hard and saving to pursue his schooling, but if he could avail this financing, it will make it much easier for him to pursue his education. Education is the basic platform or one of the pillars of life that is utmost important to make the living easier as we can see the difference of wages paid to educated and non-educated employees.

#### **Online Survey**

Verbally reaching out to many people is sort of a limitation, so we tried to reach students through a different medium. We used the Google forms to create online survey for our analysis and sent out to more than 200 people. With a high hope of having at least 20 percent respondents, we merely got 20 responses from the students. Still their responses seem to give us the perspective of certain percentage of students. The respondents' selections vary between the student loans and "Pay It forward", with no clear majority in any of the two. Although the survey gave us a significant insights to students' thoughts and what many students are going through while trying to opt for financing of their undergraduate schooling. Some points highlighted about the "Pay it forward" scheme were, the processing fee of \$2000 seems to be huge, the investors may lose money if the students don't get job on right time, and they will even lose money when the economy goes down. So there are still many other factors that need to be considered to make it more feasible.

While the 25 years seem to be too long to some students, who mentioned about planning for their retirement that becomes difficult while paying a certain percentage back to the investors till 25 years, asking for a shorter time period for paying back the amount. Even few were concerned if the model can integrate a cap, so that students earning a very huge amount in salary can repay the sum faster or can donate the sum above that cap level.

Survey results state that the model still needs to be improved or some parameters and factors need change to include different perspectives of the investors and students.

### 9 Discussion

#### **Adversary Selection Issue**

Because of the information asymmetry, "Pay it forward" scheme faces the adverse selection. The financial cash flow model has identified the reasonable salary contribution rate set with a MARR in light of the fix 30-year mortgage rate. However, we consider that our model is based on the upcoming salary, students who are possible to have interval period after graduation might prefer our model since they can pause to pay back money. We expect that female students, who need to take care of their children, will show more interest in this scheme. Another adversary selection is that students who will get a job with a relatively low income will be more interested in the "Pay it forward" scheme. Basically, the average salary after graduation shows the significant difference in respect to the different majors in university. Students who consider that their investment (tuition) will result in small return (salary) can get more benefits in comparison with other student. If the adversary selection is taken into consideration when setting the contribution rate, there should be an increase in the contribution rate of salary to compensate the risk.

#### The Comparison of "Pay it forward" to the Student Loan- Socialization

The student loan and "Pay it forward" are they very different. The student loan is in nature an individual responsible contract without the mutual assistance as "Pay it forward." "Pay it forward" has more meaning of socialization. The tuition payment of students is shared among a community consisting of all the students who choose it. Part of the students will cause the community to lose money while the other students making up the loss, which will result in a breakeven for the investor with a reasonable MARR.

### **10 Recommendations**

Based on the conclusion and discussion we provide the following recommendations:

- From the survey by the students, we can see that the students, especially low income students, are glad to have "Pay it forward" as an option to pay their tuition. They hope that the government can take part of the responsibility to pay their tuition and also take part of the risk of unemployment for them spending years studying in university.
- 2. Set the MARR with lower rate compared with the student loan since the payback could be guaranteed by the government. In this paper we set MARR in light of the fixed 30-year mortgage. However, the set of MARR is a crucial step in the feasibility research, according to the different investor and the incentive of investment, the MARR could be differed.
- 3. The contribution rate of resident student and non-resident student should be differentiated in order to fulfill the difference in the tuition rate. The resident students can enjoy lower contribution rate of salary to payback their tuition compared with non-resident students.
- 4. There are adversary selection issues existing in the "Pay it forward" scheme, which means that the students who expected themselves to have longer interval period of employment and lower salary will be more interested in the scheme. The risk should be compensated by an increase in the contribution rate of salary.

### **11 Conclusion**

This paper is for the feasibility analysis of "Pay it forward" scheme for paying tuition as a specific percentage of the future salary in 25 years. The perspective is mainly from the angle of investor; however, it also gives a view for students to understand the scheme. The data are based on the tuition of the Maseeh School of Engineering and Computer Science in Portland State University and the average initial annual salary of engineers in the US in 2013.

The NPV method and Monte Carlo simulation method are used and the results show that the 3% percentage is feasible for the resident students but not feasible for the non-resident student. The research hasn't discussed about international students since it is hard to predict where they are going to work in the future. The result suggest that the contribution rate of salary for the resident student could be lowered to around 2.34-2.42% and the contribution rate for the non-resident student could be increased to around 3.20-3.40% in order for the investor to get breakeven.

Interviews and an online survey have been conducted to get the opinion of the undergraduate students. The feedback shows that the scheme is well known and widely discussed on campus and majority of students are in favor of the scheme as an option to pay their tuition. An online survey states that the "Pay it forward" scheme still needs to be improved or some parameters and factors need change to include different perspectives of the investors and students.

The paper further discussed about the adversary selection which will exist in the choice of "Pay it forward" scheme and recommendations are provided in order to improve the proposal.

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## Appendix 1 Median Annual Earnings of Adults Age 25 and Over (Full-Time Workers), 2011



Source: Bureau of Labor Statistics, Current Population Survey, Annual Social and Economic Supplement. Last Modified Date: March 23, 2012

### Appendix 2 The Calculation of Tuition of Resident and Non-Resident Students of the Engineering

### **School of PSU**

1. Graduation Requirements: Total 180 credits 72 upper division credits

- 2. Personal Schedule for acquiring credit per year
- referring link: http://www.pdx.edu/degmap/sites/www.pdx.edu.degmap/files/degree\_maps/Degree\_map\_EE\_BS\_13\_2.pdf
- The schedule is based on the student majoring electrical engineering

#### **First Year**

Fall	winter	spring	SUM
18	17	13	48

#### Third Year

Fall	winter	spring	SUM
16	16	16	48

#### Second Year

Fall	winter	spring	SUM
16	16	16	48

Fourth Year

Fall	winter	spring	SUM
16	12	10	38

Total Credits 182

3. Tuition Fee \* Not including madantory fee(building/incidental/health service/recreation center etc)

- referring link: http://www.pdx.edu/financial-services/sites/www.pdx.edu.financial-services/files/PSU\_2013\_2014\_FeeBook.pdf

#### **First Year**

Fall		Winter	Spring	Total Cost
	\$3,409	\$3,220	\$2,462	\$9,091

#### **Third Year**

Fall		Winter	Spring	Total Cost
	\$3,030	\$3,030	\$3,030	\$9,091

#### Second Year

Fall		Winter	Spring	Total Cost
	\$3,030	\$3,030	\$3,030	\$9,091

Fourth Year

Fall		Winter	Spring	Total Cost
	\$3,030	\$2,272	\$1,894	\$7,197

#### Total Tuition: \$34,470

#### 2013 PSU Tuition per Credit

Resident	Non-resident
189.4	526

For non-resident students, they have to pay for the first year tuition with a non-resident rate, then the second year they become resident in

Oregon State and only pay for the tuition at the resident rate.

#### **First Year**

Fall	Winter	Spring	Total Cost
\$9,468.00	\$8,942.00	\$6,838.00	\$25,248.00

### **Appendix 3 The Historical Inflation Rate in the US**

Year	Inflation Rate	GDP Growth Rate
1987	3.6	4.45%
1988	4.1	3.84%
1989	4.8	2.78%
1990	5.4	0.65%
1991	4.2	1.23%
1992	3	4.33%
1993	3	2.62%
1994	2.6	4.13%
1995	2.8	2.28%
1996	3	4.45%
1997	2.3	4.39%
1998	1.6	5.00%
1999	2.2	4.86%
2000	3.4	2.86%
2001	2.8	0.18%
2002	1.6	2.03%
2003	2.3	4.34%
2004	2.7	3.12%
2005	3.4	3.04%
2006	3.2	2.41%
2007	2.8	1.89%
2008	3.8	-2.81%
2009	-0.4	-0.24%
2010	1.6	2.77%
2011	3.2	2.01%
2012	2.1	1.95%

Data source: http://www.usinflationcalculator.com/inflation/current-inflation-rates/

### **Appendix 4 The US National Average Wage Indexing Series**

Year	Salary Index	Salary Growth Rate
1988	19334.04	
1989	20,099.55	3.96%
1990	21,027.98	4.62%
1991	21,811.60	3.73%
1992	22,935.42	5.15%
1993	23,132.67	0.86%
1994	23,753.53	2.68%
1995	24,705.66	4.01%
1996	25,913.90	4.89%
1997	27,426.00	5.84%
1998	28,861.44	5.23%
1999	30,469.84	5.57%
2000	32,154.82	5.53%
2001	32,921.92	2.39%
2002	33,252.09	1.00%
2003	34,064.95	2.44%
2004	35,648.55	4.65%
2005	36,952.94	3.66%
2006	38,651.41	4.60%
2007	40,405.48	4.54%
2008	41,334.97	2.30%
2009	40,711.61	-1.51%
2010	41,673.83	2.36%
2011	42,979.61	3.13%
2012	44,321.67	3.12%

Data source: http://www.ssa.gov/oact/cola/AWI.html

Loan Type	First Disbursed between July 1, 2013
	and June 30, 2014
Direct Subsidized Loans (Undergraduate	Fixed at 3.86%
Students)	
Direct Unsubsidized Loans (Undergradu-	Fixed at 3.86%
ate Students)	
Direct Unsubsidized Loans (Graduate or	Fixed at 5.41%
Professional Students)	
Direct PLUS Loans (Parents and Gradu-	Fixed at 6.41%
ate or Professional Students)	
Perkins Loans (Undergraduate and	Fixed at 5%
Graduate or Professional Students)	

### Appendix 5 US Student Loan Interest in 2013

Note: The interest rates for federal student loans are determined by federal law. If

there are future changes to federal law that affect federal student loan interest

rates, we will update this page to reflect those changes.

Data Source: <u>http://studentaid.ed.gov/types/loans/interest-rates</u>

### Appendix 6 The Expected NPV Analysis for "Pay it for-

### ward" Scheme

Starting salary	\$62300
Salary increasing rate	3.51%
Salary increasing rate with experiences growing	5.00%
Inflation rate	2.89%
MARR	4.29%
Contribution percentage of salary as return of tuition	3.00%
Process fee for the contract	\$2,000

#### Appendix 4.1 The Parameters

Years	Resident	Non-Resident
Year 1	(\$9,091)	(\$25,248)
Year 2	(\$9,091)	(\$9,091)
Year 3	(\$9,091)	(\$9,091)
Year 4	(\$7,197)	(\$7,197)

Appendix 4.2 The Tuition in 2013

Appendix 4.3 The Cash Flow Table

	NPV \$8,672		\$8,672	-\$3,077
Voor	No	Appual Salary	Desident Cash Flow	Non-Resident Cash
rear	INO.	Annual Salary	Resident Cash Flow	Flow
2013	1	\$62,300	(\$9,091)	(\$25,248)
2014	2	\$64,489	(\$9,354)	(\$9,354)
2015	3	\$66,754	(\$9,624)	(\$9,624)
2016	4	\$69,099	(\$9,902)	(\$7,839)
2017	5	\$71,527	\$0	\$0
2018	6	\$74,039	\$2,214	\$2,214
2019	7	\$77,741	\$2,325	\$2,325
2020	8	\$81,629	\$2,441	\$2,441
2021	9	\$85,710	\$2,563	\$2,563
2022	10	\$89,995	\$2,691	\$2,691
2023	11	\$94,495	\$2,826	\$2,826
2024	12	\$99,220	\$2,967	\$2,967
2025	13	\$104,181	\$3,115	\$3,115
2026	14	\$109,390	\$3,271	\$3,271
2027	15	\$114,860	\$3,435	\$3,435
2028	16	\$120,602	\$3,606	\$3,606
2029	17	\$126,633	\$3,787	\$3,787
2030	18	\$132,964	\$3,976	\$3,976
2031	19	\$139,612	\$4,175	\$4,175
2032	20	\$146,593	\$4,384	\$4,384

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2033	21	\$153,923	\$4,603	\$4,603
2034	22	\$161,619	\$4,833	\$4,833
2035	23	\$169,700	\$5,075	\$5,075
2036	24	\$178,185	\$5,328	\$5,328
2037	25	\$187,094	\$5,595	\$5,595
2038	26	\$196,449	\$5,875	\$5,875
2039	27	\$206,271	\$6,168	\$6,168
2040	28	\$216,585	\$6,477	\$6,477
2041	29	\$227,414	\$6,801	\$6,801

Note: The initial salary in 2018 is based on the initial salary in 2013 and the US national wage index growth rate of 3.51%. The salary from 2018 to 2041 is based on an increasing rate of 5%, which includes the employees' experiences increasing according to a conservative subjective evaluation. The tuition expense is shown with negative cash flow with an inflation rate of 2.89% in the first 4 years. The fifth year, 2017, is for the students to find a job, the cash flow is assumed to be 0.

# Appendix 7 The Monte Carlo Simulation of "Pay it forward" Scheme

	Distribution	Average	Standard
	Distribution		Deviation
Starting salary	Normal	\$62,300	\$4,784
Salary increasing rate with	Normal	5.00%	1.80%
experience growing	Normai		
National wage index growth	Normal	3.51%	1.80%
Inflation rate	Normal	2.89%	1.15%

#### Appendix 5.1 Parameters

MARR	4.29%
Contribution percentage of salary as return of tuition	3.00%
Process fee for the contract	\$2,000

#### Appendix 5.2 The Calculation Table

NPV		\$8,716	-\$6,776			
	No	Salary	Inflation	Colom	Resident Cash	Non-Resident
rear	INO.	Inc-rate	Rate	Salary	Flow	Cash Flow
2013	1	5.65%	1.65%	\$67,194	(\$9,091)	(\$25,248)
2014	2	5.33%	2.05%	\$70,772	(\$9,278)	(\$9,278)
2015	3	1.16%	3.55%	\$71,594	(\$9,607)	(\$9,607)
2016	4	4.05%	1.16%	\$74,496	(\$7,694)	(\$7,694)
2017	5	2.17%	1.37%	\$76,112	\$0	\$0
2018	6	0.11%	1.71%	\$76,196	\$2,286	\$2,286
2019	7	4.00%	2.84%	\$76,280	\$2,288	\$2,288
2020	8	3.89%	1.83%	\$79,331	\$2,380	\$2,380
2021	9	6.41%	1.92%	\$82,414	\$2,472	\$2,472

Engineering & To	echnology Mana	gement Departmen	t. Portland Stat	e Universitv
J J -			-,	

2022	10	3.48%	3.06%	\$87,693	\$2,631	\$2,631
2023	11	3.93%	3.33%	\$90,745	\$2,722	\$2,722
2024	12	3.22%	2.13%	\$94,310	\$2,829	\$2,829
2025	13	6.46%	4.13%	\$97,342	\$2,920	\$2,920
2026	14	6.22%	5.58%	\$103,631	\$3,109	\$3,109
2027	15	4.91%	1.15%	\$110,075	\$3,302	\$3,302
2028	16	4.53%	5.19%	\$115,484	\$3,465	\$3,465
2029	17	6.64%	4.28%	\$120,713	\$3,621	\$3,621
2030	18	6.71%	2.92%	\$128,733	\$3,862	\$3,862
2031	19	4.83%	4.04%	\$137,375	\$4,121	\$4,121
2032	20	5.97%	3.07%	\$144,014	\$4,320	\$4,320
2033	21	3.09%	2.41%	\$152,613	\$4,578	\$4,578
2034	22	5.86%	2.01%	\$157,326	\$4,720	\$4,720
2035	23	2.75%	5.76%	\$166,552	\$4,997	\$4,997
2036	24	2.13%	3.13%	\$171,129	\$5,134	\$5,134
2037	25	1.34%	1.94%	\$174,776	\$5,243	\$5,243
2038	26	5.00%	2.50%	\$177,119	\$5,314	\$5,314
2039	27	6.15%	3.26%	\$185,978	\$5,579	\$5,579
2040	28	6.89%	0.50%	\$197,414	\$5,922	\$5,922
2041	29	3.36%	2.51%	\$211,025	\$6,331	\$6,331

Note: The initial salary of 2018 is calculated based on the initial salary of 2013 and the salary increasing rate according to the US national wage index growth. The following years from 2018 to 2041 is calculated based on the assumed conservative subjective evaluation of salary increasing rate with experiences growing of the employees. The tuition is show as negative cash flows from 2013 to 2016, which has been adjusted by the inflation rate. The 5<sup>th</sup> year, 2017, is for the student to look for a job, and it is assumed that the cash flow is 0.



#### Appendix 5.3 The Probability of Financial Gain for Investors for Resident Students

Appendix 5.4 The Probability of Financial Gain of Investors for Non-resident Students



### Appendix 8 "Pay it forward" Survey Form



Pay It Forward is a new financing tool, offering undergraduate students complete tuition for four years. Students pay back the amount by giving back 3 percent of their salary for 25 years once they get a job. The initial cost to avail this service is \$2000 and than students don't need to worry of paying anything till next 4 years of their undergraduate schooling.

Findings: Investors earn an average of \$8000 at the end of 25 years by offering this service to residential students, stating it to be a good investment for investors.

But to review the model from students perspective we are doing this survey to get more findings to make it even better. Please take the survey to give us a feedback for more insights and your thoughts about the model.

Compare it with any existing financial tool available in the market, to judge this model.

#### \*Required

#### Email address \*

This is a required question

Looking for financing for your undergraduate tuition, given two option, which one do you prefer? \*

select any one option

Educational Loan which is available at 3 to 6 percent APR.

Pay It Forward tool.

Please provide a reason for your previous selection in few words