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Model of Long-Term Savings with Several Interest Rates and Time

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The aim of this paper is to present a model of long-term savings from financial calculations, using investment instruments that offer various banking institutions with the aim of showcasing the benefits of yields and thus achieve the planned purposes with money invested, and as an option to promote savings for students.

Keywords: *Models; of long-term; Savings; Interest rate and time.*

Introduction

The calculations are developed considering an investment fund for eighteen years, which eventually will change interest rate and will be used to pay for college for a couple in a private university, that is, we assumed that invests since the born of a person up to the age that students often enter college, which on average is eighteen years. We have information of the average cost of private universities in Mexico, interest rate caps, minimum amounts of investments provided by banks in Mexico and intends to save a month is an amount of one thousand pesos. The result reveals saving costs is achieved in

eighteen years, equivalent to the amount required to pay for a college education in a private institution [1] [2].

At present, college education in Mexico is an issue that should be of great interest to young people and parents who care about the future of their children, as well as for governments to provide financial support and information about different ways in which all people can have affordable college.

Review of Literature

[3] Argues that we live in a globalized world where technology advances very quickly and makes everyday emergence of new concepts and skills to learn or deepen. That is, the need to upgrade and have more knowledge and skill set, which is the common factor of our time to better meet the challenges of the present and future world. Higher education is a mechanism by which to obtain such knowledge and cope with the demands of becoming better prepared.

On the other hand, several authors agree that studying a technical career or degree comes with good incentives. Including wage compensation, because the graduates of a university or college earn on average higher than those who only reached the high salary. There are other non-wage benefits are correlated or derived from higher education. [3] [4].

A family could avoid an unexpected expense that diminishes their budget in a timely manner if savings plans to ensure access to quality higher education that is practically since the child is born. In a less conservative stage, at least enough time to save for higher education is six years, considering that according to the Mexican Institute for Competitiveness earn a college degree at a private institution in Mexico has a cost that ranges from 125mil to 930 thousand pesos [4].

And it can say that the university study can be considered as an investment and not an expense, because in the end generates benefits; and considering arguments [5] that if you study at a private university sometimes the benefit is higher, the image deterioration of public education, however, is considered to like everything, there are exceptions and there is also graduates of public universities which then beat in various aspects of private graduates. And it is important to consider the percentage of university

applicants rejected at public universities in each school year, as an example may be mentioned universities such as UNAM and IPN, among others.

So, to ensure access to higher education of a child, there are several tools that may be helpful for parents who want their children to attend college and can also be done in a private.

One of these instruments is saving. [6] Says that the resulting monetary savings efforts of a family should be preserved and increased yields have that enable greater availability of funds in the future. For money to increase in value, its performance measured by annual effective interest rate should be higher than inflation; Furthermore, the risk can be controlled by adopting decisions on savings alternatives offered by financial institutions.

If saving is a long-term [7] recommended to use investment instruments to achieve so the money saved to generate better performance. In this sense, [8] highlights the importance of fostering a savings culture as a form of prevention and become a habit, as a means to achieve goals, both personal and family.

Then the approach of a model of savings and its variables occurs during a period of eighteen.

Problem Statement

As an option to also reach private university in Mexico, a hypothetical mathematical model simulating a monthly savings in an investment instrument is presented.

The model shows that all families who are in a position to save $ 1,000 per month could be enough to also afford access to a private college education for their children, if they have the habit of saving since the birth of these. This in a scheme to save with investment instruments that provide different rates of interest through for a period of eighteen, according [9] is the average age at which young people enter college.

Assumption:

A banking institution that offers an investment term of one year with an interest rate of 4% per annum, compounded monthly. In this case the

student's parents have planned to deposit $ 1,000.00 pesos for 18 years, for saving your child's college education.

Besides the financial institution offers the option of improving the rate if the Investment is renewed after the expiration of the first year until the completion of 18 years as follows:

Table 1: Interest by period

Renewals	Annual interest	Period
1º renewal	4%	1
2º renewal	4.2%	2
3º renewal	4.2%	
4º renewal	4.2%	
5º renewal	4.2%	
6º renewal	4.662%	3
Renewals	Annual interest	Period
7º renewal	4.662%	
8º renewal	4.662%	
9º renewal	4.662%	
10º renewal	4.662%	
11º renewal	5.198%	4
12º renewal	5.198%	
13º renewal	5.198%	
14º renewal	5.198%	
15º renewal	5.198%	
16º renewal	5.198%	
17º renewal	5.198%	
18º renewal	5.198%	

Methodology

Considering this:

To achieve calculate the total amount that parents receive on their investment at the end of 18 years, we divide each period based on the rate

increases. Hence, following the methodology proposed by [10] we use a model of anticipated annual installments from the following formula:

$$M = R_{P1}(1+\frac{i}{360}*m)^{1}\left[\frac{(1+\frac{i}{360}*m)^{n/m}-1}{\frac{i}{360}*m}\right] \quad (1)$$

Meanings:
M = Amount to be obtained
Rp = Amount to be deposited
i = annual rate period
m = capitalization, in this case monthly
n = time investment that will last

Data Analysis

$$M = \$1,000(1+\frac{.04}{360}*30)\left[\frac{(1+\frac{.04}{360}*30)^{360/30}-1}{\frac{.04}{360}*30}\right]$$

$$M = \$1,000(1+.0001111*30)\left[\frac{(1+.0001111*30)^{12}-1}{.0001111*30}\right]$$

$$M = \$1,000(1.0033333)\left[\frac{(1.0033333)^{12}-1}{.0033333}\right]$$

$$M = \$1,003.33\left[\frac{1.0407415-1}{.0033333}\right]$$

$$M = \$1,003.33\left[\frac{.0407415}{.0033333}\right]$$

$$M = \$1,003.33(12.2224629)$$

$$M = \$12,263.20 \longrightarrow 1^{o}\,año \quad (2)$$

$$Vf_2 = Vf_1(1+\frac{i}{360}*m)^{n/m} + Rp(1+\frac{i}{360}*m)\left[\frac{(1+\frac{i}{360}*m)^{n/m} - 1}{\frac{i}{360}*m}\right]$$

) (3)

$$Vf_2 = \$12,263.20(1+\frac{.042}{360}*30)^{1,440/30} + \$1,000(1+\frac{.042}{360}*30)\left[\frac{(1+\frac{.042}{360}*30)^{1,440/30}-1}{\frac{.042}{360}*30}\right]$$

$$Vf_2 = \$12,263.20(1+.0001167*30)^{48} + \$1,000(1+.0001167*30)\left[\frac{(1+.0001167*30)^{48}-1}{.0001167*30}\right]$$

$$Vf_2 = \$12,263.20(1.0035)^{48} + \$1,000(1.0035)\left[\frac{(1.0035)^{48}-1}{.0035}\right]$$

$$Vf_2 = \$12,263.20(1.1825897) + \$1,003.50\left[\frac{(1.1825897-1)}{.0035}\right]$$

$$Vf_2 = \$14,502.34 + \$1,003.50\left[\frac{.1825897}{.0035}\right]$$

$$Vf_2 = \$14,502.34 + \$1,003.50(52.1684822)$$

$$Vf_2 = \$14,502.34 + \$52,351.07$$

$$Vf_2 = \$66,853.41 \longrightarrow 5^o\ año$$

(4)

$$Vf_3 = \$66,853.41(1+\frac{.04662}{360}*30)^{1,800/30} + \$1,000(1+\frac{.04662}{360}*30)\left[\frac{(1+\frac{.04662}{360}*30)^{1,800/30}-1}{\frac{.04662}{360}*30}\right]$$

$$Vf_3 = \$66,853.41(1+.0001295*30)^{60} + \$1,000(1+.0001295*30)\left[\frac{(1+.0001295*30)^{60}-1}{.0001295*30}\right]$$

$$Vf_3 = \$66,853.41(1.0038850)^{60} + \$1,000(1.0038850)\left[\frac{(1+.0038850)^{60}-1}{.0038850}\right]$$

$$Vf_3 = \$66,853.41(1.2619377) + \$1,003.89\left[\frac{(1.2619377-1)}{.0038850}\right]$$

$$Vf_3 = \$84,364.84 + \$1,003.89\left[\frac{.2619377}{.0038850}\right]$$

$$Vf_3 = \$84,364.84 + \$1,003.89(67.4228235)$$

$$Vf_3 = \$84,364.84 + \$67,684.76$$

$$Vf_3 = \$152,049.60 \longrightarrow 6^o - 10^o\ año$$

(5)

$$Vf_4 = \$152,049.60(1+\frac{.0519813}{360}*30)^{2,880/30} + \$1,000(1+\frac{.0519813}{360}*30)\left[\frac{(1+\frac{.0519813}{360}*30)^{2,880/30}-1}{\frac{.0519813}{360}*30}\right]$$

$$Vf_4 = \$152,049.60(1+.0001444*30)^{96} + \$1,000(1+.0001444*30)\left[\frac{(1+.0001444*30)^{96}-1}{.0001444*30}\right]$$

$$Vf_4 = \$152,049.60(1.0043318)^{96} + \$1,000(1.0043318)\left[\frac{(1.0043318)^{96}-1}{.0043318}\right]$$

$$Vf_4 = \$152,049.60(1.5142985) + \$1,004.33\left[\frac{(1.5142985-1)}{.0043318}\right]$$

$$Vf_4 = \$230,248.48 + \$1,004.33\left[\frac{.5142985}{.0043318}\right]$$

$$Vf_4 = \$230,248.48 + \$1,004.33(118.7269695)$$

$$Vf_4 = \$230,248.48 + \$119,241.27$$

$$Vf_4 = \$349,489.75 \longrightarrow 11^{o} - 18^{o}\, año \qquad (6)$$

Results

Table 2: Compilation of Results

Period	Months of the period	i Annual	i Monthly	Total Annual Input	Accrued Interest	Capitalization
1 Year	12	4.0000%	0.00333333	$12,000.00	$222.46	$12,263.20
2-5 Years	48	4.2000%	0.00350000	$48,000.00	$18,622.64	$66,853.41
6-10 Years	60	4.6620%	0.00388500	$60,000.00	$91,496.44	$152,049.60
11-18 Years	96	5.1981%	0.00433178	$96,000.00	$252,137.81	$349,489.75
				Total paid in 18 years		$216,000.00
				Total interest income		$133,489.75

Source: Own

Conclusions

After saving $ 1,000.00 per month, for 18 years the rates proposed interest, the amount that parents would raise would be $ 348,137.81 pesos, which gives the amount of $ 132,137.81 pesos of interest accrued during the period, this proves that savings this type can fund education at a university and be deprived, for a person, because it is within the price range of universities in Mexico. In the event that the variables analyzed in this paper are aligned to the real scenario. This result demonstrates the importance of saving in a

timely and consistent manner to achieve the desired objectives, and above all, that the private higher education is also attainable for many families, without the savings could not as [11] they say.

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