Business calculus

Business

It is an ever increasingly important necessity now for business students to be acquainted with the hard facts of theories and their practical implications even during their period of study. Due to the rapidity with which the business scenarios are changing it has become imperative for students to experiment themselves with the variables and theories they will be confronted with in their professional lives.

One of the most important topics for business calculus to have a profound understanding upon is businessfinance. Business finance is a the study of a sea of financial tools, techniques and instruments that are needed to run businesses, provide them with adequate cash and other forms of payables and understand how the financial borrowing and payment industry works (Grossman & Cole, 2003). Corporate finance is a branch of financial studies that deals specifically with the essentials of financing forms in the corporate and business world with special emphasis on themathematicsbehind it too.

The aim of this presentation is to communicate the essentials of growth and decay models which we have found so interesting in our business calculus course to the corporate finance industry. Essentially speaking, business calculus is a dynamic field that has practical applications in business, finance, engineering, medical and several other areas of study.

Growth and Decay Models

The flourishing of mankind has led to more and more complex models of mathematics and finance being implemented in the areas of business and finance. The ethics of lending and borrowing have long ceased to be a major issue in devising policies and people have evolved from the era of the simple

interest to the compound interest. Simple interest was indeed very “ simple” where a fixed amount of interest was calculated and paid by the borrower. The formula for a simple interest calculation is as follows:

However, as time passed by, people began to understand that newer and more complex models could lead to greater profitability – especially the use of growth models. We learnt in business calculus that a growth model grows exponentially – so does a compound interest borrowing. The following is the formula for the growth model of a compound interest calculation:

The above formula shows how clearly compound interest is a replica of a growth model that is used in nearly every field of study. Decay models common in physics and other areas as well refers to the concept of annuities and provident funds. The decay of an annuity fund is essentially quite similar to a decay model where a fund is exhausted by regular payments and at the same time recovers itself through interest earned on the balance. Technically speaking there are minute differences between annuities and a decay model. But for the scope of this paper, we can safely assume it to be an application of the decay model we have all been so accustomed to use in business calculus assignments.

Business Finance Applications

Whenever a loan is given out or an annuity fund maintained, there is always an underlying growth or decay model implemented, respectively. The equations underpinned to information systems for timely calculations of p[ayments, minimum payments, annuity withdrawal amounts, accruals and interest payments are all based upon the delicacies of business calculus.

An example would better explain the practicalities that are the norm in the corporate world. A loan of $100, 000 borrowed from a bank for a period of 5 years at a yearly simple interest rate of 5% will have a yearly payment of $5, 000 for the entire 5 years. However, corporate finance theories suggest that the concept of Time Value ofMoneyshould be incorporated into finance. This is also another form of growth model where we assume (rather correctly) that the value of money disintegrates with time withrespectto the inflation and lost interest for that money had it been deposited with a bank or a financial institution. The following is the formula for Present Value of Money:

It follows from the above equation:

The former is a growth model while the latter is a decay model. It follows from this that a decay model is the inverse of a growth model even in the business finance industry. Comprehending the basics of these equations is simple if one understands the notations:

PV= Present Value of Money

FV= Future Value of Money

r= Discount/Interest Rate (prevailing)

t= Time Period of Payment from Present Time (Present Time= 0)

Business finance employs growth and decay models extensively. A loan where a customer fails to make the scheduled payment will find that he gets caught in a cycle of growing monthly payment requirements. Continuing the same example as provided for the simple interest, the yearly payment for a compound interest loan payment turns out to be $23, 097. 48 per year.

If the borrower fails to make a payment of this amount (pays lesser than this amount) the outstanding amount of the loan will increase. The next year, the borrower will have to pay $23, 097. 48 plus the interest accrued on the difference between the amount required and the amount paid last year. Even if the borrower now pays $23, 098. 47, the next years' payment will include a double years interest accrued on the first years payment difference and so on. The borrower is trapped in a growth model which can only be altered if the payment made is more than the amount required.

Decay models on the other hand work oppositely. Just like an underpayment inflates the growth model, an over-withdrawal deflates the annuity (the decay model). If however, the amount withdrawn is lesser than the amount prescribed to be withdrawn, the decay model extends into time and will never hit the 0 level. The workings of both the models are according to the laws of calculus and extend indefinitely if not altered externally (either by increasing payments of loan or increasing withdrawal amounts).

Conclusion

It is said that a picture speaks a thousand words. Thus graphs best explain situations which sometimes theoretical examples may not be able to clarify. The following is a growth model for a loan that has no repayments (the borrower decided to run away!):

Conclusion

Based on the general discussion I have presented using equations and examples, I believethat I have been able to give you a brief idea of the use and implications of business calculus in finance. The necessity for business

calculus is thus imperative since it flows over to other fields and practical applications are all based upon the injunctions of mathematics and finance.

My discussion was on growth and decay models and I hope I have done justice to my topic and that you, as an audience, have been able to grasp the fundamentals of the links between calculus and finance easily.

References

Grossman, P. Z., & Cole, D. H. (2003). *The End of a Natural Monopoly.* Carolina: Routledge.