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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	PRICE EFFECT IN DHAKA STOCK EXCHANGE OF CROSS-LISTING IN CHITTAGONG STOCK EXCHANGE MD. RAFIQU L MATIN & DR. JAWAD R ZAHID	1
2.	STUDY OF SHOPPER'S ATTITUDE TOWARDS PRIVATE LABELS IN DUBAI DR. TANMAY PANDA & K. TEJA PRIYANKA YADAV	8
3.	FACTORS INFLUENCING INDIVIDUAL INTRANET USAGE: A LITERATURE REVIEW MOHAMAD NOORMAN MASREK, DANG MERDUWATI HASHIM & MOHD SHARIF MOHD SAAD	15
4.	THE BRANDING OF A COUNTRY AND THE NIGERIAN BRAND PROJECT DR. ANTHONY .A. IJEWERE & E.C. GBANDI	21
5.	THE RELATIONSHIP BETWEEN THE INTERNAL AUDIT FUNCTION AND CORPORATE GOVERNANCE: EVIDENCE FROM JORDAN DR.YUSUF ALI KHALAF AL-HROOT	27
6.	PROPOSED FRAMEWORK FOR IMPROVING THE PAYMENT SYSTEM IN GHANA USING MOBILE MONEY MENSAH KWABENA PATRICK, DAVID SANKA LAAR & ALIRAH MICHAEL ADALIWEI	33
7.	A COMPARATIVE STUDY ON PUBLIC SECTOR BANKS (VS) PRIVATE SECTOR BANKS (A CASE STUDY ON STATE BANK OF INDIA, CANARA BANK VS CITY BANK, ICICI BANK) V. SRI HARI, DR. B. G SATYA PRASAD, VIKAS JAIN & DR. D. L. SREENIVAS.	40
8.	DATA MINING APPLICATION IN TRANSPORT SECTOR WITH SPECIAL REFERENCE TO THE ROAD ACCIDENTS IN KERALA DR. JOHN T. ABRAHAM & SWAPNA K. CHERIAN	48
9.	RURAL MARKETS-A NEW FORCE FOR MODERN INDIA RICHARD REMEDIOS	51
10.	ASSESSMENT OF TRAINING NEEDS AND EVALUATION OF TRAINING EFFECTIVENESS IN EMPLOYEES OF SELECT ITes COMPANIES AT BANGALORE DR. ANITHA H. S. & SOWMYA K. R.	54
11.	JOB HOPPING AND EMPLOYEE TURNOVER IN THE TELECOM INDUSTRY IN THE STATE OF TAMIL NADU L.R.K. KRISHNAN & DR. SETHURAMASUBBIAH	59
12.	GROWTH AND RESPONSE OF AGRICULTURE TO TECHNOLOGY AND INVESTMENT IN INDIA (A STUDY OF POST GLOBALIZATION PERIOD) SONALI JAIN, H.S. YADAV & TANIMA DUTTA	80
13.	DAY OF THE WEEK EFFECT IN INTERNATIONAL MARKET: A CASE STUDY OF AMERICAN STOCK MARKET DR. BAL KRISHAN & DR. REKHA GUPTA	86
14.	STOCHASTIC BEHAVIOR OF A TWO UNIT SYSTEM WITH PARTIAL FAILURE AND FAULT DETECTION VIKAS SHARMA, J P SINGH JOOREL, ANKUSH BHARTI & RAKESH CHIB	90
15.	SURVEY OF NEWRENO AND SACK TCP TECHNIQUES PERFORMANCE IN PRESENCE OF ERRORS FOR HIGH SPEED NETWORK MARGAM K.SUTHAR & ROHIT B. PATEL	98
16.	A STUDY OF INDIAN BANKS WITH REFERENCE TO SERVICE QUALITY ATTRIBUTES AND CUSTOMER SATISFACTION DR. ASHWIN G. MODI & KUNDAN M PATEL	103
17.	PREDICTING CONSUMER BUYING BEHAVIOR USING A DATA MINING TECHNIQUE ARATHI CHITLA	108
18.	PERFORMANCE ANALYSIS OF VALUE STOCKS & EVIDENCE OF VALUE PREMIUM: A STUDY ON INDIAN EQUITY MARKET RUBEENA BAJWA & DR. RAMESH CHANDER DALAL	113
19.	STAR RATING FOR INDIAN BANKS WITH RESPECT TO CUSTOMER SERVICE DR. M. S. JOHN XAVIER	119
20.	ROUTING OF VLSI CIRCUITS USING ANT COLONY OPTIMISATION A.R.RAMAKRISHNAN & V. RAJKUMAR	123
21.	A STUDY ON INVESTORS' CONSCIOUSNESS AND INVESTMENT HABITS TOWARD MUTUAL FUNDS: - AN EXPLORATORY STUDY OF MEHSANA DISTRICT ATUL PATEL, H. D. PAWAR & JAYSHRI DATTA	127
22.	THE JIGSAW CAPTCHA BALJIT SINGH SAINI	134
23.	STUDY OF THE AWARENESS ABOUT THE SERVICES OFFERED BY THE DEPOSITORY PARTICIPANTS IN RAJASTHAN DR. DHIRAJ JAIN & PREKSHA MEHTA	137
24.	ATTACHMENT BETWEEN STOCK INDICES FII, NSE AND BSE P. KRISHNAVENI	142
25.	UTILIZATION OF E-BANKING SERVICES BY THE CUSTOMERS OF ICICI BANK LIMITED M. S. ANANTHI & DR. L. P. RAMALINGAM	146
26.	A SYSTEM FOR EMBEDDING FIVE TYPES OF EMOTIONS IN SPEECH: USING TIME DOMAIN PITCH SYNCHRONIZATION OVERLAP AND ADD (TPSOLA) MAMTA SHARMA & MADHU BALA	153
27.	PERFORMANCE OF INDIAN SCHEDULED COMMERCIAL BANKS IN PRE AND POST GLOBAL CRISIS PRABINA KUMAR PADHI & MADHUSMITA MISHRA	159
28.	FOOD PROCESSING INDUSTRY: INDIA NEED FOR DOMINATING GLOBAL MARKETS ALI LAGZI & R.THIMMARAYAPPA	162
29.	ROLE OF BALANCED SCORECARD AS A COMMUNICATION TOOL ANSHU	167
30.	PERFORMANCE APPRAISAL OF INDIAN BANKING SECTOR: A COMPARATIVE STUDY OF SELECTED PRIVATE AND FOREIGN BANKS SAHILA CHAUDHRY	171
	REQUEST FOR FEEDBACK	181

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OBJECTIVES

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RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

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DAY OF THE WEEK EFFECT IN INTERNATIONAL MARKET: A CASE STUDY OF AMERICAN STOCK MARKET

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ABSTRACT

The main purpose of this study is to find out the impact of the days of week effect on international stock market. For these purpose seven countries indices are chosen which cover two continents. Leven test, Robust test and independent student t- test are used for this purpose. Leven test statistics shows there are no differences in the volatility of county indices' returns across the days of the week. Robust test and t test statistics shows that majority of companies have insignificant difference between mean return of days of the week.

KEYWORDS

international market, American stock exchange.

INTRODUCTION

Thus, a number of studies have documented evidence in support of anomalous pattern of daily returns in the international and Indian stock markets. Some literature in this context indicates considerably higher returns on Friday and the lowest on Monday as compared to other days of the week in Indian stock market. Some studies deny its existence. These studies indicates that day of the week effect vanished after the introduction of rolling settlement. Day of the week effect is also documented for other stock markets around the world. Among them **Jaffe and Westerfield (1985)** investigate the weekend effect in four developed markets, namely Australia, Canada, Japan and U.K. The result indicates the existence of weekend effect in all countries studied. Contrary to previous studies of the U.S. market, the lowest mean returns for both Japanese and Australian stock markets were found to be on Tuesday. In India, impact of trading settlement system on the weekend effect was conducted by **Amanulla and Thiripalraju (2001)**. They have found evidence to support weekend effect during the period of ban on carry-forward transactions. It also noticed consistent positive returns on Wednesday a phenomenon never been reported elsewhere. It is expected from an investor to look at the return of the stock while buying it. But there is also other condition that can't underestimate is the volatility of the stock price. It is very important know if high volatility of stock price is related with high volatility for a given day. If investors could identify a certain pattern for the day; they could revise their position in the stock market to avoid high volatility in their portfolio. **Kiyamaz and Berument (2003)** report that volatility varies by the day of the week for developed. **Nath and Dalvi (2005)** documented the impact of introduction of rolling settlement in India on the daily returns and noted the Monday and Fridays were critically significant trading days. It noticed that even after compulsory rolling settlement Friday continues to be the most significant trading day of the week for return propagation. **Ramesh and Kiran (2007)** has noticed day of the week effect was noticed in the sense that Mondays and Fridays were critically significant trading days before introduction of the rolling settlement. On the whole, the study documented evidence on the subject that anomalous returns pattern on the Indian bourses has dissipated after the introduction of rolling settlement. **Chander and Mehta (2007)** also the studies of some structural changes in the market leading to or removing some anomalous pattern in the stock prices, are of interest to investors and analysts. The present study was conceptualized to scrutinize whether anomalous patterns yield abnormal return consistently for any specific day of the week even after introduction of the compulsory rolling settlement of Indian bourses. Three market series viz. BSE sensex, S&P CNX Nifty and S and P CNX 500 were observed on daily basis for ten years viz 1. Pre -rolling settlement period, April 1997- December 2001 and 2. Post rolling settlement period, January 2002- March 2007 to discern evidences in this regard. Contrary to developed capital markets, the results reported in this study documented lowest Friday returns in the pre- rolling settlement period as credible evidence for the weekend effect. The findings recorded for post -rolling settlement period were in harmony with those obtained elsewhere in the sense that Friday returns were highest and those on Monday were the lowest. It implied that arbitrage opportunities existed have disappeared consequent to the rolling settlement on the whole, the study noted stock markets moved more rationally and anomalous return pattern noted earlier could not sustain, in the past rolling settlement period. **Satish and Sonal (2009)** have examined three types of anomalies namely Monday Effect, Friday Effect and Day of the week effect. The data has been collected for the period from January 2007 to December 2008 for three indices: BSE-200, CNX-100 and CNX-500. The results of this study show that the anomalies do not exist in the Indian stock market and this market can be considered as information ally efficient. It means that it is not possible to earn abnormal returns constantly that are not commensurate with the risk. Although the mean returns on Monday are negative whereas the mean returns on Friday are positive but t-test results conclude that there is insignificant difference between the returns on Monday and other week days.

DATA

The list of stock markets consists of seven countries from two continents. The name of all the sample countries and their respective stock indices are mentioned in appendix-I. Daily average equity price (Highest and Lowest price) indices of all the sample countries are obtained over a period of six years starting from April 2003 to March 2009. All the relevant data have been collected from national and international websites. Though the daily returns of most of the sample countries are matched by the calendar date, the trading sessions of the stock exchanges of those countries may not completely overlap across the market.

OBJECTIVES

The object of this study is to test the day of the week effect in North and South American stock market.

HYPOTHESES

The present study aims to examine the day of week variation in stock returns and their volatility. In order to fulfil the objectives, following hypothesis is considered:

- There are no differences in the volatility of stock indices across the day of week;

$$H_0: \sigma_{\text{MON}}^2 = \sigma_{\text{TUE}}^2 = \sigma_{\text{WED}}^2 = \sigma_{\text{THU}}^2 = \sigma_{\text{FRI}}^2$$

$$H_A: \sigma_{\text{MON}}^2 \neq \sigma_{\text{TUE}}^2 \neq \sigma_{\text{WED}}^2 \neq \sigma_{\text{THU}}^2 \neq \sigma_{\text{FRI}}^2$$

$$\sigma_i^2 = \text{variance of day of the week returns}$$

- There are no differences in the average return on stock indices across the day of the week ;
- H₀: $\bar{X}_{\text{MON}} = \bar{X}_{\text{TUE}} = \bar{X}_{\text{WED}} = \bar{X}_{\text{THU}} = \bar{X}_{\text{FRI}}$
H_A: $\bar{X}_{\text{MON}} \neq \bar{X}_{\text{TUE}} \neq \bar{X}_{\text{WED}} \neq \bar{X}_{\text{THU}} \neq \bar{X}_{\text{FRI}}$
 \bar{X}_i = Average return of day of the week
- The null hypothesis posits that specific day return has no difference with other days of the week.
- H₀: $\bar{X}_{\text{SPECIFIC DAY}} = \bar{X}_{\text{OTHER DAYS OF THE WEEK}}$
H_A: $\bar{X}_{\text{SPECIFIC DAY}} \neq \bar{X}_{\text{OTHER DAYS OF THE WEEK}}$
 \bar{X}_i = Average return of day of the week

METHODOLOGY

Following steps and methods are applied for this study:

- Average share price** of each company is obtained as:

$$\text{Share price} = \frac{P_H + P_L}{2}$$

where:

P_H = Highest market price during the day; and

P_L = Lowest market price during the day.

- The **daily return** of the S&P CNX Nifty and companies are calculated as:

$$R_t = \frac{(P_t - P_{t-1}) * 100}{P_{t-1}}$$

where:

R_t is the rate of return for the period t ; and

P_t and P_{t-1} are the price of two successive periods t and $t - 1$.

- Weekly returns** of the year are calculated as:

Specific day return = Average return of specific days in a year

- Levene's test** is employed for testing the equality of the variance of daily returns across days of the week. The Levene statistic is distributed as w statistic with $(J - 1, N - J)$ degree of freedom.

$$WW = \frac{\left\{ \sum_{j=1}^J n_j (D_{.j} - D_{..})^2 \right\} \left[\frac{(N - J)}{(J - 1)} \right]}{\left\{ \sum_{j=1}^J \sum_{i=1}^{n_j} (D_{ij} - D_{.j})^2 \right\} \left[\frac{(N - J)}{(J - 1)} \right]}$$

$$D_{ij} = |R_{ij} M_j|$$

where:

W is the result of the test;

R_{ij} is the return for week i and weekday j for $j = 1$ to 5 ;

M_j is the sample median return for weekday j computed over n_j weeks;

$$D_{.j} = \sum_{i=1}^{n_j} \frac{D_{ij}}{n_j}, \text{ which is the mean of the } D_{ij}; \text{ and}$$

$$D_{..} = \sum_{j=1}^J \sum_{i=1}^{n_j} \frac{D_{ij}}{N}, \text{ is the grand mean of } D_{ij}.$$

The significance of w is tested against $F(\alpha, k - 1, N - K)$ where F is a quintile of the F test distribution, with $k - 1$ and $N - K$ its degrees of freedom, and α is the chosen level of significance (usually 0.05 or 0.01).

- Robust test** calculates the **Brown-Forsythe** statistic to test equality of group means. This statistic prefers the F statistic. It is tested that mean in stock return is equal across all five days of the week or does it exhibit statistically significant differences. It is calculated by using SPSS 17.
- Independent t test** is tested whether mean differences of different samples are significant or not. It is used for measure the mean difference between specific day returns and other day's returns. To carry out the test, it calculates the statistic as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S} * \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

$$S = \sqrt{\frac{\sum (X_1 - \bar{X}_1)^2 + \sum (X_2 - \bar{X}_2)^2}{n_1 + n_2 - 2}}$$

where:

\bar{X}_1 is the mean of first sample;

\bar{X}_2 is the mean of second sample;

n_1 is the number of observations in the first sample;

n_2 is the number of observations in the second sample; and

S is the combined standard deviation.

RESULT AND DISCUSSION

For testing the volatility between days of the week return Levene statistics are presented in table-I. A close look at table indicates that all American country indices volatility between days of the week return are insignificant. Thus no country indices are significant at one and five per cent level. It reveals that for American indices, days of the week returns volatility have insignificant variation.

It can be cited from table-II that for 100 per cent of the American country indices the average return difference between the days of the week are insignificant. It depicts that country indices have insignificant difference between mean return of days of the week. Thus it depicts that day of the week effect does not exist in American stock market.

Independent t test is also used for each day in which specific day is considered as one group and other days are considered as second group. The results of t test are presented in table-III, IV, V, VI and VII for Monday, Tuesday, Thursday and Friday. According to this study American country indices results that there is insignificant difference between specific day and other days in a week. It reveals that null hypothesis is accepted in all the years.

In existing studies related to the different market index, daily investigation of the week has revealed that mean return on Friday is higher and on Monday is lower as compared to other days. All these studies are not based on recent year's data. While this study done on the recent data, which investigates five types of anomalies namely Monday, Tuesday, Wednesday, Thursday and Friday. The results show that no specific day is important as compared to other days; there is insignificant difference between specific day and other days. It reveals that all days are equally important for investor in American stock markets.

CONCLUSION

On the basis of the objective of the study the following results have been drawn:

- The result shows that north and south American country indices days of the week volatility have insignificant variation; and
- It also depicts that American country indices have insignificant difference between mean return of days of the week.

Numerous empirical investigations related to international and Indian stock market, however, provide evidence of having day of the week effect anomalies in the capital market. Some studies deny these anomalies in Indian stock market after introduction of rolling settlement. This study suggests the investors that all days in week are equally important. No specific day is important for purchasing and selling the securities for investor.

TABLE-I: LEVENE TEST FOR EQUALITY OF VARIANCE

Name of Countries	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	Levene Statistic	Sig.	Levene Statistic	Sig.	Levene Statistic	Sig.	Levene Statistic	Sig.	Levene Statistic	Sig.	Levene Statistic	Sig.
VENEZUELA	.568	.686	1.992	.097	.416	.797	.745	.562	.402	.807	.436	.782
PERU	.894	.468	1.946	.103	.997	.410	1.640	.165	.579	.678	.256	.906
ARGENTINA	.986	.416	1.121	.347	1.497	.203	1.093	.361	1.702	.150	.300	.878
BRASIL	1.076	.369	1.666	.159	1.155	.331	.507	.731	.390	.815	.281	.890
MEXICO	1.997	.095	2.555	.039	1.512	.199	.998	.409	1.844	.121	.263	.902
USA	.526	.717	1.552	.188	2.125	.078	1.214	.305	2.036	.090	1.194	.314
CANADA	.238	.916	2.493	.044	3.139	.015	.555	.696	.832	.506	.789	.533

TABLE-II: ROBUST TEST FOR EQUALITY OF MEAN

Name Of Countries	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	Statistic	Sig.	Statistic	Sig.	Statistic	Sig.	Statistic	Sig.	Statistic	Sig.	Statistic	Sig.
VENEZUELA	.329	.859	2.945	.022	.642	.633	2.203	.071	.841	.501	1.030	.393
PERU	.512	.727	.484	.747	.242	.914	1.182	.320	.792	.531	.528	.715
ARGENTINA	.424	.791	.624	.646	.307	.873	.667	.616	.467	.760	.658	.622
BRASIL	.745	.562	1.139	.339	.134	.970	1.079	.367	.193	.942	.292	.883
MEXICO	.183	.947	.517	.723	.674	.610	.651	.626	.198	.939	.455	.768
USA	.144	.965	.441	.779	.356	.840	1.436	.223	.086	.987	1.179	.321
CANADA	.711	.585	.612	.654	.645	.631	.180	.949	.910	.459	.500	.736

TABLE-III: INDEPENDENT T TEST STATISTIC FOR TESTING HOMOGENEITY OF DIFFERENCE BETWEEN MONDAY AND DIFFERENT DAYS OF THE WEEK

Name Of Countries	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value
VENEZUELA	0.786512	0.432395	2.19482	0.029177	0.000766	0.999389	1.791434	0.074562	0.913915	0.361748	0.861621	0.389794
PERU	0.426843	0.669881	0.004616	0.996321	-0.95166	0.342217	1.514424	0.131251	1.474421	0.141718	-0.99942	0.318626
ARGENTINA	-0.21135	0.832796	-0.02447	0.980501	0.574259	0.566322	0.764471	0.445357	1.012612	0.3123	0.533184	0.59441
BRASIL	-0.80198	0.42337	1.671402	0.095991	-0.37641	0.70695	-0.32389	0.746313	-0.11324	0.909939	-0.06085	0.951526
MEXICO	-0.261	0.794322	0.4507	0.652594	-1.17496	0.241139	-0.18698	0.851838	0.719689	0.472422	-0.55539	0.579148
USA	0.156609	0.875684	0.530912	0.595968	-0.19012	0.849373	-0.52052	0.603183	-0.49959	0.61782	0.35991	0.71923
CANADA	-0.84035	0.401558	1.131748	0.25886	-0.22162	0.824839	0.095722	0.923826	1.079458	0.281476	0.744787	0.457148

TABLE-IV: INDEPENDENT T TEST STATISTIC FOR TESTING HOMOGENEITY OF DIFFERENCE BETWEEN TUESDAY AND DIFFERENT DAYS OF THE WEEK

Name Of Countries	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value
VENEZUELA	0.15605	0.876133	1.605727	0.109706	-0.4437	0.657676	0.619158	0.536436	-1.73554	0.084026	-0.33061	0.741238
PERU	1.099788	0.27254	0.954065	0.341023	0.130054	0.896632	0.789286	0.430734	-0.36862	0.712746	0.8567	0.392491
ARGENTINA	1.001446	0.317632	-1.33581	0.182866	0.190766	0.848868	-1.15721	0.248368	-1.15104	0.250899	0.567569	0.57087
BRASIL	0.270195	0.787246	-1.03783	0.300432	0.107014	0.914868	-0.51074	0.610021	-0.72795	0.46739	-0.01019	0.991881
MEXICO	-0.38518	0.700451	-0.51624	0.606138	0.919109	0.358932	-0.5424	0.588054	-0.61817	0.537055	0.603042	0.54705
USA	0.04886	0.961071	-1.02611	0.305866	1.150182	0.251209	-0.99372	0.321366	-0.01582	0.98739	0.413273	0.679774
CANADA	0.154064	0.877691	0.161148	0.872111	1.284058	0.200607	-0.29075	0.771512	-0.50537	0.613765	0.908199	0.364708

TABLE-V: INDEPENDENT T TEST STATISTIC FOR TESTING HOMOGENEITY OF DIFFERENCE BETWEEN WEDNESDAY AND DIFFERENT DAYS OF THE WEEK

Name Of Countries	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value
VENEZUELA	-0.03889	0.969011	-0.89591	0.371236	-1.27902	0.202166	-2.08185	0.038482	-0.08448	0.932749	-2.10318	0.036537
PERU	-0.21554	0.829532	-1.25203	0.211793	0.473574	0.636229	-1.7857	0.075427	-0.45298	0.650981	0.336875	0.736515
ARGENTINA	0.608813	0.543232	-0.18508	0.853324	-0.87648	0.381631	-0.82749	0.408804	-0.09064	0.927856	-1.21613	0.225154
BRASIL	1.214946	0.225601	-0.22713	0.820521	-0.25932	0.795613	-1.40625	0.160998	-0.01847	0.985282	0.459126	0.646559
MEXICO	-0.18857	0.85059	0.972788	0.331591	-0.2097	0.834071	-1.06214	0.289255	-0.07882	0.937242	0.956855	0.339603
USA	-0.63875	0.523588	0.808219	0.419762	-0.20591	0.837034	-1.12949	0.259822	-0.0401	0.968047	0.783196	0.434281
CANADA	1.106692	0.269549	0.042265	0.966322	-1.00022	0.318413	-0.6409	0.522239	-1.56742	0.118344	-1.18705	0.236413

TABLE-VI: INDEPENDENT T TEST STATISTIC FOR TESTING HOMOGENEITY OF DIFFERENCE BETWEEN THURSDAY AND DIFFERENT DAYS OF THE WEEK

Name Of Countries	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value
VENEZUELA	0.102987	0.918065	-2.56334	0.011004	0.655654	0.512696	-1.50714	0.133172	0.574983	0.565883	1.46592	0.144036
PERU	-0.67577	0.499845	0.318423	0.750445	0.255261	0.798737	-0.53306	0.594493	-1.12177	0.263116	0.419218	0.675443
ARGENTINA	-0.52098	0.60287	0.98693	0.324663	-0.39816	0.690864	0.828692	0.408123	0.044678	0.964402	-0.19729	0.843773
BRASIL	0.456738	0.648279	0.722935	0.470448	-0.12872	0.897691	0.580195	0.562351	0.616047	0.538478	0.461794	0.646647
MEXICO	0.631044	0.528618	0.151255	0.879896	-0.50887	0.611293	0.633252	0.527179	-0.14056	0.888336	0.289754	0.772255
USA	0.447104	0.6552	0.160493	0.872627	-0.75292	0.452235	2.032481	0.043211	0.373834	0.708857	0.553813	0.580221
CANADA	0.638787	0.523578	-0.00538	0.995714	-0.52664	0.599026	0.216162	0.829056	0.007936	0.993675	0.311543	0.755665

TABLE-VII: INDEPENDENT T TEST STATISTIC FOR TESTING HOMOGENEITY OF DIFFERENCE BETWEEN FRIDAY AND DIFFERENT DAYS OF THE WEEK

Name Of Countries	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value	t value	p Value
VENEZUELA	-1.00671	0.315156	-0.27258	0.785419	0.961242	0.337431	1.073694	0.284105	0.214153	0.830623	0.015106	0.987961
PERU	-0.65112	0.515601	-0.01442	0.988503	0.091257	0.927364	0.041834	0.966667	0.476728	0.634002	-0.63385	0.526801
ARGENTINA	-0.87295	0.383572	0.503012	0.615413	0.513852	0.607821	0.288953	0.772873	0.097065	0.922758	0.314869	0.75314
BRASIL	-1.1598	0.247302	-1.10467	0.270447	0.664217	0.507194	1.647933	0.100732	0.206914	0.836262	-0.87608	0.381862
MEXICO	0.196298	0.844545	-1.06479	0.287991	0.987094	0.324559	1.095071	0.274597	0.088699	0.929396	-1.30793	0.19215
USA	-0.02088	0.983357	-0.49642	0.620051	0.057444	0.954239	0.537085	0.591709	0.186394	0.852293	-2.12235	0.034829
CANADA	-1.06202	0.289307	-1.31414	0.190043	0.419468	0.675324	0.582981	0.560487	0.852829	0.394612	-0.79479	0.427542

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APPENDIX

APPENDIX – I: NAME OF EQUITY INDEX OF DIFFERENT COUNTRIES

Serial. No	NAME OF COUNTRIES	NAME OF EQUITY INDEX
1	VENEZUELA	IBC
2	PERU	Lima General
3	ARGENTINA	MerVal
4	BRASIL	Bovespa
5	MEXICO	IPC AllShare
6	UK	FTSE 100 Financial Times
7	USA	S&P 500 (large cap)
8	USA	S&P 500 (large cap)

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