Journal of Applied Research in Finance

JARF
Journal of Applied Research in Finance

Volume IV
Issue 1(7)

Bi-annually

Summer 2012


Journal
of Applied Research in Finance

Editorial Board

Editorial Advisory Board

Publisher:

Spiru Haret University
Faculty of Financial Management Accounting Craiova
European Research Center of Managerial Studies in Business Administration
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URL: http://cesmaa.uv.ro/journals/jarf

ISSN 2066 - 5482

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Deadline for Submission of Papers:	15th November 2012
Expected Publication Date:	January (e-version) – February (hard-copy) 2013
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Journal of Applied Research in Finance

ISSN 2066 - 5482

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Apply the Analysis of the Flows at the Enterprise Strategy

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Abstract

Facing a more and more insecure environment, with a rising competition and with major technological changes, enterprises realize that adjusting to the environment and taking advantages of the opportunities it offers means a strategic approach of the actions that are to be taken in order to gain a good position on the market.

The main objective of the flow analysis is to study the different flows of the activities of the enterprise, being helped by specific tables.

Keywords: flow analysis, liquidity flow, strategic approach, financial diagnosis, regulated flows, investments

JEL Classification: D92, E62, G31

1. Introduction

The activity of an enterprise cannot be set up outside the environment when it works and evolves because its environment provides the means it needs, turns its products and services valuable, cashes and pays etc.

The environment can be defined as an ensemble of natural, economic, financial, technical, law, demographic, social and political factors where a firm acts.

Economic processes mean exchanges between the enterprise and its environment and exchanges of goods and money or currency. According to Bistriceanu, Adochiţei and Negrea (1995, 81), 'the goods and services that are transferred between the enterprise and the other economic agents are called flows'.

The American economist Jay Forrester defines the flows as 'entity transport and movement phenomenon', and considers that there are six types of flows within an enterprise: material flows, money flows, technical equipment flows, employment flows, information flows and decisional flows.

Of all the flows, the financial flows are particularly important because they are the main object of the financial implications of the enterprise economy. These flows imply the currency use operations, turning the money into production factors when the economic processes are prepared and developed, and the vice versa, turning the products and services into money at the end of the same processes.

The other operations that regard mainly the goods management (supplying, raw material processing, finite product sale) are called real/physical flows.

Dividing the flows in financial and real flows is useful in order to explain the content of the enterprise financial management that targets to assure the capital in due time and at the lowest price, enabling thus a monetary excess to cover the pre-established destinations.

The enterprise and the environment develop a variety of financial and real flows. *See* Figure 1. As obviously, the enterprise is a knot of the flows, where real and financial flows develop together. The financial flows emerge from the real flows, and both are necessarily connected to the financial management. The exchanges give birth to the enterprise financial life, since they are fulfilled with the help of the money or its substitutes. In order to run its main activity (product and/or service acquisition) and to reach its target (profit), the enterprise connects to the production factors market, customers, financial market and to the state.

The enterprise takes cars, equipment, raw materials and others from the production factors market.

The new strategic analysis methods, which are based on the income portfolio or on the study of the enterprise ability, could lead to a new definition of the financial diagnosis content and of the risk notion of the enterprise and lender.

They reveal the fact that there is a close relationship between the strategic situation of the enterprise and its financial performances. They also show that the financial diagnosis is not the only aspect that globally characterizes the enterprise performances, but it is also necessary for the enterprise to be divided in homogeneous 'activities' or categories of strategic activities.

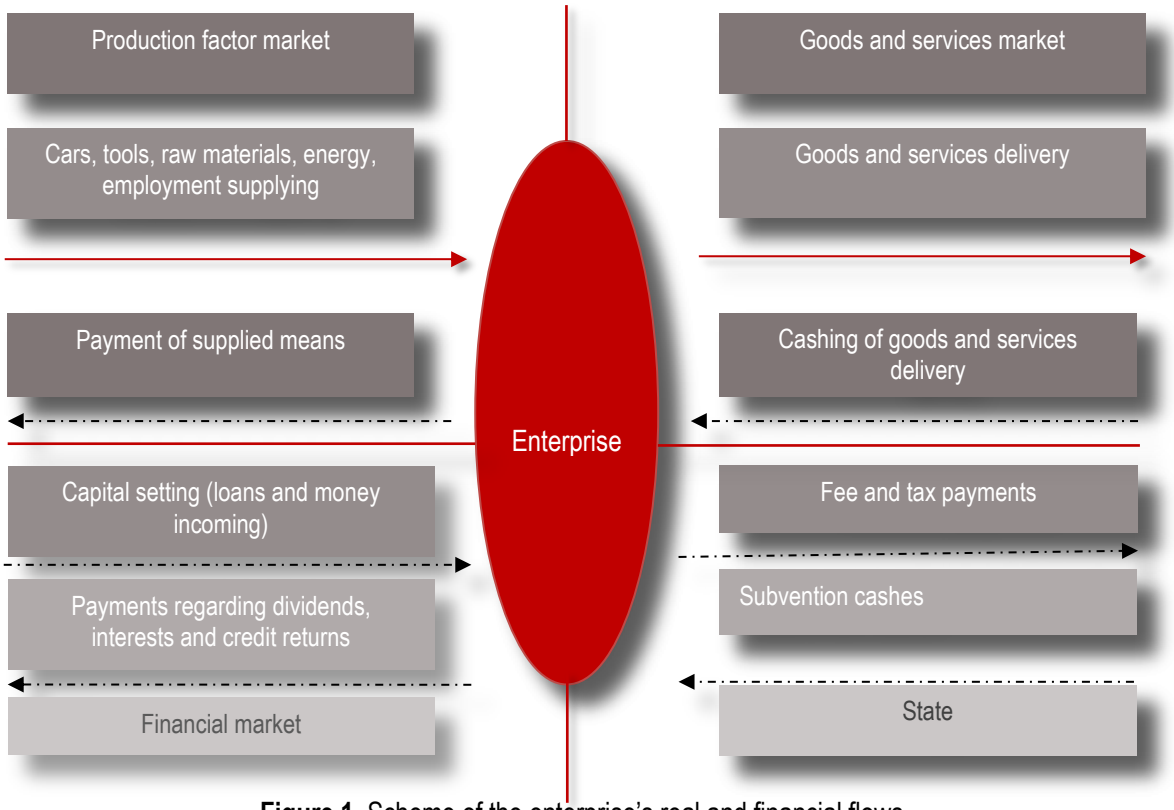

Figure 1. Scheme of the enterprise's real and financial flows

2. Financial flows of pluri-annual tables (FFPT)

In the same context, the financial flows of pluri-annual tables (FFPT) become a useful tool in order to reveal the general financial situation of the enterprise and the special financial situation of the treasury, and offers solutions to the decisions that are to be made.

FFPT can be used as an analysis tool likely to show the connections between the financial and strategically analyses.

Financially, a strategically activity can be characterized by means of three main items:

- activity rise rate. We can use the real rise rate of the added value through the activity of the enterprise. This rate is to be comparable to the market rise rate in order to know if the enterprise gains profits or not,
- beneficiary band. We can use raw result of exploitation (RRE) or raw excess of exploitation (REE), meaning a part of the added value that remains in the enterprise after paying salaries and social expenses,
- pre-established capitals to finance activities. We can use the capital coefficient:

Economic capital / Added value

that indicates the capital sum that has to be invested under the form of exploitation fixed assets and necessary working capital in order to obtain 100 lei added value.

As far as the enterprises that run only one industrial activity, such as the enterprises of electricity delivery, are concerned, the main idea regarding the use of FFPT to analyse the financial strategy, is to compare the recorded FFPT data, for a given exercise, to the operations that develop during a rise scheme of a short or long term activity, flows that are called 'normal and regulated' (Euske 1984).

The comparison between the observed and regulated flows allows to modify the targets and to adjust the enterprise to a balanced rise scheme. Thus, the use of regulated flows tables must complete the study of the enterprise financial study, through a financial strategy analysis at the level of each enterprise.

As mentioned before, in order to run an activity, each enterprise must have exploitation fixed assets and necessary working capital.

The pre-established capitals sum (exploitation fixed assets and necessary working capital), or the economical capital can be expressed in comparison with the added value. This reference to the added value is preferable to the sales figure as long as the enterprises have negotiation activities, or when materials and energy, whose prices can vary, are involved.

In order to calculate the economic capital, it is necessary to determine the sum of the re-evaluated raw fixed assets (RRFA), meaning the sum of the exploitation fixed assets that had to be invested in order to obtain 100 lei added value. The report RRFA/added value cannot be modified but by a very important technological innovation.

There are three methods that enable the calculation of RRFA:

- the method of reforming the investment re-evaluated flows and the fixed assets cession along the last exercises, on a period of time equal to the life average term of the investments,
- the method of the standard raw fixed assets (SRFA), meaning the size of the investments that are to be done, taking into consideration the modern technology, in order to assure the rise of the production, thus assuring the rise of the sales figure (SF).

If the report SRFA/SF is known, RRFA/AV can be obtained by approximation:

RRFA/AV = SRFA/SF x SF/AV

- the method of the re-evaluation coefficient (K)

$$K = \frac{RRFA}{ARFA} = \frac{R+J}{R} \times \frac{1-(1+c)^{''}}{1-(1+R+I)^{n}}$$

Where:

ARFA – Apparent Raw Fixed Assets, R – Rise, I – Average Inflation of the Period, n – Life Average Term of the Investments.

The flows that appear in FFPT answer the sums calculated when the exercises were closed, noticing that many factors can use the sums considered 'abnormal' in comparison with the enterprise rise.

Thus, firstly, we can notice that the sum of the stocks or commercial relationships in progress is very high or very low, depending on, for example, the circumstances or political events (creating speculative stock, temporary supply difficulties, customers' late payments). Secondly, they are continuous and regular, they can appear during an exercise, or they can be placed at intervals, depending on the nature of the activity. Finally, we can sometimes see in FFPT sums that reveal the deviation of the enterprise targets in comparison with the wanted rise strategy

Turning flows normal means calculating, besides the observed flows, flows that are not to be followed, taking into consideration the enterprise development and the targeted rise.

3. The way of calculating the regulated flows regarding the NWC, debts and investment fluctuation

Here we will calculate the regulated flows regarding the NWC, debts and investment fluctuation.

a. Creating regulated flows for the NWC and debts fluctuation.

If the added value rises, R +I (R – rise of the added value, I – inflation rate), stock will normally rise R + I, expressed in percentages of the added value.

Consequently, the regulated flows regarding the stock fluctuation, expressed in percentages of the added value, will be calculated as follows:

$$\frac{\Delta stock}{AV} = \frac{stock}{AV} \times (R+I)$$

In the same way, we can calculate the regulated flows regarding the commercial flows in progress, or the debts or payments lags:

$$\frac{\Delta \text{commercial operations in progress}}{AV} = \frac{\text{commercial operations in progress}}{AV} \times (R + I)$$

Where:

Δ commercial operations in progress represent:

(-) Δ customers' loan

(+) Δ suppliers' loan

(+) other lag exploitation

Suppliers' loan means customers' accounting value, respectively the registered suppliers'.

$$\frac{\Delta \text{ debts}}{AV} = \frac{\text{debts}}{AV} \times (R + I)$$

For example, if the stocks represent 10% of the added value, c = 11,7% and i = 10,3% then the regulated stock flows will be:

$$\frac{\Delta \text{ stock}}{AV} = 10\% \text{ AV} \times 22\% \text{ of AV}$$

b. The calculation of the regulated investments:

In order to understand the reasoning, let's suppose the following hypotheses:

- the fixed assets rise rate is a constant rate c,
- the life average term of the fixed assets is n.

What is the sum of the regulated investments that has to be carried out in 'n' years? Let's say that n = 5.

The investment theory involves two notions: replacement investments and rise investments:

- replacement investment, at the beginning of the 'n' year is made up of five generations of fixed assets (I).

- in (n-5), entry made 5 years before and must be finished during the exercise n;

- in (n-4), I equals I_{n-5} (1+c) ,

- in (n-3), I equals I_{n-5} $(1+c)^2$,

- in (n-2), I equals I_{n-5} $(1+c)^3$,

- in (n-1), I equals I_{n-5} $(1+c)^4$.

The total sum of the fixed assets I_m will equal:

$$I_m = I_{n-5} [1 + (1+c) + (1+c)^2 + (1+c)^3 + (1+c)^4]$$

The sum of the fixed assets I_m can be compared to the acquisition value of n investments with geometrical ratio (1+c), from 0 to n. Consequently:

$$I_m = I \frac{(1+c)^{"} - 1}{c},$$

Where the replacement investment value will be:

$$I = I_m \frac{c}{(1+c)^n - 1}$$

- the global investment is based on the rise investment calculation I_m × c, and follows the equation:

$$I = I_m \left[\frac{c}{(1+c)^n - 1} + R \right]$$

But,

$$\frac{c}{(1+c)^n - 1} + C = \frac{c + c\left[(1+c)^n - 1\right]}{(1+c)^n - 1} = \frac{c + c(1+c)^n - c}{(1+c)^n - 1} = \frac{c(1+c)^n}{(1+c)^n - 1} = \frac{c}{1 - \frac{1}{(1+c)^n}} = \frac{c}{1-(1+c)^{-n}}$$

from where the regulated investment flow is determined according to the equation:

$$I_{regulated} = I_m \bullet \frac{c}{1-(1+c)^{-n}} \ ,$$

Mentioning that for the calculation I_m, we can use the re-evaluated raw fixed assets sum (RRFA).

Making a comparison between the observed flows and those recalculated or regulated, we obtain the following table:

Table 1. Comparison between regulated and observed flows

Indicators	Observed flows according to FFPT	Regulated flows
$\frac{RBN}{AV}$	observed	observed
(-) $\frac{\Delta stocks}{AV}$	observed	regulated: $\frac{stock}{AV}(R+1)$
(-) $\frac{other\ payment\ lags}{AV}$	observed	regulated: $\frac{other\ payment\ lags}{AV}(R+1)$
(=) $\frac{ETE}{AV}$	observed	Recalculated
(-) $\frac{investments}{AV}$	observed	regulated (replacement and rise investment)
(=) sold E	observed	Recalculated
(+) $\frac{\Delta debts}{AV}$	observed	$\frac{\Delta debts}{AV}(R+1)$
(-) $\frac{financial\ expenses}{AV}$	observed	observed
(-) $\frac{tax\ profit}{AV}$	observed	observed
(=) $\frac{sold\ F}{AV}$	observed	Recalculated
$\frac{E+F}{AV} = \frac{sold}{AV}$	observed	Recalculated

Admitting the idea that the financial balance, on long term, tends to align to a rise rate with a profit rate on the basis of the FFPT, we can determine the financial profitability of the capitals, step by step, by following the equation:

Average Flow of Result = Average Flow used to Maintain Rise + Liquidity Average Flow

This relation is highlighted in FFPT, by distinguishing between the economic result and the financial result.

Consequently:

Average Flow of = Economic result	Average Flow of Economic Rise	+	Average Flow of Economic Liquidity

and

Average Flow of = Financial Result	Average Flow of Financial Rise	+	Average Flow of Financial Liquidity

This equation can equally be determined standing on the definition of the sold E or DAFIC, which answers to the pre-established capitals profitability (pre-established capitals × profitability rate of the pre-established capitals) less to the new capitals obtained by rise (pre-established capitals × rise rate).

So:

Sold E or DAFIC = (pre-established capitals × P) – (pre-established capitals × R)

where:

P – profitability of the pre-established capitals, R – added value rise.

But, in fact, the value of P is requested, from where, if dividing the equation by the sum of the pre-established capitals, we obtain:

$$P = R + \frac{\text{Sold E or DAFIC}}{\text{Pre-established capitals}}$$

Similarly, we can calculate the financial profitability rate of the capitals, P, as follows:

$$P' = R + \frac{\text{Sold G}}{\text{Pre-established capitals}}$$

4. Conclusion

In conclusion, the use of FFPT allows noticing the consequences of the decisions, when dealing with the rise – profitability balance, made over the current assets, lever effect, external rise policy, investment policy etc.

Thus, the financial performances of an enterprise mustn't be evaluated on profitability terms only, but, helped by flows, in terms of liquidity capacity, too. The study of liquidity flows must equally be done at the level of the strategic activities.

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Investment Cash Flow Sensitivity under Behavioural Corporate Finance: A Literature Review via the Classification Scheme

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Abstract:

In this paper we present a literature review and classification scheme for investment cash flow sensitivity under behavioural corporate finance. The former consists of all published articles between 2000 and 2011 in different journals that are appropriate outlets for BCF research. The articles are classified and results of these are presented and analysed. The classification of article was based on nine criteria; journals, date of publication, paper nature, the context of the study adopted behavioural biases, adopted approach, behavioural biases measurement, the adopted assumption, econometric approach and empirical findings. Literature on investment cash flow sensitivity under behavioural corporate finance isn't well developed. In fact, the behavioural corporate finance is very young (Fairchild, 2005). Our review shows that behavioural biases (optimism and overconfidence) have an explanatory power and they can succeed to explain the dependence of corporate investment on the internal cash flow availability. This result is protected at the most of cases by the some restrictive assumptions: the absence of agency costs and asymmetric information. Based on the review, suggestions for future research are likewise provide.

Keywords: behavioural corporate finance, literature review, classification scheme technique, investment cash flow sensitivity, optimism and overconfidence.

JEL Classification: G3, G31, H32

1. Introduction

The corporate investment decision has been widely studied in financial literature. Several empirical studies are conducted on the subject. An excellent survey is offered by Harris and Raviv (1991), Shleifer and Vishny (1997), Hubbard (1998) and Zingales (2000). In financial literature, two main hypotheses are proposed to explain the corporate investment distortion. The first is spawned by Jensen and Meckling (1976) in agency framework. Managers are supposed to be opportunistic and seek to maximize their own utility function and so that they insist on the existence of conflicts of interest between them and the shareholders. Managers will overinvest to increase their executives and escape the control exercised over them. The second explanation is information asymmetry between corporate insiders and the capital market, Myers and Majluf (1984). Information asymmetry creates an undervaluation of good firms. This can cause problems of financing and results in a state of under-investment.

With agency problems and asymmetric information, the investment decision depends on capital structure. These two theories insist on the presence of investment cash-flow sensitivity phenomena. The agency theory postulates that managers will increase firms' investment level with the availability of internal cash flow in order to escape the market control in case of external funding. In the presence of sufficient internal cash flow, investment increases and the probability of investment distortion increases. With asymmetric information theory, there will be sensitivity between corporate investment and internal cash flow. Managers will restrict external finance in order to avoid current share dilution; as a result investment will strongly depend on internal finance.

Empirically, field studies validate the existence of cash-flow sensitivity phenomenon (Fazzari, Hubbard and Peterson (1988), Kaplan and Zingales (1997, 2000)). These researches link the sensitivity to capital market imperfections and financing constraint.

Beyond the agency theory, the contribution of asymmetric information theory, the capital market imperfections and the financial constraints, the behavioural corporate finance (BCF) is an attractive way to find explanations to investment cash flow sensitivity other than related to the firm' characteristics. This approach studies the effect of behavioural biases on corporate decision.[1]

In sum, the literature review on the field of investment cash flow sensitivity proposes three explanations to this phenomenon. From standard finance point of view, agency problems and asymmetric information can lead to investment cash flow sensitivity. In other hand, the behavioural corporate finance proposes other possible sources deriving mainly from the cognitive psychology literature where behavioural biases should have an explanatory power on the relationship between firms' cash flow and corporate investment.

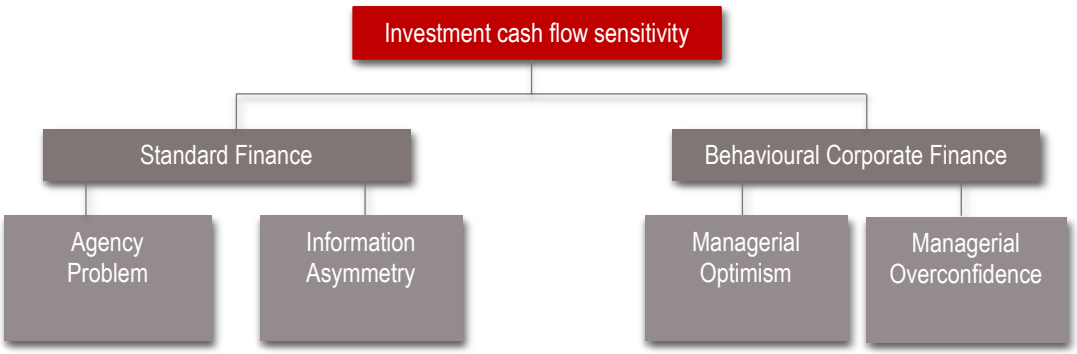

Figure 1. Investment cash flow sensitivity between standard and behavioural finance

These potential explanations mainly analyse the investment-cash flow sensitivity under the financial constraint hypothesis. Agency conflicts, asymmetric information problems and managerial optimism can explain the corporate investment distortions but their potential effects should studied also by introducing if the firm is financially constrained or not. We should note also that there some other explanations such as the corporate governance mechanisms.

The behavioural corporate finance is very younger and it essays to generate theoretical and empirical contribution to explain investment-cash flow sensitivity under personal characteristics of firms managers. While there are many survey papers that discuss the investment cash flow sensitivity under standard finance, in our knowledge, there is no survey paper that focuses on the investment-cash flow sensitivity under behavioural corporate finance.

In this paper we present an original literature review based on classification scheme technique. We essay to present a review of the major literature and key findings on investment cash flow sensitivity under behavioural corporate finance. An extensive literature search of academic journals from 2002 to 2011 was conducted, yielding a total of 6 articles. The detail of the literature search procedure is largely discussed in what follow and the limited number of published paper in this area of research will be justified.

Our objective is that this paper will serves as a roadmap in this field and help simulate further interest. Even if the literature review isn't large in investment cash flow sensitivity under managerial optimism, the methodology adopted by this survey paper will offer very interesting concluded remarks and suggests future direction of research in this subject.

The rest of paper is organized as follows: Section one backgrounds central concept of our research: the behavioral corporate finance and the investment cash flow sensitivity. Section two, introduces the applied methodology for this study. While, section three presents our results. Finally, section 6 closes the paper by offering conclusions and attempts to provide some perspectives on future research and presents the classification scheme of investment cash flow sensitivity under behavioral corporate finance.

2. Defining Behavioral Corporate Finance (BCF) and investment cash flow sensitivity

The behavioural corporate finance allows cognitive psychology to play a potentially important role in finance (Kim *et al*. 2008). In this new framework, people are assumed to be not always rational so their financial decision may be driven by behavioural biases.

[1] We can find an excellent literature review of many different types of behavioral biases that financial decision makers might hold and how these biases might affect decision making by referring to Barberis and Thaler (2000).

The behavioural corporate finance (BCF) studies the effect of behavioural biases on corporate decision. We can find an excellent literature review of many different types of behavioural biases that financial decision makers might hold and how these biases might affect decision making by referring to Barberis and Thaler (2000).

Behavioural corporate finance is a recent bloc of the behavioural finance literature. We insist on the existence of two approaches the irrational investors approach and the irrational managers' approach.

Investment cash flow sensitivity is associated with both underinvestment when cash flows are low and overinvestment when cash flows are high (Armen *et al.* 2009). The behavioural corporate finance itself proposes a new explanation of this phenomenon. Personal characteristics of Chief Executive Officer should have an explanatory power: optimistic CEOs, when investing, are predicted to exhibit a strong sensitivity to internal cash flow than non-optimistic managers do (Heaton, 2002; Malmendier and Tate, 2005).

3. Methodology

The investigation of the state of knowledge in a field or subject, Li and Gavusgil, 1995 affirm the existence of three basic approaches. The first one is the Delphi technique through which experts who are familiar with the area are surveyed. The meta-analysis is the second approach. With such method, empirical studies on the specific subject are gathered and statistically analysed. Finally, the third approach is the content analysis. This last approach is applied in this paper.

The content analysis is a research method for systematic, qualitative and quantitative description of the manifest content of literature in an area (Marasco, 2008). Following Li and Gavusgil 1995 and Seuring *et al.*, 2005, to conduct an investigation by the content analysis, we should centre on two major steps: in a first step, it is primordial to define the sources and procedures for the search of articles to be analysed. In a second step, we should define categories instrumental to the classification of the collected articles.

4. Literature search procedure

This survey was based on a study of journals. Hence, we exclude conference proceeding papers, master's thesis, doctoral dissertations, textbooks, and unpublished working papers. According to Nord *et al*. (1995), academics and practitioners usually use journals most often for acquiring information and disseminating new findings and represent the highest level of research. We note that articles are all related to investment cash flow sensitivity under behavioural corporate finance.

We use some selection criteria to select and accept articles in this study. If papers did not meet the selection criteria, then they should be excluded. The research procedure takes two steps: (1) at the first step, articles were found via electronically search of the topic areas. We use different terms when searching for paper to be considered. Namely, we use the terms (i) investment cash flow sensitivity, (ii) behavioural corporate finance, (iii) managerial overconfidence and, (iv) managerial optimism.

The first term is used in order to generate all articles that treat the investment cash flow sensitivity including papers that refers to this phenomenon via the standard finance. The second terms aims to find all articles related to behavioural corporate finance. This is an attempt to delimit papers that are related to investment cash flow sensitivity under the behavioural corporate finance. Finally, the terms managerial overconfidence and managerial optimism may help us to find some paper that treats the investments cash flow sensitivity under managerial overconfidence or optimism. These two terms are used since the overconfidence an optimism biases are the most known and studied at a behavioural corporate finance framework.

As it mentioned before, papers that are included in this literature review is limited to published works obtained from electronic sources. Our search cover literature obtained from different electronic sources. Precisely, we explore Science Direct, Springer Link, JSTOR, Wiley Interscience, Inderscience databases and Ingenta Connect databases. To obtain additional sources of information, we examine references cited in each relevant literature.

The research papers cover a period of nine years between 2002 and 2011. The choice of the starting date is governed by the publication of the first theoretical work spawned by Heaton (2002) published at the financial management journal.

In a second step, we exclude all papers that aren't related to investment cash flow sensitivity under a behavioural frame work. This means that we analyse each paper and on the basis of the title of manuscripts, his abstract, keys words we decide to exclude or conserve it. Finally, papers are fully analysed and we include only papers that are in the heart of the field analysed here. After running the research papers procedure, we obtain only 6 papers that respond to all selection criterions.

Although the limited number of papers that we found, the classification shame still an attractive technique since it can classify the considered literature and offers details in the tendency of the studies in investment cash flow sensitivity under behavioral corporate finance, this will be an easy task after proposing a classification method.

4.1. Classification method

The classification framework, as it presented in Figure 2, is based on the literature review and some research in the field of behavioural corporate finance (Baker *et al*., 2004). The articles were classified into four broad categories: (i) The adopted approach (ii) the nature of the paper, (iii) Behavioral bias (iv) The optimism or overconfidence measurement (vi) the empirical finding and (vii) the assumptions. We note that each category is divided into subcategories. We will discuss all of them in the following.

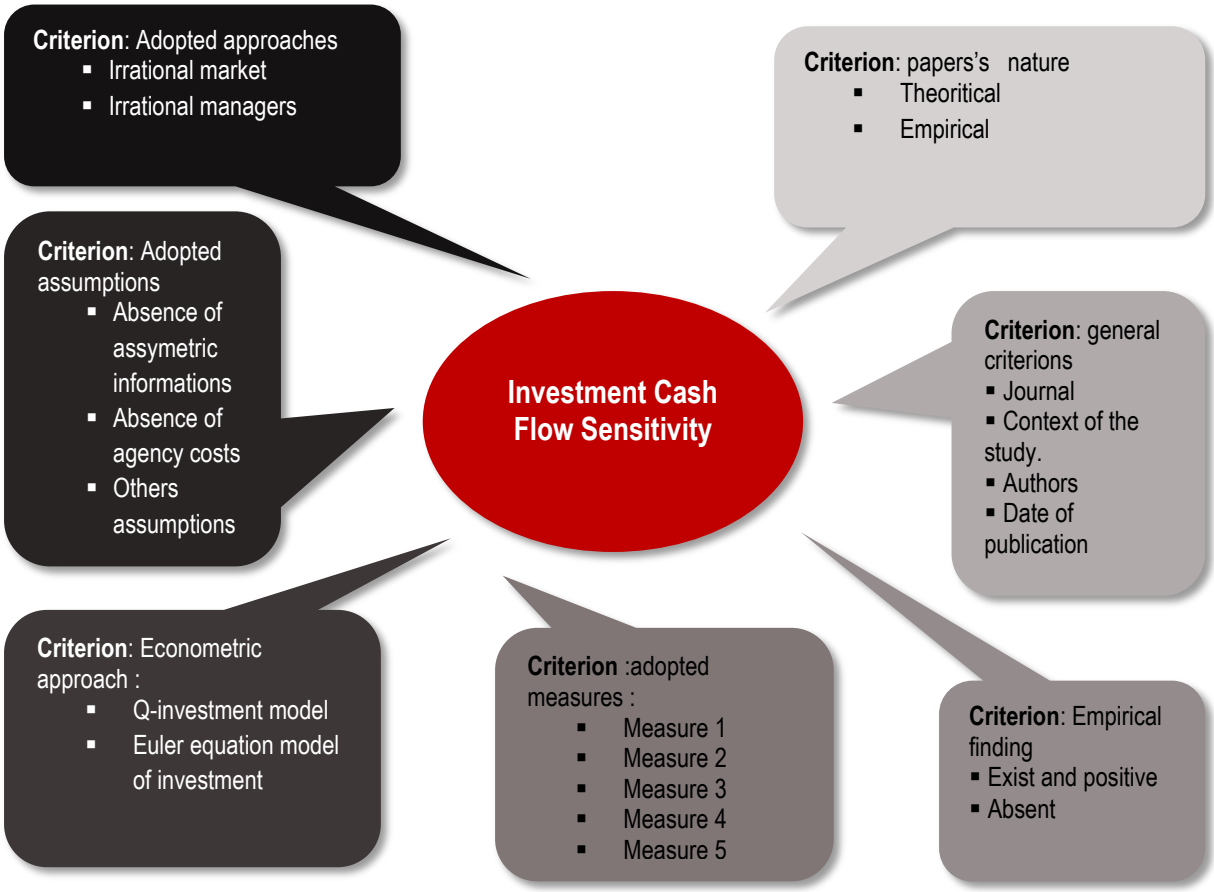

Figure 2. The proposed classification scheme

4.1.1. The nature of papers

According to this criterion, papers will be classified into two categories: a theoretical paper or an empirical one. We mean here by theoretical paper all paper that treats the problematic of investment cash flow sensitivity via the behavioural corporate finance without an empirical analysis.

4.1.2. Approaches

The literature in this classification is mainly divided into two broad categories: irrational manager approach or irrational market approach.

4.1.2.1. The irrational managers' approach

The irrational managers' approach assumes that managers are irrational and they operate in efficient capital market. To be more precise, by irrational managerial behaviour we mean behaviour that departs from rational expectations and expected utility maximization of the manager. According to Baker *et al*., 2004, this approach studies how irrational managers act in the presence of rational investors.

4.1.2.2. The irrational markets' approach

According to Baker *et al*., 2004, the 'irrational investors approach' assumes that securities market arbitrage is imperfect, and thus that prices can be too high or too low. Simply, we can affirm that is an approach that studies how rational managers act in the presence of irrational investors.

4.1.3. Behavioural biases

The behavioural corporate finance (BCF) studies the effect of behavioural biases on corporate decision. We can find an excellent literature review of many different types of behavioural biases that financial decision makers might hold and how these biases might affect decision making by referring to Barberis and Thaler (2000). In this paper, we focus on behavioural biases that seem most used in this field: overconfidence and optimism. We discuss in what follows a brief definition for each subcategory.

4.1.3.1. Overconfidence

The overconfidence effect is a well-established bias in which someone's subjective confidence in their judgments is reliably greater than their objective accuracy, especially when confidence is relatively high, Gerry *et al*., 2002.

4.1.3.2. Optimism

From the beginning of the eighties, Weinstein, 1980 talks about the rosy vision that characterizes most of the people. It emphasizes the existence of so-called unrealistic Optimism'. He showed that over 90% of those surveyed think that they are above average in such domains as driving skill, ability to g*et al*ong with people and sense humour. Other studies such as that conducted by Buehler, Griffin and Ross (1994) show that people are optimistic. The optimism bias may be active in managers or among investors. So we can speak of managerial optimism or optimistic markets. The first type of optimism is fined when a research adopt the irrational managers approach while the second type exists when the irrational investors' approach is adopted.

Even if these two biases were used to mean the same thing, we basis our classification on the linguistic term 'optimism' and 'overconfidence'.

4.1.4. Behavioral biases measures

By adopting this criterion, articles will be classified in the basis of the behavioural biases' measures. In our best of knowledge, there is no previous work that review papers in this research's area and discuss these measures. Measures will be identified, discussed and then literature review will be classified in their basis.

We can find also a simple categorization of optimism and overconfidence measures and we can find also a short comparison of them. This will probably help advancing research in this field by making easy the assimilation of all existent measures and their drawbacks and benefits.

4.2. Adopted assumptions

According to this criterion, articles will be classified into the adopted assumption. Especially, we focus on the presence or not of assumptions relative to agency problems, information asymmetry or financial constraint when investigating the relationship between corporate investment and cash flows under managerial optimism or overconfidence.

4.2.1. The econometric approach

In the financial literature, the most popular approaches to test investment cash flow sensitivity suppose the examination of can two investment models: the Q-model of investment and the Euler equation model. According to Perotti and Gelfer, 2001; Goergen and Renneboog, 2001, Allayannis and Mozumdar, 2004; Shen and Wang, 2005 and Aggrawal and Zong, 2006 each model has its own positive and negative points. The Q model affirms that firm's investments are mainly determined by expectations of future profit opportunities calculated by the ratio of the market value of assets to its replacement value. An adjusted Q-model of investment was developed by Agca and Mozumdar, 2008 to include the availability of internal funds as an additional determinant of corporate investment.

The Euler equation model postulates that firm's current investments are determined by its total sales, cash flows, past investments and total debt[2] (Laeven, 2003).

[2] *See* Bond and Meghir (1994) for the derivation of the Euler equation model and Hubbard (1998) to see the detail of derivation of the Q-model of investment.

4.2.2. Empirical findings

According to this criterion, papers will be classified using the sign of the coefficient between corporate investment and internal cash flows multiplied by a proxy of managerial optimism or overconfidence. We will focus on the validation of the theoretical prediction of the behavioural corporate finance that insists on the positive sign of this coefficient.

5. Results

5.1. The distribution of articles by journal

The number of papers that are focusing on investment cash flow sensitivity under behavioural corporate finance seems to be very limited. Table 1 show the distribution of articles in the different journal.

Table 1. Distribution of articles by journal between 2000 and 2011

Journal	2000 – 2005	2005 – 2011	Total
Pacific-Basin Finance Journal	1	1	2
The Journal of Finance	1	-	1
The Journal of Financial Economic	-	1	1
European Financial Management	1	-	1
Financial Management	1	-	1
Total	4	2	6

The pacific-Basin Finance journal published about 40% of the total articles. This percentage is partially the result of the publication of a special issue on behavioural finance in Asia. The journal focuses on investment cash flow sensitivity are very reputable since the sample includes the journal of finance and the journal of financial management. In other remarkable thing is that 4 papers were published after 2002. It is date of the publication of the first paper that theoretically opens the door for the study of the effect of managerial optimism on corporate decision making including investment cash flow sensitivity.

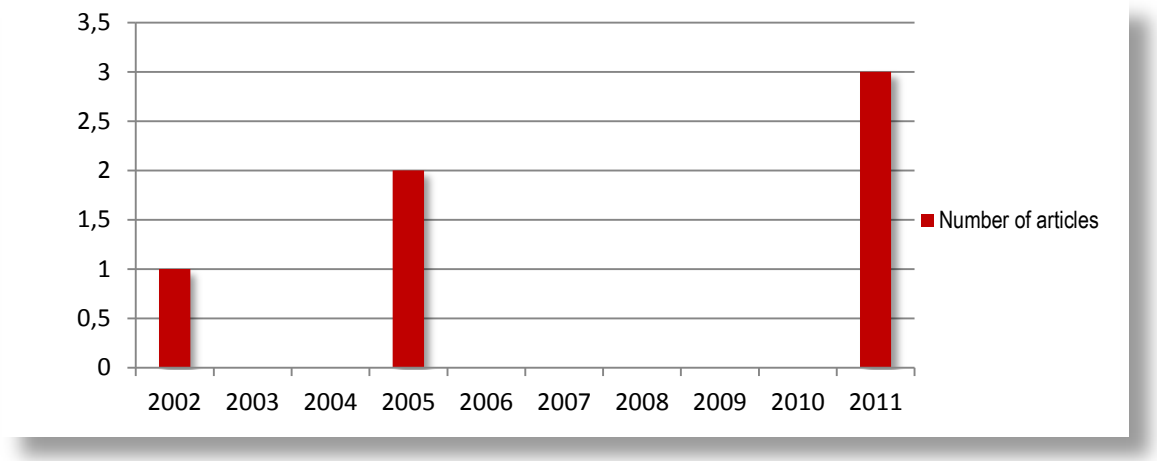

Figure 1. Distribution of articles by date of publications

It is clear that the research in this field of finance is concentrated on three dates 2002, 2005 and 2011. This distribution may be explained by the difficulties when constructing robust measures of behavioural biases. At 2005, Malmendier and Tate propose possible measure of managerial overconfidence at two works (2005). Lin *et*

al. also propose another alternative measure of optimism at the same year. This will be a factor that can explain the growth of the number of articles focusing on investment cash flow sensitivity.

5.2. The classification of papers by authors, context of studies and

Table 2, simply classify papers in our sample by authors, the nature of papers, the context of the study and the date of publications.

Table 2. Distribution of articles by date of publication, papers' nature and the context of study

Author(s)	Date of Publications	Nature of paper	Context of the study
Heaton	2002	Theoretical paper	-
Malmendier and Tate	2005	Empirical paper	American context
Wei Huang *et al*.	2011	Empirical paper	Chinese context
Lin *et al*.	2005	Empirical paper	Japanese context
Campbell *et al*.	2011	Empirical paper	American context

Heaton paper initiated the debate of the effect of managerial optimism on investment cash flow sensitivity. In a simple model, he theoretically demonstrates that optimism may affect the Investment decision because of the existence of investment cash flow sensitivity. In other word, according to Heaton (2002) model, investment depends on the existence of cash flow and this relationship will be more pronounced with the existence of an optimistic manager. Malmendier and Tate (2005) conduct an empirical study in the American context. They empirically demonstrate that overconfidence is an important factor that may explain the investment cash flow sensitivity. Their paper is the first empirical study that explores this phenomenon under behavioural consideration. After this date, we can show that all papers in this area of research tend to include an empirical exploration in this field. A logic question is why?

A possible explanation is that Malmendier and Tate (2006) offer possible measures of managerial overconfidence. As we know, overconfidence and optimism seem to be much closed. A thing that facilitates the road for others empirical papers focusing on the effect of managerial optimism in the courant debate.

One advantage of the classification scheme technique is to detect some remarkable observation such as a high concentration of literature on a precise date, journal or context. Our results also show that the studies are concentrated into two poles: the American framework and the Asian one. Availability of data can be justified the use of the American context. This will be more discussed in the section relative to optimism and overconfidence measurement. While the Japanese and Chinese context are used since, at is mentioned before, the publication of a special issue entitled 'Behavioural Finance in Asia' by the Pacific-Bain Finance Journal. This distribution may also be simply caused by authors' affiliations. For example, Malmendier and Tate paper's derives from a chapter on doctoral thesis of Malmendier with an co-author Tate two PhD student at the Harvard University in USA. So they may logically use the American context.

5.3. Classification by the adopted approach

Although the remarkable lack of literature, the classification scheme technique is a crucial technique to understand the literature in a precise area of research. It offers a possibility to detect precise observation, anomalies and conclusions. Table 3 represents the result of classifying articles from our sample on the basis of the adopted approach.

Table 3. Distribution of articles by the adopted approach

Authors	Irrational Investors Approach	Irrational Managers Approach
Heaton (2002)	-	×
Malmendier and Tatae (2005a)	-	×
Wei Huang *et al*.,	-	×
Lin *et al*.,	-	×
Malmendier and Tate (2005b)	-	×
Campbell *et al*.	-	×

Results highlight that all papers focusing on investment cash flow sensitivity under behavioural corporate finance adopt the irrational mangers approach. This means that research in this special area of literature suppose that market are rational and so investment distortions derives from personal characteristics of the CEO. Namely, they suppose that managers are affected by some psychological biases: optimism and overconfidence. But why they don't opt for the irrational investors approach?

The irrational investors' approach emphasizes the effect of investor behaviour that is less than fully rational. It assumes that arbitrage is imperfect and so prices can be too high or too low. Rational managers are assumed to perceive mispricing, and to make decisions that may encourage or respond to mispricing (Baker). This approach is silent about the relationship between investment and cash flow sensitivity. According to Heaton (2002), the irrational investors' approach is less attractive since the existence of the power of arbitrage in the market.

It is a reality that all research papers in this area adopt the irrational mangers' approach. They suppose that investors are rational and they coexist with irrational managers. CEO is supposed to be affected by their behavioural biases and then they explore implications on corporate decisions.

5.4. Classification by the adopted behavioral biases

The study of behavioural finance allows cognitive psychology to play a central role in finance. Research show that people are not fully rational and they financial decision might wholly or partially driven by behavioural biases (Kim and al, 2008). The application of behavioural finance in financial markets empirically demonstrates the effect of the behavioural biases on decision making[3].

The behavioural biases are predetermining on a behavioural framework. To provide an excellent literature review of the different types of behavioural biases that financial decision maker might hold and how these biases might affect decision making and, in turn, the financial markets we can refers to Barberis and Thaler (2003). Our aim here is to identify behavioural biases that were studied in relation with investment cash flow sensitivity. Table 4 shows the detail of the classification by the adopted behavioural biases for all the reviewed articles.

[3] The beginning of this area of research was at the mid-1980s with the work of DeBondt and Thaler (1985) when they proved that stock markets overreact to information and with the work of Shefrin and Statman (1985) where they demonstrate that investors are more likely to sell their winner stocks rather than their losers.

Table 4. The distribution of articles by the adopted behavioral biases

Articles	Optimism bias	Overconfident bias	Other behavioral biases
Heaton (2002)	×		-
Malmendier and Tatae (2005 a)		×	-
Wei Huang *et al*.,		×	-
Lin *et al*.,	×		-
Malmendier and Tate (2005 b)		×	-
Campbell *et al*.	×		-

We show that researches in this area of finance focus on two behavioural biases: optimism and overconfident. In other words, it is assumed that managers are optimistic or overconfident. A thing that may affects the investment cash flow sensitivity. This concentration can be explained by findings in experimental psychology.

Research in experimental psychology documents that people in general, and especially managers, tends to be excessively optimistic and overconfident about their abilities and prospects (Oskamp, 1965; Weinstein, 1980).

A survey by Graham and Harvey (2001) indicates that most corporate executives typically believe that their firms' equity is under valuated by the stock market. They have a rosy view of the world (Weinstein, 1980) and they are frapped by optimism bias.

Finally, we can justify the concentration of research around these two biases because simply they are well documented managerial traits (Hackbarth, 2003).

5.5. Classification by the adopted measures

In behavioural corporate finance the measurements of overconfidence and optimism presents some difficulty as it cannot be observed directly (Campbell. *et al*, 2011). It is so a necessity to construct and use some practical proxies.

Malmendier and Tate (2005) are the pioneers in constructing proxies of overconfident in a corporate framework. They measure CEO's overconfidence based on the CEO' net stock purchases and their stock option holding and exercising decision.

They apply three measures of overconfidence. The first measure of overconfident compares the benchmark predictions to the actual exercise behaviour of a CEO. If a CEO persistently exercises options later than suggested by the benchmark then it will be classified as overconfident CEO about his ability to keep the company stock price rising and wants to profit from expected stock increases by holding the options. The second measure is holding options forever. They consider that CEO is overconfident if he ever holds an option until the last year of its duration.

According to Malmendier and Tate (2005), there is no reason why a CEO should habitually increase his equity position by acquiring new shares or accumulating new shares or accumulating new stock grants without selling any shares to compensate. They affirm that the 'habitual purchases of stock may serves as overconfidence.

They measures overconfident on the basis of CEO's stock purchase. CEO are classified as overconfident if they were a net buyer of company stock more years than they were a net seller during the first five years they appear in their sample.

In Malmendier and Tate (2005 b), we find another measure of managerial overconfidence. A measure based on the CEO's portrayal in the media. They collect data on how the press portrays each of the CEOs during the sample period. They search for articles referring to the CEOs in different journals: The New York Times,

Business Week, Financial Times, The Economist and The Wall Street Journal. For each CEO and sample year, they record the number of articles containing the words 'confident' or 'confidence'; 'optimistic' or 'optimism'; and the number of articles containing the words 'reliable', 'cautious', 'conservative', 'practical', 'frugal', or 'steady'. They hand-check that the terms are used to describe the CEO in question and separate out articles describing the CEO as ' not confident' or ' not optimistic'. Finally, they construct an indicator TOTALdummy, equal to 1 if a CEO is more often described as 'confident' and 'optimistic' or as 'reliable', 'cautiois', 'conservative', 'practical', 'frugal', or 'steady'.

The Malmendier and Tate measures (2005a, 2005b) of overconfidence and optimism may be classified into two categories: the first category of measures derives from CEO's actions and his portfolio selection while, the second category of measures relies on the perception of outsiders to CEOs. It means that the first category focuses on CEO's action like his behaviour when holding and exercising stock options. However, this alternative approach as it initiated by Malmendier and Tate (2005b), tends to constructs measures for these behavioural biases by referring to outsiders perception, namely the financial journals.

Campbell *et al* (2011) base their measure of optimism on CEO's stock option exercise and holding decisions and on net stock purchases, and on firms' investment levels. They tray also to validate their results following the media-based approach developed by Malmendier and Tate (2008). Measures based on stock option and firms' shareholding are well described at the beginning of this title, we concentrate here at the fourth measure based on firms' investment level.

Departing from Malmendier and Tate (2005) results and from theoretical implications of their developed model, Campbell *et al* (2011) suggest that firm investment may contain information about CEO optimism. They classify CEOs as having low (high) optimism if their firm is in the bottom (top) quintile of firms sorted on industry-adjusted investment rate for two consecutive years. They justify the imposition of two year requirement because investment is lumpy through time, and they do not want to identify firms that just happen to bunch investment in one year.

W. Huang *et al*. (2011) propose to measure over confidence in Chinese context. In view of the data availability and financial conditions for China's stock exchange-listed company, they construct two proxies for top executives' overconfidence. The first proxy is the difference between top executives' forecasted earning and actual earning. They use a simple criterion to classified top executives as overconfident only if the number of times of over-forecast is more than that of under-forecast during the entire sample forecast. They define over-forecast as the case were forecasted earnings are greater than actual earning while under-forecast as the case were forecasted earning are smaller than actual earning. In their papers the 'confidence' variable is a static measure that has one observation per top executives or firm. This measure of overconfidence is developed around Lin *et al*. (2005) approach and many other work such as Li and Tang (2010) and Hribar and Yang (2010). They also provide the robustness of this measure in a non-static situation.

The second measure consists on the use of top executives' relative salary as proxy for managerial overconfidence. Theoretical background of this measure refers to Hayward and Hambirk (1997) who argue that a high salary of manager may introduce him to be overconfident. Research by Brown and Sarma (2006) shown that higher CEO's relative salary is associated with stronger dominance of power. And it is demonstrated that more powerful CEOs are more likely overconfident (Sivanathan and Galinsky (2007). The salary information for top three managers is used in order to measure overconfidence. The final measure of top executives 'overconfidence is the sum of top three managers' salaries to the sum of all managers' salaries and the greater this ratio is, the higher top executives' overconfidence will be. We note that this last measure is similar to Frith *et al*. (2006, 2007) 'measure.

Lin *et al*. (2005) propose a managerial optimism measure on CEOs 'personal estimation of firms earning. Departing from managerial earnings' forecasts, and accepting that all forecasts are equally weighted, they classified CEOs as optimistic manager or not. They classify whether a CEO is optimistic if he/she has at least two forecasts and define a CEO to be optimistic if there are more upwardly-biased forecasts than downwardly-biased forecasts during the CEO's tenure. They defined a forecast as upward biased if the forecast error is positive. This error is simply defined as the difference between managers' earnings forecasts and the actual earnings before tax.

In sum, we identify five measures of managerial optimism or overconfidence. Measure 1 indicates the use of stock holding and exerting behavior, measure 2 indicates the use of Net Bayer measure, measure 3 indicates the use of a measure based on press portrays of CEOs during the sample period, measure 4 is relative to the use of the earning forecast error and finally, measure 5 concerns the use of top-managers salaries to construct proxy

for managerial overconfidence. We ignore some additional measures such as firm investment level because they can't be applied to test investment cash flow sensitivity.

Table 5. Distribution of articles by the adopted measures of optimism and overconfidence

Articles	Measure 1	Measure 2	Measure 3	Measure 4	Measure 5
Heaton (2002)					
Malmendier and Tatae (2005 a)	×	×			
Wei Huang *et al*.,				×	×
Lin *et al*.,		×		×	
Malmendier and Tate (2005 b)			×		
Campbell *et al*. (2011)	×	×			

The largest use of Net Stock holding can be explained mainly by two things. The first raison is the availability of information that we need in comparing to the stock options holding and exercising information. The second one is that this measure is useful to apply; departing from insiders trading, we determinate the net position in firms' stock and so we can simply generate proxy form managerial optimism by computing the number where CEO is a net Bayer and those where not (Malmendier and Tate 2005) or we can use the net position of CEO in his stock firm as it prescribed by Campbell *et al* (2011).

In interesting remark here is that the optimism measure developed by Campbell and al. (2011) in the basis of the Malmendier and Tate (2005) work is advantageous because it generate a dynamic measure of managerial optimism year by year. The challenge is if this new measure is proper to test investment cash flow hypothesis. Proxy of managerial optimism here may be the result of asymmetric information: manager who knows exactly the financial situation of his firm and future opportunity of growth will probably act according to this private information. In this case, the sales or acquisitions of shares are just related to a rational reaction and it is far from the optimism or overconfidence impact.

In sum we can classify the adopted measure of managerial overconfidence and optimism into three categories. The first one is on the basis of CEO actions such as the options' holding and exercise, the firm' shares purchases, managerial forecasts. The second category is based on outsiders' perceptions, namely the media and the financial journals' perception. The final category includes other measures that are related to firm investment level and the top three managers' salaries. Table 6, classify measures used in papers from our sample into these three categories.

The classification of optimism and overconfidence measures shows that the most of research papers adopt measures based on CEO actions. They link the measures of behavioral biases into the proper actions of managers. The large use of these measures may be justified by its superiority to other category of measures.

Authors may be constrained by data availability when choosing between optimism and overconfidence measures. Measures based on stock options exercise and holding are constrained by the context of the study. For example, data concerning the stock options are very limited out of the United States. Other measures are also seemed to unrealizable since the large observations in data bases. This is the case when Campbell and al. want to adopt measures based on media portray. They affirm that 'Our sample construction begins with the ExecuComp population and contains over 12,000 CEO-year observations. Given the sample size, it is infeasible to hand collect measures based on the media's perception of the CEO's level of optimism'.

Table 6. The classification of optimism and overconfidence measures into the three categories

	Measures CEOs based actions	Measures based on Media perceptions	Measures based on firms' investment level and salaries
Heaton (2002)			
Malmendier and Tatae (2005a)	×		
Wei Huang *et al*.,	×		
Lin *et al*.,	×		
Malmendier and Tate (2005b)		×	
Campbell *et al*.	×		×

Another remarkable thing is that research in behavioural corporate finance use, at the most of cases, more than one optimism or overconfidence measures at the same study. This is may be not a choice but an obligation under the difficulties to measures behavioural biases that are unobservable directly. The use of a panoply of measures aims to guarantee the robustness of optimism and overconfidence measures and then robustness and validity of results.

Finally, measures validities are always protected by two hypotheses: the absence of agency conflicts and the absence of asymmetric information. These assumptions have another objective; they absorb all potential explanation of investment cash flow sensitivity that can be generated by these two theories.

Some works study the effect of managerial overconfidence in the presence of agency problems. But they support the absence of asymmetric information' assumption. The persistence of the second assumption highlights her explanatory power and his role in measures and results robustness. If we accept the presence of information's asymmetry, then measures based on CEOs actions may be perceived as signalling strategy. According to Ross (1977) model's, manager may purchase his own firm's shares in order to pass a positive signal to the financial markets on the quality of his management and on the good health of his firm. As it mentioned before, the use of measures such as the net shares purchasing when controlling for the existence of managerial behavioural biases will affect dramatically the robustness of results.

We discuss the adopted assumptions in each considered work in the next classification. Remarks and discussion will be offered in order to understand the details of each work. This will be possible if we take into consideration the lack of articles in this field of literature.

5.6. Classification by the adopted assumptions

The behavioural corporate finance aims to explain corporate investment distortions (overinvestment, underinvestment and investment cash flow sensitivities) mainly by personal characteristics of managers. Such distortions were largely explained, in the standard finance, by agency conflicts and information's asymmetry.

When discussion investment cash flow sensitivity, researches evoke three important explanations of investment distortions. The first one concerns the effect of agency theory. Conflicts of interests in the firm may be possible sources of the deviation of investment to the norms and may cause investment cash flow sensitivity. The second one links investment distortions, including the investment cash flow sensitivity, to asymmetric information's theory. Another important explanation is discussed by Kaplan and Zingales which explore the effect of financial constraints on investment cash flow sensitivity.

Table 7. Distribution of articles by the adopted assumptions

Articles	Absence of agency' conflicts	Absence of asymmetric information	The existence of firms' financial constraint
Heaton (2002)	×	×	
Malmendier and Tatae (2005a)	×	×	×
Wei Huang *et al*.,		×	
Lin *et al*.,	×	×	
Malmendier and Tate (2005b)	×	×	×
Campbell *et al*.	×	×	

Heaton (2002) affirm that '*To explore managerial optimism's explanatory power, it is important to isolate its effects from the influence of assumptions made by the two predominant approaches to corporate finance: the asymmetric information approach and the empire-building/rational agency cost approach'*

Beyond the standard finance explanations and to neutralize the effect of these potential justifications of investment cash flow sensitivity, the behavioural corporate finance supposes generally the absence of agencies problems and asymmetric information. As it discussed above, the first and the second assumptions aim to neutralize potential explanations that can derives from them. Another justification is that these assumptions are powerful factors and may affect optimism and overconfidence measures.

Huang *et al*. work' is the first one that empirically investigates the effect of managerial overconfidence on investment with the presence of agency costs. The main measure of overconfidence in their paper is the net purchasing firms' shares. The validity of this measure is more related with the absence of asymmetric information than with the absence of agency conflicts.

Malmendier and Tate (2005a, 2005b) explore the investment cash flow sensitivity under managerial overconfidence with the absence of agency costs and information asymmetry but they reintroduce the firms' financial constraints as factors that may still having an explanatory power on this new behavioural frame work.

Finally, we highlight there is some others assumptions but they are less developed in empirical studies. Heaton (2002) in his theoretical paper, suppose that capital market is rational and markets are efficient. This assumption should be relaxed in order to study the interactions between irrational managers and inefficient markets.

5.7. Articles 'classification in the basis of empirical findings

The investment cash flow sensitivity is simply the study of the sensitivity of firms' corporate investment to the availability of internal cash flow. Finance literature focuses on what may derive this relationship?

The standard finance literature empirically proves the existence of investment cash flow sensitivity and it demonstrates that this sensitivity depends mainly by the existence of agency costs and asymmetric information. According to Kaplan and Zingales, firms' financial constraints may amplify the intensity of this sensitivity.

From a behavioural corporate finance point of view, the psychological biases are in the heart of the debate and so, their introduction as potential explanations of corporate investment distortions may answer the open question: 'investment cash flow sensitivity: who derives this relationship?'.

Table 8 summarizes findings on the effect of managerial optimism and overconfidence on investment cash flow sensitivity.

Table 8. Distribution of articles by theoretical predictions and empirical findings

Articles	Nature of papers	Empirical findings
Heaton (2002)	theoretical	+
Malmendier and Tatae (2005 a)	empirical	+
Wei Huang *et al*.,	empirical	+
Lin *et al*.,	empirical	+
Malmendier and Tate (2005 b)	empirical	+
Campbell *et al*.	empirical	+

Heaton (2002) theoretically predict an investment cash flow sensitivity phenomena caused by managerial optimism. Optimistic CEOs will reject project that do not have sufficient cash flow to finance them internally (or cannot issue risk-free debt). This will induce a positive correlation between cash flow and investment.

Malmendier and Tate (2005a) test the overconfidence hypothesis and find that investment of overconfident CEOs is significantly more responsive to cash flow. Applying a revisited measure of managerial overconfidence based on outsiders perception of the CEOs (CEOs 'press portrayals) reinvestigate the relationship between corporate investment and cash flow and corroborate the Malmendier and Tate (2005a) 'findings. Wei Huang *et al*. (2011) conclude that investment cash flow sensitivity is more pronounced with overconfidence executives and persists in the Chinese context.

Lin *et al*. (2005) conduct an empirical study to explore the extent to which managerial optimism provides a satisfactory explanation for the investment decision of listed Taiwanese firms. They focus on whether cash flow plays a relatively more important role in investment decision for optimistic managers than for non-optimistic managers. They evoke the possibility that firms' may be financially constrained. An investment cash flow sensitivity phenomenon persists in the Taiwanese context; optimistic manager's exhibit higher investment-cash flow sensitivity than do non-optimistic managers. Campbell *et al*. (2011) validate this empirical finding in the American context.

It is clear that behavioural corporate finance succeed to theoretically predict a potential explanation of corporate investment distortions. Empirical studies focusing on the effect of managerial overconfidence and optimism on investment cash flow sensitivity prove the existence of a positive correlation between investment and cash flow. Corporate investment will be more sensitive to internal cash flow in the case of optimistic or overconfident managers than with non-optimistic or non-overconfident managers. The psychological biases are one for them who derives the investment cash flow sensitivity relationship.

5.8. Classification by the adopted econometric approach

Investment cash flow sensitivity is studied using only the Q-investment model. We exclude the Heaton (2002) paper which has a theoretical nature. It is true that the Q-model is advantageous because it uses information from the capital market so it can generate direct measure of expected value of firm's future profitability. It is also more informative (George *et al*. 2011). But, what happened if the stock markets prices are inefficient? In this case, the use of Q can be imprecise proxy for the value of additional unit of capital.

Empirical results on investment cash flow sensitivity may be the result of econometric bias deriving from limits of the Q-model. The Euler equation model can be an alternative approach since it is based on the exploitation of the relationship between corporate investments in successive time periods and so it has the advantage that it does not require explicit use of future values.

Table 9. Distribution of articles by the adopted econometric approach

Articles	Q-investment model	Euler equation model
Malmendier and Tatae (2005 a)	×	-
Wei Huang *et al*.,	×	-
Lin *et al*.,	×	-
Malmendier and Tate (2005 b)	×	-
Campbell *et al*.	×	-

Researches testing the investment cash flow sensitivity under managerial optimism using simultaneous these two models of investment are absent until now, thing that can affect the quality of empirical results in this field of researches.

6. Conclusion and future research directions

This paper is an essay to survey literature in investment cash flow sensitivity under behavioural corporate finance. In our knowledge, there are a few survey papers focusing on behavioural corporate finance and no paper that have the same subject of this paper.

This research has surveyed the existent articles on this area of finance. In contrast to the research into behavioural finance, the research into behavioural corporate finance is still relatively young (Fairchild, 2007). So, only 6 articles were surveyed. In fact, we conduct an electronic search of published work on this field among scientific journal between 2002 and June 2011.

A classification scheme technique was adopted in order to make a comprehensive literature study. Readers should be cautious in interpreting the results of this literature survey, since the findings are based on data collected only from academic journal articles. We assume that high-quality research is eventually published in academic journals. The literature search procedure may also cause some limitations because it is based on papers title, key words or abstracts. It is true that the title in most cases describes the content quite well this is not always the case.

Notwithstanding these limitations, it is believed that this study provides some reasonable insights and future directions into the investment cash flow sensitivity under behavioural corporate finance. Based on the review, classification and analysis of the articles, some broad suggestions for future research can be advanced:

(1) First, the classification by articles by context highlight that research in this field are restraint into only two contexts: the American context and the Asiatic one (Japan and China). The behavioural corporate finance should go away from these contexts to study the investment cash flow sensitivity in European or African context. This is in order to generalize theoretical prediction and empirical findings and to neutralize the context's effect on the relationship between corporate investment and internal cash flow sensitivity. It is primordial to assure that the sensitivity is independent from the context of the study.

(2) The classification scheme technique shows a concentration of studies on the effect of only two behavioural biases: optimism bias and overconfidence. A potential growth of literature may be possible with the adoption of other psychological biases. We show also that the optimism and overconfidence biases are studied as if they are a simple one bias. They have the same effect and they also may have the same measures. It is the time to distinguish between them. Optimism should be studied as an overestimation of the mean while overconfidence should be evaluated as an underestimation of the variance.

(3) Measures of optimism and overconfidence are closed to assumptions that may be not always realistic. It is assumed at the most of cases that agency costs and asymmetric information are absent. There are at least two possible explanations: the behavioural corporate finance aims to prove the effect of managers' characteristics

on the corporate decisions. This is way it trays to neutralize potential explanations from these theories. Another possible explanation is that measures' validity is depending to these assumptions.

(4) An interesting approach may arise if we find some measures of optimism and overconfidence that are robust even the existence of agency costs and asymmetric information. This new approach is very attractive since it will offer the possibility to explore the influence of these biases and to see their interactions with the effect of agency and asymmetric information theories.

(5) The emergence of a new framework where irrational managers will exist with irrational investors should be developed. Behavioural corporate finance should investigate the interactions of irrational behaviours from these two poles. Implications on investment cash flow sensitivity should be discussed.

(6) Another interesting point is to study the effect of optimism and overconfidence not only for CEOs. In fact, he is not alone responsible on the efficiency of corporate investment decisions. Researchers are invited to generalize their studies in orders to include other insiders such as Financial chef officer and other member of the board of director. Translation on the study of personal characteristics from top management to the optimism or over confidence seems to offer a more realistic framework to detect the effect of psychological biases on firms 'decisions.

(7) The investment cash flow sensitivity is still unexplored for the Research and development activities. It is still an open question

(8) The behavioural corporate finance focuses on how psychological biases affect mangers' decision and so how they may explain corporate investment distortions. Future directions are invited to discuss the manner on which firms will succeed to neutralize possible distortions deriving from optimism, overconfidence and other psychological biases.

(9) The investment cash flow sensitivity under managerial optimism was studied using the Q-model of investment, a thing that can reduce the significant of results. The positive coefficient between investment and cash flow multiplied by managerial optimism may be the result of econometric bias that is due to limitations of Q-model.

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Have Credit Rating Agencies Become More Stringent towards Japanese Regional Banks?*

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Abstract:

This article investigates empirically whether foreign and domestic credit rating agencies tightened their standards for evaluating Japanese regional banks from 2000 to 2009. We extend and enhance previous studies by estimating an ordered probit model using pooled data for this period. Our results reveal that foreign agencies did not rate Japanese regional banks more stringently during this period, perhaps because they wished not to repel clients and reduce their revenues. Japan's rating agencies showed the opposite tendency, perhaps to seek credibility among foreign investors.

Keywords: credit ratings, domestic credit rating agencies, foreign credit rating agencies, regional banks, rating stringency

JEL Classification: G21

1. Introduction

Investors and depositors rely on credit ratings for selecting securities and choosing a bank. Without doubt, credit ratings are convenient; the issue is whether they are reliable. After all, rating agencies are paid by the firms they rate, and securitizations of subprime loans that provoked a global financial crisis routinely carried investment-grade ratings. Since the subprime and Lehman shocks, regulation of financial institutions has become more stringent worldwide, and hence the question arises whether rating agencies have become more stringent in evaluating financial institutions. The question is germane in Japan where the unfreezing of payout limits makes reliable credit ratings essential for depositors to gauge their banks' soundness.

This article investigates whether US and Japanese rating agencies became more stringent in assessing creditworthiness of Japan's primary regional financial institutions—first-tier and second-tier regional banks. We build on and extend previous studies by estimating an ordered probit model using pooled data for 2000–2009, the period when regulation of financial institutions became more stringent worldwide.

Section 2 reviews previous studies. Section 3 discusses data and methodologies. Section 4 presents and interprets the empirical results. Section 5 summarizes and concludes.

2. Literature Review

Ordered probit models have been used to test many types of hypotheses (Miyata, 2003; Gascoigne and Turner, 2004; Grund and Gürtler, 2005 and Huang and Lin, 2006). Brooks and Naylor (2008)[4] determined that firm size and business risk had positive and negative influences, respectively, on Morningstar® equity ratings in 2005.[5]

Blume, Lim and MacKinlay (1998) revealed that more stringent rating standards explained part of the decline in S&P credit ratings of US firms from 1978 to 1995. Using data from 1988 to 1999, Doherty and Phillips (2002) demonstrated that the downtrend in A.M. Best's ratings of property-liability insurers was consistent with increased stringency.

Using data from 1987 to 1999, Pottier and Sommer (2003) showed that A.M. Best and S&P had become more stringent in evaluating credit ratings of life insurers.[6]

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* The author has conducted this study as a member of the research team at the Graduate School of Nagoya University, organaized by Professor Nobuyoshi Yamori.

[4] Poon (2003), and Ashbaugh–Skaife, Collins and LaFond (2006) also analyzed the determinants of ranks of credit ratings.

[5] Pottier and Sommer (1999) investigated the determinants of credit ratings of US insurers and found that A.M. Best, Moody's and S&P awarded higher ratings to larger insurers and lower ratings to insurers that invested in junk bonds.

[6] Only data from 1990 and 1999 were used for S&P because of data restrictions.

Gonis and Taylor (2009) investigated whether downgrades in UK corporate credit ratings reflected deteriorating creditworthiness or greater stringency by rating agencies. Applying analytical methods of Blume and MacKinlay (1998), Doherty and Phillips (2002) and Pottier and Sommer (2003) to data from 1999 to 2004, they estimated the ordered probit model including year dummies, as did previous studies, and concluded that both factors influenced downgrading in the UK.

3. Methodology and Data

3.1. Methodology

We take credit ratings of each bank as a dependent variable and estimate the ordered probit model, following previous studies. Data included pooled data of Japanese regional banks from 2000 to 2009. We assign numerical scores to credit ratings: 9 for AAA, AA+ (Aaa, Aa1), 8 for AA (Aa2), 7 for AA− (Aa3), 6 for A+ (A1), 5 for A (A2), 4 for A− (A3), 3 for BBB+ (BBB1), 2 for BBB (BBB2), 1 for BBB− (BBB3) and 0 for ratings below BBB− (BBB3).[7]

We select independent variables based on Gonis and Taylor (2009), considering variables used in previous studies and factors that rating agencies consider in evaluating creditworthiness.

Asset is the total assets of each bank and a proxy measure of size. If larger banks enjoy economies of scale or other efficiencies and receive high credit ratings, the coefficient of this variable will be positive. Financially sound small banks might also receive high ratings. This variable is converted into a natural logarithm.

Leverage is capital leverage of each bank and a proxy measure of underlying financial soundness. It is reasonable to surmise that banks with adequate capital bases would receive high ratings because they have a greater risk cushion. This coefficient should be negative.

Cash is the ratio of cash and notes due from banks to total assets of each bank. It is a proxy measure of immediate liquidity. Banks with superior liquidity can better withstand emergencies. If those banks receive high credit ratings, this coefficient will be positive.

Bond-Call is the ratio of call loans and government bonds to total assets of each bank. It is a proxy measure for assets, second only to *Cash* in liquidity and credit risk. If banks holding higher percentages of near-cash assets also have higher credit ratings, this coefficient will be positive.

Stock is the ratio of equities among each bank's total assets. It is a proxy measure of exposure to market risk and liquidity risk, which are greater for equities than are default-free assets such as government bonds. If rating agencies interpret holdings of equities as harboring risk, this coefficient should be negative.

Nonperform is each bank's non-performing loan ratio. Banks with an outsized ratio presumably are not managing risks well. Their capital bases could be impaired and their financial soundness threatened if they must dispose of non-performing loans. This coefficient will be negative.

ROA indicates profitability. Highly profitable banks can expand their capital base. If rating agencies value that ability, the coefficient of *ROA* should be significantly positive. However, highly profitable banks might engage in riskier businesses.[8] If rating agencies judge that to be the case, this coefficient will not necessarily be positive.

Concentration is the Herfindahl index for each prefecture. It is calculated based on the loans and discounted bills of first-tier regional banks, second-tier regional banks and credit associations in each prefecture. It is a proxy for concentration of regional markets. If agencies perceive that banks operating in concentrated markets cannot raise margins and profits, the coefficient of this variable will be positive; if agencies perceive regional concentration implies opportunities for small profits and nimble returns, this coefficient will be significant and negative.

Share is the share of loans and bills discounted of a bank to the sum of them in the prefecture where that bank is headquartered*. It is a proxy of regional share. In general, banks with a high share of their regional market have more stable profits.* The coefficient of this variable will be positive.

Tax is each prefecture's revenue from local taxes and is *a proxy of* a regional market's economic vitality.[9] If rating agencies believe banks in well-off regions can raise profits easily, the coefficient of this variable will be positive. This variable is converted into a natural logarithm.

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[7] The ranks of credit ratings in parentheses are those of Moody's.

[8] Cantor and Packer (1997) mentioned that if *ex ante* uncertainties about default risk of firms whose leverage and ROA are high become greater, they might voluntarily seek credit ratings to decrease uncertainties about their default risks.

[9] Prefectural GDP is preferable to *Tax* as a proxy variable of economic vitality. However, because prefectural GDP for 2009 had not been released at the time of our study, we use data for local taxes as a proxy of prefectural GDP.

Year dummies from 2001 to 2009—*Dum2001* to *Dum2009*—are added in the estimated model. Our concern is how values of these coefficients will change. If the value is smaller (higher) than it was in the previous year, ratings were presumably more stringent (less stringent) than they were in the previous year.

3.2. Data

Descriptive statistics for credit ratings appear in Table 1.[10]

Table 1. Descriptive Statistics of Credit Ratings

	S&P	Moody's	JCR	R&I
Mean	3.017	3.705	4.951	5.273
Maximum	7	8	8	8
Minimum	0	0	0	1
SD	1.550	1.852	1.477	1.605
Observations	291	224	386	278

Foreign rating agencies are believed to be more stringent than are Japanese rating agencies. That belief is borne out by comparing the averages in Table 1. The highest rating granted by Moody's, JCR and R&I was AA (or A2), whereas that for S&P was AA−. Therefore, Japanese regional banks might hesitate to ask foreign agencies for credit ratings.

The average credit ratings per year for each rating agency are shown in Figure1.

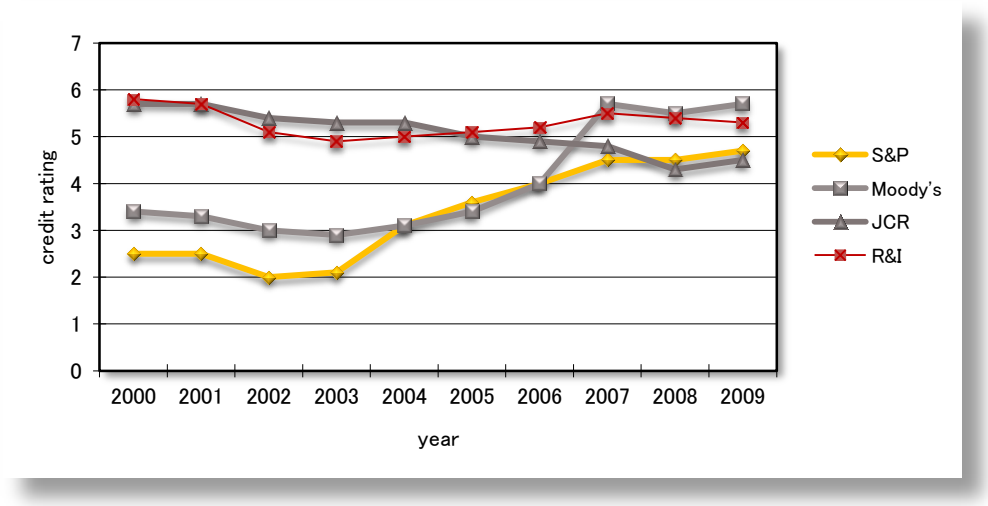

Figure 1. Average Credit Ratings

Among foreign agencies, S&P's average ratings increased after 2003 and those of Moody's increased after 2004. Among Japanese agencies, JCR's average ratings dropped from 2000 to 2008, and those of R&I decreased from 2000 to 2003 and from 2008 to 2009.

Although R&I's average rating increased from 2004 to 2007, its span of increase is less than it is for S&P and for Moody's. This may be because Japan's financial system had been unstable throughout the decade preceding the early 2000s and had recovered. This evidence suggests that domestic agencies became more stringent in their ratings.

Ratios of ratings revisions for the sample period are shown from Tables 2 to 5.

[10] We calculated them by the sample including unsolicited credit ratings.

Table 2. S&P's Ratings Revisions (%)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Upgrades	8.1	0.0	2.2	42.1	47.6	38.1	45.0	4.8	0.0
Downgrades	8.1	15.0	0.0	10.5	0.0	0.0	0.0	0.0	4.5
Maintain	83.8	85.0	97.8	47.4	52.4	61.9	55.0	95.2	95.5

Table 3. Moody's Ratings Revisions (%)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Upgrades	0.0	0.0	0.0	14.8	8.3	14.3	100.0	0.0	0.0
Downgrades	6.9	24.1	25.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintain	93.1	75.9	75.0	85.2	91.7	85.7	0.0	100.0	100.0

Table 4. JCR's Ratings Revisions (%)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Upgrades	4.2	0.0	6.9	0.0	14.3	12.5	7.0	3.8	22.2
Downgrades	8.3	15.4	20.7	3.6	0.0	2.5	0.0	34.6	7.4
Maintain	87.5	84.6	72.4	96.4	85.7	85.0	93.0	61.5	70.4

Table 5. R&I's Ratings Revisions (%)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Upgrades	0.0	0.0	0.0	0.0	11.1	10.3	21.4	6.7	3.3
Downgrades	9.1	31.8	3.8	6.9	0.0	0.0	3.6	6.7	10.0
Maintain	90.9	68.2	96.2	93.1	88.9	89.7	75.0	86.7	86.7

We find scarcely any years after the mid-2000s in which S&P and Moody's downgraded ratings of regional banks, and the ratio of upgrades is larger, especially for S&P. Conversely, we find downgrades by JCR and R&I even after the mid-2000s, when Japan's financial system and economic condition had recovered. Moreover, the ratio of their upgrades is much smaller than it is for S&P. Thus, it seems possible that Japanese agencies' ratings of regional banks became more stringent. Descriptive statistics of independent variables are in Table 6.

Table 6. Descriptive Statistics of Dependent Variables

	Asset	*Leverage*	*Cash*	*Bond-Call*	*Stock*	*Nonperform*	*ROA*
Mean	3243300	2152.674	3.731	11.568	2.442	5.465	0.062
Maximum	11693332	10754.96	14.826	25.941	9.926	15.275	1.110
Minimum	464583	1131.210	0.935	1.8146	0.308	1.667	−2.939
SD	2067116	726.482	2.007	4.102	1.341	2.371	0.445
Observations	647	647	647	647	647	647	647

Concentration	*Share*	*Tax*
3813.318	44.011	460095
7781.829	87.923	5497272
460.368	3.170	55872
1503.891	22.731	833879
647	647	647

Data on credit ratings of each bank are from the CD-ROM of *Four Seasons Reports on Companies* in the summer issue of each year (*Kaisya Shikiho*), edited by Toyo Keizai. Data for financial statements of individual banks are taken from the Nikkei NEEDS. Data absent in Nikkei NEEDS is supplemented from the *Analysis of Financial Statements of All Banks* edited by the Japanese Bankers Association. Prefectural data is obtained from the 'Financial Resources of a Nation' (*Minryoku)* edited by *Asahi* Newspaper.

4. Empirical Results

4.1. Results of foreign credit rating agencies

We take the credit ratings of S&P and Moody's as dependent variables and estimate. Results appear in Table 7.

Table 7. Estimation Results of Foreign Credit Rating Agencies

	S&P	Moody's
	Coefficient (z-value)	Coefficient (z-value)
Constant	−3.987 (−1.258)	25.760*** (4.952)
Asset	0.853*** (2.762)	−2.269*** (−4.642)
Leverage	−0.002*** (−7.442)	−0.003*** (−10.051)
Cash	0.113*** (2.704)	−0.077 (−1.646)
Bond-Call	0.065*** (3.140)	0.060** (2.387)
Stock	−0.225*** (−3.597)	−0.405*** (−5.373)
Nonperform	−0.126*** (−2.686)	−0.115** (−2.219)
ROA	−0.103 (−0.314)	−0.564** (−1.975)
Concentration	−0.001*** (−5.982)	−0.002*** (−8.224)
Share	0.051*** (4.331)	0.148*** (8.074)
Tax	−0.214 (−1.016)	1.486*** (5.171)
Dum2001	−0.049 (−0.169)	−0.373 (−1.255)
Dum2002	−0.074 (−0.253)	−0.373 (−1.192)
Dum2003	−0.072 (−0.247)	−0.400 (−1.269)
Dum2004	0.249 (0.775)	−0.456 (−1.528)
Dum2005	0.496 (1.539)	−0.515* (−1.697)
Dum2006	0.960*** (2.806)	−0.281 (−0.733)

Dum2007	1.375*** (3.819)	1.075*** (2.674)
Dum2008	1.561*** (4.562)	0.832** (2.143)
Dum2009	1.693*** (4.512)	1.167*** (2.959)
Upper boundary for rating category		
BBB-	0.067 (1.013)	1.401*** (4.557)
BBB	2.613*** (11.077)	2.538*** (7.673)
BBB+	3.346*** (13.261)	3.769*** (10.626)
A−	4.411*** (15.975)	5.196*** (13.109)
A	6.010*** (17.226)	5.722*** (13.918)
A+	6.786*** (15.797)	7.053*** (15.405)
AA−		7.905*** (15.578)
Pseudo-R^2	0.352	0.357
Log Likelihood	−308.473	−283.352
Observations	291	224

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.

Pseudo-R^2 values in the model including year dummies are 0.352 for S&P and 0.357 for Moody's. Those in the model without year dummies are 0.303 for S&P and 0.319 for Moody's. It seems apparent that ratings stringency did vary across the sample period.

As for results of independent variables, the coefficients of *Leverage* for S&P and Moody's are significantly negative at the 1% level. Banks with sound financial positions received higher ratings, as expected.

While coefficients of *Stock* are negative and significant at the 1% level for both agencies, coefficients of *Bond-Call* are significantly positive at the 1% level for S&P and at the 5% level for Moody's. It seems that these proxies reflect important considerations in evaluating credit ratings: banks that held substantial equity positions received lower ratings, whereas banks that held many government bonds and call loans received higher ratings.

The coefficients of *Nonperform* are significantly negative at the 1% level for S&P and at the 5% level for Moody's. This finding was expected for reasons explained in Section 3.

Coefficients of *Concentration* are negative and significant at the 1% level for both agencies, indicating that banks in competitive markets received higher ratings. Apparently, rating agencies appreciated these banks' competitive opportunities, and lower margins were not negatives.

Coefficients of *Share* are significantly positive at the 1% level for both rating agencies. They apparently endorsed the advantages of having larger shares in regional markets through higher ratings.

The coefficient of *Asset* is positive and significant at the 1% level for S&P and significantly negative at the 1% level for Moody's. Perhaps S&P recognized larger banks' economies of scale, and Moody's awarded higher ratings to sound banks even if they were small.

The coefficient of *ROA* for Moody's is negative and significant at the 5% level. Perhaps Moody's awarded lower ratings to banks that pursue immediate profits through higher-risk business.

The coefficient of *Cash* for S&P is significantly positive at the 1% level, as is the coefficient of *Tax* for Moody's. Both results were anticipated in Section 3.

Year dummies from 2006 to 2009 for S&P are significantly positive at the 1% level, and their values rose yearly, intimating that S&P might have awarded softer ratings since 2006. To confirm, we re-estimated the model after excluding banks with unsolicited ratings.[11] Although we omitted the table for brevity, there were no years in that estimation where coefficients of year dummies were smaller than they were in the previous year. Year dummies from 2007 to 2009 for Moody also are positive and significant, and values for 2007 and 2009 exceed

[11] Between 2000 and 2003, a large number of banks received unsolicited credit ratings than they did during other years in the sample period. As far as possible, we sought to make the number of observed samples for each year identical.

those of previous years. This estimation, too, reveals no tendency towards more stringent ratings. Therefore, evidence suggests that neither Moody's nor S&P's ratings became more stringent during the period. Financial markets believe that foreign agencies evaluate Japanese firms more critically than do Japanese rating agencies; knowing this, these foreign credit agencies might have held back, fearing loss of fee income if they frightened away potential clients among Japanese regional banks.

4.2. Results of domestic credit rating agencies

We now take the ratings of JCR and R&I as dependent variables and estimate. Table 8 presents the results.

Table 8. Estimation Results of Domestic Credit Rating Agencies

	JCR	R&I
	Coefficient (z-value)	Coefficient (z-value)
Constant	−1.749 (−0.771)	−17.926*** (−6.435)
Asset	1.184*** (6.285)	2.808*** (9.869)
Leverage	−0.001*** (−11.145)	−0.003*** (−11.361)
Cash	0.027 (0.745)	−0.056 (−1.186)
Bond-Call	0.032** (1.979)	0.086*** (4.653)
Stock	0.010 (0.153)	−0.317*** (−4.551)
Nonperform	−0.218*** (−6.043)	0.009 (0.167)
ROA	−0.859*** (−4.700)	0.296 (0.950)
Concentration	−0.000*** (−2.965)	−0.000*** (−4.634)
Share	0.032*** (4.981)	0.024*** (2.775)
Tax	−0.050 (−0.477)	−0.781*** (−4.310)
Dum2001	−0.249 (−0.791)	−0.803** (−2.152)
Dum2002	−0.246 (−0.790)	−1.187*** (−3.165)
Dum2003	−0.196 (−0.632)	−1.300*** (−3.658)
Dum2004	−0.546* (−1.776)	−1.885*** (−5.229)
Dum2005	−1.055*** (−3.627)	−1.934*** (−5.378)
Dum2006	−1.159*** (−3.984)	−1.915*** (−5.102)
Dum2007	−1.383*** (−4.771)	−1.778*** (−4.586)
Dum2008	−1.730*** (−5.904)	−1.356*** (−3.723)
Dum2009	−1.257*** (−4.128)	−0.699* (−1.929)
Upper boundary for rating category		
BBB−	5.994*** (6.042)	
BBB	7.509*** (7.489)	0.843*** (3.360)
BBB+	8.320*** (8.244)	2.673*** (7.278)
A−	9.733*** (9.429)	4.909*** (11.442)

A	11.349*** (10.686)	6.212*** (12.995)
A+	12.792*** (11.780)	8.846*** (15.516)
AA−	13.905*** (12.574)	10.011*** (16.474)
Pseudo-R^2	0.360	0.498
Log Likelihood	−438.262	−239.779
Observations	386	278

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.

Pseudo-R^2 values in the model featuring year dummies are 0.360 for JCR and 0.498 for R&I. Values in the model without year dummies are 0.320 for JCR and 0.446 for R&I. Results suggest that rating stringency varied across the sample period in these estimations as well.

For independent variables, the coefficients of *Leverage* are negative and significant at the 1% level for both Japanese agencies. Coefficients of *Bond-Call* are positive and significant at the 1% level for R&I and significant at the 5% level for JCR. These results are the same as in Table 7. Domestic agencies also regard sound financial positions and intensities of risks as important when assigning ratings.

Coefficients of *Asset* and *Share* are positive and significant at the 1% level for Japanese agencies. Both gave high ratings to larger banks and to banks with larger shares in their regional markets, as did their US counterparts.

The coefficient of *Stock* for R&I is negative and significant at the 1% level, as is the coefficient of *Nonperform* for JCR. The coefficient of *ROA* for JCR is negative and significant at the 1% level, as are coefficients of *Concentration* for both Japanese agencies. These results were expected in Section 3 and show signs similar to the estimation results for foreign agencies.

Contrary to expectations in Section 3, the coefficient of *Tax* for R&I is negative and significant at the 1% level. Perhaps results were influenced by lower ratings on banks operating where economic scales are large but where financial systems were unstable around 2000—notably Osaka prefecture.

Coefficients of all year dummies for JCR are negative. Those from 2004 to 2008 are significantly negative—at the 10% level for 2004 and at the 1% level for the other years—and their values decrease yearly. This result suggests that JCR's ratings were more stringent after 2004, confirming tendencies reported by Gonis and Taylor (2009) and others. To counter criticisms that Japanese agencies rate Japanese firms more leniently than do foreign agencies, JCR might have tightened its ratings to gain credibility among foreign investors.

All coefficients of year dummies for R&I are significantly negative. Notably, their values from 2001 to 2005 decreased yearly. On this basis, we conclude that R&I's ratings of regional banks also became more stringent. Although coefficients of year dummies from 2006 tend to be slightly larger than of previous years, all of their values were smaller compared to those from 2000. It seems that JCR continued to evaluate ratings more stringently than they did in 2000.

5. Conclusion

This study empirically investigated whether US and Japanese credit rating agencies became more stringent towards Japanese regional banks from 2000 to 2009, when regulations to financial institutions became more stringent worldwide.

First, we documented revisions in credit ratings and found it likely that Japanese agencies became more stringent, considering that Japan's financial system and economy had recovered since the mid-2000s.

Second, ordered probit models including year dummies were estimated. Results revealed that foreign rating agencies did not adopt more stringent standards toward Japanese regional banks. Perhaps they wished to avoid scaring off the Japanese clients and losing revenues.

Unlike foreign rating agencies, Japanese agencies did adopt more stringent standards—since the mid-2000s for JCR and until the mid-2000s for R&I. R&I continued to apply more stringent standards than they did in 2000, even after 2006. They, perhaps, hoped to improve their credibility among the foreign investors.

It remains for future scholarship to investigate whether ratings of Japan's non-bank industries, especially by Japanese agencies, have become more stringent and whether trends found in this study persist.

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Forecasting Exchange Rate in Iranian Economy, a New Approach

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Abstract

Forecasting exchange rate is very important for monetary policy makers in order to prevent unexpected changes of exchange rate. This paper has used Newton's method for forecasting exchange rate of U.S. dollar/pound (24/03/2003—17/11/2011) in Iranian economy. Comparison of the original trends and forecasting data confirms their parallel movement and error of very small between the trends.

Keywords: exchange rate, forecasting, secant, interpolation, Newton's method

JEL Classification: F31, C02

1. Brief review on literature

Exchange fluctuations make insecurity conditions in production and increase risk in the economic activities. On the other hand, exchange fluctuations influence value of foreign transactions among countries and generate change foreign costs. Thus establishing stability in exchange market is very important for monetary policy makers. Forecasts of exchange rates are one of the tools that can help control and confront the exchange fluctuations. Researchers have used various methods for forecasting exchange rate. Some economists such as Meese and Rogoff (1983) forecasted exchange rate by the random walk model. In this model exchange rate of future is function of current exchange rate and postulate that trend of exchange rate follow linear pattern. ARIMA or VAR and VECM models are other traditionally-used linear models in forecasting of exchange rates. Other researchers believe that linear models aren't able to forecast exchange rates precisely. They stress that changes of exchange rates have nonlinear behaviour. Engle and Bollerslev (1986), and Hsieh (1989), estimated a GARCH model for analysis exchange rates changes. In recent years, neural networks have been used for forecasting economic variables such as exchange rates. Past data are entrance variables and future data are exodus variables of neural networks. This method uses nonlinear time series data for forecasting of exchange rates. Donaldson (1996), Kuan & White (1994), Oskooei (2002), Tayyebi *et al.* (2008) in separate studies have investigated application of artificial neural network to time series forecasting. In another studies, Moshiri (2001) and Linton and Shintani (2003) have stressed the nonlinear and chaotic behavior in financial and economic variables such as exchange rate. In this method, researches test chaotic behavior and next process forecast exchange rates. Scarlet *et al.* (2007), Marites and Babazadeh *et al.* (2010), have confirmed existence of chaotic behaviour in exchange markets of Romania, Pilipines and Iran. In this paper, a new approach is introduced for forecasting of the exchange rate.

2. Exchange rate forecasting by Newton's method

Between the numerical methods, Formula of Newton method repetition is one popular and quick technique for solution mathematical equations. In this method:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_{n+1})}. \quad n = 0,1,2,... \qquad (1)$$

For solution of this equation must exist $f'(x)$ and $f'(x) \neq 0$. We can use secant method for removal of this problem. In this method, approximate of $f'(x_n)$ is being substituted

in (1). Thus;

$$f'(x_n) \cong \frac{f(x_n) - f(x_{n-1})}{x_n - x_{n-1}} \quad (2),$$

$$x_{n+1} = \frac{x_{n-1} f(x_n) - x_n f(x_{n-1})}{f(x_n) - f(x_{n-1})} \quad (3)$$

Because here given linkage don't exit for using secant method and data are time series in this study, we use interpolation method for estimation of $f(x)$. According to this method firstly, we obtain one interpolation polynomial and then us it as $f(x)$ in secant method. From Fig.1, it illustrates trend of U.S. dollar exchange rate (24/03/2003—17/11/2011) in Iranian economy that has been interpolated based on original data. Also Fig.2 shows forecasting of data resultant from Fig.1 by secant method. Comparison of these two figures shows that firstly, starting point of figures are almost equivalent together. Secondly, trend of figures is the same. That means all figures are common trends and in times of peak or crash, they move the same. Mean square error relates to original and fitted data is 18.2. This number indicates that error of prediction of exchange rate of dollar/pound on Newton's method is only 18.2 Rail (monetary unit of Iran). Obtained error isn't noteworthy. This finding confirms application of Newton's method in forecasting exchange rate.

3. Conclusions

Forecasting exchange rate helps monetary policy makers to control market fluctuations of exchange and program in order to prevent exchange disruptive. This paper introduced the Newton's method for forecasting U.S. dollar exchange rate (24/03/2003—17/11/2011) in Iranian economy. Thus firstly, trend of interpolated exchange rate got and then forecasted exchange rate. Results from forecasting exchange rate shows changes of forecast and original data are almost the same.

Figure 1. Trend of exchange rate of U.S. dollar/pound (24/03/2003—17/11/2011) in Iranian economy based on interpolation method

U.S. dollar/pound

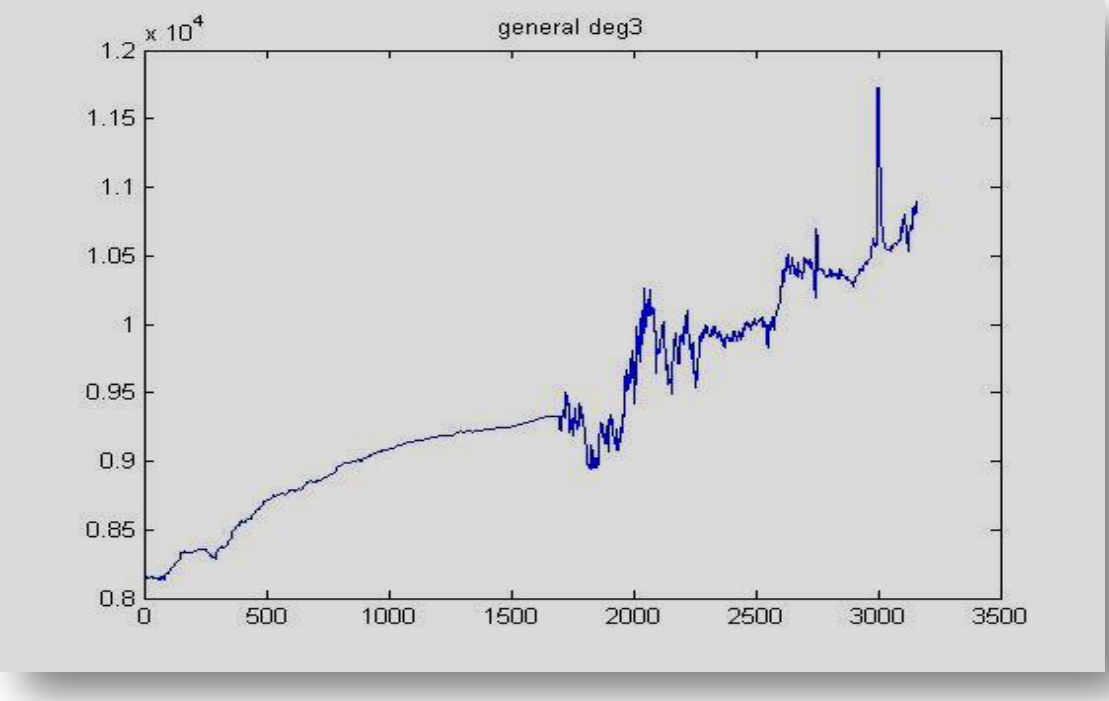
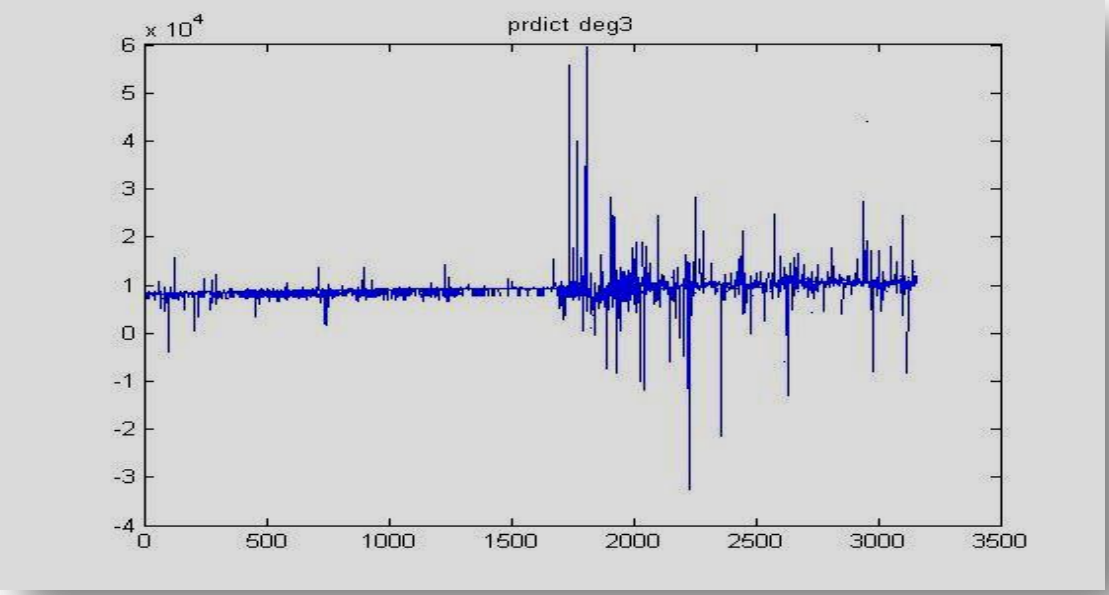


Figure 2. Forecasting U.S. dollar exchange rate (24/03/2003—17/11/2011)
in Iranian economy based on Newton's method

U.S. dollar/pound



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Indian Foreign Trade in Post Liberalisation Era

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Abstract

Liberalization of 1991 is a major turning point in the history of post-independence India. Overall both exports and imports of goods have grown from 1991 to 2012, though imports have grown more than exports over the same time period resulting in widening of trade deficit. However the surplus from services exports has helped to maintain the BOP situation. One of the major changes in export destination as well as sources for import is shift from Europe to Asia. Germany, UK and France are left behind by UAE, China and Singapore. USA still remains as one of the top five trading partner. The overall reserves and all categories of reserves have shown growth from 1991 to 2012. However SDR reserves followed by foreign currency reserves have shown the maximum increase. Indian currency has depreciated against all the major international currencies and the depreciation is highest in case of Japanese Yen and US Dollar. The depreciation has helped certain exports from India where import content is less. Overall the external debt has increased from 1991 to 2012.

Keywords: foreign trade, liberalization, performance, India

JEL Classification: F14, F41, F43

1. Introduction

Today, India is widely recognized as one of the emerging economy, even though it has slowed down a bit in recent years. However the long term growth prospects remain strong and it is still believed to be one of the major economies of the future. India's Foreign Trade Policy 2009-2014 aims to double Indian exports of goods and services by 2014 and doubling Indian share of world trade by 2020 (Commerce Ministry 2012).

However this optimism was not there till few decades ago. After independence in 1947, India as an economy was widely recognized with slow growth rates called as the Hindu rate of growth for a long time. And the foreign trade policy was dominated by the dual policies of export pessimism and import substitution. Initial efforts to promote foreign trade in 1960s showed results in 1970s and further steps were taken to improve the foreign trade arena.

The big boost came with the liberalization process in 1991. The liberalization of 1991 was a major turning point in the history of post-independence India. This paper studies the foreign trade in post liberalization.

2. Performance of Indian foreign trade

Table 1 shows the overall performance of Indian foreign trade. Exports have grown from USD 18 billion in 1991 to to over USD 304 billion in 2012. Imports have grown from USD 234 billion in 1991 to over USD 489 billion in 2012. Trade deficit has gone worse from USD 5 billion in 1991 to over USD 184 billion in 2012. Thus overall both exports and imports have grown from 1991 to 2012, though imports have grown more than exports over the same time period resulting in widening of trade deficit. The trade defi cit during 2011-12 stood higher at US$ 184.9 billion than US$ 118.7 billion during 2010-11 mainly on account of large imports of POL and gold & silver accounting for 44.4 per cent of India's imports (RBI, 2012). The trade account deficit is supported by the rising services exports. India services exports have higher share in total global services exports than India's goods exports share in total global goods exports.

Table 1. Foreign Trade Performance of India (1991-2012)

Year	Exports (US $ million)	Exports YoY (%)	Imports (US $ million)	Imports YoY (%)	Trade Balance (US $ million)	Trade Balance YoY (%)
1991	18148	9.25	23464	10.59	-5316	15.39
92	17998	-0.83	19551	-16.68	-1553	-70.79
93	17437	-3.12	20583	5.28	-3146	102.58

Year	Exports (US $ million)	Exports YoY (%)	Imports (US $ million)	Imports YoY (%)	Trade Balance (US $ million)	Trade Balance YoY (%)
94	22213	27.39	23305	13.22	-1092	-65.29
95	26337	18.57	28662	22.99	-2325	112.91
96	31842	20.9	36730	28.15	-4888	110.24
97	33498	5.2	39165	6.63	-5667	15.94
98	35049	4.63	41535	6.05	-6486	14.45
99	33187	-5.31	42349	1.96	-9162	41.26
2000	36709	10.61	49730	17.43	-13021	42.12
01	44060	20.03	49958	0.46	-5898	-54.7
02	43828	-0.53	51415	2.92	-7587	28.64
03	52703	20.25	61393	19.41	-8690	14.54
04	63886	21.22	78203	27.38	-14317	64.75
05	83502	30.7	111472	42.54	-27970	95.36
06	103075	23.44	149144	33.8	-46069	64.71
07	126276	22.51	185081	24.1	-58805	27.65
08	162988	29.07	249791	34.96	-86803	47.61
09	183091	12.33	299311	19.82	-116220	33.89
2010	178307	-2.61	287587	-3.92	-109280	-5.97
11	250806	40.66	369424	28.46	-118618	8.55
2012	304334	21.34	489254	32.44	-184920	55.9

Source: CMIE Database, 2012

Table 2 gives the composition of Indian exports. From the table it is evident that the exports in all major categories have overall increased from 1991 to 2012. However, petroleum products and manufactured goods have grown the most. This is a positive development as it is an indicator of increasing value addition in the export sector as compared to an era when Indian was identified mainly with raw material and agricultural exports. Traditionally, India has had a comparative advantage in textiles but the share of this item in India's total exports is gradually decreasing over the years (DGCI&S 2011).

Table 2. Composition of Indian Exports

Year	Agricultural and allied products (US $ million)	Agricultural and allied products YoY(%)	Ores & minerals(US $ million)	Ores & minerals YoY(%)	Manufactured goods(US $ million)	Manufactured goods YoY(%)	Petroleum & crude products(US $ million)	Petroleum & crude products YoY(%)	Other commodities (US $ million)	Other commodities YoY(%)
1991							522.74	24.93		
92	3219.3	N.A.	936.65	N.A.	13245.25	N.A.	417.76	-20.08	179.33	N.A.
93	2949.64	-8.38	693.97	-25.91	13166.81	-0.59	447.95	7.23	178.54	-0.44
94	4023.1	36.39	887.19	27.84	16636.93	26.36	397.39	-11.29	268.4	50.33
95	4227.28	5.08	988.6	11.43	20410.02	22.68	417.01	4.94	294.6	9.76
96	6120.01	44.77	1176.67	19.02	23782.44	16.52	454.42	8.97	308.33	4.66
97	6868.5	12.23	1173.36	-0.28	24634.16	3.58	482.2	6.11	339.75	10.19
98	6634.2	-3.41	1062.34	-9.46	26578.59	7.89	353.18	-26.76	420.3	23.71
99	6028.81	-9.13	892.6	-15.98	25767.32	-3.05	89.34	-74.7	409.24	-2.63
2000	5607.1	-6.99	915.96	2.62	29709.43	15.3	29.97	-66.45	446.16	9.02
01	5971.16	6.49	1152.6	25.84	34323.51	15.53	1891.79	6212.3	721.45	61.7
02	5901.44	-1.17	1262.44	9.53	33371.02	-2.78	2119.22	12.02	1174.34	62.77
03	6707.98	13.67	1995.44	58.06	40232.29	20.56	2575.75	21.54	1191.96	1.5
04	7538.27	12.38	2370.34	18.79	48525.44	20.61	3570.87	38.63	1881.56	57.85
05	8471.21	12.38	5076.48	114.17	60705.72	25.1	6986.46	95.65	2261.68	20.2
06	10212.3	20.55	6162.68	21.4	72552.12	19.51	11637.94	66.58	2510.36	11
07	12674.92	24.11	6997.78	13.55	84863.39	16.97	18666.11	60.39	3074.14	22.46
08	18441.61	45.5	9124.48	30.39	103031.6	21.41	28377.65	52.03	4012.56	30.53
09	17562.92	-4.76	7812.94	-14.37	123345.4	19.72	26872.37	-5.3	7497.59	86.85
2010	17742.79	1.02	8666.73	10.93	115237.4	-6.57	28025.94	4.29	8634.55	15.16
11	24203.67	36.41	8635.65	-0.36	157968.2	37.08	41426.15	47.81	18572.1	115.09
2012	37399.64	54.52	8148.66	-5.64	186678.8	18.17	55436.65	33.82	16670.1	-10.24

Source: CMIE Database, 2012.

In contrast to the pre-reform period (1950-90), the actual growth of exports in the post-reform period has been above the potential offered by the growth of world demand. The gap between the actual and potential is mainly explained by an improvement in the overall competitiveness of India's exports (Virmani, 2003, Veeramani, 2007). The government policy changes have supported the foreign trade. A few more schemes (such as, target plus, served from India) have been added under the Foreign Trade Policy 2004 (RBI 2004, Malik, 2005).

Table 3 gives the director of Indian exports. One of the major changes in export destination is shift from Europe to Asia in the leading destinations for Indian exports. Germany, UK and France are left behind by UAE,

China and Singapore. Gulf countries particularly UAE and East Asia particularly Singapore besides China have emerged as major export destinations. USA still remains as one of the top destination.

Table 3. Direction of Indian Exports

Year S.No	Top Export Destinations 1992	Exports to top destinations 1992	Top Export Destinations 997	Exports to top destinations 1997	Top Export Destinations 2002	Exports to top destinations 2002	Top Export Destinations 2007	Exports to top destinations 2007	Top Export Destinations 2012	Exports to top destinations 2012
1	USA	2943.07	USA	6560.95	USA	8513.68	USA	18853	UAE	35858.6
2	Japan	1663.85	UK	2048.64	UAE	2491.89	UAE	12024	USA	34312.3
3	Russia	1652.14	Japan	2007.57	Hong Kong	2366.45	China	8288.4	China	18057.5
4	Germany	1279.36	Germany	1894.66	UK	2160.96	Singapore	6064.8	Singapore	16693.4
5	UK	1146.53	Hong Kong	1864.17	Germany	1788.43	UK	5614.2	Hong Kong	12905.3
6	UAE	743.18	UAE	1477.25	Japan	1510.5	Hong Kong	4677.4	Netherlands	9150.68
7	Belgium	671.35	Belgium	1093.61	Belgium	1390.68	Germany	3976.9	UK	8585.91
8	Hong Kong	618.85	Singapore	978.29	Italy	1206.57	Italy	3580.5	Germany	7913.14
9	Italy	584.21	Italy	934.48	Bangladesh	1002.22	Belgium	3472.1	Belgium	7133.34
10	France	428.57	Bangladesh	869.69	Singapore	972.35	Japan	2860.8	Indonesia	6682.81
11	Singapore	391.11	Netherlands	853.09	China	951.99	Netherlands	2668.4	Japan	6352.39
12	Netherlands	375.38	Russia	811.84	France	945.04	Saudi Arabia	2586.4	Brazil	5750.67
13	Saudi Arabia	353.84	France	716.77	Netherlands	863.92	Korea Republic (South)	2513	Saudi Arabia	5659.75
14	Bangladesh	326.31	China	615.32	Saudi Arabia	826.47	Sri Lanka	2254.1	Italy	4848.38
15	Korea Republic (South)	246.24	Indonesia	592.34	Russia	798.22	South Africa	2245	South Africa	4739.77
16	Switzerland	220.64	Saudi Arabia	577.66	Malaysia	773.72	France	2099.4	France	4598.31
17	Malaysia	203.87	Malaysia	531.58	Spain	677.23	Indonesia	2026.7	Sri Lanka	4366.64
18	Australia	202.9	Korea Republic (South)	518.91	Thailand	633.16	Spain	1876.5	Korea Republic (South)	4309.18
19	Thailand	200.09	Sri Lanka	477.81	Sri Lanka	630.92	Bangladesh	1626.8	Israel	4032.8
20	Spain	198.64	Thailand	447.45	Canada	584.84	Brazil	1452.5	Malaysia	3980.72
21	Taiwan (Taipei)	198.08	Spain	425.36	Nigeria	563.17	Iran	1449.8	Bangladesh	3801.87
22	Canada	189.82	Taiwan (Taipei)	424.05	Indonesia	533.73	Thailand	1443.4	Viet Nam	3765.95
23	Sri Lanka	175.49	Australia	385.68	Korea Republic (South)	471.39	Pakistan	1348.7	Turkey	3511.9
24	Indonesia	149.54	Canada	353.29	Egypt	462.75	Turkey	1321.4	Taiwan (Taipei)	3316.19
25	Iran	123.44	South Africa	316.46	Israel	428.04	Israel	1320.5	Spain	2977.91

Source: CMIE Database, 2012

Table 4 gives the composition of Indian imports. Overall the imports have increased in all major categories. However the petroleum and petroleum products have shown the most growth. In non-petroleum imports, food and related items have shown maximum growth from 1991 to 2012.

Table 4. Composition of Indian Imports

Year	Petroleum crude & products (Million US $)	Petroleum crude & products YoY(%)	Non-pol items (Million US $)	Non-pol items YoY(%)	Food & related items (Million US $)	Food & related items YoY(%)	Textile yarn fab., madeup articles (Million US $)	Textile yarn fab., madeup articles YoY(%)	Chemicals and related products (Million US $)	Chemicals and related products YoY(%)	Capital goods (Million US $)	Capital goods YoY(%)	Other non-pol items (Million US $)	Other non-pol items YoY(%)	Other commodities (Million US $)	Other commodities YoY(%)
1991	6031.02	60.09	17433	-0.1	594.5	N.A.	250.2	N.A.	2416.15	N.A.	5599	N.A.	7317.6	N.A.	1256	N.A.
92	5362.94	-11.08	14188	-18.6	321	-46	138.1	-44.8	2503.09	3.6	4542	-19	6186.8	-15.5	496.92	-60.44
93	5567.39	3.81	15015	5.83	552.5	72.1	139.9	1.3	2499.08	-0.16	4596.6	1.2	6561.5	6.06	665.9	34.01
94	5746.86	3.22	17558	16.9	425.2	-23	228.2	63.15	2533.11	1.36	5540.7	20.5	7974.6	21.54	856.25	28.59
95	5929.45	3.18	22733	29.5	1264	197	329.7	44.47	3562.54	40.6	6653.9	20.1	10059	26.14	864.13	0.92
96	7537.01	27.11	29193	28.4	1103	-12.7	359.2	8.94	4780.56	34.2	8861.1	33.2	12875	27.99	1214.2	40.51
97	10044.8	33.27	29121	-0.25	1372	24.3	358.8	-0.12	4111.86	-14	8657.2	-2.3	13268	3.05	1353.5	11.48
98	8173.81	-18.63	33361	14.6	1678	22.3	409.1	14.04	4707.8	14.5	7968.3	-8	16851	27.01	1746.2	29.01
99	6392.57	-21.79	35956	7.78	2755	64.2	456.4	11.55	4488.87	-4.65	8111.3	1.79	18296	8.57	1849.4	5.91
2000	12609.3	97.25	37120	3.24	2651	-3.76	538.4	17.96	4937.01	9.98	6410.3	-21	20688	13.08	1895	2.47
1	15644.8	24.07	34313	-7.56	1684	-36.5	596.6	10.81	3854.03	-21.9	5733.2	-11	20359	-1.59	2086.2	10.09
2	14000.8	-10.51	37415	9.04	2323	38	747.5	25.3	4454.5	15.6	6518	13.7	21387	5.05	1983.7	-4.92
3	17634.2	25.95	43759	17	2692	15.9	970.1	29.78	4802.67	7.82	8047.5	23.5	24920	16.51	2327.7	17.34
4	20583.6	16.73	57619	31.7	3406	26.5	1259	29.75	6251.99	30.2	10938	35.9	33164	33.08	2601	11.74
5	29831.8	44.93	81640	41.7	3516	3.22	1571	24.78	8715.76	39.4	15081	37.9	48532	46.34	4224.2	62.4
6	43956.6	47.35	105187	28.8	3263	-7.19	2050	30.54	11382.7	30.6	24281	61	58315	20.16	5895.4	39.56
7	57067.7	29.83	128014	21.7	4911	50.5	2139	4.31	13840.5	21.6	30779	26.8	71848	23.21	4496.5	-23.73
8	79658.8	39.59	170132	32.9	5343	8.8	2465	15.27	18659.8	34.8	49847	62	88048	22.55	5769.2	28.3
9	91456.4	14.81	207855	22.2	5786	8.28	2570	4.23	29241.4	56.7	48467	-2.8	115025	30.64	6765.9	17.28
2010	86809.2	-5.08	200777	-3.4	10000	72.8	2565	-0.17	23464.7	-19.8	44465	-8.3	113554	-1.28	6728.2	-0.56
11	105833	21.91	263591	31.3	10145	1.45	3220	25.53	28319.9	20.7	51732	16.3	161171	41.93	9002.5	33.8
2012	154904	46.37	334350	26.8	13250	30.6	3896	20.99	36694.3	29.6	66058	27.7	203067	25.99	11386	26.47

Source: CMIE Database, 2012

Table 5 gives the major sources for Indian imports. The top countries for imports show a shift from European countries and Japan to other Asian countries. Within European countries, whereas traditional major import destinations of UK, Germany and France don't come in top five sources, Switzerland has emerged as one

of top five sources for imports. China and UAE has emerged as top destinations for Indian imports. USA still remains in one of the top five destinations.

Table 5. Sources for Indian Imports

Year S.No	Top Import Destinations 1992	Imports from top destination 1992 (USD Mn)	Top Import Destinations 1997	Imports from top destinations 1997 (USD Mn)	Top Import Destinations 2002	Imports from top destinations 2002 (USD Mn)	Top Import Destinations 2007	Imports from top destinations 2007 (USD Mn)	Top Import Destinations 2012	Imports from top destinations 2012 (USD Mn)
1	USA	1886.1	USA	3689	USA	3149.7	China	17449	China	57601
2	Germany	1551.8	Germany	2833.5	Switzerland	2870.9	Saudi Arabia	13375	UAE	35618
3	Belgium	1397.4	Saudi Arabia	2772	Belgium	2763.1	USA	11728	Switzerland	32247
4	Japan	1360.7	Kuwait	2406.9	UK	2563.3	Switzerland	9117.3	Saudi Arabia	31074
5	UK	1183.8	Belgium	2253.6	Japan	2146.5	UAE	8651.7	USA	23383
6	France	580.84	Japan	2189.3	China	2036.5	Iran	7622.7	Iraq	18905
7	Australia	543.82	UK	2136.5	Germany	2028.2	Germany	7541.2	Kuwait	16509
8	Italy	383.41	UAE	1737.5	South Africa	1441	Nigeria	7022.2	Germany	15716
9	Morocco	361.31	Nigeria	1527	Australia	1306.2	Australia	7003.3	Australia	14834
10	Russia	326.98	Australia	1318.3	Singapore	1304.1	Kuwait	5988.1	Indonesia	14576
11	Korea Republic (South)	309.07	Switzerland	1128.3	Korea Republic (South)	1141.4	Iraq	5522.3	Nigeria	14480
12	Singapore	307.65	Singapore	1064.2	Malaysia	1133.6	Singapore	5485.9	Iran	13632
13	Taiwan (Taipei)	295.35	Malaysia	1042.2	Indonesia	1036.9	Malaysia	5291.3	Korea Republic (South)	13131
14	Canada	275.39	Italy	988.21	UAE	915.13	Korea Republic (South)	4802.8	Qatar	12908
15	Netherlands	257.03	Korea Republic (South)	884.34	France	844.29	Japan	4592.5	Japan	12217
16	Malaysia	228.19	Iran	875.16	Hong Kong	728.89	France	4209.2	Hong Kong	10610
17	Saudi Arabia	224.91	France	768.75	Italy	704.81	UK	4171.7	Belgium	10429
18	Brazil	195.17	China	757.55	Taiwan (Taipei)	559.3	Indonesia	4166.3	South Africa	9936.1
19	Sweden	161.97	Russia	628.96	Russia	535.53	Belgium	4139.1	Malaysia	9547.5
20	Switzerland	152.12	Indonesia	599.16	Canada	529.45	Italy	2672.6	Singapore	8470
21	Jordan	145.61	Netherlands	494.39	Netherlands	466.49	Hong Kong	2482.2	UK	7562.2
22	UAE	119.22	Taiwan (Taipei)	424.16	Saudi Arabia	464.01	South Africa	2470	Venezuela	6700.4
23	Hong Kong	106.92	Sweden	371.89	Argentina	436.02	Russia	2407.9	Angola	6644
24	Finland	73.55	Morocco	347.2	Israel	427.77	Qatar	2066.9	Thailand	5414.7
25	Austria	69.01	South Africa	321.32	Thailand	423.11	Yemen	2009.5	Italy	5404.5

Source: CMIE Database, 2012.

Table 6 gives the foreign exchange and other reserves. The overall reserves and all categories of reserves have shown growth from 1991 to 2012. However SDR reserves followed by foreign currency reserves have shown the maximum increase. Incidentally, it was the crisis of shortage of foreign reserves which have forced India to go for liberalization in 1991.

Table 6. Foreign exchange and other reserves

Year	Total foreign exchange reserves $ million)	I otal roreign exchange reserves YoY(%)	Gold reserves (US $ million)	Gold reserves YoY(%)	SDR reserves (US $ million)	SDR reserves YoY(%)	Foreign currency reserves (US $ million)	Foreign currency reserves YoY(%)	Reserve position in the IMF (US $ million)	Reserve position in the IMF YoY(%)
1991	5834	47.25	3496	617.86	102	-4.67	2236	-33.61		
92	9220	58.04	3499	0.09	90	-11.76	5631	151.83		
93	9832	6.64	3380	-3.4	18	-80	6434	14.26		
94	19254	95.83	4078	20.65	108	500	15068	134.19		
95	25186	30.81	4370	7.16	7	-93.52	20809	38.1		
96	21687	-13.89	4561	4.37	82	1071.43	17044	-18.09		
97	26423	21.84	4054	-11.12	2	-97.56	22367	31.23		
98	29367	11.14	3391	-16.35	1	-50	25975	16.13		
99	32490	10.63	2960	-12.71	8	700	29522	13.66		
2000	38036	17.07	2974	0.47	4	-50	35058	18.75		
1	42281	11.16	2725	-8.37	2	-50	39554	12.82		
2	54106	27.97	3047	11.82	10	400	51049	29.06		
3	76100	40.65	3534	15.98	4	-60	71890	40.83	672	N.A.
4	112959	48.43	4198	18.79	2	-50	107448	49.46	1311	95.09
5	141514	25.28	4500	7.19	5	150	135571	26.17	1438	9.69
6	151622	7.14	5755	27.89	3	-40	145108	7.03	756	-47.4
7	199179	31.37	6784	17.88	2	-33.33	191924	32.26	469	-38
8	309723	55.5	10039	47.98	18	800	299230	55.91	436	-7.04
9	251985	-18.64	9577	-4.6	1	-94.44	241426	-19.32	981	125
2010	279057	10.74	17986	87.8	5006	500500	254685	5.49	1380	40.67
11	304818	9.23	22972	27.72	4569	-8.73	274330	7.71	2947	113.6
2012	294398	-3.42	27023	17.63	4469	-2.19	260069	-5.2	2836	-3.77

Source: CMIE Database, 2012.

Table 7 shows the exchange rate of Indian National Rupee (INR) with major international currencies. Indian currency has depreciated against all the major international currencies and the depreciation is highest in

case of Japanese Yen and US Dollor. The depreciation has helped certain exports from India where import content is less.

Table 7. Exchange Rate of INR against major currencies

Year	Indian rupees per US dollar	Indian rupees per Pound sterling	Indian rupees per Japanese yen	Indian rupees per SDR	Indian rupees per Euro
1991	17.94	33.19	0.13	24.85	
92	24.47	42.93	0.19	33.43	
93	30.79	49.83	0.25	37.14	
94	31.4	47.26	0.29	43.89	
95	31.39	48.85	0.32	45.79	
96	33.4	52.22	0.35	50.48	
97	35.47	56.4	0.32	50.89	
98	37.12	60.97	0.3	50.67	
99	42.11	69.62	0.33	57.51	47.76
2000	43.34	69.84	0.39	58.93	44.77
01	45.7	67.54	0.41	59.55	41.48
02	47.69	68.32	0.38	60.22	42.17
03	48.41	74.84	0.4	64.13	48.07
04	45.92	77.74	0.41	65.68	54.01
05	44.95	82.95	0.42	66.93	56.55
06	44.28	79.02	0.39	64.49	53.88
07	45.28	85.72	0.39		58.11
08	40.24	80.8	0.35		56.99
09	45.92	78.45	0.46		65.13
2010	47.42	75.88	0.51		67.08
11	45.57	70.89	0.53		60.22
2012	47.95	76.4	0.61		65.89

Source: CMIE Database, 2012.

Table 8 shows the external debt and its growth rate over the years. Overall the external debt has increased from 1991 to 2012. Except three years, the external debt has increased every year. The highest increase happened during 2005, 2010, 2011 and 2012

Table 8. External debt of India

Year	Total external debt (US $ million)	Total external debt YOY (%)
1991	83801	N.A.
92	85285	1.77

Year	Total external debt (US $ million)	Total external debt YOY (%)
93	90023	5.56
94	92695	2.97
95	99008	6.81
96	93730	-5.33
97	93470	-0.28
98	93531	0.07
99	96886	3.59
2000	98263	1.42
01	101326	3.12
02	98843	-2.45
03	104914	6.14
04	112653	7.38
05	134002	18.95
06	139114	3.81
07	172360	23.9
08	224407	30.2
09	224498	0.04
2010	260935	16.23
11	305931	17.24
2012	345661	12.99

Source: CMIE Database, 2012.

3. Conclusion

Overall both exports and imports have grown from 1991 to 2012, though imports have grown more than exports over the same time period resulting in widening of trade deficit. Exports in all major categories have overall increased from 1991 to 2012. However, petroleum products and manufactured goods have grown the most. This is a positive development as it is an indicator of increasing value addition in the export sector as compared to an era when Indian was identified mainly with raw material and agricultural exports. One of the major changes in export destination is shift from Europe to Asia in the leading destinations for Indian exports. Germany, UK and France are left behind by UAE, China and Singapore. Gulf countries particularly UAE and East Asia particularly Singapore besides China have emerged as major export destinations. USA still remains as one of the top destination.

Overall the imports have increased in all major categories. However the petroleum and petroleum products have shown the most growth. In non-petroleum imports, food and related items have shown maximum growth from 1991 to 2012. The top countries for imports show a shift from European countries and Japan to other Asian countries. Within European countries, whereas traditional major import destinations of UK, Germany and France don't come in top five sources, Switzerland has emerged as one of top five sources for imports. China and UAE has emerged as top destinations for Indian imports. USA still remains in one of the top five destinations.

The overall reserves and all categories of reserves have shown growth from 1991 to 2012. However SDR reserves followed by foreign currency reserves have shown the maximum increase. Indian currency has depreciated against all the major international currencies and the depreciation is highest in case of Japanese Yen and US Dollor. The depreciation has helped certain exports from India where import content is less. Overall the external debt has increased from 1991 to 2012. Except three years, the external debt has increased every year. The highest increase happened during 2005, 2010, 2011 and 2012. Post 1991, many changes have been made at policy level to promote foreign trade. The number of important trade policy reforms has been implemented after 1991, the main changes in foreign trade began to occur after a decade and some of them are yet to occur (Bhatt, 2010).

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Algorithm for Construction of Portfolio of Stocks using Treynor's Ratio

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Abstract

The aim of the paper is to implement the algorithm for selecting stocks from a pool of stocks listed in a single market index like S&P CNX 500(say) and finding the corresponding weights of the stocks in the optimized portfolio using Treynor's ratio, on the basis of historical data of Indian stock market when the short selling is not allowed. The effectiveness of this algorithm has been demonstrated with an example.

Keywords: stock, Treynor's ratio, single market index, portfolio of stocks

JEL Classification: G11, G15, C43

1. Introduction

Market offers several assets in various formats which are grounds for investing money and gaining returns after specific time periods. Investments are made in view of obtaining highest returns with lowest chance of losing money. The returns are however characterised by the nature of assets and the market factors that influence its pricing every day. Since the returns cannot be foretold with certainty, the analysis of profitability in an asset becomes an objective of utmost priority in an investment procedure. A technique of judging the behaviour returns from an asset is historical data analysis of the asset with respect to market.

The classic portfolio theory of Markowitz (1952) shows that a collective group of assets if formulated using mathematical modelled optimisation problem, can give higher returns with lower chance of losing money. In fact, Markowitz portfolio model gives the most basic and complete framework for investment decision. On the negative end, Markowitz theory exhausts the chances of selecting the asset that give unusual higher return on the cost of volatility.

This paper uses Treynor's ratio (i.e. excess return to beta) as the criteria for the selection of a stock in a portfolio as described in Elton, Gruber, Brown and Goetzmann (2009). The algorithm gives the percentage weights to be invested in each stock selected without short selling, for an optimum portfolio by evaluating the historical data available on stocks.

2. The decision making procedure of Treynor's ratio

Suppose we are having a pool of stocks of an index and we want to select stocks and calculate the weights of the selected stocks to be invested. The desirability of a stock is directly proportional to 'excess return to beta' ratio i.e. Treynor's ratio. Excess return is the difference between the rate of return of the stock and the risk free rate of return as on Treasury bill (say). Beta specifies the non-diversifiable risk (risk which cannot be eliminated by diversification).

$$\text{Treynor's ratio} = (E[R_i] - R_f)/\beta_i$$

Where: β_i – beta value of the stock (the relative change in excess return of stock with 1% change in market), $[R_i]$ – Expected return of i^{th} stock, R_f – risk free rate.

Stocks with higher Treynor's ratio means that the stock is more undervalued and hence is ranked on its value (highest to lowest). A cut off rate C* is calculated and the stocks with the higher Treynor's ratio than this C* are selected for portfolio construction. The procedure of finding C*, as given in Elton, Gruber, Brown and Goetzmann (2009), involves finding C_i for each stock assuming i^{th} stock is present in our optimum portfolio.

$$C_i = \frac{\sigma_m^2 \sum_{j=1}^{i} [\{(E[R_j]-R_f)\,\beta_j\}/\sigma_{ej}^2]}{1 + \sigma_m^2 \sum_{j=1}^{i} (\beta_j^2/\sigma_{ej}^2)}$$

Where:

σ_m – market volatility, σ_{ej}^2 – unsystematic risk of stock (risk not related to market but stock's nature), β_j – beta value of the stock (index of systematic risk present in the j^{th} stock), $E[R_j]$ – Expected return of j^{th} stock, R_f – risk free rate

Out of these C_i's, there will be only one C_i for which Treynor's ratio of all the stock preceding this i^{th} stock will be greater than this C_i and treynor's ratio of all the succeeding this i^{th} stock will be less than this C_i. This C_i will be our C* and all the stocks preceding it will be selected in our optimum portfolio.

3. Calculation of weights of stock in our optimum portfolio

The weightage of capital invested in each selected stock (X_i) can be calculated as given in Elton, Gruber, Brown and Goetzmann (2009).

$$X_i = \frac{Z_i}{\sum Z_i}$$

Where: $Z_i = (\beta_i/\sigma_{ei}^2)\,[\{(E[R_i]-R_f)/\beta_i\} - C^*]$

4. Algorithm

The algorithm requires an input of adjusted closing price of pool of stocks and of the market index. Following are the steps involved in our algorithm. The complete MATLAB program is given in the Appendix.

- The data is read from the excel files and daily return of all the stocks as well as market is calculated as

  $$r(i) = \frac{V(i+1) - V(i)}{V(i)}$$

- Average daily return is calculated by using the geometric mean of the historical daily returns as given by:

  $$DR = ((1+r_1)(1+r_2)(1+r_3)(1+r_4)\ldots(1+r_n))^{1/n} - 1$$

  Standard deviation of the daily returns (Dstd) is calculated.

- Average annual return is calculated from average daily returns assuming 252 trading days in a year.

  $$AR = (1+DR)^{252}-1$$

  Annual standard deviations can be calculated from the daily standard deviations as

  $$Astd = \sqrt{252} \times Dstd$$

- Capital Asset Pricing Model is used to calculate the raw beta for each stock which states the dependence of expected return of an asset on the market movement.

  $$R_i(t) = R_f + \beta_i \{R_m(t)-R_f\} + \varepsilon_i$$

  where $R_i - R_f$ = excess return of asset
  $R_m - R_f$ = excess return of market
  ε_i = shock factor with mean =0

  Linear regression is run for each stock on excess daily return of stock vs. excess daily return of market for finding the raw beta as per historical data. Then the adjusted beta(Aβ) is calculated from the raw

beta(Rβ) assuming that the security's beta move towards the market average over time with a 67% confidence level as given by

Aβ = 0.67*Rβ + 0.33*1

- The stocks with β coming out to be –ve are removed.
- Now the investment decision is made on the basis of Treynor's ratio as described above and the weights of the accepted stocks are calculated.

5. Application Example

We have considered index of S&P CNX 500 and the underlying stocks in the index for implementing the above algorithm using MATLAB, for the period June-2010 to June-2012.

Inputs:

- The adjusted closing price of the stocks is taken from Prowess (CMIE database) and kept in the file 'DATA.xlsx' as shown in the Figure 1.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	3I Infotech Ltd.	64.1	65.05	66.15	66.1	63.7	62.5	62.05	62.3	62.65	62.8	63.05	63	63.45	63.5	63.8	62.75	63.3
2	3M India Ltd.	2459.05	2493.9	2460.25	2467.95	2552.75	2510.9	2542.15	2550.1	2565.65	2583.85	2605.45	2638.4	2637.75	2670	2670	2665.85	2655.05
3	A B B Ltd.	854.3	854.45	859.35	858.55	858.75	852.9	855.1	858.3	858.85	861.1	862.8	861.25	865.55	861.35	869.85	871.1	872.8
4	A B G Shipyard Ltd.	244.55	249.45	253.65	250.35	250.55	246.95	246.95	250.2	248.6	251.75	253	253.55	255.45	257.05	258.5	258.2	256.7
5	A C C Ltd.	817.7	826.8	841.5	841.9	851.7	842.35	858.05	868.9	861.75	862.85	879.9	863.6	865.45	862.1	882.65	861.5	871.15
6	A I A Engineering Ltd.	405.05	411.75	403.85	401.5	394.65	393.6	398.5	398.4	404.35	400.6	399	394.05	397.55	395.35	396.45	401.1	400.05
7	Aarti Industries Ltd.	47.05	47.4	48.05	48	46.2	46	46.4	46.35	46.45	46.85	46.95	46.9	47.1	48	48.35	48	49.9
8	Aban Offshore Ltd.	691.15	694.9	695.45	699.95	674.45	658.5	647.9	645.6	657.9	662.85	678.95	708.65	730.8	731	744.85	749.05	741.25
9	Adani Enterprises Ltd.	536.5	540.85	550.2	551.05	538	535.1	534.85	545.35	542.25	542.3	544.5	544.65	545.5	543.1	539.85	537.1	537.15
10	Adani Ports & Special Econom	135.35	133.09	137.24	137.94	132.29	132.61	133.4	136.42	136.69	138.16	140.56	141.67	142.88	142.87	143.59	143.22	144.8
11	Aditya Birla Nuvo Ltd.	709.75	713.45	723.25	749.4	740.05	745.1	758.3	762.7	761.4	780.4	772.2	773.25	765.25	767.9	805.25	788.8	787.05
12	Advanta India Ltd.	424.8	423	427.25	428.35	420.25	413	413.6	416.3	418.85	419.35	419.35	420.95	418.95	412.85	416.45	414.9	416.65
13	Agro Tech Foods Ltd.	240.6	241.8	242.55	245.1	244.1	237.35	233.55	240.85	242.4	240.5	250.7	252	257.35	248.2	260	262.7	257
14	Akzo Nobel India Ltd.	594.4	599.1	600	611.5	619.35	629.4	657.75	644.05	662.2	697.55	724	737.25	721.7	736.25	742.7	734.5	751.35
15	Allahabad Bank	161.05	160.6	161.8	163.95	163.75	163.2	166	165.5	163.9	162.45	161.9	160.45	162	161.5	161.8	161.05	162.15
16	Allcargo Logistics Ltd.	163.8	159	164.65	163.35	164.45	162.8	160.4	165.65	168.2	167.55	167.65	172.1	171.3	170.6	173.75	170.9	169.95
17	Alok Industries Ltd.	19	19.1	19.1	18.6	18.35	17.85	18	18	18.1	19.45	19.7	19.25	19.3	19.1	19.45	20.4	20.95
18	Alstom India Ltd.	581.6	587.5	604.95	607.95	596.8	603.3	605.35	604.65	595.8	597.85	599.25	597.45	600.1	591.9	607.2	614.8	627.65
19	Alstom T & D India Ltd.	285.2	286.65	286.85	289.15	286.9	291.3	293.25	295.05	304.25	292.9	293.75	290.75	290.65	289.4	289.9	290.3	290.55
20	Amara Raja Batteries Ltd.	162.05	160.2	165.4	165.7	163.65	163.3	166.7	170.5	173.15	174.05	176.8	176.6	177.5	174.4	174.25	175.05	172.55
21	Ambuja Cements Ltd.	106.85	110.7	114.2	112.5	115.5	115.15	115.05	115.85	115.05	115.2	115.75	115.85	117	117.7	118.15	118.75	120.55
22	Amtek Auto Ltd.	163.25	164.65	166.8	166.7	162.65	157.75	156.8	157.7	159.5	161.7	159.4	158.45	157.9	156.95	156.55	156.4	169.05
23	Amtek India Ltd.	32.83	33.48	34.38	34.8	35.15	35.13	35.75	36.5	35.98	35.27	34.8	33.7	33.5	34.02	33.3	32.35	32.4
24	Anant Raj Inds. Ltd.	105.3	102.9	101.95	103.05	100.7	101	105.8	103.75	103.75	104.1	106.75	108.85	104.05	105.65	107.7	108.55	116.8
25	Andhra Bank	134.05	134	138.95	137.65	137.75	138.6	135.5	137.9	136	136.7	136.1	136.1	133.6	134.1	135.15	133.1	134.2

…

Figure 1. Adjusted closing price of stock

- The closing price of the market index is taken from NSE website and kept in the file 'market.xlsx' as shown in the Figure 2.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	4149.1	4189.75	4253.15	4263.45	4190	4152	4172	4228.95	4247.25	4299.05	4314.8	4319.95	4344.3	4328.65	4388.7	4368.7	4379.75	4372.35	4365.85	4429.25
2																				

…

Figure 2. Closing price of market index (S&P CNX 500)

- Risk free rate is taken as per rate of treasury bills given on RBI website.

Output of the above algorithm:

Figure 3 shows the stocks selected with respect to Security Market line. The stocks selected with their corresponding weights in are printed in 'output.xlsx' as shown in the Figure 4.

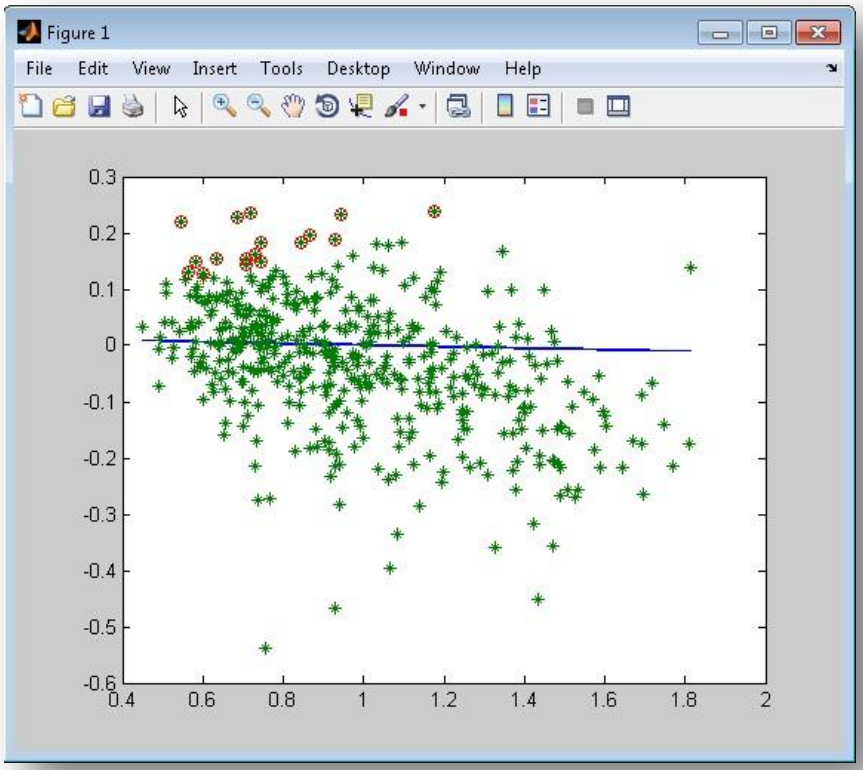


Figure 3. Security Market Line(Blue Line)
Green points show the positions of stock and the selected stocks are circled with red colour

	A	B
1	Amtek India Ltd.	0.148446
2	Page Industries Ltd.	0.143936
3	V S T Industries Ltd.	0.15801
4	Bata India Ltd.	0.110855
5	F A G Bearings India Ltd.	0.07639
6	Supreme Industries Ltd.	0.082209
7	United Breweries Ltd.	0.025375
8	Hexaware Technologies Ltd.	0.04956
9	Astrazeneca Pharma India Ltd.	0.025055
10	Kajaria Ceramics Ltd.	0.053312
11	Eicher Motors Ltd.	0.033724
12	Gitanjali Gems Ltd.	0.018644
13	Blue Dart Express Ltd.	0.022886
14	Crisil Ltd.	0.040203
15	Wabco India Ltd.	0.005871
16	Federal-Mogul Goetze (India) Ltd.	0.002297
17	Hindustan Unilever Ltd.	0.003228

Figure 4. The list of stocks selected for optimum portfolio with their corresponding weights

The performance of the portfolio constructed from the above selected 17 stocks is given in the Table 1.
Table 1. Performance of the obtained portfolio

Annual Return	67.22%
Treynor's ratio	80.96%
Beta value	0.73
Volatility	16.44

Annual Return	67.22%
Sharpe ratio	3.60
Jensen's alpha	65.28%

6. Conclusion

We found that our optimum portfolio gives an annual return of 67.22% with respect to risk free return of 7.966%. This shows that the given method is very effective in investment decision making and even in today's economic scenario and investment environment in India, we can still achieve such good returns by selecting stocks using the described methodology and algorithm.

References

[1] Markowitz, H.M. 1952. Portfolio Selection, *Journal of Finance* 7: 77 – 91.

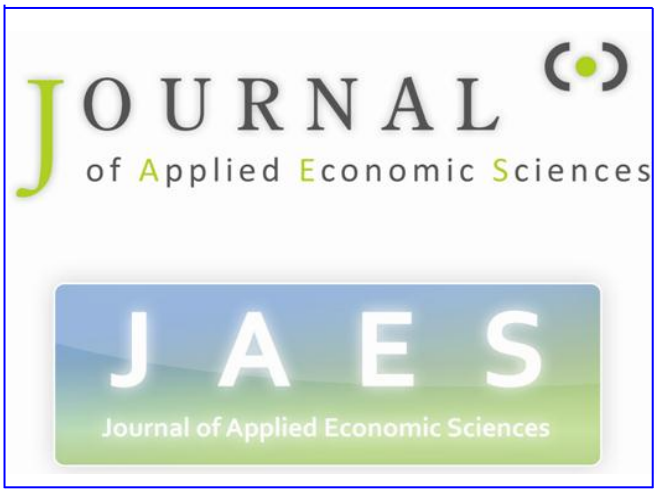
[2] Elton, E.J., Gruber, M.J., Brown, S.J., Goetzmann, W.N. 2009. *Modern Portfolio Theory and Investment Analysis*, John Wiley & Sons

APPENDIX

```
%DEFINITION AND NAMES OF VARIABLES USED

%value=daily adjusted closing price values of all the stocks
%name=name of all the stocks
%n=number of stocks
%m=number of days of which data is available
%mvalue=daily value of market index
%rfo=annual risk free rate
%rf=average daily risk free rate
%mretrn=daily return on market
%mr=average daily return on market
%msig=daily volatility of market
%msigo=annual volatility of market
%retrn=daily return of stocks
%r=average daily return of stocks
%ro=average annual return of stocks
%beta=beta value of stocks
%er=expected average daily return of stock
%sig=daily non-diversifiable risk of stocks
%sigo=annual non-diversifiable risk of stocks
%s=treynor's ratio
%co=cut-off ratio
%xx=weights of the stocks selected in our optimum portfolio
%RP=average daily return of portfolio
%RPo=average annual return of portfolio
%betap=beta value of portfolio
%tr=treynor's ratio of portfolio
%cv=covariance matrix of the stocks selected
%sigp=daily volatility of portfolio
%sigpo=annual volatility of portfolio
%jensenalpha=Jensen's alpha of portfolio



%MAIN PROGRAM

close all;
clear all;

[value,name]=xlsread('DATA.xlsx');
[n,m]=size(value);
[mvalue]=xlsread('market.xlsx');
rfo=7.966;
rf=100*(((1+rfo/100)^(1/m))-1);

for i=1:(m-1)
    mretrn(i)=100*(mvalue(i+1)-mvalue(i))/mvalue(i);
end
mr=100*(geomean(1+mretrn/100)-1);
msig=std(mretrn);
msigo=sqrt(252)*msig;
for i=1:(m-1)
    retrn(:,i)=100*(value(:,i+1)-value(:,i))./value(:,i);
end
for i=1:n
    r(i)=100*(geomean(1+retrn(i,:)/100)-1);
    ro(i)=100*(((1+(r(i)/100))^252)-1);
end
for i=1:n
    y=retrn(i,:)'-rf;
    x=(mretrn-rf)';
    temp1=ones(m-1,1);
    x=[temp1 x];
    temp2=inv(x'*x)*x'*y;
```

```
    beta(i)=temp2(2);
    beta(i)=0.67*beta(i)+0.33;
end


flagg=0;
while(flagg==0)
for i=1:n
if(beta(i)<0 || beta(i)==NaN)
            beta(i)=[];
            value(i,:)=[];
            retrn(i,:)=[];
            r(i)=[];
            ro(i)=[];
            n=n-1;
break;
            flagg=0;
else
            flagg=1;
end
end
end


er=rf+beta*(mr-rf);
plot(beta,er)
hold on;
for i=1:n
    sig(i)=sqrt((std(retrn(i,:)-rf)^2)-(beta(i)^2)*(std(mretrn-rf)^2));
    sigo(i)=sqrt(252)*sig(i);
    s(i)=(ro(i)-rfo)/beta(i);
end

[s,order]=sort(s,'descend');
beta=beta(order);
name=name(order);
sig=sig(order);
sigo=sigo(order);
r=r(order);
ro=ro(order);
retrn=retrn(order,:);

sum1=0;
sum2=0;
flag=0;
for i=1:n
    sum1=sum1+((ro(i)-rfo)*beta(i))/(sigo(i)^2/100);
    sum2=sum2+(beta(i)^2)/(sigo(i)^2/100);
    c(i)=((msigo^2/100)*(sum1))/(1+(msigo^2/100)*(sum2));
if(c(i)<s(1:i))
if(c(i)>s((i+1):n))
            co=c(i);
            io=i;
            flag=1;
end
end
end

scatter(beta,r,'*')
hold on;

if(flag==1)
for i=1:io
        z(i)=(beta(i)/(sig(i)^2/100))*(((ro(i)-rfo)/beta(i))-co);
end
for i=1:io
        xx(i)=z(i)/sum(z);
end
```

```
        xlswrite('output.xlsx',name(1:io),'A1:A10000');
        xlswrite('output.xlsx',xx(1:io)','B1:B10000');
        scatter(beta(1:io),r(1:io),'red')
        RP=sum(xx(1:io).*r(1:io));
        RPo=100*(((1+RP/100)^252)-1)
        betap=sum(xx(1:io).*beta(1:io))
        tr=((RPo-rfo)/betap)
        cv=cov(retrn(1:io,:)');
        sigp=sqrt(xx*cv*xx');
        sigpo=sqrt(252)*sigp
        sr=(RPo-rfo)/sigpo
        temp=RP-(rf+betap*(mr-rf));
        jensenalpha=100*(((1+temp/100)^252)-1)
else
'None of the stock is good for investing.'
end
```



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