P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-V, ISSUE-I, January-2016
E: ISSN No. 2349-9443 Asian Resonance

Newton & Pacioli: The Similar & Cognitive Laws

Abstract

This paper only represents the similarities between the three universal laws of Newton and the three golden rules (accounting) of Pacioli. This paper does not attempt to show any contradiction or superiority between these Laws. At one side, the golden rule of Pacioli describes the relationship between the principles acting on journal entries and its posting and on the other hand The Newton's Rule describes the relationship between the forces acting on a body and its motion due to those forces.

Keywords: Debit, Credit, Law of motion, Personal, nominal, Real Account.

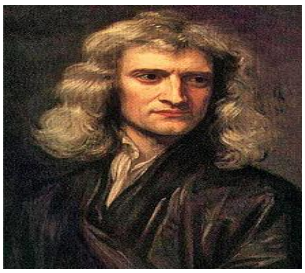
Dharma Veer
Assistant Professor,
Deptt. of Commerce,
S.K.B.B. Govt. P.G. College,
Harakh, Barabanki, U.P.

Atul Kumar Pandey
Assistant Professor,
Deptt. of Physics,
S.K.B.B. Govt. P.G. College,
Harakh, Barabanki, U.P.

Introduction

Newton's Laws of Motion

Sir Isaac Newton was born on 25 December 1642 at Woolsthorpe, Lincolnshire, England. He was a Physicist and Mathematician who is widely regarded as one of the most prominent scientists of all time. As a Physicist, Newton formulated the laws of motion, law of universal gravitation and Newtonian mechanics but as a mathematician he contributed to the study of power series, binomial theorem, roots of a function, and cubic plane curves etc. At the age of 84, Newton died in Kensington, Middlesex, England on 20 March 1727.



Sir Isaac Newton

Newton's First Law of Motion

Every Object in A State of Uniform Motion Tends to Remain in that State of Motion Unless an External Force is Applied to It.

This is known as uniform motion. An object continues to do whatever it happens to be doing unless a force is exerted upon it. If it is at rest, it continues in a state of rest. If an object is moving, it continues to move without turning or changing its speed. Changes in motion must be imposed against the tendency of an object to retain its state of motion. In the absence of net forces, a moving object tends to move along a straight line path indefinitely.

Newton's Second Law of Motion

The Relationship between an Object's Mass m, Its Acceleration a, and The Applied Force F is F = ma. Acceleration and Force is Vector; in This Law the Direction of the Force Vector is The Same as The Direction of The Acceleration Vector.

The second law states that the net force on an object is equal to the rate of change of its linear momentum **p** in an inertial reference frame:

$$\mathrm{F} = \frac{\mathrm{d}\mathrm{p}}{\mathrm{d}t} = \frac{\mathrm{d}(m\mathrm{v})}{\mathrm{d}t}$$

The second law can also be stated in terms of an object's acceleration. Since Newton's second law is only valid for constant-mass systems, mass can be taken outside the differentiation operator by the constant factor rule in differentiation. Thus,

$$\mathrm{F} = m\frac{\mathrm{d}\mathrm{p}}{\mathrm{d}t} = m\mathrm{a}$$

Where **F** is the net force applied, *m* is the mass of the body, and **a** is the body's acceleration. Thus, the net force applied to a body produces a proportional acceleration. In other words, if a body is accelerating, then there is a force on it.

Newton's Third Law of Motion

For Every Action There is an Equal and Opposite Reaction.

The third law states that all forces exist in pairs: if one object *A* exerts a force F_A on a second object *B*, then *B* simultaneously exerts a force F_B on *A*, and the two forces are equal and opposite: $F_A = -F_B$. The third law means that all forces are *interactions* between different bodies, and thus that there is no such thing as a unidirectional force or a force that acts on only one body. This law is sometimes referred to as the *action-reaction law*.

Luca Pacioli's Laws of Double Entry

Fra Luca Bartolomeo de Pacioli (sometimes Paccioli or Paciolo; 1445–1517) was an *Italian Mathematician,* Franciscan friar, collaborator with Leonardo da Vinci, and seminal contributor to the field now known as 'Accounting'.

Luca Pacioli

Following the traditional approach (also called the *British approach*) accounts are classified as real, personal, and nominal accounts. Real accounts are accounts relating to assets and liabilities. Personal accounts are accounts relating to persons or organizations with which the business has transactions and will mainly consist of accounts of debtors and creditors. Nominal accounts are revenue, expenses, gains, and losses. Transactions are entered in the books of accounts by applying the following '**Three golden rules of accounting':**

Real Account

Debit what comes in and credit what goes out

Personal Account

Debit the receiver and credit the giver

Nominal Account

Debit all expenses & losses and credit all incomes & gains

Objective of the Study

The objective of the study is to find out similarities between Luca Pacioli's Three golden rules of accounting' with Newton's three laws of motion. The main objectives are:

1. To compare the three laws of both personalities for their interdisciplinary relevance in the subject.
2. To analyze the commercial activities of accounting behaviour on the basis of science application and laws therein.
3. To analyze the accounting pattern of golden rules among science laws and fiction.

Review of Literature

The concept of creative accounting is usually used to describe the process through which the accounting professionals use their knowledge in order to manipulate the figures included in the annual accounts. Accounting has been defined as "the art of faking a balance sheet" (Bertolus J.), "the art of calculating the benefits" (Lignon M.), "the art of presenting a balance sheet" (Gounin L.), or "the art of saving money" (Ledouble D.).

The creative accounting appeared in the Anglo-Saxon literature in the 1970s, most often in the papers about the bankruptcy of enterprises and those written by Watts and Zimmerman (1978, 1986, 1990) which represent the foundation of the positive accounting theory. This research trend made the object of several empirical works trying to explain the accounting choices starting from the problem of the political costs that the enterprises are exposed to. More recently, Brown and Steele (1999) have selected a portfolio of 12 accounting techniques, combining also the accounting options with the management decisions. In addition to the political costs, it is emphasised the importance of the activity and risk sector and that of the firm operation, as significant determinants of the creative accounting.

Defining creative accounting through a well known practice, that is "the result of smoothing (smoothing income), Barnea, Ronen and Sadan (1976) appreciate that this makes its presence felt each time the profits have a high fluctuation, unjustified through the economic reality. A complex vision is provided by Naser (1993) in whose opinion, creative accounting is: "1) the process through which, due to the existence of some breaches in the rules, accounting figures are manipulated and, taking advantage of the flexibility, they choose those measurement practices allowing the transformation of the synthesis documents from what they are supposed to be into what the managers want; 2) the process through which the transactions are structured in such amanner that it allows the "production" of the "desired accounting result."

Hypothesis

Ho

Pacioli's and Newton's laws are more similar than any other laws.

Ha

Pacioli's and Newton's laws are not more similar than any other laws.

Research Design

In this research, the research design is principal based & the source of data is almost secondary. The primary data was collected in the form

of questionnaire & open discussion and thus happen to be original in character, whereas, the secondary data was collected from various books and internet websites. The research instrument used for primary data was based on questionnaire & discussion among 60 {30 professors and 30 students} persons of different colleges of Barabanki and Lucknow District in a National seminar organised by Department of Commerce, S.K.B.B. Govt. P.G. College, Harakh, Barabanki (U.P.).

Here Chi-square test has been used as a non-parametric test as of goodness of fit, chi square test enables us to see how well does the assumed theoretical distribution fit to the observed data. As a test, it enables us to explain whether the two attributes are associated with or not.

Photos of National Seminar, Where Primary Data was Collected on the Selected Topic

Sampling unit is the total number of samples differed in different category:

S. No.	Classes	No. of Classes
1	Professors	30
2	Students	30
	Total	**60**

Hypothesis Testing

The Chi-square test is applied when there are 2 categorical variables from a single population. It

is used to determine whether there is a significant association between the 2 variables.

Chi-square= $X^2 = \Sigma [(O_i - E_i)^2 / E_i]$

Where

Oi = observed frequency of the cell in i^{th} row & j^{th} column

Ei = expected frequency of the cell in i^{th} row & j^{th} column

If the calculated value of X2 is less than the table value at a certain level of significant the fit is considered to be a good but if the calculated value is greater than its table value the fit is not considered to be a good one.

Table for Hypothesis

Class	Observed frequency Oij	Expected frequency Eij	Oi-Ei	$(O_i - E_i)^2$	(Oi-Ei)/Eij
Professors	15	10	5	25	2.5
Students	18	15	3	9	0.6
			Total= E(oij-eij)2/eij		3.1

Hypothesis Testing

The Chi-square test is applied when there are 2 categorical variables from a single population .It is used to determine whether there is a significant association between the 2 variables.

Chi-square= $X^2 = \Sigma [(O_i - E_i)^2 / E_i]$

Where

Oi= observed frequency of the cell in i^{th} row & j^{th} column

Ei= expected frequency of the cell in i^{th} row & j^{th} column

If the calculated value of X2 is less than the table value at a certain level of significant the fit is considered to be a good but if the calculated value is greater than its table value the fit is not considered to be a good one.

Table for Hypothesis

Class	Observed frequency Oij	Expected frequency Eij	Oi-Ei	$(Oi - Ei)^2$	(Oi-Ei)/Eij
Professors	15	10	5	25	2.5
Students	18	15	3	9	0.6
			Total= E(oij-eij)2/eij		3.1

Chi-square value=3.1

Degree of freedom= (2-1)(2-1)=1

Level of significance=5%

Inference

The table value is 3.84 at 5% level & the calculated value is less than tabled value so the null hypothesis is accepted (H0=0) & the result is that Pacioli's and Newton's laws are more similar than any other laws.

Findings

New self generated findings achieved in above open discussion are:

The Cognate Laws [Newton and Pacioli

1^{st} Rule = 1st Law

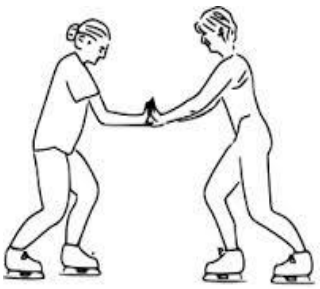
Pacioli	Newton
Real Account Debit : What Comes in Credit : What Goes Out " Product/Goods will remain in enterprise unless the internal/external decisions/factors affect it." Factors : ➢ sale/transfer of goods ➢ govt. policies ➢ LIFO/FIFO etc.	**Law of Inertia** "Every body continues to be in its state of rest or of uniform motion in a straight line unless it is compelled by some external force to change that state."

2^{nd} Rule = 2nd Law

Pacioli	Newton
Nominal Account Debit : All Expenses & Losses Credit : All Income & Gains Expense/Income & Loss/Gain is depends upon rate of change of sales, cost and demand of product. So, **P/L = Cg× Sc** S = Rate of change of Sales (P/L) Cg = cost of goods(constant) Sc = (variable), demand changes due to customer	The net force of an object is equal to the product of its mass and acceleration, or **F=ma** F = Rate of change of momentum m = mass(constant) a = acceleration(variable Now we can prove: F = m a Rate of change of momentum (F) = dp/dt F = d (m v)/dt , {p = m v}

satisfaction Now we can prove : P/L = Cg× Sc Rate of change of sales (P/L) = ds/dt (s = sales, t= time) P/L = d(Cg ×dp) / dt { S=Cg×dp} P/L = Cg ×d*dp/dt {Sc = d*dp/dt} So; P/L = Cg × Sc [Cg = cost of goods, Sc = Satisfaction of customers, S = Sales, dp = demand of product] "Cost is constant only demand of product changes due to satisfaction of customers"	F = m dv/dt So, F = m a { dv/dt = a} [F = Force, a = acceleration, P= momentum , V= velocity] "Mass (m) is constant only velocity (v) changes due to force."

3rd Rule = 3rd Law

Pacioli	Newton
"Personal Account" Debit : The Receiver Credit : The Giver There are equal amount Debited and Credited in opposite direction for Receiver and Giver both.	For every action, there is an equal and opposite reaction. 

Limitations

The researcher has to face certain difficulties while he carries out the research work. This study has the following limitations

1. The responses given by the respondents were not always accurate because the respondents gave the response according to their understanding
2. Sometimes the respondents are not willing to fill the questionnaire.
3. Academic researchers studied the behaviour i.e. conceptual and book based.

Conclusion

According to the result of the test that Pacioli's and Newton's laws are more similar than any other laws. Thus from the above, we can prove that the laws of Newton and Pacioli is definitely with similar and cognitive approach. As both were the mathematician, so concept behind these laws is in the same nature.

References

1. Andrea Gianopoulos, Charles Barnett III, Phil Miller (January 1, 2007)- Isaac Newton and the Laws of Motion (Inventions and Discovery) Paperback
2. Holzner, Steven (December 2005). *Physics for Dummies*. Wiley, John & Sons, Incorporated. p. 64. ISBN 978-0-7645-5433-9.
3. Barnea, A., Ronen, J. and Sadan, S., 1976. Classificatory smoothing of income with extraordinary items, The Accounting Review, January, pp. 110-122
4. Bertolus J. 1988. L'art de truquer un bilan, Science &Vie Economie, No.40
5. Dr. S.M. Shukla (2014), "finanacial Accounting", pg-46-58.
6. S.P. Singh (2014), "Statistics- theory and Practice', pg-750-781.

Internet

1. https://en.wikipedia.org/wiki/Newton's_laws_of_motion
2. www.accountingcoach.com/blog/what-is-the-double-entry-system