**LANGUAGE EDITING SAMPLE 1**

**TITLE: FINANCIAL ARCHITECTURE OF THE INDIAN ECONOMY**
**TYPE OF WORK: LANGUAGE EDITING**
**SUBJECT: HISTORY| ECONOMICS**

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## 1.0 Introduction to the study:

### 1.1. Introduction:

Globalization along with the distinctive reforms of the financial sector of India has brought about sea of changes in the financial architecture of the Indian economy. In today's contemporary scenario it can be observed that the activities of the financial markets along with their relationship with the real sector have assumed quite a significant importance. The inception of the different financial sector reforms brought about in the early 1990's along with the implementation of various reform measures have included a number of structural as well as institutional changes enacted in different segments of the financial markets. There are quite a number of dramatic changes in the functioning of the financial sector in the Indian economy. Therefore it can be seen that the whole gamut of institutional reforms connected to globalization program and introduction of new instruments. There are a number of changes in procedures along with widening of network of participants. This requires a need to re examine the relationship between the financial markets and the foreign sector of India.
Foreign Institutional Investors can be considered to include investors or investment funds that are from or registered in a country outside of the one in which they are currently investing. Institutional also include investors of hedge funds, insurance companies, pension funds and mutual funds . It can be seen that foreign institutional investors are those who are established outside India and are leaning towards making investment in India. ( we could use a definition with a reference here ). Positive tidings in the Indian economy combined with a fast-growing market have made India an attractive destination for foreign institutional investors.

This is an age of transnational capitalism where one can see quite a significant amount of capital flowing from developed nations in the world to high growth emerging economies. Positive fundamental growth is promoted in the developing nations. This growth is often found with regard to the increasing importance given to the fast growing markets which has made a country like India an attractive destination for foreign institutional investors. The most dynamic source of capital to emerge in the current market has been denoted by the different portfolio investments which have been promoted by these foreign institutional investors (Prasanna 2008).

This dissertation attempts to study the influence of FIIs on the Indian economy at various levels and the establishment and significance of different determinants influencing FIIs in India.

### 1.2. Organization of study report:

The present research report is organized in to six major chapters.
In Chapter one, the background of the analytical problem and background on FII is discussed. There is also a discussion of the motivation behind the study, highlighting the rationale. In addition, this chapter also sets the aims and objectives and outlines research questions discussed through the course of the dissertation presentation.
Chapter two, the literature review has determined various different factors influencing foreign institutional investments, and the reasons analyzing the existing conditions of promotion of these investments in India and other developing economies. It also analyses in depth the different factors which act as determinants of foreign institutional investments.

Chapter three describes the Research Methodology and includes the sample selection criteria, the sources and the description of the sample data collected, which also include quantitative as well as qualitative research.

Chapter four of the report focuses on the functioning of the research model that has been developed.
Chapter five of the report is the final chapter and it gives the executive summary of the study, implications and further recommendation for future study.

Chapter six of the report contains the bibliography section used in the study.

### 1.3. Objective of the study:

The participation of institutional investors, both domestic and foreign, are an important feature when it comes to the development of stock market in India the last fifteen years. The Indian stock market has witnessed a significant rise in the number of specific institutionalised foreign investors, and they have played an important role in the development of the Indian equity market. There is a marked increase when it comes to the role of foreign institutional investors both quantitatively and qualitatively in the stock market. Their diversified roles include increase in the breadth and the depth of the market, rapidly expanding security business and the dominant investment policy. These help in the emphasis of the different fundamentals which have rendered quite efficient pricing of the different stocks.

This dissertation topic was chosen in order to explore the different factors which influence foreign institutional investments in India. This study is also aimed at determining the relation to the development of the Indian capital market. This dissertation seeks to evaluate the determinants of Foreign Institutional Investments in India. Furthermore, the researcher will attempt to analyze the significance of these determinants, analyzing them in depth in the literature review.

### 1.4. Motivation for the study

It is widely believed that in India, the actions of FII's, influence the direction of the financial markets, with FII's causing a rally in the equities market from the period 2004-2007, and sparking a domestic sell-off in the equities market in 2008. FII money coming into the secondary equity market works like adrenalin and the moment it whittles down, the market will gradually begin its drift downward. I am motivated to determine the relationship between the macro-economic factors in India with FII Inflows, to judge with more accuracy and conviction the effects, gradual changes in these macro-economic variables would have on the direction of the Indian Capital Markets.

### 1.5. Rationale behind the study:

India is bound to be considered as a capital scarce country with its huge population as well as its development potential. There have been a number of measures undertaken to attract foreign investment since the beginning of reforms in 1991. An analysis by Rai and Banumathy (2004) which had considered until the end of January 2003, discovered that India succeeded in attracting a total foreign investment of around U.S.$48 billion. The interesting fact to be noted out of these figures is that out of these investments U.S.$12 billion was in the form of foreign institutional investment. These figures show the importance of these investments in the overall foreign investment program of the nation.

India is also in the process of liberalizing its capital account. This is bound to have a significant impact on foreign investments, particularly with regards to FII. This is because FIIs affect short-term stability in the financial markets. Therefore it can be established that there is a distinctive need to determine the push as well as the pull factors behind any changes in these foreign institutional investments ( Rai and Banumathy 2004) .

Thus it can be seen that the framing of our policies are bound to influence the variables which tend to attract foreign investment. It can also be observed that these FIIs can be considered to be a subject requiring intense discussion. This is because FIIs can be held to be responsible for having intensified the current currency crises of the 1990s in East Asia and other parts of the world.

### 1.6. Aims and research question :

In the course of the literature review it can be seen that some of the main reasons which are to be attributed to the increase in cross border investments apart from the increasing rate of return in differentials can be attribute to the different factors affecting

FII. It is also been said by Roy (2000) that basic motive of this flow of foreign institutional investment though driven by profit, is always found to be susceptible to sudden withdrawals. When such withdrawals occur it is seen that there is a doubt with regard to the sustainability of the economy of the country which arises. Therefore it is very important to study the factors which are to be economic determinants of foreign institutional investments. Majority of these factors include depth, size and development of domestic financial market and capital market liberalization. Roy (2000) further goes on to emphasise the factor that the capital market liberalization is quite often preceded by specific surges in the flow of capital.

This there is a need for a better empirical understanding with regard to the motives behind these types of flows. The majority of the foreign portfolio's are to be studies from an economic point of view. This study tries to address this issue in detail.

Thus the basic research questions addressed in this dissertation are

1. What are the different factors which are found to play a role in the foreign institutional investment inflow into India?
2. What are economic determinants influencing FII in India?

**1.7. Research design:**

The research design is basically a plan which has been taken up to answer the research questions previously put forth in this report. This design aims at answering the questions validly, objectively and accurately. It is therefore the arrangement of conditions for collection and analysis of data. This arrangement is often done in a manner which enables us to combine relevance to the research purpose (Miles and Huberman,1994).

The research design undertaken basically has two important functions. They relate to the identification and development of protocols as well as the logistic arrangements made to make sure the study goes on uninterrupted. Another important function of this procedure involves establishing the validity and objectivity of the research.

**1.8. Conclusion:**

This chapter has given a basic overview of the aim and objective of this dissertation report. The following chapter discusses the literature review pertaining to this study.

**2.0. Review of literature:**

**2.1. Introduction:**

During the last thirty years it has been observed that the increasingly accelerated pace of innovation and technological change has facilitated an unprecedented degree of international business as well as heightened capital flow. There are more number of cross-border investments as well as economic operations whose management has become easier, quicker and cheaper than ever before (Chakrabati 2001). The beginning of the twenty first century has marked an important position in the existing global economy which is expected to enter a new stage. It has been predicted by a number of economists that there is going to be an increase in flow of international capital which would help dramatically improve the current situation of the emerging markets in the developing nations. Foreign institutional investment has been repeatedly reviewed and has till date proven to have a significant impact on not only the economic development but also the employment rate in the country receiving this investment.

Over the last few years there has been an increase in the importance on the literature reviewed with regard to economic development by focusing on the quality of foreign institutional investments. These investments have been considered to be a key explanation to improve cross country differences with regard to both growth rates as well as income per capita. The

determinants which govern these foreign investments have also been treated with increasing interest. Over the years economists have deliberated that foreign institutional investments are one of the most vital as well as a constant component of flow of capital to the developing countries which can be a vehicle for technological progress through the use and dissemination of improved techniques. These institutions of financial investments are supposed to exert their positive influence on development through the promotion of investment in general. They face less uncertainty and higher expected rates of return. Foreign institutional investors are now a very large share of capital formation in a number of developing as well as under developed counnstries. The foreign institutional investment promoting effect of good institutions might be an important channel of overall effect on growth and development of developing nations (UNCTAD, 2004).

This literature review has determined the different various factors influencing foreign institutional investments and the reasons analyzing the existing conditions of promotion of these investments in India and other developing economies. It also analyses in depth the different factors which act as determinants of foreign institutional investments.

**2.2 Foreign institutional investments: impact on the developing economies:**

Government of India (2005) has defined foreign institutional investments as those which include growing overseas pension funds, mutual funds, investment trust, asset management company, nominee company, bank, institutional portfolio manager and university funds. It can also be seen that these fund may include a distinct number of endowments, foundations, charitable trusts, charitable societies, and a trustee or power of attorney holder which have been established outside the country but propose to make proprietary investment in the nation. These investments may also be made on the behalf of a broad-based fund. This fund often denoted as one which has more than twenty investors with no single investor holding more than ten percent of the shares or units of the above mentioned fund.

Foreign institutional investments can invest only their own funds and can also invest on behalf of their different overseas clients who are often registered with the stock trading organizations. These client accounts which these FII investors manage are called as 'sub-accounts'. A domestic portfolio manager also has the option of registering itself as foreign institutional investment firm to manage the funds of sub-accounts of the different investors as indicated by the GOI (2005).

It is seen that a restricted amount of investments which includes less than 3% of all registered ones have issued derivative instruments referred to as different participatory notes which are registered and traded overseas. These are frequently backed by the foreign institutional investments holdings of the different Indian securities (GOI 2005). This arrangement which has been accepted by the governmental organizations has raised a number of concerns in the distinctive regulatory circles. This is because it is almost improbable in particular cases to trace the ultimate beneficiary of the funds. It is therefore quite clear that there is a probability that certain corporation or individuals have the ability to bring unclean funds to the country. These funds are those which can be classified as being generated out of illegal activities into the Indian markets.

There have been mixed views about the importance as well as the promotion of these international firms. It has been prominently promoted by a number of authors that this type of portfolio flows will bring a lot of profit the economies of recipient countries. However it has been observed by different policy-makers worldwide that there is a lot of challenges as well as uneasiness which is faced when it comes to studying the impact of such investments. This category of investment has been referred to as hot money by the investors. It can be proven in certain cases where there is possibility of a stampede breaking out as a result of a slightest hint of trouble in the host country. This will leave the developing countries where these investments are made at with an economic wreck. A very good example of this situation has been observed at Mexico in 1994 (Mukerjee 2002). Foreign institutional investments have often been blamed for worsening small economic problems in a country by making large and concentrated withdrawals which often leads to crash of the stock market. These withdrawals have been spotted at the first sign of economic weakness in the countries. Rakshit (2006) is of the view that foreign institutional investments have always been considered and held responsible for spreading financial crisis in the international capital flows as well as capital controls in any non stable economy.

Therefore it has been observed by Mukerjee (2002) that the different policy makers of this country are often apprehensive about the different dangers of abrupt reversals. There are also certain definitive destabilizing consequences. These consequences are felt on equity as well as well as foreign exchange markets. The government of India over the last few years has denoted that they are making efforts in order to increase the different FII flows in India as well as bring about regulation of the different policies.

Rakshit (2006) is of the view that foreign institutional investments can be thought of as those which are far from being healthy for the economy. He strongly believes that the different foreign institutional investment inflows have essentially imposed clear encumbrances on the Indian economy.

**2.3. International Portfolio Flows to Emerging Markets:**

International capital flows to emerging markets has been considered as somewhat recent occurrences. It has been seen that international capital flow which has begun at a reasonable scale in the early 90s and this section is an important part of this literature review as it helps in the determination of the role of foreign institutional investment in developing economies. The theoretical along with the practical basis of the capital flow has been examined in depth by Mukerjee (2002). On the theoretical side, the instances of liberalization of international capital flows are built around a few fundamental tenets. These as indicated by Mukerjee (2002) include:

(a) Free capital movements which facilitate efficient allocation of global savings. It also enables channeling the different resources to countries where they will be most productive and thereby increasing the growth as well as having global effects.
(b) Access to foreign capital markets enables investors to achieve a higher degree of portfolio diversification. This allows them to obtain higher returns at lower risk.
(c) Full convertibility for capital account transactions which complement the multilateral trading system. There is also broadening of the different channels through which countries often obtain trade as well as investment finances on much easier terms.
(d) Liberalization has improved different macroeconomic performances. It can be seen that the subject governments to greater market discipline as well as penalizes the unsound monetary as well as fiscal policies.

On the practical side as indicated by (Mukerjee 2002) the surge in international portfolio investment over the past decade has been triggered by a number of parallel developments. These include the following developments:

- Institutionalization of savings in the United States as well as development of the world since the 1980s has placed massive and increasing volume of funds available. These funds have been placed under the management of professional portfolio managers. These managers for a number of tactical reasons tend to prefer a wide diversification of portfolio which has been spread out internationally.
- There has been a trend towards financial liberalization both in developing countries and countries in transition towards a developing economy. This allows different global fund managers to reach the financial markets in these countries.
- Developments in information technology resources have immensely lowered the cost of international trading in securities. It has also enabled information dissemination on a near real time basis a reality.
- A remarkable expansion of capital markets in emerging economies has occurred mostly due to the extensive privatization of previously state-owned enterprises. However it can also be observed that these elements which facilitate the inflow of foreign capital into developing countries can also have far reaching effects which are meant to enable foreign capital withdrawal from these countries far more quickly. This is a major drawback which needs to be considered by the developing economies.

Analysis of the performance of emerging equity markets during the past decade has been carried out. It has been indicated that investment in these markets can provide global investors with alluring absolute returns as well as some room to promote variant portfolios (Mukerjee 2002). In fact it has been well documented that global investors reaped such benefits in the first half of the 1990s. However it has also been observed that these gains disappeared between 1995 and 2001. This reversal of performances of these markets which are relative to their matured counterparts as already mentioned can be attributed the variation in the properties of determinants of foreign institutional investments (IMF, 2002).

Such performance reversals have shepherded in tactical investors such as a hedge funds. These funds are those which often try to achieve high as well as absolute returns. These returns are absolutely essential and are made more attractive by exploiting the high volatility of returns in these markets through the timing of market (Bekaert 1998). It can also be observed that such speculations as well as opportunistic behavior of the tactical investors have contributed to the volatility of foreign institutional investments inflows into emerging markets (Mukerjee 2002).

It is to be noted that these global financial integrations can be found to have two distinct as well as conflicting effects of the presence of a bias at home. As more and more countries especially the emerging economies open up their markets for foreign investment it can be observed that this investor of the developed countries are found to have a number of different opportunities to hold the foreign assets (Chakrabati 2001). However Chakrabati also notes that these flows themselves when considered together with the greater trade flows have a tendency to cause different national markets to increasingly become part of a more unified global market scenario. This enables a reduction in their diversification benefits. The empirical issue to be considered is as to which of these would influence the overall effect, however considering extent of the home bias it is quite likely that for quite a few years to come, FII flows have an ability to increase with global integration (Chakrabati 2001).

**2.4. Host-country characteristics that attract Foreign Investments:**

The determinants of the foreign institutional investments are found to be dependent on the characteristics of the host country. It can also be observed that dependent on the motives of foreign investors three types of foreign institutional investments can be undertaken. As indicated by Dunning (1993) the following types of FIIs can be considered:

- One type of FII is called as market-seeking FII where the purpose is to serve local as well as regional markets. These are also considered as horizontal FIIs as they involve the replication of production facilities in the host country. It is also seen that the tariff jumping FII is a variant of this type. The main purpose of horizontal FII is to promote local production, size of the market as well as the growth of market which serves as key drivers of the host economy (Esanov et al 2001).

- The second type of FII is called resource seeking FII. This type of FII is often found in situations where the firms invest abroad in order to acquire resources not available in the home country. These resources include natural resources, raw materials, or low cost labor. This type of FII in contrast to horizontal foreign institutional investments is bound to have vertical and export-oriented investments which are involved along with relocating parts of the production chain to the host country. Availability of labor at a very low cost is an important driver for export-oriented foreign institutional investments. It can also be attributed that these FIIs are more often than not directed towards the resource sectors like oil, natural gas where there is possibility of high returns from the investment due to the booming markets.

- The third type as classified by Dunning are referred to as efficiency seeking FII. These investments often occur when the corporation can gain from the common governance of geographically dispersed activities. This common governance can be carried out in the presence of economies of scale and scope as indicated by (Bevan and Estrin 2000). This has been found this to be true for the first wave of European Union accession countries. . Barrell and Pain (1999) have discovered that the presence of a distinctive and prospective membership in the European Union

has attracted more efficiency seeking FIIs. This is because these regions are found to be conductive to the establishment of regional corporate networks.

**2.5. Determinants of Foreign Institutional Investments:**

There has been a growing interest in the determinants of foreign institutional investments and their role in different developing countries. These investments till date have been considered to be very stable components of capital flows to developing countries. It has also been observed that the presence of these investments can be looked upon as vehicles for technological progress by using and disseminating improved production techniques. A number of authors have studied the link between institutions and FIIs. Good institutions are supposed to exert their positive influence on development of investments by promoting the investment in general. These investments are often faced with less uncertainty and higher expected rates of return. Foreign institutional investments are now found to play a very large share of capital formation in poor countries (UNCTAD, 2004). In this section of the literature review let us analyze the different factors which are considered to be determinants of FIIs.

**2.5.1. Realized Risk Factor:**

Investments when considered to flow from either domestic or foreign are found to be heavily dependent on different risk factors. Therefore it has been noted by Agarwal (1997)that the while studying the behaviour of FII, it is important to consider the risk factor. Without an in depth understanding of the risk factor involved it is not possible to predict outcomes of FIIs. This realised risk can be divided into ex ante risk as well as unexpected risk. Ex ante risk has determined to be a very common and an easily observed component and is found to be negatively related to FII. However it is established the existing relationship between the unexpected risk as well as the Foreign Institutional investments is found to be obscure (Rai and Bhanumurthy 2004)

A study conducted by Wheeler and Mody (1992) found the first principal component of thirteen risk factors. These factors included bureaucratic red tape, political instability, corruption as well as the quality of the legal system. These factors have been discovered to have no significant impact on the location of United States foreign affiliates. However this index also contained factors like the living environment of expatriates or inequality which cannot be directly linked to the quality of institutions (Hall and Jones 1999).

2.5.2. **Quality of the Institution:**

The quality of the institution has also been studied as a risk factor associated with FIIs. It can be observed that these FIIs have an ability to promote the effect of good institutions. It can also be seen that the quality of these institutions are to be regarded as important channel in the overall effect on growth and development of the FIIs (Wei, 2000). Several authors have documented several reasons with regard to the importance of quality of institutions may matter for attracting these investments. Wei (2000) has indicated that the raise in productivity prospects along with good governance infrastructures have an ability to attract foreign investors. Another reason for the importance of quality is that poor institutions have a tendency to bring additional costs to these FIIs. This is more often than not attributed to be a case of corruption (Wei, 2000).

Another reason can be associated with the presence of high sunk costs. These foreign institutional investments have an ability to be vulnerable to any form of uncertainty, including uncertainty. This uncertainty often stems from poor government efficiency, the effect of policy reversals, graft or weak enforcement of property rights and of the legal system in general (Wheeler and Mody 1992).

**2.5.3. Volatility factor:**

It is important to account for volatility while one considers the different determinants of FIIs. The volatility or the arch effect is often expected in most of the monthly financial time series data. Given the trends in increase in financial market integration, both at a local and global level financial markets, accounting for volatility is unavoidable as well as important. Rai and Bhanumurthy (2004) had discovered that the existing studies either do not incorporate volatility in foreign and domestic markets or they do not make use of the presence of certain realized risk factors. These factors can be considered to be an approach that does not always yield robust results. This is because the variance that has been obtained is often found to increase irrespective of the direction in which stock returns move. It has also been established that this volatility is directly linked to the direction of movement of foreign institutional investments which can be determined by bull and bear phases (Rai and Bhanumurthy 2004).

The relationship between stock market volatility and liberalization has also been examined extensively by numerous authors. Bekaert and Harvey (1997) have utilized a cross sectional framework to study whether capital market liberalization has any influence on volatility. The empirical result obtained by them has revealed that most countries have experienced liberalization have had a distinctive decrease in volatility.

Kwan and Reyes (1997) conducted a study and have stated that a free market is the best possible approach for producing economic development in the distinctive neoclassical economies. It can also be understood that the presence of these liberalizations of stock markets are often a controversial issue when it comes to the developing economies. A number of researchers who are in favor of their study have suggested that there are 4 benefits of stock market liberalization for developing countries as indicated by Kwan and Reyes (1997) which have an effect on price volatility on domestic as well as foreign markets:

1. Filling of the gaps indentified in the availability of savings for domestic investment requirements as well as foreign investments.
2. Facilitation of a more efficient allocation of investment resources towards domestic as well as global markets
3. Foster a distinctive discipline among the different corporate managers.
4. Ensure that there is very little dependence on financing by debt.

Bekaert and Harvey (1997) have provided three disadvantages of stock market liberalization which may serve to be an important factor influencing FIIS:

(1) The lack of the long-term commitment which is required to promote stability in real fixed investments
(2) The presence of a weakened ability for the government to pursue its industrial development policies.
(3) The availability of an increased susceptibility to speculation and economic or political storms abroad.

Kwan and Reyes (1997) have also indicated that beyond this rapid expansion of the domestic economy in the developing regions of the world especially in countries like China and India there is a chance that Taiwan as well as Bombay would emerge as a powerhouse in the world economy. They will have a much wider impact especially in the Asia-Pacific region of the world.

Wang and Shen (1999) have effectively studied the foreign investment destabilization as well as demonstration effects on Taiwan's stock and foreign exchange markets. The findings have a threefold impact.

- It is observed that when these foreign investments are seen there is bound to be an effective positive influence with regard to the volatility of the exchange rate.
- Foreign investment is often found to affect a very tiny fraction of stock market volatility.
- Stock returns are often found affected by the presence of factors which are non fundamental.

Foreign exchange rate volatility is found to have an influence of the value of the firm. It is seen that since the future cash flows of the firm is found to change with the fluctuations in the foreign exchange rates, there can be an effect on the currency of the host country. If the country is supposed to be denominated by the presence of import then the presence of a specific weak currency can lead to a negative impact on the country (Kumar 2009).

### 2.5.4. Geographical distribution:

Another very important variable for which is an important factor influencing the FII is the geographical distribution of the foreign institutional investments. The geographical distribution is dependent on the availability and the promotion of agglomeration of economies. When such agglomerate economies are present, it is observed that new investors mimic past investment decisions by other investors in choosing where to invest. This location next to other firms enables them to benefit from positive spillovers of the previously existing investors who are already in place. Some of the most common sources for these positive externalities are knowledge spillovers, specialized labor, and intermediate inputs (Krugman 1991).

Together it is observed that these factors which are found to attract different types of foreign institutional investments suggest that those nations in possession of a large market, low-cost labor, abundant natural resources, and close proximity to the major (Sohnke et al., 2001). Western markets would attract large amounts of foreign institutional investment inflow. Foreign Institutional Investments thus are sent to those countries which have favorable initial conditions to promote the improvement of share holders (Lankes and Venables 1996).

### 2.5.5. Governance indicators:

Wei (1997, 2000) has pointed out corruption as a significant impediment to inward foreign institutional investments. This result was confronted by Daude and Stein (2001) who indicated that there was the presence of very high co linearity between the different measure of corruption as well as the GDP per capita employed by Wei. This is found to spurious results when GDP per capita is not included in the equation. Therefore Daude and Stein considered a more wider as well as a more distinctive range of institution variables. Their results showed that inward foreign institutional investments are found to be significantly influenced by the quality of institutions.

Kaufman et al. (1999) provided six different indicators which may be considered to promote these foreign institutional investments. There were five out of six governance indicators which proved to be conclusively affect and act as determinants of foreign investment markets. These determinants include political instability along with promotion of violence, government effectiveness and efficiency, regulatory burden, rule of law as well as graft.

La Porta et al. (1998) have shows the presence of different indicators which have an ability to risk FIIs. These include repudiation of contracts by government, risk of expropriation as well as shareholder rights to matter. Globerman and Shapiro (1999) have promoted the fact that the same governance factor determinants should have an impact on both inward as well as outward foreign institutional investments. For instance, good institutions could have a positive impact on foreign institutional investments outflows. This is because they create favorable conditions for multinational companies to emerge therefore having the ability to invest abroad (Sohnke et al., 2001). Globerman and Shapiro (2002) have also indicated that these estimates have a direct impact on the principal components of the six governance indicators constructed by Kaufman et al. (1999) on both inflows and outflows of foreign institutional investments.

**2.5.6. Firm level indicators:**

In order to comprehend the effect of foreign institutional investments on the country it is very imperative to determine the different firm level factors which can influence the foreign investments from an economic standpoint. It has been perceived that outside investors will lower the price they pay if they dread expenditure of private benefits of control family. It has also been discovered by Choe, Kho, Stulz (2005) that investors from the United States are less inclined to hold fewer shares in firms with ownership structures that are more conducive to confiscation by controlling insiders.

It has been observed by Prasanna (2008) that in certain companies where there are some insiders there is a domination of information access as well as availability to the shareholders. This is often reflected on the transparency of the company. With the presence of a lesser degree of information available it is seen that foreign investors are often confronted with an contrary selection problem. This is an indicator that they invest in such stocks to a lesser degree and a greater amount of caution (Prasanna 2008).

Leuz, Nanda and Wysocki (2003) have further emphasized that the propagation of information has caused several problems with foreigners. It has also lead to the promotion of obtaining fewer assets in firms. Firm level characteristics are frequently anticipated to contribute to this information dissimilation as well as asymmetry problems.

Haw, Hu, Hwang and Wu in (2004) have analyzed different firm level factors. They have come to a conclusion that there is distinctive ability of firms to provide information asymmetry which directly has a number of effects on foreign institutional investments. The empirical analysis carried out by them has found evidences with regard to investments from the US. These investments are found to be much lower in firms where managers do not have effective control over the proceedings as well as the investment processes.

A number of researchers have also distinctively discovered the presence of a distinct relationship between better firm level governance as well as higher financial and equity performances. These factors are found to contain distinctive number of developing as well as emerging market sectors. This area of study has been carried out by a number of authors including Ishi and Metrick (2001), Klapper and Love (2003) and Black, Jang and Kim (2003).

It has been discovered by Lang, Lins and Miller (2002) that foreign investors are more likely to invest in firms that have higher visibility rate. They have found out that these firms which contain higher rates of American depository receipts may contain better information environments. This is a direct indication that they have been associated with higher market valuations which is further supported by the work of Edison and Warnock (2003).

**2.5.6. Role of Corporate performance with regard to Foreign individual investment:**

It has been summarized by a number of individuals that the presence of corporate performance will be the major influencing factor for investment decision of any foreign investor. Aggarwal, Klapper and Wysocki (2005) have studied in depth the impact of six firm level variables on portfolio investment of fund companies influencing FIIs. These variables are include the following:

**Ownership structure**

Prasanna (2008) has investigated the ideas on whether the ownership has any influence on the investment decision of foreign institutional investors. He has distinctively observed that shareholders such as family groups, financial institutions, government, and individuals have their own divergent goals. Therefore there is a distinctive possibility of a correlation between ownership structure as well existing trends in foreign institutional investments.

**2.5.6.2. Share returns:**

Ahmadjian and Robbins (2005) have observed foreign institutional investments in the Japanese economy during the 1990s. Their analysis of over thousand firms between the year of 1991 and 2000. It has been effectively shown that these foreign investors were more interested in investment returns rather than in the growth of long-term relationships. They have also discovered that these contribution have a direct influence on foreign funds and were weak in closely-knit companies with close ties to domestic financial institutions and corporate groups.

**2.5.6.3. Price to book value**

Over eighty percent of the reporting parameters which have been used to manage the company are designed to gauge returns with regard to shareholders. Most management decisions are therefore biased towards delivering short term value to them with very little focus on long term. An income statement or balance sheet does not reveal the company's ability to create value for customers, employees or shareholders (Prasanna 2008). A number of researchers have also observed that most companies are well aware of the facts and figures contained in the financial reports and often fail to capture the complete essence of their operations. This fact is quite evident in the case of companies where the book value is quite different from the market value. The book value of the equity measures the different capital contributions of the shareholders. However it is seen that the influence of market price on the equity directly reflects the productivity of the firms. These firms have employed the capital contributed by the shareholders as assessed by stock market. The ratio of price to book value enables gauging whether the market valuation of the company is relative its worth or not (OECD 2007).

Chakrabati (2001) has determined that the nature and causes of foreign institutional investment equity flows into the Indian market appeared. In his analysis Chakrabati has made the use of distinctive monthly data foreign institutional investment net inflow. He has used FII as a proportion of the previous month's market capitalization along with the different as well as the relevant stock market variables. He has also used certain financial market indicators. These include deposit rate, exchange rate, etc. and obtained the following main results which seem to directly influence the price to book valuation:

(a) Foreign institutional investment flows are found to be highly correlated with equity returns especially in India. However this can be attributed to the effect rather than the cause of such returns.
(b) Investment in the Indian equity markets was analyzed and it was determined that global investors do not seem to be at an informational disadvantage compared to local investors. Therefore there is an equal distribution of and
(c) The Asian crisis marked a regime shift in the determinants of foreign institutional investment flows to India. It can noted that the presence of this domestic equity returns becoming the sole driver of these flows in the post Asian crisis period.

**2.5.7. Macroeconomic indicators in foreign institutional investments"**

Khanna (2002) examines the macro economic impact on Indian capital market as well as the corporate sector and what are the macro economic effects on inflows of capital to Indian and micro economic effects on the capital market during 1989 to 2002. He has studied in depth the presence of a specific macro variable as foreign direct investments, foreign portfolio investments, presence of NRI deposits, availability of external assistance and other factors like GDP, GDS, GNP. He has indicated that entry of international capital flows helps to provide greater depth to the domestic capital market and reduce the systematic risk of the economy.

Chakraborty (2001) explain the effects of inflows of private foreign capital on some major macroeconomic variables in India using quarterly data for the period 1993-1999. She analyses of trends in private foreign capital inflows and some other variables indicate instability. She has taken the net inflows of private foreign capital as well as macro economic variables foreign currency assets, wholesale price index, money supply, real and nominal effective exchange rates and exports. The Co integration test confirms the presence of long-run equilibrium relationships between a few pairs of variables. But the dependence of each variable on private capital flows invalidates such co integration except in two cases: co integration exists

between foreign currency assets and money supply and between nominal effective exchange rate and exports, even after controlling for private capital flows. The Granger Causality Test shows unidirectional causality from private capital flows to nominal effective exchange rates- both trade-based and export based-, which raises concern about the RBI strategy in the foreign exchange market. Finally, instability in the trend of foreign currency assets could be partially explained by the instability in private capital flows with some lagged effect.

The rapid liberalization of financially repressed economy often leads to large capital and rapid expansion of domestic financial market followed by a capital account crisis and economic contraction. The elimination of capital controls exposes domestic capital markets and macroeconomic policies to discipline of international capital market, starting a race between financial reforms and crash. Indian policy is following a determined gradual path towards economic liberalization and international integration. Following the liberalization of transaction on the current account, restrictions on capital inflows have been relaxed steadily with an emphasis on encouraging long-term investment and saving. The pattern of liberalization capital inflows in India has been the gradual raising of quantitative restriction on inflows and the size of flows that automatically approved.

Thus it is observed from the works of Khanna (2000), Chakrabati (2001b) and Sethi (2000)that the macro economic variables affecting the growth of foreign direct investments are dependent on the other factors listed above. They have indicated that the process of FII determinants was governed simultaneously by the evolution of specific factors which are found to encourage the flow of specific private capital when it is applied across the world. This development is found to have presented a very important interest when it comes to understanding the nature as well as the economic effects of FII inflow and the different policies which are required to be safeguarded when it comes to establishing the financial instability of the global movement of private capital.

**2.6. Impact of Institutional Investors on markets:**

Impact of institutional investors has been studied in detail by a number of different researchers. So far it is not very clear whether or not the investment of foreign institutions will completely alter or affect the present existing stock prices. Numerous empirical studies conducted so far have indicated that the presence of these institutional investors' investment behavior may not directly have any kind of influence on the existing pattern of stock prices. (Lee and Ward 1980, Scholes 1972, Close 1975 and Fama 1970).

It is seen that because stocks are good alternate for each other it is to be anticipated that as soon as the price of one gets out of the line with the markets' anticipation that there are going to be investors immediately reacting by buying this stock. It is also seen that if there is a decline in the price by a substantial margin or if the price has increased ahead of market expectations investors would be willing to sell the stock (Close 1975).

There are other scholars who have arrived at a number of different conclusions when it comes to the behavior of foreign investors' in the stock market. Liquidity Effect Hypothesis was one which was proposed in order to be used by certain investors to show that the institutional investors' trading had an important influence on the existing stock prices (Kraus and Stoll 1972a, Close 1975).

The foreign institutional investments have been looked at from the perspective of certain types of supply as well as demand. Harris and Gruel (1986) have remarked that the price pressure hypothesis would help promote their viewpoint. A number of other hypothesis like the Parallel Trading Hypothesis which has been effectively proposed by Kraus and Stoll (1972b) and the Information Effect Hypothesis put forth by Close (1975) have led to the determination and the conclusion that foreign investors' behavior might have a direct effect on stock prices.

It has been studied and denoted by Douma, Pallathiatta and Kabir (2006) that there is positive effect of foreign ownership on firm performance. They investigated the impact of foreign institutional investment on the performance of emerging market

corporations. They also made an in depth analysis of the impact of foreign investments on the business group affiliation of local as well as global corporations. Foreign investors often prefer those companies which provide better corporate governance when compared to those with poor factors. They further indicated that it is almost impossible to achieve certainty of investor protection. This is because this kind of protection is poor in case of firms with controlling shareholders who have ability to expropriate assets (Douma, Pallathiatta and Kabir 2006).

The block shareholders are often found to affect the value of the firm along with its influence the private benefits they receive from the firm. Companies who are in the position of such shareholders will find it expensive to raise external funds especially those like foreign institutional investments. (Aggarwal, Klapper and Wysocki 2005).

Li (2005) has observed that in certain cases of poor corporate governance the foreign investors choose foreign institutional investment rather than indirect portfolio investment. Li indicates that the general consensus is that foreign institutional investments could be better protected by private means.

Dahlquist et al. (2003) conducted empirical analyses of the foreign ownership and firm characteristics in the Swedish market. It was determined that when foreign investors have greater presence in large firms, there is a possibility that firms pay low dividends and in firms with large cash holdings. They indicated that firm size is driven by their liquidity which in turn can influence the current market price. They have measured international presence by including different foreign listings as well as export sales. They have established that foreigners tend to underweight the firms with a dominant owner.

Covirg et al. (2007) have empirically analyzed that the foreign fund managers have less information about the domestic stocks than the domestic fund managers. They found that ownership by foreign funds is related to size of foreign sales, index memberships and stocks with foreign listing which will directly have an influence on the existing patterns of stock market prices.

**2.7. Investment Strategies of Institutional Investors**

Another important aspect to be reviewed in the literature review is with regard to how investors follow or replicate other investors' steps in constructing portfolios in the stock markets especially when it comes foreign institutional investments. These strategies directly reflect on the different factors which determine FIIs.

Scharfstein and Stein (1990) have stated that there are some important determinants that can lead to herd behavior in stock markets. They indicated that under many circumstances it was observed that the managers simply imitate the different investment decisions made by other managers. This is often carried out by ignoring substantive information available on this issue.

An informational cascade is found to occur when it is optimal for an individual. This individual having observed the action of those ahead of him often follows the behavior of the preceding individuals while ignoring his own information and his own reasoning (Bikhchandani, Hirshleifer and Welch 1992). Huang's paper (2000) has dealt in depth about three major institutional investors in Taiwan's stock market. What he determined was that investment trust institutions play a follower role in Taiwan's stock market, as they follow foreign investors and security dealers. Bikchandani et al (1992) indicates that this trend is bound to continue when it icomes to foreign institutional investments.

Choe, Kho and Stulz (1999) had taken quite a large sample of the Korean stocks to examine and determine whether foreign investors destabilized the Korean stock market in 1997. Their findings has clear evidence of positive feedback trading and herding behavior in the Korean stock market. This trend they noted was found to be quite steady in the presence or absence of a crisis.

**2.9. FII preferences in India:**

India opened its stock markets to foreign investors in September 1992 and has, since 1993, received considerable amount of portfolio investment from foreigners in the form of foreign institutional investor's investment in equities. This has become one of the main channels of international portfolio investment in India for foreigners (Chakrabati 2001).

In order to trade in Indian equity markets, foreign corporations need to register with the Securities and Exchange Board of India as an established foreign institutional investor. The SEBI definition of foreign institutional investments presently includes foreign pension funds, mutual funds, charitable/endowment/university funds etc. as well as asset management companies and other money managers operating on their behalf (Chakrabati 2001).

Analysis of the daily flow data during 1999 was conducted by Chakrabarti (2001). He has concluded that in the post-Asian crisis period, stock market performance has been the sole driver of foreign institutional investments flows, though monthly data in the pre-Asian crisis period may suggest some reverse causality.

Gordon and Gupta (2003) have analyzed monthly data over the period 1993-2000 and concluded that foreign institutional investments flows are negatively related to lagged stock market returns. This suggests a distinctive negative feedback trading. There are, however quite a lot of issues which show distinctive appropriateness when it comes to the use of monthly data in this analysis (Pal 2006).

Chakrabarti (2001) has also found no evidence of any informational disadvantage for foreign investors when it comes to their domestic counterparts. The Asian crisis marked a specific regime shift in determining the inflows of foreign institutional investments. In the pre-crisis period, the beta of the Indian market with the American S&P 500 index has been found to inversely influence foreign institutional investments flows to India. However this effect disappeared in the post-crisis period.

India's country risk rating did not seem to affect foreign institutional investments flows. Mukherjee et al (2002) have questioned the diversification motive behind foreign institutional investments flows to India. He has reported autocorrelation or inertia in these flows. Gordon and Gupta (2003) however have reported that foreign institutional investments flows are sensitive to the London Inter-bank Offer Rate along with the macroeconomic fundamental conditions of India.

Coondoo and Mukherjee (2004) have also argued that both the stock market as well as foreign institutional investments flows in India have high and related volatility. In their analysis of the effects of regulatory measures on investment flows from other countries, Bose and Coondoo (2004) find that liberalizing policy changes have had expansionary effect on such investment flows. This has also led to distinctive restrictive measures which are aimed at giving regulators greater control over foreign institutional flows do not necessarily dampen them.

It is seen that the presence of foreign institutional investments are found to play a very important role when it comes to the process of formation of capital as well as the growth of economy of the nation. It is also seen this increase in the net flow of FII from the years 2003-07 is found to play a very important role when it comes to the process of formation of capital as well as the economic growth of the nation.

The presence of these foreign institutional investments however has had its drawbacks too. There was a pulling out of about USD 13 billion in the wake of the recent global financial crisis (January 2008 – March 2009) from India. Foreign institutional investments are supposed to be important economic drivers because they play an important diversification role. One of the key aspects of these types of investments into the country is that there are more than hundred new FIIs who have registered after the subprime crisis. This is an indicator that India is quite a attractor of foreign institutional investment (Rao et al., 2009).

There have been specific factors which have been identified by Mishra et al (2010) for the increase in the number of incoming FIIs into India. These include:

- Increase in the recognition of the long term growth potential of the Indian emerging economy.

- There is the presence of quite a favourable demographic structure in India which is supposed to have established a competitive advantage when it comes to quite a number of spheres including the growth of the software industry.
- A number of these FIIs have made note of the fact that unlike other countries where it is quite possible that the direct investments have gained predominance, in India there has been a significant increase in the number of FIIs.
- The Indian industry is known world over to possess the ability to produce goods and services at quite a low cost. The conditions of the scarce employment opportunities in India indicates that with the presence of a good competition when it comes to the labour force and cheaper labour there is quite an improvement in the natural quality as well as the productivity which is supposed to be quite highly favourable when it comes to the foreign corporations.

**2.10. Conclusion:**

This section of the dissertation report has analyzed in depth the different factors which act as determinants of foreign institutional investments. There is also a listing the different reasons analyzing the existing conditions of promotion of these investments in India and other developing economies. The next section deals with the research methodology adopted this dissertation.



**CHAPTER III**

**Research Methodology**

***3.0. Introduction***

This section addresses about the research methodology adopted for the present study. The steps involved in choosing the research approach with appropriate justification, appropriate data collection methods adopted are also explained in this chapter. "Methodologies refer to the overall approach to the research process, from the theoretical underpinning to the collection and analysis of data. Like theories, methodologies cannot be true or false, only more or less useful" was the definition provided Silverman to define pure research methodology (as cited in Hussey & Hussey, 1997, p.54)

***3.1 Research Designs***

In any business research, researchers have to explore their findings by providing systematic enquiry as mentioned by Cooper and Schindler (2003). There are different kinds of research usually adopted for the study which includes explanatory,

descriptive, and exploratory. In the present study, researcher used exploratory research design, where it aims at assessing phenomena and new insights are obtained (Saunders et al, 2007). In the present study researcher attempted to identify the determinants of FII on the Indian economy at various levels.

In order to find out the determinants of FII investments, the present study used macroeconomic approach. Moreover, institutional factors are reflected directly in macroeconomic factors such as noted by LaPorta and Others (1997) and Garcia (1999), high income is always associated with better general environment for business, property rights and better education.

**Model**

The linearity was assumed between the independent explanatory and dependent variable of FII. In order to identify the macro-economic factors that make India attract FII from abroad, a model for FII inflows in India would require certain macroeconomic and financial parameters. Yet, it is difficult to analyse all the information related to foreign countries and its effect or influence on Indian economy. Thus, to overcome this hurdle, the present study used US economy as a proxy while return on equities; interest rate differential and inflation are used as comparing indicators.

Since over 38 per cent of FII inflows into India originate from the US and moreover the United States is India's major trade partner, in the present study researcher used the US economy as an effective proxy (Chakrabarti, 2001). It's not due to precedent; the researcher used the US economy as a proxy for the analysing FII investments in India, but it is believed that the results obtained through the present study such as US financial variables with Indian variables can be extrapolated to other countries or can be proxy for the remaining part of the world. Data for stock market returns as a significant flow of FII investment was relied for measuring attractiveness of a destination to FII Investments.

The above model illustrates that in India foreign institutional investments is a linear function of the National Stock Exchange Index Sensex, S&P 500 stock index value, US equities and Indian equities investing riskiness as provided through the sensex and S&P 500 standard deviation of the movement, Indian inflation rate, exchange rate in nominal, the corresponding previous two time periods, the FII inflows.

β1 = the term intercept

β2.....9 = Slope coefficients partial regression

ut = error term in random (Stochastic)

The time series analysis has been used to analyse the monthly estimates data. The data ranges from the year January 2001 to June 2009 and which has 8 year monthly estimates data and there are 96 observations, ie., 8 X 12 = 96 observations.

*In the model following variables has been used*

| Variable Type | Variable | Unit | Label |
|---|---|---|---|
| **Dependent** | fiit | In USD mn | Foreign institutional investments |
| **Independent** | Wpit | In per cent | Whole sale price index for India |
| **Independent** | Sp500 | Points | S&P 500 index |
| **Independent** | Sensex | Points | NSE sensitive index |
| **Independent** | Stdev_NSE | - | Sensex Standard deviation |
| **Independent** | Stdev_SP500 | - | S&P 500 Standard deviation |
| **Independent** | Er | Rs. Per USD | Nominal exchange rate |
| **Independent** | | | |
| **Independent** | | | |

**Foreign Institutional investment**

In September 1992, India opened its stock market to foreign investors and has received considerable attention since 1993 where substantial amount of portfolio in the form of Foreign Institutional Investor's (FII) investment in equities has been received from foreigners to the country where it is currently investing and this being one of the important international portfolio investments (13). Foreign corporate has to register with the Securities and Exchange Board of India (SEBI) as FII, in order to trade in Indian equity markets (ref14). The definition of FIIs as given by SEBI includes presently are university funds/endowments/charitable, mutual funds and foreign pension funds etc and further the money managers which are operated

on their behalf and the asset management companies. The Reserve Bank of India (RBI) database has been used to obtain monthly time series data for FII inflows into India and through USD millions the FII equities are measured.

**Indian Economy – Whole sales Price Index**

In order to measure for inflation in the Indian economy, the study used the monthly time series data for Wholesale Price Index (WPI). The WPI monthly data on Indian Economy was collected from the RBIs Database.

**Standard & Poor's 500 stock index**

The stocks of 500 Large Cap Corporations, mostly from American are present in the S&P 500 index. The most widely watched index of large Cap US stocks are the S&P 500 and for the US economy, it is considered to be a bellwether as it contributes to 70 percent of all U.S publicly trade companies. In the present study in order to protect the returns its always been invested outside in India, particularly in the stock exchange which comprised of 500 leading companies of the US economy, thus for the present the monthly time series data for S&P 500 has been used. Yahoo! Finance database was used to collect the historical data for the S&P variable.

**National Stock Exchange –**In order to encourage stock exchange reform through competition and system modernization the National Stock Exchange (NSE), which is India's first debt market was launched. This stock exchange further encourages foreign investors to invest in Indian stock market. The NSE NIFTY was globally accepted review and construction methodology and also scientifically designed methodology. In the present study to measure returns from investing in Indian equities, the NSE has been used as an index. As similar to S&P 500 index, the present NSE index was obtained from Yahoo! Finance.

**Nifty Standard deviation**

In order to measure the volatility, the standard deviation for S&P 500 index was calculated. The risk associated with investing in the US equities, the standard deviation calculated are used a proxy. The Standard deviation was calculated using the month's daily returns data and for the individual months, SD is calculated. In the present study in order to capture the combination of ex-ante risk and unexpected risk, the present study used ex-ante risk rather than realized risk. (Roy & Bhanumathy)

**Exchange Rate:**

The number of units of domestic currency obtained per foreign currency has been defined as the nominal exchange rate. In decision making process of an FII investment, the exchange rate plays an important role. This is because there is a considerable loss due to the conversion of foreign currency which results in depreciation of the domestic currency. At the same time there is a high return for the foreign investments whenever there in appreciation of the domestic currency.

**S&P Standard deviation**

In order to measure the volatility, the standard deviation for sensex was calculated. The risk associated with investing in Indian equities, the standard deviation calculated are used a proxy. The Standard deviation was calculated using the month's daily returns data and for the individual months, SD is calculated.

**Lag Variables**

In order to capture the lagged effect of FII investments, two lag variables have been introduced in the model, fiit-1 and fiit-2.

**Description of samples**

**Data Collection**

**3.1.6.1. Data collection Methods**

Any imprecision in the data collection methods would certainly affect the whole results. Thus, it is always this part of the study is a crucial aspect. Primary and secondary data are the two types of data collection available for the present study.

**Data Variable and sources**

| Data variable | Source |
|---|---|
| **FII, Foreign Institutional Data in India (INR)** | Reserve Bank of India Handbook of statistic, 2009 |
| **Indian Inflation data based on WPI** | Reserve Bank of India Handbook of statistic, 2009 |
| **US inflation data** | US bureau of Labor statistics |
| **Daily Return on NSE Index** | www.nseindia.com |

| | |
|---|---|
| **Monthly Return on NSE Index** | Computed by the researcher using daily return |
| **Daily Return on S&P 500 Index** | www.yahoofinance.com |
| **Monthly Return on S&P 500 Index** | Computed by the researcher using daily return |
| **Currency exchange rate (USD=INR currency rates)** | Data from http://www.oanda.com/currency/average |

**Data analysis**

Rationale of the statistical analysis

1. **Stationarity tests**

The regression model as stated above should be estimated after conducting the Stationarity test which analyse the most appropriate form of the trend in the data. Prior to analysis, particularly when using ARMA modelling the data must be transformed to stationary and trend needs to be removed. The test was conducted in order to identify the presence of unit roots (trending data) in all variables included in the study. In the present study researcher adopted "Augmented Dickey-Fuller (ADF) test" by Dickey and Fuller (1979). This test is used to check for the homoscedasticity of residual errors and independency (or deterministic, stochastic or combination of both).

The Augmented Dickey Fuller (ADF) test (1979, 1981) is used for this purpose.

The three different ADF Regression equations are

$$\Delta Y_t = \alpha_1 Y_{t-1} + \sum_{j=1}^{P} \gamma_j \Delta Y_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{P} \gamma_j \Delta Y_{t-j} + \varepsilon_t \ldots\ldots$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 t + \sum_{j=1}^{P} \gamma_j \Delta Y_{t-j} + \varepsilon_t$$

Where et is white noise. The additional lagged terms are included to ensure that the errors are uncorrelated. The tests are based on the null hypothesis (H0): Yt is not I (0). If the calculated DF and ADF statistics are less than their critical values from Fullers table, then the null hypothesis (H0) is accepted and the series are non-stationary or not integrated of order zero.

In the second step we estimate co integration regression using variable having the same order of integration. The cointegration equation estimated by the OLS method is given as

Yt = a0 + a1 Xt + zt

In the third step residuals (Zt) from the cointegration regression are subject to the Stationarity test based on the following equation.

$$(DF)\ \Delta Z_t = \alpha + \beta_0 Z_{t-1} + V_t \ldots\ldots\ldots\ldots\ldots\ldots$$

$$(ADF)\ \Delta Z_t = \alpha + \beta_0 Z_{t-1} + \sum_{i=1}^{k} \beta_i \Delta Z_{t-i} + V_t \ldots\ldots$$

where, $Z_t$ is the residual from equation (6).

The sequential procedure involves testing the most general model first. Since the power of the test is low, if we reject the null hypothesis, we stop at this stage and conclude that there is no unit root. If we do not reject the null hypothesis, we proceed to determine if the trend term is significant under the null of a unit root. If the trend is significant, we retest for the presence of a unit root using the standardized normal significant, we retest for the presence of a unit root using the standardized normal distribution. Otherwise it does not. If the trend is not significant, we estimate equation and test for the presence of a unit root. If the null hypothesis of a unit root is rejected, we conclude that there is no unit root and stop at this point. If the null is not rejected, we test for the significance of the drift terms in the presence of a unit root. If the drift term is significant, we test for a unit root using the standardized normal distribution. If the drift is not significant, we estimate equation (10) and test for a unit root.

2. Autoregressive conditional heteroskedasticity (ARCH)

This model was introduced by Engle (1982), in order to capture the behaviour of the volatility ARCH regression model tool has been used particularly when it is time varying in a high frequency. This model brings the difference between the conditional and the unconditional second order moments. In financial data in particular, traditional econometric models are unable to explain several typical features and using ARCH model, these typical features are treated in the present study.

First, the returns have leptokurtic distribution rather than normal distribution was indicated by Stenius (1991) from stock market data. The reason behind such distribution is due to the discontinuous trading resulted in asset prices jumps and continually markets are not opened, resulted in asset prices jumps which in turn result in returns of both positive and negative. All these features could result in fat tails and excess peakedness which is nothing but leptokurtic distribution (Watshman and Parramore, 2002). Further volatility clustering is the second features, which means that small returns expected to follow small returns and vice versa. In order to address these issues ARCH model, which assumes variance of errors is not constant or changes over time as a function of past errors which is known as heteroskedasticity.

3. General Autoregressive conditional Heteroskedasticity (GARCH)

As a function of past errors together with the lagged values of conditional variance, the GARCH specification allows the past conditional variance to change over time (Bollserslev, 1986). Several studies used GARCH models particularly for the variables such as foreign exchange rates, interest rates and inflation rate (Engle et al, 1987; Kendall and MacDonald, 1989)

4. Breusch Godfrey Serial Correlation Test

In the present in order to assess the serial correlation, the researcher used Breusch Godfrey serial correlation test. This test assumes about the independence of the disturbances from observation to observation. There is the problem of autocorrelation exists, if this assumption is violated the errors in one time period are correlated with their own values in other period. The auto correlated disturbances can occur due to following types of mis-specification

1. Dynamic structure incorrect
2. Functional form incorrect'
3. Explanatory variables omitted

Null hypothesis: Errors are serially independent up to order p

Step 1: Run OLS model $y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \ldots . \beta_k X_{kt} + \varepsilon_t$

Step 2: Calculate predicted residuals

Step 3: Run auxiliary regression

$$\hat{\varepsilon}_t = \rho \hat{\varepsilon}_{t-1} + v_t$$

or with higher order lags—Bruesch-Godfrey test

4. Step 4: T-test on $\hat{\rho}$

**Statistical Analysis**

E-views software has been used to analyze the data. At the 5% significance levels the null hypothesis could be rejected and similarly if the p value was greater than α = 5% which at the 5% significance levels, the alternative hypothesis was rejected.

## Conclusion

As this chapter has argued, the research methodology that is most suited for this study is a quantitative methodology whose framework follows the theoretical model as indicated above. The data used is both primary and secondary in nature. The next chapter will present the results of the analysis carried out based on the statistical tests proposed and gives the conclusions of the objectives of the study.



Chapter IV

Results and Analysis

### 4.1. Introduction:

This chapter focuses on the analysis statistical models proposed in the research methodology to arrive at the aims and objectives of the study. Following the analysis there is a discussion of results where there is comparison of the obtained results with that of the previous research conducted.

### 4.2. Stationary test:

Empirical studies have shown that (Engle and Grander, 1987) that several time series variables are non-stationary or not integrated of order zero. The time series variables considered in this paper are the stock prices and macroeconomic variables.

In order to avoid a 'spurious regression' (Granger and Newbold, 1974) situation the variables in a regression model must be stationary or co integrated. Therefore, in the first step, we perform unit root tests on these time series variables to investigate whether they are stationary or not. Before testing the association between FII and their determinants the variables under study are scrutinized using Augmented Dickey Fuller Test.

**Table 1.** Results of Unit Root Based On Augmented Dickey-Fuller Test

| Variable | Test statistics | Critical value[a] | Conclusion |
|---|---|---|---|
| FII_NET | -7.926 | -2.890 | No unit root |
| INDIAN_INFLATION_DATA | -3.771[c] | -3.455 | No unit root |
| NSE_INDEX | -6.659[d] | -3.455 | No unit root |
| R_SDNRF | -8.089 | -2.890 | No unit root |
| R_SDSRF | -9.689 | -2.890 | No unit root |
| SDNR | -5.878 | -2.890 | No unit root |
| SDNRF | -3.668 [b] | -3.455 | No unit root |
| SDSR | -3.401 | -2.890 | No unit root |
| SDSRF | -3.119 | -2.890 | No unit root |
| SP500_INDEX | -7.373[d] | -3.455 | No unit root |
| US_INFLATION_INDEX | -4.304 [c] | -3.455 | No unit root |
| USD_INR_CR | -6.316 [d] | -3.455 | No unit root |

[a]At 5 percent level of significance

[b]Indicates the ADF model with trend and intercept

[c]indicates the ADF model with trend and intercept and lag=1

[d]indicates the ADF model with trend and intercept; lag=1; First level difference

The above table shows the Stationarity tests on all the variables. The results are presented in above Table 1. As expected, monthly financial variables contains unit root such as Indian inflation data and US inflation index ( Does it contain unit root or not , the table above shows that it doesn't ?? , please clarify). The ADF *t*-test has value t = -7.926, which is smaller than the 5% critical value of -2.890. Therefore the ADF *t*-test rejects the null hypothesis of a trend (at the 5% significance level). Since, the null hypothesis of a trend is rejected by the ADF *F*-test. Thus the trend is deterministic and concludes that the FII are stationary. Similarly, for the variable R_SDNRF, SP500_INDEX, US_INFLATION_INDEX and USD_INR_CR the Augmented Dickey Fuller Test equation for which *t* statistics value are smaller than the critical value at 5% level of significance. However, the Augmented Dickey Fuller Test equation for R_SDNRF, R_SDSRF, SDNR, SDSR and SDSRF which *t* statistics values are greater than critical values at 5% level of significance. Hence the null hypothesis is accepted. The above variables which are stochastic and not determinists converted to stationery using the difference stationery process test.

### 4.3. Prediction of risk:

There is an assumption that the agents are found to form a rational expectation. Therefore in order to calculate the ex ante risk ARMA model is used. The auto correlation function and the partial auto correlation function is used in order to predict the values of SDBR and SDSR. By using the ARMA (1,1) model the values of SDBRF and SDSRF are calculated which in turn help capturing the predictable components of risk associated as depicted in Tables (II a and II b)

**Table II. Estimation of Ex-Ante and Ex-post Risk**

II A. **Estimated ARMA (1, 1) Model for SDBR**

Dependent Variable: SDNR
Method: Least Squares
Date: 09/08/10 Time: 22:33
Sample (adjusted): 2 102
Included observations: 101 after adjustments
Convergence achieved after 17 iterations
MA Backcast: 1

| | Coefficient | Std. Error | t-Statistic |
|---|---|---|---|
| Constant | 0.016150 | 0.003271 | 4.936532 |
| AR(1) | 0.916053 | 0.079604 | 11.50762 |
| MA(1) | -0.657335 | 0.133984 | -4.906083 |

| | | | |
|---|---|---|---|
| R-squared | 0.251355 | Mean dependent var | 0.015384 |
| Adjusted R-squared | 0.236077 | S.D. dependent var | 0.008540 |
| S.E. of regression | 0.007464 | Akaike info criterion | -6.928081 |
| Sum squared residue | 0.005460 | Schwarz criterion | -6.850404 |
| Log likelihood | 352.8681 | Hannan-Quinn criter. | -6.896635 |
| F-statistic | 16.45162 | Durbin-Watson stat | 1.756347 |
| Prob(F-statistic) | 0.000001 | | |

| | |
|---|---|
| Inverted AR Roots | .92 |
| Inverted MA Roots | .66 |

**II. B. Estimated ARMA (1, 1) Model for SDSR**

Dependent Variable: SDSR
Method: Least Squares
Date: 09/08/10 Time: 22:37
Sample (adjusted): 2 102
Included observations: 101 after adjustments
Convergence achieved after 7 iterations
MA Backcast: 1

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Constant | 0.011476 | 0.002221 | 5.167528 | 0.0000 |
| AR(1) | 0.785709 | 0.078569 | 10.00025 | 0.0000 |
| MA(1) | 0.017289 | 0.127866 | 0.135215 | 0.8927 |

| | | | |
|---|---|---|---|
| R-squared | 0.629277 | Mean dependent var | 0.011620 |
| Adjusted R-squared | 0.621711 | S.D. dependent var | 0.007643 |
| S.E. of regression | 0.004701 | Akaike info criterion | -7.852934 |
| Sum squared residue | 0.002166 | Schwarz criterion | -7.775257 |
| Log likelihood | 399.5731 | Hannan-Quinn criter. | -7.821488 |
| F-statistic | 83.17425 | Durbin-Watson stat | 1.987358 |
| Prob(F-statistic) | 0.000000 | | |

| | |
|---|---|
| Inverted AR Roots | .79 |
| Inverted MA Roots | -.02 |

**( Explain this table )**

### 4.4. Model for foreign Institutional Investment

The financial variables always tend to change over time and always smaller changes tend to follow the large changes and vice versa. In the dependent variables, episodes of volatility are generally characterized by large shocks. In order to mimic this phenomenon the conditional variance function is formulated. In the model of regression, from its conditional mean or equivalently a large positive or negative value of error term, a large deviation of dependent variable is represented through a large shock. An irrespective of the signs, the variance of the current error in the ARCH regression model shows an enhanced function of the lagged errors magnitude. Thus, a large error to either sign is followed through the smaller errors of either sign. And similarly, a small error to either sign is followed through the large error of either sign. In conditioning the variance of subsequent errors, the order of the lag q determines the length of time for which a shock persists. Further, if the value of Q tends to be larger, then the volatility will also tend to be larger.

Further it is necessary to look at the difference between “bad news” and “good news” and this is particularly important and need to be cautious when we deal with financial markets. The assets price gets decreased when there is bad news which in turn would decrease the return, causing FII to pull from the market. While, increase return and cause FII to attract will happen whenever there is good news, which in turn results due to asset price increase. Yet, the investor’s sensitivity would be greater when investors invest than the sensitivity of withdrawal. In comparison to their speed to withdraw, their speed to invest will be slower as the investor will be more cautious when investing than withdrawing. The reason for giving asymmetry between the effects of good news and bad news is due to their nature of being risk averse as they tend to react more aggressively to bad news than to good news. In the model FII, researcher has employed TARCH or threshold ARCH in order to capture this phenomenon.

Before regressing FII on D_INDIAN_INFLATION_DATA, D_US_INFLATION_INDEX, D_NSE_INDEX, D_SP500_INDEX, D_SDNRF and SDSRF, the presence of autocorrelation was shown in the Breusch-Godfrey serial correlation LM. Thus, presence of autocorrelation was corrected through reestimated procedure. Since the ARCH effect was present in the re estimated period, researcher tried the ARCH (1) model. However, diagnostic test showed indication of more lags. Hence in the model an attempt was made to include GARC (1, 1). Further, TARCH was estimated in order to account for the possible presence of asymmetry. At the 1 percent level, the asymmetric component is found be significant (Table III). ( This has already been included in the new research methodology)

The estimated model is presented below

**Table III. TARCH Model for FII**

**A. TARCH model for FII with Ex-Post Risk**

Dependent Variable: FII_NET
GARCH = C(12) + C(13)*RESID(-1)^2 + C(14)*RESID(-1)^2*(RESID(-1)<0)
+ C(15)*GARCH(-1)

| | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | 2009.061 | 274.3600 | 7.322717 | 0.0000 |
| **D_INDIAN_INFLATION_DATA** | **-286.0755** | **101.3643** | **-2.822252** | **0.0048** |
| D_US_INFLATION_INDEX | 127.6244 | 169.1187 | 0.754644 | 0.4505 |
| **D_NSE_INDEX** | **14.00093** | **0.938191** | **14.92332** | **0.0000** |
| **D_SP500_INDEX** | **-8.408767** | **-2.035866** | **-4.130315** | **0.0000** |
| D_SDNRF | 24383.28 | 37028.78 | 0.658495 | 0.5102 |
| **SDSRF** | **-56047.03** | **14694.95** | **-3.814033** | **0.0001** |
| R_SDNRF(-1) | -1081.492 | 16313.21 | -0.066295 | 0.9471 |
| **R_SDSRF(-1)** | **123659.8** | **31974.81** | **3.867413** | **0.0001** |
| **SEAS** | **915.4131** | **275.0297** | **3.328415** | **0.0009** |
| **AR(1)** | **0.170298** | **0.055457** | **3.070810** | **0.0021** |
| | Variance Equation | | | |
| C | 17251887 | 14793149 | 1.166208 | 0.2435 |
| RESID(-1)^2 | 0.577082 | 1.069830 | 0.539415 | 0.5896 |
| RESID(-1)^2*(RESID(-1)<0) | 0.767483 | 2.100914 | 0.365309 | 0.7149 |
| GARCH(-1) | 0.052185 | 0.250779 | 0.208091 | 0.8352 |
| GED PARAMETER | 0.575655 | 0.150685 | 3.820242 | 0.0001 |

| | | | |
|---|---|---|---|
| R-squared | 0.374999 | Mean dependent var | 2237.821 |
| Adjusted R-squared | 0.263391 | S.D. dependent var | 5487.986 |
| S.E. of regression | 4710.114 | Akaike info criterion | 19.30975 |
| Sum squared resid | 1.86E+09 | Schwarz criterion | 19.72658 |
| Log likelihood | -949.4876 | Hannan-Quinn criter. | 19.47845 |
| F-statistic | 3.359983 | Durbin-Watson stat | 2.321927 |
| Prob(F-statistic) | 0.000197 | | |

Inverted AR Roots .17

**B. TARCH model for FII without Ex-Post Risk**

Dependent Variable: FII_NET
GARCH = C(11) + C(12)*RESID(-1)^2 + C(13)*RESID(-1)^2*(RESID(-1)<0)
+ C(14)*GARCH(-1)

| | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | 3334.818 | 412.8092 | 8.078352 | 0.0000 |
| **RB(1)** | **-0.099016** | **0.019124** | **-5.177524** | **0.0000** |
| **RP(1)** | **0.114002** | **0.012076** | **9.440166** | **0.0000** |
| D_INDIAN_INFLATION_DATA | -76.14309 | 92.55143 | -0.822711 | 0.4107 |

| | | | | |
|---|---|---|---|---|
| D_US_INFLATION_INDEX | 148.5168 | 83.55299 | 1.777516 | 0.0755 |
| **DUMMY** | **-2568.321** | **57.11360** | **-44.96864** | **0.0000** |
| D_SDNRF | 50066.65 | 28844.76 | 1.735728 | 0.0826 |
| **SDSRF** | **-203191.8** | **25296.36** | **-8.032454** | **0.0000** |
| **SEAS** | **1731.057** | **209.9331** | **8.245753** | **0.0000** |
| AR(1) | 0.178111 | 0.042919 | 4.149944 | 0.0000 |

Variance Equation

| | | | | |
|---|---|---|---|---|
| C | 22703140 | 20360089 | 1.115081 | 0.2648 |
| RESID(-1)^2 | 2.816705 | 2.644626 | 1.065067 | 0.2868 |
| RESID(-1)^2*(RESID(-1)<0) | -1.341777 | 2.578881 | -0.520294 | 0.6029 |
| GARCH(-1) | -0.085815 | 0.109209 | -0.785786 | 0.4320 |
| GED PARAMETER | 0.482718 | 0.142994 | 3.375802 | 0.0007 |

| | | | |
|---|---|---|---|
| R-squared | 0.236387 | Mean dependent var | 2403.197 |
| Adjusted R-squared | 0.089940 | S.D. dependent var | 5817.820 |
| S.E. of regression | 5550.029 | Akaike info criterion | 19.33391 |
| Sum squared resid | 2.25E+09 | Schwarz criterion | 19.75618 |
| Log likelihood | -835.6921 | Hannan-Quinn criter. | 19.50403 |
| F-statistic | 1.614152 | Durbin-Watson stat | 2.156623 |
| Prob(F-statistic) | 0.095587 | | |

| | |
|---|---|
| Inverted AR Roots | .18 |

Estimation Command:

==========

ARCH(THRSH=1,GED,H,BACKCAST=0.7,DERIV=AA) FII_NET C RB(1) RP(1) D_INDIAN_INFLATION_DATA D_US_INFLATION_INDEX D_USD_INR_CR D_SDNRF SDSRF SEAS AR(1)

Estimation Equation:

==========

FII_NET = C(1) + C(2)*RB(1) + C(3)*RP(1) + C(4)*D_INDIAN_INFLATION_DATA + C(5)*D_US_INFLATION_INDEX + C(6)*D_USD_INR_CR + C(7)*D_SDNRF + C(8)*SDSRF + C(9)*SEAS + [AR(1)=C(10)]

GARCH = C(11) + C(12)*RESID(-1)^2 + C(13)*RESID(-1)^2*(RESID(-1)<0) + C(14)*GARCH(-1)

Substituted Coefficients:

==========

FII_NET = 3334.81807679 - 0.0990155291934*RB(1) + 0.114002440652*RP(1) - 76.1430948889*D_INDIAN_INFLATION_DATA + 148.516818536*D_US_INFLATION_INDEX - 2568.32110846*D_USD_INR_CR + 50066.6498502*D_SDNRF - 203191.817953*SDSRF + 1731.05677605*SEAS + [AR(1)=0.178111347896]

GARCH = 22703139.7914 + 2.81670525604*RESID(-1)^2 - 1.34177716223*RESID(-1)^2*(RESID(-1)<0) - 0.0858147201803*GARCH(-1)

**Dependent Variable: FII_NET**

***GARCH = C(11) + C(12)*RESID(-1)^2 + C(13)*RESID(-1)^2*(RESID(-1)<0)***
***+ C(14)*GARCH(-1)***

| | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | 1776.433 | 488.8367 | 3.634001 | 0.0003 |
| RB(1) | -0.144546 | 0.016184 | -8.931365 | 0.0000 |
| RP | -0.290007 | 0.021941 | -13.21776 | 0.0000 |
| D_INDIAN_INFLATION_DATA | 52.24214 | 125.9125 | 0.414908 | 0.6782 |
| D_US_INFLATION_INDEX | 144.7419 | 182.0071 | 0.795254 | 0.4265 |
| D_USD_INR_CR | -3127.086 | 149.9172 | -20.85876 | 0.0000 |
| D_SDNRF | 138884.8 | 56916.25 | 2.440161 | 0.0147 |
| SDSRF | -81758.66 | 30024.25 | -2.723087 | 0.0065 |
| SEAS | 1455.000 | 352.0846 | 4.132530 | 0.0000 |
| AR(1) | 0.224304 | 0.069588 | 3.223316 | 0.0013 |
| | Variance Equation | | | |
| C | 22800405 | 21715638 | 1.049953 | 0.2937 |
| RESID(-1)^2 | 0.714177 | 1.941146 | 0.367915 | 0.7129 |
| RESID(-1)^2*(RESID(-1)<0) | 0.253073 | 2.080520 | 0.121639 | 0.9032 |
| GARCH(-1) | -0.006828 | 0.486130 | -0.014045 | 0.9888 |
| GED PARAMETER | 0.594276 | 0.172451 | 3.446049 | 0.0006 |
| R-squared | 0.249647 | Mean dependent var | | 2407.555 |
| Adjusted R-squared | 0.103746 | S.D. dependent var | | 5851.402 |
| S.E. of regression | 5539.564 | Akaike info criterion | | 19.61499 |
| Sum squared resid | 2.21E+09 | Schwarz criterion | | 20.04015 |
| Log likelihood | -838.2520 | Hannan-Quinn criter. | | 19.78619 |
| F-statistic | 1.711064 | Durbin-Watson stat | | 2.393142 |
| Prob(F-statistic) | 0.072048 | | | |
| Inverted AR Roots | .22 | | | |



The above Tables illustrated that in comparison to good news reactions was more towards bad news among the investors.( - what variable signifies this and how ?) Further, the results indicated highly significant (p<0.0001) for Indian equity return (D_NSE_INDEX) with coefficient value of 14.0 (SE: 0.93). Thus, Indian equity returns are the main driving force for foreign Institutional Investment. In addition, SDNRF was not found to be significant and thus, in the present study inflow of FII was adversely not affected by SDNRF (β=24383.28) – ( are you sure about this because it is a very important determinant in the model paper of Balwant Rai and Bhanumurty) in Ex-ante risk in the domestic stock market. Further, as hypothesized the domestic inflation rate (IND) was found be highly significant (β=-286.07, p=0.0048) and adversely affects FII due to the presence of negative sign. The similar results also found in the study conducted by Agarwal (1997).

The expected negative sign with highly significant at the 5 per cent level (β=-8.8408. p<0.0001) was also found for the return in the foreign market (D_S&P500). This shows that any increase in the U.S stock market returns would affect

adversely the Indian portfolio investment. The foreign markets predictable risk also affects adversely Indian FII flows and as in the model this was highly significant. On FII flowing, the negative impact of SDSRF illustrated the US stock market dominant position. This means, when the markets in the US are adversely affected investors would not invest any more in the market this is also applicable to the foreign institutional investing in India. Further, positive sign (β=127.62) was shown by the inflation rate in the United States (INF), which illustrates that when increase in the US inflation, there is also parallel increase in the Indian FII flow. However, although there is a trend, the results are not significant.

### 4.5. Ex-post risk:

In regards to the ex-post risk, they can be expected to react with a lag since agents can only react to it after it has been observed. In the Indian stock market, Ex-post risk was represented by R_SDNRF and for the US stock market R_SDSRF and in the present study later (US stock market) was found to be highly significant.**(it is not significant in the study , please change)** However, formal was not. This shows that foreign institutional investment flowing into India do seem to be affected by ex-post risk particularly with regards to US stock market. Further the main reason behind the negative association between FII and ex-post risk was when market goes bearish, the decline in the stock price, selling pressure mounts which in turn lead to negative monthly returns. While, monthly returns become positive when the market turns bullish, rallies in stock price due to the market turns bullish which leads to positive association between ex-post risk and FII. Hence, the number of bull/bear phases would lead the net impact of ex-post risk on FII. Moreover, there can be neutralization when there is a possible phases of bear and bull which FII do not affect the ex-post risk.

### 4.6. FII flows and Equity Returns in India:

The previous section of the results has given the importance of the returns from equity. This section employs something called as the causality test which was provided by Granger. This test is important to determine if the presence of one time series would be useful in providing forecast details. The granger's test uses regressions in order to provide interpretations on the set of tests to reveal something with regard to the causality.

In this study there was a pair-wise Granger causality test which is carried out between the returns on a monthly basis on the BSE National Index and the overall inflow of FII into the country. The net inflow is calculated as a proportion of the BSE market capitalization index of the previous month considered. Table (IV) indicates that it is difficult to establish a causal direction. This is because the concept of non causality has been rejected in both the directions which considered at a level of significance of 5%. Therefore when a single lag is considered it is almost impossible to determine which the cause is and which is the effect when it comes to net inflows and rate of equity returns.

**Table IV: Pair wise Granger test – Net inflows versus returns**

Pairwise Granger Causality Tests
Date: 09/14/10 Time: 14:16
Sample: 1 250
Lags: 1

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| RETURNS does not Granger Cause FII_NET_INFLOWS | 247 | 13.9022 | 0.0002 |
| FII_NET_INFLOWS does not Granger Cause RETURNS | | 0.24983 | 0.6176 |

Therefore a time series of lags is considered (returns ). When a series of F tests are conducted on the lagged values of returns (along with lagged vales of net inflows), then the values of returns can be used to provide statistically significant information with regard to the future values of net inflows.

Since the data from the previous table was found to be inconclusive it was seen that there was a need to introduce multiple lags. Daily data of net FII inflows which is available on The SEBI website are used. It is seen that the data for our given time

period is used to obtain a better directionality by implementing the pair wise Granger Causality test with several lags and the results obtained as shown in Table V. The results obtained from this type of testing are found to be more unequivocal in nature. At every single lag it is observed that the Granger Casuality test is found to reject the hypothesis that the returns do not cause net inflows. This result is obtained when it is considered at a 1% level of significance. However when one considers the non causality null hypothesis it is observed that throughout all the lags it is accepted. Therefore the researcher firmly believes that the available data seems to indicate that when inflow of foreign institutional investments are considered they are more of an effect rather than a cause, especially when considered with regard to equity returns from the market in India.

**Table V: Pairwise Granger Causality Tests- With lags**

Pairwise Granger Causality Tests
Date: 09/14/10 Time: 14:16
Sample: 1 250
Lags: 2

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| RETURNS does not Granger Cause FII_NET_INFLOWS | 245 | 9.41428 | 0.0001 |
| FII_NET_INFLOWS does not Granger Cause RETURNS | | 0.15076 | 0.8601 |

Pairwise Granger Causality Tests
Date: 09/14/10 Time: 14:16
Sample: 1 250
Lags: 3

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| RETURNS does not Granger Cause FII_NET_INFLOWS | 243 | 7.44640 | 9.E-05 |
| FII_NET_INFLOWS does not Granger Cause RETURNS | | 0.51821 | 0.6701 |

Pairwise Granger Causality Tests
Date: 09/14/10 Time: 14:16
Sample: 1 250
Lags: 4

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| RETURNS does not Granger Cause FII_NET_INFLOWS | 241 | 5.36467 | 0.0004 |
| FII_NET_INFLOWS does not Granger Cause RETURNS | | 0.73402 | 0.5696 |

Pairwise Granger Causality Tests
Date: 09/14/10 Time: 14:17
Sample: 1 250
Lags: 5

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| RETURNS does not Granger Cause FII_NET_INFLOWS | 239 | 6.25143 | 2.E-05 |
| FII_NET_INFLOWS does not Granger Cause RETURNS | | 0.27387 | 0.9271 |

Pairwise Granger Causality Tests

Date: 09/14/10 Time: 14:17
Sample: 1 250
Lags: 6

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| RETURNS does not Granger Cause FII_NET_INFLOWS | 237 | 5.81306 | 1.E-05 |
| FII_NET_INFLOWS does not Granger Cause RETURNS | | 0.50927 | 0.8010 |

### 4.7. Discussion:

This section of the results and analysis discusses the results obtained and compares them to previous results obtained by other researchers. This section discusses the ADF stationary test results, the volatility factor and finally the inter relationship between net equity returns FII Inflows. (I Corrected this from equity and net returns )

#### 4.7.1. Stationary nature of the variables under study:

The unit root tests were performed on the different time series variables to investigate whether they are stationary or not. It was observed that the null hypothesis was accepted. The variables studied were found to be stochastic and not determinists converted to stationery using the difference stationery process test. This result was found to be quite similar when compared to the results of others. A Similar stationary tests have been conducted by Khan et al (2010) and it was discovered that when the net inflow of FII was considered it was seen that the time series, mean and variance was found to be constant indicating the presence of a stationary in the time series observed. The research conducted by
Kumar (2009) has indicated that there is a need to integrate the stock returns as well as the exchange rate at the order of one in order to obtain a result of stationarity.

#### 4.7.2. Volatility:

The TARCH model adopted has discussed the importance of the volatile nature of the dependent and the independent variables. The result seen here is found to be (as indicated in the result, after table 2 please give whether or not there is volatility, as I am unable to understand.)>

It was observed by Dara Khambata (2000) who had explained that there is extreme volatility when the dependent variables were considered especially in emerging markets. He has indicated that there is a significant decrease in the volatility when the entry of foreign investors is seen. The study has also established that while considering ex ante risk equity returns are the most important factors which are found to influence the net flow of FIIs. The study by the Ministry of Finance of India conducted in 2005 has indicated that the equity returns unlike flow of portfolios is found to have significant evidences of being volatile in nature. The research conducted by Batra (2004) has indicated that there were significant shifts with regard to the structural volatility. He has indicated that these structural results are found to be caused a result of major policy changes including liberalization of FII net inflows into India. However he has also indicated that small policy changes may have only a very benign effect when it comes to the return on stock volatility.

It was also observed from the research by Singh and Mehta (2010) on select Asian market indices, has indicated that while trading volume has a direct impact on the volatile nature of the equity returns, they were unable to find conclusive results when only foreign institutional investments were considered.

### 4.7.3. The relationship between net returns and equity: ( Isnt this supposed to be Equity Returns and Net FII Inflows )

It has been observed that the reactions of stock market returns and FIIs are interdependent on each other. The Granger causality test has indicated that when inflow of foreign institutional investments are considered they are more of an effect rather than a cause, especially when considered with regard to equity returns from the market in India. The research of Chakrabati (2000) also concentrated on the cause effect relationship of net returns and equity. His research also supported the results of this dissertation of the FII inflow being the result and not the cause of equity returns. However his research was found to concentrate on two distinctive period's pre Asian and Post Asian. He has discovered that there was a reversal of causality when one considers the follows and returns in the pre and post Asian crisis period.

Chakrabati (2000) further stresses the importance of a priori modelling when it comes to determination of the cause effect relationship. The Granger causality test can be used to serve as a preliminary check when it comes to determine the cause effect relationship.

Agarwal, Chakrabarti et al (2003) have found in their research that the equity return has a significant and positive impact on the FII. But given the huge volume of investments, foreign investors could play a role of market makers and book their profits, i.e., they can buy financial assets when the prices are declining thereby jacking-up the asset prices and sell when the asset prices are increasing. Hence, there is a possibility of bi-directional relationship between FII and the equity returns.

The daily data from 1999-2002 was analysed by Mukerjee et al. (2002).(mention mukherjees methodology of using daily data and his methodology rationale of taking fii purchases and fii sales instead of taking net inflows) Their results are also found to confirm this chasing behaviour of return of FII. They have discovered a consequence of returns and not purchases is the sale of Indian stocks by foreign investors.

The foremost driver of the stock market returns especially when India is considered is found to be foreign capital return according the study by the financial press(- reference). It has also been discovered that the inflow of capital is found to be the effect and not the cause when the stock market performance is taken into consideration.

The financial press has also made note of four main incidents of susceptibility when it comes to the Indian situation. These incidents are found to influence the Indian economy, and it was viewed that there were certain very harmful shocks found to disturb the economy. They include the following: East-Asian crisis in 1997, Pokhran Nuclear explosion in May 1998 and attendant sanctions, stock market scam in early 2001, and Black Monday of May 17, 2004.

### 4.7.4. Ex ante risk and FII:

In the Indian stock market, Ex-post risk was represented by R_SDNRF and for the US stock market R_SDSRF and in the present study later (US stock market) was found to be highly significant.( ex post was not found to be significant in the earlier study , but ex –ante was found to be significant , please rectify this wherever needed) This shows that foreign institutional investment flowing into India is found to be affected by ex-post risk particularly with regards to US stock market. There have been a number of previous literatures which has studied this risk factor when it comes to the stock market. ( we need to mention these literatures )

Richard W.Sias (1996) has found that a trader-intensified transactions database is employed to investigate the role of institutional investors in closed-end funds and the effect of risk. Empirical results are consistent with the hypothesis that buyers (sellers) of closed-end funds face upward (downward) sloping supply (demand) curves. The results also demonstrate that ownership statistics that there is a risk factor associated with the institutional investors' importance in closed-end funds market.

Rai Kulwant et al (2003) held that the present study tries to examine the determinants of Foreign Institutional Investments in India, which had crossed almost US$ 12 billions by the end of 2002. Given the huge volume of these flows and its impact on the other domestic financial markets understanding the behavior of these flows becomes very important at the time of liberalizing capital account. In this study, by using monthly data, we found that FII inflow depends on stock market returns, inflation rate (both domestic and foreign) and ex-ante risk. In terms of magnitude, the impact of stock market returns and the ex-ante risk turned out to be major determinants of FII inflow. This study did not find any causation running from FII inflow to stock returns as it was found by some studies. Stabilizing the stock market volatility and minimizing the ex-ante risk would help in attracting more FII inflow that has positive impact on the real economy.

### 4.8. Conclusion:

This chapter has provided the analysis of the statistical models proposed in the previous section. There is also a discussion of the results which compares the results of this dissertation with that of previously published work. The following chapter discusses the implications of the study, limitations as well as the recommendations for future research.

## Chapter V
## Conclusion

### 5.1. Introduction:

India is a developing economy which is found to have immense growth and success. There has been a rapid development which is aimed towards making this country as one of the most successful economies in the world in possession of a well developed stock market. As a drive towards this factor a number of decisions were taken by policy makers towards the liberalization of the stock market to improve its efficiency as well as reduce the burden of capital within the country.

As an important step towards that it was seen that there was an opening of the stock markets to foreign investors in the form of FII inflow. This research has been found to contribute to the existing literature on determinants of FII with a focus on India. The research provided a very broad summary on the existing literature with regard to the FII policies and analysis the current trends of FII investments on the Indian Stock Market. This chapter provides the implications, limitations and recommendations for future research.
( this introduction is a bit vague and off-topic slightly , in here we also need to mention what has ultimately been established in our research , both qualitative and through our statistical analysis)

### 5.2. Implications of the study:

There has been a thorough examination of the various determinants of foreign institutional investments. The liberalizations polices which have been depicted above has shown us very clearly that there has been a substantial increase in the flow of foreign capital to India. This increase in the movement of capital is found to influence the growth of the domestic economy. The literature review in this particular dissertation has tried to bring into light the need for monitoring the behaviour of the flow of capital. So far most of the studies conducted have talked about the influence of this inflow on the domestic market. In order to monitor the flow of capital there is a need to study the determinants of foreign institutional investments in India.

To minimize the possible adversary impacts on the economy there is a need to monitor the behaviour of the flows. There is also a need to be aware of determinants of foreign capital, rather than what influences this capital to cross borders.

This dissertation has examined the determinants of foreign institutional investments in India. With the help of monthly data from to this study has examined the significance of risk, returns, inflation and currency rates on Net FII investments. It has also studied the other important factors which have influenced the flow of FII into the country.

The risk considered here is ex ante risk as well as ex-post risk, and not realised risk which is a combination of predictable and unpredictable risk which may therefore may not have an impact on the behaviour of FII inflow. The estimation of econometrics using TARCH procedure has helped the researcher establish the significance of ex-ante risk to Net FII Investments.

The estimation of the empirical estimates are found to be perfectly in accordance with the proposed theoretical model, except for ex-post risk in the U.S. stock market, which has been found to have an adverse effect on the inflow of FII into India. This study has also discovered the presence of a cause effect relationship between the equity returns as well as the net inflow of FII.

**5.3. Limitations of the study:**

An important limitation of this study is that data collection occurred over one particular period. This limitation while addressed in the recommendations for the future may not reflect on a conclusive response. This is because the same study repeated during a better performing market may provide different results. There is also a prospective that other factors external to the influence of the researcher which may cause variations in the result.

The Granger causality used can only serve as a preliminary check for the direction of causality. The orthodox way of doing such analysis would almost always begin with *a priori* modeling of these variables. This is because in financial markets, information flows drive both returns and investment flows; implications about causality between these two variables can also be highly model-specific.

The study is based on NIFTY sample. The NIFTY companies have an external image that they are the best performers in the country. If the sample companies consist of probably a heterogeneous group then the results may give better insight in to relationship of the specific variables.

The data is taken on monthly basis. The data on daily basis can give more positive results.( give reasons why from the Research Methodology of the model dissertation , there is a sub-heading called data wherein you can find this information)

.

**5.4. Recommendations for future research:**

There is a need to conduct a more detailed study using the daily data of stock returns as well as the transactions of FIIs at stock market levels using both Bombay stock exchange and National stock exchange. The same methodology can be used to relate herding and positive feedback trading behaviour of the FIIs.

There can be an examination of the characteristics of institutional and foreign investor stock ownership, and the stock price performance in India and a comparison of the results obtained to another emerging economy like China.

Needless to say, there are numerous other issues which can be identified as prospects for future research. However these two are found to be the most pertinent to this study and those which might have immense practical applications.

**5.5. Conclusion:**

The foreign portfolio flows have become the important source for strengthening and improving the functioning of the domestic capital markets. There is a general understanding that Indian stock market is primarily driven by FIIs. The markets of the country have grown enormously in the past twenty years and liberalizations have played an important role in its development. Risks as well as equity returns are part and parcel of liberalization and policy makers should further liberalize the stock markets for the FIIs by weighing the benefits against the risks of liberalization and take another step towards development.

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## LANGUAGE EDITING SAMPLE 2

**FILE NAME: CE1_CD1_15MED002_RESEARCH PROPOSAL_13_10_2015_8_30_PM**

**TYPE OF WORK: LANGUAGE EDITING +BASIC FORMATTING SERVICES + PROPOSAL**

**RESEARCH PROPOSAL**

**MILITARY CADETS' SLEEPING DURING CLASS HOURS: PERSONALITY PROFILE, STRESSORS, AND HEALTH RISK BEHAVIOURS**

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## 1.0 Introduction

Sleep is an integral aspect of human existence and plays a major role in the day to day functioning of humans. There is no substitute for sleep nor can anyone abstain from sleeping without facing disastrous consequences. Sleep is considered as a state of physical and mental rest wherein an individual is unaware of his or her surroundings and it is a period when they experience a temperate activity. The number of hours slept is inversely proportional to the prevalence of sleepiness. Lack of sleep occurs when a person is not getting the required amount of sleep that is required to sustain appropriate alertness, health and performance and could either be due to a drastic reduction in sleep hours or owing to uneven sleep patterns. Reams of writing exists that outline the adverse impact of sleeplessness that is caused by a person not receiving the requisite amount of sleep required for the human body to rest (Aigboje & Osa-Afiana, 2014). Deprivation of sleep would relate to an absolute absence of sleep over a specific period of time or a reduction in sleep patterns that is optimally required. Sleep deprivation can be attributed to several factors which would include a hectic individual lifestyle and also includes long working hours. A large number of people are afflicted with sleep deprivation. A drastic decrease in sleep patterns or irregular sleep that severely disrupts the sleep cycle can lead to strenuous conditions such as; it can impact the cognitive abilities of the individual concerned, reduce the attention spans and severely affect memory (Orzeł-Gryglewska, 2010).

Sleep deprivation is not uncommon in military life, especially during exercises, demanding training periods and combat; causing the activities both rigorous and strictly enforced (Miller et al., 2008).This situation leaves most of the cadets staying up past midnight in order to complete their homework or their military duties. In addition, cadets also have to wake up early due to the morning activities as well as a mandatory breakfast formation. Miller *et al*. (2009) found that sleep deprivation had an effect on academic performance. When discussing cadets who had performed poorly, faculty members made references to cadets who regularly fell asleep in class who did not seem to remember anything the next day. Since it has become a necessity to demand cognitive functions and thinking abilities from our cadets, it is crucial that the cadets pay the most attention during class hours.

### 1.1 Background of the study

It is for a fact to understand that military cadets are highly regimental in their daily activities. The cadets are expected to be disciplined and obedient. Military are goal-oriented, persistent in nature and have readily acceptance of responsibility. Military life requires behaviour that includes intimidation, drills, routine, and loyalty oaths. These methods are appropriate because the military needs to train soldiers who will follow commands unquestioningly (Starr-Glass, 2011). However, the armed force order becomes taxing to the cadets when additional academic responsibilities and duties are incorporated to their daily lives. The recent year's research has showed that cadets are experiencing learning burnouts, which mainly reflects the lack of motivation and being confused about their own development (Xueren *et al*., 2013). Lack of motivation, especially in the speciality of being a soldier and living in a special environment in military academics, obscures the focus of the cadets. Moreover, the cadets are often physically tired due to daily workouts and by the time the academy class starts, their energy is sapped.

## 2.0 Literature Review

### 2.1 Concept and definition of Sleep deprivation

Sleep deprivation can be defined as a reduction in sleep than what is required to support appropriate awareness, performance and health. It can either be caused by a drastic drop in sleep received or sleep received in intermittent intervals and largely disrupted. Chronic sleep deprivation would relate to an absolute absence of sleep or a drastic reduction in the number of sleeping hours that would generally last over a period of one or two days. An individual is exposed to chronic sleep deprivation when they regularly sleep for few hours than what is necessary for ideal functioning (Cirelli *et al*., 2015). Sleep deprivation as a concept has been recognized as a situation where a person is not getting adequate sleep. Deprivation in sleep can manifest in two forms such as acute or chronic sleep deprivation. As is evident in conditions where individuals lose sleep, sleep deprivation can lead to significant alterations in the cognitive and physical operation of an individual and can also cause mood swings. On the other hand fragmentation of sleep occurs when the regular sleep pattern of an individual is routinely

disturbed, wherein the individual experiences periods of wakefulness within their sleep cycles. General symptoms observed amongst individuals with fragmented sleep would involve a significant rise in objective sleepiness (as evaluated by the Multiple Sleep Latency Test), a drastic reduction in performance of psychomotor functions on several activities that involve activities pertaining to short term memory, alertness, response time and a change in mood (Neylan *et al.*, 2010).

**2.2 Factors influencing sleep deprivation**

Several studies have proved that sleep deprivation among military cadets have caused attention deficit, inability to retain long term memory and decision making (Aigboje & Osa-Afiana, 2014). In congruence to the findings, Miller *et al.* (2011), (Lindsay & Dyche, 2012), (Olsen *et al.*, 2010, 2013) claimed that the critical macro-cognitive activities such as critical thinking, dynamic planning, managing competing demands and exemplifying complex communication, which are inherent to the military environments, were also affected. Moreover, cadets are not able to process the information; in fact, the cadets can't even interpret the details that they have gathered. As sleep deprivation takes its toll on mental tasks and creative performance, sleeping during class hours further worsened and defeats the purpose of cadets attending academic classes.

Miller *et al.* (2011) suggested that daytime napping strategies during the day could possibly be a technique to compensate the cadets' night sleep. Likewise, Lindsay *et al* (2012) agreed that brief naps about 10 to 20 minutes compensated and made sleep deprivation effects more tolerable. On the contrary, Miller et al. (2008) explained that unlike the civilians, the cadets are required to attend all academic classes, meals and activities, so the opportunities for naps or to catch-up with sleep are further cut. Thus, this makes the classroom sessions as the best options to sleep when it is actually crucial for the cadets to pay utmost attention to assimilate knowledge during class hours.

Apart from sleeping deprivation, other stressors were also discussed in several studies. Womble (2003) revealed that cadets might be experiencing emotional problems, social skills deficits, issues with peers and superiors, classroom conditions additionally to teachers approach, teasing and bullying among friends, family problems, health and other related issues that might influence cadets to sleep during class hours. (Miller et al., 2008, 2010) claimed that there are gender differences in sleeping during class hours patterns as male cadets slept less than female cadets. The authors claimed that males demonstrate a more pronounced evening sleeping habits. Furthermore, academic levels equally contributed to sleep issues. Cadets in the first and fourth semester tend to get less sleep than other cadets, according to a longitudinal study conducted by Miller *et al.* (2011). On one hand, cadets who had just arrived were experiencing adjustment stress that often accompanies the indoctrination into military education and training regimen. On the other hand, the senior academic level cadets were seen to have more responsibilities, let it be class or military duties.

**2.3 Previous studies on Sleep deprivation among cadets in general and specific to Malaysia**

Studies on Sleep deprivation among cadets (military education and training environment) are limited in general while majority have been conducted in developed countries like the US. These studies are conducted in Naval operations, sleep in training and education environment or combat and operational environment.

Blassingame (2011) did examined the US navy submarine sleep pattern in four different operational environment such as on leave, on shore duty, in port and at sea. The findings revealed that there is a significant difference in the quality and quantity of sleep pattern in the four operational conditions. The other survey by Gamboa (2002) did focus on environmental constraints and time as factors related to fatigue and sleep among 258 submariners using self-reported measures. The interesting findings from his thesis was that experienced submariners lack adequate sleep thereby they are more likely to drop of service. Subsequent study by Osborn (2004) did evaluate the sleep using wrist-worn activity monitors using experimental study design and monitored the sleep. Later, Miller and Nguyen (2003) and Nguyen (2002) evaluated quality and quantity of sleep using wrist-worn activity using survey methodology. The study by Sawyer (2004) did assessed the self-reported assessment of the mood states using the same participants in the Nguyen (2002) were the findings showed that younger were more angrier than older. Further, authors also found significant interaction between mood and sex. Further, there are other few studies such as by Haynes, (2007) where sleep pattern was evaluated among onboard the USS chung Hoon using actigraphy recordings and daily sleep activity long. In contrast, the study by Mason (2009) and the Green (2009) where they did calculated

the available time required for duty and sleeping time. These studies although shed light on overall sleep pattern, quantity and quality of sleep and methodological variation used to measure the sleep such as self-report or by wrist activity monitors.

The study by Miller *et al*. (2010) through the 4-year longitudinal study investigated sleep pattern of cadets where the authors had followed 80 cadets in a college age population attending the United States Military Academy. Authors in this study evaluated the number of hours that the cadets slept, napping, sleeping during academic year, semester, season, sex, school day or weekend and day of the week. However, the study did evaluated the only the sleep pattern but did not focus on the personality traits, or perceived stress and its impact on academic performance. There are other set of studies did focused on fatigue among US navy (Baldus, 2002; Andrews, 2004).

**2.4 Studies conducted in Malaysia on Sleep deprivation**

A study conducted by Siraj *et al*. (2014) defines sleep as an active, redundant and revocable condition of perceptual detachment from an individual's surroundings that includes a marked indifference to the environment. It also highlighted the importance of sufficient sleep that necessarily contributed to the overall well-being and health of an individual. However, the study also indicated that loss of sleep was a substantial problem that plagued modern society. The objective of this particular study was to probe the sleep patterns of students and their overall performance in day to day life and academics. The study adopted a cross sectional approach and was conducted amongst the students in the 4$^{th}$ year of medical studies at the University Kebangsaan Malaysia [UKM] in the year 2011-2012. The total number of respondents covered during this study included the entire 4$^{th}$ year students that totalled 234 in number. The study evaluated the respondents sleep patterns on the basis of a questionnaire that was distributed to the students.

The questionnaire included relevant questions pertaining to students' demography, sleep habits, ideal sleep and academic performance. The results were arrived at by perusing the data collected through the questionnaire that was distributed amongst the students. The findings of the study revealed that out of the 234 students, 186 students presented a response rate that totalled 79.5 per cent wherein 73 per cent of the students were girls and 69 per cent of the respondents resided within the University campus. The study found that on an average that included weekdays and weekends, 56. 2 per cent of the respondents received sleep for a duration of 6-8 hours, 29.1 per cent received sleep for a duration of 8 hours. Further, the study also revealed that on an average around 53.35 per cent of respondents received irregular sleep during the day time while 34.9 per cent frequently received sleep during day time and subsequently 11.75 per cent of the respondents did not indulge in any day time sleeping whatsoever. To conclude, the findings of the study revealed that students who received sleep for more than 6 hours exhibited a substantially higher level of academic performance. The study recommended that it was necessary for students to understand the importance of sleep and needed to sleep at least for 6-8 hours in order to ensure their good health and well-being and also to maintain their academic scores.

Another study executed by Kamath *et al*. (2014) was of the opinion that sleep was a key aspect that influenced the physical and mental health of any individual. The number of hours of sleep received by a person was instrumental in influencing their rate of metabolism and also helped to regulate their body weight. The aim of the study was to evaluate the cross-sectional relation between the overall duration of sleep with body mass index [BMI] and ratio of waist-hip amongst students in Malaysia. To effectuate the study, a total of 89 Malaysian students involving both male and female were included. These students had a mean age of 21.2 (0.9) years. The ethical validity of the study was ensured by obtaining a clearance from the Institutional Ethics Committee before commencing the study. The study was executed by quizzing the students with regards to their average sleep hours per day. The sleep durations reported by students were classified as less than 6 hours per day (short sleep duration), 6-7 hours per day and greater than 7 hours per day. The study also involved recording the height of the students, their weight, waist-hip circumference. These facets were accurately measured and recorded.

The ratio of BMI and waist-hip was calculated by utilizing the right formula and were indicated as standard deviation. In addition, the number of hours of sleep received was matched with the ratio of BMI and waist-hip by utilizing one way ANOVA. The findings of the study revealed that there did not exist enough statistical evidence that indicated an association of sleep duration and BMI ($p=0.65$) and waist-hip ratio ($p=0.95$). Moreover, the study also revealed that the number of hours of sleep received by the respondents did not have any impact on the BMI or the waist-hip ratio. Further, it was also suggested that the

age and healthy lifestyle pattern of students could be the reason why an apparent lack of sleep did not have an impact on their BMI and waist-hip ratio. The study concluded on the note that there was no significant relation between lack of sleep and increase in BMI and waist-hip ratio amongst Malaysian students.

The above review clearly indicated that the studies did conducted focusing sleep quality, sleeping quantity, and outcome factors such as fatigue and stress due to deprived sleep. Further studies also did measured the sleeping pattern with different tools such self-reported measures, activity log diary and wrist-worn.

**3.0 Research Gap**

This section details the research gap based on the above review. At first, it was observed that there are limited studies being conducted with specific reference to military education and training environment. Secondly, even those studies being carried out were in the United States. It is well known that there would be a slight variation in the mission and set of traditions for each service academy, especially with reference to developing countries context than developed country, therefore it is predicted any findings observed in developed countries would less likely to apply in the developing countries context (Miller et al., 2008). Thirdly, studies conducted elsewhere did showed difference in the quality and quantity of sleep timings. Fourthly, those studies that reported difference in the quality and quantity of sleep timings in fact less likely to compare between the studies due to the methodological variations or measures used as few authors did used self-reported and others wrist-worn method. Therefore, it is unlikely to compare these studies and thereby difficult to conclude the sleep timings across these studies. Fifthly,

Further, this study was conducted in the US; therefore applicability of the findings would further limit to developing countries like Malaysia.

**4.0 Statement of the problem**

Recently, numerous lecturers at the National Defence Military University (NDFU) have complained of cadets sleeping in class. It's worrisome as it might be contagious to other attentive cadets, especially when there is no discreet solution to the above mentioned matter. Moreover, there were limited national studies that explored the profile setting of cadets' characteristics, distinguishing the key factors causing sleep among cadets in class and possible resolutions. Therefore, it is essential to carry out a thorough study among the cadets to understand the problems in engaging alertness in class. In accordance to few studies, the sleeping issue in class might depend on academy levels, gender, academic grades, personal factors, family issues, external factors such as peers, superior officers, classroom matters, social adjustment, and so forth. Thus, this study contradicts to the United States Navy (USN) practices, which applies sleep deprivation techniques as a screening tool to rule out candidates as unsuitable for military life as mentioned in Miller *et al*. (2008); on the contrary, emphasis on effective training in sleep and fatigue management will be given importance to bring positive operational capacities within cadets at the National Defence University of Malaysia.

**5.0 Research Purpose and Objectives**

The purpose of the study is to explore the profile characteristics of cadets sleeping during class hours, the effects of perceived stress on cadets' alertness and attentiveness in class, and to identify the extent of the factors causing stress among cadets and whether unhealthy stress relievers will further affect their sharpness in class and academic performance.

***The research objectives:***

1. To determine the profile characteristics of cadets sleeping during class hours
2. To evaluate the key factors/ stressors contributing to the cadets' sleeping during class hours
3. To investigate whether, and to what extent, the stressors/predictors cause cadets to sleep during class hours
4. To determine if the unhealthy stress relievers further influence sleep during class hours

***Research question for qualitative stage*:**

Understanding experiences and beliefs of military cadets with regard to sleeping during class hours.

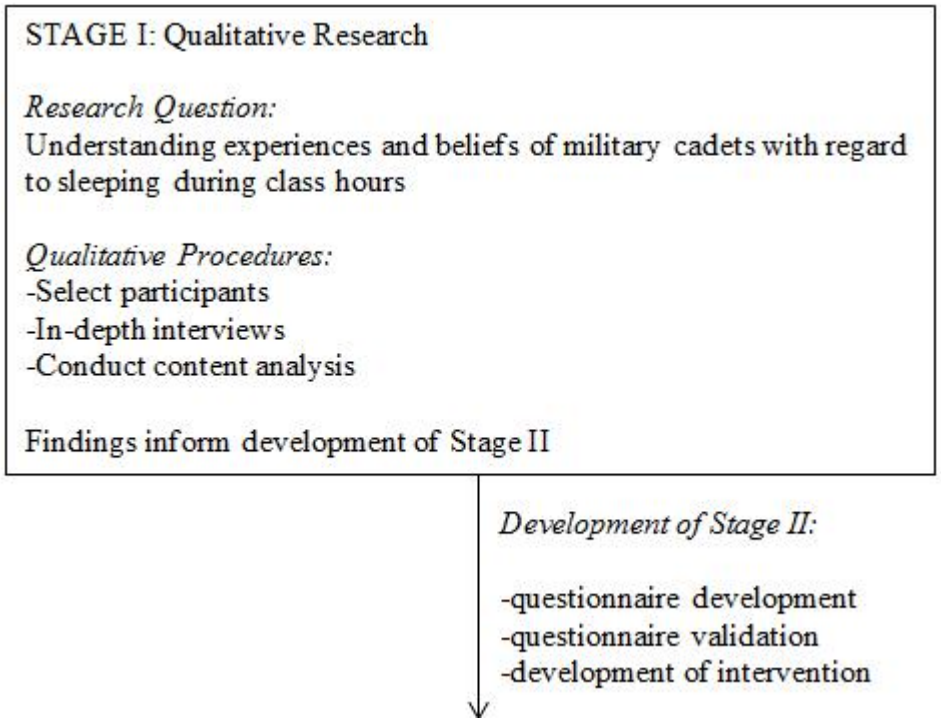
***Research questions for quantitative stage*:**

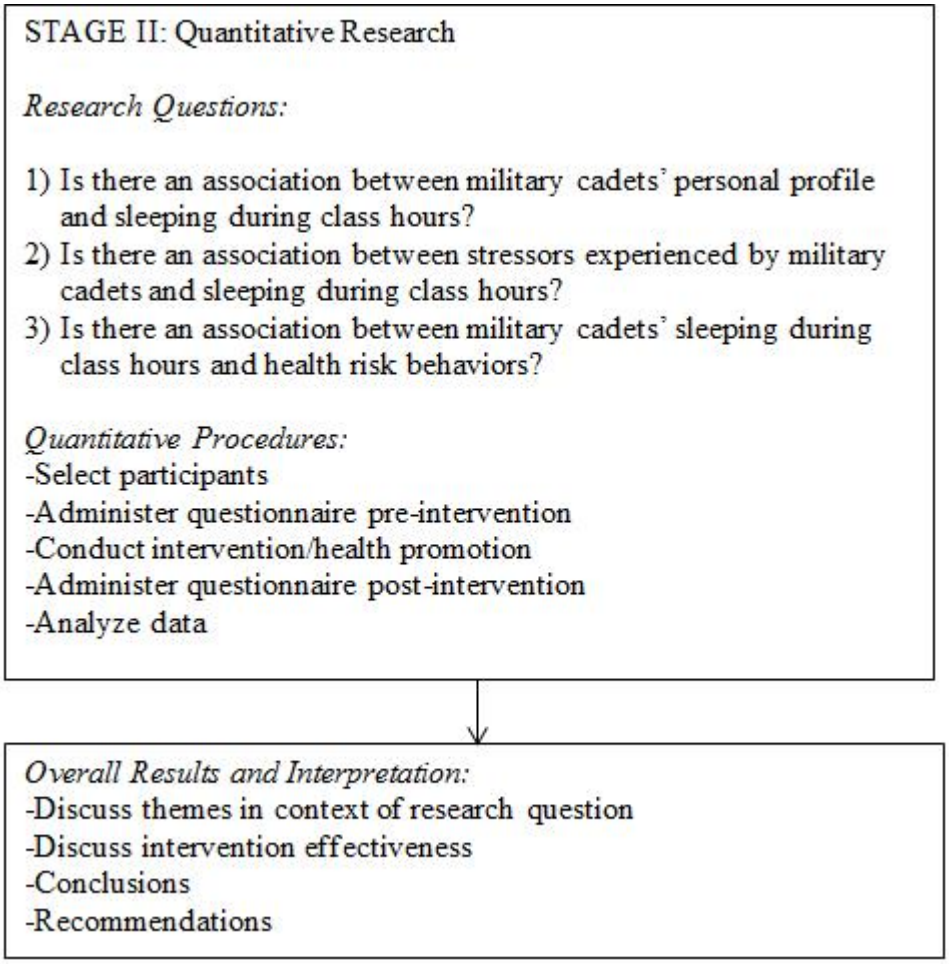
1) Is there an association between military cadets' personal profile and sleeping during class hours?
2) Is there an association between stressors experienced by military cadets and sleeping during class hours?
3) Is there an association between military cadets' sleeping during class hours and health risk behaviours?

**6.0 Proposed Methodology**

This study will use mixed methodology research designs. In stage one; qualitative exploration of military cadets' experience of sleeping during class hours will be conducted via individual in-depth interviews. A semi-structured interview will be developed based on literature findings and their respective guidelines. The questionnaire will be developed in order to engage cadets in accordance to their academic levels on their attitudes of sleeping in class. Cadets will be asked about their own personal influence, from their parents, peers, the nature of admittance to army, classroom set-up, their relationships with teachers, their inclination in studies/passion, their behaviours in terms of performing well academically, household rules of encouraging cadet's well-being, cultures and events that support academic excellence. A content analysis will be performed to identify, group and compare themes providing insights into their understanding of sleeping during class hours. This qualitative stage data will inform the subsequent development of a large-scale quantitative investigation via questionnaire-based survey. Questionnaire development and validation will be done correspondingly. The questions will quantitatively examine sleeping during class hours, the stressors and it's extend and how the stress relieves influence sleeping among military cadets. Analyses of the data will use Chi-square test of independence, MANOVA, ANOVA and factor analysis while the relationship between sleeping, stressors, relievers and specific factors of military culture will be analysed using logistic regression. Military cadets from the UPNM will participate in both stages of the study.

**7.0 Research framework: Diagram**






**8.0 Scope and delimitations**

The study will be conducted at the National Defence University, Malaysia and its cadets will be targeted as samples to this study. The cadets will be selected in accordance to the reports from teachers, peers and self. Average point grades of the cadets will also be considered. The variables will include the sleep issue as the dependent variables and the rest factors to be determined in association with sleep will be the independent variables. In this research, a combination of qualitative and quantitative study methods will be used.

**9.0 Expected Outcome**

The exploration study will enable us to look into profile characteristics towards sleeping in class among young cadets, to understand the current situation by identifying factors contributing to sleeping from cadets, parents, teachers, peers, senior rank officers, classroom aspects and others. Secondly, the study will enable to comprehend the extent of stressors like sleep deprivation, lack of interest in class, poor coping skills, physical tiredness et cetera and eventually, exposing potential introduction of unhealthy stress relievers like smoking, alcohol, drugs, video games and others. The investigation will also serve to examine the sleep issues of cadets in class and to come up with possible solutions for better academic performance in future army soldiers. In addition, this study will also lead to recommendations on the level of sleep needed for the cadets for effective functioning during class hours and at accomplishing army duties.

**10.0 Chapterization**

The followings are the characterization followed in this research.

**Chapter 1—Introduction**

It comprises of introduction to the study, research background, aims, objectives, significance and limitations of the study. Again, this chapter will brief over research questions and a problem statement.

**Chapter 2- Literature review**

This section will contain the reviews of previous studies on the impact of culture on the architecture of rural housing. In addition, this chapter presents research gap identification and sets the tone of the theoretical framework.

**Chapter 3- Research Methodology**

This chapter will provide the details of research methodology like research design, research strategy, research approach, sample design, techniques of data collection, and research ethics.

**Chapter 4- Results and Findings**

This chapter will provide information on primary and secondary data, descriptive statistics, demographic characteristics, sample test, regression and correlation.

**Chapter 5- Conclusion and Recommendations**

This chapter will present results as per the chapter 4 and will also comprise the conclusion after bridging the research objectives with facts inferred from results. Moreover, this chapter will present strategies and suggestions for further research.



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**Timeline/ Gantt chart**

| | April | May | June | July | August | Sept | Oct | Nov | Dec | Jan | Feb | March |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Literature Review | / | / | / | / | / | / | / | / | / | / | / | / |
| Proposal writing | | / | / | | | | | | | | | |
| Discussion with supervisors, team members | | / | / | / | / | / | / | / | / | / | / | / |
| UPNM, Grant & Ethics Approval | | | / | / | | | | | | | | |
| Material Printing/ pamphlets/ brochures | | | | / | / | / | / | / | / | | | |
| Permission from faculty members | | | | | | / | / | / | / | / | / | |
| Promoting study/ talks/ activities | | | | | | / | / | / | / | / | / | |
| Data collection phase 1 | | | | | / | / | | | | | | |
| Transcribe Data & analysis | | | | | / | / | | | | | | |
| Questionnaire development & validation | | | | | | / | / | | | | | |
| Health promotion | | | | | | | / | | | | | |
| Data collection 2 | | | | | | | / | / | | | | |
| Data analysis | | | | | | | | | / | | | |
| Report writing | | | | | | | | | | / | / | / |
| Intervention | | | | | | | | | | / | / | / |

Phase 1: Exploratory Qualitative Research: Thematic and Prompt Questions

Major Themes

1. Socio- demography
2. Motivational (performance, compare with previous years)
3. Why the cadets sleep: sleeping factors
4. Classroom set-up (lecturers) ; formal & informal schedules
5. Stressors- students perspectives of stress
6. Health risk behaviours/ unhealthy stress relievers- smoking, alcohol, drug use, use of network after study hours
7. Interpersonal relationship (parents, peers, seniors)
8. Nutrition-overeating, caffeine use ( association with sleeping)

A. Socio-Demographic questions:

Gender, academy levels, grades, ethnicity, parent's marital status, parental education

B. Individual

1. Did you have any passion or interest to join the army?
2. Or was it your parents' idea?
3. Did you plan to further your studies at the army camp?
4. Did you realise the hardship in the camp to pursue studies?
5. Are you prepared to face the challenges?
6. After enrolment to the camp, do you feel you have made a mistake?
7. What about your high school grades in comparison to the university?

C. Sleep in class

1. Do you sleep in class?
2. How long do you sleep?
3. Why do you think you sleep?
4. Do you do anything to stop sleeping?

D. Nutrition

1. Do you sleep after heavy meals/ breakfast/ lunch?
2. Do you fall asleep after heavy meals?

3. Have you tried small, light snacks before going to class?

4. Have you tried not eating before going to class just to be alert?

5. Have you tried any other methods to keep you awake like coffee, caffeine, sweets, etc.

E. Classroom Set-up

1. What do you think about the teachers?

2. Do you feel happy with the teachers or not?

3. Do you think the teaching is boring, or difficult that you can't follow and tend to sleep?

4. Do you feel the teachers understand your difficulties?

5. What about the teaching hours?

6. What about the classroom interaction?

7. How is the classroom condition?

8. Do your friends think the same about the teacher?

9. Do the teachers punish you in class if caught sleeping?

10. Do you think the teachers have reacted appropriately with the mode of punishment?

F. Coping issues

1. How did you perform in high school? What about now?

2. Are you happy with your grades? Homework, examinations, co-curricular activities?

3. Do you have enough money for expenses in school? Have you experienced any financial problems due to shortage of money?

4. Have you ever got into trouble with the law? Traffic police, policeman, public, school authorities?

G. Stressors

1. Do you feel stress?

2. What do you do to relieve the stress?

3. Does it help?

4. Does the relieve mechanism makes you to pay more attention in class or prevent you from sleeping in class?

H. Alcohol/ Tobacco /Drugs consumption to relieve stress

1. Have you ever taken alcohol? How old were when you first took alcohol?

2. What did you take? Beer, champagne, alcopops, wine, hard liquor? How much or how many drinks?

3. Where and how do you get this alcohol drinks? Do you buy, get from parents or friends?

4. Was there any specific reason to take alcohol? Problems at camp? Pressure from family or friends? Personal, social, economic, cultural, religious reasons?

5. Do you binge drinking? Can you stop drinking? Is there anything that helps you to know when it is time to stop drinking?

6. Have you ever been drunk? How many times? What do you do when you get drunk?

7. Have you ever taken alcohol and other psycho active drugs? What kind of drugs? Cannabis, mandrax, cocaine, marijuana, etc.

8. How frequent do you take these drugs alone or with alcohol?

9. Do you use tobacco products? Cigarettes, E-Cigarettes, Hookah, pipe, cigars, smokeless tobacco?

10. Did you start with drugs first, followed by tobacco or alcohol? Was there some kind of sequence or you took it simultaneously?

11. Alcohol is not as bad as drugs or tobacco or vice versa. What do you think?

12. Do you feel smoking, alcohol or drugs relieve your stress?

13. Upon taking this substance use, do you sleep well at night?

14. Usually, how long does it take or after how many minutes do you sleep upon smoking, or taking drugs or alcohol?

15. What about in class? Do you feel the after effects of this substance prolonging to the next day?

16. What about the use of networking at night? How late can you go? Is it relevant to studies or just as in leisure hours?

17. What about video gaming?

I. Parents

1. How are your parents? Relationship? Bonding? Communication? Problem solving

2. Do your parents try to understand your problem? Spend time with you? Interested to know what is happening on camp? Take an effort to know your friends? And your activities? Your schedule at the camp?

3. Do you think parents should know your sleeping issues? How can that help?

4. How would they react if they knew you were sleeping in class?

J. Peers / Senior officers

1. Do you have many friends at camp? Or outside camp? If not schooling, what do they do?

2. Do your friends/ seniors help you in class? What activities do you get involved in or after class hours?

3. Do you feel or have you ever felt under pressure with your friends or seniors, officers?

4. Do you feel safe being with friends/seniors? Do you hang out with seniors?

5. What about bullying/ raging?

6. What about the senior officers? How is their punishment?

7. Do you share your problems with them?

Plan of analysis

Discussions will be made after listening to the recording by all research team members while consensus/ agreement are being made; which will occur simultaneously & repeatedly:-

1. Identification of themes -To break into manageable data units, synthesizing it, searching for patterns.
2. Open coding- to group words, events, phrases that are similar
3. Audit trail- a scheme to identify these data chunks according to the speaker and the context
4. Axial coding- re-examining the categories identified, to determine how they are linked and to build a conceptual model based on the findings
5. To determine if sufficient data were presented to support the interpretations; does the story make sense; coherence and consistent description
6. The content will be analysed using NVivo, (a qualitative research software); for verification
7. Agreement will be made and read to others; yields to generate working hypotheses

**INFORMED CONSENT- ENGLISH**

**INFORMATION SHEET**

**1. Title:**

Military Cadets' Sleeping During Class Hours: Personality Profile, Stressors, and Health Risk Behaviors

**2. Name of investigator and institution:**

Dr. Mala A. Manickam
National Defense University of Malaysia,
Kem Sungai Besi
57000 Kuala Lumpur.
No.tel:03-90513400
No Faks: 03-90513028

**3. Name of sponsor**:

National Defense University of Malaysia

**4. Introduction**

Sleep deprivation is not uncommon in military life, especially during exercises, demanding training periods and combat; causing the activities to be both rigorous and strictly enforced. The situation becomes taxing when additional academic responsibilities are incorporated to their daily lives. Due to this regimental activities, most of the cadets stay up past midnight in order to complete their homework or their military duties. Furthermore, cadets also have to wake up early due to the morning activities. This leads to the cadets to sleep during class hours to compensate for the previous night sleep. As sleep deprivation takes its toll on mental tasks and creative performance, sleeping during class hours further worsens and defeats the purpose of cadets attending academic classes. Therefore, it is essential to carry out a thorough study among the cadets to understand the problems in engaging alertness in class.

**5. What is the purpose of the study?**

In this study we will talk to cadets and civilian students about what their ideas of sleeping during class hours; pertaining to issues or factors that most likely contribute and the ways cadets' employ to overcome sleeping during class hours. We will invite them to share their knowledge and understanding with us so that we can find ways of meeting their needs to be alert and attentive during class hours.

This study will involve about 700 respondents. Counseling sessions will be conducted to help students to overcome sleeping issues in class, along with efforts to eliminate stress barriers and behavioral modifications to handle health risk behaviors.

**6. What will happen if you decide to take part?**

If you are interested in this study, you will participate in an interview with a researcher or myself in the phase one study. If you do not wish to answer any of the questions during the interview, you may say so and the interviewer will move on to the next question. The interview will take place in (location of the interview], and no one else but the interviewer will be present unless you ask for someone

else to be there. The information recorded is confidential, and no one else except the research team members will have the access to the information documented during your interview.)

Later, in the phase two study, you will have to answer a self-administered questionnaire.

If you do not wish to answer some of the questions included in the questionnaire, you may skip them and move on to the next question. The questionnaire has to be filled in by 2 times in a six month's interval. You may also be required to attend the counseling sessions during the 6 months period. The information recorded is confidential, and no one else except [name of person(s) with access to the information] will have access to the questionnaire

**7. What are your responsibilities when taking part in this study?**

It is important that you answer all the questions completely and honestly when asked by the researchers. This study does not need you to contribute any money.

**8. What are the potential risks and side effects of being in this study?**

None

**9. What are the benefits of being in this study?**

To assist researcher in terms of exploring cadets' sleeping during class hours, examining its contributing stressors and possible risk behaviours and to initiate efforts targeted to help cadets to be attentive in class.

**10. Can the research or my participation be terminated early?**

Researchers or sponsors may terminate this study or terminate your participation in this study at any time.

**11. Will my information be kept private?**

All your information obtained in this study will be kept and handled in a confidential manner, in accordance with applicable laws and/or regulations. When publishing or presenting the study results, your identity will not be revealed without your expressed consent. The sponsor or its affiliates and governmental or regulatory authorities may inspect and copy your records, where appropriate and necessary.

**12. Who should I call if I have questions?**

You can contact this research officer Dr. Mala A. Manickam on mobile connection 012-6546004 if you have any questions about this research. If you have any questions regarding your rights as a participant in this research, please contact: **Secretary of the Ethics and Medical Research, Ministry of Education, Malaysia, by telephone 03-. (don't forget to mention the IRB and Ethics Committee)MM**

**CERTIFICATE OF CONSENT**

**Project Title:** **Military Cadets' Sleeping During Class Hours: Personality Profile, Stressors, and Health Risk Behaviours**

**Principal Investigator:** **Dr. Mala A. Manickam**

**What if you have any questions?**

- You are free to ask any questions regarding this study at any time. You can call the research officer personally. The contact number is **03-22979400(CHECK OUT MM)**.

**Other information about the study**

- If you decide to be in the study, please write your name and sign below. You can also withdraw from the study when you no longer wish to participate. A copy of this agreement form will be returned to you for your referral upon your withdrawal from the study.

☐ Yes, I wish to participate
☐ No, I don't wish to participate

_____ _____ _____

Name Signature Date



Language editing with correcting sample 2

Subject: chemistry |life science

# Carbon dioxide absorption through ceramic membrane in ~~different~~ ~~water~~different water

## Abstract

~~An attempt has been made to assess t~~The efficiency of clay alumina based ceramic membrane for the absorption of Carbon ~~D~~dioxide ($Co_2$) in various types of water was investigated~~.~~ The dissolutions of $Co_2$~~carbon dioxide~~ are observed for three different types of water – tap ~~water~~and simulated water of Central Glass and Ceramic Research Institute (CGCRI) Kolkata, and ~~simulated sea water prepared in the CGCRI laboratory~~ and milli-Q water (resistance of 18.2 Ω). The absorption of $Co_2$~~Carbon Dioxide absorption set up~~ was with porous tubular ceramic membrane module having a contact surface area 6329.86 $mm^2$ ~~is used for the experiment~~. The objective of this work is to present experimental data that would show absorption efficiencies of different types of ~~the above mentioned three different types of~~ water, their compositions after absorption, physical and chemical nature, the effect of temperature, rate of dissolution, and pH. ~~etc~~.

**Key words:** $CO_2$ dissolution, absorption~~, membrane~~, membrane contactor, Henry's law, natural water

## Introduction

Due to the industrial revolution, there is a continuous emission and absorption of greenhouse gases in the atmosphere which resulted in ~~Global warming or~~ the continual and significant rise in the average temperature of the earth[12]. ~~is mainly caused by the emission of greenhouse gases into the atmosphere.[1] The greenhouse gases absorb and radiate harmful infrared rays and radiate them into the atmosphere, increasing the earth's temperature by significant amount.[2]~~ $Co_2$ was found to be ~~O~~one of the most hazardous greenhouse gases on the earth's atmosphere ~~is Carbon Dioxide. The emission of Carbon Dioxide into the earth's atmosphere has increased manifold over the past three decades because of the industrial revolution. It is estimated that the concentration of Carbon Dioxide~~ which has increased from 290 ppm in 1900 to about 400 ppm at present.[3] Approximately 60% of Global emissions of gas was due to $Co_2$. ~~Carbon Dioxide gas contributes to more than 60% of global emissions because of the large of gas that is produced~~.[4] Figure 1 show~~s~~ the global emissions of $Co_2$~~CO2~~ emission by sector. In order to mitigate global climate change concern, researchers in the past made an attempt to capture and sequestrate the emission of $Co_2$ before it released into the atmosphere. This approach would capture $Co_2$ from large sources, such as unmineable coal seams, saline formations, depleted oil and gas fields. ~~alleviate the effects of global warming caused by the emission of carbon dioxide, it is necessary to capture and store the gas before it is released into the atmosphere.~~ Several ~~There are several~~ technologies such as chemical[5], and physical absorption[6], biological[7] and geological sequestration[8], and catalytic conversion ~~that can be~~ are applied for $Co_2$ ~~Carbon Dioxide sequestration~~ sequestration. ~~or the capture and storage of Carbon Dioxide. They are Chemical Absorption of Carbon Dioxide,[5] Physical Absorption of Carbon Dioxide,[6] Biological Sequestration of Carbon Dioxide,[7] Geological Sequestration of Carbon Dioxide8 and Catalytic Conversions of Carbon Dioxide.[9]~~

Despite several technologies, ~~M~~membrane separation is one of the key chemisorptions processes used for the capture and sequestration~~storage~~ of $Co_2$ ~~carbon dioxide~~.[10] The membrane processes used include membrane gas-separation,[11] and sequestration through membrane contactors[12], ~~etc~~. Several researchers in the past ~~A lot of researchers~~ have carried out $Co_2$~~Carbon Dioxide~~ sequestration using polymer membranes due to its reliability, scalability, easy operation and low costs membranes[13]~~.because the membranes are easy to operate and give reliable performances. Moreover polymeric membranes are easy to scale up and are low cost membranes, thus making them desirable among many~~.[13] In comparison to other conventional technologies, ~~M~~membrane contactors are

advantageous ~~compared to other conventional technologies~~ because of their high interfacial contact area, their ability to withstand unlimited load, and enabl~~ing~~ed mass transfer free of dispersion.[14] Polymeric hollow fiber membrane contactors have been used by ~~R~~ Naim et al (2012) for stripping $Co_2$~~Carbon Dioxide~~ using diethanolamine solution.[15] However, ~~But~~ fouling of polymeric membranes was~~is~~ common that lead to ~~leading to~~ low flux through the membrane. In addition, ~~T~~the ~~polymeric~~ membrane~~s~~ lack sufficient mechanical strength and are mostly hydrophobic in nature.[16] Due to these limitations, ~~Because of these disadvantages,~~ other types of membranes and membrane contactors were considered for effective sequestration of $Co_2$~~Carbon Dioxide~~. Ceramic membrane contactors ~~-~~are found to be cost effective, ~~-and have~~ withstand very high temperature, pressure, ~~-and~~ high chemical stability, and ~~high~~ durability. As a result, the probability of corrosion was less and resists ~~they do not corrode easily and can resist very~~ high temperatures, ~~-and~~ pressures and strong chemicals. They are an excellent alternative to polymeric membranes when it comes to $Co_2$~~Carbon Dioxide~~ capture.[17]

Given this advantage, ~~In the present study~~the aim of this study was to investigate ~~,~~ the efficiency of a ceramic membrane contactor to capture $Co_2$~~Carbon Dioxide~~ by the phenomenon of physical absorption ~~is tested.~~ The~~i~~s study aimed to ~~-aim of the work is to~~ prepare a water saturated with $Co_2$ (medium saturated), which has ~~medium saturated with Carbon Dioxide. Water saturated with Carbon Dioxide has~~ several useful applications. For example, carbonated water injected into oil ameliorates oil recovery process and also ~~helps~~ assists in ~~storing the~~ $Co_2$ storage ~~Carbon Dioxide~~ which is retained in the oil.[18] Carbonated water can also be used for mixing cement and the properties of the carbonated mix are found to be significantly different from that of a non-carbonated mix.[19] Carbonated water ~~is very frequently~~was frequently used in photo-bioreactors. The carbonated medium prepared may be used in the photo bioreactor as an even more saturated source of carbonated water.[20] [**Reference required**]. Soft drinks and alcoholic beverages are prepared from carbonated water and also widely used in ~~. Carbonated water is also used in~~ cooking.[21]

In this work an attempt has been made ~~taken~~ to assess the feasibility of $Co_2$~~carbon dioxide~~ dissolution ~~feasibility~~ in natural water bodies and the influence of ionic solutes, organic compounds, and particulate matters on the dissolution of $Co_2$~~**Carbon Dioxide**~~ in water. $Co_2$~~Carbon Dioxide~~ and water react to form four different species [CO2 (aq), $H_2CO_3$(aq), $HCO_3$-(aq) and $CO_{32}$ -(aq)] ~~etc.~~[22], ~~-A~~as a group, these are called 'carbonate species'. The formation of these species ~~helps~~ enables in the dissolution of $Co_2$~~CO2.~~ At equilibrium the reaction mechanism ~~is~~ was as follows:

$Co_2$ ~~CO2~~(g) = $Co_2$ ~~CO2~~(aq) (1)

$Co_2$ ~~CO2~~(aq) + $H_2$~~2~~O = $H_2$~~2~~$CO_3$(aq) (2)

$H_2CO_3$ ~~H2CO3~~(aq) + $H_2O$ = HO $Co_2$~~CO2~~ -(aq) + $H_3O$+(aq) (3)

$HCO_3$~~HOCO2~~ -(aq) + $H_2$~~2~~O = $CO_{32}$_ + $H_3O$+(aq). (4)

The species $H_2CO_3$ ~~is~~ was estimated to ~~exist~~exist for only a~~one~~ nanosecond and its concentration is extremely less compared to the $CO_2$ species (a few per mil of $CO_2$). Mathematically, it is possible to eliminate the $H_2CO_3$ species and the equation in terms of equilibrium constants can be written as:

$[HOCO_2\text{-(aq)}]/[\ CO_2(aq) = 3.0 * 107[OH\text{-}]$ (5)

Compared to $CO_2$ (aq), the bicarbonate species dominates and owing to the presence of a high concentration of OH-, a direct route for bicarbonate formation ~~is~~ was obtained as follows: [23]

$CO_2$ ~~2~~(aq) + OH-(aq) = $HOCO_2$~~2~~ -(aq). (6)

For the experiment, three types of water, namely, seawater, distilled water and tap water have been used to absorb $CO_2$ ~~Carbon Dioxide~~ with the help of a ceramic membrane contactor. Temperature and pressure affects the solubility of $CO_2$ ~~Carbon dioxide~~ in water provided that the parameters are in equilibrium with the concentration of ion~~s~~ and pH~~, pH~~ of the medium are constant ~~etc~~.[24] The mass transfer coefficient for each of the different types of water has been calculated and compared with other experimental results from literature.

## Materials and Methods

### *Materials used and Apparatus description*

Water from various sources was used for the experiment: a) Tap water taken from CGCRI, b) Milliq water with a resistance of 18.2 Ω taken from CGCRI laboratory, c) simulated~~Simulated~~ sea water

prepared in the CGCRI ~~laboratory G~~gas containing 99.9% Carbon Dioxide and 99.9% Nitrogen is purchased from BOC. Table 1 ~~shows~~show the weight compositions and physical characteristics of water used in the study while ~~.T~~the schematic diagram for the ~~e~~ experimental setup is ~~xperimental set-up is~~was shown in **Figure 1.** The gas-liquid contactor module made of tubular ceramic membrane (three in number) in line ~~is~~ was connected to a feed water tank with a capacity of 2.5 liters and a pump ~~which is~~was fitted for circulating feed through the membrane module. The flow rate through the magnetic drive chemical process pump ~~is~~ was 750 ml/min. The ceramic membranes are made from 80% and 20% clay,~~m 80%~~ alumina with an ~~and 20% clay and they have an~~ outer (O.D) and inner diameter (O.D.) of 10 mm ~~and an inner diameter (I.D.) of~~ and 7 mm respectively. The average pore size of the membranes ~~i~~was~~s~~ 0.5 to 1.5 micron with ~~. The membranes have~~ a contact area of 5.3298*103 $mm^2$ and a ~~and a~~ packing density of 41.52443 $m^2/m^3$ (total contact surface of the module~~ace area~~ /total volume of module). Effective length of each membrane ~~is~~was 125.6 mm, ~~and~~ thickness of the wall ~~of each membrane is~~was 2.58 mm and the ~~. The~~ total volume of the module ~~is~~was 152435.6 mm3. The membranes are manufactured by the ~~Central Glass and Ceramic Research Institute~~CGCRI **(Figure 1)** **(Table 1).**

A display of the experimental set-up used and details of the apparatus are shown in Figure 2. A source line from gas cylinders that constitutes~~s~~ pressure reducer valves, pressure gauge, flow meters and ~~is~~ are connected to a mixing chamber in turn ~~which is connected~~ to the membrane module. The feed tank made of stainless steel has a rectangular cubic structure with a capacity of 2.5 liters. It is connected to the membrane module and a magnetic drive chemical process pump. The two ends of the three-membrane Perspex cylindrical module are connected to the feed tank and pump respectively.

***Method***

The experiment ~~is~~ was carried out with milli-q water, tap water from CGCRI, Dhakuria lake water, Ichamati river water and simulated sea water. The simulated sea water ~~is~~ was prepared in CGCRI laboratory by mixing 3.5 % sodium chloride with milli-q water. The feed tank ~~is~~ was filled with 2.2 liters of feed (for each type of water) and ~~. The feed is~~ circulated at 750 ml/min through the tube side of the module via the magnetic drive chemical pump. Simultaneously $CO_2$ ~~Carbon Dioxide~~ gas (15%, 20% and 100% $CO_2$ ~~Carbon Dioxide~~ in a mixture of $CO_2$ ~~Carbon Dioxide~~ and Nitrogen gas) ~~is~~was passed through

the shell side at the rate of 200 ml/min. The partial pressure of $CO_2$ ~~Carbon Dioxide~~ in the gas mixture ~~is~~ was 0.10 Kg/cm2. For each type of water, samples are collected at regular intervals of time and the various parameters such as pH, conductivity, turbidity, TDS, and alkalinity ~~etc. are~~are measured. The total dissolved ~~Carbon Dioxid~~$CO_2$ ~~e~~ in the aqueous solution was~~is~~ calculated by sample titration with ~~titrating the samples with~~ sodium hydroxide to estimate ~~and~~ the amount of ~~estimating the amount of~~ $HOCO_2^-$ ions ~~.~~ **(Figure 2)**

***Characterization of tubular ceramic membrane elements***

Tubular ceramic membranes with 10mm ~~od~~ OD 7mm id ~~i~~wass used in this $CO_2$ ~~carbon dioxide capture~~ sequestration experiments. Characterizations of these elements are done by XRD, FESEM, Chemical analysis and porosity, and pore size distributions,

Fig. a shows the pore size and morphology of the prepared clay alumina based ceramic tubular membrane (10mm od 7mm id). The slightly rough surface indicates that these particles are essentially secondary agglomerates of finer grains. There ~~is~~ was a linear rod shaped crystal formation and nearly disc like structures. The micrograph showed different morphologies and their pore size varied in narrow different ranges. It was found that many fine ~~-~~deep penetrated pores denoted in FESEM. ~~-~~Fig 3 ~~Generally~~ some pores exhibit ~~a~~an irregular structures this make better surface contact with gas phase $co_2$ gas mixture and liquid phase natural water two phases.

The XRD patterns of membrane elements are shown in Fig. 4~~.~~ which ~~S~~shows sharper crystalline clay alumna compounds like $Al_2O_3$, $SiO_2$ and $Al_6Si_2O_{13}$. Further, XRD shows corresponding peaks of this compounds and ~~. it is~~ calcined at $1350^0$C. The above compounds are inert towards natural water ~~natural water~~, and strong acid or base and ~~. It~~ seems to be agglomeration nanoparticles which forms ~~forming~~ perforation. Fig 5 shows the ~~P~~pore size distribution graph, where ~~fig.5. shows~~ some pores are with diameters as small as 0.02 µm and some with as high as > 1 µm. A close look at these micrographs reveals that all the large pores are inter-connected through small pores. Thus, the porosity and pore size distributions of ~~these sintered tube~~these sintered tubes have an immense scope in separation **(Figure 3, 4, 5)**.

## Result and discussion

### *Calculations:*

Formula used for calculating the Overall Mass Transfer Coefficient:

$K_o = Q_L/A * (C_{out} - C_{in})/ \Delta C_m$ .....(A)

Where

QL = Liquid flow rate = 750 ml/min = (750*10^3)/60 $mm^3$/sec

A= Area of contact = 6.3298*10^3 mm2

$C_{out}$ = Outlet concentration of $CO_2$ i.e. the bulk concentration of $CO_2$ (moles/liter)

$C_{in}$ = Inlet concentration of $CO_2$ (to be calculated) (moles/liter)

$\Delta C_m = (C_{out} - C_{in})/\ln (C_{out}/C_{in})$ .....(B)

Therefore from (B) equation (A) can be written as,

$K_o = Q_L/A * (C_{out} - C_{in})/ \{(C_{out} - C_{in})/\ln (C_{out}/C_{in})\}$ mm/sec

or, $K_o = Q_L/A * \ln (C_{out}/C_{in}) * 1/1000$ m/sec

### *Finding the inlet concentration of $CO_2$:*

200 ml 0.00623(N) NaOH was titrated against three types of water (MiliQ water, ~~Simulated~~simulated seawater, Tap water) which were kept in open air for $CO_2$ absorption. Samples of

water were collected after regular intervals of time and titrated against the known concentration of NaOH. The amount of $CO_2$ absorbed ~~is~~was noted which provides ~~found out and that gives~~ the inlet concentration of $CO_2$

***Values of Overall Mass Transfer Coefficients found from literature***

For hollow fiber membrane contactor

Gas used: $CO_2$

Solvent used: Water

**Ko = 0.0000476122 m/sec [25] (Table 2)**

The values of the ~~O~~overall m~~M~~ass ~~T~~transfer ~~C~~coefficients are found to be about 100 times more than the values found in literature. The reason behind such a diversion ~~is~~ was that, ~~in~~ the system used for the $CO_2$ experiment ~~Carbon Dioxide is~~was purged through a highly porous membrane, which increased the contact area. ~~. Hence the contact area increases.~~ Further, the gas once more contacted with the ~~Moreover, the gas again comes in contact with the~~ liquid in the tank and mass transfer occurs due to the scrubbing effect. As a result, both the rate of mass transfer and hence the overall mass transfer coefficient increases. Yet, if the system been ~~Had the system been~~ a normal membrane contactor, there was a possibility of much ~~the overall mass~~lesser mass transfer coefficients ~~would be much less~~ than the values calculated from the experimental data.

***Comparison of CO2 absorption by different water***

Solubility of gas in high salt electrolyte solutions ~~are~~ was usually smaller than that of normal water. Further, increase in ~~As~~ salt concentration ~~increases~~ lead to decrease in $CO_2$ dissolution ~~decreases.~~[26, 27] ~~Simulated~~In this experiment simulated sea water used ~~in experiment have~~ had heavy salinity (55% chloride of total TDS 10556 ppm of Na+) ~~and its~~with pH ~~is~~of 8.6. Although the ~~Though the~~ pH was higher still ~~is higher, its~~ it's the dissolution capability ~~is~~was lower in seawater because ~~of~~

~~higher~~of higher salinity. The equilibrium values of dissolved $CO_2$ ~~carbon dioxide~~ obtained ~~were~~was lower than tap water as it ~~. It~~ absorbs around 42 mg per ~~litre~~liter of water. In ~~in~~ the case of experiment with 15~~% composition~~% composition of $CO_2$ and 200 mg per liter, the absorption was ~~in the experiment with~~ 99.9% $CO_2$. The major difference between seawater and other water are ~~is~~ the total concentration and the relative proportion of ions dissolved in the solution (~~t~~Table no 1). Seawater contains more salt causing a solvent effect as compared with other water. [28] On the other hand, the higher concentration of salinity decreases Henry's constant, $H_e$, due to salting-out effect (high concentration of Cl- ions depresses formation of $CO_2$-, $HCO_3$-). Higher salinity led the lower dissolution at equilibrium and did not significantly affect the absorption rate or the slope of the dissolution curves at the beginning of $CO_2$ absorption process~~,~~ But salting-out effect rather significantly depresses $CO_2$ absorption while the solvent effect enhancing $CO_2$ absorption ~~is~~ was very weak.[29] The results suggest that the salting-out effect ~~overcame~~ override the solvent effect, this resulted in ~~and as a result caused the decrease in~~ dissolution decrease at equilibrium in our experiments. ( **Figure 6, Figure 7, Figure 8)**

The characteristics of Milli-Q used in ~~this experiments~~this experiment were ~~are~~ shown in T~~t~~able 1. Milli-Q water ha~~s~~d ~~very~~ less ionic compounds ~~.~~while metallic ions like Na+ K+ Ca2+ Mg2+ are not detectible with -Hach digital multi parameter water analyzer- and shows conductivity of 2.02 µS/cm, 0.18 NTU turbidity and 1mg/l TDS. Further, Milliq ~~. It has an~~shows an acidic nature with pH 6.2 to 3.8~~.~~ and this is because~~A~~ according to berrum plot, $CO_2$ dissolution will be less in lower pH value as dissolution produces acidic products. ~~fig 1~~ Milli-Q water shows comparatively lower absorption due to increase in the~~.~~ $CO_2$ absorption ~~increases~~ when products radicals are stable in water as shown in Fig 1. ~~m~~Metallic ions like $Ca^{2+}$ $Mg^{2+}$ $k^+$ $Na^+$ ~~etc~~ stabilizes negative radicals which formed (bicarbonate ($HCO_3^-$), carbonate ion ($CO_3^{2-}$)) from dissolution, while absence of these components leads lower reaction enhancement factor and solvent effect

Tap water has got comparatively higher absorption with a ~~. It has a~~ pH of 7.6. Salting out effect was not prominent as like in the sea water. It shows higher reaction enhancement factor due to the presence adequate amount of Ca2+ Mg2+ (having high $CO_2$ affinity) ions. ~~These ions enhance~~These ions enhance stabilization of $CO_3^{2-}$and $HOCO_2^-$ by weathering and metamorphism process[30]. In case of 15%and 20% co2 composition, tap water shows comparatively higher absorption than that of Milli-Q water and sea water. Tap water ~~have~~has considerable increment in case of experiment with 99.9% $CO_2$ composition, which ~~. It~~ implicate the effect of partial pressure was

considerably dominant (Hentrys law). This increment in absorption reveals that it might not saturate from 15 and 20% carbon dioxide compositions.

## Conclusion

~~Carbon dioxide absorption through ceramic membrane in different water~~ The carbon dioxide absorption through ceramic membrane was compared using the ~~T~~three different types of water ~~were~~ ~~used~~ as a solvent. Later, ~~for the absorption of carbon dioxide using porous tubular ceramic membranes.~~ ~~T~~the mass transfer coefficient was calculated at ~~was~~ about 100 times higher than the values obtained from literature indicating more absorption of carbon dioxide~~Carbon Dioxide~~. This was mainly ~~because~~ ~~of~~due ~~the~~to the combined effect of membrane ~~contacting,~~contacting; reactive absorption and scrubbing effect in the ~~system~~ system which is used for the experiment. Since these combined effect which increases the absorption capacity and also ~~, thereby~~ increasing the membrane efficiency, therefore the system can be successfully and effectively used for the absorption of carbon dioxide by ~~Carbon Dioxide~~ using other solvents and hence this effect support the ~~helping in~~ Carbon dioxide sequestration.

**Acknowledgements:** The financial support of the CSIR Supra Institutional Project …… is gratefully acknowledged.

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## Tables and Figures

### List of Tables

### Table I: Characteristics of water from different Sources

| Water from different sources | Conductivity [µS/cm] | Turbidity [NTU] | pH | TDS [mg/l] | Na [ppm] | K [ppm] | Ca [ppm] | Mg [ppm] |
|---|---|---|---|---|---|---|---|---|
| Milli-Q water | 2.02 | 0.18 | 5.9 | 1.0 | N D | N D | N D | N D |
| Tap water | 170 | 3.36 | 6.9 | 85.0 | 17.2 | 2.84 | 35.99 | 8.85 |
| Sea water | 31287 | 0.53 | 5.25 | 20403 | 10556 | 380 | 400 | 1272 |

### Table II: Calculated values of Overall Mass Transfer Coefficients

| Experiment No | Type of water | Inlet concentration of $CO_2$(moles/liter), $C_{in}$ | Outlet concentration of $CO_2$(moles/liter), $C_{out}$ | In ($C_{out}/C_{in}$) | Overall Mass Transfer Coefficient, $K_o$ (m/sec) |
|---|---|---|---|---|---|
| 1 | MiliQ water | 0.0000056636 | 0.0000120697 | 0.7566384474 | 0.00149 |
| | Tap water | 0.0000028318 | 0.000024666 | 2.8159824476 | 0.00556 |
| | Simulated Seawater | 0.00000255 | 0.0000473182 | 2.269332418 | 0.00448 |

## List of Figures

Fig. 1- Carbon dioxide dissolution lab scale setup

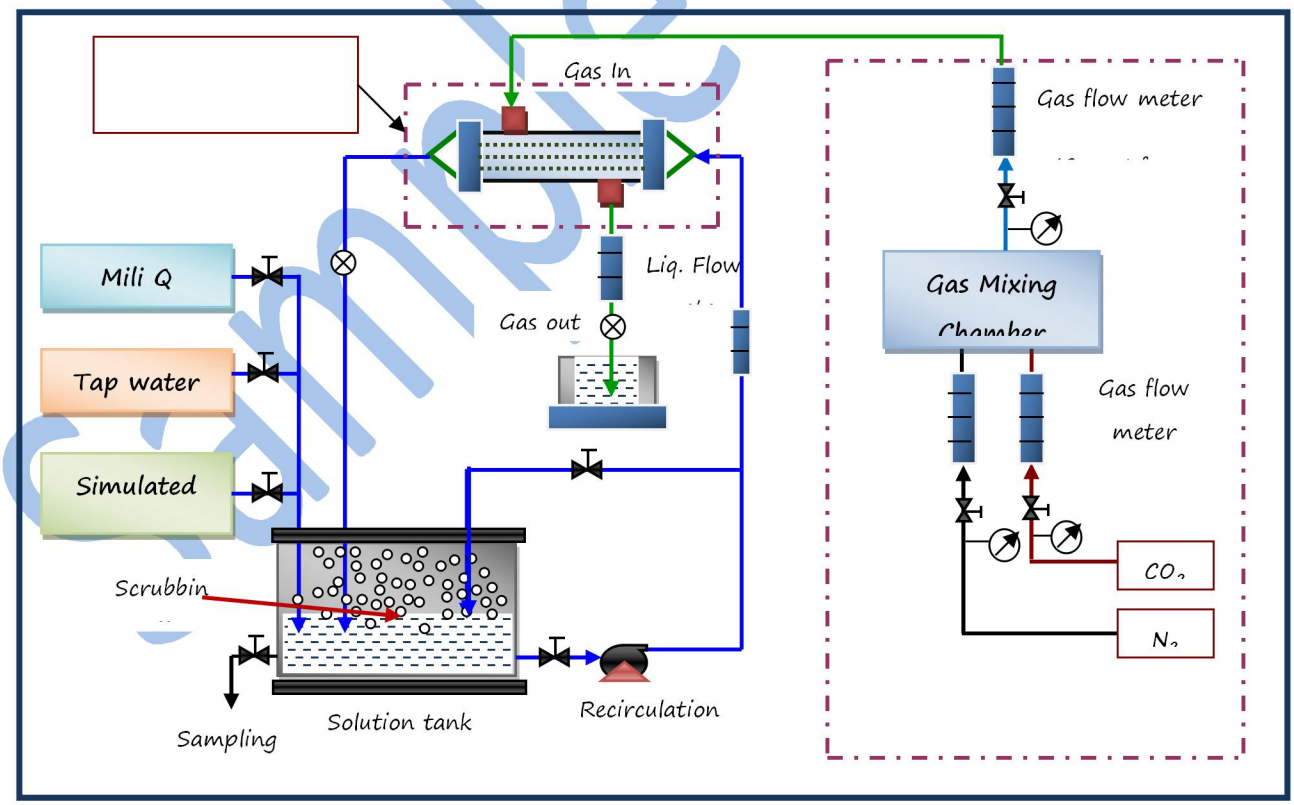


Fig. 2- Ceramic Membrane based Contactor setup for $CO_2$ capturing

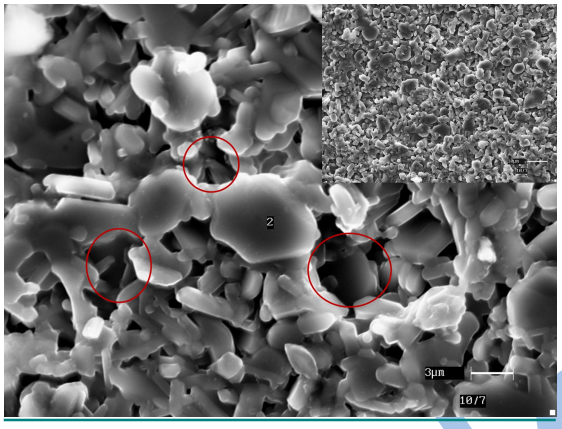


Fig. 3- FESEM of surface of tubular element (10mm od/7mm id)

FESEM with lower magnification is in inset

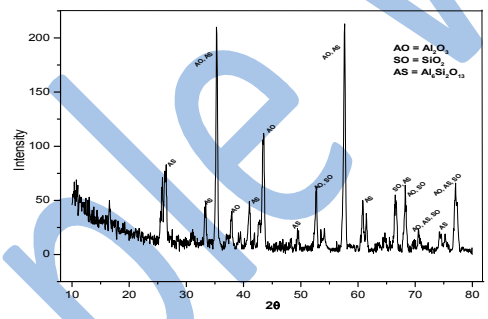


Fig. 4- XRD of membrane elements

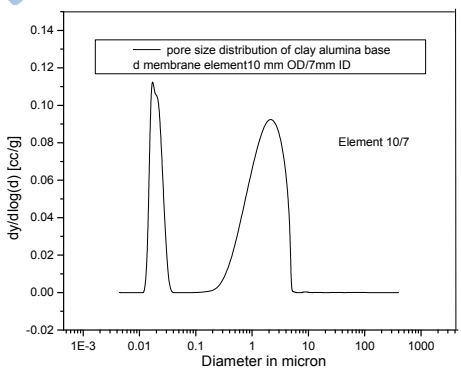


Fig. 5- Pore size distribution of membrane elements

element B (5mm OD/3mm ID)

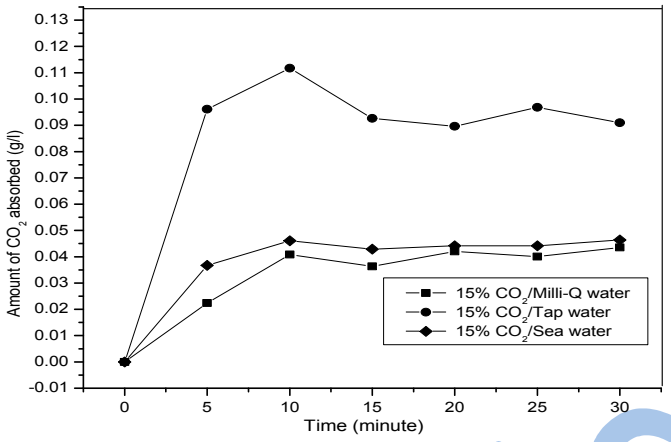


Fig. 6- Graph of 15 % $CO_2$

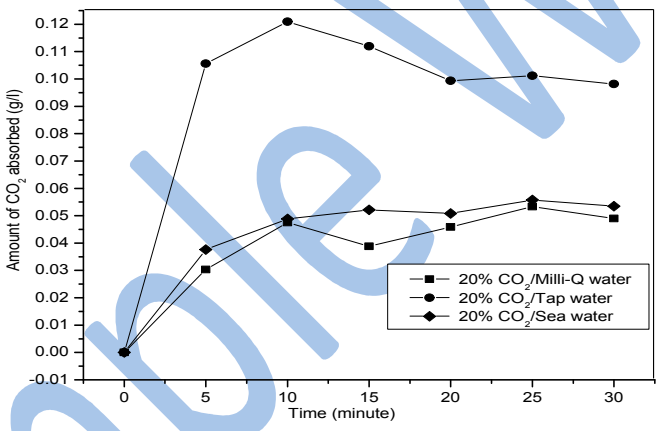


Fig. 7- Graph of 20% $CO_2$