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Payment Scheme and the Effect of Compounded Interest: An Analysis under Three Scenarios

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Abstract: The aim of this paper is to analyze a pay scheme with three possible scenarios, all under the hypothetical premise of the purchase of an appliance under three different terms of payment. In theory we know that the greater the capitalization of an interest rate, the greater the increase of the burden of interest on the person who acquires the credit. However, the calculations show that option 4, weekly payments, appears to be the option with the smallest interest payment (5.93%) versus 5.99% and 6.20% for options 2 and 3, respectively. Finally, it is important to mention that the import of each payment is what makes the difference: option 2 is $106.62, option 3 is $53.18 and option 4 is $24.53. Option 1 is cash payment.
Keywords: interest rate, compound interest, annuity, consumption, savings, AMS: 91B28, JEL: G210

INTRODUCTION

Nowadays, the scheme of fixed payments is an attractive option for those customers who do not have access to a credit card or do not have enough resources to make a payment in cash; however, we must make it clear that such credit type can be the most expensive in the market.

Usually, long run loans are the most expensive, so these become unaffordable, and there are many cases where debtors are unable to settle debts; in these circumstances, a debt restructuring could relieve some debtors, such as shown by García-Santillán in a study on debt restructuring models [2], in addition to this, Gilson, Kose and Lang [1] analyze different scenarios in which companies could benefit from debt restructuring instead of starting the bankruptcy process.

Regarding to personal debts CONDUSEF [3], states that one of the most serious problems is due to poor financial education, resulting in the debt without control. Also, Lea [4] identifies some factors that could trigger personal debt level, social emulation [5], impulsiveness [6, 7], and materialism [8], among others. All of these, clearly reveal a lack of financial education, and this becomes even more concerning if other factors such as the affordability of payments [9] or total cost miscalculation [10] are added.

Hence, one of the main reasons why we fall in debt is the lack of financial literacy. In this sense, Cooper [11] points that the costs of the lack of financial education are high, and people with lower incomes are the most affected. Although today, due to technological progress, we have at hand a range of investment opportunities that help us to achieve our future plans; nevertheless, much of the population does not manage its resources properly and not plan your future [12].

This has led us to a social scenario where more and more debt is acquired by the lack of seriousness in the decision to apply for a credit. Regarding this, a study by Moreno-García, García-Santillán and Munguía [13] showed that even students who are studying careers related to administrative economic area lack financial education, contrary to what you could expect from students of these disciplines.

Furthermore, Lea, Webley and Levine [14] reported that the new schemes associated with patterns of saving and consumption funding has tried to promote a new debt culture, where it can be manageable by the debtor. This culture is directly related to the concept of financial well-being, which, according to the Office for Financial Consumer Protection [15] involves a scenario in which individuals manage efficiently its resources, and, because of that, are able to cope with changes in the socioeconomic environment.

Scenario development

One of the most requested credit forms is to purchase home appliances or technological items (Mexican Internet Association, 2015). Based on this premise, suppose that we find an “irresistible offer" to get a 32-inch screen and we are given the following payment options:

- Option 1: $1,200.00 in cash.

- Option 2: 12 equal payments, with an interest rate of 12% compounded monthly (during one year).
- Option 3: 24 equal payments, with an interest rate of 12% compounded every two weeks (during one year).
- Option 4: 52 payments, with an interest rate of 12% compounded weekly (during one year).

Therefore, using the example and these three scenarios, we will determine the final amount once credit is completed. Therefore, from de formula of *NPV* we have:

$$NPV = Rp\,\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{i/m}$$ In order to calculate *Rp*, we substitute from the equation:

Option 2

$$Rp = \frac{NPV}{\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{i/m}}$$

$$Rp = \frac{\$1,200.00}{\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{i/m}} = \frac{\$1,200.00}{\frac{1-\left(1+\frac{.12}{360}*30\right)^{-12}}{.12/360*30}} = \frac{\$1,200.00}{\frac{1-(1.01)^{-12}}{.01}} = \frac{\$1,200.00}{\frac{1-(0.88744923)}{.01}}$$

$$Rp = \frac{\$1,200.00}{\frac{0.11255077}{.01}} = \frac{\$1,200.00}{11.2550775} = \$106.62$$

Option 3

$$Rp = \frac{NPV}{\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{i/m}}$$

$$Rp = \frac{\$1,200.00}{\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{i/m}} = \frac{\$1,200.00}{\frac{1-\left(1+\frac{.12}{360}*15\right)^{-24}}{.12/360*15}} = \frac{\$1,200.00}{\frac{1-(1.005)^{-24}}{.005}} = \frac{\$1,200.00}{\frac{1-(0.88718567)}{.005}}$$

$$Rp = \frac{\$1,200.00}{\frac{0.11281433}{.005}} = \frac{\$1,200.00}{22.5628662} = \$53.18$$

Option 4

$$Rp = \frac{NPV}{\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{i/m}}$$

$$Rp = \frac{\$1,200.00}{\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{i/m}} = \frac{\$1,200.00}{\frac{1-\left(1+\frac{.12}{360}*7\right)^{-52}}{.12/360*7}} = \frac{\$1,200.00}{\frac{1-(1.00233333)^{-52}}{.00233333}} = \frac{\$1,200.00}{\frac{1-(0.88586401)}{.00233333}}$$

$$Rp = \frac{\$1,200.00}{\frac{0.11413599}{.00233333}} = \frac{\$1,200.00}{48.9154231} = \$24.53$$

After, we proceed to probe each of the three scenarios shown above, using an amortization chart.

Table-1: **Amortization chart (compounded monthly)**

Payment No.	Annuity	Interest	Capital	Balance
0				$ 1,200.00
1	$ 106.62	$ 12.00	$ 94.62	$ 1,105.38
2	$ 106.62	$ 11.05	$ 95.56	$ 1,009.82
3	$ 106.62	$ 10.10	$ 96.52	$ 913.30
4	$ 106.62	$ 9.13	$ 97.49	$ 815.81
5	$ 106.62	$ 8.16	$ 98.46	$ 717.35
6	$ 106.62	$ 7.17	$ 99.45	$ 617.91
7	$ 106.62	$ 6.18	$ 100.44	$ 517.47
8	$ 106.62	$ 5.17	$ 101.44	$ 416.02

9	$ 106.62	$ 4.16	$ 102.46	$ 313.56
10	$ 106.62	$ 3.14	$ 103.48	$ 210.08
11	$ 106.62	$ 2.10	$ 104.52	$ 105.56
12	$ 106.62	$ 1.06	$ 105.56	-$ 0.00
	$ 1,279.42	$ 79.42	$ 1,200.00	$ -

Source: own

Table-2: **Amortization chart (compounded every two weeks)**

Payment No.	Annuity	Interest	Capital	Balance
0				$ 1,200.00
1	$ 53.18	$ 6.00	$ 47.18	$ 1,152.82
2	$ 53.18	$ 5.76	$ 47.42	$ 1,105.39
3	$ 53.18	$ 5.53	$ 47.66	$ 1,057.74
4	$ 53.18	$ 5.29	$ 47.90	$ 1,009.84
5	$ 53.18	$ 5.05	$ 48.14	$ 961.71
6	$ 53.18	$ 4.81	$ 48.38	$ 913.33
7	$ 53.18	$ 4.57	$ 48.62	$ 864.71
8	$ 53.18	$ 4.32	$ 48.86	$ 815.85
9	$ 53.18	$ 4.08	$ 49.11	$ 766.74
10	$ 53.18	$ 3.83	$ 49.35	$ 717.39
11	$ 53.18	$ 3.59	$ 49.60	$ 667.80
12	$ 53.18	$ 3.34	$ 49.85	$ 617.95
13.00	$ 53.18	$ 3.09	$ 50.09	$ 567.85
14.00	$ 53.18	$ 2.84	$ 50.35	$ 517.51
15.00	$ 53.18	$ 2.59	$ 50.60	$ 466.91
16.00	$ 53.18	$ 2.33	$ 50.85	$ 416.06
17.00	$ 53.18	$ 2.08	$ 51.10	$ 364.96
18.00	$ 53.18	$ 1.82	$ 51.36	$ 313.60
19.00	$ 53.18	$ 1.57	$ 51.62	$ 261.98
20.00	$ 53.18	$ 1.31	$ 51.87	$ 210.11
21.00	$ 53.18	$ 1.05	$ 52.13	$ 157.97
22.00	$ 53.18	$ 0.79	$ 52.39	$ 105.58
23.00	$ 53.18	$ 0.53	$ 52.66	$ 52.92
24.00	$ 53.18	$ 0.26	$ 52.92	-$ 0.00
	$ 1,276.43	$ 76.43	$ 1,200.00	

Source: own

Table-3: **Amortization chart (compounded weekly)**

Payment No.	Annuity	Interest	Capital	Balance
0				$1,200.00
1	$24.53	$2.80	$21.73	$1,178.27
2	$24.53	$2.75	$21.78	$1,156.49
3	$24.53	$2.70	$21.83	$1,134.65
4	$24.53	$2.65	$21.88	$1,112.77
5	$24.53	$2.60	$21.94	$1,090.83
6	$24.53	$2.55	$21.99	$1,068.84
7	$24.53	$2.49	$22.04	$1,046.81
8	$24.53	$2.44	$22.09	$1,024.72
9	$24.53	$2.39	$22.14	$1,002.58
10	$24.53	$2.34	$22.19	$980.38
11	$24.53	$2.29	$22.24	$958.14
12	$24.53	$2.24	$22.30	$935.84
13	$24.53	$2.18	$22.35	$913.49
14	$24.53	$2.13	$22.40	$891.09
15	$24.53	$2.08	$22.45	$868.64
16	$24.53	$2.03	$22.51	$846.13

17	$24.53	$1.97	$22.56	$823.58
18	$24.53	$1.92	$22.61	$800.97
19	$24.53	$1.87	$22.66	$778.30
20	$24.53	$1.82	$22.72	$755.59
21	$24.53	$1.76	$22.77	$732.82
22	$24.53	$1.71	$22.82	$710.00
23	$24.53	$1.66	$22.88	$687.12
24	$24.53	$1.60	$22.93	$664.19
25	$24.53	$1.55	$22.98	$641.21
26	$24.53	$1.50	$23.04	$618.17
27	$24.53	$1.44	$23.09	$595.08
28	$24.53	$1.39	$23.14	$571.94
29	$24.53	$1.33	$23.20	$548.74
30	$24.53	$1.28	$23.25	$525.49
31	$24.53	$1.23	$23.31	$502.18
32	$24.53	$1.17	$23.36	$478.82
33	$24.53	$1.12	$23.41	$455.41
34	$24.53	$1.06	$23.47	$431.94
35	$24.53	$1.01	$23.52	$408.42
36	$24.53	$0.95	$23.58	$384.84
37	$24.53	$0.90	$23.63	$361.20
38	$24.53	$0.84	$23.69	$337.51
39	$24.53	$0.79	$23.74	$313.77
40	$24.53	$0.73	$23.80	$289.97
41	$24.53	$0.68	$23.86	$266.11
42	$24.53	$0.62	$23.91	$242.20
43	$24.53	$0.57	$23.97	$218.23
44	$24.53	$0.51	$24.02	$194.21
45	$24.53	$0.45	$24.08	$170.13
46	$24.53	$0.40	$24.14	$146.00
47	$24.53	$0.34	$24.19	$121.81
48	$24.53	$0.28	$24.25	$97.56
49	$24.53	$0.23	$24.30	$73.25
50	$24.53	$0.17	$24.36	$48.89
51	$24.53	$0.11	$24.42	$24.47
52	$24.53	$0.06	$24.47	-$0.00
	$1,275.67	$75.67	$1,200.00	

Source: own

DISCUSSION

After the calculation of each scenario, now the result is discussed and the best option that represent a benefit for who acquires “32-inch screen”, is indicated.

In Option 1, the payment is in cash

In option 2, the total amount to be paid is $1,279.42, which $1,200.00 is capital and $79.42 the corresponding interest for financing. The percentage of interest represents 6.20% of the total payment ($79.42/$1,279.42).

In option 3, the total amount to be paid is $1,276.43, which $1,200.00 is capital and $76.43 the corresponding interest for financing. The percentage of interest represents 5.99% of the total payment ($76.43/$1,276.43).

In option 4, the total amount to be paid is $1,275.67, which $1,200.00 is capital and $75.67 the corresponding interest for financing. The percentage of interest represents 5.93% of the total payment ($75.67/$1,275.67).

With these results, we can see the effect that a variation in the interest rate produces on capital. In this case, the rate of interest will increase as the compounding periods are becoming shorter.

We remember that in theory the frequency of capitalization is very important because, as capitalizations increase, then, greater will be the amount to be pay, despite that the payment of each annuity is "small."

In the above examples the payment was different for the 3 scenarios (*Rp* value), with the same interest rate but the period of capitalization rate is varied. However, in practice, department stores for each of the scenarios could have offered a different annuity and the interest rate for each capitalization period as well.

Apparently the most suitable scenario to buy the "32 inch screen" is the option 4, because the percentage of interest that pays in comparison to the other options is the lowest. In addition, the frequency of payments although it is higher, is significantly reduced in amount.

It is very easy and comfortable pay this type of credit, considering the little disbursements. Also we have the certainty that the amount established from the beginning will not change during the term of the loan. About this condition we must know that will be fulfilled if agreed payments are met.

CONCLUSION

Buying a household appliances or technological items in payments, is a risky decision for personal finance; this is why, before incurring debt, we must review the charging schemes offered to us by department stores or financial institutions.

Also, it is recommended that when you apply for credit, the consumer must evaluate their ability to pay either weekly, biweekly, monthly, etc., since there will be times when contingencies could arise and may avoid performing their subscriptions on time and this will generate more interest and higher debt.

It is true that at first glance a tiny payment scheme offered by department stores is attractive, but once the consumer analyzes the total cost of financing, and therefore, the asset acquired, decide which financing option is the most convenient, reflecting a higher level of financial education and more efficient approaches scenario.

We remember what Lea [4] say in his own words: "*Consumer credit is a* necessary function in a modern economy and used appropriately it allows flexibility and enhances consumer choice. But it has risks. What actions could be taken to discourage inappropriate use, and reduce the number of casualties? (a) Improve education, (b) Improve restricted access, (c) Improve credit awareness and (d) Improve access to impartial debt advice.

REFERENCES

1. GILSON, S., Kose, J. & Lang, H. (1990). Troubled debt restructuring. An empirical study of private reorganizations of firms in default. *Journal of Financial Economics* (27) 1990, 315-353. North Holland.
2. García-Santillán, A.; Escalera, M.; Moreno, E.; Rojas, C. (2015). Debt restructuring model: from commercial credit to non-payment of debt. *International Research Journal of Pure Algebra* Vol.5 pp 203-209.
3. CONDUSEF. (2014). Apaga tus deudas. Revista Proteja su dinero. (176).
4. LEA, S. (2014). The British Psychological Society. Behaviour Change: personal debt.
5. SULLIVAN, T., Warren, E. & Westbrook, J.L. (1989). *As we forgive our debtors*. New York: Oxford University Press.
6. Joireman, J., Kees, J., & Sprott, D. (2010). Conocer with immediate consequences magnifies the impact of compulsive buying tendencies on college students' credit card debt. *Journal of Consumer Affairs*, *44*(1), 155-178.
7. Ottaviani, C., & Vandone, D. (2011). Impulsivity and household indebtedness: Evidence from real life. *Journal of economic psychology*, *32*(5), 754-761.
8. Watson, J. J. (2003). The relationship of materialism to spending tendencies, saving, and debt. *Journal of economic psychology*, *24*(6), 723-739.
9. Stewart, N. (2009). The cost of anchoring on credit-card minimum repayments. *Psychological Science*, *20*(1), 39-41.
10. McHugh, S., Ranyard, R., & Lewis, A. (2011). Understanding and knowledge of credit cost and duration: Effects on credit judgements and decisions. *Journal of Economic Psychology*, *32*(4), 609-620.
11. COOPER, M. (2016). Why Financial Literacy Will Not Save America's Finances. The Atlantic. May 2, 2016.
12. Jeszeck, C. A., Collins, M. J., Glickman, M., Hoffrey, L., & Grover, S. (2015). Retirement Security: Most Households Approaching Retirement Have Low Savings.
13. MORENO, E.; García-Santillán, A.; Munguía, J. (2013). Some aspects about financial knowledge of undergraduate students. International *Journal of Management and Sustainability*, .3 (4), 40-62.
14. LEA, S., Webley, P.; Levine, RM. (1993). The economic psychology of consumer debt. *Journal of Economic Psychology*. Vol. 14 no. 1, pp 85-119, doi:10.1016/0167-4870(93)90041-I
15. Bureau, C. F. P. (2015). Financial well-being: The goal of financial education. *Report, Iowa City, IA: Consumer Financial Protection Bureau*.