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highlights

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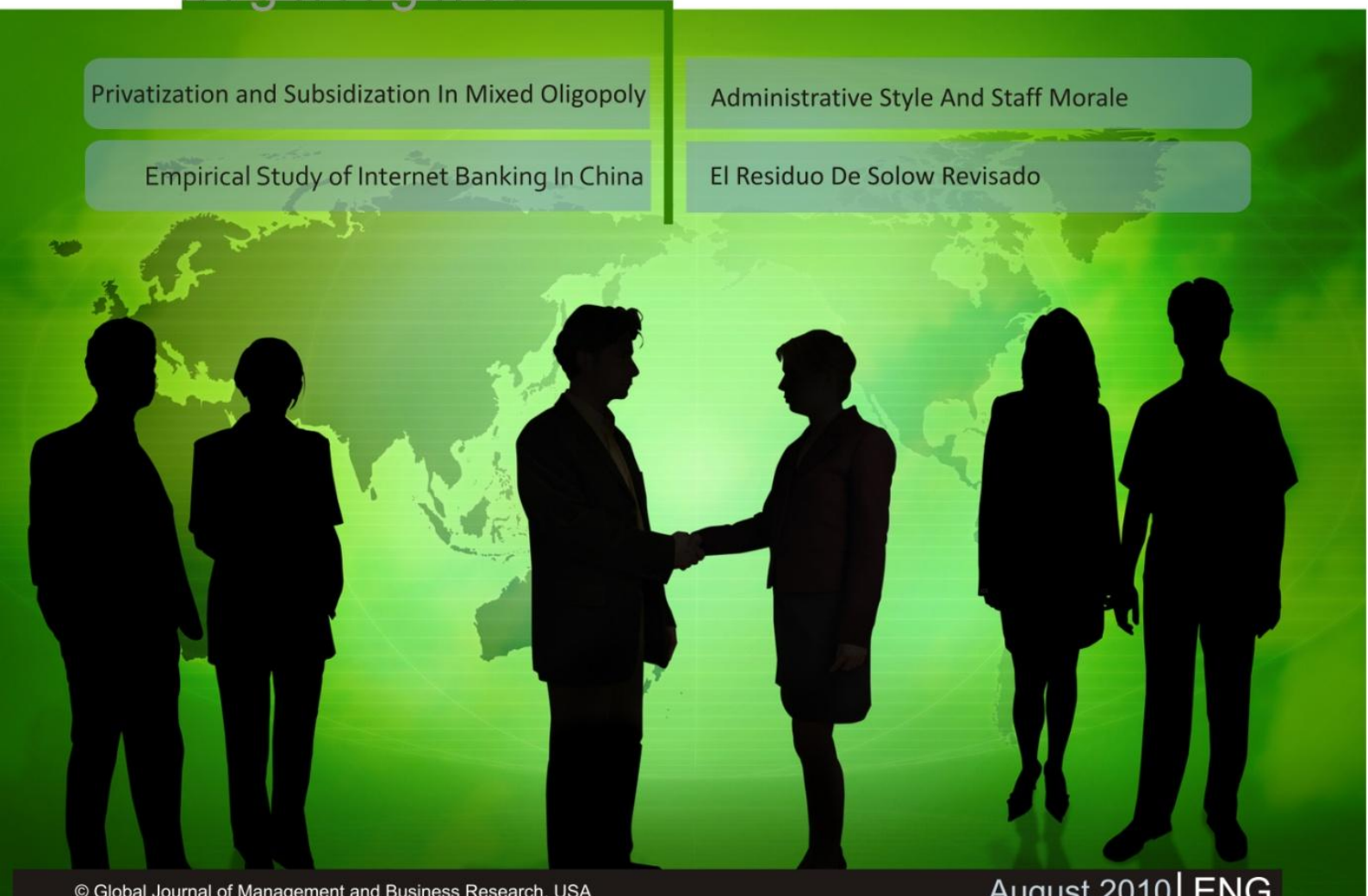

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From the Chief Author's Desk

We see a drastic momentum everywhere in all fields now a day. Which in turns, say a lot to everyone to excel with all possible way. The need of the hour is to pick the right key at the right time with all extras. Citing the computer versions, any automobile models, infrastructures, etc. It is not the result of any preplanning but the implementations of planning.

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Dependence Structure And Bivariate Loss Distributions With Copulas - An Application On Islamic And Conventional Interbank Rates

Ravindran Ramasamy[1], Mohd Hanif Mohd Helmi [2]

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Abstract- **In this article we use the time series data of daily Islamic Interbank Offered rates (IIBOR) and Conventional interbank offered rates (CIBOR) in Malaysia since 2000 to prove tail dependency. These two data streams evolve from the same economy but are priced using two diametrically opposite principles. IIBOR is more orthodox, subscribing to Islamic views that avoid coupon interest, but uses profit rate as an alternative. CIBOR uses conventional principle where the coupon rate is similar to any other country's coupon rate. These rates are computed by taking weighted average of overnight lending and borrowing among banks. We use five copulas Gaussian, t, Frank, Gumbel and Clayton to assess the tail dependency using Kendall and Spearman correlation coefficients. Our findings reveal that both IIBOR and CIBOR demonstrate poor correlation. The evidence of poor correlation implies that Islamic and Conventional interbank offered rates behave independently. Several extreme values appear in CIBOR scattered around upper and lower tails whereas the IIBOR is tightly distributed around its mean. It is an indication of a low risk nature of Islamic finance. When both the rates are tested for their dependence in tails Gaussian, t and Frank copulas do not reveal tail dependence. These copulas show uniform behaviour in tails between IIBOR and CIBOR. The Clayton copula and Gumbel copula show different results. Clayton copula indicates lower tail dependence while Gumbel copula indicates upper tail dependence. Our research paper is unique as it compares the IBORs for their tail behaviour. This tail dependence behaviour is important in pricing credit default swaps, collateralised debt obligations, and other structured finance products.**

Keywords: Islamic and conventional interbank offered rates, Copulas, Tail dependence, Marginal Distribution, uniform distribution, BASEL II

I. Introduction

The economic meltdown all over the globe which triggered financial crisis and subsequent failure of well established banks in the recent times perplexes everyone. The present economic crisis is a result of unchecked growth of subprime lending to properties, auto sectors coupled with mindless creation of credit debt obligations (CDOs) (Burtshell, 2008) in the form of structured products. The USA economy is the first to be affected and subsequently the crisis spreads to the global financial institutions due to their interconnection though they operate in different countries independently. Basel II makes it mandatory for banks to quantify risk, particularly the portfolio risk by imposing regulatory capitals that need to be maintained by banks. Basel II regulations are aimed to maintain a healthy banking system and prevent any bank failures (Basel, 2004). On the other spectrum, economists recommend even stricter supervision procedures for financial institutions since banks deal with public deposits. Prior to economic crisis, the BASEL and other stringent legislations have enhanced the confidence of the European as well as developing nations' investors to deposit their surplus funds in US banks and purchase its products especially the Collateralised Debt Obligations (CDOs). CDOs are structured finance products created by special purpose vehicles set up by parent banks. The structured finance products consist of senior tranches, junior tranches and equity tranches (Duffie, 2001). Junior and equity tranches absorb their percentage of losses followed by senior tranches which are AAA rated and ultimate bearer of any losses. Therefore, investors placed much trust on senior trenches which are deemed safe without any credit risk. However, the contrary was true. Many strong banks all over the world slipped into financial crunch due to the weaknesses in pricing CDOs, their risk assessment and its relation to other structured products. Modelling credit risk in isolation is somewhat easy where it could be quantified through cash flows of specific obligor. Therefore, default of an individual obligor inflicts less damage on lender. However, complications arise when several obligors default simultaneously in a loan portfolio, credit risk aggravates the exponentially. Severity of default losses increase not only financial damages but also affect the psyche of investors for a long time in future (Merton, 1974). One of the very important variables is term structure (yield) rate that determines any investment and financing decisions in a firm. This yield rate is significantly influenced by the by the central bank by fixing base lending rate (BLR). Any central bank will periodically adjust its BLR in line with the economic conditions prevailing in the country. The BLR is neither determined by market forces nor by demand and supply of funds required by various financial institutions. On the contrary, short-term overnight Interbank Offered Rate (IBOR) is market driven. The IBOR is the weighted average of overnight rates charged by various banks within a country when banks transfer funds among themselves. Therefore, IBOR is the preferred rate used for most of the financial decisions.

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Several Islamic countries, including Malaysia, have dual banking and financial systems operating side by side. Of late even non-Islamic countries offer two modes of financing: one is based on conventional principles and the other is on Islamic principles. The main differences between lending and borrowing rates under these two principles are tabulated below.

Table 1 Differences between conventional and Islamic rates

Parameters	Conventional Interest Rate	Islamic Yield Rate
Coupon Rate	Clearly stated	No coupon rate as Riba is prohibited in Islam
Yield Rate	Computed after taking into account fees received, risk, transaction costs and market price	Decided in the form of profit sharing ratio or marking up by a certain percent or sold at deep discount rates
Approval	No approval is needed from anyone	Appropriate Shariah council has to approve the method of finance and rate chargeable
Nature of Investments	Borrowed funds could be used for any investment purpose	Invested only in Shariah council approved schemes and projects. Investment linked to liquor, gambling, entertainment etc are prohibited in Islamic finance.
Risk Sharing	Totally borne by the borrower	Shared between the borrower and investor in the form of profit sharing ratio
Uncertain future assets (not in existence now)	Investment is allowed	Except Bai-Salam contracts future uncertain assets are not eligible for investment in Islamic finance

The present global financial crisis is due to weaknesses in assessing the yield rate commensurate with the risk in modelling joint distribution or multivariate distribution. Marginal distributions and Pearson‘s correlation coefficients are being used to capture dependence as well as to join the distributions (Clemen, 1999). However, recent studies recommend copula functions to join marginal distributions to model a joint distribution (Schweizer, 1981; Frees, 1998; Fantazzini, 2006). Two transformations of data are recommended prior to applying copula to join them (Nelson, 1993; Cherubini, 2004). Marginal delta data are to be normalised by cumulative density function since marginal not adequate for copula function. The normalised uniform data very well quantify dependency structure around tails (Fortin, 2002). Therefore, non parametric rank correlations such as Kendall‘s tau rank correlation and Spearman‘s rank correlation rho are very useful. Once the rank correlations are calculated, they are transformed into copula parameters such as Gaussian and ‗t‘ distributions. In bivariate distributions, a coupling measure alpha is used to couple instead of correlations, especially in Clayton, Frank and Gumbel Archimedean copulas (Klugman, 1999; Melchiori, 2003).Our primary focus in this paper is to investigate tail dependence between real macroeconomic variables IIBOR and CIBOR. In addition, we demonstrate the existence of relationship between IIBOR and CIBOR. This will help us to identify an appropriate copula to model any extreme events. Our aim is to illustrate the mathematical aspects of dependence structure for both marginal and uniform data. In addition we also highlight tail dependence through Kendall‘s Tau and Spearman‘s rank correlation. Finally we use IIBOR and CIBOR to show tail values through Archimedean family such as Clayton, Frank and Gumbel. Our results will be significant as we use real variables instead of simulating two uniform variables artificially to study the dependencies. This study is unique in the sense that it uses interbank offered rates of two different principles. This will help in understanding better the Islamic finance and its comparability with conventional finance operating in the same economy.

The remaining part of the paper is organised as follows. Section two investigates the existing literature in the areas of extreme values, dependence structures and copulas to understand the gap and criticisms. Section three explains the methodology adopted to estimate copulas and tail dependence. The results of analysis and their interpretations are given in section four. Section five concludes the paper.

II. Literature Review

In the last decade, many attempts were made using copulas to determine multivariate normal distribution (Marshall, 1988) to model financial risks such as market risk, credit risk (default risk) etc. Way back in 1959 Sklar demonstrated how marginal distributions could be coupled together to get joint distribution. Since then, the Sklar‘s technique is being used to model multivariate normal distributions in survival analysis as well as actuarial sciences. The structured financial products such as credit default swaps (CDS), collateralised debt obligations (CDOs) use copula based multinormal distribution to quantify default probabilities and expected losses. This technique helps in pricing default leg and in fixing premium for different tranches of a CDO.

Traditional techniques of risk quantification through Pearson correlation proved to be inadequate (Hull, 2001) in explaining the tail behaviour of financial random variables. Researchers have highlighted the weaknesses of Pearson correlation as it lacks the property of capturing curve-linear relationship and significantly affected by the extreme values (Hemantha, 2007). As an improvement, copulas are recommended since they can accommodate uniform

variables rather than financial marginal variables which are in the form of marginal returns. Financial random variables are not only non stationary but also lose the property of stability during transformation from marginal to uniform data. Taking either Kendall's tau or Spearman rank correlation coefficients the copulas join several individual normal distributions into multivariable normal distribution. Normal Gaussian copula is criticised for its failure to quantify extreme tail values (Melchiori, 2003) whereas t copula is weak in its application due to degrees of freedom. When degrees of freedom reach 30, t distribution converges to normal distribution. Strong fat tails appears for lower degrees of freedom which creates correlation smiles. It is challenging to provide correct degrees of freedom to determine accurate tail values (Daul, 2003).

Apart from Gaussian and t copulas another bivariate family of Archimedean copulas are recommended as the solution to rectify any weaknesses found in the previous copulas (Genest, 1993). Clayton, Frank and Gumbel copulas are applied to study tail dependence present in financial variables. These copulas are suitable for bivariate distributions like IIBOR and CIBOR. To prove tail dependent behaviour, prior studies use Monte Carlo simulation technique to generate random normal data artificially (Hull J. a., 2004). The main theme of these Archimedean copulas is to prove that they capture the tail dependence and asymptotic behaviour of uniform variables well. Therefore it is tried in IIBOR and CIBOR, avoiding artificial data.

III. Methodology and Data

The algorithm pertaining to computation of various parameters of copula is explained below. Our objective is to observe tail dependence in time series data especially when these data are extracted from same economy with the same objective and aim. The IIBOR and CIBOR fit our expectation excellently well. Previous studies have shown tail dependence behaviour through Monte Carlo Simulated data which are artificial random variables. In this study, joint probability distribution is estimated using five copula functions: Gaussian, ‗t', Clayton, Frank and Gumbel. The Gaussian and ‗t' copulas could accommodate multivariate copula parameters rho to form a joint probabilities distribution whereas the Archimedean copulas can accommodate only bivariate data. The Pearson's correlation coefficients hitherto used to join the probability distributions are linear therefore lacks the property of capturing nonlinear dependence. In addition when data is transformed from marginal to uniform returns the results are not stable. To overcome this problem, Kendall's Tau and Spearman's rank correlation are used to study the dependence.

The following algorithm is employed to obtain the upper and lower tail values. In the beginning, the time series data of IIBOR and CIBOR are converted to returns, hence marginal data is derived. The purpose of this process is to convert data into stationary form, as non-stationary data will have properties of varying mean that keeps changing along with time. In addition the corresponding mean square error also keeps changing which will be unsuitable for statistical analysis (Kumar, 2004). Let X_n and Y_n be the IIBOR and CIBOR time series respectivelyBoth the time series are differentiated with respect to time to get returns

Set $R_x = \frac{dx}{dt}$, $R_x = (r_{x1}, r_{x2},...,r_{xn})^T$

Set $R_y = \frac{dy}{dt}$, $R_y = (r_{y1}, r_{y2},...,r_{yn})^T$

R_x = Islamic Returns
R_y = Conventional Returns

From IIBOR and CIBOR returns (Rx and Ry) basic statistical parameters such as Mean, Standard Deviation, Minimum and Maximum rates, Skewness and Kurtosis have been computed. The results will be used to observe distribution patterns and understand properties of interbank yield rates. In addition, IIBOR and CIBOR returns are used to compute frequency distribution by converting them into histograms to visually observe the behaviour of the returns. Bivariate Pearson's product moment correlation coefficient is also computed from the above marginal data to prove the stability while transforming the data from marginal to uniform.

Pearson Correlation coefficient:

$$\boldsymbol{R_P} = \frac{\sum_{t=1}^{N}(x_i - x)(y_i - y)}{N\sigma_x\sigma_y}$$

The rank correlation Kendall's tau based on the principles of concordance and discordance of pairs of data and the Spearman Rank correlation which is based on ranks between pairs of the above return are computed to prove their stability while transforming the data.

Kendall's tau coefficient:

$$\boldsymbol{R_K} = \frac{\sum_{i<j} sign\,(x_i - x_j)(y_i - y_j)}{0.5 * n(n-1)}$$

Spearman's rank correlation coefficient:

$$\boldsymbol{R_S} = 1 - \frac{6\ d_i^2}{n(n^2-1)}$$

Marginal returns of IIBOR and CIBOR were transformed into uniform returns through cumulative normal density (CDF) function. The above conversion is done to transform the data uniform between 0 and 1.

$Z_x = (z_{x1}, z_{x2},..., z_{xn})^T$ $\quad Z \sim N(0,1)$

IIBOR uniform returns

$Z_y = (z_{y1}, z_{y2},..., z_{yn})^T$ $\quad Z \sim N(0,1)$

CIBOR uniform returns

We have repeated the computation of linear Pearson's product moment correlation, Kendall's Tau and Spearman's rank correlation to test the behaviour of the transformed data to observe whether the transformed data produce the same correlation coefficient.

The tail dependencies are evaluated through copula parameters. To determine copula parameter values we use

rho for Gaussian Copula and ‗t' Copulas as in Andersen (2005). For Archimedean family of copulas we use theta Clayton, Frank and Gumbel as in Melchiori (2003).

To compute the copulas parameter under quadrature phase the following formulae to Kendall tau and Spearman rank correlations are applied.

$$\rho_K = \sin\frac{\pi}{2} * R_{k\ x,y}$$

$$\rho_S = 2 * \sin\frac{\pi}{6} * R_{s\ x,y} \quad 1$$

ρ_k = Kendall tau copula parameter

ρ_s = Spearman copula parameter

Archimedean copula parameter theta (θ) is unique which is computed as follows for Clayton and Frank copulas. The Clayton copula is positive dependent if $\theta > 0$ whereas the Frank copula may be positive or negative depending on the level of .

$$\theta_K = \frac{2R_K}{1 - R_K}$$

$$\theta_S = 2q/(1-q)$$

θ_k = Kendall tau copula parameter

θ_s = Spearman copula parameter

We use equation 11 to compute variable q using Monte Carlo simulation method since there is no closed form of solution for Spearman rank correlation.

The Gumbel copula is positive if $\theta > 1$. The Gumbel Copula parameter theta is computed as follows.

$$\theta_K G = 1/(1 - R_K)$$

$$\theta_S G = 1/q$$

θ_k = Kendall tau copula parameter

θ_s = Spearman copula parameter

We proceed to test how pairs of interbank yield rates behave at the extremes when the limits touch upper level and lower level (1 and 0). The upper tail dependence occurs when the pairs of returns jointly move at the first quadrant. When the pairs of return rates jointly move in the third quadrant, lower tail dependence appears. When both tail values changes equally, then there is no tail dependence in either direction. However, when the tail values are disproportionate either in upper or lower tails, then tail dependence arises. If the tail value difference is zero then both the distributions are deemed to be independent. To compute the tail values, the following formulae are applied.

$$\lambda_{upper} = \lim_{u\to 1} Pr\ Y \geq F_Y^{-1}\ u\ |X \geq F_x^{-1}(u)$$

equivalently

$$\lambda_{upper} = \lim_{u\to 1} \frac{1 - 2u + C(u,u)}{1-u}$$

Similarly the lower tail values for limit zero could be found using the following formula.

$$\lambda_{lower} = \lim_{u\to 0} Pr\ Y \leq F_Y^{-1}\ u\ |X \leq F_x^{-1}(u)$$

equivalently

$$\lambda_{lower} = \lim_{u\to 0} \frac{C(u,u)}{u}$$

λ = 1 if x =1 Tail-independent

We used the above methodology to compute tail values in different correlations and copulas. The rates will be efficiently priced, meaning that the rates will be efficient and there will be no larger deviations from each other. Larger deviations will lead to arbitrage and speculation. With this idea in mind, we have collected IIBOR and CIBOR from Bank Negara Website from January 2000 to November 2008. We could get 2573 daily rates, when differentiated for the change in rates we get 2572 data pairs. We compute all parameters discussed above and present the results in the following section.

IV. Analysis and Interpretation

Tail dependence is an important area of study, especially in the recent context of global financial crisis. The analysis and results of Interbank offered rates of IIBOR and CIBOR are reported in the following tables.

Table 2 Descriptive Statistics of IIBOR and CIBOR

	IIBOR	CIBOR
Average Returns	0.027	0.028
Standard Deviations	1.635	4.268
Maximum	27	58
Minimum	-24	-88
Skewness	1.586	-2.432
Kurtosis	90.580	112.691

The mean returns of IIBOR and CIBOR show a meagre difference of 0.001%. The average CIBOR is slightly higher than IIBOR. The variation in terms of standard deviations of CIBOR is greater than IIBOR with a significant difference of more than 2.5 times. The tight distribution shown by the IIBOR reveals its lesser variability among the interbank

market. The maximum return of CIBOR is more than double when compared to IIBOR and the minimum return differs by almost 350%. The Skweness demonstrates the distribution's tail pattern. The IIBOR is slightly right skewed which reveals more positive returns whereas the CIBOR reveals a negative skew depicting more negative returns in the interbank market. The Kurtosis coefficient is the peakedness of the distribution. The IIBOR distribution is flatter than the CIBOR. IIBOR's Kurtosis value is 90.58 and CIBOR's value is 112.69. Both the distributions are leptokurtic.

The frequency distribution of both IIBOR and CIBOR are presented in table three. A closer observation reveals that the IIBOR for 2545 days has zero return while CIBOR shows zero return for 2416 days. Among IIBOR and CIBOR, only CIBOR changes frequently.

Table 3 Frequency Distributions of IIBOR and CIBOR

Bins	IIBOR	IIBOR %	CIBOR	CIBOR %
-90	0	0	1	0.0
-80	0	0	0	0
-70	0	0	0	0
-60	0	0	0	0
-50	0	0	1	0.0
-40	0	0	1	0.0
-30	0	0	5	0.2
-20	3	0.1	8	0.3
-10	9	0.3	56	2.2
0	2545	99.00	2416	93.9
10	10	0.4	65	2.5
20	4	0.2	12	0.5
30	1	0	3	0.1
40	0	0	3	0.1
50	0	0	0	0
60	0	0	1	0.0
Total	2572	100	2572	100

Negative returns are observed for 72 days for CIBOR, whereas IIBOR shows a negative return for only 12 days in the immediate two bins. An extreme return in CIBOR is in the last bin (-90), this causes the tail. On the positive side, IIBOR shows a positive return for 15 days in three bins, while the CIBOR spreads not only up to 60th bin but also in larger number of days, to be precise 84 days. In percentage terms the IIBOR does not vary much and 99% of days there was no change in the rates. In the case of CIBOR 93% of days it shows zero returns. The rates spread 2.2% and 2.54% in the negative and positive directions respectively. All these reveal that IIBOR is stable and does not have fat tails though it shows a higher and a thin peak. In contrast CIBOR exhibits more variability and also exhibit fat tail in both positive and negative directions.

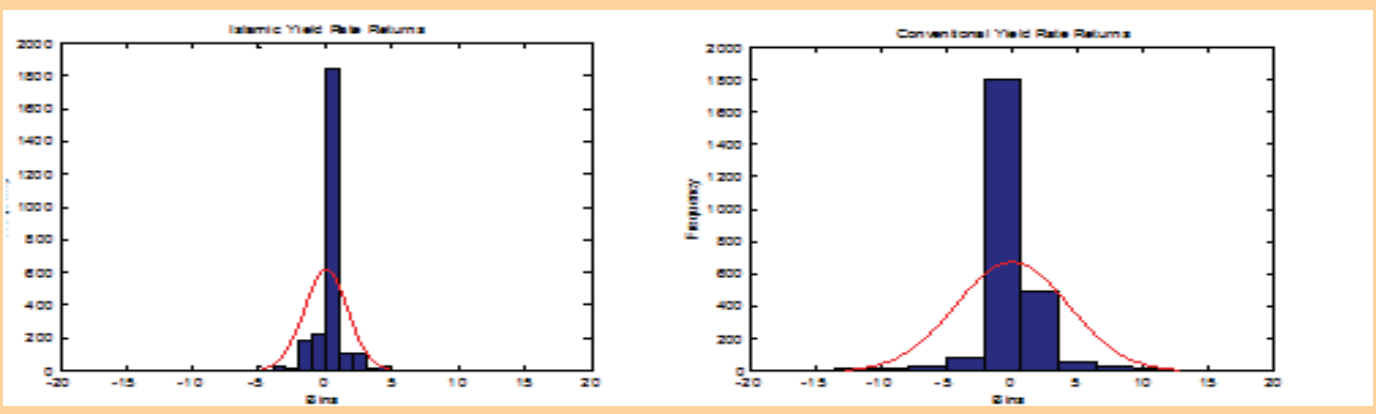

Figure: 1a. Distribution of IIBOR, 1b. Distribution of CIBOR

Figure 1a and 1b show the distribution pattern discussed above. IIBOR just spreads between -10 and 10 bins whereas CIBOR spreads between -20 and 20 bins meaning that CIBOR has more fat tail behaviour than IIBOR.

Table 4 Normal Cumulative Distribution Functions of IIBOR and CIBOR - Uniform Variables [0,1]

Days	IIBOR Marginal	IIBOR uniform	CIBOR Marginal	CIBOR uniform
1	0	0.5	0	0.5
2	0	0.5	0	0.5
3	0	0.5	0	0.5
4	0	0.5	0	0.5
5	0	0.5	0	0.5
6	0	0.5	0.07	0.528
7	0	0.5	-0.06	0.476
8	0	0.5	0.09	0.536
9	0	0.5	0.2	0.579
10	0	0.5	-0.11	0.456
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
2568	-1	0.1587	0.1	0.54
2569	0	0.5	-0.25	0.401
2570	0	0.5	-0.1	0.46
2571	0	0.5	0	0.5
2572	0	0.5	0	0.5

The above table gives the overview of conversion of marginal returns to uniform returns useful in finding Kendall's tau and Spearman's rank to compare against the Pearson correlation for their stability property.

Using both marginal and uniform data, we have calculated Pearson product moment correlation, Kandall's Tau Rank correlation and Spearman's rank correlation. The results are reported in table 5 below.

Table 5 Correlation coefficients between IIBOR and CIBOR marginal and uniform data

	Marginal data		Gauss - Uniform data [0,1]	
Pearson's Correlation	1	0.0057	1	0.0183
	0.0057	1	0.0183	1
Kendall Tau	1	0.0145	1	0.0145
	0.0145	1	0.0145	1
Spearman Rho	1	0.0173	1	0.0173
	0.0173	1	0.0173	1

Pearson correlation coefficient is positive with 57 points in marginal data which is deemed as very poor correlation. When marginal data is converted to uniform data, the results show a higher correlation coefficient with a positive value of 183 points. This is a clear indication that transformation of data from marginal to uniform produces different correlation coefficient value. This type of changes in correlation coefficient leads to different dependence structures when the data was transformed. Kendall's Tau correlation coefficient is computed for both marginal and uniform data. It is Interesting to note that the correlation coefficients for marginal data and uniform data yield the same positive coefficient of 145 points. Similar pattern is noted in Spearman rank correlation which also shows a coefficient Rho of positive 173 points. Therefore, Tau and Rho coefficients are deemed better in capturing dependence structure. The stable correlation coefficient will be ideal for joining distributions using copulas to generate multivariate distribution.

The marginal data again transformed by using Gamma _t' distribution instead Gaussian as t distribution captures the fat tails efficiently. All three correlation coefficients are computed using Gamma transformed uniform data.

Table 6 Correlation coefficients between IIBOR and CIBOR marginal and Gamma ‚t' uniform data

	Marginal Data		Gamma _t' Uniform data [0,1]	
Pearson Correlation	1	0.0057	1	0.0183
	0.0057	1	0.0183	1
Kendall Tau	1	0.0145	1	0.0135
	0.0145	1	0.0135	1
Spearman Rho	1	0.0173	1	0.0159
	0.0173	1	0.0159	1

Kendall's tau and Spearman correlation coefficients have declined for _t' transformed data. For Gaussian data the transformation produced the same correlation coefficients under Kendall and Spearman but in gamma transformed data the results differ. Kendall's tau value declines from 145 to 135 points and similarly for Spearman rho the coefficients slipped from 173 to 159 points. The results are unstable. Therefore the gamma transformation is not suitable in studying the tail values.

The Pearson correlation coefficient is not stable while transforming and hence unsuitable to study the tail dependency. The Kendall tau and Spearman correlations are used to estimate the dependent structure. The upper tail values computed with different copulas are given below with associated probabilities. To compute the upper tail values we use Kendall's tau rank correlation first and later othercoefficients

Table 7 Upper Tail dependence IIBOR and CIBOR - Kendall's Tau

Tau	**0.0145**							
Rho	0.0228							
U→ 1	0.9900	0.9925	0.9950	0.9975	0.9990	0.9995	0.9999	0.99995
$C_{Gaussian}(u,u)$	0.9801	0.9851	0.9900	0.9950	0.9980	0.9990	0.9998	0.9999
λ_{Upper}	*0.0117*	*0.0089*	*0.0060*	*0.0031*	*0.0013*	*0.0007*	*0.0001*	*0.0001*
Nu	7							
$C_{t'}(u,u)$	0.9806	0.9854	0.9902	0.9951	0.9980	0.9990	0.9998	0.9999
λ_{Upper}	*0.0569*	*0.0530*	*0.0484*	*0.0425*	*0.0372*	*0.0344*	*0.0303*	*0.0291*
Theta	0.0294							
$C_{Clayton}(u,u)$	0.9801	0.9851	0.9900	0.9950	0.9980	0.9990	0.9998	0.9999
λ_{Upper}	*0.0103*	*0.0077*	*0.0051*	*0.0026*	*0.0010*	*0.0005*	*0.0001*	*0.0001*
Theta	0.0294							
$C_{Frank}(u,u)$	0.9801	0.9851	0.9900	0.9950	0.9980	0.9990	0.9998	0.9999
λ_{Upper}	*0.0101*	*0.0076*	*0.0051*	*0.0025*	*0.0010*	*0.0005*	*0.0001*	*0.0001*
Theta	1.0147							
$C_{Gumbel}(u,u)$	0.9803	0.9852	0.9901	0.9951	0.9980	0.9990	0.9998	0.9999
λ_{Upper}	*0.0297*	*0.0273*	*0.0249*	*0.0224*	*0.0210*	*0.0205*	*0.0201*	*0.0200*

A closer observation of the above results in Table 7 highlights almost similar tail dependence measures for normal, Clayton and Frank copulas where their values decrease in meagre negligible quantities when the tail probabilities increase from 99% to upper limit of one. The t distribution and the Gumbel tail dependencies show different patterns with a higher tail values. The t distribution tail dependency value starts at 5.69% and gradually decreases and touches 2.91% at the highest probability. A descending pattern is noted in Gumbel tail value where it dropped from 2.97% to 2%. The arbitrary degrees of freedom of seven chosen to compute t dependent values contribute to a higher tail value in t distribution. The lower degrees of freedom produce higher values in tails and vice versa. At 30 degrees of freedom the t values converge with Gaussian values.

Table 8 shows the tail values when the same test was performed using Spearman's rank correlation. These results are similar to Kendall's tau rank correlation with almost same values for all the copulas.

Table 8 Upper Tail dependence IIBOR and CIBOR – Spearman Rank Correlation

Spearman	**0.0173**							
Rho	0.0181							
U → 1	*0.9900*	*0.9925*	*0.9950*	*0.9975*	*0.9990*	*0.9995*	*0.9999*	*0.99995*
C Gaussian (u,u)	0.9801	0.9851	0.9900	0.9950	0.9980	0.9990	0.9998	0.9999
λ Upper	*0.0114*	*0.0086*	*0.0058*	*0.0030*	*0.0012*	*0.0006*	*0.0001*	*0.0001*
Nu	7							
C 't' (u,u)	0.9806	0.9854	0.9902	0.9951	0.9980	0.9990	0.9998	0.9999
λ Upper	*0.0560*	*0.0521*	*0.0476*	*0.0418*	*0.0366*	*0.0338*	*0.0297*	*0.0286*
Theta	0.0334							
C Clayton (u,u)	0.9801	0.9851	0.9900	0.9950	0.9980	0.9990	0.9998	0.9999
λ Upper	*0.0103*	*0.0077*	*0.0052*	*0.0026*	*0.0010*	*0.0005*	*0.0001*	*0.0001*
Theta	0.0334							
C Frank (u,u)	0.9801	0.9851	0.9900	0.9950	0.9980	0.9990	0.9998	0.9999
λ Upper	*0.0102*	*0.0076*	*0.0051*	*0.0025*	*0.0010*	*0.0005*	*0.0001*	*0.0001*
Theta	1.0071							
C Gumbel (u,u)	0.9802	0.9851	0.9901	0.9950	0.9980	0.9990	0.9998	0.9999
λ Upper	*0.0195*	*0.0171*	*0.0146*	*0.0121*	*0.0107*	*0.0102*	*0.0098*	*0.0097*

The Gumbel copula computed with Kendall's tau starts from 0.0297 at a tail level of 0.99 and ends at 0.0200 for a limit level close to one in probability. As for the Spearman rank correlation, the copula tail value starts at 0.0195 at a tail level of 0.99 probability and ends at 0.0097 for the highest limit level of one. From the above results it is noted that the copulas do not show any upper tail dependence.

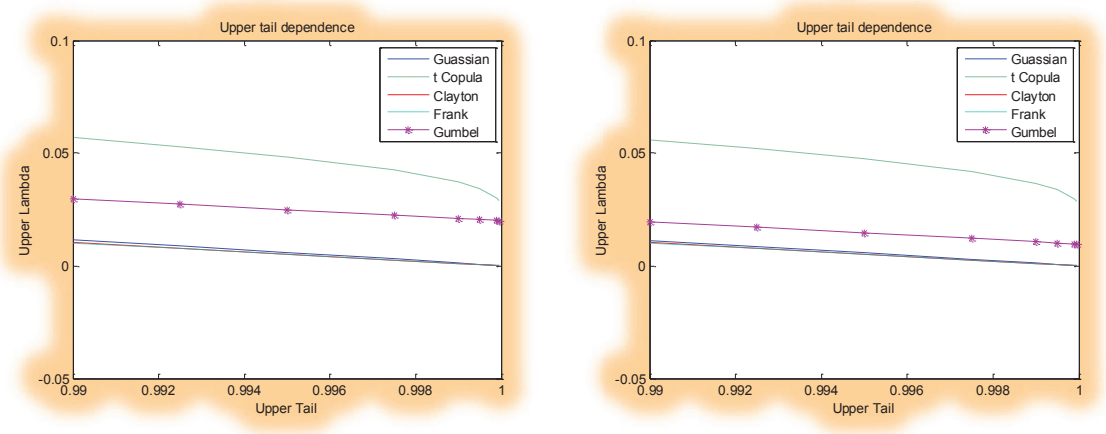

Figure: 2a Kendall Tau – Upper tail dependence, 2b Spearman rank correlation – Upper tail dependence

The figures 2a and 2b given above illustrate the upper tail dependencies. Figure 2a shows the tail dependency for Kendall's tau and 2b displays the Spearman's upper tail dependency. The results are almost similar except for Gumbel copula. The upper tail dependency in t copula is far higher than other copulas. This is due to the subjective degrees of freedom chosen to compute tail dependency. If the degrees of freedom are close to 30 the t distribution becomes Gaussian normal distribution, when the degrees of freedom are close to one, then the distribution shows heavy tail distribution. At degrees of freedom of seven the t distribution shows a higher tail value. The t results are almost same in both Kendall and Spearman correlations. There is no upper tail dependency in copulas except the Gumbel copula, which is also meagre.

Table 9 Lower Tail dependence IIBOR and CIBOR – Kendall's Tau

Tau	**0.0145**							
Rho	0.0228							
U → 0	*0.0100*	*0.0075*	*0.0050*	*0.0025*	*0.0010*	*0.0005*	*0.0001*	*0.00005*
C *Gaussian (u,u)*	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0117*	*0.0089*	*0.0060*	*0.0031*	*0.0013*	*0.0007*	*0.0001*	*0.0001*
Nu	7							
C *'t' (u,u)*	0.0006	0.0004	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0569*	*0.0530*	*0.0484*	*0.0425*	*0.0372*	*0.0344*	*0.0303*	*0.0291*
Theta	0.0294							
C *Clayton (u,u)*	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0173*	*0.0139*	*0.0102*	*0.0061*	*0.0032*	*0.0020*	*0.0007*	*0.0005*
Theta	0.0294							
C *Frank (u,u)*	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0101*	*0.0076*	*0.0051*	*0.0025*	*0.0010*	*0.0005*	*0.0001*	*0.0001*
Theta	1.0147							
C *Gumbel (u,u)*	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0110*	*0.0083*	*0.0056*	*0.0028*	*0.0011*	*0.0006*	*0.0001*	*0.0001*

The lower tail dependency computed through Kendall's Tau rank correlation between IIBOR and CIBOR is given in the above table. The lower tail dependency is also similar to the upper tail dependency. The Gaussian, t and Frank tail dependencies are exactly the same as in the upper tail dependence. The Archimedean copulas of Clayton and Gumbel show slight difference. The t copula's tail difference is greater as the degrees of freedom is taken arbitrarily as seven.

Table 10 Lower Tail dependence IIBOR and CIBOR – Spearman Rank Correlation

Tau	**0.0173**							
Rho	0.0181							
U → 0	*0.01*	*0.0075*	*0.005*	*0.0025*	*0.001*	*0.0005*	*0.0001*	*0.00005*
C *Gaussian (u,u)*	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0114*	*0.0086*	*0.0058*	*0.003*	*0.0012*	*0.0006*	*0.0001*	*0.0001*
Nu	7							
C *'t' (u,u)*	0.0006	0.0004	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.056*	*0.0521*	*0.0476*	*0.0418*	*0.0366*	*0.0338*	*0.0297*	*0.0286*
Theta	0.0334							
C *Clayton (u,u)*	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0185*	*0.0149*	*0.0111*	*0.0068*	*0.0037*	*0.0023*	*0.0009*	*0.0006*
Theta	0.0334							
C *Frank (u,u)*	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0102*	*0.0076*	*0.0051*	*0.0025*	*0.001*	*0.0005*	*0.0001*	*0.0001*
Theta	1.0071							
C *Gumbel (u,u)*	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
λ *Lower*	*0.0105*	*0.0079*	*0.0053*	*0.0026*	*0.0011*	*0.0005*	*0.0001*	*0.0001*

The Spearman's rank correlation is taken as the basis to compute lower tail dependence and the results are given in Table 10. The pattern in tail dependence is exactly same as shown by the Kendall's tau. The value of degrees freedom which is seven causes the t distribution values to be high.

Except for Clayton's and Gumbel copulas, the other copulas generate same results both in Kendall's tau and in Spearman's rank correlation. The figures given below show the position very clearly.

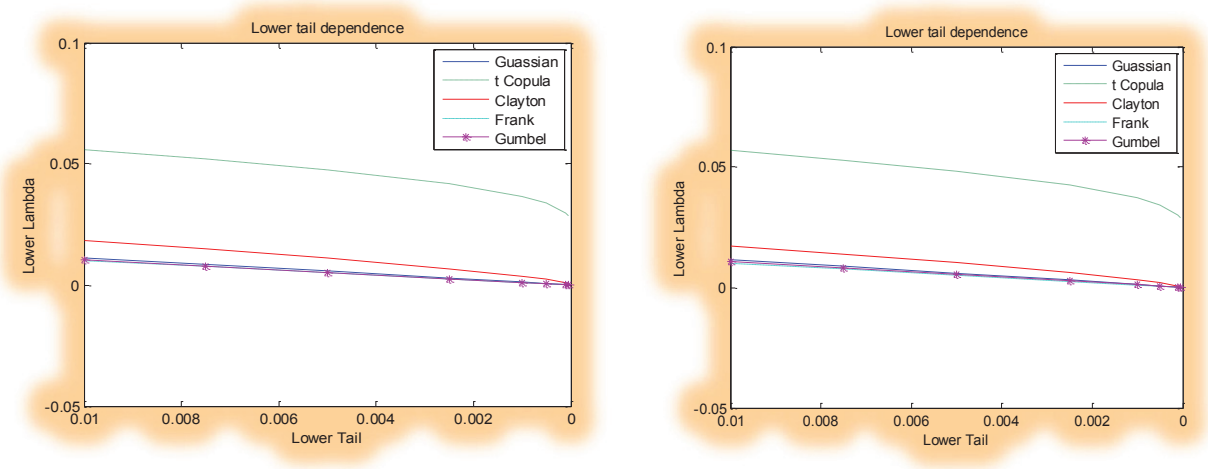

Figure: 3a Kendall Tau – Lower tail dependence, 3b Spearman rank correlation – Lower tail dependence

In figure 3a, it could be observed that for all copulas, except t copula, the lower tail values converge towards the lower limit of zero. The t tail value is high because of small degrees of freedom. When the degrees of freedom approach to 30 the t tail value moves closer to normal. The same pattern appears in Spearman rank correlation also.

Kendall's tau and Spearman's rank copula values are tabulated to find the deviation in upper and lower tail values. The results are presented in Tables 11 and 12.

Table 11 Deviation between upper and lower tail values IIBOR and CIBOR – Kendall's tau

Gaussian		t		Clayton		Frank		Gumbel	
Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
0.0117	0.0117	0.0569	0.0569	0.0103	0.0173	0.0101	0.0101	0.0297	0.0110
0.0089	0.0089	0.0530	0.0530	0.0077	0.0139	0.0076	0.0076	0.0273	0.0083
0.0060	0.0060	0.0484	0.0484	0.0051	0.0102	0.0051	0.0051	0.0249	0.0056
0.0031	0.0031	0.0425	0.0425	0.0026	0.0061	0.0025	0.0025	0.0224	0.0028
0.0013	0.0013	0.0372	0.0372	0.0010	0.0032	0.0010	0.0010	0.0210	0.0011
0.0007	0.0007	0.0344	0.0344	0.0005	0.0020	0.0005	0.0005	0.0205	0.0006
0.0001	0.0001	0.0303	0.0303	0.0001	0.0007	0.0001	0.0001	0.0201	0.0001
0.0001	0.0001	0.0291	0.0291	0.0001	0.0005	0.0001	0.0001	0.0200	0.0001
	0.0000		0.0000		-0.0070		0.0000		0.0187
	0.0000		0.0000		-0.0062		0.0000		0.0190
	0.0000		0.0000		-0.0051		0.0000		0.0193
	0.0000		0.0000		-0.0035		0.0000		0.0196
	0.0000		0.0000		-0.0022		0.0000		0.0199
	0.0000		0.0000		-0.0015		0.0000		0.0199
	0.0000		0.0000		-0.0006		0.0000		0.0200
	0.0000		0.0000		-0.0004		0.0000		0.0199

The upper and lower tail dependencies are exactly the same for Gaussian, t and Frank copulas. The Clayton copula gives rise to negative values when the lower tail values are greater than the upper tail values. In the case of Gumbel copula the results show opposite pattern where the upper tail dependence values are greater than the lower tail dependence values. The Clayton copula differences increase from -0.0070 and touches -0.0004 when the limits reach one for upper tail and zero for lower tail. The differences gradually decrease and disappear and the values converge to zero. In contrast, the Gumbel copula tail values do not converge but they show almost the same gap. The differences are more or less the same.

Table 12 Deviation between upper and lower tail values IIBOR and CIBOR – Spearman's correlation

Gaussian		t		Clayton		Frank		Gumbel	
Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
0.0114	0.0114	0.0560	0.0560	0.0103	0.0185	0.0102	0.0102	0.0195	0.0105
0.0086	0.0086	0.0521	0.0521	0.0077	0.0149	0.0076	0.0076	0.0171	0.0079
0.0058	0.0058	0.0476	0.0476	0.0052	0.0111	0.0051	0.0051	0.0146	0.0053
0.0030	0.0030	0.0418	0.0418	0.0026	0.0068	0.0025	0.0025	0.0121	0.0026
0.0012	0.0012	0.0366	0.0366	0.0010	0.0037	0.0010	0.001	0.0107	0.0011
0.0006	0.0006	0.0338	0.0338	0.0005	0.0023	0.0005	0.0005	0.0102	0.0005
0.0001	0.0001	0.0297	0.0297	0.0001	0.0009	0.0001	0.0001	0.0098	0.0001
0.0001	0.0001	0.0286	0.0286	0.0001	0.0006	0.0001	0.0001	0.0097	0.0001
	0.0000		0.0000		-0.0082		0.0000		0.0090
	0.0000		0.0000		-0.0072		0.0000		0.0092
	0.0000		0.0000		-0.0059		0.0000		0.0093
	0.0000		0.0000		-0.0042		0.0000		0.0095
	0.0000		0.0000		-0.0027		0.0000		0.0096
	0.0000		0.0000		-0.0018		0.0000		0.0097
	0.0000		0.0000		-0.0008		0.0000		0.0097
	0.0000		0.0000		-0.0005		0.0000		0.0096

In Spearman Rank correlation also the results of tail value differences show exactly the same pattern as is in Kendall's tau. The Gaussian, t and Frank copulas do not show any difference while Clayton copula shows negative increasing lower tail values starting from -0.0082 and ending at -0.0005. They gradually converge to zero at the upper limit and lower limit values of one and zero respectively. The Gumbel tail difference values are positive and stable around 0.0095. The Gumbel tail values do not converge at the limits.

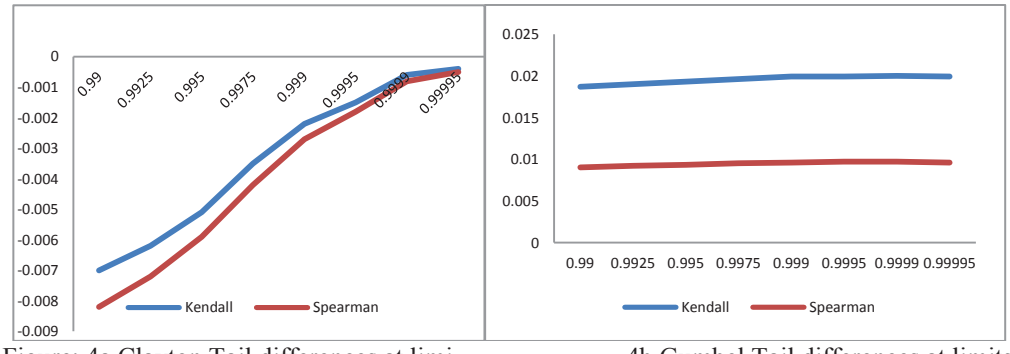

Figure: 4a Clayton Tail differences at limi 4b Gumbel Tail differences at limits

The above figures show the convergence of value of tail differences. The first figure 4a shows the tail differences of Clayton copula. The tail values converge to zero in Kendall and Spearman coefficient values. In the case of Gumbel

copula figure 4b the tail differences do not converge but they go in parallel between Kendall and Spearman rank correlations. Kendall's Tau values are higher when compared to Spearman's values.

V. Conclusion

Tail dependence is vital for estimating probabilities of extreme values, quantifying joint and multivariate distributions. The issuance of subprime loans and unregulated CDOs led to global financial crisis. Presently investors go in for indirect portfolios meaning the reference assets' structured products. The quantification of the reference assets' joint multivariate probability of default requires the individual default distributions to be coupled. While coupling the default distributions, ordinary Pearson correlation coefficient is insufficient as it lacks the property of dependence when data is transformed from marginal to uniform. Copulas are becoming popular which use cross correlations for the above purpose. Previous studies prove or disprove the tail dependency by Monte Carlo simulated random data. We overcome this weakness by taking IIBOR and CIBOR as random variables to prove dependence structure.

We proved the instability of Pearson Correlation coefficient when marginal data is transformed to uniform, while Kenal's tau and Spearman rank correlation coefficients are stable. Secondly the IIBOR and CIBOR are two independent random variables with little correlation, though they operate in the same economy serving same purpose. We tested the tail dependencies by taking Kendall's tau and Spearman's rank correlation with support of five copulas such as Gaussian, t, Clayton, Frank and Gumbel. The Gaussian, t and Frank copulas neither show upper nor lower tail dependence. They have equal values in upper and lower tails. These copulas fail to capture the extreme risks present in financial assets. The Clayton copula produces higher values in lower tail than in upper tail indicating lower tail dependence. The Gumbel copula shows diametrically opposite result to Clayton copula. The upper tail values are more than the lower tail values thus indicating the upper tail dependence. Kendall's tau and Spearman correlations' tail values converge gradually to zero. The Gumbel copula tail values move parallel to each other in Kendall's tau and Spearman correlations. For a bivariate data like the IIBOR and CIBOR Gumbel copula will be a better choice to get joint distribution for risk management purposes.

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Privatization And Subsidization In Mixed Oligopoly

GJMBR Classification
FOR:140202,140219
JEL:L33,R13,H25,H32

Dr. Najiba Benabess

Abstract-**This paper investigates the impact of privatization on social welfare in the presence of subsidy. White (1996), Poyago-Theotoky (2001) and Myles (2002) prove that equilibrium output level and all firms' profits and social welfare are identical before and after privatization of a public firm in a mixed oligopolistic market. While Pal and White (1998) prove that where there is subsidy, privatization increases welfare in a Cournot model, I show that when the public firm is the Stackelberg leader, privatization does not increase the social welfare even if there is a subsidy.**

I. Introduction

Recently a number of papers have studied —mixed markets" in which public and private firms compete. These studies assume that the public firm maximizes social welfare, defined as the sum of consumer surplus and firm profits while the private firm maximizes its own profit. Under these assumptions, the existing work has investigated the consequences of privatization. DeFraja and Delbono (1989) shows that privatization of the public firm is desirable in terms of social welfare when the number of existing private firms is large. Governmental interventions such as a production subsidy are considered, however, this is not always true. By using simultaneous-moves oligopoly, White (1996) showed privatization of the public firm is fruitless because if the subsidy is utilized, then under the optimal output subsidy, all firms‘ output, profits and social welfare are identical before and after privatization of the public firm. Also, Poyago-Theotoky (2001) and Myles (2002) show that the optimal output subsidy is identical and profits, outputand social welfare are also identical irrespective of whether (i) the public firm moves simultaneously with the private firms or (ii) the public firm acts as a Stackelberg leader or (iii) all firms behave as profit-maximizers. These are called ‗irrelevance results.‘ By organizing these cases, it appears that there is one missing case which is the Stackelberg model (table 1). This paper fills the gap in this literature by investigating the impact of privatization on welfare when the public firm is a Stackelberg leader in the presence of subsidy. This paper is organized as follows: section 2 covers the model. Section 3 presents the effect of privatization on welfare, and section 4 concludes this paper.

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II. Model

There is an industry composed of *m* private firms and one domestic public firm producing a homogenous good. The outputs of the private firms are denoted $q_i, i = 1,\ldots m$ and that of the public firm by q_0 . And *n* is the number of foreign private firms which makes *m+n+1* the total firms. In addition foreign and domestic products are perfect substitutes and transportation costs are zero.

The total output, the cost function, the demand function, the social welfare and the private and public firms profit are presented below:

$$Q = q_0 + \sum_{i=1}^{m} q_i + \sum_{j=1}^{n} qj \,.$$

$$C(q) = c + (1/2)kQ^2 \quad \text{Where } k>0$$

$$D = a - Q; \;\; a > 0.$$

The profit of the public firm, the profit of the private domestic firms and welfare are as follows:

$$pr_0 = (a - q_0 - mq_i - nqf)q_0 - c - (1/2)kq_0^{\,2} + sq_0$$

$$pr_i = pq_i - c - (1/2)kq_i^{\,2} + sq_i$$

The domestic government announces the level of domestic production subsidy *s* per unit of output provided to the domestic private and public firms. The announced subsidy acts as a commitment for the rest of the game. Thus the government can influence the output of the firms through the chosen level of subsidy. The government‘s objective is to set the subsidy optimally to maximize either the domestic welfare or the public firm‘s profit if it is privatized.

III. The Effect of Subsidization on Privatization

In this section, I examine the effect of subsidizing domestic market on the decision to privatize a public firm under leadership.

Table 1 collects the results that have been done on the influence of privatization on welfare and shows the missing case that has not been done.

Pal and White (1998) showed that in the presence of domestic production subsidies privatization always increases welfare under Cournot competition. Sepahvand (2004) showed that if the domestic market is open to foreign competition and the government of the home country uses a subsidy to the production of the domestic private firms

optimally before and after privatization, the equilibrium levels of the optimal subsidy and welfare are identical irrespective of whether i) firms are involved in a public firm Stackelberg leadership game in a mixed market structure or ii) the public firm is privatized and regulated by a subsidy while it moves simultaneously with other private firms in a Cournot competition.

I examine the effect of privatization on welfare when a public Stackelberg leader becomes a private Stackelberg leader in open economy in the presence of subsidy. The results of this case are presented below.

1. *stackelberg to stackelberg in open economy with subsidy:*

I present and examine the effect of privatization on social welfare when a public Stackelberg leader becomes a private Stackelberg leader. I consider a three- stage game. In stage 1: the government commits to an output subsidy s. In stage 2: the public Stackelberg leader sets output. And in stage 3, the remaining firms observe the announced subsidy and then simultaneously choose their output levels.

a. *Public Stackelberg Leader:*

The profit of the public firm, the profit of the private domestic firm and the welfare expressions are presented in equations below:

$$pr_0 = (a - q_0 - mq_i - nq_f)q_0 - c - 1/2kq_0^2 + sq_0$$

$$pr_i = pq_i - c - 1/2kq_i^2 + sq_i$$

$$W = 1/2(q_0 + mq_i + nq_f)^2 + pr_0 + mpr_i - sq_0 - smq_i$$

Solving the model yields the equilibrium subsidy, public output and private domestic firm's output:

$$s^S_{pub} = \frac{a(k^2 + 2n + 3nk + 1 + 2k + nk^2)}{\phi}$$

$$q^S_{0\,pub} = \frac{a(k^2 + 2nk + 2n + 1 + 2k)}{\phi}$$

$$q^S_{i\,pub} = \frac{a(k^2 + 2nk + 2n + 1 + 2k)}{\phi}$$

The equilibrium social welfare is presented in equation:

$$W^S_{pub} = \frac{a^2(2n + 2nk + 1 + m + 2mk + mk^2 + k^2 + 2k + 2mn + n^2k + 2mnk)}{2\phi}$$

Where: $\phi = mk^2 + n^2k + 1 + 3.k + k^3 + 2.nkm + 2.nk^2 + 3.k^2 + 4.nk + 2.mn + 2.n + m + 2.km$

b. *Private Stackelberg leader*:

The public firm acts a private Stackelberg leader and there are *m* domestic private firms and *n* private foreign firms. *(m+n)* firms maximize their profits simultaneously.

The welfare is a function of *m*, *n*, *c*, *a* and *k*.

The equilibrium outputs and the welfare of this case are very long but are available upon request.

1. *Proposition 1:*

In an open economy with subsidy, welfare decreases when a public Stackelberg leader becomes a private Stackelberg leader.

2. *Proof of the proposition:*

The sign of the change of the optimal welfare of a public Stackelberg leader and the welfare of a private Stackelberg leader is a negative value. Because this difference of the resulting welfares is very long (it is available upon request) let *m=n=1* for simplicity.

The equilibrium welfare of the private Stackelberg leader when *m=1*and *n=1* becomes:

$$W^S_{priv\,m=n=1} = \frac{a^2(2k^{15} + 101k^{14} + 2293k^{13} + 31082k^{12} + 281436k^{11} + 1802822k^{10} + 8435953k^9 + 29341818k^8 + 76425348k^7 + 148962425k^6 + 215377880k^5 + 226764216k^4 + 168250656k^3 + 83025040k^2 + 24349440k + 3195904)}{2(k^8 + 26k^7 + 278k^6 + 1595k^5 + 5353k^4 + 10711k^3 + 12416k^2 + 7580k + 1824)^2}$$

The equilibrium welfare of the public Stackelberg leader when m=n=1 *becomes:*

$$W^S_{pub\,m=n=1} = \frac{5.a^2(6 + 9.k + 2.k^2)}{6.k^2 + 12.k + 6 + k^3}$$

$$W^{S}_{priv_{m=n=1}} - W^{S}_{pub_{m=n=1}} =$$

$$-\frac{(0.5.a^{2}(1.8044313610^{8} + 4.20856.10^{15} + 1.77407075210^{9}.k + 4.58461010^{6}.k^{14} + 3.629624010^{7}.k^{13} + 2.1627495110^{8}.k^{12} + 9.9094815410^{8}.k^{11} + 3.53637327610^{9}.k^{10} + 9.89420758310^{9}.k^{9} + 2.17349819510^{10}.k^{7} + 4.98499630810^{10}.k^{6} + 5.08624948310^{10}.k^{5} + 3.87737460310^{10}.k^{4} + 2.12834542410^{10}.k^{3} + 7.91068425610^{9}.k^{2} + 26457.k^{16} + 18.k^{18} + 1017.k^{17})}{[(k^{8} + 26.k^{7} + 278.k^{6} + 1595.k^{5} + 5353.k^{4} + 10711.k^{3} + 12416.k^{2} + 7580.k + 1824)^{2}.(6.k^{2} + 12.k + 6. + k^{3})]} < 0$$

This means that welfare decreases with privatization when a public Stackelberg leader becomes a private Stackelberg leader in open economy with a presence of a subsidy when *m=n=1*.

The intuition behind this proposition is as follows: The public leader‘s output is decreasing in *s* and the optimal subsidy achieves first best as *MC=P*. While the private leader‘s output is increasing in *s* and the optimal subsidy no longer leads to symmetric outputs equilibrium (the optimal subsidy no longer achieves the first best quantities), instead the private leader‘ output exceeds that of any follower, i.e. the privatized leader produces where MC>P and the followers produce where P>MC. The optimal subsidy decreases with privatization. This latter decreases the leader‘s output, increases the followers‘ outputs, higher price and lower welfare. Subsidy will remedies the low output of imperfect competition but it will not restore the cost inefficiency as it did in public leadership, because private leader will always produce more than any follower and have a higher MC.

IV. Conclusion

This paper had demonstrated that a Stackelberg public firm should not privatize even if the government subsidizes the domestic market. Privatization decreases welfare. In contrast, a Cournot player should privatize when there is subsidy but only when the market is open to foreign competition. My findings have been obtained for linear demand and a quadratic cost function, but these can be obtained for more general functions.

Table 1: The effects of privatization on welfare when there is a subsidy

With Subsidy in open economy	With Subsidy in closed economy
1.Cournot to Cournot: **Pal and White (1998)** **+**	**1.Cournot to Cournot: Paygo Theoky (2001)** **0**
2.Stackelberg to Cournot Sepahvand (2004) **0**	**2.Stackeberg to Cournot:** **Paygo Theoky (2001)** **0**
3.Stackelberg to Stackelberg: **?**	**3.Stackelberg to Stackelberg: Fjell and Heywood (2004)** **-**

Key
+ Means that welfare increases with privatization.
0 Means that welfare doesn't change with privatization.
+ Means that welfare increases with privatization.
Means that welfare decreases with privatization
? Means that the result is missing and will be covered in this paper

Table 2: The *completed* table represents the effects of privatization on welfare.

	No Subsidy	**With Subsidy**
Closed Economy **(No Foreign Firms)**	1.Cournot to Cournot: De Fraja &Delbono (1989) +/- 2.Stackelberg to Cournot: De Fraja & Delbono (1989) - 3. Stackelberg to Stackelberg Benabess (2007) -*	**1.Cournot to Cournot: Paygo Theoky (2001)** **0** **2.Stackeberg to Cournot:** **Paygo Theoky (2001)** **0** **3.Stackelberg to Stackelberg: Fjell and Heywood (2004)** **-**
Open Economy **(Presence of Foreign Firms)**	**1.Cournot to Cournot:** **Benabess (2007)** +/- **2.Stackelberg to Cournot: Benabess (2007)** **-** **3.Stackelberg to Stackelberg (Fjell and Heywood 2002)** **-***	**1.Cournot to Cournot:** **Pal and White (1998)** **+** **2.Stackelberg to Cournot Sepahvand (2004)** **0** **3.Stackelberg to Stackelberg:** **Benabess (2008)** **-**

Key:
(+/-) Means that the change in welfare depends on the number of domestic firms in the market.
- Means that welfare decreases with privatization.
0 Means that the welfare doesn‘t change with privatization.
+ Means that welfare increases with privatization.
-* Means that the change in welfare is non- positive

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Impact Of Macro-Economic Variables On Stock Prices In India

GJMBR Classification
FOR:140303,150205
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***Abstract*- The paper analyzes long term relationship between BSE and macroeconomic variables, vis-à-vis, change in exchange rate, foreign exchange reserve, inflation rate and gold price. The multiple regression equation model (Galton, 1877) in order to investigate the relationship among these factors. The period of the study is January 2008 to January 2009. Results reveal that there is high correlation between the empirical results reveal that exchange rate and gold prices highly effect the stock prices on the other hand the influence of foreign exchange reserves and Inflation on the stock price is upto limited extend only.**

I. Introduction

The movement of stock indices is highly sensitive to the changes in fundamentals of the economy and to the changes in expectations about future prospects. Expectations are influenced by the micro and macro fundamentals which may be formed either rationally or adaptively on economic fundamentals, as well as by many subjective factors which are unpredictable and also non quantifiable. It is assumed that domestic economic fundamentals play determining role in the performance of stock market. However, in the globally integrated economy, domestic economic variables are also subject to change due to the policies adopted and expected to be adopted by other countries or some global events. The common external factors influencing the stock return would be stock prices in global economy, the interest rate and the exchange rate. For instance, capital inflows and outflows are not determined by domestic interest rate only but also by changes in the interest rate by major economies in the world. Burning example in India is the appreciation of currency due to higher inflow of foreign exchange. Rupee appreciation has declined stock prices of major export oriented companies. Information technology and textile sector are the example of falling stock prices due to rupee appreciation.From the beginning of the 1990s in India, a number of measures have been taken for economic liberalization. At the same time, large number of steps has been taken to strengthen the stock market such as opening of the stock markets to international investors, regulatory power of SEBI, trading in derivatives, etc. These measures have resulted in significant improvements in the size and depth of stock markets in India and they are beginning to play their due role. Presently, the movement in stock market in India is viewed and analyzed carefully by large number of global players. Understanding macro dynamics of Indian stock market may be useful for policy makers, traders and investors. Results may reveal whether the movement of stock prices is the outcome of something else or it is one of the causes of movement in other macro dimension in the economy. The study also expects to explore whether the movement of stock market are associated with real sector of the economy or financial sector or bothWe analyze the long term relationship between BSE and certain macroeconomic variables. We use the regression equation model (Galton, 1877) in order to investigate the relationship among these factors. Results reveal that there is high correlation between the empirical results reveal that exchange rate and gold prices highly effect the stock prices on the other hand the influence of foreign exchange reserves and Inflation on the stock price is upto limited extend only.

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II. Objectives of the Study

The paper aims at the following objectives:

1)To explore the major macro economic variables.
2) To study the effect these macro economic variables on stock price
3) To study is their any correlation between stock price and macro economic variables.

III. Review of Literature

This paper's contributions are as follows. First by embracing a study period that extends beyond January 2008, this paper provides the first attempt to analyze the health of stock market near to the elections. The time period examined by existing studies on time series behaviour of BSE do not cover the post election period. Naka(1990) employed a vector error correction model (VECM) (Johansen (1991)) in a system of five equations to investigate the presence of cointegration among these factors. analyzed a negative relationship between interest rates or inflation and stock prices, and a positive relation between output growth and stock prices. Sharma (2008) tests weak form of efficiency of the BSE. Bhattacharya (2001) by applying the techniques of unit–root tests, cointegration and the long–run Granger non causality test recently proposed by Toda and Yamamoto (1995), tests the causal relationships between the BSE Sensitive Index and the five macroeconomic variables, viz., money supply, index of industrial production, national income, interest rate and rate of inflation using monthly data for the period 1992-93 to 2000-01. They found that (i) there is no causal linkage between stock prices and money supply, stock prices and national income and stock prices and interest rate, (ii)index of industrial production lead the stock price, and (iii) there exists a two – way causation between stock price and rate of inflation. Mishra (2004) by using monthly data for the period 1992 to 2002, examined the

relationship between stock market and foreign exchange markets using Granger causality test and Vector Auto Regression technique study suggested that there is no Granger causality between the exchange rate return and stock return. Ray (1993) attempt to unravel the relationship between the real economic variables and the capital market in Indian context by using modern non-linear technique like VAR and Artificial Neural Network researcher finds out that certain variables like the interest rate, output, money supply, inflation rate and the exchange rate has considerable influence in the stock market movement in the considered period, while the other variables have very negligible impact on the stock market. Abdalla (1996) investigate interactions between exchange rates and stock prices in the emerging financial markets of India, Korea, Pakistan and the Philippines. The results of the granger causality tests results show uni-directional causality from exchange rates to stock prices in all the sample countries, except the Philippines Dornbusch(1980) alternative explanation for the relation between exchange rates and stock prices can be provided through portfolio balance approaches that stress the role of capital account transaction He found that rising (declining) stock prices would lead to an appreciation (depreciation) in exchange rates. Chen (1986) have argued that stock returns should be affected by any factor that influences future cash flows or the discount rate of those cash flows by using discounted cash flow or present value model (PVM) the researcher tries to relate the stock price to future expected cash flows and the future discount rate of the cash flows. Again, all macroeconomic factors that influence future expected cash flows or the discount rate by which the cash flows are discounted should have an influence on stock price. Sangeeta Chakravarty indicates that there is no causal relation between stock price and exchange rate. Similarly there is no causal linkage between gold price and stock price. Sahid Ahmed (2008) using quarterly data . Johansen`s approach of cointegration and Toda and Yamamoto Granger causality test have been applied to explore the long-run relationships while BVAR modeling for variance decomposition and impulse response functions has been applied to examine short run relationships. The study reveals that the movement of stock prices is not only the outcome of behaviour of key macro economic variables but it is also one of the causes of movement in other macro dimension in the economy. Mukherjee(1995) and Bernanke(2005)argue that a change in the money supply provides information on money demand, which is caused by future output expectations. Agrawalla (2005) by using VECM (vector error correction model) has estimated that the share price index and the macroeconomic variables are cointegrated. Hondroyiannis (2001) by doing VAR analysis tries to investigate whether movements in the indicators of economic activity affect the performance of the stock market for Greece. The major findings of the study is that the domestic market economic activity affects the performance of domestic stock market. Habibullah et al (2000) determines the lead and lag relationships between Malaysian stock market and five key macroeconomic variables. Naka (2001) analyses long-term equilibrium relationship among selected macroeconomic variables and the Bombay Stock Exchange index. The results of the study suggest that domestic inflation is the most severe deterrent to Indian stock market performance, and domestic output growth as its predominant driving force. Pethe (2000) using Indian data for April 1992 to December 1997 reports weak causality running from IIP to share price index (Sensex and Nifty) but not the other way round. Bhattacharya (2002) investigates the nature of the causal relationship between stock prices and macroeconomic aggregates in the foreign sector in India. By applying the techniques of unit–root tests, cointegration and the long–run Granger non–causality test recently proposed by Toda and Yamamoto (1995)finds out that that there is no causal linkage between stock prices and the variables. Basabi(2006) investigates the nature of the causal relationship between stock returns, net foreign institutional investment (FII) and exchange rate in India and finds out that that (a) a bi-directional causality exists between stock return and the FII, (b) unidirectional causality runs from change in exchange rate to stock returns (at 10% level of significance), not vice versa, and (c) no causal relationship exist between exchange rate and net investment by FIIs. Chatrath (1997) study a negative relationship between stock market returns and inflationary trends has been widely documented for developed economies in Europe and North America. This study provides similar evidence for India. Horobet Livia (2007) explore the interactions between exchange rates and stock market prices applied to Romania, one of the emerging economies in Central and Eastern Europe and a new member of European Union since January 2007. The study uses standard bivariate cointegration tests, using both the Engle-Granger and the Johansen-Juselius methodology, as well as standard and modified Granger causality tests. . The analysis involved the January 1999 – June 2007 period, but also two sub-periods (January 1999 - October 2004 and November 2004 – June 2007) to take into account the alteration of the Romanian foreign exchange market occurring after the end of 2004.The results indicate indicates no cointegration between the exchange rates and the stock prices, the use of the Johansen-Juselius procedure suggests the presence of cointegration between the two stock market indices and the exchange rates, either nominal bilateral, nominal effective or real effective rates. When standard Granger causality test were performed on non-cointegrated variables, they identified unilateral causality relations from the stock prices to exchange rates for the entire period and the second sub-period, and one bilateral causality relation between the stock prices and the bilateral exchange rate against the US dollar for the first sub-period. Mazharul H. Kazi (2008) reviewed the recent trends of analyzing the relationship between the security market movement and a priori variables, while retaining the basic attributes of asset pricing theory He used the cointegration approach one can efficiently analyze the long-run relationship between a priori variables (macroeconomic variables) that are considered as proxy for systematic risk factors and security market prices. Mookerjee and Yu (1997) study the Singapore stock market pricing mechanism by investigating whether there are long-term relationships

between macroeconomic variables and stock market pricing. They find that three out of four macroeconomic variables are cointegrated with stock market prices. Nasseh(2000) study the longrun relationships between stock market prices (represented by relevant share price indices) and domestic and international economic activity in six countries that included France, Germany, Italy, Netherlands, Switzerland and the UK. and find out that although stock prices are explained by economic fundamentals in the medium and short-run, the underlying volatility inherent in stock prices is related to macroeconomic movements in the long-run. Mohiuddin (2008) investigated the explanatory power of various macro-factors on the variability of stock prices Multiple regression analysis has been conducted to asses the relationship No significant relationship has been found between the stock price and any of the macroeconomic factors. Cheah Lee Hen 3 (2006) makes use of Kalman filter and variety of ARCH type models to investigate the feedback causal relationship between stock prices with each of currency exchange and derivative product. Since the development by Kalman and Bucy in 1960s, Kalman filter technique has been the subject of extensive research and application. , and find out that there is no evidence of risk-return tradeoff in the Malaysian stock market. Kandir (2008) investigates the role of macroeconomic factors in explaining Turkish stock returns. A macroeconomic factor model is employed for the period that spans from July 1997 to June 2005 Empirical findings reveal that exchange rate, interest rate and world market return seem to affect all of the portfolio returns, while inflation rate is significant for only three of the twelve portfolios. On the other hand, industrial production, money supply and oil prices do not appear to have any significant affect on stock returns. okuyan (2008) investigate the relationship between real macroeconomic variables and stock prices in Turkey under "Proxy hypothesis" developed by Fama (1981) The long-run relationship between the variables is tested by Bound testing approach developed by Paseran et al (2001).

IV. Research Methodology

The study is focused on four major macro economic variables vis-a-vis Gold price , foreign exchange reserves, exchange rate and Inflation. We study the impact of these variables on the stock prices. Various factors played role in selecting these variables for study as recession is heading so the exchange rate is fluctuating often and at that period of time the value of dollar is also depreciating and the value of Gold is appreciating as they have an inverse relationship and Inflation is also disturbing a lot at that point of time hence our study is based on these major economic variables. The paper presents the brief description of macro economic variables and after extensive survey we arrived at a conclusion that the macro variables mentioned played major role in the economy .using these variables we try to find out the relationship between BSE prices(as dependent Variables) and macro variables (as independent variables) For doing this, we take the stock prices for the period Jan 2008 to Jan 2009 are taken into account Macroeconomic variables used in this study are, change in exchange rate, foreign exchange reserve , inflation rate and gold price a multiple regression model is employed to test for the effects of macroeconomic factors on stock .The analysis is conducted by using weekly data for the period spans from Jan 2008 to Jan 2009. The data used in the study is divided into two sub-groups. First data set consist of stock data (BSE Sensex). Second data set consist of macroeconomic factors such as inflation rate, foreign exchange reserve, exchange rate and gol]d price In this study only Secondary data is used. Exchange rate data is collected from the the federal reserve statistical release. Inflation data and foreign exchange reserve data are obtained from Reserve Bank of India. Gold price is obtained from NASDAQ. BSE. Stock returns are obtained from Bombay Stock Exchange and The Money Control A stastical technique that simultaneously develop a mathematical relationship between a single dependent variable and two or more independent variables.

With four independent variables the prediction of Y is expressed by the following equation:

$$Y'_i = b_0 + b_1X_{1i} + b_2X_{2i} + b_3X_{3i} + b_4X_{4i}$$

The "b" values are called regression weights and are computed in a way that minimizes the sum of squared deviations

$$\sum_{i-1}^{N}(Y_i - Y'_i)^2$$

Y'_i = is the return on the stock portfolio i,
X_{1i} = is the change in whole sale price
X_{2i} = is the change in exchange rate,
X_{3i} = is the change in foreign exchange reserve
X_{4i} = is the change in gold price.

V. Causal Relationship Between the Macroeconomic Variables and Stock Prices

With the help of regression analysis we try to interpret the observation taking stock prices as dependent variable and macro economic variables as independent.

Table 1
Descriptive Statistics

Descriptive Statistics			
	Mean	Std. Deviation	N
Stock Price	13892.4336	3428.08609	55
Inflation Rate	8.4338	2.99887	55
Exchange Rate	43.9260	3.72590	55
Foreign exchange Reserve	285817.25	24888.775	55
Gold Price	870.3231	65.84736	55

Table 1 show that stock price standard deviation is very high. It reflects significant variability in stock price. Inflation rate mean is 8.4338 and standard deviation is 2.99887 implying that there is moderate variability in inflation rate. Exchange rate mean is 43.9260 and standard deviation is 3.72590. So there is not so significant variability in exchange rate. Foreign exchange reserve mean is 285817.25 and Standard deviation is 248888.775. It shows that there is moderate variability in foreign exchange reserve .Gold price mean and standard deviation is 870.3231 and 65.84736.There is high moderate variability in gold price.

Table 2
Correlations Matrix

Correlations						
		Stock Price	Inflation Rate	Exchange Rate	Foreign exchange Reserve	Gold Price
Pearson Correlation	Stock Price	1.000	-.189	-.943	.754	.555
	Inflation Rate	-.189	1.000	.180	.294	-.224
	Exchange Rate	-.943	.180	1.000	-.817	-.677
	Foreign exchange Reserve	.754	.294	-.817	1.000	.653
	Gold Price	.555	-.224	-.677	.653	1.000
Sig. (1-tailed)	Stock Price	.	.083	.000	.000	.000
	Inflation Rate	.083	.	.094	.015	.050
	Exchange Rate	.000	.094	.	.000	.000
	Foreign exchange Reserve	.000	.015	.000	.	.000
	Gold Price	.000	.050	.000	.000	.
N	Stock Price	55	55	55	55	55
	Inflation Rate	55	55	55	55	55
	Exchange Rate	55	55	55	55	55
	Foreign exchange Reserve	55	55	55	55	55
	Gold Price	55	55	55	55	55

Table 2 shows correlation of the stock price with the Inflation rate, foreign exchange reserve and gold price. Exchange rate correlation is -.943 showing that exchange rate has high negative correlation with stock price. Inflation rate correlation is -.189, which reflects that inflation very low negative correlation with stock price. This variable

doesn't influence the stock price. Foreign exchange reserve correlation of .754 has a positive correlation with stock price. Gold price correlation with stock price is .555 implying that the gold price has a moderate correlation with stock price

The relation between inflation rate and exchange rate is highly positive to the extent of .094 but it is less than 1.There is very low positive relation between foreign exchange reserve and inflation rate to the extent of .015. There is moderate positive relation between inflation rate with gold price to the extent of .05. There is no relation between exchange rate and foreign exchange reserve. There is .0 relation between exchange rate and foreign exchange reserve. Similarly there is not any relationship between exchange rate and gold price. There is zero correlation between foreign exchange reserve and gold price.

Table 3

Variables entered

Variables Entered/Removed			
Model	Variables Entered	Variables Removed	Method
1	Exchange Rate	.	Forward (Criterion: Probability-of-F-to-enter <= .050)
2	Gold Price	.	Forward (Criterion: Probability-of-F-to-enter <= .050)
a. Dependent Variable: Stock Price			

As in Table 3, multiple regression analysis accepts two variables i.e. Exchange rate and gold price which has effect on stock price.

Table 4

Model Summary[c]									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.943[a]	.889	.887	1153.91790	.889	423.593	1	53	.000	.488
2	.950[b]	.902	.898	1095.47475	.013	6.806	1	52	.012	.
a. Predictors: (Constant), Exchange Rate										
b. Predictors: (Constant), Exchange Rate, Gold Price										
c. Dependent Variable: Stock Price										

R^2 is a statistic that will give some information about the goodness of fit of a model. In regression, the R^2 coefficient of determination is a statistical measure of how well the regression line approximates the real data points. An R^2 of 1.0 indicates that the regression line perfectly fits the data.

The range of R^2 is from 0to1. In model 1 exchange rate coefficient of correlation is 0.943. It shows the very high positive correlation between stock price and exchange rate R^2 indicates the 88.9% exchange rate has relation with stock price. The impact of exchange rate on stock price is

significant. In model 2, coefficient of correlation (R) is .950 indicating that very high positive correlation between stock price and gold price. R^2 is 90.2% .The results shows in model 2 gold price has 90.2% impact on stock price .there is a significant relation between stock price and exchange rate and gold priceAdjusted R^2 (sometimes written as) is a modification of R^2 that adjusts for the number of explanatory terms in a model. Unlike R^2, the adjusted R^2 increases only if the new term improves the model more than would be expected by chance. The adjusted R^2 can be negative, and will always be less than or equal to R^2. Adjusted R square in model first is .887 which is less than R square .In model 2 Adjusted R square is .902 which is less than R square

Table 5

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.640E8	1	5.640E8	423.593	.000[a]
	Residual	7.057E7	53	1331526.522		
	Total	6.346E8	54			
2	Regression	5.722E8	2	2.861E8	238.401	.000[b]
	Residual	6.240E7	52	1200064.938		
	Total	6.346E8	54			

a. Predictors: (Constant), Exchange Rate

b. Predictors: (Constant), Exchange Rate, Gold Price

c.Dependent Variable: Stock Price

Anova table examines the difference in the mean value of the dependent variable i.e. stock price associated with the effect of the controlled independent variables. Results show that there is a significant relation between exchange rate and stock price. Because f calculated value is greater than the table value. In model 2 shows there is a significant relation between dependent variable and independent variable. Exchange rate and gold price effect have significant effect on gold price.

VI. Conclusion:

The main objective of the study is to determine the lead and lag interrelationships between the stock price and macroeconomic variables. A number of studies have found that a relationship exists between macroeconomic variables and equity market returns. The relationship between stock returns and macroeconomic factors is well documented for developed countries [Chen, Roll and Ross (1986), Chen (1991), Clare and Thomas (1994), Mukherjee and Naka (1995), Gjerde and Saettem (1999), Flannery and Protopapadakis (2002)) and East-Asian (Bailey and Chung (1996), Mookerjee and Yu (1997), Kwon and Shin (1999), Ibrahim and Aziz (2003)). There are also cross-country studies (Cheung and Ng (1998), Wongbangpo and Sharma (2002)]. These studies have provided different results. The results of the previous studies have changed according to the macroeconomic factors used. This study extends the literature by considering the effects of macroeconomic variables on the stock price. In this study, a multiple regression model is employed to test for the effects of macroeconomic factors on stock price for the period Jan 2008 to Jan 2009. Macroeconomic variables used in this study are, change in exchange rate, foreign exchange reserve, inflation rate and gold price. In the regression models, stock price are used as dependent variables, while the macroeconomic variables are used as independent variables. Empirical result reveals that exchange rate, and gold price to affect the entire BSE Stock price. There is 88.9% correlation of exchange rate with stock price and gold price has 90.2% correlation with stock price.

Independent variables except inflation rate and foreign exchange reserve have a significant relation with stock price. Null hypothesis is rejected. Exchange rate and gold price seem to affect the entire stock price while inflation rate is significant for only three of the twelve portfolios. On the other hand, inflation rate and gold price do not appear to have any significant affect on stock returns. Null hypothesis is accepted. It means that inflation rate and foreign exchange reserve don't influence the stock price.

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The Relationships Among E-Service Quality, System Quality, Information Quality and Customer Loyalty: An Empirical Study of Internet Banking In China

GJMBR Classification
FOR:150309,150503,150502
JEL:M15

Sun Quan

Abstract- **In order to measuring online banking customer perceived e-service quality and study on relationship with customer loyalty in China. This study use E-S-QUAL scales and D&M IS success model to design the research model of this research. Structural equation modeling was used to analyze the data collected from banks' customers in China. The main findings are as follows: 1) the research supported that the four e-SERVQUAL dimensions–efficiency, fulfillment, system availability and privacy are the determinants of Chinese internet banking service quality. 2) System quality, electronic service quality and information quality all have a positive effect on customer perceived value and customer satisfaction. 3) E-service quality has both direct effect on customer loyalty and indirect effect on customer loyalty through customer perceived value and customer satisfaction.**

I. Introduction

As the Internet flourishing, many traditional commercial banks believe that the Internet is a new marketing channel. To face this trend, more and more commercial banks gradually through the Internet to engage in banking activities. At present, there are many commercial banks through the Internet to provide financial products and services to consumers.nternet banking services are a demand driven industry, which constitute an important part of the services industry. In the service industry, the delivery of high-quality services to consumers is a key factor affecting the performance of firms. Service quality measurement has become the main subject of several empirical and conceptual studies in services marketing. The historical development of the service quality literature presents several theories and measurement scales.Commercial banks in all over the world offer similar kinds of services matching with competitors. However, customers perceive quality of services differently [1]. In general, because of the higher profits and higher customer retention to which they lead, high-quality services are believed to provide banks with competitive edge in the marketplace. From the above mentioned, it becomes obvious that high service quality is essential for commercial banks to survive in the highly competitive environment [2] [3]. This leads to the fact that,

a good understanding of the attributes that customers use to judge service quality is necessary in order for the banks to be able to monitor and enhance its service performance and improve its overall service quality [4].Up to now, a stream of researches has conducted on customer satisfaction and its behavioral outcomes in the past two decades. Customer satisfaction is an important theoretical as well as practical issue for most marketers and consumer researchers, with customer satisfaction being considered the essence of success in today's high competitive world of business [5]. Customer satisfaction is another important aspect for service organizations and is highly related with service quality. As service improves the probability of customer satisfaction increases. Increased customer satisfaction leads to behavioral outcomes such as loyalty, commitment, intent to stay, creation of a mutually rewarding relationship between the service provider and the user, increased customer tolerance for service failures and positive word-of-mouth advertising about the organization [6]. Customer satisfaction, to date, has been studied within the banking industry and most of the studied have been linked to the service quality. Banks now know that delivering quality service to customers is essential for success and survival in today's global and competitive banking environment [2] [3].This study employs an extended model by DeLone and McLean's updated Information Systems Success Model (D&M updated IS Success Model) [7] as a conceptual framework to examine the effects of e-quality on website consumer satisfaction and loyalty and explain consumers' behavioral intentions. The D&M updated IS Success Model modified their model to address some limitations of the original model. A key addition in the updated model was the inclusion of service quality as an additional aspect of IS success; it was added because the changing nature of IS required the need to assess service quality when evaluating IS success. D&M also recommended assigning different weights to system quality, information quality, and service quality depending on the context and application of the model. In this study replace service quality with Parasuraman, Zeithaml and Malhotra's E-S-Qual scales [8].

II. Conceptual Framework and Research Hypotheses

A. E-S-Qual

E-service quality (E-S-Qual) is defined as overall customer assessment and judgment of e-service delivery in the virtual marketplace [9]. The importance of delivering high quality e-services has been recognized by many companies, but still there is the problem of how the quality of online services is

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defined, which its determinants are and how it can be actually measured. There exist many models and methods for measuring the quality of traditional services [10], but there is not that based on the explorative study by Zeithaml et al., Parasuraman et al. provide the most comprehensive work on e-service quality so far. They empirically test a multiple item scale (E-S-QUAL) for assessing service quality of online shopping providers. Their findings correspond to the insights of their explorative study: two different scales are necessary to measure e-service quality [8].Additionally, the E-RS-Qual scale is proposed to be relevant when customers face nonroutine encounters" during the online-shopping process which are related to service recovery like product returns, dealing with problems, etc. [8]. The E-S-Qual includes 4 constructs: 1) efficiency; 2) fulfillment; 3) system availability and 4) privacy. Some researchers find the issue of assurance and trust (credibility) of high importance as far as financial services are concerned. Furthermore, many researchers have found assurance (credibility) to be considered as a quality dimension for the evaluation of e-services quality [11] [12]. Based on this, the following hypotheses are proposed:H1a. Efficiency will have a positive effect on e-service quality. H1b. Fulfillment will have a positive effect on e-service quality. H1c. System availability will have a positive effect on e-service quality.H1d. Privacy will have a positive effect on e-service quality.

B. D&M Is Success Model

D&M reviewed the literature published in 1981–1987 in seven publications to develop a taxonomy of IS success. This taxonomy was based upon Mason's modification of the Shannon and Weaver model of communications which had identified three levels of information: the technical level, the semantic level and the effectiveness level. D&M identified categories for system success by mapping an aspect of IS success to each of Mason's effectiveness levels. This analysis yielded six variables of IS success: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact [13].In the years that followed, several researchers altered or extended the model, while others adapted it for specific applications, such as knowledge management [14] or e-commerce [15] systems. Recognizing these potential improvements over their original model, D&M acknowledged these modifications and revised their model accordingly. D&M also modified their model to address some limitations of the original model. A key addition in the updated model was the inclusion of Service Quality as an additional aspect of IS success [16]; it was added because the changing nature of IS required the need to assess service quality when evaluating IS success. D&M also recommended assigning different weights to System Quality, Information Quality, and Service Quality depending on the context and application of the model. Another modification was the elimination of Individual Impact and Organizational Impact as separate variables, replacing them with Net Benefits. This change addressed the criticism that IS can affect levels other than individuals and organizations. Thus, the updated model accounted for benefits occurring at any level of analysis; the choice of which level was to be determined by the researcher using the model.

C. Perceived Value

Perceived value can be defined from the perspectives of money, quality, benefit, and social psychology. Cronin et al. argued that the study of perceived value (along with service quality and satisfaction) has dominated research in the services literature [17]. In addition, Fassnacht and Köse also explored the relationship between e-service quality and customer perceived value in a virtual channel [18]. Perceived value has its root in equity theory, which considers the ratio of the consumer's outcome/input to that of the service provider's outcome/input. In marketing literature, value usually refers to a trade-off between quality and price. In this study, perceived value is the evaluation of the benefits of a product or a service by customers based on their advance sacrifices and exposit perceived performance when they use internet banking services.In the research of the relationships between service quality and perceived value in conventional retailing and online shopping, most of the empirical studies have pointed out that service quality will positively influence perceived value [19]. Among the studies of the telecom industry, Wang et al. and Turel and Serenko, respectively, investigated the mobile services in China and Canada and found out that service quality is positively related to perceived value [20] [21]. In addition, we decided to examine the relationships among the system quality and information quality variables of D&M IS success model and perceived value. To do so, the following hypotheses are proposed:H2a. System quality will have a positive effect on perceived value.H2b. Information quality will have a positive effect on perceived value.H2c. E-service quality will have a positive effect on perceived value.

D. Customer Satisfaction

From the marketing point of view, satisfied customers will be more likely to continue to purchase the product while dissatisfied customers will be more likely to switch brands and tell others about a bad experience. Customer satisfaction has long been recognized in marketing thought and practice as a central concept as well as an important goal of all business activities [22]. High customer satisfaction has many benefits for the firm, such as increased customer loyalty, enhanced firm reputation, reduced price elasticity's, lower costs of future transactions, and higher employee efficiency [22]. It is believed that customer satisfaction is a fundamental indicator for a firm's future profits, due to the fact that attracting new customers is much more expensive than keeping old ones.Customer satisfaction was defined as the contentment of the customer with respect to his or her prior purchasing experience with a given electronic commerce firm [22]. Szymanski and Hise proposed a model for measuring the influences on customer satisfaction and defined customer satisfaction as the customer's overall feeling of the online shopping experience [23]. With focus-group interview, Szymanski and Hise concluded a priori four advance organizers for customer satisfaction, including convenience, product offerings and product information, site design, and financial security. Results of empirical studies indicated that convenience, product offerings and product

information, and financial security are significantly and positively correlated to customer satisfaction [23]. Burke also found that online shoppers were most satisfied with the convenience, product quality, value provided, and product selection offered by the online shopping experience [24]. According to the study of Jeong, Oh, and Gregoire, increasing customers' satisfaction with website information through high quality product provisions has a significant positive influence on customers' intention to make a reservation online [25]. In addition, Fassnacht and Köse also found that e-service quality and satisfaction have strong correlation for the e-service quality research [18]. Seddon found that both information quality and system quality were positively related to online satisfaction [26]. Based on this, the following hypotheses are proposed:H3a. System quality will have a positive effect on customer satisfaction.H3b. Information quality will have a positive effect on customer satisfaction.H3c. E-service quality will have a positive effect on customer satisfaction.H4. Perceived value will have a positive effect on customer satisfaction.

E. Customer Loyalty

In the context of service industries, customer loyalty is the feeling of attachment to or affection for a company's people, products, or services that will directly influence customer behavior.Griffin proposed customer loyalty has four characteristics repeat purchasing frequently, purchasing other products or services that the company provided, building word-of-mouth, and a resistance to promotion that other competitors follow out. Moreover, Sirohi et al. mentioned that three measures for the store loyalty are: willingness to repurchase, willingness to purchase more in the future, and willingness to recommend the store to others. Sirdeshmukh et al. included four items measuring the share of category wallet, intention to recommend, and likelihood of repeat purchase [27]. De Wulf and Odekerken-Schroder measured behavior loyalty by purchasing frequency and expenditure amount [28]. The importance placed on online satisfaction and loyalty has increased because of the competitive nature of the on-line market, fueled by the increase in the number of online retailers and service providers. Cyr et al. defined e-Loyalty as intention to revisit a website or to purchase from it in the future [29]. Flavia'n, Guinali'u and Gurrea suggested online loyalty or e-loyalty has been conceived as a consumer's intention to buy" from a website, and that consumers will not change to another website [30].Most studies on the relationship between consumer satisfaction and loyalty consistently support that these two constructs are strongly related. Similarly, studies on online satisfaction have found a positive relationship between customer satisfaction and customer loyalty [22]. Fassnacht and Köse also show that increasing customer's satisfaction will help to enhance customer's loyalty [18]. Based on this, the following hypotheses are proposed:H5. Perceived value will have a positive effect on customer loyalty.H6. E-service quality will have a positive effect on customer loyalty.H7. Customer satisfaction will have a positive effect on customer loyalty.

F. Conceptual Framework

The conceptual framework linking the six major components of system quality, e-service quality, information quality, customer satisfaction, perceived value and customer loyalty is presented in Figure 1.

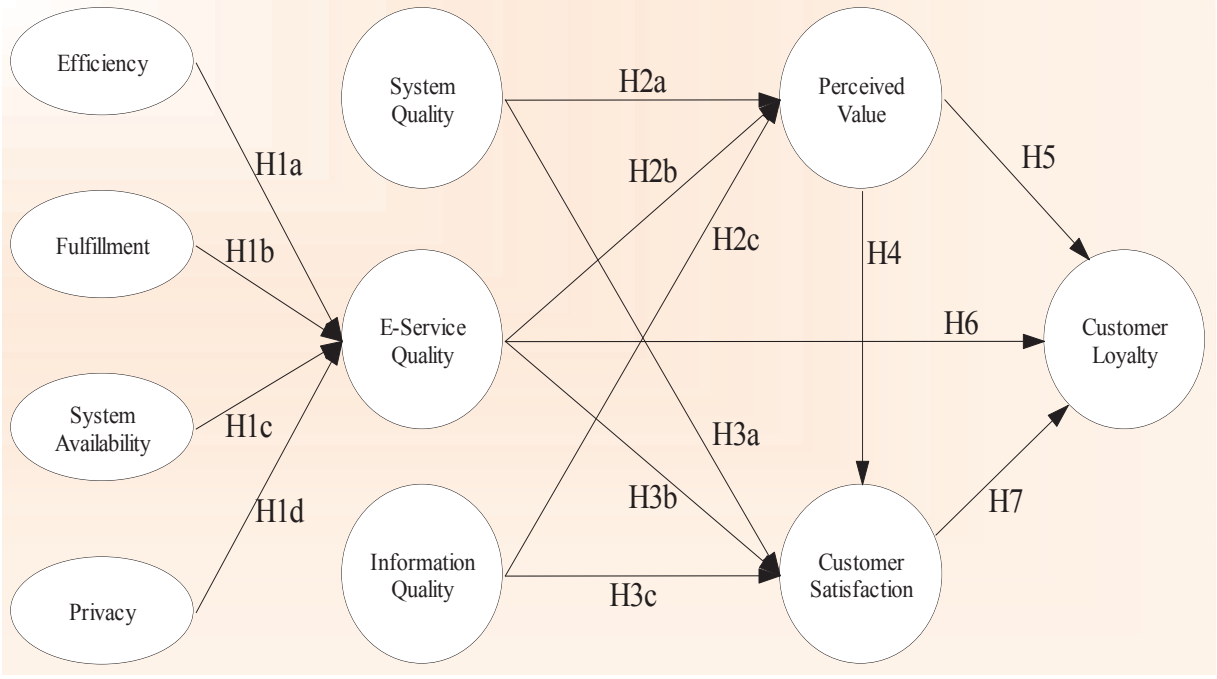


Figure 1: Conceptual Framework

III. Method and Results

A. Questionnaire Design And Data Collection

In order to test the hypotheses, this study relied on six sets of constructs and their indicators. All indicators came from the items in a survey questionnaire designed with a 5-point scale from strongly disagree (1) to strongly agree (5). The questionnaire is designed to measure internet banking customer perceived e-service quality and study on relationship with customer loyalty; all the dimensions included in the questionnaire have been described and used based on the researches of Parasuraman, Zeithaml and Malhotra's E-S-QUAL scales and D&M IS success model. The questionnaire consists of 41 questions and demographic information about the respondents, including name of the bank they use, gender, age, length of Internet Banking usage and frequency of Internet Banking transactions per month.Before the formal distribution questionnaire, we do pre-test to understand subjects whether confused the theme of questionnaire. First of all, there are 50 postgraduates of Finance of graduate schools join the pretest. After collected subjects' opinion, we modified these unclear items and adjusted these statistic verification items. Finally, we refined and finalized the appearance and format of the questionnaire.This study used e-mail questionnaire to collect data. We are not only posted the questionnaires through e-mail. A total of 405 questionnaires were returned, and 18 surveys were unusable due to answering the same scale during February 25 through March 20, 2009. Therefore, the final useful sample contained 387 respondents.

B. Measurement Model

A confirmatory factor analysis (CFA) was used to assess the goodness-of-fit of the measurement model, which considering e-service quality as predictor variables, e-customer satisfaction and perceived value construct as mediating variable, and e-loyalty construct as dependent variable. Nine common model-fit measures were used to assess the model's overall goodness of fit: the ratio of χ^2 to degrees of freedom (d.f.), normalized fit index (NFI), non-normalized fit index (NNFI), comparative fit index (CFI), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), and root mean square error of approximation (RMSEA). As shown in Table 1, all the model-fit indices exceeded their respective common acceptance levels suggested by previous research, thus demonstrating that the measurement model exhibited a fairly good fit with the data collected. Therefore, we could proceed to evaluate the psychometric properties of the measurement model in terms of reliability, convergent validity and discriminant validity [31].

Table 1: Fit Indices For Measurement And Structural Models

Fit indices	Recommended value	Measurement model	Structural model
χ^2/df	≤3.00	1.494	**1.813**
NFI	≥0.90	0.933	**0.931**
NNFI	≥0.90	0.910	**0.919**
CFI	≥0.90	0.924	**0.925**
GFI	≥0.90	0.935	**0.954**
AGFI	≥0.80	0.910	**0.943**
RMSEA	**≤0.08**	**0.064**	**0.056**

Reliability and convergent validity of the factors were estimated by composite reliability and average variance extracted (see Table 2). The composite reliabilities can be calculated as follows: (square of the summation of the factor loadings)/{(square of the summation of the factor loadings)+(summation of error variables)}, where the factor loadings are obtained directly from the program output, and the error variables is the measurement error for each indicator. The interpretation of the composite reliability is similar to that of Cronbach's alpha, expect that it also takes into account the actual factor loadings, rather than assuming that each item is equally weighted in the composite load determination.

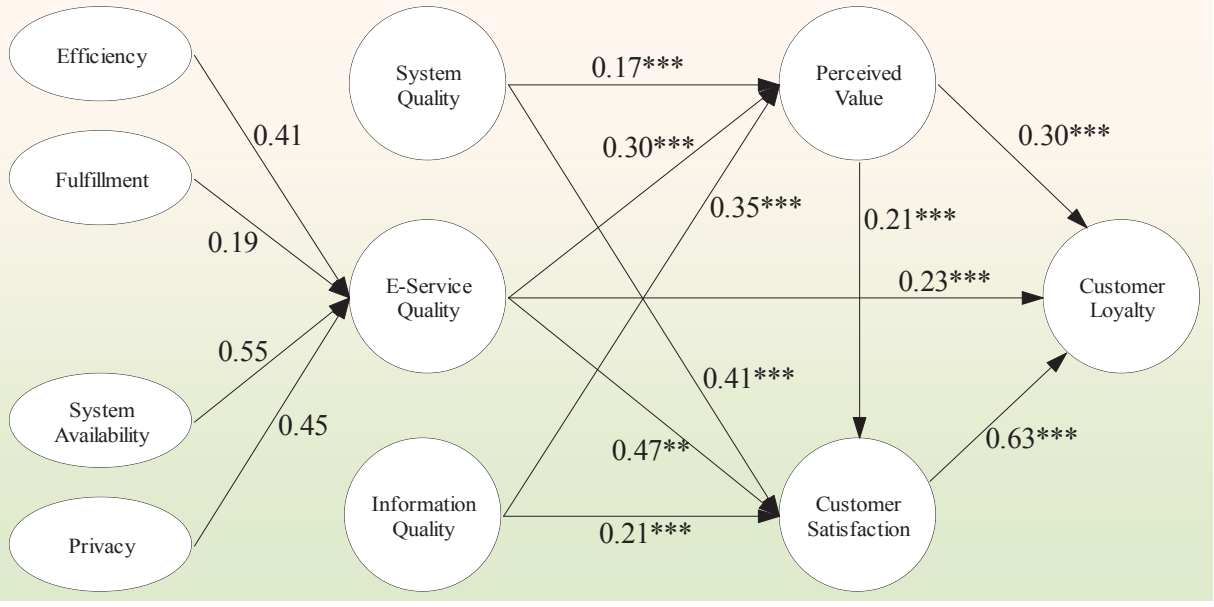
C. Structural Model

A similar set of fit indices were used to examine the structural model (see Table 1). A comparison of all fit indices with their corresponding recommended values provided evidence of a good model fit. Thus, we could proceed to examine the path coefficients of the structural model. Properties of the causal paths, including standardized path coefficients, t-values and variance explained, for each equation in the hypothesized model, are presented in Figure 2. The estimated path coefficients of the structural equation model presents in Table 3.

Table 2: Reliability, average variance extracted and discriminant validity

Factor	1	2	3	4	5	6	7	8	9	10
Efficiency	1.00									
Fulfillment	0.57*	1.00								
System Availability	0.57*	0.43*	1.00							
Privacy	0.35*	0.48*	0.19*	1.00						
E-service Quality	0.39*	0.43*	0.36*	0.53*	1.00					
System Quality	0.30*	0.39*	0.34*	0.39*	0.57*	1.00				
Information Quality	0.32*	0.30*	0.31*	0.47*	0.49*	0.42*	1.00			
Perceived Value	0.29*	0.49*	0.37*	0.51*	0.60*	0.40*	0.45*	1.00		
Customer Satisfaction	0.45*	0.34*	0.34*	0.37*	0.51*	0.46*	0.42*	0.44*	1.00	
Customer Loyalty	**0.36***	**0.39***	**0.45***	**0.43***	**0.37***	**0.38***	**0.38***	**0.50***	**0.55***	**1.00**

*p<0.01



*p<0.05, **p<0.01, ***p<0.001

Figure 2: Hypotheses testing results

The mediation analysis would be done by a structural equation modeling program when latent variables were included in the model. The measures and tests of indirect effect can address mediation more directly than a series of separate significance tests not directly involving the indirect effect in the mediation model. The amount of mediation of one initial variable (e.g., E-S-Qual, one of the antecedents of the mediator Customer Loyalty) can be estimated by the indirect effect of the initial variable when adding the path from the initial variable to the so-called outcome variable (i.e., Customer Loyalty), while controlling the mediator (Customer Satisfaction) and the other initial variable (i.e., System Quality or Information Quality) as covariate in the mediation model. In the mediation model the total effect can be used to estimate the direct effect of the initial variable on the outcome variable when the model does not include the mediator. If the total effect of the initial variable is significant meaning that there is an effect that can be mediated. In addition, if the direct effect is not significant in the alternative model, the mediator has a complete mediating effect on the relationship between the initial variable and the outcome variable. If the direct effect is still significant, the mediator has a partial mediating effect on the relationship between the initial variable and the outcome variable. The total, direct, and indirect effects, the results with t values were given in Table 4.

Table 3: Hypothesis results for the structural model

Hypothesis	Path	Path Coefficients	Conclusion
H1a	Efficiency→E-service Quality	0.41	**Supported**
H1b	Fulfillment→E-service Quality	0.19	**Supported**
H1c	System Availability→E-service Quality	0.55	**Supported**
H1d	Privacy→E-service Quality	0.45	**Supported**
H2a	E-service Quality→Perceived Value	0.30***	**Supported**
H2b	System Quality→Perceived Value	0.17***	**Supported**
H2c	Information Quality→Perceived Value	0.35***	**Supported**
H3a	E-service Quality→Customer Satisfaction	0.47**	**Supported**
H3b	System Quality→Customer Satisfaction	0.41***	**Supported**
H3c	Information Quality→Customer Satisfaction	0.21***	**Supported**
H4	Perceived Value→Customer Satisfaction	0.21***	**Supported**
H5	Perceived Value→Customer Loyalty	0.30***	**Supported**
H6	E-service Quality→Customer Loyalty	0.23***	**Supported**
H7	**Customer Satisfaction→Customer Loyalty**	**0.63*** **	**Supported**

Table 4: The direct, indirect, and total effects

Variables	Direct Effect	Indirect Effect			Total Effect
		Through Perceived Value	Through Customer Satisfaction	Through Perceived Value and Customer Satisfaction	
E-service Quality	0.23	0.09	0.30	0.04	**0.66**
System Quality	—	0.05	0.26	0.02	**0.33**
Information Quality	—	0.11	0.13	0.05	**0.29**
Perceived Value	0.30	—	0.13	—	**0.43**
Customer Satisfaction	**0.63**	—	—	—	**0.63**

IV. Conclusions and discussions

Taking into consideration the huge commercial banks make in Internet infrastructure, customer satisfaction and retention are turning into the crucial factors for success in internet banking meaning that the generation of positive customer value on the Internet requires the establishment of long-term customer relationships [32]. One of the ways for achieving high customer satisfaction and gaining the loyalty of customers is for banks to offer high quality services. That is why being able to measure and evaluate the quality of their internet banking services is deemed important for banks in order for them to take action to correct those features of their online services which customers don‘t find that satisfactory. Based on previously conducted studies, this study adding e-service quality scale E-S-Qual to the D&M IS Success Model to assess the websites satisfaction model, the proposed model fits the data very well. It explains a substantial amount of variance for perceived value and customer satisfaction, which, in turn, also explains a substantial amount of the variance for customer loyalty. The results of data analysis and hypotheses testing revealed that three of the perceived quality dimensions, system quality, e-service quality and information quality, have strong effects on perceived value and customer satisfaction and which, in turn, has significant effect on customer loyalty. It implies that the more the consumers are satisfied with the system quality, information quality provided and the service quality offered, the more the consumers are more likely loyal to the internet banking they used. A detailed description of the analytical results to verify each hypothesis is given below. The e-services quality includes four quality dimensions: efficiency, fulfillment, system availability and privacy. The results found that e-service quality has a significant positively effect on customer satisfaction. It means that the better e-service quality, the more customer satisfaction of the internet banking services. The internet banks provided service quality to improve customer toward customer loyalty by increasing customer satisfaction. Hence, to banks provided that extremely sound e-service quality is the best way of to maintain between with customer relationship. The literature of this study has been emphasized that important of e-service quality. All of these comments, we found our conclusions accord with previous studies. The system quality, e-service quality and information quality all have a significantly positively effect on perceived value. It shows that the internet banks provide well system quality; e-service quality and information quality can enhance the customer perceived value.The customer satisfaction has significant positively effect on customer loyalty. It means the higher customer satisfaction with internet banking services can increase customer loyalty. The result of this study is consistent with that found by Yang and Peterson. Therefore, if internet banks can provide the internet banking e-service quality to increase customer satisfaction, it would enhance customer uses frequency of these services, intention to recommend, and likelihood of repurchase from these services in the future.The perceived value have significantly positively effect on customer satisfaction and customer loyalty. It shows that the higher customer perceived value will enhance customers‘ satisfaction and loyalty. In banking, the quality of the core service is difficult for the average customer to judge and he or she has relatively little contact with the service provider. Therefore, an important implication for bank managers is that it is essential to meet customer expectations for the service core. The basic promise or implicit contract must be delivered, as it is a significant driver of customer satisfaction, which directly related to future intentions. This confirms prior research that has identified the importance of delivering the core service or the basic promise to customers. It also points out the importance of getting it right the first time.” Bank managers need to understand what their basic promise is to the customer and deliver on that promise. This promise generates the basic expectations that customers have with respect to the service. The promised could also include the time to complete of the service. Customer will evaluate core service quality based on the promises made, which may include secondary aspects of the core. Thus, the bank manager needs to deliver on all the promised made to meet core expectations. Before bank managers want to acquire customer satisfaction, they focus on service quality. To gain more positive customer loyalty from e-service quality, perceived value and customer satisfaction, which directly affected customer loyalty, should be further considered simultaneously. Although the results emphasize the importance of quality as an operational tactic and strategic objective, the acceptable price range concept should not be ignored. That is to say, buyers have a price range that is acceptable for a given purchase, rather than a single price. Besides, bank managers should actively enhance customer satisfaction in many ways, such as service providers‘ performances and enhancement of corporate image, so as to attract customers. Finally, the services manager who only contemplates the possible effect of service quality momentum on his or her customers‘ loyalty may make a mess if he or she does not also ponder over the impact of such a strategy on satisfaction attributed to his or her firm‘s services. Nowadays, though there are no effective approaches to solving the complicated decision- making process, at least, making efforts to ensure core service quality will pay in terms of customer satisfaction traits.

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Administrative Style And Staff Morale In Private Institutions In Malaysia: A Case Study of International College University of Technology (Twintech)

GJMBR Classification
FOR:150305,150301,150311
JEL:M16,D21

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I. Introduction

Globally, administrative styles in institutions is concerned with the way and manners in which the authority works with subordinate staff for the purposes of achieving desired stated goals and objectives set by the institutions. However, Management, leadership/administration are often used synonymously according to Coleman despite the fact that they mean different things.[1] He states that management has to do with finance, structure, staffing, mission and effectiveness. On the hand, he looks at leadership administration as taking an institution/organization where it is now to where it has to be in the future leadership/ administration is providing a direction that drives the institution in a specific direction.[2] But Goldbach looks at administration as an art and science. He explains that leadership is an art because it is applied to real life with skills. And it is a science because it can be learned.[3] According to Krietner, he looks at leadership as a process of social influence, which a leader seeks the voluntary participation of subordinate staff in an attempt to achieve the goals of an institution. It is the art to inspire others to willingly execute institutional activities. In this study administration is used interchangeably with management to mean the capacity to direct and coordinate human and material resources to attain specified objectives. Important to note is that it is administration of human resources that seem to be the major focus of administration. This is because it is persons that coordinates and manages resources for the purposes of the intended mission and goals of institution. In the light of this, administration and management analysts usually look on the problems of human resources administration. This involves motivation, job satisfaction, recruitment and training among others.Successful achievement of these depends more on the leadership/administration style and is crucial in implementing decisions successfully.[4] In this study, administrative style refers to the ways and manner in which the administration runs the institution as it relates to staff and other persons linked to the institution. In the administration of private or public institutions of higher learning, the leadership or administration style matters very much for the success of the institution. The administrative style will determine the relationship of the workers to the institution's administration. This would directly or indirectly affect services in the institution. Institutional administration is considered effective when it focuses on both the objectives of the institution and its staff's needs.[5] Malaysia is increasing developing fast to catch up developed countries in all sectors including education sector. Contextually, since education is an investment, there is a wet desire for the country to ensure, it provides opportunity to both public and private investment in this sector. In this quest, there are both national and international public and private institutions of higher learning offering educational services. However, little is known about the administrative style and staff motivation in terms of training, remuneration, nature of communication between administration and staff and the administrative style in private international institutions, particularly International College University of Technology (TWINTECH). These are key aspects in the operation of an institution because even if an institution has strong financial muscle, may fail if the leadership style is poor in motivating its staff to accomplish their defined tasks. Therefore, the objectives of this study are:

(i) To identify and examine the channels of communication between administration and staff of TWINTECH.
(ii) To identify and evaluate the administrative/management style at TWINTECH.
(iii) To find out the morale of staff at TWINTECH.

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[2] Ibid.
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(iv) To investigate the degree of participation of staff in decision making of the institution.

(v) To suggest or recommend strategies how administration could improve their administrative style to suit the institution.

II. Study Questions

The following study questions are used as a guide to the study:

(i) What are the channels of communication between administration and staff?

(ii) What is the management/administrative style utilized at TWINTECH?

III. Significance of the Study

The significance of this study lies in its nature of the findings as it attempts to highlight the administrative styles utilized in international private institution in Malaysia. It focuses on mainly on the views of staff on administrative style at the two campuses of TWINTECH. The study is innovative in the way that it adds on the literatures, which have already been unveiled on similar topic. Furthermore, efficiency in any institution of organization requires to evaluate its internal environment for challenges and opportunities to remain competitive and sustain its growth and expansion.[6] The study is expected to demonstrate the relevance of good administrative policy as a necessary condition for the success of any institution to achieve its defined goals and objectives. The study also provides to members of top administration the opportunity to assess themselves and to know the impact of administrative actions to their staff. Besides, the conclusion and suggestion reached in this study fosters better administrative style practices particularly, at TWINTECH. On overall, the findings of the study reveal areas, which need much attention for the effective and efficient administration in institutions and provides the basis for further studies related to administrative style and staff morale in international private institutions in Malaysia.

IV. Literature Review

According to studies on administrative style and staff morale available, a great deal of research has been done in this area. Administrative style takes many shapes. For purpose of this study, democratic and authoritarian styles are reviewed. The democratic administrative style, which is sometimes, is referred to by some scholars as participative stands popular among leaders. In this style of administration, Alais argues that leaders involve their subordinate staff in most, if not all, activities of the organization.[7] Lewin's study found that democratic administrative style is ideally the most effective leadership style.[8] Leaders in this perspective offer guidance to staff but staff too are allowed to give their input. On the other hand, authoritarian administrative style Grossman and Ross argue that this is a coercive style of administration, where staff are forced to act as they are told. In other words, the administration provides direction by telling the staff what to do without giving opportunity for their inputs.[9] In the light of this, Lewin found that this caused the most level of discontent among staff.[10] It is argued that excellent services can be achieved in institutions where there are employment security, extensive training, good staff morale and decentralized decision making executed by good administration effectively fulfilling its functions identified by Henry Fayol.[11] These functions as quoted in Stoner and Freeman are: planning, which means devising a course action that will enable the organization meet its goals; organizing, which means mobilizing the material and human resources of the organization to put plans into effect; commanding, which implies providing direction for the employees and getting to their work; coordinating, which means making sure that the resources and activities of the organization are working harmoniously to achieve the desired goals; and controlling, which refers to monitoring the plans to ensure that they are being executed properly.[12] He stresses that this makes subordinates supportive of the institution as they become critical of service delivery. Goldbach in his work highlight the importance of communication between administration and staff. He argues that communication involves being a good listener and in close contact with subordinates.[13] To him this creates an environment in which the administration can perform well as well as motivating subordinates to build teamwork. According to him communication is a very important process of action that involves sending messages by some medium in institutions.In the same vein, Cole points out that communication is considered the most important, single skill because it a foundation of understanding and comprehending workers ideas.[14] On the other hand, according to Sisson and Storey in their study found out that employees' involvement in the administration decisions of institutions builds their commitment to it.[15] They argue that staff committed to an institution hardly leaves it. Within this line of reasoning Cole points out that leadership or administration is responsible for the group's activities at the

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institution. This suggests that labour turnover will be low and the institution will have a strong staff retention capacity.In many studies on human resource development and utilization, agree that it is human resource and not other resources such as capital or natural resource, which determine the effectiveness and efficiency of an institution but the morale of human resources therein.[16] According to Steyn and Niekerk, suggest that creating opportunities for all staff in an institution and removing any form of discrimination needs action to realize staff morale and this, builds efficient and effectiveness of teamwork.[17] Creating equal opportunities for all staff requires provision of training and development. In this context, Rowley claims that to motivate behaviour of staff, an institution has to provide effective and efficient multi-faceted reward system, which satisfies the basic needs of all categories of staff in an organisation.[18] This will keep staff working at full of their potential. According Bernadin, this kind of system is related to financial returns and tangible benefits staff in an institution receives as part of employment relationship.[19] Cole argues that this may include medical allowances, transport allowance, training opportunities, annual leave and pension among others.[20] Elton Mayo and Mary Parker Follet found out that physical condition like heating, good furniture and lighting were significant factors in motivating staff.[21] Rafikul Islam and Zaki Hj Ismail in their study in Malaysia found out that good working condition has widely favoured employees' motivation.[22] They claim that Malaysia consider job security as a priority to maintain stability among staff. However, they note that employees in Malaysia are less concerned about appreciation of their work well done. They further point out that monetary incetive plays a significant role in motivating Malaysian employees.

V. THEORETICAL FRAMEWORK

This study borrows ideas of Herberg and Likert in their theories where they have all suggested that participatory decision making would lead to effective higher staff mole, and Abraham Maslow's theory of motivation, which emphasizes that allowing employees a voice in decision making. Frederick Herzberg's motivation-hygiene theory posits that workers are not only motivated by extrinsic factors such as salary, working conditions and job security but also intrinsic factors like achievement, recognition, promotion, work itself and responsibility.[23] Therefore according to this theory workers are motivated by two sets of factors. On the other hand, Rensis Likert theory focuses on the relationship, involvement and roles between administrators and their subordinates in institutional setting. In his theory he categorises administration/management into four systems; exploitative authoritarian, benevolent authoritarian, consultative and participative group system.[24] He argues that in the exploitative authoritarian system, subordinates do not participate in decision making. They have to follow and abide by the decisions made by the top administration. In this context the institution uses threat and fear to achieve its work and there is hardly team work. In the benevolent authoritarian style, he posits that it is like the exploitative authoritarian style but the only difference is that the administration motivates its staff through rewards through their contribution to the institution. He stresses that there could be flow of information from staff but it restricted to what the administration would wish to hear. In the third style, Likert argues that staff are motivated by rewards and a certain degree of involvement in the decision making process. He mentions that the administration makes use of subordinates ideas and opinion and there is more flow of information between the administration and the staff but major decisions are made the administration. Finally, in the participative group system, he postulates that the administration of the institution have full confidence in their staff. There is full flow of communication, staff expresses their ideas and opinion and they are well involved in decision making process. They believe that have the obligation in contributing to achievement of the goals and objectives of the institution.

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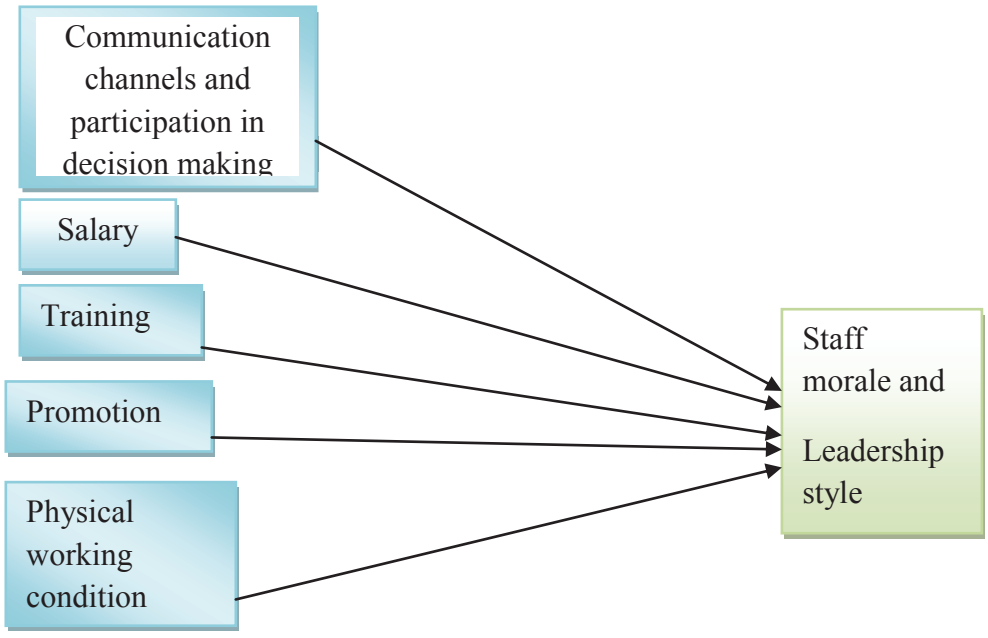
Figure 1: Relationship among variables



VI. Operationalisation of Variables

From the theoretical framework there are many variables for measuring staff morale. There are six variables:Staff morale: an individual's or group's state of mind with respect to confidence, cheerfulness, discipline etc.Salary: this is the monthly earning of the staff Training: this refers to the existence of good training policy or number of times a worker has benefited from in-service training to improve on his/her skills. All these make a difference with respect to staff morale of motivation.Promotion: existence of good promotion prospects, that is, whether one has been promoted or not; whether one's promotion was delayed or ran normally; whether there is discriminatory on the basis say on ethnic, racial, religious, sex etc.Physical working conditions: this refers to good office accommodation, transport, housing, medical, education for staff children, and availability of working materials and recognition for innovative creativity in one's work.

VII. Methodology

This study sought to analyse administrative style and staff morale in the international private institution in Malaysia. TWINTECH was chosen as a case study because it is a well established private International University College in Malaysia. It has four campuses, one of which is located in Kuantan and three are in Kuala Lumpur. This study focused three campuses, offering educational services. It has well laid down administrative structures with substantial number of staff both national and international staff totaling to 360. The study used quantitative method. Thus, a survey method was utilized a research design for this study. Survey research is the best method available to social scientists who are interested in collecting original data to contribute to the development of new knowledge.[25] The staff of TWINTECH forms the study population for this study. A total of 210 staff out of the entire staff of TWINTECH was selected using stratified sampling technique to fill in the questionnaire. This was done in such a way to include all categories of staff (administrative, academic and support). This sample study population was obtained from the official staff list of three campuses that is, Sri Damansara campus, Jalan Ipoh and Bangi campus, that was provided by Human Resource Management (HRM) department. Thus, a face-to face questionnaire distribution was administered to the sampled study population. This was carried out at their place of their work. Instruction on how to fill the questionnaire was given. And respondents were assured of the confidentiality of the information they were to provide. In this regard, data for this study was collected on independent variable, which was Communication channels, participation in decision making, salary, training, promotion and working condition and, that of dependent variable, which was administrative style and staff morale. It was anticipated that the survey questionnaire would provide wider scope of the study, which could be credibly applied to a wider population from the sample study.[26] In this study, the data was mainly obtained on variables, which provide an understanding of the administrative style and staff morale. The data collected was subjected to simple quantitative analysis. This involved counting the responses provided by the respondents and finally findings are presented in tables using frequencies and percentages. However, in this study some limitations were met. First, although it would have been very useful to study many international private educational institutions in

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Malaysia to attain a better understanding of the administrative/management style and staff morale in these institutions in this country, it was not possible due to inadequate resources. Another limitation was that the study focused on limited scope of variables due to time and fund constraints. Therefore, the findings of this study may not be generalized to all international private institutions in Malaysia.

Table 1: Questionnaire Administration and Response

staff Category	Questionnaire administered	No. of questionnaire collected	Percentage
Administration	50	27	13
Academic staff	100	55	26
Support staff	60	39	19
Total	210	101	58

Source: Field Survey 2010.

Table 1 represents the questionnaires that were filled and returned from the staff of TWINTECH. 210 questionnaires were administered, and 101 representing 58% were returned.

Findings of the study

Table 2: Distribution of Respondents by sex, age group and Experience

Sex	Frequency	Percentage
Male	45	44.5
Female	56	55.5
Total	101	100
Age		
20-30	47	46.5
31-40	36	35.6
41+	18	17.9
Total	101	100
Experience		
0-6 Months	20	19.8
1-2 Years	35	34.6
3+ Years	46	45.6
Total	101	100

Source: Field Survey 2010

This study was intended to highlight the administration/management style and staff morale in international higher educational institutions in Malaysia with particular focus on TWINTECH. The study was guided by the stated objectives and research questions of the study. Data was specifically collected using questionnaire. The data gathered was analysed and presented in tables using frequencies and percentages

Table 3: Communication Channels

Statement	Responses					
	Yes	%	No	%	No Response	%
Is communication in your organization through official memo?	89	88.1	12	11.9	-	-
Is top-down and down-up communication adequate means of communicating?	56	55.4	39	38.6	6	5.9
Do you have a suggestion box?	81	80.1	20	19.9	-	-
Is your top administration involved in communication with other Head of Departments in your organization to improve services?	80	79.2	17	16.8	4	3.9
Are you allowed to communicate through other channels?	67	66.3	34	33.7	-	-
Is communication in your organization through verbal method only?	15	14.8	86	85.1	-	-

Source: Field Survey 2010

The table above shows the responses of staff on different channels of communication. A question was asked for respondents to choose from the options provided. Is communication in your organization through official memo? Out of the total responses 88.1% indicated yes while 11.9% indicated that it is not through memo. Another question was asked, is top-down and down-up communication adequate means of communicating? The biggest percentage (55.4%) answered yes whereas 38.6 % were of the view that it is not actually adequate. That implies that down ward communication flows from individuals in higher level positions to those in lower positions in the hierarchy in the institution. A further question was also asked, do you have a suggestion box? A total of 19.9% expressed ignorance of the existence of a suggestion box at the college while the remaining 80.1 % said yes.However, a question was asked, is your top administration involved in communication with other Head of Departments in your organization to improve services? The sum of 79.2 % said yes while 16.8% said no and remaining 4% preferred not to answer the question. This means that administration gives room for individual opinion. On the question, is communication in your organization through verbal method only? It was only14.8 % who answered yes while 85.1% of the staff who filled the questionnaire said no.

Table 4: Hurdles to effective Communication

Statement	Responses			
	Yes	%	No	%
Does distortion occur because of framers references?	51	50.4	38	37.6
Do you trust your boss?	73	72.2	28	27.8
Do the verbal messages sent to you always filter?	46	45.5	55	54.5

Source: Field Survey 2010

The study also probed about barriers to effective communication at the institution. Table 4 above shows the responses to question, does distortion occur because of framers references? Out of the total responses to this question 50.4% said yes while 37.6 indicated no. the remaining 12% preferred not to respond. Another interesting finding from the study was trust staff had in their immediate boss. A question was asked, do you trust your boss? A high percentage (72.2%) indicated yes while 27.8% said no. this suggests that majority of the staff at the institution trust their boss. A further question was asked, do the verbal messages sent to you always filter? In response to this question, 45.5% indicated yes, while 54.5% indicated no. this seem to suggest that the messages sent were either well delivered.

Table 5: Administrative Style

Statement	Responses			
	Yes	%	No	%
Does your boss involve you in decision making process?	68	67.3	33	32.7
Is your boss an authoritarian leader?	42	41.5	55	54.4
Does the management allow you to establish the goal and motivation of your department?	63	62.3	38	37.7

Source: Field Survey 2010

Table 5 shows responses on administrative/management style revealed during the study. As it can be seen in the said table when asked does your boss involve you in decision making process? Majority (67.3) indicated yes while 32.7% said no. This signifies that there is cordial relationship between the administration and the staff. Another question which sought to know whether the institution's administration is authoritarian was asked, is your boss an authoritarian leader? Four staff (4.1%) of the total respondents preferred not to provide answer to this question while 41.5% said yes whereas the biggest percentage (54.4%) indicated no. It can be deduced from these responses that leaders at the institution are not authoritarian. Also a question was asked, does the management allow you to establish the goal and motivation of your department? 63 (62.3%) staff indicated yes while 37.7% said no.

Table 6: Staff Morale

Statement	Response			
	Yes	%	No	%
Have you been sponsored for training?	43	42.5	58	57.5
Is your promotion taken into consideration when due?	31	30.7	70	69.3
Have you been getting medical treatment or bill allowance, transport and education for your children within your organization?	26	25.7	75	74.3
Is your office well furnished?	25	24.7	74	75.3
Are you provided with housing?	03	2.9	98	97.1
Do you enjoy your annual leave grant?	39	38.6	62	61.4
Is your salary paid regularly?	69	68.3	32	31.7
Does your salary meet all your needs?	16	15.8	82	84.2
Do you get commendation for job well done?	35	34.6	66	65.4
Have you ever been promoted since you started working within the institution?	35	34.6	66	65.4
Is there any discrimination in the promotion policy in your institution such as racial, sex, religious or ethnic?	30	29.7	71	70.3

Source: Field Survey 2010

Table 6 above presents responses to questions that were used to find out the staff morale. On overall with the exception of regular payment of salary, all other responses indicates that little attention is paid on most of the factors that build confidence among staff as identified in the literature review. The percentage responses ranged from 57.5 % to 84.2% in this perspective.

VIII. Discussion of the Findings

Leadership is the ability to influence the behaviour of others towards the accomplishment of institutional goals and objectives. It is the behaviour of individual, which initiates structure and interaction within social system. Therefore, the administration/management of any institution public or private, national or international plays a central role in determining its efficiency and morale of the staff. If the administration is authoritarian, it can trim down morale for work. The nature of administration of the institution determines staff retention and performance of staff. Hausknecht, Rodda and Howard are of the view that there is a strong consensus around researchers that administrators who use democratic style are likely to have staff with higher satisfaction more than those who use autocratic style of administration.[27] The study established that unless the institution's administration is well equipped with administrative/management knowledge and skills, they would not be able to motivate their staff.In addition, from the study, it was discovered that one of the most frequently used channel of communication was through memos. The participant in the study revealed that the institution's administration was committed to this channel of communication in delivering messages to its staff. The established that verbal communication was unreliable because it either created misunderstanding of the message as a result reduction in the information intended to be delivered or doubts of the information.However, it is arguably that the flow of information is not only for top-down but also from bottom-up. Staff therefore, may have substantial influence on the administration at the same time the administrators have influence on them.[28] Effective communication in any institution creates efficiency. But when there is communication difficulty leads to hiccup in the operation of an institution. This is in line with Lewis who argued that communication that is not directed to the proper receivers becomes rumours and finds its way through the institution, according to who will listen.[29] This suggests that communication should always be well directed to reach the intended persons. Furthermore, the staff in the study institution was asked about their boss's administrative style and most of them were of the view that the administrative/management style at TWINTECH is participative. Participatory administration decentralizes institutional decisions to ensure that many arise from consultation with staff as a result of their participation. Dew gave the merits of participative administrative style to include; (i) the staff ‗s feeling of self-worth and satisfaction are increased because the administration conveys confidence in its staff; (ii) participation provides staff to satisfy high needs such as esteem and self-actualisation by letting them take part in important decision and (iii) staff participation in decision making improves the quality of the decisions, because when more people think about same problem, it is likely to generate a better solution to it.[30] The morale of staff in the institution is not limited to salary, physical environment, job security but also achievement, recognition and responsibility among others. This study revealed that the administrative style at TWINTECH reflect democratic or participative. All responses to the three variables used, 67.3%, 54.4% and 62.35% of the respondents indicated that the administration involved the staff in the decision making of the institution. However, results of the study also suggest that staff morale at TWINTECH seem to be poor. As it argued, promotion to a new level enhances workers' dignity of labour and pride in any institution,[31] staff at TWINTECH indicated that promotion is given less attention when it is due. This is more likely to affect the morale of staff at the institution. Staff promotion in institutions boosts their morale. It is stressed that promotion enhances performance and quality of work. But staff at TWINTECH (69.3%) revealed that they are not given their promotion when it is due. On the staff development, majority (57.5%) revealed that they had not been sent for further training. Only 42.5% indicated that they had been sent for training. This suggests that the institution needs to pay more attention on training its staff if they are to aspire high. In fact, TWINTECH can achieve enormous greater success if the administration of the institution provides adequate fringe benefits, which gives its staff commitment to the institution including job security.

IX. Conclusion and Recommendation

This study gives an insight into administrative style and staff morale at TWINTECH in Malaysia. The study findings suggest that institutional administrators should see that staff under their supervision is treated equitably and they are given recognition for the creative innovation achievement reached. Also, by making extra effort to keep different channels of communication open with staff can assist in detecting dissatisfaction regarding working condition of the employees. It can be said that staff at TWINTECH were having good relationship with the administration. But their motivation seems to be poor. Based on the findings of the study, the following recommendations are raised: (i) there is

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need to improve channels of communication in the institution; (ii) verbal method of communication should be discouraged as much as possible (iii) distortion in communication should be minimized as much as possible. And finally (iv) the institution should provide adequate facilities to aid the employees in their work and need to focus on the different factors, which motivates and gives staff commitment to the institution.

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El Residuo De Solow Revisado

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JEL:C22,C32,O39,O40,O57

***Abstract*-This work shows that the percentage contribution to the growth of the Solow Residual economic is a disproportionate amount in real terms. For this reason, there is a new calculation basis of technical progress in the function Cobb-Douglas production and demonstrates that this can be expressed as Harrod´s theorem more technical progress.**
This technical progress is compared with the traditional Solow Residual for the United States, Colombia and 15 European Union countries. We conclude that technical progress does not exceed the rate of economic growth contrary to Solow's seminal approach.

Keys words-Economics Growth, Technical Change, Aggregate Production Function, Harrod´sTheorem.
JEL: E22, O39, O40, O57

I. INTRODUCCION

Solow publicó su artículo en 1957 sobre el cambio tecnológico y la función de producción agregada. Desde entonces hasta nuestros días, el procedimiento paradistinguir entre las variaciones de la producción debidas al progreso técnico y las causadas por los cambios en la disponibilidad del capital, ha tenido sustento teórico enel trabajo seminal de Solow. Esta contribución de Solow radica en que el progreso técnico es cuantificado de manera residual. Por esta razón, al progreso técnico se leconoce también como el residuo de Solow o como la productividad total de los factores (PTF).En la literatura reciente sobre crecimiento endógeno se involucra la productividad total de los factores (PTF) como un factor que depende de una serie de variables como los factores institucionales, la organización del mercado, los aspectos macroeconómicos, los conflictos sociales, etc. Hoy en día, existe un consenso sobre la importancia de la productividad como fuente de crecimiento. Estudios como los de Prescot (1997,1998) reafirman esta posición argumentando que el estudio sobre esta variable aún es muy precario pero que su importancia se refleja en el hecho de que este factor explica mas del 80% del crecimiento económico en los países desarrollados y cerca del 40% en los del tercer mundo. En la práctica, todo el mundo calcula el progreso técnico de la manera como Solow lo planteó hace ya más de 50 años para establecer las fuentes del crecimiento económico o, algunos autores citan esta propuesta en muchos trabajos que sobre cambio técnico se han escrito (i,e Khan (2009), Hulten (2009), European Comisión3 (2005), Greenwoody Krusell (2006), Maia y Nicholson (2001), Crafts (2008), Fuentes R y otros (2004), Gay A. (2009), Felipe y McCombie (2004) entre muchos otros). El problema de este cálculo reside en que el valor de ese progreso técnico es alto, a tal punto, que su contribución porcentual al crecimiento de la economía muchas veces supera el 100% o inclusive el 200%. Solow calculó este residuo y su contribución al crecimiento fue del 87% en promedio entre 1909 y 1949. ¿No es este cálculo exagerado para explicar el crecimiento de la economía? o como el mismo Solow dice, ¿no refleja este hecho nuestra gran ignorancia acerca de lo que realmente explica el crecimiento? o realmente, ¿la function 1 Este trabajo es producto de una extensión de la tesis doctoral –Teoría del Crecimiento Económico: Un Punto de Vista Heterodoxo. 3 La Comisión Económica de Europa realiza el cálculo de la PTF para 30 países (ver la pag http://ec.europa.eu/economy_finance/db_indicators/eu_klems/2005/index_en.htm) de producción utilizada, es apropiada para representar el comportamiento de las economías?.En términos mas precisos, debería ser cierto, que si utilizamos una función de

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producción como por ejemplo la cobb-Douglas ($Y = K^{\alpha}L^{\beta}$), esta función tendría que explicar mas del 80% del crecimiento y no esperar a incluirle un factor residual ($Y = AK^{\alpha}L^{\beta}$) para concluir que ese residuo contribuye al crecimiento en más del 80%.

El ejercicio de Solow muestra que en 1910 la contribución al crecimiento fue del 156%, en 1926 del 304% y en 1927 y 1928 de -191% y -180% respectivamente. Como es posible que existan estos cambios tan bruscos? Y como es que algo que no se conoce sea lo que contribuye al crecimiento o decrecimiento de la economía?. En el lenguaje de la teoría evolucionista esto no sería posible, los agentes no olvidan, no se desaprenden, por el contrario, existe una mejora continua. Desde el punto de vista del sentido común, nadie creería que este residuo contribuya al crecimiento en tan despro porcionadas magnitudes. En el trabajo del Grupo de Investigaciones Sobre Crecimiento Económico del Banco dela República (GRECO) se observan también las enormes oscilaciones de la PTF entre 1950 y 1996. En este sentido, la contribución al crecimiento de la economía Colombiana para 1950 fue de -249% y pasó en 1957 a 0,65% y a -71% en 1958 y a 107% en el siguiente año. En 1982 se da el dato menos creíble desde el punto de vista de la economía, la contribución de la PTF en ese año fue de -617%. Donde esta la contribución al crecimiento por efecto de la adición de los factores productivos?. Esnecesario repensar, si realmente el cálculo de la PTF tal y como lo planteó Solow refleja realmente un progreso técnico continuo. Cualquiera que sea la respuesta a los interrogantes anteriores, se ha seguido calculandoel progreso técnico por residuo para establecer las fuentes del crecimiento de las diferentes economías del mundo a partir de la función de producción neoclásica tradicional. Este trabajo muestra que aún cuando se siga utilizando esta función, elcálculo del progreso técnico debe contribuir al crecimiento pero no exageradamente como se muestra en las estimaciones realizadas en los diferentes países del mundo. Eneste sentido, este trabajo no pretende establecer los posibles determinantes de la productividad total de los factores o progreso técnico, ni involucrar la teoría delcrecimiento endógeno como explicación del residuo. Se pretende, con base en el trabajo seminal de Solow, mostrar que es posible un nuevo cálculo del progreso técnico. Paraeste fin, el trabajo se divide en 5 partes siendo esta introducción la primera. En lasegunda se expone la propuesta seminal de Solow, mientras que en la tercera se plantea un enfoque alternativo para el cálculo de la productividad multifactorial. En la cuarta sección se realizan las estimaciones correspondientes para Estados Unidos, Colombia y quince Países de la Unión Europea. En la quinta y última sección se presentan las conclusiones del trabajo

II. BASES TEORICAS DEL MODELO DE SOLOW

Los fundamentos teóricos del progreso técnico pueden ser planteados matemáticamentey gráficamente. Matemáticamente se asume que la función de producción agregada dela economía puede escribirse de la siguiente manera:

$$Y = f(K, L, t) \qquad (1)$$

De donde Y es el producto de la economía, K es el capital utilizado es derivado de los incrementos sucesivos en la inversión que realiza la economía y *"t"* es el progreso tecnológico que experimenta la economía a través del tiempo y en la función planteada reflejará todo tipo de desplazamiento de esta función. Por comodidad, Solow empieza suponiendo que el cambio técnico es neutral, es decir, que un desplazamiento de la función de producción deja inalterada la distribución del ingreso para una relación capital trabajo dada. En consecuencia, la función de producción tomaría la siguiente forma:

$$Y = A(t) f(K, L,) \qquad (1A)$$

En este caso, el factor multiplicativo $A(t)$ mide el efecto acumulado de las modificaciones del producto a lo largo del tiempo como lo expresa Solow. Por lo tanto, derivando (1A) respecto al tiempo y luego dividiendo por Y se obtiene:

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + A\frac{\partial f}{\partial K}\frac{\dot{K}}{Y} + A\frac{\partial f}{\partial L}\frac{\dot{L}}{Y} \qquad (2)$$

Los puntos indican derivadas respecto al tiempo. Adicionalmente, si se define α y β como las participaciones relativas de cada uno de los factores dentro del producto, es decir $\alpha = \partial Y/\partial K * K/Y$ y a $\beta = \partial Y/\partial L * L/Y$ y sustituyendo en la ecuación 2 se obtiene:

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \alpha\frac{\dot{K}}{K} + \beta\frac{\dot{L}}{Y} \qquad (2A)\ \text{ó}$$

$$gy = ga + \alpha gk + \beta gl \qquad (3)$$

De donde gy es la tasa de crecimiento del producto, ga es la tasa de crecimiento del progreso técnico, gk y gl son las tasas de crecimiento del stock de capital y trabajo respectivamente y α y β son las correspondientes participaciones a las remuneraciones del capital y trabajo dentro del producto. La misma función de producción puede ser expresada en términos del producto por trabajador suponiendo homogeneidad y se puede llegar a la siguiente ecuación:

$$gy_p = ga + \alpha gk_p \qquad (4)$$

En donde gy_p es el producto por trabajador y gk_p es el capital por trabajador y α sigue siendo la participación de la remuneración al capital dentro del producto.

Se puede plantear así mismo, una función de producción explícita como la Cobb-Douglas denominada así en honor a los autores que la propusieron. Esta función tiene la propiedad de que es homogénea de grado uno, Formalmente se tiene:

$$Y = AK^{\alpha}L^{\beta} \qquad (5)$$

Expresando esta función como el producto por trabajador en función del capital por trabajador se llega a la siguiente ecuación:

$$y_p = Ak_p^{\alpha} \qquad (6)$$

Donde y_p es el producto por trabajador, A es el progreso técnico y k_p la relación capital trabajo y α sigue siendo la participación de la remuneración al capital dentro del Producto. Así mismo, podemos llegar a la siguiente expresión después de linealizar la ecuación 7 de la siguiente manera:

$$gy_p = ga + \alpha gk_p \qquad (7)$$

Con base en la ecuación 4 o en la ecuación 7 se puede calcular *ga* por residuotaly como lo realizó Solow, esto quiere decir, que la tasa de crecimiento del producto por trabajador es observada al igual que la tasa de crecimiento del capital por trabajador y la participación de la remuneración al capital en el producto. Por lo tanto se plantea esta ecuación de la siguiente manera

$$ga = gy_p - \alpha gk_p \qquad (8)$$

El crecimiento del progreso técnico será entonces igual a la tasa de crecimiento del producto menos la tasa de crecimiento del capital ponderada por la participación de la remuneración al capital dentro del producto. Con base en el crecimiento del progreso técnico se puede hallar el índice de progresotécnico $A(t)$ de la siguiente manera y como lo propone el mismo Solow en su artículo:

$A(t) = (1+ga)^t$, siendo ga la tasa de crecimiento. También se puede calcular $A(t)$ en tiempo continuo en cuyo caso se tendrá que $A(t) = e^{gat}$.

III. NUEVO CÁLCULO DEL RESIDUO DE SOLOW

Solow (1957) dice que para ~~a~~islar los desplazamientos de la función de producción de los movimientos a lo largo de dicha función" es necesario tener ~~tr~~es series temporales: la producción por unidad de trabajo, el capital por unidad de trabajo y la participación del capital". Por lo tanto, con base en la ecuación (8) se puede realizar un análisis diferente y llegar a un cálculo de la productividad multifactorial alternativo a la propuesta de Solow

En la ecuación (8) ($ga = gy_p - \alpha gk_p$) Se supone que α es la participación de las ganancias dentro del producto, o la participación de la remuneración al capital en el producto, esto es rK/Y, de donde r es la remuneración a una unidad de capital que debe ser igual al producto marginal del capital $\Delta Y / \Delta K$. En consecuencia, αgk debe ser igual a:

$$\alpha gk = r * \frac{K}{Y} * \frac{\Delta K}{K} = r * \frac{\Delta K}{Y} \qquad (9)$$

Además, si se asume que las variaciones en el capital ΔK son iguales a la inversión (I), entonces se puede plantear que:

$$\alpha gk = r * \frac{\Delta K}{Y} = r * \frac{I}{Y} = r * \frac{S}{Y} \qquad (10)$$

De donde $\frac{I}{Y}$ es la tasa de inversión que debe ser igual a la tasa de ahorro de la economía $\frac{S}{Y}$ igual a "s". la propensión marginal o media a ahorrar. Si además se supone que $r = 1/C$, donde *C es la relación incremental capital producto (ICOR),* por lo tanto, se llega a la ecuación de Harrod de la siguiente manera:

$$\alpha gk = \frac{s}{C} = \frac{i}{C} \qquad (11)$$

En consecuencia, combinando 12 y 9 podemos llegar a:

$$ga = gy - \frac{i}{C} \qquad (12)$$

O bien:

$$ga = gy - \frac{s}{C} \qquad (13)$$

Se observará que se ha partido de la misma función de producción propuesta por Solow, en cuyo caso la tasa de crecimiento de la economía viene dada por:

$$gy = ga + \frac{s}{C} \qquad (14)$$

O bien:

$$gy = ga + \frac{i}{C} \qquad (15)$$

Con las ecuaciones 12 y 13 se puede calcular el progreso técnico por residuo, pero se considera que la ecuación 12, es decir, donde se involucra la tasa de inversion productiva, puede aproximarse mas a resultados reales que considerando la tasa de ahorro, la explicación es que parte del ahorro se dedica a la especulación mientras que la inversión se realiza en actividades productivas. Adicionalmente, cualquiera de las ecuaciones 14 o 15, explican la tasa de crecimiento de la economía y a su vez, esta tasade crecimiento está explicada en más del 95% por los cambios en la relación marginal capital producto (Bernal J, 2007) Bajo este contexto sigue existiendo un residuo que refleja el progreso técnico, pero la pregunta que surge inmediatamente es: ¿el residuo de la ecuación 12 o 13 es del mismo tamaño que el residuo de la ecuación 8?. Para responder esta pregunta es preciso hacer los cálculos correspondientes. Pero antes de pasar a realizar dichas estimaciones es necesario señalar que Kalecki había propuesto un enfoque similar en la determinación de la tasa de crecimiento de la economía. Kalecki (1976) propone que la variación del ingreso

ΔY de un año a otro, dependen en primera instancia del efecto productivo de la inversión (I). Si se denota por C a la relación marginal capital producto, entonces, el efecto de la inversión será la multiplicación de (1/ *C*) por la inversión, es decir, (1/ *C*) * I. Kalecki también argumenta que existe una tendencia a que el crecimiento del ingreso nacional provenga de mejoras en la utilización del equipo productivo, o mejoras en la organización del trabajo, o en un uso mas racional de las materias primas etc, en definitiva, el crecimiento del ingreso dependerá del progreso técnico. Las implicaciones de estos hechos se convierten en un aumento en el ingreso nacional en la fracción *a* *Y.

Con base en las consideraciones anteriores se llega a la siguiente fórmula para el crecimiento del ingreso nacional:

$$\Delta y = \tfrac{1}{c} I + aY \qquad (16)$$

si se divide esa ecuación por Y se obtiene:

$$gy = \tfrac{1}{c}\frac{I}{Y} + a\frac{Y}{Y} \qquad (17)$$

Se denota *y G* a la tasa de crecimiento del ingreso $\Delta Y/Y$.

Ahora por el equilibrio macroeconómico donde el ahorro es igual a la inversión respectivamente se tiene S=I y como porcentaje del ingreso nos da que S/Y = I/Y. Denotando S/Y por (s) se llega a la ecuación modificada de Harrod donde se tiene:

$$gy = \frac{s}{C} + a \qquad (18)$$

La ecuación 5 implica que la tasa de crecimiento del ingreso es igual a la tasa de ahorro dividida por la relación marginal capital producto más el crecimiento del Adelanto tecnológico o innovaciones tecnológicas o progreso tecnológico. Kalecki argumenta que el coeficiente (*a*) permanece constante si todos los adelantos o progresos se dan a una tasa uniforme siempre y cuando la capacidad productiva este plenamente ocupada. De no ser así, este coeficiente podrá cambiar a través del tiempo y dependerá de la relación entre la demanda y la capacidad productiva. Kalecki (1976, pag 31 a la 34) supone que la productividad en las fábricas que entran enoperación crece a una tasa constante, es decir que de un año a otro este crecimiento de la productividad del trabajo puede ser expresado como

$(1+\alpha)$.

Así mismo, el
crecimiento de la nueva producción deberá estar dado por (1+ *y G*) porque la tasa de inversión se incrementa a una tasa anual constante si se mantiene la relación capital producto constante. En este sentido, tanto la productividad como el crecimiento de la producción aumentan a tasas constantes en las nuevas fábricas que entran en funcionamiento, por tal razón, el crecimiento de la ocupación también deberá crecer a la misma tasa. Formalmente se podría escribir el crecimiento de la ocupación como (1+e) que debe ser igual a la relación entre el crecimiento de la producción y el crecimiento de la productividad, es decir que

$$(1+\varepsilon) = (1+ G_y)/ (1+\alpha).$$

Se observa entonces, que el
crecimiento de la economía queda determinado por la suma de la tasa de crecimiento de la productividad del trabajo y la tasa de crecimiento de la ocupación, pero a que es la tasa de crecimiento de la productividad del trabajo esta determinada por el progreso técnico. En consecuencia, de la ecuación 5, el progreso técnico ¨*a*¨ que crece a una tasa constante queda representado por la relación constante entre el crecimiento de la productividad del trabajo y el crecimiento de la producción, es decir

$(1+\alpha)/(1+ G_y)$.

De acuerdo con lo anterior, Kalecki hace explícito la introducción del cambio técnico o progreso tecnológico y demuestra que este progreso técnico debe aumentar la productividad del trabajo, de tal manera que el crecimiento de la economía sea la suma de la tasa de crecimiento de esa productividad y la tasa de crecimiento de la población como lo había planteado Harrod. En consecuencia, la ecuación 18 es igual a la ecuación 15, es decir, la tasa de crecimiento de la economía es la suma de la tasa del progreso técnico más la ecuación fundamental de Harrod. Se procederá ahora a realizar los cálculos del progreso técnico utilizando esta ecuación y a comparar su contribución para Estados Unidos, Colombia y 15 países de la Unión Europea.

IV. Estimaciones

Para cuantificar el progreso técnico con base en la ecuación de Harrod se utiliza la base de datos Penn World Table con

información desde 1980 hasta 2003 y se compara con la PTF tradicional. En otras palabras se utilizarán la ecuación 12 para los cálculos y estos resultados se compararán con el residuo tradicional de Solow para cuantificar la magnitud de la contribución al crecimiento económico. En cada caso, es decir, para Estados Unidos, Colombia y los 15 países de la Unión europea, el residuo tradicional de Solow es tomado de las diferentes fuentes que aparecen al final de cada cuadro

Cuadro 1
Cálculos del progreso técnico para Estados Unidos.

0	1	2	3	4	5	6	7	8
Año	I/Y=i	*C*	*gy*	*i/C*	gaH	ptf	gaH/gy	ptf/gy
1979	19,84	6,95	2,94	2,85	0,08		2,85	
1980	18,13	-25,67	-0,70	-0,71	0,00	-2,24	-0,71	319,29
1981	19,04	7,97	2,45	2,39	0,06	0,81	2,39	32,93
1982	16,80	-10,92	-1,51	-1,54	0,02	-2,49	-1,54	164,58
1983	17,39	3,69	4,95	4,71	0,23	2,16	4,71	43,77
1984	20,43	2,94	7,47	6,95	0,52	1,99	6,95	26,62
1985	19,78	4,93	4,18	4,02	0,17	0,49	4,02	11,75
1986	19,22	5,80	3,43	3,31	0,11	1,04	3,31	30,22
1987	19,08	5,96	3,31	3,20	0,11	0,24	3,20	7,18
1988	18,65	4,84	4,01	3,86	0,15	0,98	3,86	24,52
1989	18,91	5,65	3,46	3,35	0,12	0,47	3,35	13,62
1990	18,23	10,61	1,75	1,72	0,03	0,45	1,72	25,53
1991	17,13	-45,40	-0,38	-0,38	0,00	-0,47	-0,38	126,10
1992	17,75	5,26	3,49	3,38	0,12	2,53	3,38	72,49
1993	18,51	6,42	2,97	2,88	0,09	0,16	2,88	5,40
1994	19,79	4,73	4,36	4,18	0,18	0,89	4,18	20,39
1995	19,94	7,76	2,64	2,57	0,07	-0,36	2,57	-13,70
1996	20,78	5,46	3,96	3,81	0,15	1,54	3,81	38,95
1997	22,12	4,79	4,84	4,62	0,22	0,95	4,62	19,67
1998	23,09	5,40	4,46	4,27	0,19	0,86	4,27	19,20
1999	23,80	5,38	4,63	4,42	0,20	1,21	4,42	26,07
2000	24,16	6,59	3,80	3,67	0,14	1,14	3,67	30,06
2001	22,59	55,25	0,41	0,41	0,00	-0,04	0,41	-8,78
2002	21,94	16,50	1,35	1,33	0,02	1,84	1,33	136,32
2003	22,09	8,41	2,70	2,63	0,07	2,66	2,63	98,45

Col 1. Participación de la inversión dentro del producto. Fuente: WPT 6.1, Heston, Summers y Aten.
Col 2. Relación incremental capital producto. Cálculos propios con base en WPT 6.1, Heston, Summers y Aten.
Col 3. Tasa de crecimiento de la Economía. fuente: WPT 6.1, Heston, Summers y Aten.
Col 4. Ecuación de Harrod. Columna 1/columna 2.
Col 5. El residuo o progreso técnico aplicando la ecuación 13.
Col 6. Productividad Total Factorial. Fuente: Timmer, Ypma and van Ark (2003), updated June 2005, o por Bureau of Labor Statistics and Office of Productivity and Technology. FOR MAY 6, 2009 UBLICATION.
Col 7 y 8. Contribución porcentual al crecimiento desde Harrod y Solow respectivamente

El cuadro 1 muestra que el progreso técnico calculado con base en la ecuación 12 es siempre positivo (columna 5) mientras que el progreso técnico calculado con base en la ecuación 9 por Ypma y Ark (2003) es positivo y negativo, por ejemplo para 1980 es - 2,24 o para 1982 es – 2,49% o para el 2001 es -0,04%. Así mismo, se observa para 1980 que la tasa de crecimiento fue de -0,7% y el progreso técnico fue de -2,24%, esto quiere decir que la caída en la tasa de crecimiento de la economía fue explicada en un 320% por la disminución del progreso técnico. ¿Tiene sentido este resultado?. Desde el punto de vista económico

no es posible pensar que esto haya sucedido. ¿Cómo entender que no hubo progreso técnico y que por el contrario este disminuyó?. Si se observan los datos para 1982, se encuentra que la tasa de crecimiento de la economía fue de -1,51 y la del progreso técnico fue de -2,49%, lo que quiere decir que la caída en la tasa de crecimiento estuvo explicada en un 164% por la caída en el progreso técnico, lo que se traduce en que el capital por trabajador contribuyó en el 64%. El sentido común de los economistas diría que este resultado no es coherente. La tasa de crecimiento para 2003 fue de 2,7% y la del progreso técnico fue de 2,66%, lo cual implica que la contribución al crecimiento es del 98,45%, es decir que el capital por trabajador sólo contribuyó al crecimiento en 1,55%.En síntesis, para este periodo el residuo de Solow o la PTF contribuyó al crecimiento en promedio en 53%, lo que significaría que el capital por trabajador contribuyó en el 47%. Estos resultados deben ser evaluados con más rigor y no darle un peso trascendental a la contribución del progreso técnico sobre el crecimiento de las economías. Pasa todo lo contrario si se calcula el progreso técnico con base en la ecuación 12. En este contexto, la gran contribución al crecimiento está determinada por la ecuación de Harrod expresada como la tasa de inversión dividida por la relación marginal capital producto, mientras que el progreso técnico juega un papel marginal en la contribución al crecimiento como se observa en el cuadro 1. Los resultados muestran en primer lugar que el progreso técnico es siempre positivo al menos para el periodo de estudio en referencia como lo muestra la columna 5. En segundo lugar, se observa que cuando el progreso técnico tiende a ser cero en algunos años, la tasa de crecimiento de la economía es negativa, por ejemplo en 1980, 1982, 1991 y en el año 2001. Así mismo para estos años se evidencia una caída en la tasa de inversión (columna 1). Parece ser que, según estos resultados, los efectos de mayores tasas de inversión jalonan el cambio técnico y este contribuye al crecimiento de la economía, mientras que si se disminuye la inversión, no se genera cambio técnico y por lo tanto la tasa de crecimiento de la economía experimenta caídas importantes. De todas maneras esta es una hipótesis que merece ser estudiada con mucha profundidad pues supera los alcances de este documento. Los resultados muestran con base en la ecuación 12 que el progreso técnico equivale a menos del 1% en todos los años de estudio y que su contribución al crecimiento es en promedio del 2,9%. Este parece ser un resultado mucho más lógico que el 53% calculado con base en la ecuación 8. De igual manera, al observar la tasa de crecimiento más alta de la economía de USA fue en 1984 y por supuesto la contribución a este crecimiento a partir del progreso técnico fue del 6,95% en contraste con el 26% utilizando la ecuación 8. Según estos datos, ¿cuando USA crece a tasas elevadas el progreso técnico es menor?, no tiene sentido, como tampoco tiene sentido que con bajas tasa de crecimiento como en el 2002 (1,3%) la contribución a este crecimiento con la ecuación 9 sea del 136% mientras que con base en la ecuación 12 la contribución solo sea apenas del 1,33% para un crecimiento del progreso técnico del 0,02% frente al 1,84% estimado con base en la ecuación 8. En el cuadro 2 podemos observar los datos de la productividad total de los factores calculada a partir de la ecuación 8 (GRECO) y los calculados a partir de la ecuación de Harrod. Este cálculo se realiza con las series originales del grupo de estudios del Banco de la República para el periodo de 1950 a 1996. El cuadro 2 muestra que en 1950 la tasa de crecimiento de la economía Colombiana fue de 1,1% y según los cálculos del GRECO el crecimiento de la productividad total de los factores fue de -2,72%, esto quiere decir, que la contribución al crecimiento por parte de la PTF es del -246,9% mientras que el capital por trabajador contribuyó en 346,9%. La magnitud de estos resultados merece urgentemente una discusión profunda.

Cuadro 2

Cálculos del progreso técnico para Colombia.

0	1	2	3	4	5	6	7	8	9	10	11
año	y	gy	ktal	inv	I/y	C	gyH	gaH	ptf	gaH/gy	ptf/gy
1950	117454	1,10	358871	13946	11,87	9,67	1,23	-0,12	-2,72	-11,22	-246,19
1951	120742	2,80	373007	14137	11,71	4,30	2,72	0,08	0,55	2,72	19,76
1952	128408	6,35	388016	15009	11,69	1,96	5,97	0,38	6,03	5,97	95,03
1953	134953	5,10	404217	16202	12,01	2,48	4,85	0,25	3,76	4,84	73,86
1954	144625	7,17	427346	23131	15,99	2,39	6,69	0,48	6,21	6,68	86,69
1955	150362	3,97	451755	24409	16,23	4,25	3,82	0,15	0,81	3,82	20,38
1956	157507	4,75	476516	24760	15,72	3,47	4,54	0,22	2,06	4,54	43,38
1957	162823	3,38	500438	23922	14,69	4,50	3,26	0,11	0,02	3,27	0,65
1958	165916	1,90	517428	16990	10,24	5,49	1,86	0,04	-1,35	1,86	-70,84
1959	177806	7,17	535635	18206	10,24	1,53	6,69	0,48	7,65	6,69	106,69
1960	184932	4,01	559135	23554	12,74	3,30	3,86	0,15	1,64	3,63	40,85
1961	194432	5,14	586773	27585	14,19	2,91	4,88	0,26	2,68	5,07	52,10
1962	204613	5,24	608064	21291	10,41	2,09	4,98	0,26	3,79	4,98	72,41
1963	211178	3,21	629314	21250	10,06	3,24	3,11	0,10	0,39	3,11	12,24
1964	223915	6,03	655458	26144	11,68	2,05	5,69	0,34	4,78	5,69	79,28
1965	232906	4,02	680582	25123	10,79	2,79	3,86	0,16	1,68	3,86	41,94
1966	245865	5,56	716407	35825	14,57	2,76	5,27	0,29	2,69	5,27	48,33
1967	254985	3,71	740000	23591	9,25	2,59	3,58	0,13	0,92	3,58	24,75
1968	270928	6,25	774007	34009	12,55	2,13	5,89	0,37	4,36	5,88	69,74
1969	288102	6,34	807632	33625	11,67	1,96	5,96	0,38	4,69	5,96	74,00
1970	307496	6,73	849354	41722	13,57	2,15	6,31	0,42	4,78	6,31	70,96
1971	325825	5,96	892810	43455	13,34	2,37	5,63	0,34	2,46	5,63	41,34
1972	350813	7,67	933609	40799	11,63	1,63	7,12	0,55	5,81	7,12	75,70
1973	374398	6,72	979254	45645	12,19	1,94	6,30	0,42	3,94	6,30	58,64
1974	395910	5,75	1037758	58503	14,78	2,72	5,43	0,31	2,02	5,43	35,07
1975	405108	2,32	1079950	42193	10,42	4,59	2,27	0,05	-2,37	2,27	-101,87
1976	424263	4,73	1127464	47514	11,20	2,48	4,51	0,21	1,53	4,51	32,28
1977	441906	4,16	1185911	58447	13,23	3,31	3,99	0,17	-0,02	3,99	-0,58
1978	479335	8,47	1249193	63282	13,20	1,69	7,81	0,66	7,30	7,81	86,18
1979	505119	5,38	1310717	61524	12,18	2,39	5,10	0,27	2,27	5,10	42,16
1980	525765	4,09	1380804	70087	13,33	3,39	3,93	0,16	-0,15	3,93	-3,78
1981	537736	2,28	1462710	81906	15,23	6,84	2,23	0,05	-3,59	2,23	-157,65
1982	542836	0,95	1548898	86188	15,88	16,90	0,94	0,01	-5,85	0,94	-616,97
1983	551380	1,57	1630469	81571	14,79	9,55	1,55	0,02	-4,32	1,55	-274,45
1984	569855	3,35	1703054	72585	12,74	3,93	3,24	0,11	-0,67	3,24	-19,89
1985	587561	3,11	1762893	59839	10,18	3,38	3,01	0,09	-0,34	3,01	-10,83
1986	621781	5,82	1825814	62921	10,12	1,84	5,50	0,32	3,93	5,50	67,46
1987	655164	5,37	1896996	71182	10,86	2,13	5,10	0,27	2,91	5,10	54,12
1988	681791	4,06	1975761	78765	11,55	2,96	3,91	0,16	0,47	3,91	11,62
1989	705068	3,41	2043215	67455	9,57	2,90	3,30	0,11	-0,11	3,30	-3,34
1990	735259	4,28	2108178	64240	8,74	2,15	4,06	0,22	1,76	5,17	41,09
1991	749976	2,00	2160541	52392	6,99	3,56	1,96	0,04	-1,73	1,91	-86,34
1992	780312	4,04	2256898	96402	12,35	3,18	3,89	0,16	0,36	3,84	8,97
1993	822335	5,39	2409150	152277	18,52	3,62	5,12	0,27	1,02	5,02	18,92
1994	870151	5,81	2601455	204572	23,51	4,02	5,84	-0,03	0,67	-0,46	11,48
1995	919534	5,68	2851891	171561	18,63	4,94	3,77	1,90	1,15	33,50	20,32
1996	938321	2,04	3086051	138560	14,74	12,40	1,19	0,85	0,00	41,82	0,00

Columnas 1=Producto interno bruto a peso de 1975
Columna 2=tasa de crecimiento del PIB,12
Columna 3=Capital a pesos de 1975
Columna 4=Inversión a peso de 1975
Columna 5=tasa de inversión,
Columna 6= Relación marginal capital producto. Cálculos del autor con base en la columna 1 y 3
Columna 7=Ecuación de Harrod calculada con base en la columna 5/ 6
Columna 8= Calculo del progreso técnico con base en la ecuación 13.
Columna 9= Productividad Total de los Factores. Cálculos del GRECO
Columna 10 y 11= contribución al crecimiento a partir de 8 y 9.
Toda la información es tomada de las estadísticas del Grupo GRECO.

Así mismo, en 1959 la tasa de crecimiento de la economía fue de 7,17% mientras que la del progreso técnico fue de 7,65%, es decir, hubo una contribución al crecimiento de mas del 100%, lo que quiere decir que el capital por trabajador contribuyó negativamente al crecimiento en un 6,69%. En otras palabras, para ese periodo todo el crecimiento recayó sobre el progreso técnico o productividad total de los factores, el capital no jugó ningún papel a pesar de que hubo incrementos en el capital como lo muestran las cifras. En 1975 la tasa de crecimiento de la economía fue de 2,32% y el progreso técnico fue de -2,37%, es decir la contribución al crecimiento fue negativa y del orden del -101%. ¿Cómo explicar estos hechos? Tal vez la teoría existente detrás de la función de producción este errada y es justamente lo que se demuestra interpretando la función de producción como la ecuación de Harrod en el cálculo del progreso técnico. En la revisión de la PTF para Colombia, el dato menos creíble, si es que se creé en los otros, es el dato de 1982. En este año la tasa de crecimiento de la economía fue de 0,95% mientras que la del progreso técnico fue de -5,85%. Como explicar que el progreso técnico cayó 5,85%? Y más aún, ¿Cómo explicar que la contribución al crecimiento de la economía fue del -616,9% si se asume que el progreso técnico siempre es positivo? Bajo estas consideraciones es necesario replantear el cálculo del progreso técnico tal y como se muestra en la ecuación 12. Los datos de la columna 10 del cuadro 2 son más coherentes con el crecimiento de la economía que los calculados por el GRECO con base en el residuo de Solow tradicional. Los datos obtenidos con base en la ecuación 12 para Colombia (columna 10) muestran que excepto en 1950 todas las contribuciones al crecimiento de la economía son positivas y su magnitud no supera el 7,5% a excepción de los años 1995 y 1996. Si se toma como ejemplo el mismo año de 1959, la contribución al crecimiento es apenas del 6,69% mientras que según el GRECO la contribución es de más del 100%. Así mismo al observar el año de 1982 donde la tasa de crecimiento fue del 0,95, la contribución al crecimiento fue de 0,94% mientras que según el GRECO fue del -616,9%. En general, los datos del progreso técnico hallados a partir de la función de producción tradicional pero interpretada con base en la ecuación de Harrod son mucho más consistentes. Nuevamente, no es posible pensar que el crecimiento o decrecimiento de la economía estuvo explicado en más del 100% o del -616,9% o del -254,7, etc, por el progreso técnico. Los cálculos de la PTF para 15 países de la Unión Europea (Austria, Bélgica, Dinamarca, Finlandia, Francia, Alemania, Grecia, Irlanda, Italia, Luxemburgo, holanda, Portugal, España, Suecia y Reino Unido), también evidencian que la contribución de 13 esta variable al crecimiento es del 54% en promedio para el periodo 1980-2004. El cuadro 3 muestra estos datos.

Cuadro 3

Cálculos del progreso técnico para 15 países de la Unión Europea.

año	gy	i/y	C	gaH	ptf	gaH/gy	ptf/gy
1980		15,81			0,47		
1981	0,07	15,02	211,78	0,00	0,33	0,07	457,85
1982	0,92	14,61	15,95	0,01	1,07	0,92	116,24
1983	1,80	14,24	8,07	0,03	1,27	1,76	70,61
1984	2,45	13,93	5,82	0,06	2,12	2,39	86,39
1985	2,49	14,13	5,81	0,06	1,11	2,43	44,72
1986	2,78	14,32	5,30	0,07	1,25	2,70	44,93
1987	2,81	14,85	5,44	0,08	1,07	2,73	37,96
1988	4,21	15,58	3,86	0,17	1,47	4,04	34,89
1989	3,53	16,24	4,76	0,12	1,17	3,41	33,22
1990	3,05	16,45	5,56	0,09	0,62	2,96	20,22
1991	1,84	16,01	8,86	0,03	1,05	1,81	57,02
1992	1,17	15,61	13,46	0,01	0,97	1,16	82,38
1993	-0,34	14,38	-41,85	0,00	0,50	-0,34	-145,68
1994	2,82	14,13	5,15	0,08	2,15	2,74	76,03
1995	2,44	14,12	5,92	0,06	1,26	2,38	51,60
1996	1,71	14,14	8,40	0,03	0,45	1,68	26,17
1997	2,55	14,21	5,71	0,06	0,94	2,49	37,00
1998	2,93	14,97	5,26	0,08	0,31	2,84	10,63
1999	2,90	15,33	5,45	0,08	1,05	2,81	36,40
2000	3,59	15,66	4,51	0,12	1,52	3,47	42,37
2001	1,74	15,48	9,05	0,03	-0,11	1,71	-6,51
2002	1,08	15,08	14,13	0,01	0,29	1,07	27,19
2003	0,86	14,90	17,37	0,01	0,21	0,86	24,68
2004	2,18	15,14	7,09	0,05	1,06	2,14	48,50

Marcel P. Timmer, Gerard Ypma and Bart van Ark, IT in the European Union: Driving productivity Convergence?. Downloadable at http://www.ggdc.net/pub/online/gd67(online).pdf

En 1981 la tasa de crecimiento para los 15 países de la Unión Europea es de 0,07% mientras que el progreso técnico o PTF creció 0,33%; este valor del progreso técnico contribuye al crecimiento de las economías en el 457,8%, mientras que si se observa el progreso técnico calculado con base en la ecuación de Harrod la contribución es del 0,07. Nuevamente, no es posible que haya existido un cambio tecnológico que jalone el crecimiento de las economías europeas en más del 450%. De igual manera, el crecimiento de estas economías para1993 fue negativo (-0,34%) mientras que el crecimiento de la PTF fue positivo y del orden de 0,5%, si se calcula su contribución porcentual al crecimiento se observa que fue mas del 100%. Pasa todo lo contrario al realizar los cálculos con base en la ecuación de Harrod pues la contribución al crecimiento es apenas del 0,34%. Los anteriores cuadros muestran que existe una magnitud del progreso técnico incomprensible, datos del 100% o más no son consistentes con la realidad. O es que ¿seha evidenciado un cambio técnico que jalonó el crecimiento de la economía en mas del 200%?, ¿ de un año a otro, se presentó una innovación que duplicó la producción pero a pesar de eso la economía decreció?. Indiscutiblemente estos datos nos invitan a pensar en la pertinencia de la utilización del método de Solow para calcular el progreso técnico.

V. Conclusiones

Dadas las desproporcionadas magnitudes de la contribución porcentual al crecimiento económico por parte del progreso técnico o productividad total de los factores, es indispensable repensar el cálculo de este residuo con base en la metodología utilizada por Solow en 1957. Tanto para estados Unidos, como para Colombia y los 15 países de la Unión Europea, el residuo de Solow explica en algunos años más del 100% o del 200% el crecimiento o decrecimiento de las economías. Se presenta una reinterpretación de la función de producción cobb-Douglas y se obtiene un residuo o progreso técnico con base en la ecuación de Harrod. Este nuevo cálculo del progreso técnico es mucho más razonable y su contribución al crecimiento es moderada, a lo sumo 7%. Así mismo, cuando se calcula la contribución promedio

al crecimiento en un periodo de tiempo largo, esta contribución tiende a ser igual a la tasa promedia de crecimiento de la economía. En Estados Unidos por ejemplo, el nuevo residuo calculado con base en la ecuación de Harrod contribuye al crecimiento en el 2,87% mientras que la tasa de crecimiento promedia de la economía fue de 2,99% para el periodo 1980- 2004. En Colombia, la tasa de crecimiento promedia entre 1950 y 1996 fue de 4,56% y la contribución al crecimiento del progreso técnico fue de 5,1%, esto implica que la contribución del capital al crecimiento fue del 95%. Finalmente, este documento muestra que existe una magnitud del progreso técnico incomprensible, datos del 100% o más no son consistentes con la realidad. O es que ¿se ha evidenciado un cambio técnico que jalonó el crecimiento de la economía en mas del 200%?, o de un año a otro, se presentó una innovación que duplicó la producción pero a pesar de eso la economía decreció? Indiscutiblemente estos datos nos invitan a pensar en la pertinencia de la utilización del método de Solow para calcular el progreso técnico. Bajo estas consideraciones, el debate queda abierto.

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La Volatilidad De La Tasa De Crecimiento De La Economia: Una Explicación Desde El Teorema De Harrod

GJMBR Classification
FOR:140301,140302,140303
JEL:O47,O57,C31

José Reyes Bernal Bellón

***Abstract*- One of the stylized facts of Kaldor (1961) refers to the constancy that is observed in the ratio of capital product to different countries. The objective of this paper is to show that the product capital ratio is constant but differs substantially from the high volatility of the incremental capital product relation (ICOR). Additionally, use Harrod's theorem to show through simple graphic that defines the volatility of volatility ICOR growth rate of the economy.**

Keys words- Economics growth, incremental capital output ratio, marginal propensity to save. JEL: E22, O39, O40, O57

I. INTRODUCCION

Uno de los hechos estilizados de Kaldor (1961) se refiere a la constancia de la relación capital producto. Algunos autores han mostrado esta relative constancia de la relación capital producto como es el caso de Maddinson (1982) quien observa este hecho para 16 países de la OCDE. Easterly (1999) también supone una relación capital producto constante en las estimaciones que realiza con base en el modelo Harrod-Domar para 88 países, con el objetivo de verificar si los incrementos en la inversión y la ayuda externa generan crecimiento o no. La literatura sobre crecimiento y la misma academia reconocen y aceptan este hecho como una regularidad internacional. De igual manera, parece existir un consenso general en suponer que la relación capital producto es igual a la relación incremental capital producto y que por lo tanto esta última también es constante (i, e Jones (1988), grabowski R. y Shields M. (2000), Melhum H. (2004)). El objetivo de este artículo es mostrar que la relación capital producto difiere sustancialmente de la relación incremental (ICOR) capital producto. Adicionalmente, se pretende mostrar a través de la propuesta de Harrod que la volatilidad de la relación marginal capital producto define la volatilidad de la tasa de crecimiento económico. El trabajo no pretende explicar la alta volatilidad del (ICOR), por el contrario, este es el gran reto de la teoría del crecimiento económico. Este trabajo se desarrolla con base en las ecuaciones fundamentales de Harrod y contiene en primer lugar esta breve introducción. En segundo lugar se plantea el modelo de Harrod y se muestra empíricamente la estabilidad de la relación capital producto frente a la gran volatilidad de la relación marginal. capital producto. En tercer lugar, se muestra cual es la incidencia de la relación marginal capital producto sobre la tasa de crecimiento de la economía a través de estimaciones data panel. En la cuarta y última sección se presentan las conclusiones del trabajo

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II. LA ECUACION FUNDAMENTAL DE HARROD

La ecuación fundamental Harrod parte de la igualdad entre la inversión (I) o las variaciones en el capital y el ahorro, es decir,

$$I = \Delta K = S = sY.$$

Así mismo, establece la relación marginal capital producto como

$$C = \Delta K/\Delta Y,$$

es decir, establece que la inversión depende de cambios en las variaciones en el producto. Con base en estas ecuaciones deriva su ecuación que representa una senda de crecimiento, así:

$$G_y = \frac{s}{C} \qquad [1]$$

De donde *y G* es la tasa de crecimiento observada, ―*s* ” es la tasa de ahorro y ―*C* ” es la relación marginal capital producto. El interés fundamental de este trabajo consiste en analizar el comportamiento de la relación marginal capital producto *C* y su relación con la tasa de crecimiento de la economía. Harrod (1979, Pág. 175) argumenta que sus ecuaciones fundamentales son¨axiomas que serían la base de una teoría general del crecimiento económico ¨.Bajo esta consideración, una alta tasa de crecimiento estará asociada a una alta tasa de ahorro o a una baja relación marginal capital producto. Así mismo, cuando hay una alta tasa de crecimiento pero existe un bajo ahorro, el resultado será una menor relación marginal capital producto. De igual manera puede coexistir una baja tasa de crecimiento del producto con una alta tasa de ahorro, en ese caso la ecuación mostrará que la relación marginal capital producto se ha incrementado considerablemente. Estas variaciones notables de la razón marginal capital producto tienden a explicar las variaciones en la tasa de crecimiento de la economía, mientras que la tasa de ahorro juega un papel residual en la determinación de dicha tasa. Bernal (2008) muestra que pueden coexistir altas tasas de ahorro con bajas tasas de crecimiento o bajas tasas de ahorro con altas tasas de crecimiento económico. Por lo tanto, y de acuerdo con la ecuación fundamental de Harrod, la volatilidad del crecimiento económico estaría definida por la volatilidad de la relación incremental capital producto. Con base en la

sencilla ecuación de Harrod se puede extraer la siguiente interpretación: si la tasa de ahorro juega un papel residual o acomodaticio en la ecuación, la relación incremental capital producto es la que define la tasa de crecimiento de la economía. En primer lugar, una alta (baja) tasa de crecimiento estará asociada a una baja (alta) relación marginal capital respectivamente. En segundo lugar, la relación marginal capital product determina el signo positivo o negativo de la tasa de crecimiento de la economía; así por ejemplo, cuando un país presenta una tasa de crecimiento negativa (-2,5%) el signo lo establece la relación marginal capital producto y no la tasa de ahorro que siempre será positiva por ser un porcentaje del ingreso. En consecuencia, una caída absoluta en el ingreso o en el stock de capital generará el signo negativo de la tasa de crecimiento. En tercer lugar, si se define el teorema de Harrod como la tasa de ahorro dividida por la relación capital producto, esta tasa de crecimiento será siempre positiva, no habrá posibilidad de que se genere una tasa de crecimiento económico negativa porque la relación capital producto siempre será positive al igual que la tasa de ahorro.Si por el contrario se define la tasa de crecimiento con base en la relación marginal capital producto se tendrá, o bien tasas de crecimiento positivas o negativas según sea el signo de la relación incremental capital producto. Así mismo, una tasa de crecimiento definida con la relación capital producto que tiende a ser constante y con unas tasas de ahorro que no varían mucho, darían como resultado una tasa de crecimiento relativamente constante y por lo tanto la volatilidad del crecimiento estaría en entre dicho pues es, justamente esta volatilidad la que impera en todas las economías del mundo.

1) Comparación entre la Relación Capital Producto y la RelaciónMarginal Capital Producto

A continuación se presentarán los gráficos de la relación capital producto y de la relación marginal capital producto para algunos países de la OCDE, Sur América, Asia y África. Este ejercicio se realiza con base en la información de la Penn World Table de Summers, Heston y Aten de 2002 para 88 países con información comprendida entre 1970 y 1996. Los datos de la relación capital product (K/Y) y de la relación marginal capital product

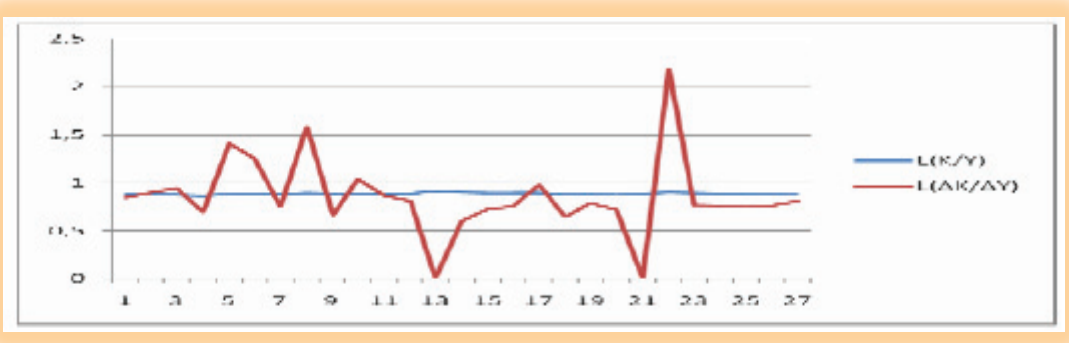
$$\Delta K/\Delta Y$$

están expresados en logaritmos. Se mostrará entonces, la enorme volatilidad de la relación marginal capital producto frente a la nula o baja volatilidad de la relación capital producto. En consecuencia,los resultados podían mostrar que ambas relaciones no tienden a ser iguales como se plantea en los libros de texto donde siempre se asu me que

$$K/Y = \Delta K/\Delta Y.$$

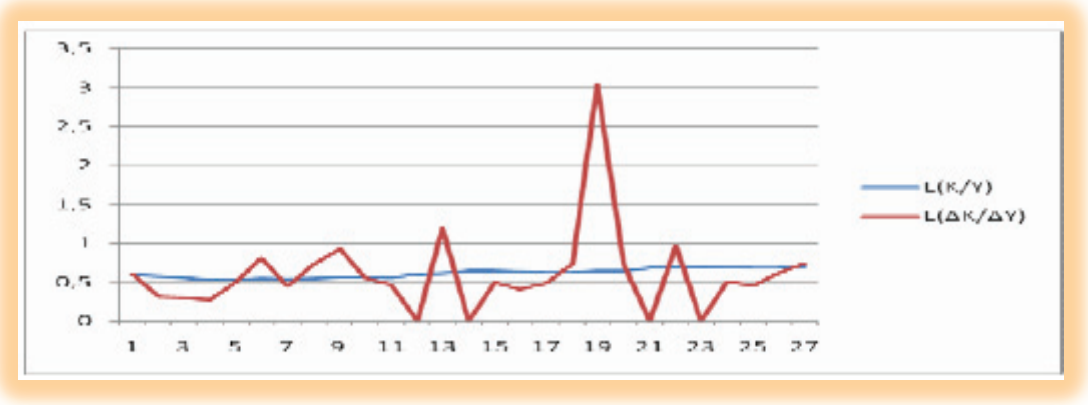
Este supuesto lo han utilizado las instituciones financieras internacionales para fijar metas de crecimiento o establecer brechas de financiación sin resultados robustos. A continuación se presentan los gráficas de cada una de las relaciones en mención.

Gráfica 1
La relación capital producto y la relación marginal capital producto para Australia



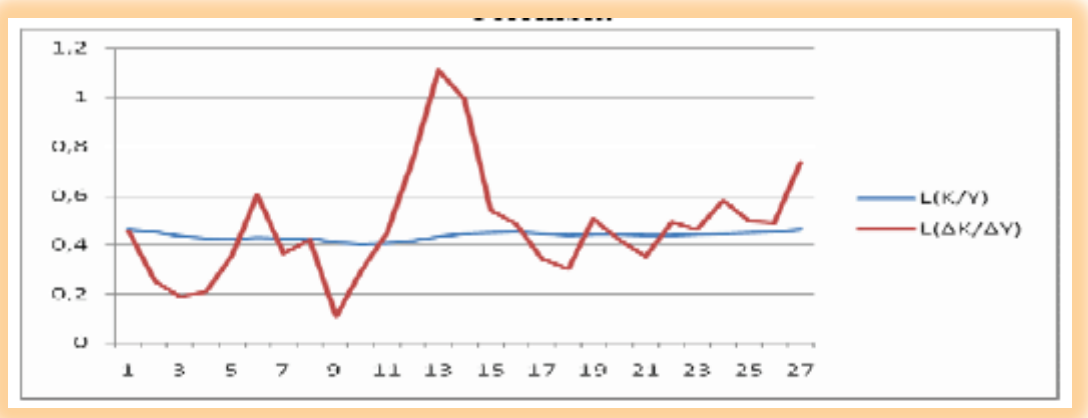
Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 2
La relación capital producto y la relación marginal capital producto para Brasil



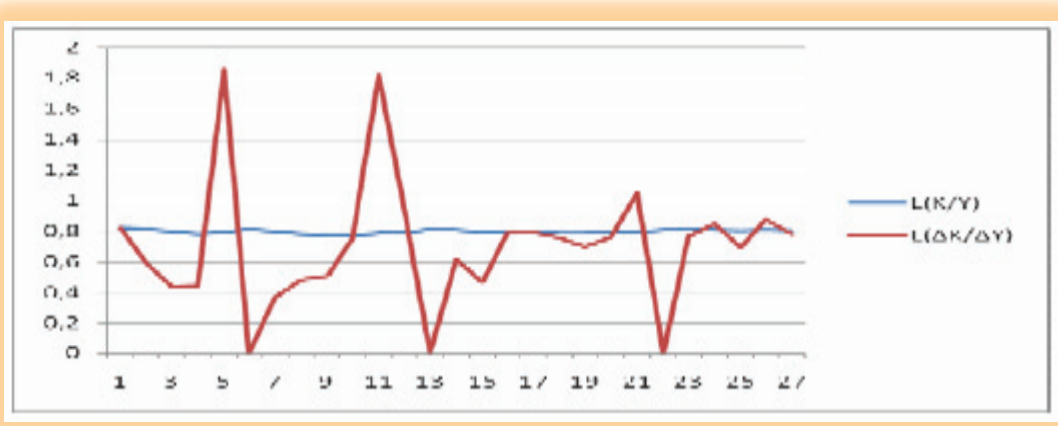
Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 3
La relación capital producto y la relación marginal capital producto para Colombia



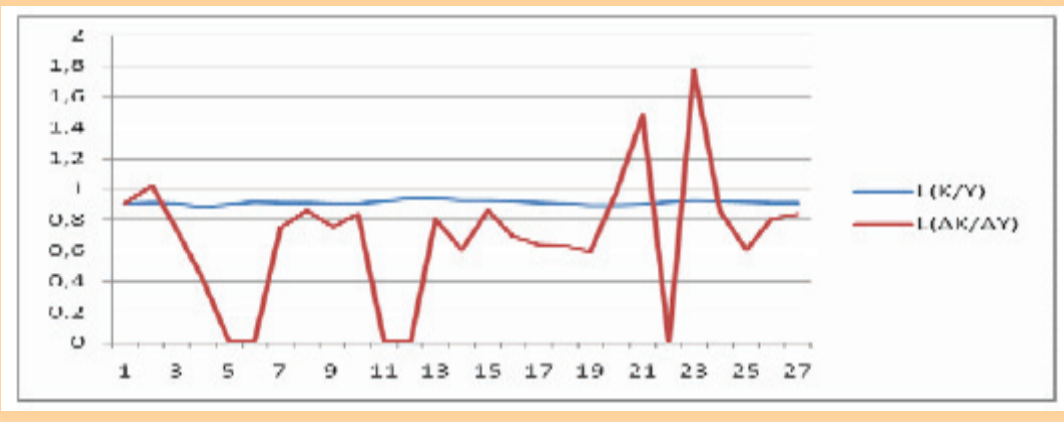
Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 4
La relación capital producto y la relación marginal capital producto para Estados Unidos



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 5
La relación capital producto y la relación marginal capital producto para Reino Unido

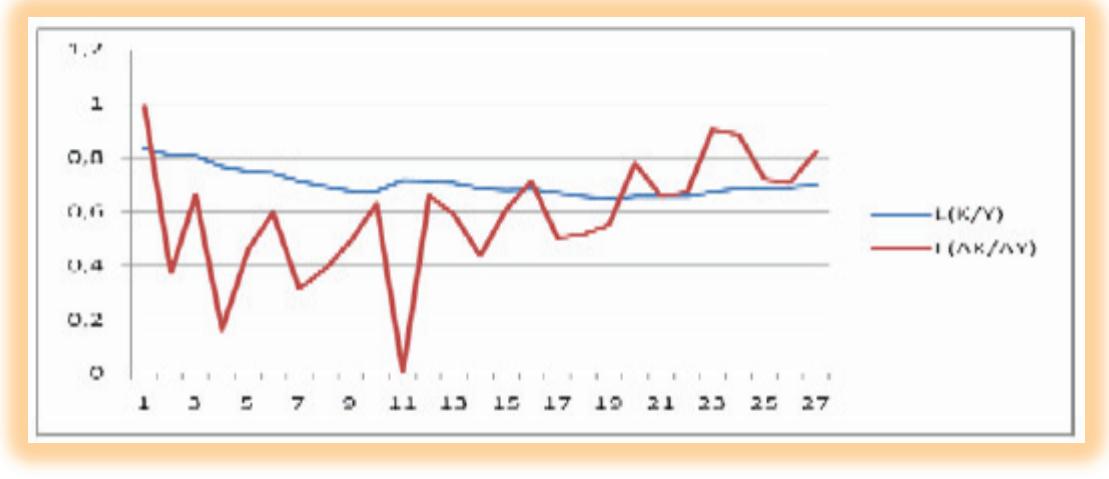


Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 6
La relación capital producto y la relación marginal capital producto para Singapur

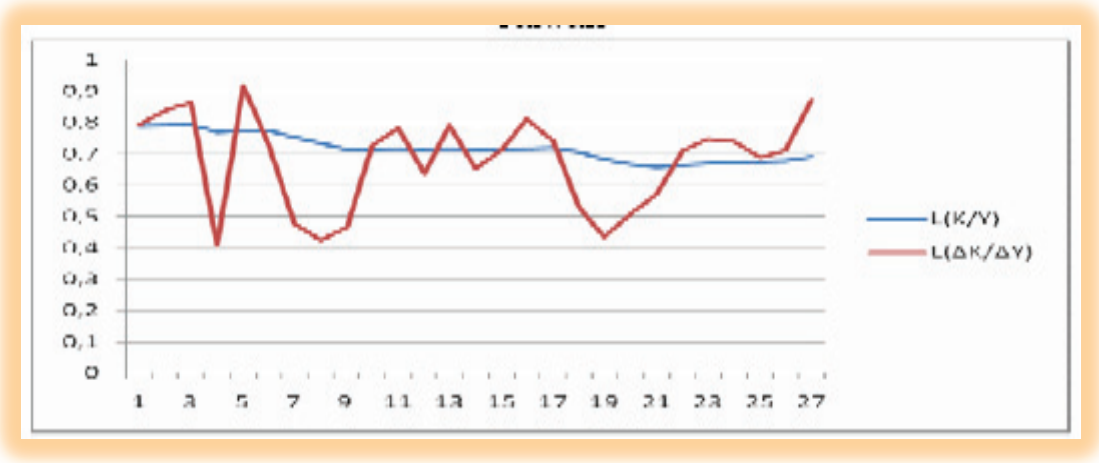
Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 7
La relación capital producto y la relación marginal capital producto para Korea



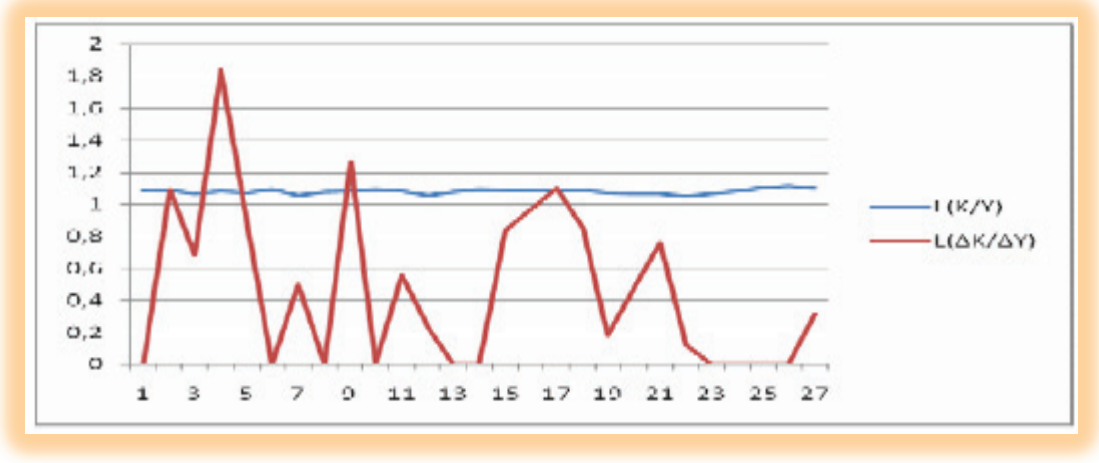
Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 8
La relación capital producto y la relación marginal capital producto para Taiwan



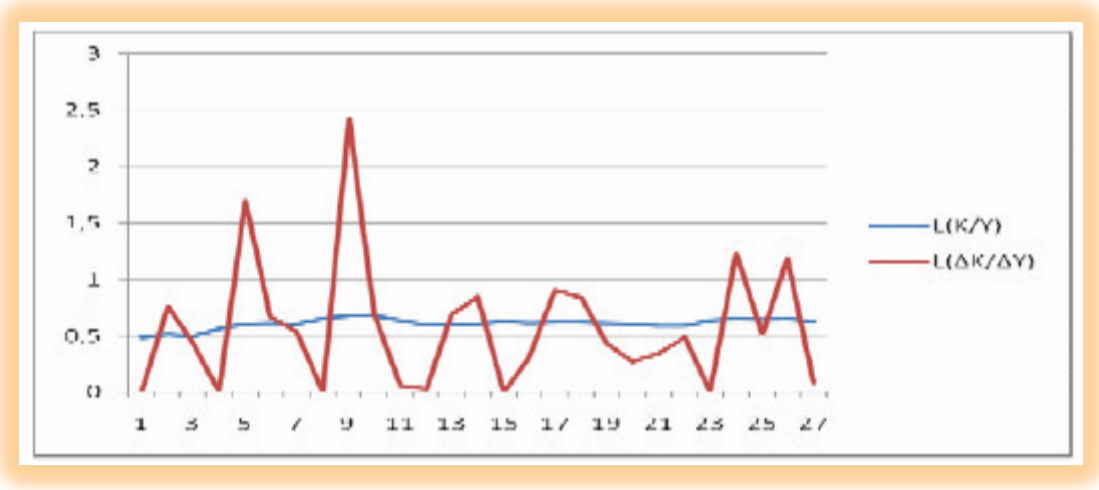
Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 9
La relación capital producto y la relación marginal capital producto para Zambia



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 10
La relación capital producto y la relación marginal capital producto para Zimbawe



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Al observar las gráficas de la 1 a la 10 se concluye que la relación capital producto para esta muestra de países es constante o relativamente constante, mientras que la relación marginal capital producto es extremadamente volátil. Este mismo resultado se verifica para todos los países del mundo y se invita al lector a que lo compruebe. En general, se presentan dos regularidades en todos los países del mundo, una, la relación capital producto tiende a ser constante y dos, la relación marginal capital producto es muy volátil. La volatilidad de la relación incremental capital producto también puede comprobarse utilizando la desviación estándar y comparándola con la de la relación capital producto. Se observará que las dos desviaciones difieren significativamente para todos los países de la muestra. El cuadro 1 presenta estos resultados.

Cuadro No. 1
Desviación estándar de la relación capital producto (K/Y) y de la relación marginal capital producto ((ΔK/ΔY)

País	Desv E. (K/Y)	Desv E. (ΔK/ΔY)
AUSRALIA	0,2	31,3
BRASIL	0,6	214,5
COLOMBIA	0,1	2,5
ESTADOS UNIDOS	0,2	18,7
GRAN BRETAÑA	0,2	14,6
SINGAPUR	0,3	5,5
KOREA	0,6	3,7
TAIWAN	0,2	3,6
ZAMBIA	0,4	15,8
ZIMABWE	0,4	51,5

Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

En el cuadro No. 1 se observa que la desviación respecto a la media de la relación capital producto es mínima, es decir tiende a cero en todos los países analizados, mientras que la desviación estándar de la relación marginal capital producto es muy volátil o la dispersión es grande respecto a su media. En el anexo 1 se presenta esta información para todos los países seleccionados. Se ha mostrado que la relación marginal capital producto de Harrod es muy volátil y que no

es igual a la relación capital producto. A continuación se analizará cual de las dos relaciones define una tasa crecimiento. (Bernal, 2008) mostró que la ecuación de Harrod, es decir la tasa de ahorro dividida sobre la relación marginal capital producto tiende a ser una ley del crecimiento.

III. La relación marginal capital producto

$(\Delta K/\Delta Y)$ define la tasa de crecimiento de la economía.

Bernal (2008) mostró que el teorema de Harrod tiende a ser una ley del crecimiento, por lo tanto, la tasa de ahorro dividida por la relación marginal capital producto sigue el mismo comportamiento que la tasa de crecimiento real de la economía. En este trabajo se muestra la diferencia de dividir la tasa

de ahorro entre la relación capital producto versus dividir la tasa de ahorro entre la relación marginal capital producto. Cada uno de estos resultados sera comparado con la tasa de crecimiento real de la economía la cual siempre se calcula como Gy = ((PIBt – PIBt-1)/PIBt-1)*100 Para mostrar este ejercicio se seguirá con los mismos países con los cuales semostró escasa variabilidad de la relación capital producto (K/Y) frente a la volatilidad de la relación marginal capital producto

$(\Delta K/\Delta Y).$

No obstante, se puede elegir cualquier país de la muestra y también se verificarán los mismos resultados. En las gráficas Gy es la tasa de crecimiento real de la economía y las otras dos curvas son el teorema de Harrod con la relación capital producto (s/(K/Y)) y con la relación marginal capital product

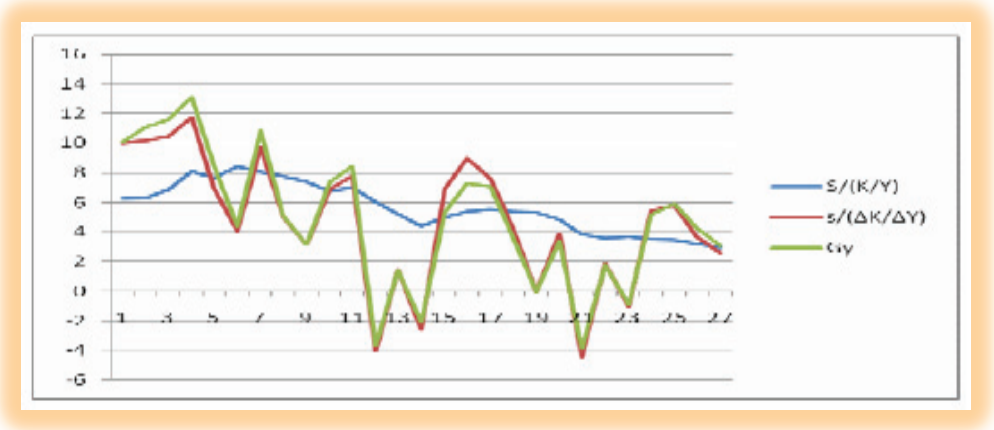
$(s/(\Delta K/\Delta Y)).$

Gráfica 11
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Australia

Nota: año 1 = 1970, año 27 = 1996
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

En la gráfica 11 se observa que la tasa de crecimiento real (Gy) tiende a ser igual al teorema de Harrod cuando se utiliza la relación marginal capital producto, mientras que cuando se usa la relación capital producto la curva tiende a ser horizontal mostrando tanto la estabilidad de esta relación como la poca variación de la tasa de ahorro para este país. De igual manera al explorer los datos puntualmente se observará que los años en los cuales la tasa de crecimiento fue alta, también corresponde una relación marginal capital producto baja y viceversa tal como se muestra en Bernal (2008). Por ejemplo, en 1977 se dio una de las tasas de crecimiento más bajas en Australia (0,6%) y esa tasa de crecimiento es compatible con una relación marginal capital producto alta (38), mientras que por ejemplo, en 1983 la tasa de crecimiento de la economía fue del 5% y con una relación marginal capital producto de 3,9, mucho mas baja que en 1977.

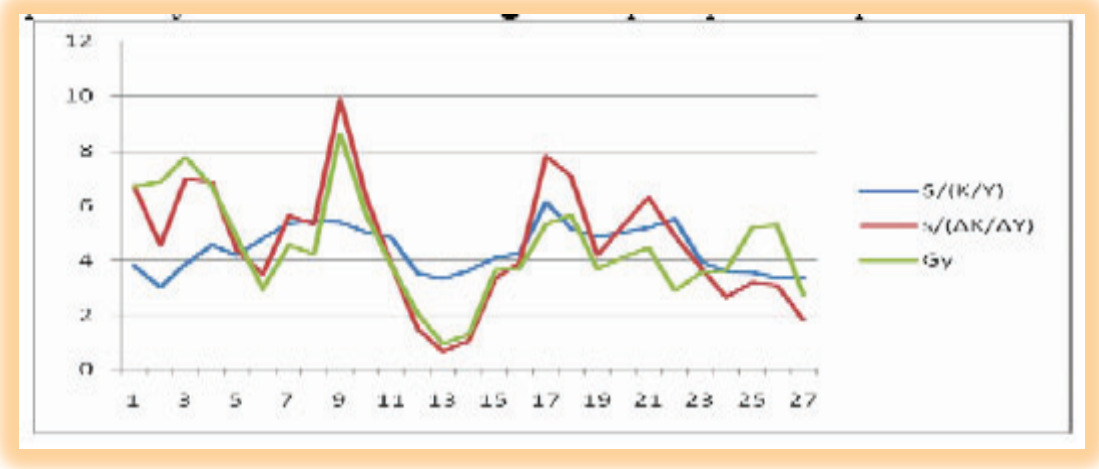
Gráfica 12
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Brasil



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

En la gráfica 12 también se observa el mismo comportamiento de las tres curvas pero la relación capital producto para Brasil presenta una leve tendencia descendente aún cuando su comportamiento es estable. De igual manera el teorema de Harrod se cumple para Brasil y es la volatilidad de la relación marginal capital producto la que determina la volatilidad de la tasa de crecimiento. En Brasil, la tasa de crecimiento real mas alta (13,1%) se dio en 1973. En ese año, la tasa de ahorro era del 27% y la relación capital product fue de 2,3. Así mismo, en 1975 con una tasa de ahorro del 29,7% la economía brasileña alcanzó una tasa de crecimiento de apenas el 4,4% y con una relación marginal capital producto del orden de 7.2 más alta que en 1973. Por lo tanto, se puede concluir que periodos de alto crecimiento son consistentes con bajas relaciones incremental capital producto y no así con altas tasas de ahorro

. Gráfica 13
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Colombia

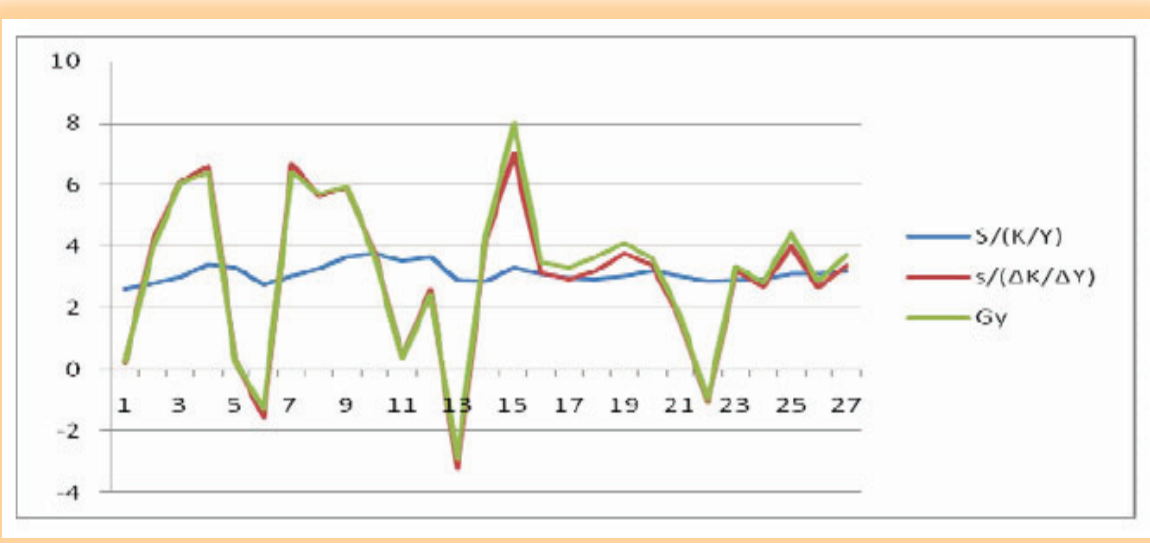


Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

En Colombia, de acuerdo con la gráfica 13, también se evidencia que el teorema de Harrod determina una tasa de crecimiento de la economía y que tiende a ser igual a la tasa real de crecimiento cuando se utiliza la relación marginal capital producto, mientras que si el teorema utiliza la relación capital producto la curva que se genera es relativamente estable. Bajo estas consideraciones, la volatilidad de la relación marginal capital product determina la volatilidad de la tasa de crecimiento real porque, como lo

muestran los datos, periodos de alto crecimiento son compatibles con una relación marginal capital producto bajay viceversa. Por ejemplo, ~~l~~la tasa de crecimiento mas alta de la economía Colombiana se dio en 1978, 8,6% con una tasa de ahorro del 13, 5% y una relación marginal capital producto de 1,3. Por el contrario, en 1991 la tasa de ahorro de la economía ascendió al 15% pero la relación marginal capital producto se incrementó hasta alcanzar el 3,1 generando de esta manera una tasa de crecimiento real apenas del 2,8%. De igual manera, la tasa de ce crecimiento de la economía para el año 1982 fue de 0,9% con una tasa de ahorro del 8,9% pero con una relación marginal capital producto de 13,3. Se comprueba una vez más, que existe una relación directa entre la productividad marginal del capital y la tasa de crecimiento de la economía" Bernal (2008).

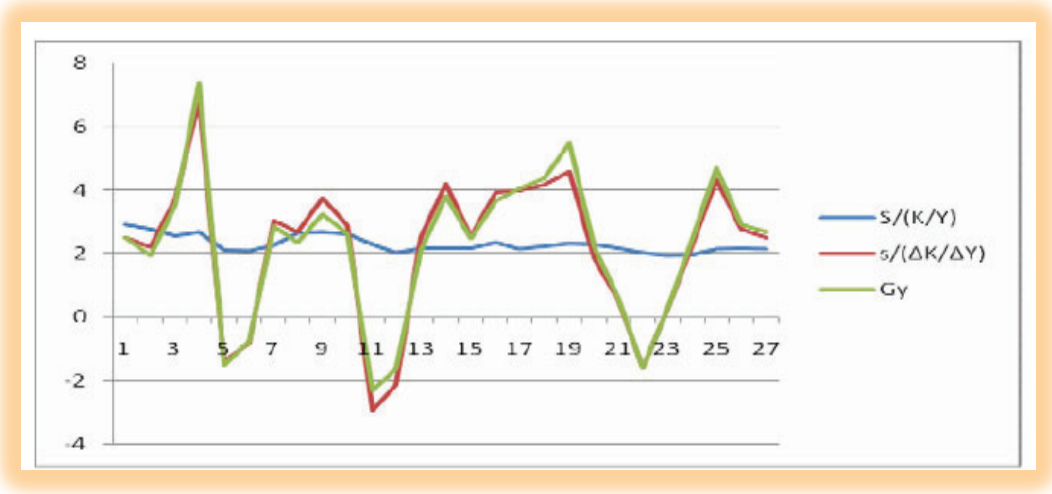
Gráfica 14
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Estados Unidos



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Para Estados Unidos y de acuerdo a la gráfica 14, también se evidencia que el teorema de Harrod determina una tasa de crecimiento de la economía y que tiende a ser igual a la tasa real de crecimiento cuando se utiliza la relación marginal capital producto, mientras que si el teorema utiliza la relación capital producto la curva que se genera es muy estable poniendo en entre dicho la volatilidad de la tasa de crecimiento. ~~E~~En Estados Unidos, se evidencia el mismo comportamiento de la relación capital producto frente a la tasa de crecimiento. En 1984 la tasa de crecimiento de los Estados Unidos fue una de las más altas durante el periodo de análisis, 7,98%. Si bien la tasa de ahorro fue del 20%, una de las más altas del periodo, la relación marginal capital producto fue de 2,9, la más baja en todo el periodo. Con una tasa de ahorro similar, es decir del 20,5% para 1974, la tasa de crecimiento apenas alcanzó el 0,26%. La explicación de esta caída está en la relación marginal capital producto que fue la mas altas durante este periodo, 71,3"

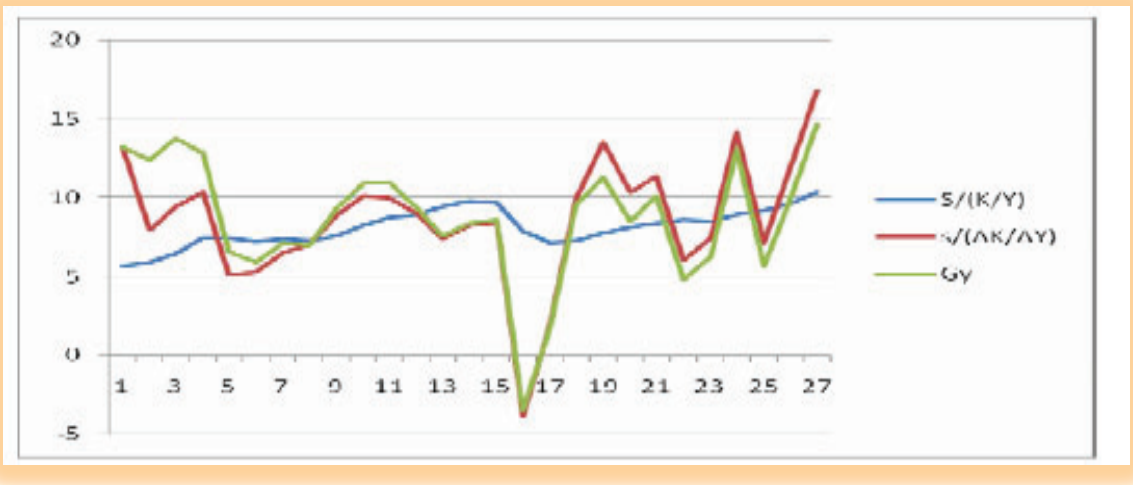
Gráfica 15
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para el Reino Unido



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

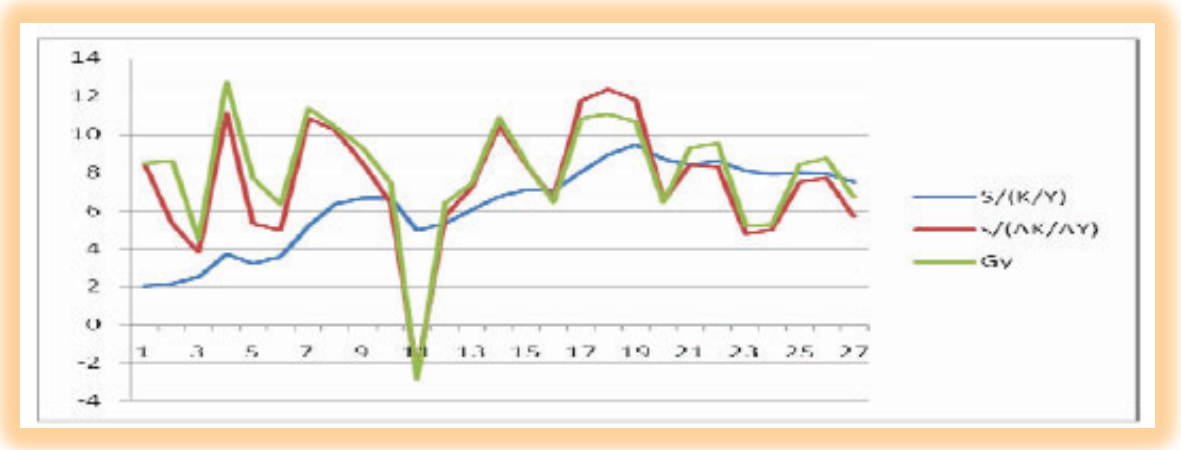
La gráfica 15 es la perfecta para demostrar que una la relación capital producto estable junto con una tasa de ahorro que se modifica levemente da como resultado una curva casi perfectamente horizontal. Por el contrario, el teorema de Harrod en el que se involucra la relación marginal capital product tiende a ser igual a la tasa de crecimiento de la economía la cual es muy volátil. En este caso se comprueba que dada una tasa de ahorro, la variable que determina la volatilidad de la tasa de crecimiento de la economía es la relación marginal capital producto.

Gráfica 16
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Singapur



Nota: año 1 = 1970, año 27 = 1996
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 17
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Korea

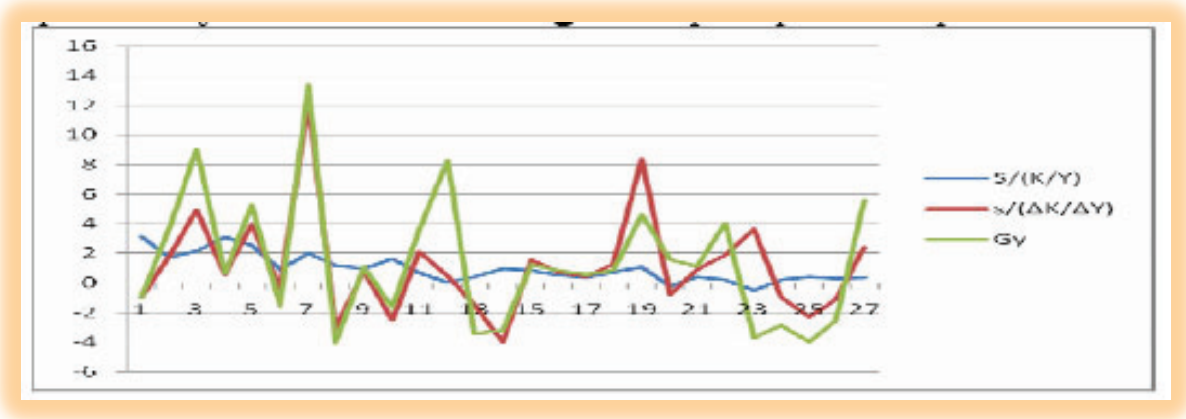


Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 18
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Taiwan

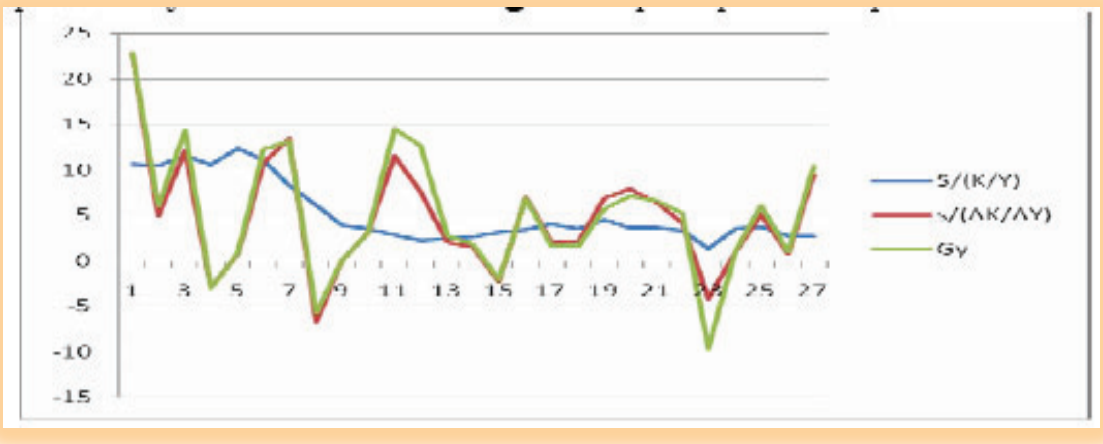
Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 19
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Zambia



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Gráfica 20
La tasa de crecimiento real y el teorema de Harrod con la relación capital producto y con la relación marginal capital producto para Zimbawe



Nota: año 1 = 1970, año 27 = 1996.
Fuente: cálculos propios con base en WPT 6.1, Heston, Summers y Aten.

Las gráficas de la 11 a la 20 muestran que el teorema de Harrod, es decir la tasa de ahorro dividida por la relación marginal capital producto tiende a ser igual a la tasa de crecimiento real de la economía y no así la tasa de ahorro dividida por la relación capital producto. En todos los países de estudio se demuestra que la tasa de ahorro no guarda una relación lineal con la tasa de crecimiento económico. Por lo tanto, el ahorro apenas es una variable acomodaticia en la ecuación de Harrod y la relación marginal capital product se convierte en la variable que define la tasa de crecimiento económico y así mismo, la volatilidad de esta relación, también esta relacionada con la volatilidad de la tasa de crecimiento. En todos los países de análisis, se comprueba que la tasa de ahorro no juega un papel significativo en la explicación de la tasa de crecimiento real. Es decir, se evidencia en todos los casos que pueden coexistir altas tasas de ahorro con bajas tasas de crecimiento o igualmente bajas tasas de ahorro con altas tasas de crecimiento. La explicación fundamental proviene de la relación marginal capital producto porque siempre se demuestra, que altas tasas de crecimiento son consistentes con relaciones marginales capital producto muy bajas y a la inversa. El comportamiento de la relación inversa entre tasa de crecimiento de la economía y la relación marginal capital producto, se comprueba para todos los países de análisis, mientras que la tasa de ahorro no muestra una relación lineal con la tasa de crecimiento. Una verificación alternativa a través de el método de data panel podría confirmar aún mas la relación negativa entre la relación marginal o incremental

capital producto (ICOR) y la tasa de crecimiento de la economía. El siguiente cuadro (2) muestra estos resultados y la salida de la estimación se presenta en el anexo 2.

CUADRO No. 2
Relación entre la tasa de crecimieto (LGy) y la relación marginal capital producto(LCr).
Datos anuales 1970-1996.
Variables en logaritmos.

	EC. No.	VAR DEP	INDEP C	dLCr	DW	R^2
88 Países	No. 1	dLGy	0,0027	-1,0067	2,1	0,98
	Est T.		0,72	-275,7		
OCDE	No. 3	dLGy	0,0134	-1,0385	2,2	0,96
27 países	Est T.		3,28	-224,5		
Sur A.	No.5	dLGy	0,0205	-1,0092	1,8	0,98
11 países	Est T.		2,04	-99,06		
Asia	No.7	dLGy	0,0181	-1,0008	2,2	0,98
10 países	Est T.		2,12	-99,8		
África	No.9	dLGy	-0,0242	-0,9702	2,1	0,97
24 Países	Est T.		-2,3	-109,8		

NOTA:
Est T= Estad. T
Todas las variables son Significativa al 99%.

El cuadro 2 muestra que en todos los casos se cumple la relación inversa entre la tasa de crecimiento de las economías y la relación marginal capital producto. Los resultados son robustos a nivel regional y tomando el total de los 88 países. Estos resultados sugieren que existe una alta significancia de la relación marginal capital producto para explicar el crecimiento económico de los diferentes países, esta variación en la tasa de crecimiento está explicada en más de un 98% por los cambios en el ICOR. En general se comprueba, que la alta volatilidad del ICOR determina la alta volatilidad de la tasa de crecimiento de la economía. Este hecho puede explicar también la diferencia en las tasas de crecimiento de los diferentes países del mundo. Los países que experimentan más altas tasas de crecimiento son aquellos que tienen un ICOR muy bajo y a la inversa.

IV. Conclusiones

El trabajo muestra que la relación capital producto es constante y difiere sustancialmente de la relación marginal capital producto para todos los países analizados. Se demuestra que la relación marginal capital producto es muy volátil y según la ecuación de Harrod define la volatilidad de la tasa de crecimiento de la economía. Este hecho se comprueba para los 88 países seleccionados, y a nivel regional para Asia, África, los países de la OCDE, Centro América y Sur América. La relación marginal capital producto es la variable que determina la tasa de crecimiento de la economía. Se mostró que una baja relación marginal capital producto es compatible con altas tasas de crecimiento y a la inversa, tanto a nivel de toda la muestra como regionalmente. Si la relación marginal capital Producto determina la tasa de crecimiento de la economía, entonces, el gran reto de la teoría del crecimiento consiste en explicar por que se presenta esta gran volatilidad de la relación incremental en todos los países del mundo y como es que esta volatilidad también determina la volatilidad de la tasa de crecimiento.

V. Referencias

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Anexo 1.
Desviación estándar de la relación capital producto **(K/Y)** y de la relación marginal capital producto **(ΔK/ΔY)**.

País	Desv E. (K/Y)	Desv E. (ΔK/ΔY)	País	Desv E. (K/Y)	Desv E. (ΔK/ΔY)
ARG	1,0	8,0	**JAM**	0,9	26,3
AUS	0,2	31,3	**JPN**	0,3	26,5
AUT	0,3	29,0	**KEN**	0,1	81,2
BEN	0,1	8,5	**KOR**	0,6	3,7
BOL	0,3	5,5	**LKA**	0,1	11,4
BRA	0,6	214,5	**LUX**	0,5	8,5
BRB	0,4	12,7	**MAR**	0,1	12,8
BWA	0,6	8,7	**MEX**	0,4	5,3
CAF	0,4	12,0	**MUS**	0,1	2,8
CAN	0,4	13,6	**MYS**	0,3	18,2
CHE	0,8	43,0	**NAM**	1,0	14,5
CHL	0,3	5,1	**NER**	0,6	12,1
CHN	0,3	14,0	**NGA**	0,3	19,0
CIV	0,3	17,1	**NIC**	17,0	7962,0
CMR	0,4	6,5	**NLD**	0,3	21,9
COG	0,3	10,5	**NOR**	0,3	41,0
COL	0,1	2,5	**NPL**	0,1	4,9
CPV	0,6	18,1	**NZL**	0,6	682,9
CRI	0,3	7,7	**PAK**	0,2	11,8
CYP	0,7	9,8	**PAN**	0,3	6,9
DNK	0,4	34,1	**PER**	0,9	30,8
DOM	0,3	18,0	**PHL**	0,4	16,1
DZA	0,4	5,3	**PNG**	0,4	9,5
ECU	0,6	9,2	**PRT**	0,3	61,6
ESP	0,4	38,7	**PRY**	0,2	9,2
ETH	0,1	3,3	**ROM**	1,5	13,2
FIN	0,6	46,1	**SGP**	0,3	5,5
FJI	0,5	8,2	**SLV**	0,5	6,0
FRA	0,3	55,4	**SWE**	0,3	14,2
GAB	0,6	6,6	**TGO**	0,5	4,3
GBR	0,2	14,6	**THA**	0,5	1,6
GHA	0,3	5,7	**TTO**	0,4	3,5
GIN	0,3	5,0	**TUN**	0,2	21,7
GRC	0,7	74,2	**TUR**	0,2	19,5
GTM	0,2	60,9	**TWN**	0,2	3,6
GUY	1,5	10,0	**TZA**	1,2	61,6
HKG	0,3	13,6	**URY**	0,6	56,7
HND	0,2	10,0	**USA**	0,2	18,7
IDN	0,3	1,7	**VEN**	0,6	38,9
IND	0,1	34,7	**ZAF**	0,2	44,9
IRL	0,2	14,0	**ZAR**	0,5	5,0
IRN	1,0	171,8	**ZMB**	0,4	15,8
ISL	0,5	92,6	**ZWE**	0,4	51,5
ITA	0,2	13,4			

ANEXO 2
SALIDA DE LAS ESTIMACIONES CON BASE EN EL PROGRAMA EVIEWS.

ESTIMACION PARA TODOS LOS PAISES SELECCIONADOS.

Dependent Variable: DLGY
Method: Panel Least Squares
Date: 09/15/09 Time: 16:33
Sample (adjusted): 1971 1996
Periods included: 26
Cross-sections included: 87
Total panel (unbalanced) observations: 1583

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002712	0.003757	0.721959	0.4704
DLCR	-1.006769	0.003651	-275.7635	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.981900	Mean dependent var	-0.033963
Adjusted R-squared	0.980521	S.D. dependent var	1.070274
S.E. of regression	0.149376	Akaike info criterion	-0.895998
Sum squared resid	32.80022	Schwarz criterion	-0.512877
Log likelihood	822.1823	Hannan-Quinn criter.	-0.753656
F-statistic	712.0102	Durbin-Watson stat	2.074430
Prob(F-statistic)	0.000000		

ESTIMACION PARA LOS PAISES SELECCIONADOS DE SURAMERICA

Dependent Variable: DLGY
Method: Panel Least Squares
Date: 09/23/09 Time: 15:38
Sample (adjusted): 1971 1996
Periods included: 26
Cross-sections included: 11
Total panel (unbalanced) observations: 187

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020585	0.010061	2.046105	0.0425
DLCR	-1.009237	0.010127	-99.65836	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.987752	Mean dependent var	-0.048567
Adjusted R-squared	0.984813	S.D. dependent var	1.113707
S.E. of regression	0.137248	Akaike info criterion	-0.958806
Sum squared resid	2.825552	Schwarz criterion	-0.319496
Log likelihood	126.6483	Hannan-Quinn criter.	-0.699757
F-statistic	336.0377	Durbin-Watson stat	1.842450
Prob(F-statistic)	0.000000		

ESTIMACION PARA TODOS LOS PAISES SELECCIONADOS DE LA OCDE

Dependent Variable: DLGY
Method: Panel Least Squares
Date: 09/15/09 Time: 16:39
Sample (adjusted): 1971 1996
Periods included: 26
Cross-sections included: 27
Total panel (unbalanced) observations: 554

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013470	0.004095	3.289507	0.0011
DLCR	-1.038584	0.004625	-224.5544	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.991157	Mean dependent var	-0.030810
Adjusted R-squared	0.990240	S.D. dependent var	0.974428
S.E. of regression	0.096268	Akaike info criterion	-1.752586
Sum squared resid	4.643023	Schwarz criterion	-1.339572
Log likelihood	538.4664	Hannan-Quinn criter.	-1.591238
F-statistic	1079.943	Durbin-Watson stat	2.222979
Prob(F-statistic)	0.000000		

ESTIMACION PARA TODOS LOS PAISES SELECCIONADOS DE ASIA

Dependent Variable: DLGY
Method: Panel Least Squares
Date: 09/15/09 Time: 16:40
Sample (adjusted): 1971 1996
Periods included: 26
Cross-sections included: 10
Total panel (unbalanced) observations: 226

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018014	0.008497	2.120123	0.0353
DLCR	-1.000826	0.010025	-99.83332	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.984382	Mean dependent var	0.005153
Adjusted R-squared	0.981504	S.D. dependent var	0.939144
S.E. of regression	0.127722	Akaike info criterion	-1.132851
Sum squared resid	3.099446	Schwarz criterion	-0.587987
Log likelihood	164.0121	Hannan-Quinn criter.	-0.912966
F-statistic	342.1462	Durbin-Watson stat	2.224425
Prob(F-statistic)	0.000000		

ESTIMACION PARA TODOS LOS PAISES SELECCIONADOS DE ÁFRICA.

Dependent Variable: DLGY
Method: Panel Least Squares
Date: 09/15/09 Time: 16:42
Sample (adjusted): 1971 1996
Periods included: 26
Cross-sections included: 24
Total panel (unbalanced) observations: 358

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.024292	0.010206	-2.380161	0.0179
DLCR	-0.970205	0.008831	-109.8688	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.977511	Mean dependent var	-0.041490
Adjusted R-squared	0.973933	S.D. dependent var	1.195914
S.E. of regression	0.193084	Akaike info criterion	-0.322482
Sum squared resid	11.48274	Schwarz criterion	0.219492
Log likelihood	107.7242	Hannan-Quinn criter.	-0.106938
F-statistic	273.2115	Durbin-Watson stat	2.164133
Prob(F-statistic)	0.000000		

Power of Intentions is the Success Formula Says Management

Bhagavad-Gita and Management Techniques

Intentions are your Expressions Says GITA

Power of Intentions is the Success Formula Says Management

Mr. V.Vijay Anand Sriram

GITA Says- ***Your Intentions should be clear, practical, achievable and should differentiate you from others***

Key players who can determine the power of your intentions

I. WISDOM AND SCIENCE (GYANA AND VIGYANA)

GITA says Science can be understood by our senses, i.e. Mouth speaks and understands various issues through, eyes, ears and other senses.Wisdom will make the power of your intentions very strongWisdom will create an inner feeling (Intuition), which can be transformed in to Introspection, after series of inner understanding if your mind says yes it becomes intentions GITA says use the value of science for taking decisions in known things, Science why, Wisdom can focus how.

II. INTENTIONS SHOULD BE A MIND FACTOR SAYS **GITA**

E.g.: You're planning to fast today and you will proclaim to people that, I will not eat any food, Science can brings ways and means, yes I can drink water, fruit juices But what if you're Mind thinks of delicious foods and contemplating on that, then your action (FASTING) does not call for any value Power of Intentions is mind phenomenon

Arjuna was able to visualize only the Parrot, when all others saw different parts of Trees Yudhister was able to see only good people. But Duroydhana was able to see only bad people. But People are the same, intention power is different

III. POWER OF INTENTIONS IS THE SUCCESS FORMULA SAYS MANAGEMENT

Organizations slowly understand the power of intentions

Try this Exercise

Visualize that you are smelling the fragrance of ROSE …….

Visualize that you are smelling garbage ….

Observe the two reactions in a Mirror ……

The Answer …… is clear….

So it is evident that inner intentions can only parallel your outer expressions , even though a small amount of camouflage is done finally you get what you intend .

Many times we hear jargon like Think Global Act Local

I will say the Jargon Actually shows the power of intentions, you know why

When you think global, you will automatically make your local a global place

So Intentions starts with an inner feeling, then transforms into intuitions and travels as introspection and ably supported by wisdom becomes an action plan and your expressions and through science it becomes success formula

B.SC (Hons), MBA, PGDHRM, PGDHR, PGDHRD, MS, M.PHIL, MA, M.Sc (Psy), PHDCERTIFIED CORPORATE TRAINER – HARRINGTON & ASSOCIATES, USA 2)EXECUTIVE DIRECTOR A.RIPE INSTITUTE PRIVATE LIMITED An ISO 9001:2000 Certified Training Organisation

Reflections On Knowledge Value Life Cycle (KVLC)

[1]Muhammad Syed-ul Haque,[2]Irfan Anjum Manarvi

Abstract - **Life cycle is a period of life which is followed by the next generation of the same species. Product life cycle, human life cycle, software life cycle and knowledge life cycle are the prime examples. Software life cycle and product life cycle can be considered resultant of knowledge life cycles because new knowledge discovery/development is directly responsible for creating new products/services. Value of the product has been given importance but the value of knowledge is ignored. Knowledge is stored in data bases in the form of digital, image, or hard copies. It is secured through patents, copy rights or some coded form by the discoverer. As a result, the value of knowledge is not known throughout the life cycle of product and also knowledge. Newly created or discovered knowledge undergoes its life cycle consisting of : Creation, Gathering, Capturing, Accessing, and Use. When considered obsolete, it is replaced by higher level of knowledge to develop new and innovative processes, products and systems. In the entire scenario, the monetary value of knowledge is hardly determined. This paper will try to investigate further on the concept of 'Knowledge Value Life Cycle' (KVLC).**

Keywords-Product life cycle, knowledge value life cycle, KVLC, knowledge life cycle

I. INTRODUCTION

Life cycle is a period of life which is followed by the next generation of the same species. The following generation could be more aligned and more adaptable with the demands of the surroundings. Software life cycle, product life cycle, human life cycle and knowledge life cycle are the best examples of typical life cycles. According to Gartner Group (1998) the life cycle of knowledge consists of: Create, Organize, Capture, Access and Use. Data generates information which can develop knowledge. The knowledge is used to produce more information. Therefore there is a relationship between knowledge and information (Blumentritt & Johnston, 1999). They both generate each other. Knowledge is always present in an organization. Some knowledge would be in its initial phase of life and some in its later phase. Some knowledge may have longer life cycles and some may undergo regeneration quickly. In terms of a product, its value is determined from the maximum price the buyer is willing to pay for. This value is dependent on the assumptions the buyer has about the benefits the product promises to generate in the future. In other words, the value of the product is directly related with the future benefits it produces for the buyer.This concept may be applied on the knowledge life cycle. Lot of work has been carried out on defining the life cycle of knowledge, however, the literature on determining the value of knowledge at its various stages of life cycle are very limited.This research paper will attempt to investigate further and develop more on the concept of Knowledge Value Life Cycle (Haque and Manarvi, 2010) by applying it on different products and exploring the its life cycle pattern.

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II. METHODOLOGY

Unstructured interviews were conducted with various professionals from variety of backgrounds and area of work. Review of past literature on the topic and related subject were made. Investigation identified certain factors that could influence the life cycle of knowledge in terms of its monetary value. The identified factors were applied on the original data gathered from the databases of Pakistan Institute of Management (PIM). The data was compiled under three significant variables: revenue generated from the training program, number of people attended the training program, and the time when the training program was offered and conducted. A detailed analysis was carried out and relationships were established between the value of knowledge and the three variables.

III. KNOWLEDGE

Changes in the economic scenario due to the learning ability of an economy, places the need of knowledge in an organization. Therefore an understanding of importance of knowledge in an organization is required. Knowledge is highly dependent on information. Data develops information that leads to knowledge and knowledge then generates more information (Blumentritt & Johnston, 1999).Knowledge provides the capacity to individuals to respond to new situations. It is developed and stored in the mind of individuals. Knowledge, to be useful requires context and it could be explicit or tacit knowledge or combination of both (Tianyong, Zhengliang and Ge, 2006). It is a value added behavior and has to be focused, latest, tested and shared. Knowledge brings a decisive competitive advantage to an organization. Therefore, Knowledge is now considered as a strategic resource of modern day organizations for their competitiveness (Feher, 2004).

IV. KNOWLEDGE LIFE CYCLE

Like other life cycles, studies shows knowledge also follows certain pattern in its life cycle. According to Fruchter et al.(2007) Knowledge life cycle is based on knowledge capture, sharing and its reuse. Unlike product life cycle,

knowledge life cycle never reaches to zero.Internet and intranet has provided enormous facilities in managing knowledge. Portals are the key websites which manage large amount of unstructured data/information and make them accessible through the net. These portals are basically "knowledge portals" which are primarily engaged in production, acquisition, and transmission of knowledge which is the functions of knowledge management. The lifecycle of knowledge in these portals constitutes five phases: 1.Creation, 2.Import/Gathering, 3.Capture, 4.Retrieval/Access, and 5.Use of Knowledge (Staab, 2002).

Competition is the name of the game in modern day business environment. Knowledge is considered as a strategic asset when it is providing competitive advantage to the organization. Managers are supposed to manage this knowledge asset effectively. To manage well, executives need to understand the dynamics of knowledge lifecycle in their industry. Birkinshaw and Sheehan (2002) while emphasizing on the need of understanding the dynamics of knowledge management, introduced the life cycle of knowledge in terms of simple S-curve having fours stages: creation, mobilization, diffusion, and commoditization.To manage knowledge in the organization, there is a need of formal management system that should help organization in creating/acquiring, retaining, storing, using, disseminating and protecting the knowledge (Gallupe, 2001). Therefore Knowledge Management System is a mean through which firms create, share and use its knowledge. While discussing about the tools and techniques that are needed in the Knowledge Management System (KMS) Gallupe (2001) quoted Leidner & Alavi (2000) and Ruggles (1997) that knowledge lifecycle consists of four stages, consisting of: 1. Knowledge Creation or Acquisition, 2. Knowledge Codification and Storage, 3. Knowledge Transfer or Dissemination, and 4. Knowledge Use. None of them considered knowledge reaching to obsolescence.Studies show none of the researchers so far has incorporated value parameter of knowledge at any stage of its life cycle. In fact, there is very limited literature available that discusses the value of new found knowledge. This paper will use "Knowledge Value Life Cycle" (KVLC) (Haque and Manarvi, 2010) concept and applies it to develop a typical life cycle pattern of knowledge using different products.

V. KNOWLEDGE VALUE DETERMINING FACTORS

A distinctive difference between the value of knowledge and value of product is the later reaches to zero towards the end of its life cycle while the former may not. It may vary over time and can fluctuate between minimum and maximum depending upon the value determining factors. Investigations show following are the factors on which the value of knowledge may depend:

1. Short Term and Long Term Benefits
2. Beneficiaries
3. Process Improvement
4. Cost Incurred
5. New Products/Services Developed
6. Time lapsed

1) *Short Term and Long Term Benefits*

This factor defines the value of knowledge in terms of benefits generated by the use of new knowledge over a certain period of time. The time period could be short term i.e., less than twelve months and long term i.e., more than twelve months. Satellite technology has revolutionized the communication worldwide. Voice, image and data transfer are now easy and less time consuming at very low cost. Australia launched its first satellite FedSat in December 2002. The knowledge of satellite technology and its use has given an opportunity to Australia to have better communication, conduct space-science and engineering experiments for long period of time in the future (Moody and Dodgson, 2006). Example of sustainable first mover advantage is difficult to find in the service industries especially in the mobile telecommunication industry. Easy availability of technology has made possible for mobile communication service providers to copy in a very short period of time and give the same services and facilities to its customers as the pioneering company was giving. In most of the developed countries in Europe, first movers advantage based on technological leadership and low cost service are copied in very short span of time (Fernandez and Usero, 2007). As the number of competitors‟ increases, supply also increases, therefore the price of the product/service decreases and the value of knowledge decreases. However, the first mover might have enjoyed high profits when the competitors are less hence the value of new knowledge then was high.

2) *Beneficiaries*

This factor includes the people, organizations and government who become beneficiary of the new knowledge by its use. The value of knowledge also depends upon the status and size of the beneficiary.Discovery of new knowledge is usually the result of hard work research made by individuals or group of individuals. People have to be motivated for such a work. Usually, monetary benefit or recognition is the best to motivate people. Researchers and scientists are given recognitions by their community and government for their efforts. International Piece Price is an example of recognition for extraordinary contribution made by people in their respective fields. In December 2009, the Nobel Price was given to Elizabeth H. Blackburn, Carol W. Greider, and Jack W. Szostak for the discovery of new knowledge and solving a major problem in biology regarding how chromosomes are protected by telomeres and telomerase enzyme during cell division and are protected from degradation (Dong, Murdter and Klotz, 2009). When the benefit is high, the beneficiary will value the new found knowledge high.Organizations invest to generate or acquire new knowledge to gain or retain competitive advantage in their business. The Boeing Company was able to generate $45 billion in its product sales by achieving 1002 net new aircraft orders including new Boeing 777 and advance version of 747 and 737 (Boeing Company, 2005). Boeing 777 LR was the latest addition in the company‟s product line which was based on new knowledge. Unmanned Aerial

Vehicles (UAV) is used by US military for number of purposes. The first UAV was Q-2 made by Ryan Aeronautical in 1950. With the production of new high power Lithium Ion and Lithium polymer batteries, UAV has been improved significantly (Chao, Cao, and Chen, 2010). These UAV are used by several governments for civilian as well as military operations especially in war on terror.

3) *Process Improvement*

The products / services generated in an organization are the result of certain business process. If the new knowledge brings improvement in the business process, the knowledge would be valued high. The improvement in the business process may not always result in the improvement of the product/services produced. It may only reduce cost or time or improve efficiency or productivity of the process. The robot technology provides number of example for the improvement in the process. Landmines are real threat to life of people in the countries trying to recover from conflict and war. They not only kill and injure innocent people, obstruct medical assistance, block development and agricultural activities. Mine clearing activity is difficult, time consuming, dangerous and costly. It is a slow process and carried out through a sensor stick, probing the ground a few centimeters at a time. Use of robotic technology has reduced time in clearing the land from mines; it is also much less dangerous to human life (Rachkov, Marques and Almeida, 2005). Another example is the modern software for statistical tools like Minitab and others that has assisted researchers and managers to handle range of data for making useful analysis and better decision making (Gardiner, 2001).

4) *Cost Incurred*

This factor consists of three sub-factors: (1). cost incurred on acquiring new knowledge through education and training of individuals, (2). cost incurred in generating new knowledge, and (3). cost incurred on protecting new knowledge.To produce economic value, education, experience and practice are the prerequisites. The increase in economic value directly impacts on economic growth of the country. Therefore, quality of education has positive correlation with the economic growth of the nations (Agiomirgianakis, Asteriou and Monastiriotis, 2002). Higher and technical education has stronger effect on the economic growth. Because of dynamism of business environment and continuous change in technology, organizations have to invest on a regular basis on employees training and development. Organization benefits from the employee training through increase in productive value, savings from higher retention of workers, and increased profitability through enhanced performance by the trained employees (Birati, 1999).Normally, R&D activities are costly and time consuming. This may include cost of acquiring fixed assets, cost of licensing, and cost of material, overhead and the research activity. For example in 1973, NASA and ESRO (European Space Research Organization later became European Space Agency) reached an agreement according to which later will build a laboratory facility to be stationed in space for research activities. NASA would provide the launching facility for the rocket. The first Spacelab was developed with the approximate cost of $800 million and launched on 28 November 1983 by NASA (Russo, 1999). Knowledge is an intangible asset and its effective management requires investment in other assets like creation, editing, pruning, movement, storage of documents, and purchase of technology infrastructure (Davenport, 1997). Organizations protect their valuable asset of knowledge. This could be through copyrights patents so that their knowledge may not be used by others. The Trade Related Aspects of Intellectual Property Rights (TRIPS) is the most comprehensive patent law which requires all the member countries to provide patent protection to any invention whether in the form of products or processes in the field of technology (Tvedt, 2007).

5) *New Products / Services Developed*

This factor is related with the introduction of new products / services produced with the help of new found knowledge. This also includes the improvement made in the existing products/services. A new product or service introduction needs innovative approach in process or change in existing process. Innovation may refer to gradual or radical improvement in products/services, processes or in thinking. For the business organization, innovation should bring positive change in profitability through its productivity. Therefore innovation may lead to improvements in efficiency, productivity, quality, competitive positioning, market share, etc. Innovation is equally applicable to manufacturing and service industry like educational institutions, hospitals, governments.Today dynamic and busy life has increased the importance of health care systems. Therefore, devices are required to monitor the vital human body information. These instruments are used to be large in size and were not possible to be attached with human body. Therefore obtaining real time human body information during exercises was difficult. Bluetooth technology and its gadgets have solved this issue. They are light weight, easy to carry and wearable instruments. They can monitor and transmit the human body information during physical movements and exercises to the recording devices like PC for analysis (Sugimoto et al., 2005). The new knowledge of blue tooth technology made it possible to develop new instruments and gadgets that significantly improved the existing healthcare services provided to the people especially the patients and athletes.A new knowledge could be about customer demand or specification of services or product needed and can be acquired through customer survey and market studies. From the ages, libraries are main source of knowledge. They contain books, journals and other knowledge material for the readers and researcher. This is the reason; libraries are called knowledge banks where the reader visits and spend time to gain knowledge. Over the time with the development of communication technology and change in life style, the dynamics of knowledge sharing and transferring has changed from libraries and classroom settings to online education and

distance learning. Therefore libraries are required to meet the needs of its users through new kind of services for distance learning students and teachers. For example universities are now introducing online library services for its faculty and students. These online libraries provide linkage to its own databases and to various research journals and other electronic resources (Beth and Frances, 2009). By the use of latest communication technology, libraries are now upgrading and improving their services and enabling the users to enhance their quality of work.

6) *Time Lapsed*

For business organizations, time is a resource. Because of competition timely launching of new products are critical. The process of creating and marketing new product / service is comprised of conceptualizing, designing, manufacturing, advertising, promoting and selling of the products / services. This whole cycle consumes time. And when time factor is critical in the business, organizations cannot afford to spend extra hour in its operations. Therefore invention and innovation is needed in the process of manufacturing new products / services and also in the products / services to be offered. Invention and innovation requires research which is time consuming. The quality of process, product and services produced depends upon the quality of research work. And to measure the quality of research we have parameters such as its inputs in terms of time spent, research funds available, research facilities accessible, networks ties, professional training and education, level of personal motivation, environment for research, and the research outputs (Tien, 2000). In this regard, the value of new knowledge is dependent on two aspects: time spent in creating new knowledge and the time market took to know about the new knowledge.Quality of research is often dependent on the time spent on research work. Uninterrupted time for research is critical for focused and dedicated approach on the subject matter. Research organizations like universities provide sabbatical leave facility to their faculty from teaching obligations so that they may spend more time on the research (Witten, 2002). Launching of new product or service is a sign of new knowledge development or acquisition by the organization. This could be the result of some breakthrough in research or getting the copyright of some existing valuable knowledge. In order to develop potential market and take first movers advantage, organizations at times advertise their research work and achievements. As an example, the announcement by the Canon Inc., on October 1, 1991 regarding the acquisition of Ferroelectric Liquid Display (FLD) technology (Sigurdson, 1998) resulted in the increase of Canon"s stock value in Tokyo Stock Exchange. The knowledge of FLD was not new; however, the industry was unable to make use of this knowledge. It is the announcement and subsequent production based on the technology which enabled the market to value the newly discovered knowledge.

VI. KNOWLEDGE VALUE LIFE CYCLE

Based on the above discussion, knowledge value life cycle (KVLC) can be drawn on a typical parabolic shape containing its value determining factors inside the parabola (figure 1). These factors push the value of knowledge upwards according to their significance and strength at any particular time frame.

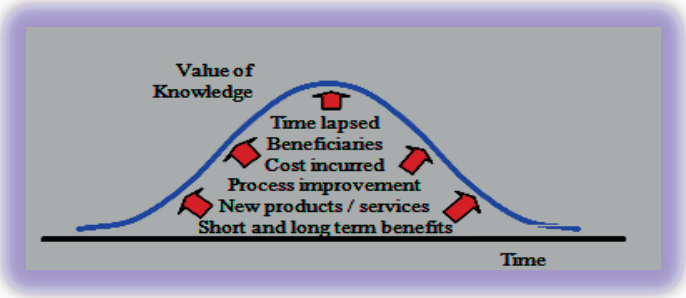

Figure 1: Knowledge value life cycle

However this graph may have different shape according to the value of knowledge. When a particular knowledge was discovered and for certain reason was not valued high in its initial stages but then a spurt came and its value surged to its peak and remained there for some time before it declines (figure 2). An example could be the acquisition of FLD technology by Canon Inc., (Sigurdson, 1998). The FLD technology was developed much earlier but the industry was unable to make use of this knowledge hence it was not valued in the beginning but as soon as Canon Inc., start using it, its value jumped to its heights

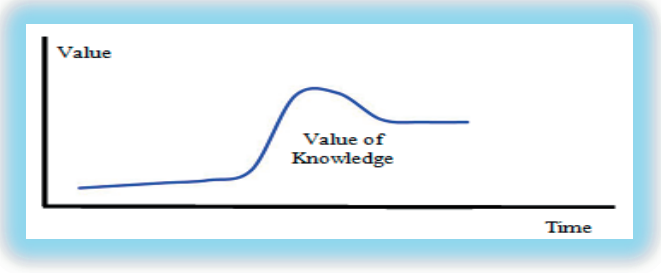

Figure 2: Delayed increase in the value of knowledge

There are cases when the new knowledge was valued instantly high as soon as it was discovered (figure 3). As an example, the third generation (3G) technology for mobile phones. The new technology enabled people to e-mail, play games, communicate, download and transfer data, and purchase entertainment packages on the move. All those facilities that the internet presents are now on the mobile phone. This phenomenal growth in the capabilities of the mobile phone offered remarkable services to its users (Reid, 2005). The instant demand for 3G phones motivated other phone manufacturers to manufacture 3G phones in order to stay in the business.

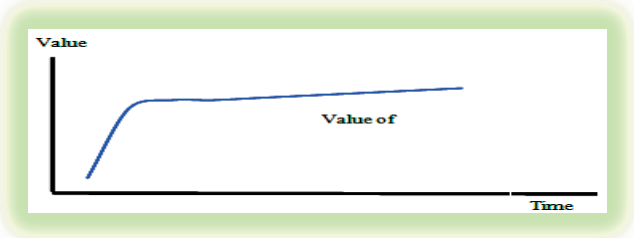

Figure 3: Immediate increase in value of Knowledge

There is some newly discovered knowledge whose value is consistently increasing over the past decades. As an example, the satellite communication technology which started in October 1957 with the launch of Sputnik-I have been on the rise continuously (Golding, 1998). The knowledge of satellite communication has improved significantly and its value increased many fold over the past few decades because of its importance in modern day business and military use (figure 4).

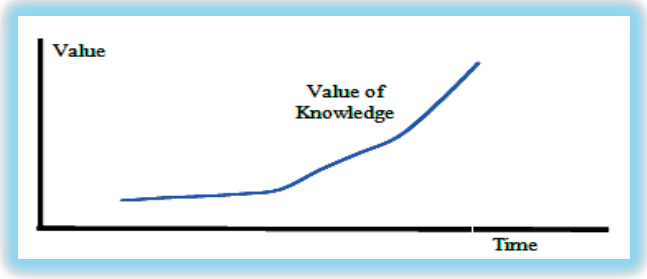

Figure 4: Continuous increase in the value of knowledge

VII. FINDINGS

The above six factors were applied on two management development programs which are the products of a well renowned institute, the Pakistan Institute of Management (PIM) (www.pim.com.pk) at its facilities in Karachi and Lahore, Pakistan. The Institute is a pioneer in the field of executive development in Pakistan and specializes in the training, development, and education of managers from business and industry. The two courses were:

Quality System Documentation for ISO 9000

Quality System Documentation for ISO 9000:2000

VIII. EFFECT OF THE SIX FACTORS ON THE TWO COURSES

The first course covered the documenting principles and requirements stated under the requirements of ISO 9001, ISO 9002, and ISO 9003 standards. The second course covers the requirement of ISO 9000:2000 standards. In 1994, the International Organization for Standardization (ISO) developed quality management system standard ISO 9000. There are number of commonalities among the family of ISO 9000 standards and the British Standard BS 5750 of 1979. To train its faculty in the newly developed knowledge of ISO 9000, PIM sent its faculty to British Standard Institute (BSI), UK in 1996 to attend the training program on ISO 9000 standard. On their return, the trained faculty designed and launched training programs on ISO 9000 standard. One of them was „Quality System Documentation for ISO 9000".The International Organization for Standardization (ISO) upgraded the ISO 9000 standard in the year 2000. The new version was named ISO 9000:2000. The new version had some new requirements for documentations therefore PIM designed and offered new course „Quality System Documentation for ISO 9000:2000. The first course „Quality System Documentation for ISO 9000" underwent its own lifecycle and was replaced by new knowledge „Quality System Documentation for ISO 9000:2000" (figure 5).

Table 1 shows the revenue generated and the number of participants who attended the two courses from 1996 till December 2004. Figure 6 shows the lifecycle of the two courses in terms of the revenue generated in Pakistan Rupees along with the number of participants attended the two courses every year at PIM. The increase in revenue was the direct result of increase in trainees. In 1997 maximum number of trainee attended the course „Quality System Documentation for ISO 9000". And in the year 2000 maximum number of trainee attended „Quality System Documentation for ISO 9000:2000". The value of knowledge was maximum in these two years. The value of knowledge decreased when the number of trainee decreased. (table 1, figure 5, and figure 6)

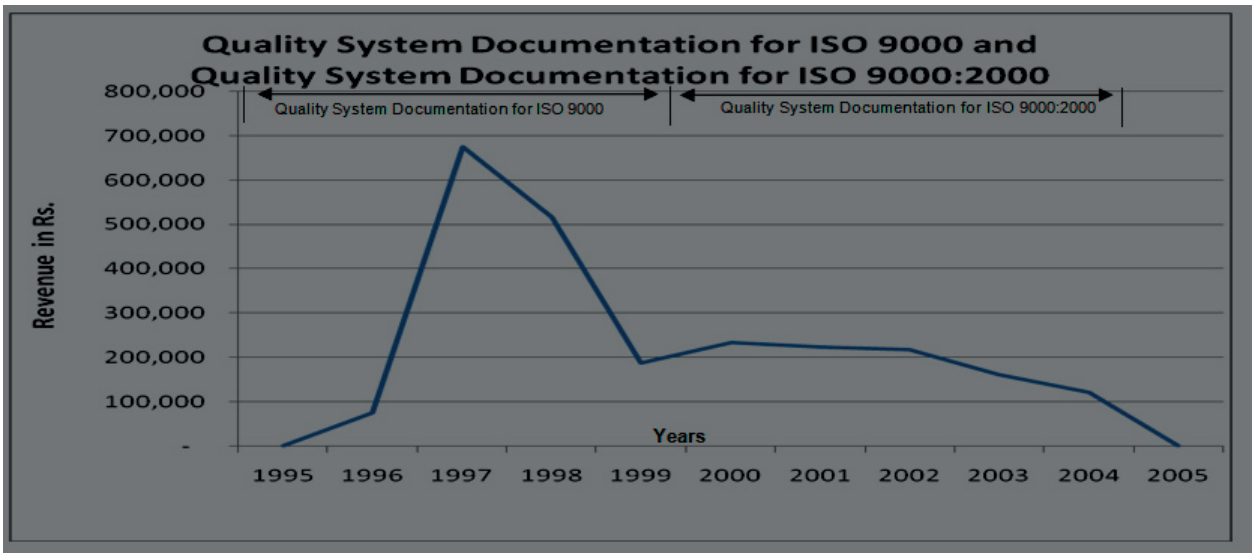

Figure 5: Lifecycle of two training programs: „Quality System Documentation for ISO 9000" and „Quality System Documentation for ISO 9000:2000" designed and conducted by PIM, in terms of revenue generated

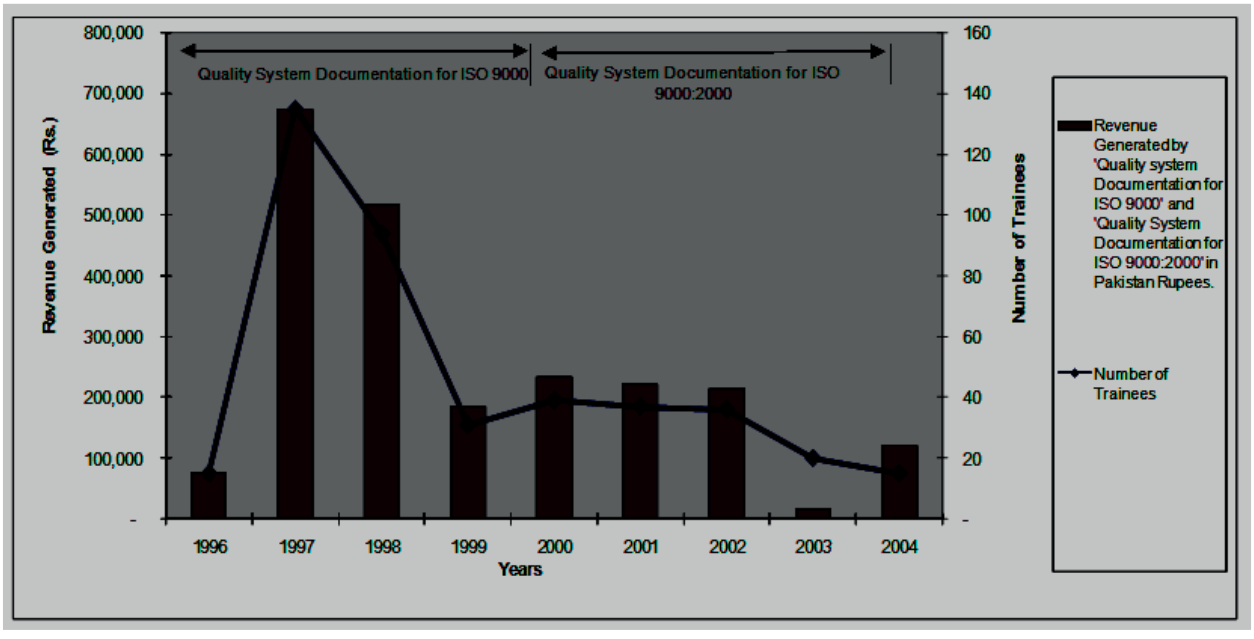

Figure 6: Lifecycle of the two training courses „Quality System Documentation for ISO 9000" and „Quality System Documentation for ISO 9000:2000", in terms of revenue generated and number of trainees trained each year in PIM

	Quality System Documentation for ISO 9000		Quality System Documentation for ISO 9000:2000	
Years	Revenue (Rs.)	No. of Participants	Revenue (Rs.)	No. of Participants
1996	75,000	15	-	-
1997	675,000	135	-	-
1998	517,000	94	-	-
1999	186,000	31	-	-
2000	-	-	234,000	39
2001	-	-	222,000	37
2002	-	-	216,000	36
2003	-	-	16,000	20
2004	-	-	120,000	15
TOTAL	1453,000	275	808,000	147

Table 1: Revenue generated and number of participants in the two training courses „Quality System Documentation for ISO 9000" and „Quality System Documentation for ISO 9000:2000" designed and conducted by PIM.

a) Short Term and Long Term Benefits

By offering „Quality System Documentation for ISO 9000" course in 1996, PIM received number of benefits both in short term and long term. In short term, the revenue increased from zero to Rs. 675,000 in just two years. And by launching „Quality System Documentation for ISO 9000:2000" course in the year 2000 the revenue jumped to Rs. 234,000. Therefore PIM"s benefit in short term was increase in revenue.For the long term, the Institute was considered as a trusted name for introducing new technologies and knowledge in the country. And the two courses also continued to generate revenue for next few years of their life. PIM was the first institute to offer training programs on ISO 9000 in the country. It enjoyed the first movers" advantage by offering range of courses on ISO 9000 series of standard.On the client side of PIM, the new knowledge introduced in 1996 was very useful especially for those engaged in export businesses. The international importers particularly European and US requires them to certify for ISO 9000 standards in order to ensure quality. Certification and compliance to ISO 9001 in 1996 and ISO 9000:2000 in 2001 gave these organizations long term advantage in their business.

b) Beneficiaries

The new knowledge of ISO 9000 documentation was beneficial to individuals, organizations and also to the country. Individuals who received training on ISO 9000 documentation were valued high by their employers. They are often asked to help the organization for ISO 9000 certification. In the beginning there was less number of professionals having this knowledge, therefore many switched their jobs for better opportunities and higher salaries.Organizations after certification enjoyed greater market share and enhanced profitability. Customers" confidences on quality improved therefore international orders were increased significantly. Certification for ISO 9000 standards is considered an achievement and organization proudly advertises for the information of its market and other stakeholders. The two courses offered by PIM were valued high by the client organizations, and PIM operated at its capacity during this period. The data in table 1 shows the peaks touched in 1997 and 2000, the maximum level of revenue earned by the Institute through these two courses.Because of increase in export business, the foreign exchange earning of the country also swelled significantly. The increase in the foreign reserves of Pakistan resulted in better and stable economy during those years.

c) Process Improvement

Documentations help organization to improve on their processes and products. Improvements are made after identification of mistakes and errors. The mistakes and errors are captured when the actual are compared with the specifications. Therefore, documentations are useful for continues improvement as well as in normal business process. ISO 9001:2008 clause 4.1 requires an organization to establish, document, implement, and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of this International Standard. Because of the requirement in the standard, the knowledge of documentation process was valued high by the organizations intending for ISO 9001 certification.

d) Cost Incurred

For PIM, the knowledge of ISO 9000 was highly valued. The Institute acquired this knowledge by incurring huge cost of sending three faculty members to UK. The cost of the course fee, air travel, and boarding and lodging are few to mention. The client organizations also value this knowledge because they incur cost by paying the course fee charged by PIM.R&D activities at times incur huge cost. The cost of fixed assets and other facilities often has to be financed by government or big business organizations. Usually capable and learned researchers offer their services at high price. Therefore, as the cost of generating new knowledge increases, the value of knowledge also increases. Organizations engaged in R&D activities when certifying for ISO 9000 standard has to develop and maintain their documentation. Their employees were sent to attend the two courses offered by PIM. Protection of newly acquired or generated knowledge is very important for business organizations facing tight competition. The new knowledge may be giving competitive advantage to the organization. Therefore proper documentation is critical in safe guarding the knowledge. The documentation could be in the form of paper, magnetic, electronic or optical computer disc, and

photograph. Documentation also includes the accessibility right of individuals to certain documents. All individuals may not be given access to all the documents. Organization incurs cost in protecting their knowledge in the form of hardware, software and other means like copyright. Increasing salary and other benefits of valued employee having critical knowledge, in order to prevent them from leaving the organization, is another means of protecting knowledge.

e) New Products and Services Developed

The two new courses under study are meant to bring improvement in the process of documenting. Proper documentation not only addresses the requirement of the standard but also ensures the smooth operations and improvement in the processes and products. Since the benefit to the organization was high, the courses were valued by the business concerns and this is clearly visible by the increase in the revenue generated by the two courses as shown in table 1.

f) Time Lapsed.

There was a market demand in the country for training courses and consulting services on ISO 9000 in the year 1995. PIM responded immediately to this demand by acquiring the new knowledge of ISO 9000 standards from BSI and then offered training courses and consulting services to the local industry. The total time spent in the process of acquiring new knowledge and offering the new courses to the local market was minimal. Meantime no other training organization came up with the same kind of services and courses. The Institute was able to acquire first movers‟ advantage.Those client organizations who trained their employees through PIM courses in the early days were able to market their name and product with pride. Many were able to capture even international markets. There are cases when the business organization took long time to certify them for the standard, meanwhile a competitive organization ceased the opportunity by certifying first and took the first movers advantage.Therefore in acquiring and making use of new knowledge, time factor is very important and may define success or failure.

IX. Conclusion

This paper explains the Knowledge Value Life Cycle concept in terms of its monetary value. All newly discovered knowledge follows its lifecycle, comprising of knowledge capture, sharing, storage and reuse. Newly discovered knowledge or advanced knowledge, replaces the old one and undergoes its own cycle. Unlike product, knowledge always has some minimum value, because of its unique characteristic of being always useable.The six factors which determine the value of knowledge are short and long term benefits, beneficiaries, process improvement, cost incurred, new products/services, and time lapsed. When a long term/short term benefit is expected, the knowledge would be valued high. At the individual level, if the recognition of developing new knowledge is significant, certainly the individual will value the new knowledge. If beneficiaries of the new knowledge are in large number, then knowledge will be considered valued. And when the new knowledge brings improvement in the process through increase in efficiency or productivity, the process owners and other stakeholders will value that knowledge high. The activity of acquiring or developing new knowledge always costs. If the cost is high, certainly the acquirer will consider the new knowledge dear. Likewise, if the products/services developed are of high value/demand, the knowledge used in developing product/service will be valued high. In most of the cases, new knowledge is the result of hard work done by some individuals. The process consumes time. Longer the time spent, probably more resources will be consumed, and hence value of knowledge will increase. If the new knowledge is developed and used at the right time and maximum benefit was generated, the knowledge will be valued high.Finally, there are possibilities for expanding beyond these concepts to show further in detail the inter-relationships of identified factors and their effect on the value of knowledge during the different stages of life cycle.

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