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Stock Market Performance under Different Government Periods: Evidence from Bangladesh

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ABSTRACT

While there are many factors that influence stock market activity, the main focus of this paper is to examine stock market performance under different political leadership in Bangladesh. This study mainly considers two different daily DSE indices' (DSI and DGEN) return and some key market indicators for the sample period March 20, 1991 to April 30, 2013. We basically analyzed average market return, volatility and risk for each government term (five terms) individually. By means of descriptive observation and statistical analysis we found evidence that the performance of stock market was superior under government term 4 (2006 to 2009) while performance was worst under government term 2 (1996 to 2001) and term 5 (2009 to 2013). It was also found that the government term 4 was led by nonpolitical party, i.e. Caretaker government whereas the government terms 2 & 5 were led by the same political party.

Keywords Return, Volatility, Democracy, Political, Dhaka Stock Exchange, Performance

1.INTRODUCTION

The people of Bangladesh discovered their identity through the Language Movement in 1952. The struggle to establish their identity and national spirit began soon after 1947 when they realized that under Pakistan created on the two nation theory there was little scope for the distance culture of Bangladeshis to flourish. Thus Bangladesh plunged into a civil war. During the nine months struggle which ensued an estimated three million Bengalis died and ten million refugees fled into neighboring countries. On December 16, 1971, the Bangladesh emerged as an independent and sovereign country in the world. The new state, the People's Republic of Bangladesh was founded as a constitutional, 1988 in Bangladesh (Bijon, 2012). But most of the time Bangladesh endured political turmoil and military coups. However, to avoid such type of political turmoil and military coups, Bangladesh spread no stone unturned. After all these efforts, a caretaker government was first introduced in 1990. Since then, the Caretaker government held the elections in Bangladesh. This can be recognized as the restoration of democracy in Bangladesh. It is called that Bangladesh has an endless possibilities to become a developed country within the shortest period of time. But, since independence, it continues to face a number of major challenges, including political and bureaucratic corruption and political instability. Since 1991, our two main parties: Bangladesh Nationalist Party (BNP) and Bangladesh Awami League (AL), come on the power one after another. But both parties always tried to discontinue the previous Government policies. In addition, massive anomalies, corruption and political unrest were seen in all terms of the Government while the economic development was always ignored. It is thought that this bad politics always strike our stock market harshly which resulted several turmoil in 1990, 1996, 2011 and 2012 for instance. Stock market is a very sensitive market and confidence among investors is the main thing. Political instability and unrest obviously destroy confidence among investors on the stock market.

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Table 1. Details of Sample Government periods

Details of Sample Government periods	
Political Parties	**Ruling Periods**
Government Term 1	1991 to 1996
Government Term 2	1996 to 2001
Government Term 3	2001 to 2006
Government Term 4	2006 to 2009
Government Term 5	2009 to 2013 (continue)

Whenever our stock market goes turmoil, all keep accusing Government. They make a particular Government responsible for all the chaos in stock market. Although this blame has no base as any formal research was conducted yet regarding this issue in Bangladesh, but government cannot ignore the liability for any turmoil in the market during their regime. Hence, we inspired to conduct this study. This study mainly investigates the performance of stock market under different Government periods in Bangladesh since 1991 to 2013. Our sample period covers four political Government terms: 1991 to 1996, 1996 to 2001, 2001 to 2006 and 2009 to 2013, including one nonpolitical Government; Caretaker (2006 to 2009). Table 1 details the sample Government periods.

We performed two analyses: descriptive and statistical analysis. For descriptive analysis we used turnover, market capitalization, market capitalization to GDP ratio, index, IPO, turnover ratio, and average daily value traded. For descriptive statistical analysis: we used market return (through "DSI" and "DGEN" index). Here, stock market means Dhaka stock exchange only as it is the main bourse of Bangladesh. From both the analyses, we found that the government term 4 (2006 to 2009) was the best for stock market performance where the market experienced comparatively less volatility along with highest average return. On the other hand, the government term 2 (1996 to 2001) and term 5 (2009 to 2013) were the worst for stock market performance with high volatility against very low or negative average return and most of the market indicators showed very low or negative growth.

The rest of the paper is therefore organized as follows. Part 2 will discuss the literature review regarding this issue. Part 3 will brief about the Dhaka stock exchange. Part 4 will focus on Methodology and data. Part 5 will analyze the result of this research. Part 6 will conclude the study.

2. Literature Review

The performance of the stock market is influenced by a number of factors, the main ones among them being the activities of governments and the general performance of the economy. Extensive studies have been carried out in America and Britain examining the performance of stock markets before and after general elections. They have also examined the performance of the stock markets based on the party of the President or Prime Minister in Power. These studies indicate that the stock market react differently based on the party of the President elected in America while there was no difference in Britain. On the other hand, we did not find any research linking different Government terms with stock market performance in Bangladesh. We, first time, are going to conduct such study in Bangladesh. Now we will discuss some major works related to our study.

Relationship between presidency and stock market has shown very prudently by Ray and Marshall (2012). They focused on the relationship between U.S. political parties holding presidential office and S&P 500 performance, volatility, and risk. The research was encompassed the specific years within presidential cycle were evaluated for price change over time and observations were made to determine if there were any relationships between the political party in office and historical stock market performance. They described through Descriptive observations that the average S&P 500 nominal returns shows 55.03 percent and 23.48 percent for the two different government period in USA for the period of January 20, 1949 to projected January 20, 2013. To minimize the argument regarding inflation, they made further adjustments using the Consumer Price Index chain with a base year of 1980 equal to 100. The results were more modest. They also found that, while the descriptive observations would suggest some difference between the political parties holding the presidency and the performance of the S&P 500, there was no significant statistical difference between the political party that holds the government and S&P 500 performance at the 95 percent level of confidence both in the nominal as well as in the adjusted composite price levels.

Applying conditional volatility models, Roland and Michael (2007) analyzed the impact of expected government partisanship on stock market performance in the 2002 German federal election. Their results showed that small-firm stock returns were positively (negatively) linked to the probability of a right- (left-) leaning coalition winning the election. Moreover, they found that volatility increased as the electoral prospects of right-leaning parties improved, while greater electoral uncertainty had a volatility-reducing effect. political party in office and historical stock market performance. They described through Descriptive observations that the average S&P 500 nominal returns shows 55.03 percent and 23.48 percent for the two different government period in USA for the period of January 20, 1949 to projected January 20, 2013. To minimize the argument regarding inflation, they made further adjustments using the Consumer Price Index chain with a base year of 1980 equal to 100. The results were more modest. They also found that, while the descriptive observations would suggest some difference between the political parties holding the presidency and the performance of the S&P 500, there was no significant statistical difference between the political party that holds the government and S&P 500 performance at the 95 percent level of confidence both in the nominal as well as in the adjusted composite price levels.

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Jedrzej, Katrin and Tomasz (2006) performed an analysis of 24 stock markets and 173 different governments and found that there are no statistically significant differences in returns between left-wing and right-wing executives. Consequently, international investment strategies based on the political orientation of countries' leadership are likely to be futile.

Oumar and Ashraf (2011) examined the link between stock returns and the presidential cycle in the United States. They investigated whether there is a risk-based explanation for higher returns during Democratic presidencies compared with Republican presidencies. The findings show that the market exhibits higher returns when Democrats control the presidency, with smaller companies experiencing the most significant improvement.

Santa-Clara and Valkanov (2003) found that there was a higher excess return in the stock market (using a stock market index compared to three-month Treasury Bill) when Democrats were in office. According to their research, which does not include the last two presidential terms, the excess returns were 09 percent for the value weighted stock indexes and 16 percent for the equal weighted portfolio.

Beyer, Jensen, and Johnson (2004) showed that political gridlock as well as monetary expansion and restrictive fiscal policies had effects on security performance. They concluded that the evidence is contrary to popular opinion that the stock market benefits from political gridlock. After controlling for shifts in the political landscape, they found strong evidence that shifts in Fed policy have a significant relationship with the security returns.

Nikhar (2013) used the surprise, positive jolt that Osama Bin Laden's capture gave to Barack Obama's 2012 re-election prospects to study the relationship between business campaign contributions, political connections, and stock market valuation changes. He found that following Bin Laden's death, firms that had previously donated to Democrats registered significant positive returns whereas firms that had donated to Republicans registered significant negative returns. His findings indicate that campaign contributions serve as financial investments that can yield major valuation payoffs to firms because investors view these as signals of political connections.

Ansolabehere, Snyder Jr. and Ueda (2004) found that these rulings appear to have had no noticeable effect on the stock prices of firms that were directly affected leading the authors to conclude that the fundamental critique of campaign finance in America-that donations come with a quid pro quo and extract very high returns for donors-is almost surely wrong.

3. The Dhaka Stock Exchange (DSE): a Brief Description

In early 1952, five years after the independence of Pakistan, the Calcutta Stock Exchange prohibited transactions in Pakistani stocks. This necessitated the formation of a stock exchange in East Pakistan. Eventually, on 28 April 1954 the East Pakistan Stock Exchange Association Ltd. was incorporated. However, formal trading began in 1956 with 196 securities listed on the DSE with a total paid up capital of about Taka 4 billion (Chowdhury, 1994). It changed its name to East Pakistan Stock Exchange Ltd on 23 June 1962 and finally to Dhaka Stock Exchange (DSE) on 14 May, 1964.

After 1971, the trading activities of the Stock Exchange remained suspended until 1976 due to the liberation war. The trading activities resumed in 1976 with only 9 companies listed having a paid up capital of Taka 137.52 million on the stock exchange (Chowdhury, 1994).

There are 250 members and total 522 listed securities in Dhaka Stock Exchange till May 30, 2013. The working days of DSE is 5 days in a week without Saturday, Sunday public holidays & other government holidays. The trading time is from 10:30 am to 2:30 pm (local time). Investment options for an investor in this market are ordinary share, Debenture, Bond & Mutual funds.

In the beginning, DSE was a physical stock exchange and used to trade in the open out-cry system. After that to secure smooth, timeliness & effective operation on the market, DSE uses automated trading system. The system was installed on 10th August, 1998 and was upgraded time to time. The latest up-gradation was web based trading software-MSA Plus which is introduced on June 10, 2012. Now, investors are able to submit buy/sale orders on Dhaka stock exchange from anywhere of the world through Internet. Before January 28, 2013, DSE had three indices, DSI (All share), DGEN (A, B, G & N) and DSE 20 where DGEN was treated as benchmark. None of the DSE indices include mutual funds, bonds and debentures. However, on January 28, 2013 DSE introduced two new indices which are known as the DSE Broad Index (DSEX) and DSE 30 Index (Ds30) based on free float and S&P methodology. Now, DSEX is considered as benchmark index in DSE.

4. Methodology and Data

For our present study we have basically performed two analyses:

1) Descriptive observations and

2) Descriptive statistical analysis

Applying these two analyses we mainly evaluated the market return, volatility and risk of the stock market at each government period individually since 1991. We also observed whether the political parties holding power in government had any statistical influence on stock market performance. For the descriptive analysis, we used some key indicators of stock market, i.e. turnover, market capitalization, market capitalization to GDP ratio, index, IPO, turnover ratio, and average daily value traded. Here, we observed the growth pattern of these indicators. Descriptive analysis also includes graphical presentation where we showed daily index and turnover.

Here,

Turnover ratio (%) = Total turnover/ Market capitalization * 100

Average daily value traded = Total turnover / number of trading days

Market capitalization to GDP ratio = Market capitalization / GDP * 100

For descriptive statistical analysis, we used daily index return as market return (through "DSI" and "DGEN" index). DSI index includes all stocks where DGEN index includes all stocks except Z category firms. The daily index return in period t is calculated using the simple return formula,

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Where, P t = Value of security DSI / DGEN Index on day and P t−1 = Value of security DSI / DGEN Index on day prior to day

Our sample data covers the period from March 20, 1991 to April 30, 2013. This sample period is also divided into five different government terms: Term 1 (March 20, 1991 to March 19, 1996), Term 2 (June 23, 1996 to July 15, 2001), Term 3 (October 10, 2001 to October 22, 2006), Term 4 (October 31, 2006 to January 05, 2009) and Term 5 (January 05, 2009 to April 30, 2013). The last term of government is not completed yet.

Since, before November 27, 2001 DSE had only one index, DSE all share Price Index (DSI) and the DSE General Index (DGEN) was introduced on November 27, 2001, for all analyses, we used DSI index for the first two government terms ('1991 to 1996' and '1996 to 2001') and used DGEN for the rest of the three terms ('2001 to 2006', '2006 to 2009' and '2009 to 2013'). But, before January 01, 1995, daily turnover is not available, only monthly turnover is available. Therefore, for the first government term (1991 to 1996), graphical presentation starts from January 01, 1995.

All data related to stock market are collected from DSE official website; www.dsebd.org and DSE library. GDP data are collected from Bangladesh bank official website; www.bangladesh-bank.org. For all the statistical computation, we used Microsoft Excel and its data analysis tool.

5. Data Analysis and Result

This section has two parts. In first part, we just described the results obtained from both the descriptive and statistical analyses for each government term separately. The second part includes major findings where we performed comparative analysis among different government terms. Government Term 1 (1991 to 1996)

Descriptive Observations: In table 2; on March 20, 1991 the aggregated value of all trading deals that measures the efficiency and intensity of assets allocation was Tk. 0.37 million, which stood at Tk. 29.50 million on March 19, 1996 representing 7856 percent growth. The total value of a stock exchange; Market Capitalization was Tk. 11.90 billion on March 20, 1991, which reached at Tk. 52.44 billion on March 19, 1996 registering 341 percent growth. DSE All Share Index (DSI) was 351.00 points on March 20, 1991 which increased to 830.69 points on March 19, 1996 confirming 137 percent up. The average daily value traded was Tk. 9.46 million during this period which was Tk. 0.54 million in previous term of the government demonstrates 1657 percent appreciation. Market Capitalization to GDP ratio was 3.15 on March 19, 1996. At the beginning of the term, the turnover ratio was 0.003 percent, that increased by 1706 percent to 0.056 percent. During the tenure, a total 67 firms have off-loaded shares in the capital market.

Chart 1 shows the daily DSI index and turnover value. The highest daily turnover value and DSI Index were Tk. 141.01 million and 903.04 points respectively whereas the lowest turnover and DSI Index were Tk. 3.62 million and 284.37 points respectively during this term.

Statistical Analysis: In table 7, total 1337 observations have been used in statistical analysis for this government term. In statistical findings based on the DSI Index return, the expected value or average mean return was 0.075 percent. It is the mean value of returns that investors try to maximize at each level of risk. The median return was 0.014 percent. The Standard deviation and coefficient of variation (CV) were 1.63 percent and 21.59 respectively.

Table 2. Government TERM-1 (1991 to 1996)

Government Term- 1 (1991 to 1996)			
Particulars	**March 20, 1991**	**March 19, 1996**	**Change in %**
Turnover Value Tk. in Million	0.37	29.50	7,855.91
Market Capitalization Tk. in Million	11,904.48	52,442.35	340.53
DSE All Share Price Index (DSI) in Points	351.00	830.69	136.66
Initial Public Offerings Nos.		67.00	
Market cap to GDP ratio in Percentage	0.88	3.15	258.31
Turnover ratio in Percentage	0.003	0.056	1,706.00
Average Daily Value Traded Tk. Million	0.54	9.46	1,656.97

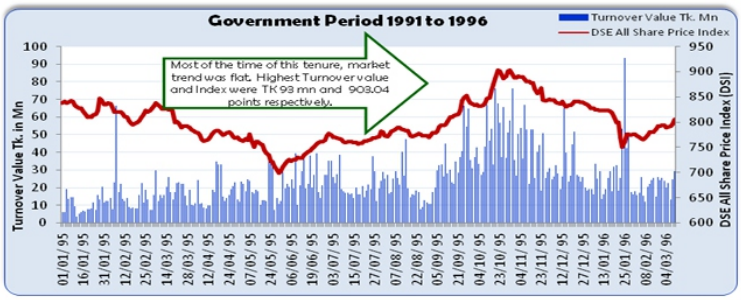

Chart 1. Government Period 1991 to 1996

Descriptive Observations: In table 3; on June 23, 1996 the turnover value was Tk. 90.65 million, which stood at Tk. 120.10 million on July 15, 2001 representing 32 percent growth. The Market Capitalization was Tk. 66.28 billion on June 23, 1996, which reached at Tk. 70.28 billion on July 15, 2001, registering 6 percent growth. DSI Index was 976.20 points on June 23, 1996, which decreased to 707.77 points on July 15, 2001 witness 28 percent down. The average daily value traded was Tk. 132.44 million during this period which was Tk. 9.46 million in previous government term demonstrates 1300 percent appreciation. Market Capitalization to GDP decreased from 3.99 percent to 2.57 percent during the tenure. At the beginning of the term, the turnover ratio was 0.14 percent, that increased by 25 percent to 0.17 percent. During the tenure, a total 61 firms have off-loaded shares in the capital market.

Table 3. Government Term-2 (1996 to 2001)

Government Term- 2 (1996 to 2001)			
Particulars	**June 23, 1996**	**July 15, 2001**	**Change in %**
Turnover Value Tk. in Million	90.65	120.10	32.49
Market Capitalization Tk. in Million	66,283.82	70,282.93	6.03
DSE All Share Price Index (DSI) in Points	976.20	707.77	(27.50)
Initial Public Offerings Nos.		61.00	
Market cap to GDP ratio in Percentage	3.99	2.57	(35.59)
Turnover ratio in Percentage	0.137	0.171	24.95
Average Daily Value Traded Tk. Million	9.46	132.44	1,300.00

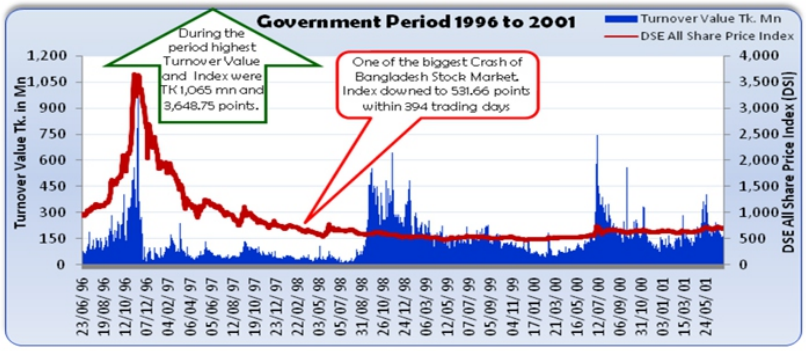

Chart 2. Government Period 1996 to 2001

Table 4. Government Term-3 (2001 to 2006)

Government Term- 3 (2001 to 2006)			
Particulars	**October 10, 2001**	**October 22, 2006**	**Change in %**
Turnover Value Tk. in Million	257.85	215.48	(16.43)
Market Capitalization Tk. in Million	70,339.88	282,123.48	301.09
DSE General Index (DGEN) in Points	702.30	1,542.44	119.63
Initial Public Offerings Nos.		45.00	
Market cap to GDP ratio in Percentage	2.57	5.97	132.30
Turnover ratio in Percentage	0.367	0.076	(79.16)
Average Daily Value Traded Tk. Million	132.44	170.63	28.84

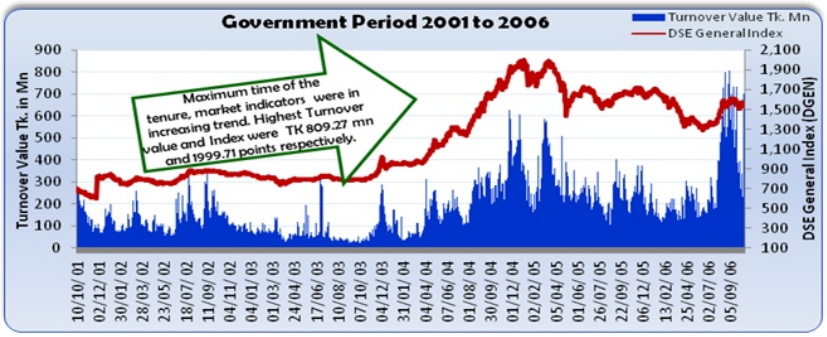

Chart 3. Government Period 2001 to 2006

Chart 2 shows the daily DSI index and turnover value. The highest turnover value and DSI Index were Tk. 1065.04 million and 3648.75 points during this term.

Statistical Analysis: In table 7, total 1344 observations have been used for government term 2. The mean and median return were (0.002) and (0.022) percent respectively where the Standard deviation was 2.13 percent.

Government Term 3 (2001 to 2006)

Descriptive Observations: In table 4; on October 10, 2001, the turnover value was Tk. 257.85 million, which stood at Tk. 215.48 million on October 22, 2006 representing 16 percent negative growth. The Market Capitalization was Tk. 70.34 billion on October 10, 2001, which reached at Tk. 282.12 billion on October 22, 2006, registering 301 percent growth. DGEN Index was 702.30 points on October 10, 2001, which increased to 1,542.44 points on October 22, 2006 confirming 120 percent up. The average daily value traded was Tk. 170.63 million during this period which was Tk. 132.44 million in previous government term demonstrates 28.84 percent appreciation. Market Capitalization to GDP decreased from 2.57 percent to 5.97 percent during the tenure. At the beginning of the term, the turnover ratio was 0.367 percent, that decreased by 79.16 percent to 0.076 percent. During the period, a total 45 firms have off-loaded shares in the capital market.

Chart 3 shows the daily DGEN index and turnover value.

The highest turnover value and DGEN Index were Tk. 809.27 million and 1,999.71 points during this term.

Statistical Analysis: In table 7, total 1350 observations have been used for government term 3. The mean and median returns were 0.067 and 0.01 percent respectively where the Standard deviation and CV were 1.35 percent and 20.28 respectively.

Government Term 4 (2006 to 2009)

Descriptive Observations: In table 5, on October 31, 2006, the turnover value was Tk. 261.21 million, which stood at Tk. 4,642.24 million on January 05, 2009, representing 1,677 percent huge growth. The Market Capitalization was Tk. 281.40 billion on October 31, 2006, which reached at Tk. 1,057.95 billion on January 05, 2009, registering 276 percent growth. DGEN Index was 1,541.65 points on October 31, 2006, which increased to 2,808.45 points on January 05, 2009 confirming 82 percent up. The average daily value traded was Tk. 1,978.80 million during this period which was Tk. 170.63 million in previous government term demonstrates 1,060 percent appreciation. Market Capitalization to GDP decreased from 5.96 percent to 15.24 percent during the tenure. At the beginning of the term, the turnover ratio was 0.093 percent, that increased by 372.71 percent to 0.439 percent. During the tenure, a total 28 firms have off-loaded shares in the capital market.

Table 5. Government Term-4 (2006 to 2009)

Government Term- 4 (2006 to 2009)			
Particulars	**October 31, 2006**	**January 5, 2009**	**Change in %**
Turnover Value Tk. in Million	261.21	4,642.24	1,677.21
Market Capitalization Tk. in Million	281,397.10	1,057,947.03	275.96
DSE General Index (DGEN) in Points	1,541.65	2,808.45	82.17
Initial Public Offerings Nos.		28.00	
Market cap to GDP ratio in Percentage	5.96	15.24	155.70
Turnover ratio in Percentage	0.093	0.439	372.71
Average Daily Value Traded Tk. Million	170.63	1,978.80	1,059.69

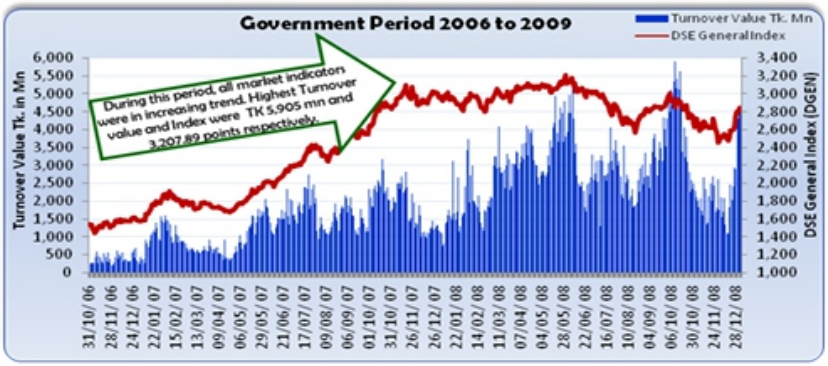

Chart 4. Government Period (2006 to 2009)

Chart 5. Government Period (2009 to 2013)

Table 6. Government Term-5(2009 to 2013)

Government Term- 5 (2009 to 2013)			
Particulars	**January 6, 2009**	**April 30, 2013**	**Change in %**
Turnover Value Tk. in Million	3,788.71	1,364.33	(63.99)
Market Capitalization Tk. in Million	1,042,968.82	2,166,577.33	107.73
DSE General Index (DGEN) in Points	2,756.66	3,618.49	31.26
Initial Public Offerings Nos.		70.00	
Market cap to GDP ratio in Percentage	15.02	23.68	57.66
Turnover ratio in Percentage	0.363	0.063	(82.67)
Average Daily Value Traded Tk. Million	1,978.80	7,906.66	299.57

Table 7. Descriptive Statistics Findings

Descriptive Statistics Findings					
Statistical Findings	***Term 1***	***Term 2***	***Term 3***	***Term 4***	***Term 5***
	1991-1996	***1996-2001***	***2001-2006***	***2006-2009***	***2009-2013***
Mean	0.00075	(0.00002)	0.00067	0.00125	0.00047
Median	0.00014	(0.00022)	0.00012	0.00140	0.00045
Standard Deviation	0.01628	0.02126	0.01352	0.01284	0.02058
Coefficient of Variation (CV)	21.5930		20.2833	10.2752	43.7875
Kurtosis	196.3268	43.9968	292.5431	0.6639	18.9264
Skewness	1.7979	1.7536	11.5671	0.1083	1.5256
Minimum	(0.25079)	(0.22204)	(0.07095)	(0.03921)	(0.08908)
Maximum	0.33098	0.30366	0.33930	0.04737	0.22608
Number of Observations	1,337	1,344	1,350	514	1,038

Chart 4 shows the daily DGEN index and turnover value. The highest turnover value and DGEN Index were Tk. 5,905.15 million and 3207.89 points during this term. Statistical Analysis: In table 7, total 514 observations have been used for government term 4. The mean and median returns were 0.125 and 0.140 percent respectively where the Standard deviation and CV were 1. 28 percent and 10.28 respectively

Government Term 5 (2009 to 2013)

Descriptive Observations: In table 6; on January 06, 2009 the turnover value was Tk. 3,788 million, which stood at Tk. 1,364 million on April 30, 2013 representing 64 percent negative growth. The Market Capitalization was Tk. 1,042.97 billion on January 06, 2009, which reached at Tk. 2,166.58 billion on April 30, 2013 registering 108 percent growth. DGEN Index was 2,756.66 points on January 06, 2009 which increased to 3,618.49 points on April 30, 2013 confirming 31 percent up. The average daily value traded was Tk. 7,906.66 million during this period which was Tk. 1978.80 million in previous government term demonstrates 300 percent appreciation. Market Capitalization to GDP increased from 15.02 percent to 23.68 percent during the tenure. At the beginning of the term, the turnover ratio was 0.363 percent, that decreased by 82.67 percent to 0.063 percent. During the term, a total 70 firms have off-loaded shares in the capital market.

Chart 5 shows the daily DGEN index and turnover value. The Glorious record of single day's highest turnover value was Tk. 32,000 million and DSE General Index reached its highest level at 8,991 points on December 05, 2010.

Statistical Analysis: In table 7, total of 1038 observations have been used for government term 5. The mean and median returns were 0.047 and 0.045 percent respectively where the Standard deviation and CV were 2.058 percent and 43.79 respectively

Major Findings: - a comparative analysis

From the above analyses and table 7, we observe that the government term 4 has the highest mean and median return (0.125% & 0.140%) where the term 2 has lowest mean and median return (Negative). On the other hand, although the term 4 has highest mean return, its volatility or risk was lowest among all the government terms as its standard deviation is only 1.28 percent which is lowest. The term 4 has also the lowest coefficient of variation (CV) which measures the risk per unit of return is 10.28. But, even though the government term 2 has negative return, it has highest volatility or risk as its standard deviation is 2.13 percent, which is largest.

Apart from government term 2, the current term 5 has the highest volatility with comparatively lower mean return. In contrast, the government term 1 and 3 have almost similar and consistent risk-return pattern as their CV were 21.59 and 20.28 respectively. And surprisingly, these two terms (1 & 3) were led by the same political party; BNP. If we further examine the descriptive observations and table- 2 to 6, we also found that all the market indicators have comparatively very significant positive growth under government term 1 and 4 while the government terms 2 and 5 have very poor or negative growth in terms of most of the indicators.

Another important thing to be noted that the two big crashes (1996 & 2011) occurred during the government terms 2 and 5 respectively which are depicted in chart 2 and 5. The market performance under these two government terms was also worse than that of rest of the terms. And coincidentally, the same political party; Bangladesh Awami League has been at government during these two terms. Thus, it is evident from the above analysis that the political parties holding power in government had significant impact on the stock market performance as the political parties at government changes; the market performance also changes significantly.

Khondoker Ibrahim Khaled's probe report on stock market crash in 2011 found that market got imbalanced during the Caretaker government in 2007 which ultimately translated into a market crash in 2011 during the AL regime. However, why the market performance during AL regime is not good comparing to during BNP's leadership is an area of further research.

6. Conclusion

From our analysis it is evident that the performance of stock market was better during non-political government (caretaker) in 2006 to 2009 in all aspects. Under this period, the average market return was highest while volatility was lowest and all other market indicators had shown significant growth. However, if we consider only political governments, the performance of stock market was best during BNP led government in 1991 to 1996 in all aspects. During this period, the average market return was highest while volatility was low and all other market indicators had shown significant growth. On contrary, the performance of stock market was very poor during Awami league regime in 1996 to 2001 in all aspects. During this period, the average market return was negative while volatility was highest. Even during the current Awami league administration, market experiences very low average return combined with high volatility. However, in both terms of BNP led government, i.e., 1991 to 1996 and 2001 to 2006, market experienced comparatively consistent return-volatility relation.

To that end, we may conclude that the market performed best under the non-political government (caretaker) during 2006-2009 while market performed worse under Awami league led government during 1996-2001 & 2009-2013. However, the market performance was well and consistent under BNP led government during 1991-1996 & 2001-2006. Therefore, from the above analysis it is evident that the political parties holding power in government had significant influence on stock market performance.

Even though Ibrahim Khaled's probe report on stock market crash in 2011 has given some comfort to Awami League that the market got imbalanced or bubble during earlier government in 2007 which translated into a crash in their term in 2011, Awami League government cannot ignore the liability for repeated market crashes (1996 & 2011). However, why market got into crash repeatedly during Awami League regime, why the market performance during AL regime is not good comparing to during BNP's leadership is an area of further research.

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IFRS Subjectivity: the Other Side of the Coin

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A B S T R A C T

The study shows the benefits of more discretion and less guidance in IFRS by presenting an arbitrariness and subjectivity index. The measurement of discretion proposed is based on a scale of values which improves the accuracy of information on measurements, allowing stakeholders to understand independently the level of subjectivity inherent in any accounting items. The study illustrates the matrix format statement, in which retrospective and dynamic accounting results, based on historical cost and fair value are combined, associated with an "accounting discretion view". By highlighting the degree of accounting discretion, this approach provides users with a clear and realistic vision in which accounting choices or estimates can be credible signals of a firm's financial performance. Regulators and users of accounting information have to accept a limited subjectivity in pursuit of more informative financial reporting because results seem to suggest that discretion, in spite of all the opportunities to manipulate reported outcomes and mislead users, appears to add value: reasonable and legal management decision making and reporting tend to achieve stable and predictable financial results.

Keywords Matrix Format Statement, Accounting Subjectivity, Accuracy of Information

1.INTRODUCTION

In this work, we propose an alternative method for representing balance sheet data that is able to monitor, measure and classify the level of discretionary power inherent in the evaluation of each of the items in the balance sheet.

The annual balance sheet – with reference both to the profit and loss account and to the statement of assets and liabilities – actually presents a collection of accounting items that are extremely heterogeneous, including the way in which they are determined.

In fact, each accounting item may derive from a "sure" base (for example the balance of a current account), or on the contrary, may be founded on values conjectured by the balance sheet compiler: this is the case, for example, of depreciations, devaluations and, in general of "fair value" assessments.

The presence of an evaluation activity, based on the discretionary power of the compiler of the balance sheet, is at one and the same time both a vital requisite and an element of risk in drawing up the annual balance sheet:

it is indispensable because without the evaluation activity, the balance sheet would be nothing but the statement of account of a series of financially "certain" elements, without the possibility to explain the activity carried out by the company with regard to the accrual basis or the future prospects of the same (for international accounting principles, the evaluations of a dynamic nature, based essentially on "fair value");

→ it represents an obstacle to a true and correct representation of the company's accounting data insofar as it is based mainly on the sensitivity (or, in pathological cases, on the undeclared aims) of the balance sheet compiler. The discretionary power in evaluation is, therefore, subject potentially to operations of "earnings management", because of the very subjectivity of the balance sheet evaluations.

2. Studies in Literature Connected with "Earnings Management"

In order to better understand the need to monitor the level of subjectivity in the assessment of financial statement it is necessary to first make a digression concerning '"earnings management".

Literature has dealt widely with the phenomenon of "earnings management", in the sense of an abuse of the discretionary power in evaluation on the part of the balance sheet compiler for the purpose of subjugating the accounting data to their own ends.

The problem of balance sheet policies and the related alteration of the accounting evaluations has assumed such proportions and importance over the last few decades that it has attracted the attention of the international scientific community.

"Earnings management" has been defined as [1] "the management of information", understood as an intentional intervention in the process of financial reporting aimed at the external users of the company, in the aim of achieving personal interests, whatever they may be.

The consequence of the "earnings management" is the so-called "smoothing", understood as a reduction or "levelling" of the variations in the accounting data over time.

As from the 1960s [2] a conviction developed amongst experts on an international level that the more promising the information was regarding the profits shown in the financial year balance sheet, the more positive was the markets' reaction.

From this derived the managers' keenness to mention income results in their periodic communications (and, consequently, the financial results and the statement of assets and liabilities) that were at least equal or above the expectations expressed by the market. Consequently, a dangerous combination of factors can be sensed:

→ a class of stakeholders appointed to draw up the balance sheet (managers or directors) which possesses all the accounting and operational information regarding the company and is able to exclude all the other stakeholders (with the exception, in part, of the auditors) from consulting such data;

→ in preparing the annual balance sheet, managers alone handle the accounting data and adjust them in order to calculate the income for the financial year, applying technical discretionary power attributed to them and which is essential in order to perform correct evaluations;

→ technical discretionary power is attributed to a class of stakeholders with their own individual interests, which, as such, cannot act neutrally towards the other stakeholders: therefore, there may be some justification for thinking that this group of subjects can use the information that it alone possesses for its own benefit;

→ the evaluation choices put into effect by the administrators in virtue of the technical discretionary power attributed to them, are rarely contested by the other stakeholders: in fact, the evaluations are made according to accounting regulations which apart from being complex, are also based on the sensitivity and honesty of the balance sheet compiler, and hard to confute [3].

Burgstahler and Dichev identify two possible reasons for "earnings management":
→ the "need" to report positive information in order to minimise the transaction costs with the stakeholders;

→ the aversion to absolute or relative losses, that is in any case inherent in the management. However, further reasons may be identified [4]:

→ the managers' interest in obtaining the remuneration promised to them on the basis of the income results;

→ their wish to make their job more secure;

→ the need to reduce the risk of penal sanctions linked to the violation of financing contracts;

→ the fear of interventions by regulatory bodies (e.g. for proceedings with the participation of more than one claimant or for the rules of the capital market);

→ the aim of concealing a transfer of wealth from one class of stakeholder to another [5].

Furthermore, a tendency has been noted [6] among managers dealing in the context of the U.S. GAAP regulation to take advantage of the considerable discretionary power conceded to them by the accounting principles regarding the choice of the evaluation procedures.

In one of the milestones of «earnings management» theory, it is asserted that a statistic of between 30% and 44% of the companies with a debit balance in the income results made adjustments, within their discretionary evaluation powers, in order to make positive improvements to the incomes.

The operations on the profits were mainly singled out as manipulations of the cash flow, as alterations of the circulating capital (which had the advantage of not directly influencing the determination of the cash flow), by altering the research, development and advertising expenses or the timing of the fixed assets management [7].

Besancenot and Vranceanu showed that simulations and tax-evasion do not only occur in situations of financial difficulty, but, on the contrary, are frequent even in more prosperous companies where managers often have the tendency to overestimate their performance for the very purpose of benefiting from undeserved bonuses that the company can, in any case, afford to grant them.

Moreover, it can also be added that, from the study carried out [8], it would seem that a positive correlation has been perceived between the solidity of the companies and the bad faith of the details stated in the annual accounts. Standard setters have often been interested in establishing parameters that regulate the trade-off between discretionary powers and earnings management.

The presence of a trade-off becomes evident in the definition of «earnings management» given by Healy and Wahlen [9], when it is understood as that attitude of managers who use the discretionary powers bestowed on them and their judgement to modify accounting data, to deceive the other stakeholders regarding the economic performance of the company or to influence the possible contractual outcomes that depend on the accounting data.

The trade-off appears even more important if consideration is given to the fact that discretionary powers form a part of the discernment that is essential for managers to run the companies entrusted to them: if this were not the case, the managers would not have the instruments necessary for managing the company and their role would be totally pointless.

However, discernment represents the main root of the “earnings management” principle and, apparently, it can only be opposed by reducing or monitoring the discretionary powers and the subjective evaluation. The incomes can be modified by moving the income components appropriately from one financial year to another (so-called "direct management" or “timing”) or by employing "misreporting" [10] practices.

Misreporting is identified with bad accounting management and involves the systematic violation of the evaluation procedures, with the complicity of the other people responsible for the accounts, or the modification of the information processes, so that the other people are kept in the dark.

As in the case of exaggeratedly precise rules, it has been shown [11] that when postulates are too wide and abstract they leave room for discretionary powers, encourage managers to take advantage of the wide gap left by the abstractness and discourage auditors (as they themselves are “confused” by the complication of the regulation) from intervening by sanctioning the managers’ behaviour. In any case, neither the production of specific rules nor the transfer to a accounts system based on general principles can tackle the main weak point of accounting which lies in the absolute and inevitable dependency on subjective evaluations. Consequently, an instrument is needed that is able to measure and show in the balance sheet the degree of discretionary powers involved in each accounts item.

3. The Segregation of Accounts Items Subject to “Remeasurement”: the “Matrix Format” Balance Sheet

From the points made so far, it can be deduced that:

→ most of the “earnings management” phenomena occur when there is an abuse of the iscretionary powers of evaluation granted, as a necessity, by the accounting principles to the balance sheet compilers;

→ the “earnings management” phenomena include a wide range of more or less fraudulent perations for the purpose of modifying the perception that the stakeholders have of the accounts informations;

→ the possibilities of altering the accounting data connected with “earnings management” increase in proportion to the complexity and the discretionary powers of the accounting evaluations: it follows that it is “simpler” to alter the accounting data based on international principles than when observing accounting principles based on historical cost and on the related principle of prudence;

→ it has been shown [16 – 17 - 18] that the advent of international financial standard in countries where there was only the historical cost principle, has increased the use of earnings management: this suggest that "earnings management" has intensified with increasing editor's discretionary power.

It may be deferred that if the accounting items subject to greater discretionary powers of evaluation ("remeasurement") could be segregated and identified, the phenomenon of "earnings management" could be partly restrained. To satisfy these needs, a new balance sheet format must be defined, that is able to separate the more objective accounting elements (that are "certain" or, at least based on historical costs), compared with those that are remeasured on conjectural bases, but without having to forego the informative capacity of a modern balance sheet based on "fair value".

To establish this ideal statement, it is necessary to draw simultaneously on the lengthy experience acquired by FASB, the new methods established by international Standard Setters and the analyses performed by the scientific community in recent years.

It is evident that the need to provide at least two values for each accounting item requires the balance sheet data to be displayed according to a matrix system.

In fact, IASB moved in this direction in the period 2001 - 2003, in the framework of a joint project with the UK Accounting Standards Board (ASB) on "performance reporting".

The aim of the project was to catalogue and show all the income and costs for the period in order to allow the users to understand fully the company's performance.

The study suggested by the Standard Setters [12] and the doctrine [13] focused only on the income statement as the best method to achieve the purpose of standard setter, classifying the costs and the income in the profit and loss account for the financial year under the values "pre remeasurement" and "post remeasurement".

The so-called "matrix format income statement" has been studied in practice by Tarca and others [14] [15], whose studies are a milestone in the field.

The work drew inspiration from the matrix format income statement proposed by the IASB and the FASB, quickly shelved as it was considered confusing and misleading to apply in practice, both for user and preparers.

The purpose of Tarca's study was to demonstrate the benefits in terms of better information provided to readers, ability to extract the best information and to categorise and display all income and expenses for the period in a way that enhances users' understanding of the entity's financial results.

The studies conducted by Tarca et alii show that the multi-column income statement report has not damaged users' confidence, but, on the contrary, it improves the accuracy in the extraction of information from the financial statement.

Tarca concluded as follows: "Our findings suggest that adopting the matrix format would not pose a major educational challenge, at least when it comes to financial analysts, accountants and managers. Our experiment is a useful starting point for evaluating a matrix format for the reporting of

comprehensive income.”.

The work of standard setters and the literature cited, however, have paid attention only to the income statement: as its aim was to define and categorize the revenue and costs, segregating components subject to remeasurement, as to obtain greater clarity with particular regard to the "comprehensive income".

The abandoned project of standard setter is here taken up and extended to the balance sheet; like the work cited above, the goal is to show the best quality of information provided by the matrix format, extending the benefits of the income statement matrix format to the balance sheet account.

The company’s balance control based on the historical cost approach, adopted for the implementation of financial reporting of national budgetary frameworks, has always been based on the balance sheet’s provisions instead of income statement’s cash flows.

In such contexts, the activities of earnings management, as well as the issues of transparency in financial statements, have their focus of interest even more on the balance sheet rather than the income statement.

The balance sheet, in fact, reflects the discretionary assessments of income statement, returning each year evaluation errors, changes in the budget, or assessments that reflect the preparer’s personal, subjective perspective.. In addition, fair value cause a second discretionary distortion which exacerbates earning management phenomena: so that, the reader of the financial statement needs data presented in a format that segregate and highlight all remeasured accounts.

In this contest, we try to show an example of application of the matrix format profit and loss (including the section "comprehensive income"), too hastily abandoned by standard setter: in fact, the matrix format also affects the balance sheet as fund of discretionary policy assessment.

In this case, the segregation operates on two levels, one "static", based on historical cost evaluations, and the other "dynamic", which includes the values at "fair value" and all the values that arise from discounted prospective results..

The scale of values is divided in the following way: - Historical cost; - remeasurement; - Dynamic values In addition, the example shows, differently to the draft proposed by the standard setters, the income statement widely streamlined, with a reduction of three columns.

5. Case Study

Here below we propose an operating structure of a balance sheet set out according to a “matrix format” project. Let us suppose that the following account situation is given by the accounting records of a Company “X”:

Table 1. The account stuation

Statement of Assets	
Non-current assets	
property, plant and equipment	6.000,00
Goodwill	1.500,00
other intangible assets	450,00
participation in associated companies	2.500,00
financial assets available for sale	1.200,00
deferred tax assets	-
Total non-current assets	11.650,00
Current assets	
Unsold stock	3.989,00
Account receivable	3.005,00
other current assets	1.231,00
Cash and cash equivalents	123,00
Total current assets	8.348,00
Non-current assets classified as held for sale	-
Total Assets	19.998,00
Statement of Liabilities	
Shareholders' equity	
Share capital	3.000,00
Retained earnings (accumulated losses)	1.435,00
Other components of the shareholders' equity	2.323,00
Operating profit (loss)	1.440,00
Total shareholders' equity	8.198,00
Non-current liabilities	
Long term loans	5.379,00
Deferred tax liabilities	541,00
Long term financial liabilities	870,00
Total non-current liabilities	6.790,00
Current liabilities	
Trade and sundry payables	1.548,00
Short term loans	1.500,00
Current portion of long term loans concerning current taxes	340,00
Current taxes	650,00
Short term funds	972,00
Total current liabilities	5.010,00
Liabilities relating to non-current assets classified as held for sale	-
Total shareholders' equity and liabilities	19.998,00
Profit and loss account	
Revenue	12.593,00
Other income	250,00
Changes in inventories, finished goods, work in progress	275,00
Capitalised development costs	350,00
Raw goods and expendable materials used	-4.500,00
Employee benefits expense	-3.760,00
Depreciation	-911,00
Reduction in value of property, plant, equipment	-150,00
Other costs	-917,00
Operating profit	**3.230,00**
Financial expenses	-350,00
Equity in earnings of associates	-
Profit before tax	**2.880,00**
Income taxes payable	-1.440,00
Operating profit of the continuing activities for the year	**1.440,00**
Profit of non-current activities destined for sale	-
Operating profit	**1.440,00**

During evaluation, the following variations are made to bear in mind the potential prospective income components (the number of each adjustment operation, indicated below, corresponds to the number of the note at the side of the relevant accounting adjustment in the financial year balance sheet):

1. The historical cost relative to the item "Property, plant and equipment" is readjusted to the fair value, with an increase of 800 and a consequent increase of 80 in depreciation. The difference, equal to 800 - 80 = 720 is not put to reserve, but straight into the profit and loss account

2. The financial liabilities for employee benefits are also included amongst the long term financial liabilities (non-current liabilities of the statement of assets and liabilities). The actuarial evaluation of this financial liability shows a profit of 50, given by the negative variation in the actual value of the liability undertaken.

3. The "other current assets" include securities "held for trading" the estimated fair value of which exceeds the historical cost registered in the statement of assets and liabilities by 149.

4. The item "depreciation" includes 300 for the depreciation of the goodwill. After performing the impairment test, it is held that said depreciation is not due, as it is estimated that the goodwill has lasted for an indefinite period. The depreciation already ascribed to the profit and loss account is cancelled.

5. The fair value of the "financial assets available for sale" exceed the historical value registered in the balance sheet assets by 375.

6. The taxes estimated on the incomes of the "other components of the comprehensive profit and loss account" amount to 470. The counter-item is allocated to the item "deferred tax liabilities".

7. Included amongst the "non-current assets" is the accounting item "hedging instruments" relative to an interest rate swap, equal to 72. The balance sheet in matrix format, rectified to take into account these adjustment operations calculated on the basis of dynamic methodologies, is as follows:

Table 2. The matrix format project

Statement of assets	**Historical values**	**Remeasurement**	**Dynamic values**	**Notes**
Non-current assets				
property, plant and equipment	6.000,00	720,00	6.720,00	1
Goodwill	1.500,00	300,00	1.800,00	4
other intangible assets	450,00	0,00	450,00	
participation in associated companies	2.500,00	0,00	2.500,00	
financial assets available for sale	1.200,00	375,00	1.575,00	5
Hedging instruments	0,00	72,00	72,00	7
deferred tax assets	0,00	0,00	0,00	
Total non-current assets	**11.650,00**	**1.467,00**	**13.117,00**	
Current assets				
Unsold stock	3.989,00	0,00	3.989,00	
Account receivable	3.005,00	0,00	3.005,00	
other current assets	1.231,00	149,00	1.380,00	3
Cash and cash equivalents	123,00	0,00	123,00	
Total current assets	**8.348,00**	**149,00**	**8.497,00**	
Non-current assets classified as held for sale	0,00	0,00	0,00	
Total Assets	**19.998,00**	**1.616,00**	**21.614,00**	
Statement of liabilities				
Shareholders' equity	**Historical values**	**Remeasurement**	**Dynamic values**	**Notes**

Share capital	3.000,00	0,00	3.000,00	
Retained earnings (accumulated losses)	1.435,00	0,00	1.435,00	
Other components of the shareholders' equity	2.323,00	0,00	2.323,00	
Operating profit (loss) for the year	1.440,00	1.196,00	2.636,00	
Total shareholders' equity	**8.198,00**	**1.196,00**	**9.394,00**	
Non-current liabilities				
Long term loans	5.379,00	0,00	5.379,00	
Deferred tax liabilities	541,00	470,00	1.011,00	6
Long term financial liabilities	870,00	-50,00	820,00	2
Total non-current liabilities	**6.790,00**	**420,00**	**7.210,00**	
Current liabilities				
Trade and sundry payables	1.548,00	0,00	1.548,00	
Short term loans	1.500,00	0,00	1.500,00	
Current portion of long term loans concerning current taxes	340,00	0,00	340,00	
Current taxes	650,00	0,00	650,00	
Short term funds	972,00	0,00	972,00	
Total current liabilities	5.010,00	0,00	5.010,00	
Liabilities relating to non-current assets classified as held for sale	0,00	0,00	0,00	
Total shareholders' equity and liabilities	19.998,00	1.616,00	21.614,00	

Profit and loss account	**Economic values realised**	**Remeasurement (Income components not realised)**	**Dynamic income values**	**Notes**
Revenue	12.593,00	0,00	12.593,00	
Other income	250,00	149,00	399,00	
Changes in inventories, finished goods, work in progress	275,00	0,00	275,00	
Capitalised development costs	350,00	0,00	350,00	
Raw materials and expendable materials used	-4.500,00	0,00	-4.500,00	
Employee benefits expense	-3.760,00	0,00	-3.760,00	
Depreciation	-911,00	-80,00	-991,00	
Reduction in value of property, plant and equipment	-150,00	0,00	-150,00	
Other costs	-917,00	0,00	-917,00	
Operating profit	**3.230,00**	**69,00**	**3.299,00**	
Financial expenses	-350,00	0,00	-350,00	
Equity in earnings of associates	0,00	0,00	0,00	
Profit before tax	**2.880,00**	**69,00**	**2.949,00**	
Income taxes payable	-1.440,00	0,00	-1.440,00	
Profit for the year of the continuing operations in the period	**1.440,00**	**69,00**	**1.509,00**	
Profit from the non-current assets destined for sale	0,00	0,00	0,00	
Operating profit	**1.440,00**	**69,00**	**1.509,00**	
Other components of the comprehensive profit and loss account (other comprehensive income)				
Differences in the exchange rate deriving from the conversion of the balance sheets managed abroad		0,00	0,00	
Profit (loss) from recalculation of value of financial assets available for sale		375,00	375,00	5
Profit (loss) from hedging instruments		72,00	72,00	7
Revaluation of property, plant and equipment and intangible assets		800,00	800,00	1
		300,00	300,00	4
Actuarial profit (loss) from defined benefit plans		50,00	50,00	2
Quotas of other components of the comprehensive profit and loss account concerning associates		0,00	0,00	
Income tax relative to the other components of the comprehensive profit and loss account		-470,00	-470,00	6
Total of the other components of the comprehensive profit and loss account after taxes		0,00	0,00	
Total comprehensive income for the operating year	**1.440,00**	**1.196,00**	**2.636,00**	

Comments on the adjustments.

1. As a consequence of the adjustment of the item "Property, plant and equipment" to the fair value of the historical cost, in the matrix format of the statement of assets and liabilities, an increase equal to 720 is shown in the second column (given by the difference between the greater value calculated at fair value, reduced by the greater depreciation calculated on the difference). Therefore, in the matrix format of the profit and loss account, a greater depreciation equal to 80 is added in the second column of the accounting item "depreciation", while in the accounting item "Profit (loss) from recalculation of the value of financial assets available for sale" a surplus of 800 is added that has not been realised.

This surplus is added in the comprehensive income statement as:
→ it has not yet been realised;
→ it refers to a non-current capital asset.

2. The non-current liability for the pension fund, estimated at fair value on the basis of an actuarial calculation, shows a reduction of 50, which reduces the liability from 870 to 820.

The reduced liability presents, as a counter-item, a profit which, as coming from an evaluation, has not yet been realised; as it refers to a non-current balance sheet element ,the profit is registered amongst the components of the comprehensive income directly in the second column of the profit and loss account, thus influencing only the income components referring to dynamic evaluations. 3. The adjustment to fair value of the securities "held for trading" leads to an increase in the value of the shareholders' equity to be entered in the second column of the statement of assets and liabilities.

In the counter-item, in the second column of the profit and loss account, a surplus is shown on securities (which, for simplicity, in this example is added to the item "other income"). It concerns a profit which has not yet been realised, but regards current balance sheet elements and, therefore, it is not added to the "other items of comprehensive income", but directly amongst the items of the profit and loss account.

4. The net accounting value of the goodwill, depreciated by 300 according to the static methods of evaluation, stood, as of 31-12-n at 1500, including the depreciation referred to financial year n.

Following the ascertainment of the permanency of the value by means of the impairment test, it is believed that the useful life of this balance sheet element is still intact and can be projected into the future for an indefinite period, and so a decision is taken to cancel the depreciation carried out.

An increase in value equal to 300 is entered in the second column of the statement of assets and liabilities; in the same way, amongst the "other components of the comprehensive income" a positive income component that has not yet been realised equal to 300 is noted and refers to a non-current element of the assets.

5. This concerns a revaluation of non-current assets and refers in particular to securities " held for trading". The entry of the greater value in the second column of the assets of the balance sheet occurs as a counter-item of the surplus not yet realised, recorded amongst the "other components of comprehensive income".

6. The allocation of the taxes concerning the “other components of comprehensive income”, occurs in the same section of the incomes to which they refer and leads to the entry in the statement of assets and liabilities of a non-current liability.

7. The historical cost regarding the interest rate swap, as in the first column of the assets of the statement of assets and liabilities, is equal to zero: in fact, the possible payment of the premium does not occur at the undersigning of the contract, but only when the commitment to pay the difference between the variable interest rate and the rate pre-set in the contract must be honoured.

The fair value of the hedging instrument is equal to 72: this evaluation depends on the fair value of the hedging instrument (calculated by estimating the potential value or, subordinately, the prospective updated value of the expected benefits) and is entered for the first time in the assets of the statement of assets and liabilities, as a counter-item of an entry of the “other components of comprehensive income”. The report currently used in the preparation of financial statements does not allow an immediate overview of how dynamic value affected the financial report; therefore, the reader of the financial statements can’t quantify the deviation due to earnings management in the context of the amount stated in the accounts.

As already seen, the unlawful practices of earnings management may have a better chance with dynamic assessments: the editor of the financial report would be forced to alter objective historical values, corresponding to the cost of purchase, or to alter the division of economic elements over time, with the immanent likelihood of being unmasked.

The empirical example shows that the matrix format is useful in informing stackeholders on the economic and financial position of the company, presenting each accounting item in its different parts that make it up. Furthermore, the segregation provided by the matrix schema can also be useful in countering any phenomena that arise from earnings management, since it separates in a specific area those amounts subject to discretion.

The latter benefit can be seen especially when the matrix format is presented with several columns as it shows the evolution of the amounts of each accounting and segregates the "objective" amount from values that arise from conjecture .

In the case suggested above, the reader of the accounts is promptly informed that the assets remesurement amounts to a total of 1,616.00 € (over the different accounting items as shown in the table) and that the profits subject to discretionary redetermination are almost twice the profits determined on the basis of objective elements (2.636 € instead of 1.440 €).

Even so, the matrix format is obviously not the solution to all the earnings management problems: for example, it does not allow to counteract the representation of accounting fraud (with regard to the falsification of accounting records) or fraudulent transactions (for example, a transaction between two companies exclusively aimed at creating useful for an entity and losses for the other company); however, segregation of items in different columns allows the reader to have accounts purified from accounting estimates.

So will the reader, according to their preparation, decide whether to refer to the conjectures of the financial report’s editor or, alternatively, base its assessment on objective data.

7. Conclusions

This study has tackled the question of adopting international accounting principles in view of the potential risks of an over-estimation of the income and the equity and, consequently, distortions in the information of the company that may derive from their application. The IAS/IFRS principles do not only keep account of the assets, liabilities and financial position inherited from the past, but also consider the present potentialities still to be realised and the prospective potentialities that will be realised in subsequent financial years. The dynamic evaluation methods imposed by the main international accounting principles have proven to be extremely useful for understanding the potential and future managerial activities.

Stakeholders are increasingly interested in the financial and economic performances achieved during the financial year and in their future developments and it is for this reason that they require exhaustive, pertinent, reliable and timely information.

A growing number of companies is adopting dynamic evaluation methods and, consequently, it is becoming increasingly necessary to highlight the more volatile elements and the way in which they contribute towards the income. From the research carried out, it has emerged that this objective can be achieved by grouping together such components in a special section of the profit and loss account. This gives rise to the concept of Comprehensive Income, understood as a "new" profit and loss account, oriented towards the emergence of a "broadened" income compared with the traditional net income.

A correct evaluation of performance is essential for investors to enable them to decide whether to maintain, modify or cancel their investment; this explains the decision of the IAS/FASB to give greater relevance to the performance measurements calculated by means of the Comprehensive income instrument.

In fact, apart from the incomes that fall within the traditional profit and loss accounts, it also includes the changes in the net equity that do not derive from the shareholders' intervention and which, therefore, derive not only from financial or commercial transactions, but also from the variations in value produced by depreciations or revaluations. This "comprehensive income" enables the accounting data to be presented in a transparent and organic way and may be considered as a meeting point between the net income and variations in the assets and liabilities.

Apart from this, it has been noted that Comprehensive income may be considered as a valid measurement of the company's performance because, by including all the variations at fair value of the company's operations by third parties in the definition of income, it provides investors with additional information compared with the traditional net income. It is true that it was already possible to pinpoint the data regarding the "Other Comprehensive income" in other parts of the balance sheet, but by placing them in a special section it allows investors to recognise the aleatory elements and the potentialities inherent in the company more easily and immediately.

The representation of the income according to the Comprehensive income model seems to be essential for a proper structuring of the balance sheet and it is important for its very function of clarity, for the efficiency with which it groups together and isolates the "critical" income data and for its capacity to provide supplementary information on the performance of the company. The Comprehensive income is, therefore, an essential element for presenting the income accounting data in a clear and transparent way.

The Comprehensive income is, therefore, an essential element for presenting the income accounting data in a clear and transparent way. The objective of this instrument is not only a neat display of the income elements in order to provide stakeholders with better and clearer information, but also to guarantee the segregation of the same in order to make the readers of the balance sheet more aware of the aleatory nature of the results achieved and to prevent their evaluations from being modified by possible overestimates.

Amongst the advantages offered by this instrument, there is the richness of the information and the possibility of separating the dynamic adjustments from the accounting data, so as not to confuse or mislead the stakeholders. All of this must, however, be accompanied by an awareness on the part of the stakeholders themselves about the transience and aleatory nature of these elements. In fact, it must be borne in mind that the data contained in the Comprehensive income also refer to potential values and forecasts for the future calculated by means of discretional estimates and could be manipulated by the balance sheet compilers. This discretionary power to represent and evaluate is essential for calculating a correct financial year income, but it can also prove to be extremely dangerous. Indeed, widespread use is made today of "Earnings management" phenomena, in other words, the alteration of the accounting data for the purpose of influencing the choices made by the stakeholders.

Questions have, therefore, been raised regarding the appropriateness of this "new" profit and loss account as far as the presentation of accounting data is concerned and the representation of the actual company situation, in order to guarantee at the same time the significance, competence, prudence and comparability of the accounting information.

This consideration has given rise to the realisation that the simple use of the Comprehensive income does not solve any of the problems: and this, in our opinion, even if the comprehensive income is presented under matrix format.

For example, the traditional models of the statement of assets and liabilities does not reveal which part of the same is to be attributed to the income calculated using static methods and which, on the other hand, is attributable to variations in the balance sheet. Although it is a precious information instrument, the income statement matrix format is not, therefore, able to satisfy the requirements of the stakeholders by itself, and, in fact, if the dynamic methods of valuation are not compared with the static criteria, they run the risk of providing an excessively subjective view of the company's situation.

From this the need has emerged to associate its use with a representation of the balance sheet statements (formed from the balance sheet and income statement matrix format)which allows investors to gain more information about the past and future performance of the company: a representation offered by the "Matrix format" balance sheet.

The main innovation introduced by the matrix format is the segregation of the dynamic remeasurements of the accounts values in the "Remeasurement" column applied on the balance sheet that literature had not previously considered.

In the traditional balance sheet models based on international accounting principles, the value of the assets and liabilities subject to "Remeasurement" is entered at its fair value and the relative historical cost is shown in the notes; however, it could be more useful to readers of the balance sheet, as proposed by the Matrix format, to see both the values directly from the statement of assets and liabilities in order

to gain a more immediate and instantaneous representation of the accounts. Thanks to this balance sheet model, stakeholders can easily obtain information concerning the company's capacity to produce income by means of the operative income and the comprehensive income capacity of the same. Furthermore, the prospective income capacity of the company can be pinpointed thanks to the introduction, by means of dynamic evaluation methods, of income elements that have not yet been entirely realised and calculated. The Matrix format allows additional information to be acquired about the past and future performance of the company by showing clearly the effects of using different accounting models for example, or there again by highlighting the consequences of using subjective data and measurements.

The format itself is very accurate and entails a very high level of transparency of the elements that it contains. All the information concerning the income elements (both realised and not) are grouped together in one single statement although they are separated from each other; as a result, it is easy to read and interpret, thanks, above all, to the presence of the "Remeasurement" column.

Although the representation is complex and costly, it also provides a quality and quantity of accounting information that no other type of balance sheet representation could offer. It offers information that is undoubtedly essential and which stakeholders must know how to use with caution. Having considered that since the implementation of international accounting standard the complexity level of corporate structures has generally increased, the full matrix format analised by Tarca et alii can be a starting point for research for companies, economists and consulting professionals.

Use of the Comprehensive income and the Matrix format, therefore, allow not only the way the income has been formed to be illustrated but also the way in which it may evolve in the future by a projection of the management performances.

This type of approach leads to an improved representation of the company's performance and, in particular, an easier identification of the nature, amount and "weight" of the elements that have not yet actually been realised. It also allows an immediate and greater understanding as to whether these elements or those that have actually been realised have contributed more to the total income. Moreover, it can be used to show how the components that have not yet been realised vary in time.

In this context, the question was raised as to whether the combined use of the Comprehensive income and the Matrix format represent a valid measurement of a company's performance.

In the light of the results given by the analysis of literature and the results obtained from the two practical cases, it can be concluded that use of the Comprehensive income combined with the Matrix format represents a valid measurement of a company's performance as it ensures investors are given exhaustive information. It allows not only the way in which the income is formed to be illustrated, but also the way in which it may evolve in the future. In fact, in just one statement, but under separate columns, it includes the certain accounting data that have already been realised and the data that have not yet been realised and which are estimated or expected for the future, in order to provide stakeholders with a wider and thorough vision of the company, guaranteeing them maximum transparency.

From the analysis performed, it emerges that the values resulting from the representation in Matrix format based on the Comprehensive income are more representative of the real performance of the company, as they are not restricted just to the simple accounting data, but also consider the future possibilities that the company has, the opportunities offered by the context in which the company works and, consequently, a more complete vision of the company's actual situation.

Furthermore, this representation allows the influence that the prospective income items have on the final result to be shown; in fact, by segregating the prospective elements, the stakeholders can more easily obtain information about the future prospects of the company's performance without the risk of any illusions.

The examples given hereto must be further tested by extending the number of cases analysed. Moreover, any future work should concentrate on the "transformation"-"remeasurement" of the other balance sheet statements, for example the statement of income.

To conclude, the application of the dynamic accounting principles, based on fair value, presents undoubted advantages but, at the same time, at least one risk element: in fact, such principles contrast quite weakly with the "earnings management" phenomena as the qualitative and quantitative calculations are very complex and, consequently, they make it more difficult to identify the smoothing operations.

On the contrary, the accounting principles based on the historical cost lack information but are more objective in their calculation.

Having established the difficulty of resolving these problems, it is in any case considered worthwhile informing the stakeholders of the items that have undergone a greater degree of remesurement during the application of the dynamic accounting principles.

We believe that future research must first examine the segregation of the items of a dynamic nature, with a matrix format,for both the balance sheet and the income statement:: this will, undoubtedly, encourage a greater transparency in company information.

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Factors' Affecting the Hospital's Cost Structure: the Case of a Greek University Hospital

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ABSTRACT

This paper analyzes the data that compose the cost structure of Greek Public Hospitals. Moreover, an attempt is made to explore the main operating factors that affect the total cost of public hospitals. This study, tries to contribute to literature in order to group into categories the expenses of public hospitals, while also it provides information to users on the cost structure of those hospitals. In order to do so, a big Public University Hospital of Greece was taken into account, for the period 2005-2009 in a quarterly basis for both financial and operative factors. Eleven cost categories which constitute the cost structure of the Hospital and four operative factors were taken into account for this analysis. The results show the cost who significantly affect the cost structure of this particular University Hospital.

Keywords Operative Costs, Cost Structure, Public Hospitals, Greece.

1. INTRODUCTION

During the last century, several changes have been made in health sector in various countries of the world. The aim was to reorganize the units providing health services to provide better and high quality care. In this reorganization, significant role has the Accounting Science. Accounting, through its theory, has promoted the fact that it is not a neutral science, but is a highly flexible and changeable science, which shape by social relevance (Arnold and Oakes, 1995, Hopwood, 1987, Cooper and Sherer, 1984, Tinker and Neimark, 1987). Within the organization either it is a private enterprise or public sector organization, accounting developments are increasingly seen to be associated with both the administration and financial decision making (Becker and Neuheuser, 1975).

A global phenomenon nowadays is the rising costs of health care services that the governments have to face. This trend has gained momentum in the developed as well as the developing countries, thus leading to encourage control of operating costs and the efficiency of hospitals (Hsihui et al., 2004, Scott, 1999, Weil, 1992). Although changes in health sector started from Australia (Willis, 1988) and USA (McKinlay and Arches, 1985), the literature suggests that these changes were an international trend which embraced countries like Canada (Fried et al., 1987), Sweden (Heidenheimer, 1980), Norway (Riska, 1988) and the UK (Ham et al., 1990). Australia and the USA were the first countries that adopted Accounting within hospitals, in order to monitor their economic efficiency, expecting more information for the costs of health care services.

Developed countries have introduced accounting within their hospitals, because they wished to know the constant and increasing economic and social efficiency of their services (Bowe, 1977, Haber 1964). The use of accounting in hospitals provides information about the management of the financial resources and therefore leads to a more efficient production (Ellwood, 1996). The efficiency will occur from lower costs due to economies of scale (Wagstaff, 1989) and through decreases of inflows

(Bartlett and Le Grand, 1992). The introduction of accounting in health sector brought undeniable changes. Jones and Mellett (2007) summarized these changes into three categories: First of all accounting is a tool within an institutional framework. Secondly, accounting was the tool for changes, aimed to reduce operating costs and providing information to stakeholders. Finally, accounting emphasized the role of separate actions in the hospital.

2. Literature Review

The introduction of accounting in hospitals, aimed to the identification and control of the operating costs of hospitals. Like any other business, the health units should take into serious consideration their operational costs. Private Hospitals have taken important steps to this goal, as they are forced to operate independently (without government grants), covering their expenses from their earnings (Danzon, 1982). However, Public Hospitals operate under a different philosophy than the Private ones. Public Hospitals are free of the profit motive for the continuation of their business, because their funding sources are from grants from the government. The effectiveness of the Public Hospitals cannot be measured by the profit, since the services they provide are paid through taxation of citizens. For this reason, in the literature, the economic indicators are based on the cost of these units.

The cost of health units is a tool with which measure the diachronic efficiency of a unit. Furthermore, there is the possibility of comparing one unit to another and record the most efficient. Finally, the cost can be used as a tool to cut expenditures and increase efficiency (Wu, 2010). The data that built the operating cost of a hospital are the basis for the budgeting of that hospital and help in determining the participation of each department to the total cost of hospital.

The operational cost of hospitals is the sum of all expenditures carried out by the hospital in order to offer its services. This cost can be divided in direct and indirect cost (Bellas et al., 2009). The direct costs include expenses for raw materials, direct labor and direct expenses.

The costs for raw materials include the catering of patients, medications, laboratory materials, cost of laboratory reagents, and generally all those consumable items that are used daily by the various clinics or departments of a hospital for the production of health care services (Bellas et al., 2009, Johannesson and Jonsson, 1991). The cost for direct labor consist the salary and the bonuses of the personnel that involved for the production of health care services. Finally, the direct costs are those that directly contribute to the provision of a service from a clinic or a hospital department, but do not fit into any of the above two categories, like electricity or the heating, etc. (Bellas et al., 2009). On the other hand, indirect cost includes all the costs that are not direct involve to the provision of health care service. These kinds of costs are the expenditure of auxiliary functions that exist in a hospital, such as the technical service and the administrative department.

As mentioned above, apart from financial factors, there are some operational factors as well, that affect on the cost structure of a hospital. According to Haslam (2005), in order to calculate the cost may take into account various factors related to the patient and include features such as gender, age, race, socio-economic profile of the patient and the general characteristics of the episode. Moreover, Evans et al. (1995), take into account the length of stay of a patient, indicated that a decrease in days of hospitalization may decrease the total cost. Finally, Thanasas (2012), indicated that the larger a hospital is (measured by the number of beds), the more operational cost faces.

The need to determine the operational cost of hospitals was the last four decades the primary goal for health policy-makers of the developed countries. Since the 1970s, several studies (Brooks, 1971, Ginsburg, 1972, Berry, 1974, Gaitanides, 1979, Karger and Vora, 1979) have been carried out with a view to costing approach of hospitals. During the 1970s decade, it has become imperative to try to reduce the operating costs of health units, by establishing the control of expenditures of hospitals (Sloan, 1982).

Nowadays, the need of governments worldwide is to cut expenses from their budgets. In order to do so, a new trend has emerged, called New Public Management (Hood, 1995). New Public Management highlights the accurate measurement of the cost and revenues of public institutions, while leads to the efficient use of resources and the achievement of the results (Venieris and Cohen, 2004). New Public Management has increased the responsibility of the public administration and control; outcomes became more compelling, since it leads to improved performance by reducing bureaucracy (Ossege, 2012). The public sector's restructuring affected the health sector as well. According to Levaggi (2005) in most development countries, half of total expenditures on health occur by hospital care accounts.

This study reports the data that compose the cost structure of a public hospital in Greece. Furthermore, an attempt is made to explore all those factors that affect the total cost of a public hospital. It should be noted here, that the Greek National Health System consists mainly public hospitals, which have the same cost categories, while offer their services to the entire population of the country. It is more than obvious that public hospitals in Greece have the same characteristics and therefore are comparable.

Moreover, since 2009 Greece faces a big economic crisis that resulted in an increasing concern over public debt. One of the most costly sectors of Greek Public is the one of public health. Therefore it is more than necessary to rationalize the costs that arise by hospitals. Until now, no other study has record the cost categories of Greek Hospitals, so that one can accurately know the costs faced by public hospitals. This gap is trying to cover the current study.

3. Research Methodology

The purpose of this study is to explore the factors that influence the cost structure of a Public University Hospital. In order to do so, we use some operational factors of the Hospital, like the number of beds, the inpatients, the patient days and the average length of stay. These factors examined for the period 2005 – 2009 in quarterly basis as well as the financial data of the Hospital.

The costs that were measured for the model include the below cost categories: the cost of consumables, the cost pharmaceutical supplies, the cost of orthopedic materials, the cost of laboratory reagents, the cost of cleaning, the cost of catering, the cost of electromechanical equipment, the cost of repairs and maintenance, the cost of third party services, the cost of salary and finally the other costs. All the above cost categories refer to cost per bed.

First of all we have to mention that the cost categories are the key variables of the model used in this analysis, while the operational factors of the hospital are the explanatory variables. Initially, we check whether there is correlation between the explanatory variables by the coefficient of Pearson. The Pearson coefficient indicates strong positive linear correlation (0.822) between patient days and the number of inpatients. According to the above, we removed from the model the variable representing the number of inpatients since the knowledge of the effect of patient days is sufficient for the interpretation of the model.

Moreover, before the multiple regression technique is used, the variables are converted to the same scale (each variable is measured by bed) so they can be compared, thereby avoiding large differences between the values of variables in the model. So for each cost category we will construct a forecasting model with the following independent variables: i) the number of beds, ii) the patient days and iii) the average length of stay. The aim is to estimate the above parameters of the model by multiple regressions. Below are the results of multiple OLS with depended variables the various cost categories and the total cost as well.

4. Empirical Research

Considering all the above, the analysis starts by checking which of the explanatory variables affect significantly the costs of medical supplies. Applying a multiple regression, the results show that the model explained 35.9% of the total variance; the only variable which ultimately participates in the interpretation of the model is the number of beds. The multiple coefficient of determination R 2 is a measure of how well the model explains the data.

In the Table 1 below, we observe that the P-value control is small (0.01 <0.05), therefore the null hypothesis that the parameter values are equal to zero is rejected, thus the model appears in the first stage well suited to our data.

Table 1. ANOVA Analysis

Model	Sumof Squares	df	Mean Square	F	Siq
Regression	6.81	1	6.81	10.065	0.01
Residual	12.19	18	0.68		
Total	19.00	19			

From the Table 2 of coefficients, we conclude that an increase in the number of beds increases the cost of consumables by 0.6 units or 60% or alternative, a decrease in the number of beds leads a reduction in costs of medical supplies by 0.6 units or 60%.

Table 2. Coefficients

Coefficients	Standardized Coefficients Beda	t	Sig
(Constant)		0.000	1.000
No of Beds	0.599	3.772	0.005

Dependent: Pharmaceutical Consumables, R^2 =15%, Adjusted R^2 =32.3%

This time we repeat the multiple regressions with dependent variable the cost of pharmaceutical consumables. The results in Table 3 indicate that the model is not well suited to our data, as explained only 15% volatility of the cost, by the independent variables. Additionally, F-test suggests that our data cannot be adequately described by the linear model (p> 0.05).

Table 3. Multiple Regressions of Pharmaceutical Consumables

Modal	Sum of Squares	df	Mean Square	F	Sig
Regression	2.78	3	0.93	0.913	.457a
Residual	16.22	16	1.01		
Total	19.00	19			

Dependent: Pharmaceutical Consumables, R^2 =15%, Adjusted R^2 =32.3%

The explanatory variables in cost of orthopedic consumables, explains 41.7% of the total variance. Furthermore, we confirm by the F-test, the model is well adjusted. All these are shown in the Table 4 below.

Table 4. Multiple Regressions of Orthopedic Consumables

Modal	Sum of Squares	df	Mean Square	F	Sig
Regression	7.91	3	2.64	3.808	.031a
Residual	11.09	16	0.69		
Total	19.00	19			

Dependent: Orthopedic Consumables

The coefficients that are statistically significant are the patient days and the average length of stay (LOS). As shown in Table 5, with all other factors constant, an increase in patient days leads to an increase in costs of the orthopedic consumables by 0.626 or 62.6%, while a reduction of patient days leads to a reduction in costs of the orthopedic consumables by 0.626 or 62.6%. Moreover, if all the other factors are constant, an increase in the average length of stay leads to increased costs of orthopedic consumables by 0.702 or 70.2%, while a decrease in the average length of stay leads to a reduction in costs of the orthopedic consumables by 0.702 units or 70.2%.

Table 5. Results of Coefficients

Coefficients	Standardized Coefficients Beda	t	Sig
(Constant)		-3.039	1.000
No of Beds	0.057	0,299	0.005
Patient Days	0.626	2.737	0.015
LOS	0.702	3.057	0.008

Dependent: Orthopedic Consumables, R^2 =41.7%, Adjusted R^2 =30.7%

According to the multiple regressions of the explanatory variables, the cost of the laboratory reagents, the cost of cleaning, and the cost of the electromechanical equipment revealed that these variables cannot interpret the linear models.

The results of the multiple regressions with independent variable the cost of catering indicates in Table 6, that the model is adjusting well, as explained the 68.1% of the total variance. The number of beds and the average length of stay significantly affect the interpretation of the model.

To understand whether the variables contribute to the impact of cost of catering, we take into consideration the standardized coefficients; all the variables have been converted on the same scale to be compared. The coefficient Beta of the number of beds is 0.609; indicates that the number of beds contributes more to the interpretation of the model compared with the average length of stay (0.452).

Table 6. Standardized Coefficients

Coefficients	Standardized Coefficients Beda	T	Sig
(Constant)		-2.977	0.008
No of Beds	0.609	4.050	0.001
LOS	0.452	3.004	0.008

Dependent: Cost of Catering, R^2 =61.8%, Adjusted R^2 =57.3%

Similar results (Table 7) arise from the linear regression with independent variable the cost of repairs and maintenance. The model is interpreted sufficiently, due to small percentage volatility of the cost (21.8%), while the F-test confirms the well adjustment of the model.

Table 7. Linear Regression of Cost of Repairs and Maintenance

Modal	Sum of Squares	df	Mean Square	F	Sig
Regression	4.15	1	4.15	5.025	.038a
Residual	14.85	18	0.83		
Total	19.00	19			
Coefficients	Standardized Coefficients Beda			t	Sig
(Constant)				0.000	1.000
No of Beds	-0.467			-2.242	0.038

Dependent: Cost of Repairs and Maintenance, R^2 =21.8%, Adjusted R^2 =17.5%

The linear regression of dependent variable the other costs indicated that the model is interpreted 26.1% of variance in costs (Table 8). The standardized coefficient indicates that an increase in the number of beds leads to a reduction in other costs by 0.511 or 51.1%, while a decrease in the number of beds increases the other costs by 0.511 units or 51.1%.

Table 8. Linear Regression of Other Costs

Coefficients	Standardized Coefficients Beda	t	Sig
(Constant)		0.000	1.000
No of Beds	-0.511	-2.523	0.021

Dependent: Other Costs, R^2 =26.1%, Adjusted R^2 =22%

Repeating the linear regression of dependent variable the cost of third party services, the model is interpreted by 22.2% of the total variance and the F-test indicates that none of the model parameters is not zero (0.036 <0.05). From the table of coefficients we observe that the only variable that ultimately involved the interpretation of the model is the average length of stay. The results of the standardized coefficient in the Table 9 below indicate that an increase in the average length of stay increases the cost of third party services by 0.472 or 47.2%, while a decrease in the average length of stay leads to a reduction in costs of third party services by 0.472 or 47.2%.

Table 9. Linear Regression of Cost of Third Party Services

Coefficients	Standardized Coefficients Beda	t	Sig
(Constant)		-2.249	0.037
LOS	0.472	2.269	0.036

Dependent: Cost of Third Party Services, R^2 =22.2%, Adjusted R^2 =17.9%

Finally the results of the linear regression of dependent variable the cost of salary (Table 10) indicate that the model is interpreted by 54.4% of the total variance of the coefficients, while only the number of beds remains finally to the model and is statistically significant. An increase in number of beds increases the cost of salary by 0.737 or 73.7%, while a decrease in the number of beds leads to a reduction in costs of salary by 0.737 or 73.7%.

Table 10. Linear Regression of Salary

Coefficients	Standardized Coefficients Beda	t	Sig
(Constant)		0.000	1.000
No of Beds	0.737	4.631	0.000

Dependent: Cost of Salary, R^2 =54.4%, Adjusted R^2 =51.8%

While previously we examined which factors affect the structure of the hospital cost separately, now the analysis concerned about the effect of these factors on the total cost of the hospital. The total cost of the hospital is the sum of the different cost categories presented above, for each quarter for 2005-2009.
From the Table 11 below we can see that applying the linear regression, 44% of the volatility of the total cost is interpreted by the number of beds and the results of the F-test indicates that the model fits well to the data (0.001 <0.05). The standardized coefficient Beta (0.663) indicates that the number of beds affects quite strongly to the interpretation of the model. An increase in the number of beds increases the total cost by 0.663 or 66.3%, while a decrease in the number of beds leads to reduced total costs by 0.663 or 66.3%.

Table 11. Linear Regression of Hospital's Total Cost

Coefficients	Standardized Coefficients Beda	t	Sig
(Constant)		0.000	1.000
No of Beds	0.663	3.762	0.001

Dependent: Total Cost, R^2 =44%, Adjusted R^2 =40.9%

5. Conclusions 2 R =40.9% 0.001 In this paper, an analysis was made to examine the cost structure of a Greek Public University Hospital. The purpose of this study was to investigate the cost factors who significantly affected the structure of the cost of a Public University Hospital. In order to examine that, financial and operating data in quarterly basis of a Public University Hospital were taken into account, for the period 2005 – 2009.

Initially, various tests were carried out (e.g. Test of Normality, coefficient determinations, ANOVA etc.) and some factors that correlate were excluded from the survey.

After that, we found those variables that are statistically significant and contribute to the impact of the hospital's cost. In addition the OLS method was held, with depended variables each cost category and the total cost as well.

The results of the various tests indicate that from all the variables, those of the cost of the laboratory reagents, the cost of cleaning and the cost of the electromechanical equipment cannot interpret the linear models.

Regarding to all the other cost categories, the results of the tests show that an increase/decrease in the number of beds, lead to an increase/decrease in costs for consumables by 60% and to an increase/decrease by 51.1% to the other cost.

Additionally, an increase/decrease in the number of beds leads to an increase/decrease of the cost of salary by 73.7% and an increase/decrease in patient days leads to an increase/decrease in the cost of orthopedic materials by 62.5%.

Moreover, if all the other factors are constant, an increase/decrease in the average length of stay leads to an increase/decrease in the cost of orthopedic materials by 70.2% and an increase/decrease in the average length of stay, results in an increase/decrease by 47.2% in the cost of third party

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Assessing the Forecasting Performance of GARCH Models in the Presence of Instabilities

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ABSTRACT

The issue of organization of payments to employees at the enterprise is the basis of social and labour relations of employees, employers and the state, affecting the effectiveness of labour management in general, they are one of the most critical and complex areas of work, occupying a central place in the accounting system. The authors analyzed the theoretical and methodological basis of payments to employees, compared to international and domestic standards for employee benefits. Authors also analyzed the dynamics of average and minimum wages over the past 10 years, and revealed the features of the organization of wages and the general scheme of accounting for wages. The authors demonstrated the essence of the concept of "payments to employees" and its components, analyzed in detail the features of the existing practice of accounting and audit of settlements with employees. A thorough theoretical and methodological analysis of the study allowed the authors to propose improvements in accounting for settlements with employees on practical examples, namely the detailed structure of account 66 "Payments to employees". The authors also proposed an improved audit methodology that will allow the auditor to cover all aspects of payroll accounting, investigate the correctness, timeliness, legality of reflection in payroll, cover all aspects of payroll accounting, identify violations promptly, conduct a quality audit.

Keywords Accounting, Audit, Employee, Payment, Salary

1. INTRODUCTION

Proper modeling and anticipation of business volatility play an important role in risk management, derivatives allocations, and the price of assets in a finance research field. Hence, it means the requirement for forecasting models that deliver accurate forecasts during those periods. An accurate forecasting model is critical for interpreting financial data, and confirming the time series is stationary is a vital step in model development. Moreover, one must select a model that does well in a particular asset class. There is no single best model across all asset classes and periods. As a result, identifying a model that performs well in specific asset classes is critical. Several forecasting models are available to decision-makers, and no single model emerges as the best all-around. This is due to instability in predicting performance, which varies by state and is based on time-varying economic factors. As a result, this study compares the forecasting abilities of some GARCH models for exchange rate data on the South African market by using traditional and fluctuation tests within normal students, and general error distribution assumptions. Forecast accuracy was assessed using four model accuracy measures: root mean square error, mean absolute error, mean absolute percentage error, and the Theil inequality coefficient. The Giacomini and Rossi (2010) fluctuations test and the Diebold and Mariano test were used to evaluate relative predicting skills in the face of instabilities. In contrast, the Rossi-Sekhposyan (2016) test was utilized to determine if absolute predicting performance is robust to instabilities. It is revealed that symmetric GARCH models do not overperform those models with asymmetry under several assessment indicators and error distributions. Giacomini and Rossi's (2010) test confirms the efficiency of all models undertaking the t-distribution approach. However, the Sekhpoysan (2016) test

suggested that despite all models generating good forecasts, an individual model might be making weak predictions compared to the others. The practical implication is that all models can make accurate predictions. It may perform poorly solely when compared to other models.

Keywords Forecasting Abilities, Traditional Tests, Fluctuation Tests, Symmetric GARCH Models, Asymmetric GARCH Models, Exchange Rate Data, South Africa Accurate modeling and forecasting of market volatility are crucial for risk management, derivative allocation, and asset pricing in finance research [1]. A reliable forecasting model is crucial for analyzing financial data, and ensuring the time series is stationary is a key step in developing a model. A stationary time series has the property that its variance, mean, and autocorrelation structure remain constant over time [2]. The use of non-stationary time series data in financial models results in unreliable and spurious outcomes, causing poor understanding and forecasting [3].

Fluctuation tests were proposed to circumvent the consequences associated with stationarity assumptions when making inferences concerning predictive ability. Examples are Giacomini and Rossi [4] and Rossi and Sekhposyan [5] test. In contrast to Giacomini and Rossi [4] who measure models' relative predictive performance, Rossi and Sekhposyan [5] consider single models' absolute predictability ability and forecast optimality.

Uncertainty in the modelling of the underlying asset will appear as a risk in derivative pricing and hedging. There is typically a way to price and hedge financial derivatives (currencies in this case) with high accuracy if one has a good model of the underlying asset. Using an incorrect pricing and hedging model may lead to unexpected and undesirable financial outcomes [6].

No single model is optimal across all asset classes and periods [7]. Therefore, finding a model that performs well in specific asset classes is crucial. Odendahl, et al. [8] also stressed that "decision-makers face numerous forecasting models, with no single model emerging as the best overall. This is due to instabilities in forecasting performance, which depends on the sample and is state-dependent due to time-varying economic mechanisms." As a result, this study compares asymmetric and asymmetric GARCH models using the exchange rate as a financial asset, aiming to find a model that performs better in this asset class. Furthermore, it will also aim to determine whether the preferred model performs better in the short or long horizon.

The literature on models addressing instabilities is limited, especially in South Africa. Previous studies have used traditional techniques to compare forecasting models, but this paper will employ models that are robust to instabilities, which is a crucial aspect of financial risk management. Given this, the present paper makes a comparison of the forecasting performance of symmetric and asymmetric GARCH models in the presence of instabilities using non-stationary data under different distribution errors.

2. Materials and Methods

This section outlines the research methodology, discussing both theoretical and empirical models, data description, and out-of-sample evaluation of volatility forecasts in subsections 2.1, 2.2, 2.3, and 2.4 respectively.

2.1. Symmetric and Asymmetric Models

Symmetric GARCH models differ from asymmetric ones in that they do not incorporate asymmetry found in the returns financial data. This implies that bad news surprises increase conditioned variance

more than equivalent good news.

Generalized autoregressive conditional heteroscedasticity (GARCH)

GARCH was first presented by Bollerslev [9] and is a generalization of the earlier ARCH model [10]. The GARCH (1, 1) model is stated as:

$$h_{t+1}^2=\omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2 \quad (1)$$

In this case, all the parameters must be positive, while the sum of $(\alpha + \beta)$, measures the persistence of shocks to volatility. The GARCH (1, 1) model generates one-step-ahead forecasts of volatility as a weighted average of the constant long-run or average variance, ω, the previous forecast variance, h_t^2 and previous volatility reflecting squared 'news' about the return, ε_t^2. As volatility forecasts are increased following a large return of either sign, the GARCH specification captures the well-known volatility clustering effect.

Exponential General Autoregressive conditional heteroscedasticity (EGARCH)

A modification of the GARCH model introduced by Nelson [11] is the exponential generalized autoregressive conditional heteroskedastic time series model and is also identified using the abbreviation, EGARCH. The model is taken from ARCH family models that have been propounded for handling the volatility in time series data [12]. These models make the conditional variance as a function of time (t) [11, 13]. Later, Nelson [11] suggested that the EGARCH model captures volatility asymmetries exponentially, allowing skewness and asymmetrical ARCH processes. Conditional variance is an asymmetric

function of the lagged disturbances, ε_{t-i} .

The model is stated as follows:

$$\varepsilon_t=\sigma_t Z_t;\ ln\sigma^2 = \omega + \alpha_i {\varepsilon_{t-i}}^2 + \sum_{j=1}^{q} \gamma_j \ln \sigma_{t-j}^2 \quad (2)$$

On its part, when $\gamma < 0$ captures the larger impact on the market by negative shocks, than positive shocks of equivalent magnitude, and a significant α captures the volatility clusters effect. The last point regards using a logarithm form. Because of this property of the log, if parameters are negative then the conditional variance will not become negative itself.

Threshold general autoregressive conditional heteroscedasticity (TGARCH) model

The Threshold GARCH (TGARCH) model, presented by Glosten, et al. [14] and Zakoian [15] introduces a model that distinguishes between the impact of positive and negative news on conditional variance.

The TGARCH model of order q can be written as:

$$\sigma_t^2 = w \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{t=1}^{p} \alpha_i \varepsilon_{t-i} + \sum_{k=1}^{r} \gamma k\, \varepsilon_{t-k} I_{t-k}) \quad (3)$$

In this model, good news, $\varepsilon_{t-i} > 0$, and bad news, $\varepsilon_{t-i} < 0$ have differential effects on the conditional variance. Here, α_i has an impact of good news while $\alpha_i + \gamma_i$ has an impact of bad news. If $\gamma_i > 0$, bad news has a greater impact of conditional variance, whereas if $\gamma_i \neq 0$, news impact is asymmetric.

In this model, good news, $\varepsilon_{t-i} > 0$, and bad news, $\varepsilon_{t-i} < 0$ have differential effects on the conditional variance. Here, α_i has an impact of good news while $\alpha_i + \gamma_i$ has an impact of bad news. If $\gamma_i > 0$, bad news has a greater impact of conditional variance, whereas if $\gamma_i \neq 0$, news impact is asymmetric.

Asymmetric power autoregressive conditional heteroscedasticity (APARCH) model

Ding, Granger, and Engle [1] introduced the APARCH model, which estimates the power δ of the heteroscedasticity equation from data. This model captures asymmetry in return volatility, showing volatility increases more with positive returns. The power parameter on the standard deviation is estimated and not imposed:

$$h_t^{\delta} = \omega + \alpha_1(|\varepsilon_{t-1}| - \gamma\varepsilon_{t-1})\delta + \beta_1 h_t^{\delta} \quad (4)$$

Parameter δ in the equation denotes the exponent of conditional standard deviation, while parameter γ describes the asymmetry effect of good and bad news on conditional volatility. A positive value of γ means that negative shocks from the previous period have a higher impact on the current level of volatility, and otherwise [16].

An APARCH (p, q) model assumes that:

$$\sigma_t^{\delta} = \omega + \alpha_i(|\varepsilon_{t-1}| - \gamma\varepsilon_{t-1})\delta + \beta_j \sigma_t^{\delta} \quad (5)$$

A positive (resp. negative) value of γ_i's means that past negative (resp. positive) shocks have a deeper impact on current conditional volatility than past positive shocks ([17, 18].

- **Integrated general conditional heteroscedasticity (IGARCH) model**

Engle and Bollerslev [19] introduced the integrated GARCH (IGARCH) model, which incorporates exponential decay in the autocorrelation of conditional variances to account for volatility persistence. This model highlights the long-lasting impact of shocks in financial asset returns.

IGARCH models, which have a unit root in the AR polynomial of the GARCH representation, capture the effect of shocks on future volatility over an infinite horizon [20].

The integrated GARCH (IGARCH) is specified as:

$$\sigma_t^2 = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \quad \sigma_{t-j}^2 \quad (6)$$

The sum of coefficients is restricted to 1. The exogenous variable can be easily reflected in the various specifications of GARCH models just by the addition of α and β.

2.2. Specification of the Models

This section presents the empirical models that are employed in this study.

2.2.1. Empirical Models

The empirical models are stated as follows:

GARCH (1, 1) model

A simple GARCH model can be stated as follows: `

$$R/US\$_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta US\$_{t-1} + \varepsilon_t \quad (7)$$

Where the forecast variance of Rand/US$ daily exchange rate is represented by $R/US\$_t$.

- **Exponential GARCH (EGARCH) model**

EGARCH (1, 1) model can be written as:

$$lnR/US\$_t = \omega + \alpha_i \varepsilon_{t-i}{}^2 + \sum_{j=1}^{q} \gamma_j \ln R/US\$_{t-j} \quad (8)$$

- **Threshold GARCH (TGARCH) model**

The TGARCH model of order q can be written as:

$$R/US\$_t = = w\sum_{t-1}^{q} \alpha_i \varepsilon_{t-i}^{\delta} + w\sum_{t-1}^{q} \alpha_{t-i}^{-} I(\varepsilon_{t-i} < 0) \quad (9)$$

- **Asymmetric ARCH (APARCH) model**

The APARCH model can be stated as:

$$R/US\$_t = \omega + \alpha_1(|\varepsilon_{t-1}| - \gamma\varepsilon_{t-1})\delta + \beta_1 R/US\$_{t-1} \quad (10)$$

- **Integrated GARCH (IGARCH) model**

The IGARCH model is as follows:

$$R/US\$_t = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}{}^2 + \sum_{j=1}^{q} \beta_j \quad R/US\$_{t-j} \quad (11)$$

2.3. Description of the Type of Sample to be Used

The study uses a 5-day week Rand per US Dollar rate sourced from the Federal Reserve Economic Data (FRED) online, covering the period 2007/01/01 to 2018/12/31. Both the EViews and Stata software packages were employed.

2.4. Out-of- sample Forecasting

2.4.1. Evaluation Forecasting Criteria

Different models are used to assess forecast accuracy, but individual models may face misspecification bias. Combining forecasts across models can help robustify predictions against these biases and measurement errors. Combining individual model forecasts can enhance forecast accuracy and predictive ability [21, 22]. This study uses four model accuracy measures: Root Mean Square Error, Mean Absolute Error, Mean Absolute Percentage Error, and Theil Inequality coefficient to select the best model for out-of-sample forecast using Eviews 11 software. The data sample will be divided into three periods: 2007-2018, 2007-2008, and 2008-2009.

3. Results

3.1. Results for Forecast Performance Evaluation of the

Models

The results for the three sample periods (2007 to 2018, 2007 to 2008 and 2009 to 2018) are presented in Tables 1, 2 and 3 respectively.

2007-2018 sample period

The sample period 2007 to 2018 combines both the period of crisis and normal (post-crisis) period. Table 1 results reveal that the IGARCH model is the best performer in terms of out-of-sample forecasting in 2 of the 4 criteria (RMSE and Theil's Inequality coefficient) under the 3 distribution errors (normal, student-t and general error distribution). The CGARCH model follows closely holding the second-best performance in 1 out of 4 criteria (MAE) under the 3 distribution errors. We can thus conclude that asymmetric models have the better out-of-sample fit relative to symmetric ones. This is depicted in Table 1 below.

Table 1. Evaluation of out-of-sample volatility forecasts (2007-2018)

Model	Distribution	RMSE	MAE	MAPE	Theil Inequality coefficient
PARCH	Normal	3.784345	2.788958	23.04458	0.211135
PARCH	Student-t	3.671928	2.703921	22.41857	0.202951
PARCH	Generalized Error	3.784345	2.788958	23.04458	0.211135
TARCH	Normal	10.44803	10.08103	100.0000	1.000000
TARCH	Student-t	3.663741	2.698245	22.38051	0.202390
TARCH	Generalized Error	3.524451	2.612557	21.89078	0.192401
EGARCH	Normal	3.686247	2.714032	22.48780	0.204015
EGARCH	Student-t	3.629838	2.675373	**22.23225**	0.199949
EGARCH	Generalized Error	3.682598	2.711430	22.46980	0.203757
IGARCH	Normal	**2.744837**	2.422447	25.19064	**0.133705**
IGARCH	Student-t	**2.744837**	2.422447	25.19064	**0.133705**
IGARCH	Generalized Error	**2.744837**	2.422447	25.19064	**0.133705**
CGARCH	Normal	2.747718	**2.412758**	24.77677	0.134683
CGARCH	Student-t	2.820988	**2.405598**	23.403812	0.141915
CGARCH	Generalized Error	2.753087	**2.408660**	24.52213	0.135513
GARCH (1,1)	Normal	3.665967	2.699781	**22.39075**	0.202551
GARCH (1,1)	Student-t	3.665967	2.699781	22.39075	0.202551
GARCH (1,1)	Generalized Error	3.515519	2.607668	**21.86835**	0.191764

Sample 2007-2008

From Table 2 below, the period 2007 to 2008 is the global financial crisis. Under the 2 error distributions (normal and general error), the IGARCH model holds the best performance in 2 out of 4 criteria (RMSE and Theil's U coefficient) respectively, and the CGARCH model, holding the best performance in 2 out of 4 criteria (MAE and MAPE) under normal distribution and 2 out of 4 criteria (RMSE and Theil's inequality coefficient) under student-t distribution. This suggests that asymmetric models outperform symmetric models during the crisis period.

Sample 2009-2018

Among three error distributions, Gaussian (normal), student-t, and general error, IGARCH demonstrated superior performance in three of the four criteria (RMSE, MAE, and Theil's U coefficient). Following closely is the APARCH model, excelling in MAPE under normal and student-t distributions, and in MAE under general error distribution. This leads to the conclusion that asymmetric models outperform symmetric models, even in post-crisis periods.

Table 2. Evaluation of out-of-sample volatility forecasts (2007-2008)

Model	Distribution	RMSE	MAE	MAPE	Theil Inequality coefficient
GARCH (1,1)	Normal	1.082091	0.655106	7.561632	0.072662
GARCH (1,1)	Student-t	1.082091	0.655106	7.561632	0.072662
GARCH (1,1)	Generalized Error	1.075951	**0.651899**	**7.531559**	0.072182
EGARCH	Normal	1.077125	0.652386	7.535525	0.072274
EGARCH	Student-t	1.077121	0.652384	7.535507	0.072273
EGARCH	Generalized Error	1.080030	0.653865	7.549215	0.072501
IGARCH	Normal	0.968216	0.693303	8.59484	0.062865
IGARCH	Student-t	1.108572	0.672737	7.747772	0.074724
IGARCH	Generalized Error	**0.973165**	0.660929	8.010454	**0.063946**
TARCH	Normal	1.080948	0.654399	7.554471	0.072572
TARCH	Student-t	1.080362	0.654057	7.551100	0.072527
TARCH	Generalized Error	1.080362	0.654057	7.551100	0.072527
PARCH	Normal	1.077086	0.652368	7.535370	0.072271
PARCH	Student-t	1.077084	**0.652367**	**7.535363**	0.192495
PARCH	Generalized Error	1.080888	0.654361	7.554091	0.072568
CGARCH	Normal	1.077066	0.652360	7.535304	0.072269
CGARCH	Student-t	**0.971378**	0.666134	8.121105	**0.063515**
CGARCH	Generalized Error	1.095337	0.663784	7.652106	0.073694

Table 3. Evaluation of out-of-sample volatility forecasts (2009-2018)

Model	Distribution	RMSE	MAE	MAPE	Theil Inequality coefficient
GARCH (1,1)	Normal	3.629846	2.838667	23.42160	0.190177
GARCH (1,1)	Student-t	3.629846	2.838667	23.42161	0.190177
GARCH (1,1) *	Generalized Error	2.758000	2.409495	23.57475	0.130909
EGARCH	Normal	3.533992	2.729504	22.31258	0.185042
EGARCH	Student-t	3.534000	2.729510	22.31263	0.185042
EGARCH	Generalized Error	3.022094	2.514999	**22.03074**	0.151329
IGARCH	Normal	**2.630252**	**2.401867**	24.27654	**0.122573**
IGARCH	Student-t	**2.630252**	**2.401867**	24.27654	**0.122573**
IGARCH	Generalized Error	**2.630252**	**2.401867**	24.27654	**0.122573**
TARCH	Normal	2.725294	2.409647	24.75462	0.126943
TARCH	Student-t	2.759593	2.410049	23.55591	0.131050
TARCH	Generalized Error	2.761630	2.410781	23.53286	0.131228
PARCH	Normal	3.366601	2.637627	**21.89361**	0.173919
PARCH	Student-t	3.447897	2.677108	**22.03026**	0.179304
PARCH	Generalized Error	2.703594	**2.401867**	22.83977	0.129774
CGARCH	Normal	2.726649	2.405209	24.48510	0.126943
CGARCH	Student-t	2.727503	2.403517	24.31863	0.127368
CGARCH	Generalized Error	2.726656	2.405099	24.47585	0.126964

3.2. Tests of Forecasting Performance Robust to Instabilities

3.2.1. Tests of Relative Forecasting Performance Robust to Instabilities

The comparison between the outcomes of the new and old methods (specifically, the Giacomini and Rossi [4] fluctuation test and the Diebold and Mariano [23] test) is presented in Table 4. These results reveal that when examining models accommodating instabilities, the error assumption based on the t-distribution outperforms other error distribution assumptions. This suggests that all models perform well when operating under the t-distribution assumption, especially when forecasters aim to use GARCH models for predicting series, notably exchange rates, while considering inherent instabilities. Conversely, in the realm of traditional tests, both t-distribution and general error distribution assumptions take precedence, with the t-distribution assumption leading the way.

Table 4. Relative comparison (distribution vs distribution)

		Accounting for instabilities: Giacomini and Rossi (2010) test				Traditional tests: Diebold & Mariano (2010) test				
Competing Models		**t-statistic**	**Critical value**	**Conclusion on the hypothesis that 2 models have same forecast accuracy**	**dominant distribution**	**MSE criterion**	**MSE criterion**	**P-value**	**Conclusion on the hypothesis that 2 models have same forecast accuracy**	**dominant distribution**
Model 1	Model 2					Model 1	Model 2			
$Garch_t$	$Garch_{normal}$	3.9213176	3.393	We reject H_0 and conclude Garcht is best	t dominates as it is better than normal and ged; followed by ged which is better than normal	0.1358	0.01364	0.0002	GARCHt dominates	t dominates as it is better than normal and ged
$Garch_t$	$Garch_{ged}$	3.7944076	3.393	We reject H_0		0.1358	0.01364	0.0005	GARCHt dominates	
$Garch_{ged}$	$Garch_{normal}$	2.5557673	3.393	We fail to reject H_0		0.01364	0.01364	0.8995	GARCHged equals to GARCHnor	
$IGarch_t$	$IGarch_{normal}$	4.0300879	3.393	We reject H_0	t dominates as it is better than normal and ged; followed by ged which is better than normal	0.01357	0.01362	0.0000	IGARCHt dominates	t dominates as it is better than normal and ged;.
$IGarch_t$	$IGarch_{ged}$	3.9307961	3.393	We reject H_0		0.01357	0.01361	0.0000	IGARCHt dominates	
$IGarch_{ged}$	$IGarch_{normal}$	3.5585911	3.393	We reject H_0		0.01361	0.01362	0.0020	IGARCHged dominates	
$TGarch_t$	$TGarch_{normal}$	3.9674876	3.393	We reject H_0	t dominates as it is better than normal and ged; followed by ged which is better than normal	0.01358	0.01365	0.0000	TGARCHt dominates	t dominates as it is better than normal and ged;
$TGarch_t$	$TGarch_{ged}$	3.8006337	3.393	We reject H_0		0.01358	0.01364	0.0003	TGARCHt dominates	
$TGarch_{ged}$	$TGarch_{normal}$	3.2511346	3.393	We fail to reject H_0		0.01364	0.01365	0.1205	TGARCHged equals to TGARCHnor	

Table 4. Continued

$EGarch_t$	$EGarch_{normal}$	3.8903286	3.393	We reject H0	t dominates as it is better than normal and ged; followed by ged which is better than normal	0.01358	0.01368	0.0008	EGARCHt dominates	t dominates as it is better than normal and ged;
$EGarch_t$	$EGarch_{ged}$	3.7139485	3.393	We reject H0		0.01358	0.01368	0.0016	EGARCHt dominates	
$EGarch_{ged}$	$EGarch_{normal}$	3.6064937	3.393	We reject H0		0.01368	0.01368	0.8725	EGARCHged quals to EGARCHnor	
$APARCH_t$	$APARCH_{normal}$	4.4628382	3.393	We reject H0	t dominates as it is better than normal and ged; followed by ged which is better than normal	0.01373	0.01383	0.0000	APARCHt dominates	t dominates as it is better than normal and ged;
$APARCH_t$	$APARCH_{ged}$	4.0508819	3.393	We reject H0		0.01373	0.01377	0.0065	APARCHt dominates	
$APARCH_{ged}$	$APARCH_{normal}$	4.3404236	3.393	We reject H0		0.01377	0.01383	0.0008	APARCHged dominates	

Table 5. Rossi – Sekhposyan's (2016) test statistics

Model	t-stat	Critical value	Conclusion
Garchnor	45.007565	69	Rejects the null hypothesis of forecast rationality
Garcht	42.049564	75	Rejects the null hypothesis of forecast rationality
Garchged	42.153557	81	Rejects the null hypothesis of forecast rationality
EGarchnor	41.328762	343	Rejects the null hypothesis of forecast rationality
EGarcht	37.562038	349	Rejects the null hypothesis of forecast rationality
EGarchged	38.51445	355	Rejects the null hypothesis of forecast rationality
IGarchnor	47.630093	164	Rejects the null hypothesis of forecast rationality
IGarcht	42.531448	170	Rejects the null hypothesis of forecast rationality
IGarchged	46.108101	176	Rejects the null hypothesis of forecast rationality
TGarchnor	44.215855	254	Rejects the null hypothesis of forecast rationality
TGarcht	43.603016	260	Rejects the null hypothesis of forecast rationality
TGarchged	42.600109	266	Rejects the null hypothesis of forecast rationality
AParchnor	69.572197	432	Rejects the null hypothesis of forecast rationality
AParcht	64.624062	438	Rejects the null hypothesis of forecast rationality
AParchged	57.134777	444	Rejects the null hypothesis of forecast rationality

3.2.2. Tests of Absolute Forecasting Performance Robust to Instabilities

Classic tests for forecast rationality, like those by Mincer and Zarnowitz [24] and West and McCracken [25], rely on the assumption of stationarity, making them unsuitable when dealing with instabilities as noted by Rossi, et al. [26]. In contrast, the fluctuation rationality test, as proposed by de Prince, et al. [27], aligns with the concept of instability, resulting in a reduced likelihood of rejecting the null hypothesis of forecast rationality compared to traditional tests.

From Table 5 above, the forecast rationality is not supported in each model, as the Rossi-Sekhposyan test statistics indicate rejection of the null assumption, implying that forecast errors are predictable by all the models under review. Consequently, each of these models does well, meaning that they can make a good prediction. It is only if one model has to be chosen from several pools that matter. This explains the outcomes of the relative comparison which reveal that certain models are worse off.

4. Discussion

The results from the three sample periods exhibit that different asymmetric models outperform symmetric ones under different evaluation criteria with different error distributions. Hence, asymmetric GARCH models can be said to have better forecasting performance with regard to out-of-sample forecast.

All other distribution assumptions are outperformed by t- distribution error assumption which gives an impression that the model is good with t- distribution error assumption. However, even with a traditional test, the t-distribution comes first.

The individual models results derived from the Rossi – Sekhposyan test statistics are such that each model works well. It is only when a model is compared with another one that it can be said to have poor performance.

5. Conclusions

Combining predictions from different models has an average improvement in accuracy compared to the individual models as shown by the outcome from all three sampled cases. Three out of four model's accuracy indexes (RMSE, MAE and Theil inequality coefficient) indicated the IGARCH model as the best performer. This conforms to Stenberg [10] who used MAPE and RMSE. Their results indicate, as a matter of fact, that the forecasting model used consistently produced highly accurate predictions and compared well to other models for each currency studied. Similarly, Preminger and Raphael [28] noted that forecast performance measures including MAE, MAPE, RMSE and Theil U statistic can be quite beneficial in terms of choosing the best model.

This coincides with what Shen, et al. [29] did using the MAPE and the RMSE. Their findings indicate that the applied method of prediction produces remarkably high levels of precision, which is superior for all currencies to compete models. This supports Timmermann [21], who demonstrated that combining several prediction models can give on average more accuracy than that of the individual models.

Based on the findings of this study, we therefore conclude that symmetric models can outperform asymmetric ones under t-distribution, which is inconsistent with previous literature that suggests that asymmetric models outdo symmetric ones in terms of forecasting under non-normal distributions due to their ability to capture asymmetric effect. We can therefore conclude that symmetric models should also be used in forecasting as they can make better forecast than asymmetric ones. The practical implication is that all models can produce accurate forecasts. Only when compared to another model (other models) does it exhibit poor performance.

As the results indicate that traditional tests can yield accurate predictions as well, we can thus suggest that future studies on similar topics should explore diverse error distributions and utilize both traditional and innovative techniques. These variations might yield different results from previous findings, which stated that traditional models falter in making accurate predictions during periods of macroeconomic weaknesses. Exploring more advanced GARCH models across short and long-term horizons could shed further light and potentially support the current findings.

Finally, there appears to be a lack of literature on studies that combine traditional models with robust new techniques designed to handle instabilities. This study aims to bridge that gap and contribute significantly to this area of research.

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