



## Restructuring debt proposal in three hypothetical scenarios: Equal payments, different amounts and unknown payments

Elena, Moreno-García<sup>1</sup>, Arturo, García-Santillán<sup>2</sup>, Agustín, Bermúdez-Pérez<sup>3</sup>,  
Paulo César, Almeida-Fernández<sup>4</sup>

<sup>1</sup>Researcher at Universidad Cristóbal Colón, Veracruz MÉXICO

<sup>2</sup>Researcher at Universidad Cristóbal Colón, Veracruz MÉXICO

<sup>3</sup>Master program student at Universidad Cristóbal Colón

<sup>4</sup>Master program student at Universidad Cristóbal Colón

### Abstract

To acquire products or services, people used to sign some promissory notes with different maturities. Derived from the potential problems of illiquidity, the need to renegotiate debts arises. Several methods are used to do this. In this paper it is presented a proposal with three hypothetical scenarios from modeling with equivalent equations. The aim is to set a practical methodology that allows identify a factor that could be used to calculate a new value of debt scheme, and furthermore, integrate the variables such as time, interest rate, coefficients, original value scheme and new value scheme. Results show that in the new payment scheme necessarily the creditor will have a benefit for getting an interest in debt restructuring, however the debtor wins too, getting a deferral through time, allowing a better management of his cash flow, improving the administration of his working capital, and generating better indicators of solvency and liquidity.

**Keywords:** Debt; Original value scheme; New value scheme; Equal payments; Promissory notes; Restructuring debt.

### 1. Introduction

Currently, one of the most frequent financial problems to which enterprises are facing, is the lack of funds to finance their current activities, either by the lack of charging customers or the costs incurred by normal operation of the enterprises, are increasing, coupled with this, inflation that affects the prices of the raw material, among other factors.

The economic situation where the country finds itself at the moment has caused uncertainty for the purchase and sale of some products or services. This brings a reduction in sales and therefore cash flow decreased because of less income. All this becomes an element which makes it more difficult to managing collection of accounts receivable, hence, also incurs non-payment of the debts owed to the suppliers or creditors.

This may unchain a multiplier effect of debt, i.e. derived from non-payment; default interest is also generated, in addition to interest usually charged by creditors for extending credit in the acquisition of inputs, raw materials or products. Financial managers in enterprises have the authority to take financial decisions, because they are the responsible for finding practical solutions to the possible problems lack of liquidity and therefore, the non-payment of their liabilities incurred with their suppliers or creditors. All this, with the aim of overcomes the obstacles that appear by the lack of economic resources.

Following the proposals of García-Santillán and Vega-Lebrún (2008), García-Santillán, Venegas-Martínez and Escalera-Chávez (2014), in this paper a hypothetical model for a debt restructuring is proposed. On the assumption that the company presents an unfavorable event of illiquidity that would prevents pay their liabilities incurred in previous periods. This proposal is conditioned upon the creditor is willing to restructure debt, giving more time to the debtor in order to meet its commitments.

## Review of Literature

About the issue of debt restructuring, we must first understand what is or where it came from, and later talk about a model of restructuring, as part of the strategy, all this, on the assumption that the debtor is facing a lack of liquidity, and derived from it, to the potential default in payment of the liabilities incurred. Therefore, the debt, we may understand as the link through which the debtor and creditor are linked as a result of some operation of purchase and sale on credit or financing. The debtor is obliged to pay to the creditor, financed capital with interest derived from this financial transaction as part of the agreement which they have signed between them and which also, the economic benefit is the object of the obligation assumed (García-Santillán et al, 2008; García-Santillán, Venegas-Martínez and Escalera-Chávez, 2014).

Although it is true, the financing strategy is recommended to support the operation of enterprises, should also be considered at any moment some variables such as: the financial situation of the company, the profitability margins of the company and parallel the interest rates prevailing at the time of contracting debt, among other factors. A high level of indebtedness is appropriate only when the rate of return on total assets of the company is higher than the average cost of capital. In other words, if the company works with borrowed money, is good, whenever a net return than the interests that have to pay for financed money is achieved (Álvarez, 2015).

Debt indicators are designed to measure to what degree and in what way the creditors are participating in the financing of the company. Likewise, it seeks to identify their risk: the creditors and owners, and determine the convenience or inconvenience of a particular level of indebtedness for the company. The problems begin when the company requests and acquires a larger loan amount to which can actually pay, i.e. the profitability of the enterprise not enough to cover both principal and accrued interest.

The excessive debt is defined as the status of "consumer who, although not definitively be insolvent, is not able to meet their debts according to a rational plan of revenues" (Krausz, 2005). Another definition is "Excessive debt poses a number of serious risks to your business. While financing is a common way to raise capital, too much debt imposes short-term and long-term financial burdens on your business. Finding the right balance between debt capital and equity investing is a core financial matter for any business" (Kokemuller, 2015).

About credit cards, Taylor (2015) makes an approach about how getting rid of the excessive credit card debt. Refers that if debtor try to eliminate his credit card debt, then should follow the next six step plan to do this: "Do whatever it takes to stop using the credit cards; Write down your current credit card debts; Prioritize them based on balance or interest rate; Start using every extra dollar in your budget and pay the first card off; Repeat that last step until all your cards are paid off; Enjoy being in control of your credit card debt" (sic).

In the Mexican context, the National Commission for the Protection and Defense of Users of Financial Services (Comisión Nacional para la Protección y Defensa de los Usuarios de Servicios Financieros) defines debt restructuring as "The modification of established credit terms for the benefit of the debtor when he says to the institution, the possibility of non-payment and to comply with the terms agreed, or because he would like to take new financial market conditions that most favor it"(CONDUSEF, 2015).

It is important to note that the debtor should permanently monitoring their cash flows, to avoid falling into the non-payment of debts to the creditors and thereby avoid legal recovery actions, since the creditors will do everything necessary to recover the loan granted and the interests specified in the contract of funding. Hence, it is essential that in case of possible non-payment to consider the rapprochement with his creditor, in order to reach an agreement in which they carried out a debt restructuring with new payment schemes, suitable to the cash flow of the company, but mainly, the capacity to pay and times where they consider that they may do.

With the above exposed, and being able to develop a financial model with equivalent equations, it is necessary to propose an hypothetical case of a company seeking to restructure debt, considering that the company has suffered adjustments in their cash flows and therefore, cannot meet its commitments.

## Methodology

Assuming that a year before the focal date carried out an agreement to restructure debt with all the promissory notes overdue and also, with those who have not expired, because the cash flow forecasting is not enough to pay debt (see table 1).

The data are following:

Table 1. ORIGINAL VALUE SCHEME ( $O_{VS}$ )

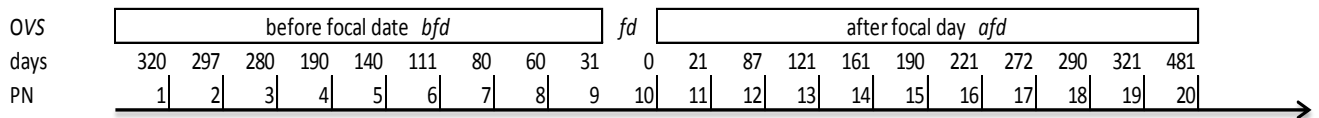
Promissory notes (PN)	Overdue or not expired	Date	Days	Interest rate	Amount
1	<i>bfd</i>	15/04/2014	320	<i>Eir</i>	\$450.00
2	<i>bfd</i>	08/05/2014	297	<i>Eir</i>	\$270.00
3	<i>bfd</i>	25/05/2014	280	<i>Eir</i>	\$125.00
4	<i>bfd</i>	23/08/2014	190	<i>Eir</i>	\$90.00
5	<i>bfd</i>	12/10/2014	140	<i>Eir</i>	\$197.00
6	<i>bfd</i>	10/11/2014	111	<i>Eir</i>	\$88.00
7	<i>bfd</i>	11/12/2014	80	<i>Eir</i>	\$245.00
8	<i>bfd</i>	31/12/2014	60	<i>Eir</i>	\$89.00
9	<i>bfd</i>	29/01/2015	31	<i>Eir</i>	\$156.00
10	<i>fd</i>	01/03/2015	0		\$50.00
11	<i>afd</i>	22/03/2015	21	<i>Rir</i>	\$171.50
12	<i>afd</i>	27/05/2015	87	<i>Rir</i>	\$152.00
13	<i>afd</i>	30/06/2015	121	<i>Rir</i>	\$184.00
14	<i>afd</i>	09/08/2015	161	<i>Rir</i>	\$322.00
15	<i>afd</i>	07/09/2015	190	<i>Rir</i>	\$156.00
16	<i>afd</i>	08/10/2015	221	<i>Rir</i>	\$190.00
17	<i>afd</i>	28/11/2015	272	<i>Rir</i>	\$87.50
18	<i>afd</i>	16/12/2015	290	<i>Rir</i>	\$47.00
19	<i>afd</i>	16/01/2016	321	<i>Rir</i>	\$150.00
20	<i>afd</i>	24/06/2016	481	<i>Rir</i>	\$450.00
					\$3,670.00

Where: *bff* before focal date; *afd* after focal date; *ff* focal date;

*Eir* Effective interest rate; *Rir* Real interest rate

Source: own

The time line as follow:



The debtor seeks to be financed and to do this, he presents to his creditor a new scheme of payments, which include the amounts and date to pay and at the end, leaves only one payment in approximately 30% of total debt (table 2).

The nominal interest rate is 18.5% compounded every 21 days, for all cases, with an inflation rate of 2.95%, so it should calculate the effective interest rate and the real interest rate. Should be calculated the Original Scheme Value with the effective interest rate for overdue promissory notes and a real interest rate in the case of any promissory notes that not yet mature in its term (table 3).

The hypothetical case to solve is presented in three scenarios:

The first hypothetical scenario with 20 equal payments (table 3), the second hypothetical scenario with different amounts and one payment at the end of the period (table 4), where the amount is unknown and therefore must be calculated (PN-20 as an unknown payment and should to solve), and the last hypothetical scenario with different amounts and three unknown payments (table 5), one at the beginning, another in the payment 12 and another at the end of the scheme (PN-1, PN-12, PN-20 as an unknown payment and should to solve).

**Table 2.** NEW VALUE SCHEME ( $N_{VS}$ )

Promissory notes (PN)	Overdue or not expired	date	Days	Interest rate
1	<i>bfd</i>	05/05/2014	300	<i>Eir</i>
2	<i>bfd</i>	04/07/2014	240	<i>Eir</i>
3	<i>bfd</i>	13/08/2014	200	<i>Eir</i>
4	<i>bfd</i>	12/09/2014	170	<i>Eir</i>
5	<i>bfd</i>	01/12/2014	90	<i>Eir</i>
6	<i>bfd</i>	10/01/2015	50	<i>Eir</i>
7	<i>bfd</i>	14/02/2015	15	<i>Eir</i>
8	<i>fd</i>	01/03/2015	0	
9	<i>afd</i>	31/03/2015	30	<i>Rir</i>
10	<i>afd</i>	30/04/2015	60	<i>Rir</i>
11	<i>afd</i>	30/05/2015	90	<i>Rir</i>
12	<i>afd</i>	29/08/2015	181	<i>Rir</i>
13	<i>afd</i>	27/10/2015	240	<i>Rir</i>
14	<i>afd</i>	06/12/2015	280	<i>Rir</i>
15	<i>afd</i>	05/01/2016	310	<i>Rir</i>
16	<i>afd</i>	14/02/2016	350	<i>Rir</i>
17	<i>afd</i>	15/03/2016	380	<i>Rir</i>
18	<i>afd</i>	24/04/2016	420.75	<i>Rir</i>
19	<i>afd</i>	24/05/2016	450.5	<i>Rir</i>

Where: *bff* before focal date; *aff* after focal date; *ff* focal date;

*Eir* Effective interest rate; *Rir* Real interest rate

Source: own

The time line as follow:

	before focal date bfd							fd	after focal day afd											
NVS	300	240	200	170	90	50	15	0	30	60	90	181	240	280	310	350	380	420.75	450.5	591
days																				
PN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

## Data Analysis

### Scenario 1

To become  $N_{ir}$  in its effective rate, we must calculate  $E_{ir}$  (we utilized effective rate to accumulation with all promissory notes overdue). Also to become  $N_{ir}$  in its Real interest rate, we must calculate  $R_{ir}$

$$E_{ir} = \left[ \left( 1 + \frac{N_{ir}}{m} \right)^{t/m} - 1 \right] * 100 \quad \text{and} \quad R_{ir} = \frac{(E_{ir} - I_{nl})}{(1 + I_{nl})} * 100$$

Where:  $E_{ir}$  = effective interest rate;  $N_{ir}$  = nominal interest rate;  $t$  = time and  $m$  = type of capitalizations;  $I_{nl}$  = Inflation rate

$$\begin{aligned} E_{ir} &= \left[ \left( 1 + \frac{N_{ir}}{m} \right)^{t/m} - 1 \right] * 100 & R_{ir} &= \frac{(E_{ir} - I_{nl})}{(1 + I_{nl})} * 100 \\ E_{ir} &= \left[ \left( 1 + \left[ \frac{0.185 * 21}{365} \right]^{365/21} - 1 \right) * 100 \right] & R_{ir} &= \frac{(0.202042 - 0.0295)}{(1 + 0.0295)} * 100 \\ E_{ir} &= \left[ \left( 1 + [0.01064384]^{17.3809524} - 1 \right) * 100 \right] & R_{ir} &= \frac{(0.172542)}{(1.0295)} * 100 \\ E_{ir} &= \left[ (1.01064384)^{17.3809524} - 1 \right] * 100 & R_{ir} &= (0.1675979) * 100 \\ E_{ir} &= [1.2020420 - 1] * 100 & R_{ir} &= 16.75979\% \\ E_{ir} &= 0.2020420 * 100 \\ E_{ir} &= 20.20420 \end{aligned}$$

To calculate  $O_{VS}$ , we utilize for all promissory notes overdue  $\sum PN_{bfd}$  the effective interest rate  $E_{ir}$  in its capitalization format and for all promissory notes that not overdue  $\sum PN_{afd}$ , we utilize  $R_{ir}$  in its capitalization format as well. Therefore, we have:

$$O_{VS} = \sum PN_{bfd} \left[ 1 + \left( \frac{E_{ir}}{t} * m \right) \right]^{t/m} + PN_{fd} + \frac{\sum PN_{afd}}{\left[ 1 + \left( \frac{R_{ir}}{t} * m \right) \right]^{t/m}}$$

Solving, we have:

$$O_{VS} = \sum PN_{bfd} \left[ 1 + \left( \frac{E_{ir} * m}{t} \right) \right]^{t/m} + PN_{fd} + \frac{\sum PN_{afd}}{\left[ 1 + \left( \frac{R_{ir} * m}{t} \right) \right]^{t/m}}$$

$$O_{VS} = \$450 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{320/21} + \$270 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{297/21} + \$125 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{280/21} + \dots$$

$$\dots + \$90 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{190/21} + \$197 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{140/21} + \$88 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{111/21} + \dots$$

$$\dots + \$245 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{80/21} + \$89 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{60/21} + \$156 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{31/21} + \dots$$

$$\dots + \$50 + \frac{\$171.5}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{21/21}} + \frac{\$152}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{87/21}} + \frac{\$184}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{121/21}} + \dots$$

$$\dots + \frac{\$322}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{161/21}} + \frac{\$156}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{190/21}} + \frac{\$190}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{221/21}} + \dots$$

$$\dots + \frac{\$87.5}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{272/21}} + \frac{\$47}{\left[ 1.0116243 \right] + \left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{290/21}} + \frac{\$150}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{321/21}} + \dots$$

$$\dots + \frac{\$450}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{481/21}}$$

$$O_{VS} = \$450(1.0116243)^{15.2380952} + \$270(1.0116243)^{14.1428571} + \$125(1.0116243)^{13.3333333} + \dots$$

$$\$90(1.0116243)^{9.047619} + \$197(1.0116243)^{6.6666667} + \$88(1.0116243)^{5.2857143} + \$245(1.0116243)^{3.8095238} + \dots$$

$$\dots + \$89(1.0116243)^{2.8571429} + \$156(1.0116243)^{1.4761905} + \$50 + \frac{\$171.5}{(1.0096426)^1} + \frac{\$152}{(1.0096426)^{4.1428571}} + \dots$$

$$\dots + \frac{\$184}{(1.0096426)^{5.7619048}} + \frac{\$322}{(1.0096426)^{7.6666667}} + \frac{\$156}{(1.0096426)^{9.047619}} + \frac{\$190}{(1.0096426)^{10.5238095}} + \frac{\$87.50}{(1.0096426)^{12.952381}} + \dots$$

$$\dots + \frac{\$47}{(1.0096426)^{13.8095238}} + \frac{\$150}{(1.0096426)^{15.2857143}} + \frac{\$450}{(1.0096426)^{22.9047619}}$$

$$\begin{aligned}
O_{VS} &= \$450(1.1925699) + \$270(1.1775696) + \$125(1.1666038) + \$90(1.1102283) + \$197(1.0800943) + \dots \\
&\dots + \$88(1.0629928) + \$245(1.0450112) + \$89(1.033572) + \$156(1.0172071) + \$50 + \frac{\$171.5}{(1.0096426)} + \dots \\
&\dots + \frac{\$152}{(1.0405574)} + \frac{\$184}{(1.0568508)} + \frac{\$322}{(1.0763465)} + \frac{\$156}{(1.0907054)} + \frac{\$190}{(1.1062664)} + \frac{\$87.50}{(1.1323514)} + \dots \\
&\dots + \frac{\$47}{(1.1417039)} + \frac{\$150}{(1.1579925)} + \frac{\$450}{(1.2458318)}
\end{aligned}$$

$$\begin{aligned}
O_{VS} &= \$536.66 + \$317.94 + \$145.83 + \$99.92 + \$212.78 + \$93.54 + \$256.03 + \$91.99 + \$158.68 + \$50.00 + \dots \\
&\dots + \$169.86 + \$146.08 + \$174.10 + \$299.16 + \$143.03 + \$171.75 + \$77.27 + \$41.17 + \$129.53 + \$361.20
\end{aligned}$$

$$O_{VS} = \$3,676.52$$

Now, we calculate  $N_{VS}$  20 equal payments (which mean that every payment has value 1)

$$N_{VS} = \sum 1_{bfd} \left[ 1 + \left( \frac{E_{ir} * m}{t} \right) \right]^{t/m} + 1_{fd} + \frac{\sum 1_{afd}}{\left[ 1 + \left( \frac{R_{ir} * m}{t} \right) \right]^{t/m}}$$

$$\begin{aligned}
N_{VS} &= 1 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{300/21} + 1 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{240/21} + 1 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{200/21} + \dots \\
&\dots + 1 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{170/21} + 1 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{90/21} + 1 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{50/21} + \dots \\
&\dots + 1 \left[ 1 + \left( \frac{0.202042}{365} \right) * 21 \right]^{15/21} + 1 + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{30/21}} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{60/21}} + \dots \\
&\dots + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{90/21}} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{181/21}} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{240/21}} + \dots \\
&\dots + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{280/21}} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{310/21}} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{350/21}} + \dots \\
&\dots + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{380/21}} + \frac{1}{\left[ 1.0116243 \right] + \left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{420.75/21}} + \dots \\
&\frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{450.5/21}} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} \right) * 21 \right]^{591/21}}
\end{aligned}$$

$$\begin{aligned}
N_{VS} &= 1(1.0116243)^{14.2857143} + 1[1.0116243]^{11.4285714} + 1[1.0116243]^{9.5238095} + \dots \\
&\dots + 1[1.0116243]^{8.0952381} + 1[1.0116243]^{4.2857143} + 1[1.0116243]^{2.3809524} + \dots \\
&\dots + 1[1.0116243]^{0.7142857} + 1 + \frac{1}{[1.0096426]^{1.4285714}} + \frac{1}{[1.0096426]^{2.8571429}} + \dots \\
&\dots + \frac{1}{[1.0096426]^{4.2857143}} + \frac{1}{[1.0096426]^{8.6190476}} + \frac{1}{[1.0096426]^{11.4285714}} + \dots \\
&\dots + \frac{1}{[1.0096426]^{13.3333333}} + \frac{1}{[1.0096426]^{14.7619048}} + \frac{1}{[1.0096426]^{16.6666667}} + \dots \\
&\dots + \frac{1}{[1.0096426]^{18.0952381}} + \frac{1}{[1.0096426]^{20.0357143}} + \frac{1}{[1.0096426]^{21.452381}} + \dots \\
&\dots + \frac{1}{[1.0096426]^{28.1428571}}
\end{aligned}$$

$$\begin{aligned}
N_{VS} &= 1(1.1795154) + 1(1.141203) + 1(1.1163552) + 1(1.0980751) + 1(1.0507783) + \dots \\
&\dots + 1(1.0278994) + 1(1.0082894) + 1 + \frac{1}{(1.0138036)} + \frac{1}{(1.0277976)} + \frac{1}{(1.0419849)} + \dots \\
&\dots + \frac{1}{(1.0862288)} + \frac{1}{(1.1159134)} + \frac{1}{(1.1364986)} + \frac{1}{(1.1521863)} + \frac{1}{(1.1734406)} + \dots \\
&\frac{1}{(1.1896382)} + \frac{1}{(1.2119988)} + \frac{1}{(1.2285883)} + \frac{1}{(1.3100566)}
\end{aligned}$$

$$\begin{aligned}
N_{VS} &= 1.1795154 + 1.141203 + 1.1163552 + 1.0980751 + 1.0507783 + 1.0278994 + \dots \\
&\dots + 1.0082894 + 1.0000000 + 0.9863843 + 0.9729542 + 0.9597068 + 0.9206164 + \dots \\
&\dots + 0.8961269 + 0.8798955 + 0.8679152 + 0.8521948 + 0.8405917 + 0.8250833 + \dots \\
&\dots + 0.8139423 + 0.7633258
\end{aligned}$$

$$N_{VS} = 19.2008530$$

$$\text{To calculate } Y \text{ (equal payments)} \quad Y = \frac{O_{VS}}{N_{VS}} Y = \frac{\$3,676.52}{19.2008530} Y = \$191.48$$

The new scheme payments is as follow (considering equal payments)



Table 3. New Value Scheme ( $N_{VS}$ )

Promissory notes (PN)	Overdue or not expired	date	Days	Interest rate	Y
1	<i>bfd</i>	05/05/2014	300	<i>Eir</i>	\$191.48
2	<i>bfd</i>	04/07/2014	240	<i>Eir</i>	\$191.48
3	<i>bfd</i>	13/08/2014	200	<i>Eir</i>	\$191.48
4	<i>bfd</i>	12/09/2014	170	<i>Eir</i>	\$191.48
5	<i>bfd</i>	01/12/2014	90	<i>Eir</i>	\$191.48
6	<i>bfd</i>	10/01/2015	50	<i>Eir</i>	\$191.48
7	<i>bfd</i>	14/02/2015	15	<i>Eir</i>	\$191.48
8	<i>fd</i>	01/03/2015	0		\$191.48
9	<i>afd</i>	31/03/2015	30	<i>Rir</i>	\$191.48
10	<i>afd</i>	30/04/2015	60	<i>Rir</i>	\$191.48
11	<i>afd</i>	30/05/2015	90	<i>Rir</i>	\$191.48
12	<i>afd</i>	29/08/2015	181	<i>Rir</i>	\$191.48
13	<i>afd</i>	27/10/2015	240	<i>Rir</i>	\$191.48
14	<i>afd</i>	06/12/2015	280	<i>Rir</i>	\$191.48
15	<i>afd</i>	05/01/2016	310	<i>Rir</i>	\$191.48
16	<i>afd</i>	14/02/2016	350	<i>Rir</i>	\$191.48
17	<i>afd</i>	15/03/2016	380	<i>Rir</i>	\$191.48
18	<i>afd</i>	24/04/2016	420.75	<i>Rir</i>	\$191.48
19	<i>afd</i>	24/05/2016	450.5	<i>Rir</i>	\$191.48
20	<i>afd</i>	12/10/2016	591	<i>Rir</i>	\$191.48
				<i>Total</i>	<b>\$3,829.54</b>

Source: own

The time line as follow:

$N_{VS}$ days PN	before focal date <i>bfd</i>							<i>fd</i>	after focal day <i>afd</i>												
	300	240	200	170	90	50	15		0	30	60	90	181	240	280	310	350	380	420.75	450.5	591
	1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20

Scenario 2

Effective interest rate  $E_{ir} = 20.20420\%$

Real interest rate  $R_{ir} = 16.75979\%$

We utilize the value of  $O_{VS}$  which calculate in scenario 1  $O_{VS} = \$3,676.52$

To calculate  $N_{VS20}$

$$N_{VS20} = \frac{\sum 1_{afd}}{\left[1 + \left(\frac{R_{ir} * m}{t}\right)\right]^{t/m}} N_{VS20} = \frac{1}{\left[1 + \left(\frac{0.1675979}{365} * 21\right)\right]^{591/21}}$$

$$N_{VS20} = + \frac{1}{[1.0096426]^{28.1428571}}$$

$$N_{VS20} = \frac{1}{(1.3100566)} = N_{VS20} = 0.7633258$$

To calculate  $Y_{20}$

$$Y_{20} = \frac{O_{VS} - (\sum PN_1 \dots PN_{19})}{N_{VS20}}$$

$$= \frac{\$3,676.52 - (\$85.00 + \$70.00 + \$25.00 + \$60.00 + \$111.00 + \$120.00 \dots +$$

$$\dots + \$145.00 + \$150.00 + \$97.00 + \$150.00 + \$121.00 + \$282.00 + \$124.00 \dots +$$

$$\dots + \$348.00 + \$176.00 + \$290.00 + \$187.50 + \$67.00 + \$45.00)}{0.7633258}$$

$$Y_{20} = \frac{\$3676.52 - \$2653.50}{0.7633258}$$

$$Y_{20} = \frac{\$1,026.02}{0.7633258}$$

$$Y_{20} = \$1,340.21$$

The new payments scheme, considering the last payment as unknown, is as follow:

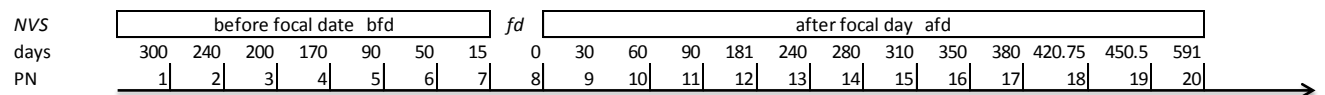
**Table 4.** New Value Scheme ( $N_{VS}$ )

Promissory notes (PN)	Overdue or not expired	date	Days	Interest rate	Amount	Y
1	aff	05/05/2014	300	Eir	\$85.00	\$85.00
2	aff	04/07/2014	240	Eir	\$70.00	\$70.00
3	aff	13/08/2014	200	Eir	\$25.00	\$25.00
4	aff	12/09/2014	170	Eir	\$60.00	\$60.00
5	aff	01/12/2014	90	Eir	\$111.00	\$111.00
6	aff	10/01/2015	50	Eir	\$120.00	\$120.00
7	aff	14/02/2015	15	Eir	\$145.00	\$145.00
8	ff	01/03/2015	0		\$150.00	\$150.00
9	dff	31/03/2015	30	Rir	\$97.00	\$97.00

10	dff	30/04/2015	60	Rir	\$150.00	\$150.00	
11	dff	30/05/2015	90	Rir	\$121.00	\$121.00	
12	dff	29/08/2015	181	Rir	\$282.00	\$282.00	
13	dff	27/10/2015	240	Rir	\$124.00	\$124.00	
14	dff	06/12/2015	280	Rir	\$348.00	\$348.00	
15	dff	05/01/2016	310	Rir	\$176.00	\$176.00	
16	dff	14/02/2016	350	Rir	\$290.00	\$290.00	
17	dff	15/03/2016	380	Rir	\$187.50	\$187.50	
18	dff	24/04/2016	420.75	Rir	\$67.00	\$67.00	
19	dff	24/05/2016	450.5	Rir	\$45.00	\$45.00	
20	dff	12/10/2016	591	Rir		\$1,340.21	
						<b>Total</b>	<b>\$3,993.71</b>

Source: own

The time line as follow:



Scenario 3

Effective interest rate  $E_{ir} = 20.20420\%$

Real interest rate  $R_{ir} = 16.75979\%$

We utilize the value of  $O_{VS}$  which calculate in scenario 1  $O_{VS} = \$3,676.52$

To calculate  $N_{VS1,12,20}$

$$N_{VS1,12,20} = \sum S \left[ 1 + \left( \frac{E_{ir}}{t} * m \right) \right]^{t/m} + \dots + \frac{\sum S}{\left[ 1 + \left( \frac{R_{ir}}{t} * m \right) \right]^{t/m}}$$

$$N_{VS1,12,20} = 1 \left[ 1 + \left( \frac{0.202042}{365} * 21 \right) \right]^{300/21} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{181/21}} + \frac{1}{\left[ 1 + \left( \frac{0.1675979}{365} * 21 \right) \right]^{591/21}}$$

$$N_{VS1,12,20} = 1(1.0116243)^{14.2857143} + \frac{1}{[1.0096426]^{8.6190476}} + \frac{1}{[1.0096426]^{28.1428571}}$$

$$N_{VS:1,12,20} = 1(1.1795154) + \frac{1}{(1.0862288)} + \frac{1}{(1.3100566)}$$

$$N_{VS:1,12,20} = 1.1795154 + 0.9206164 + 0.7633258$$

$$N_{VS:1,12,20} = 2.8634576$$

To calculate  $Y_{1,12,20}$

$$Y_{1,12,20} = \frac{O_{VS} - [(\sum PN_2 \dots PN_{11})] + [(\sum PN_{13} \dots PN_{19})]}{N_{VS:1,12,20}}$$

$$Y_{1,12,20} = \frac{\$3,676.52 - (\$70.00 + \$25.00 + \$60.00 + \$111.00 + \$120.00 + \$145.00 + \$150.00 + \$97.00 \dots + \dots + \$150.00 + 121.00 + \$124.00 + \$348.00 + \$176.00 + \$290.00 + \$187.50 + \$67.00 + \$45.00)}{0.7633258}$$

$$Y_{1,12,20} = \frac{\$3,676.52 - \$2,286.50}{2.8634576}$$

$$Y_{1,12,20} = \frac{\$1,390.02}{2.8634576}$$

$$Y_{1,12,20} = \$485.43 \text{ \_\_\_ every \_\_\_ payment}$$

The new payment scheme, considering the first, the twelfth and last payment as unknown, is as follows:

**Table 5.** New Value Scheme ( $N_{VS}$ )

Promissory notes (PN)	Overdue or not expired	date	Days	Interest rate	Amount	Y
1	<i>bfd</i>	05/05/2014	300	<i>Eir</i>		<b>\$485.43</b>
2	<i>bfd</i>	04/07/2014	240	<i>Eir</i>	<b>\$70.00</b>	<b>\$70.00</b>
3	<i>bfd</i>	13/08/2014	200	<i>Eir</i>	<b>\$25.00</b>	<b>\$25.00</b>
4	<i>bfd</i>	12/09/2014	170	<i>Eir</i>	<b>\$60.00</b>	<b>\$60.00</b>
5	<i>bfd</i>	01/12/2014	90	<i>Eir</i>	<b>\$111.00</b>	<b>\$111.00</b>
6	<i>bfd</i>	10/01/2015	50	<i>Eir</i>	<b>\$120.00</b>	<b>\$120.00</b>
7	<i>bfd</i>	14/02/2015	15	<i>Eir</i>	<b>\$145.00</b>	<b>\$145.00</b>
8	<i>fd</i>	01/03/2015	0		<b>\$150.00</b>	<b>\$150.00</b>
9	<i>bfd</i>	31/03/2015	30	<i>Rir</i>	<b>\$97.00</b>	<b>\$97.00</b>
10	<i>bfd</i>	30/04/2015	60	<i>Rir</i>	<b>\$150.00</b>	<b>\$150.00</b>
11	<i>bfd</i>	30/05/2015	90	<i>Rir</i>	<b>\$121.00</b>	<b>\$121.00</b>
12	<i>bfd</i>	29/08/2015	181	<i>Rir</i>		<b>\$485.43</b>
13	<i>bfd</i>	27/10/2015	240	<i>Rir</i>	<b>\$124.00</b>	<b>\$124.00</b>

14	<i>bfd</i>	06/12/2015	280	<i>Rir</i>	<b>\$348.00</b>	<b>\$348.00</b>
15	<i>bfd</i>	05/01/2016	310	<i>Rir</i>	<b>\$176.00</b>	<b>\$176.00</b>
16	<i>bfd</i>	14/02/2016	350	<i>Rir</i>	<b>\$290.00</b>	<b>\$290.00</b>
17	<i>bfd</i>	15/03/2016	380	<i>Rir</i>	<b>\$187.50</b>	<b>\$187.50</b>
18	<i>bfd</i>	24/04/2016	420.75	<i>Rir</i>	<b>\$67.00</b>	<b>\$67.00</b>
19	<i>bfd</i>	24/05/2016	450.5	<i>Rir</i>	<b>\$45.00</b>	<b>\$45.00</b>
20	<i>bfd</i>	12/10/2016	591	<i>Rir</i>		<b>\$485.43</b>
						<i>total</i> <b>\$3,742.80</b>

Source: own

NVS days PN	before focal date <i>bfd</i>							<i>fd</i>	after focal day <i>afd</i>												
	300	240	200	170	90	50	15		0	30	60	90	181	240	280	310	350	380	420.75	450.5	591
	1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20

### Summary

Scenario 1		Scenario 2		Scenario 3	
<i>Sum of all promissory notes</i>	\$3,670.00	<i>Sum of all promissory notes</i>	\$3,670.00	<i>Sum of all promissory notes</i>	\$3,670.00
$O_{VS}$	\$3,676.52	$O_{VS}$	\$3,676.52	$O_{VS}$	\$3,676.52
$E_{ir}$	20.20420%	$E_{ir}$	20.20420%	$E_{ir}$	20.20420%
$R_{ir}$	16.75979%	$R_{ir}$	16.75979%	$R_{ir}$	16.75979%
$N_{VS}$	\$3,829.54	$N_{VS}$	\$3,993.71	$N_{VS}$	\$3,742.80
<i>Equal payments</i>		<i>different amounts and one unknown payment</i>		<i>different amounts and three unknown payment</i>	

Source: own

## Results and Discussion

Using equivalent equations, this paper presents three scenarios to carry out a debt restructuring, on the assumption that the debtor cannot meet their commitments.

Starting from overdue promissory notes and not yet overdue, we could establish the proposal of hypothetical scenarios. In the case of overdue promissory notes we can see in the new proposal of payments (Table 2 and 3), that these would be paid at other dates, or at least, in different dates to which they had agreed.

It is important to note that the original debt scheme is being displayed one year before it happens, hence, overdue promissory notes, would be paid on a different date, than originally had, as well as a different amount.

Therefore, the scenarios proposed for the financial modeling are performed, considering that the debtor has displayed over time (a year before the event occurs), a possible default in payment of all promissory notes which they are due, and under this premise, a new payment scheme is proposed.

## Conclusions

Throughout this paper, we could observe a serious problem that permanently the debtor is faced, this is, the lack of control over their cash flows, i.e., serious financial problems when there are commitments to fulfill.

The proposal described in this paper aims to provide an alternative solution for those debtors who, for lack of financial resources, should consider a debt restructuring with its creditors, which would allow them reach an agreement in order to pay their debts.

Equivalent equations models seek to encourage to all involved, firstly the debtor who for some reason was unable to fulfill the obligation to cover some payments and the creditor, for recovering the money given on the debtor by financing or credit.

In their seminal works Garcia-Santillán and Vega-Lebrun (2008), García-Santillán, Venegas-Martínez and Escalera-Chavez (2014), suggest identify a common factor based on the valuation of original debts and the new proposal scheduled payments dates, which allows to establish a parameter in the timeline, which also seek a balance between the overdue and not yet overdue promissory notes, which favor both, the debtor and the creditor.

In the new payment scheme necessarily the creditor will have a benefit for getting an interest in debt restructuring, however the debtor wins too, getting a deferral through time, allowing a better management of his cash flow, improving the administration of his working capital, and generating better indicators of solvency and liquidity.

## References

- [1] **CONDUSEF (2015)** Comisión Nacional para la Protección y Defensa de los Usuarios de Servicios Financieros [National Commission to Protect and Defense of User of the Financial Services]. Retrieved from:  
<http://www.condusef.gob.mx/index.php/component/seoglossary/glossary/1/138/reestructura-de-deuda>
- [2] **GARCÍA-SANTILLÁN, A.**, (2011). *Financial Management I*. EuroMediterranean Network, Full text at: Universidad de Málaga, ISBN-13: 978-84-693-7162-6 Retrieved from:  
<http://www.eumed.net/libros/2010c/729/index.htm>.
- [3] **GARCÍA-SANTILLÁN, A.**, and Vega-Lebrún, C. (2008). Debt restructuring through a common factor and equivalent equation modeling. *Contributions to Economics*, April 2008. ISSN: 1696-8360.
- [4] **GARCÍA-SANTILLÁN, A.** Venegas-Martínez, F., Escalera-Chávez, M. (2014). Modeling Restructuring Debt with Equivalent Equations: Theoretical and practical implications. *American Review of Mathematics and Statistics Vol 2 (2) pp.91-106* ISSN: 2374-2348 DOI: 10.15640/arms.v2n2a5.
- [5] **KRAUSZ, A.** (lunes 22 de agosto de 2005).  
<http://alankrausz.blogspot.com/2005/08/elsobreendeudamiento.html> . Recuperado el 20 de abril de 2012.
- [6] **MARIN AZABE, C.**, & Araya Vega, S. (2008). <http://recerconsultores.cl/crecer/art23.html>. Recuperado el 20 de abril de 2012.

## Authors' Biography

### Arturo García-Santillán



Researcher Professor at Universidad Cristóbal Colón. Member of the National System of Researchers in Mexico. He has a Postdoctoral studies in Mathematics (*Escuela Superior de Economía del Instituto Politécnico Nacional ESE-IPN*). PhD in Management (mayor) Financial (minor). MBA (*Universidad Autónoma de Ags.-México*) and Bachelor in Financial Management. He obtained the Fischler award in USA for his research and publications on Financial Mathematics teaching, among others. He published more than ninety papers in indexing journals.



**Elena Moreno-García**

Researcher Professor at Universidad Cristóbal Colón. Member of the National System of Researchers in Mexico. She has a PhD in Economics from Almería University, Spain, a master degree in finance from Universidad de las Américas - Puebla and a Bachelor in Economics. She has published more than fifteen papers in indexing journals about math anxiety, financial education and regional and urban economics.



**Agustín, Bernúdez-Pérez**

Master program student at Universidad Cristóbal Colón



**Paulo César, Almeida-Fernández**

Master program student at Universidad Cristóbal Colón