TRANSLATING FINANCIAL MATHEMATICS INTO BRAZILIAN PORTUGUESE

Naomi J. S. de Moraes
Just Right Communications Ltda.

Abstract: A descriptive comparison of the methods and terms used in financial mathematics in the US and Brazil. This talk is appropriate for novice financial translators into Portuguese, and into other languages (since the concepts are described in English).

"An investment in knowledge always pays the best interest." – Benjamin Franklin

1. INTRODUCTION

This material is the result of research we had to perform for a special, long-term project that was mostly mathematical (one of our specialties) with some financial calculations thrown in as examples. As mentioned in Robert George Dewsnap's article in the Proceedings from last year's ATA conference (Ref. 1), the best way to translate a specialty subject is read material in the target language and match it with the terms and concepts in the source text. Fortunately, I also worked as a bookkeeper's assistant in my youth, and have always liked numbers.

2. SIMPLE AND COMPOUND INTEREST (*CAPITALIZAÇÃO SIMPLES E COMPOSTA*)

Simple interest (*juros simples*), which is rare in the financial market, occurs when interest is always calculated based on the initial investment:

interest = present value x rate x time (*juros = valor presente x taxa x tempo*)

Note that if the rate is based on months, the time is the number of months. Compound interest (*juros compostos*) occurs when the interest for the next month is based on the total (principal + interest / *principal + juros*) at the end of the current month. Note that the compounding period (*período de capitalização*) must be the same as the interest payment period (a counter example would be interest paid every month, but compounded quarterly or yearly). The initial amount, or investment (*capital, valor presente, valor atual, investimento*) grows to become the future value (*valor futuro, montante*).

future value = capital x $(1 + \text{rate})^n$, where n = number of periods
($montante = capital\ x\ (1 + taxa)^n$) , *onde n = número de períodos*

An interesting feature is the translation of interest rate conventions. In the US, the number of days in each interest period may be the real number of days or a convenient number of days. Examples are: 30/360, actual/360, actual/365, and actual/actual. The first number is the number of days in the month, and the second is the number of days in the year. The 30/360 calculation corresponds to *juros ordinários* in Brazil, while the actual/actual calculation corresponds to *juros exatos*.

3. ANNUITIES (*ANUIDADES*)

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An annuity is commonly thought of as a retirement plan sold by an insurance company, but also has a more general meaning: a series of payments with a set amount and frequency. This second definition is the more common in Portuguese. It is, basically, a complication of the interest calculation above, with money paid out (*pago*) or paid in (*recebido*) at fixed intervals. Needless to say, whether money is paid or received depends on the point of view, so the calculations are the same.

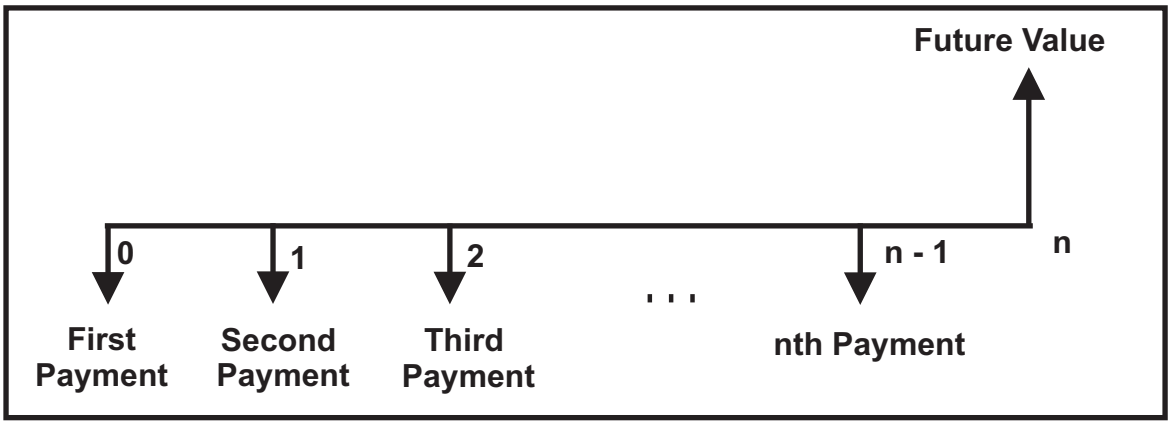

Figure 1 Series of Payments Made at the Beginning of the Month (*Anuidade Antecipada*)

Let us look at an investment situation (*capitalização*). n-1 payments are made, one at the beginning of each month. At the beginning of the Nth month, the future value (*montante*) is:

$$\text{Future value} = p\,(1 + i)\,\{[(1 + i)^n - 1] / i\}$$

where p = monthly payment (*pagamento mensal, prestação*)
i = monthly interest rate (*taxa mensal*)
n = number of periods (*número de períodos*)

Whether the monthly amount is paid at the beginning or the end of the month makes a difference in the calculation. The next example (Figure 2) is an ordinary annuity (*anuidade postecipada*).

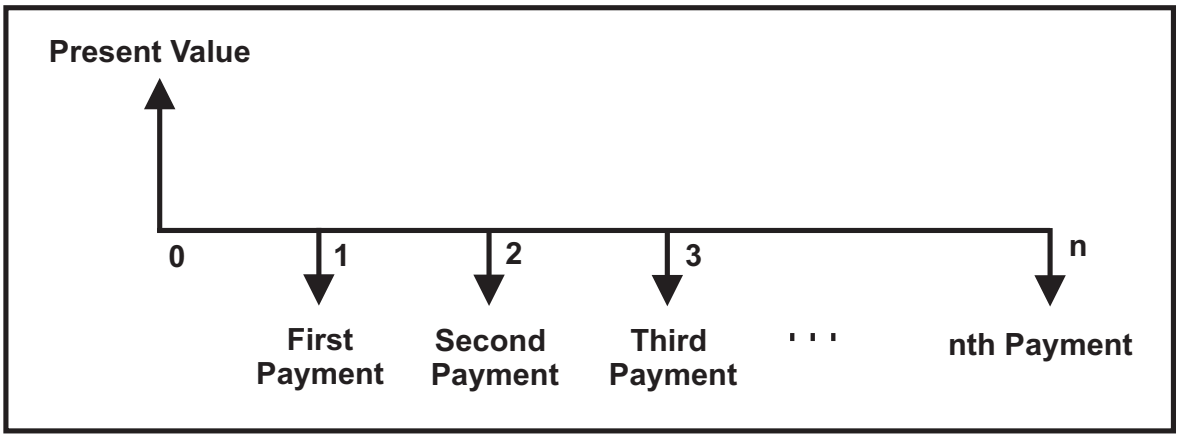

Figure 2 Series of Payments Received at the End of the *Month (Anuidade com Termos Vencidos*)

In this case, given the number of payments and their value, the initial amount that must be paid (*valor atual*) is:

Present value = p { $[(1 + i)^n - 1] / [i (1 + i)^n]$ }
where p = monthly payment (*pagamento mensal, prestação*)
i = monthly interest rate (*taxa mensal*)
n = number of periods (*número de períodos*)

Note: When the payments are made at the beginning of the month, they are *antecipados*. When made at the end of the month, they are *postecipados* or *vencidos*.

4. DEPRECIATION (*DEPRECIAÇÃO*)

Depreciation is an estimate of lost or expired usefulness of an item. In fact, when and how the item is actually paid for has nothing to do with its depreciation. Depreciation can also be seen as a way to determine the current value of an item purchased in the past, for accounting purposes.

The simplest method is straight-line depreciation (*depreciação linear*). The formula is:

d = (pp - ex) / n
where d = value of depreciation for each accounting *period (valor da depreciação*)
pp = purchase price of item (*valor de compra do bem*)
ex = remaining depreciable value (*valor residual*) -or- salvage value (*valor de revenda após a vida útil*)
n = number of accounting periods equal to useful life*(número de períodos correspondentes à vida útil*)

Just to complicate matters, accelerated methods were invented. Any good accounting book should describe the following:

- sum-of-the-years-digits depreciation (*depreciação usando o método da soma dos dígitos dos anos*)
- declining-balance method (*método de saldos decrescentes*)

The method chosen is usually that which reduces taxes.

5. AMORTIZATION (*AMORTIZAÇÃO*) AND LOANS (*EMPRÉSTIMOS*)

A loan is when a lender (*mutuante, credor*) lends money to a borrower (*mutuário, devedor*). For loans with periodic, fixed payment amounts and compound interest, see section two on annuities. The complicated part is amortization, or in other words, how much of a given payment goes to paying the interest (*a parte usada para amortizar os juros*) and how much goes to paying the principal. Most people are aware that, when they buy a house, they are paying almost pure interest for the first 5 years or so. The bank wants its profit up front.

The most common is the direct reduction loan with equal periodic payments. This is known in Brazil as the *sistema francês de amortização* and a few other names (*amortização segundo a*

tabela price, or *empréstimos com prestações constantes*). One problem in Brazil is that, due to decades of high inflation, lenders adjust the payment and total owed amounts on a yearly basis! These adjustments are based on indices published by government economists. So, when taking out a loan for a house, for example, you have no way of knowing up front how much you will actually pay for it. Mortgages taken out by sensible people are usually for 3-5 years. Most middle class home owners pay cash for their homes, after saving long years (usually investing in certificates of deposit (*certificados de depósito*) or similar fixed-rate investments).

6. LEASING (*ARRENDAMENTO MERCANTIL / LEASING*)

The option to lease a vehicle or machine can be compared to purchasing the same item by evaluating the present value of the total amount paid (see section two on annuities), with adjustments for the residual value *(valor residual*) and any tax consequences of purchasing. In the simplest case, for comparison, the item is paid for in cash (*à vista*) rather than in installments (*parcelado*). This comparison method, where the present value (future value plus interest) of all future cash flows (*fluxos de caixa*) is calculated, is called the net present value method (*método do valor atual*).

The lessor (*arrendador*) grants the lessee (*arrendatário*) full use of the item during the stipulated period, often the useful lifetime, with the option to buy the item when the lease term ends by paying the residual value. The installments (*contraprestações*) are usually paid monthly, but no "interest" is involved, at least not explicitly. Once again, in Brazil, lease contracts—both for goods (*bens móveis*) and property (*bens imóveis*)—often involve annual recalculation of monthly payments and total owed based on government indexes.

7. BONDS (*TÍTULOS*)

A bond is a contract to pay interest, usually semiannually, at a given rate called the coupon rate (*taxa de cupom*). The face value or redemption value or par value (*valor nominal*) of the bond is paid on some specified future date called the maturity date (*data de vencimento*). A bond looks like this:

Company XXX Face value: $1000 Maturity date: Dec 31, 2020 Coupon rate: 3%

When a bond is purchased directly from a company (or from the government), its price is fixed. However, bonds are often sold later in the bond market. In this case, the internal rate of return [IRR] (*taxa interna de retorno [TIR]*), also called the yield to maturity, is used to calculate the true yield given that the bond is sold at a discount (*com deságio*) or at a premium (*com ágio*).

As shown in Figure 3, bonds can be viewed as an annuity (see section 2) with an extra payment on the maturity date equal to the face value. Therefore, the net present value can be calculated (see section 5) along with the yield. But what happens when a bond is purchased by a second person, whose yield will be dependent on the date and price of purchase (second case in Figure 3)?

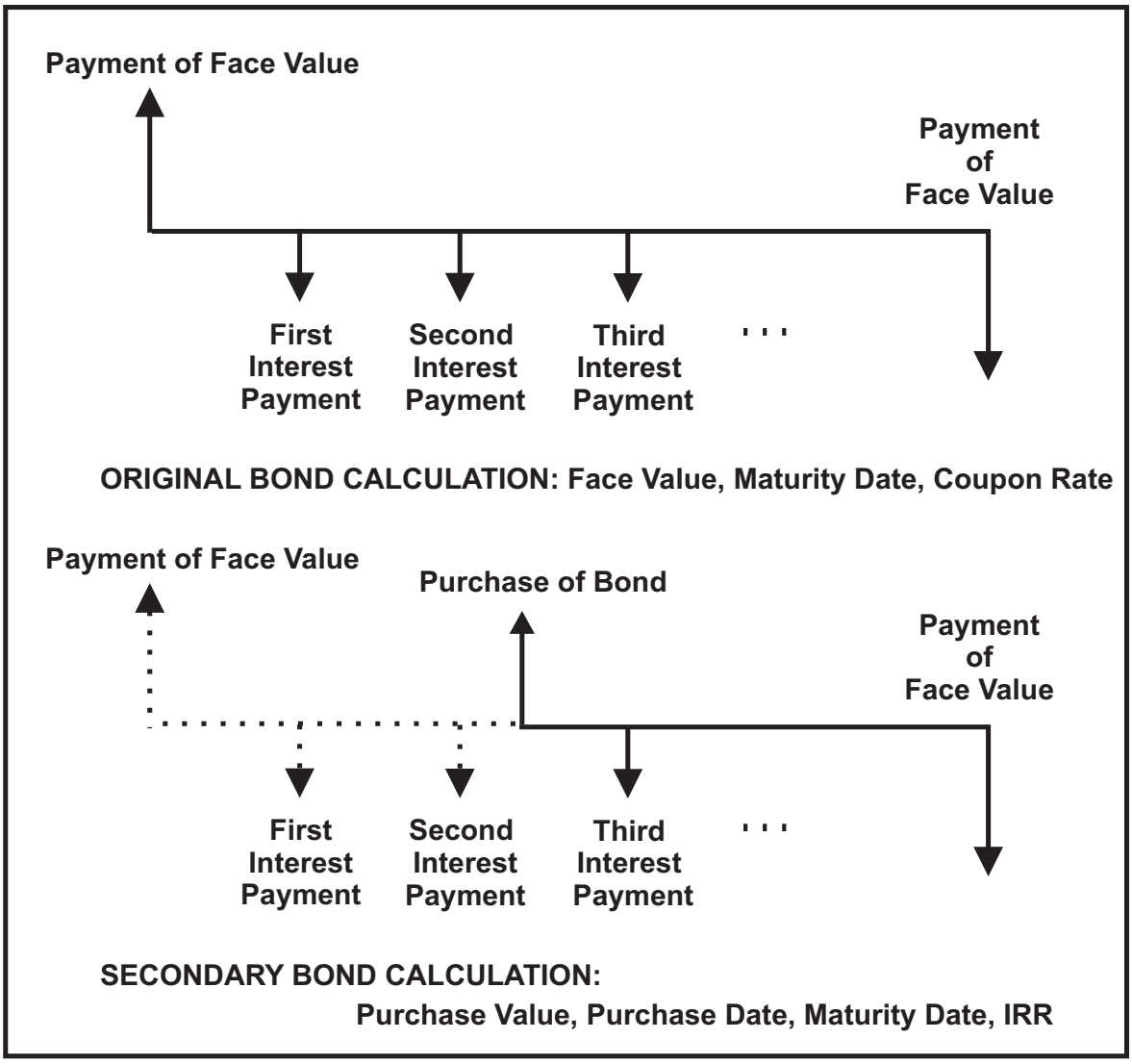

Figure 3 Bond Calculations

The calculation is iterative: given the coupon rate, the maturity and purchase dates (and thus the number of interest payments remaining), and the face value, the purchase price for a desired yield (IRR) can be calculated, or vice-versa.

REFERENCES

1. Dewsnap, Robert George. "What is an Aorta? How to Become a Specialist Translator". *Proceedings of the 43rd Annual ATA Conference*, Atlanta, Georgia, 2002. p. 11-19.

2. Fortuna, Eduardo. *Mercado financeiro: produtos e serviços*. 15ª ed. Rio de Janeiro: Qualitymark Ed., 2002.

3. Kuhnen, Osmar Leonardo and Bauer, Udibert Reinoldo. *Matemática Financeira Aplicada e Análise de Investimentos*. 3ª ed. São Paulo: Ed. Atlas, 2001.

4. Guerra, Fernando. *Matemática financeira através da HP-12C*. 2ª ed. Florianópolis: Editora da UFSC, 2001.

5. Reynolds, Issac N. et. al. *Elementary Accounting*. Hinsdale, Illinois: The Dryden Press, 1978.