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An Attempt to Predict Economic Turnaround Using Proposed 'Leading Leading' Indicators

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Master of Business Administration

13th November 2008

ABSTRACT

This exploratory research attempted to devise an additional simple means to predict economic change in South Africa. It was envisaged that economic turnaround could be predicted at an earlier stage than the RMB/BER Business Confidence Index, the FNB/BER Consumer Confidence Index and the South African Reserve Bank's Leading Indicator using calculus and existing economic indicators.

This research used the inflection point of the rate of change of the South African Reserve Bank's Leading Indicator as the possible predictor of possible economic change in South Africa. This calculation produced what was referred to as the Leading-Leading Indicators. The research also analysed, using graphical and statistical methods, the ability of the RMB/BER Business Confidence Index, the FNB/BER Consumer Confidence Index and the South African Reserve Bank's Leading Indicator to predict economic change in South Africa.

The research indicated that the proposed Leading-Leading Indicators were a poor predictor of economic change. It also indicated that whilst the RMB/BER Business Confidence Index, the FNB/BER Consumer Confidence Index and the South African Reserve Bank's Leading Indicator appeared to have good predicting possibilities when analysed graphically, due to autocorrelation, statistically, these economic indicators are also poor predictors of economic change.

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Rodney Martin Date

Acknowledgements

I would like to acknowledge the following people, whose support and assistance have allowed me to complete this research:

Mr Gavin Price, my research supervisor, whose support and critical review of this research has allowed the findings to be captured and represented accurately and professionally.

Mr George Glynos, an economist friend, who proposed this research topic and the methodology employed.

Dereck and Yvonne Martin, my parents, whose support throughout my life has given me too many opportunities to mention. Without you, having the opportunity to study at this level would have been an impossible dream.

Louise Rosset, my fiancée, who sacrificed time and effort for me throughout this research and whose support for my studies has been unwavering. I look forward to our life together.

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1. INTRODUCTION

Businesspeople, policymakers, investors, and indeed most people, have a significant stake in understanding the outlook for the economy (Ellis, 2005). Questions around whether an economy is at the beginning or middle of an economic advance or a downturn with more to go is often asked.

According to Ellis (2005), “Any corporate CEO or investment manager will confirm that even though economists have made outstanding contributions in many areas of theory, data gathering and specialised analysis (labour, health care, etc.), the profession as a whole has had difficulty in forecasting key economic turning points with sufficient timeliness to prove useful. Quarterly and annual forecasts are published by virtually every government and financial institution; theories are espoused; and Nobel Prizes are awarded. However, few, if any, individual forecasters or groups of economists have track records sufficiently accurate to warrant their being relied on by the business or investment community.”

Consumption, savings and production decisions made by individual agents and monetary fiscal policy made by policymakers are based on forecasts about the future developments of macroeconomic variables (Camacho & Perez-Quiros, 2002). The state of the business cycle is one of the key elements for the evolution of such variables.

According to Khomo & Aziakpono (2007), since economies are observed to move in cycles, the question is how long this expansion will last before the next recession is seen. Hence, forecasting turning points is crucial for the optimality of the economic agents' decision (Camacho & Perez-Quiros, 2002). Policymakers always seek to avoid recessions and steer the economy on a steady non-inflationary growth path and are always on the lookout for information that indicates the likelihood of recessions. To paraphrase Christiano & FitzGerald (1998), the business cycle remains a puzzle.

A model that can correctly predict turning points in the economy would clearly be useful to the business community and the general public. Investment decisions are made with an eye towards the future economic conditions (Del Negro, 2001). The clearer the crystal ball, the wiser the decision. Policymakers would also benefit from the ability to forecast turning points (Del Negro, 2001).

The primary purpose of this study was to therefore to attempt to develop a 'Leading-Leading Indicator' to predict possible changes in the South African economic growth. This 'Leading-Leading indicator' built onto the work already done by economists in developing other economic indicators.

An additional purpose of this study was to determine, using the various business and consumer confidence indexes available in South Africa and the South African Reserve Bank's Leading Indicator, whether one is able to predict

if the South African economy is entering a period of sustained growth or, alternatively, whether the economy is entering a period of economic slowdown or even recession.

Governments, central banks, investors and financial market participants normally use complex macroeconomic models and composite indexes of leading business cycle indicators to forecast the path of the economy and the likelihood of recessions (Khomo & Aziakpono, 2007). Financial variables such as interest rates, share prices and monetary aggregates can also provide useful information about future economic activity (Khomo & Aziakpono, 2007).

Ellis (2005) states that although some people will argue that we can get better results using econometric analyses: complex computerised statistical analyses that economists have come to rely on to track and relate the greatest number of variables driving the outcome of a series being forecast. He says however, that after years of observing these forecasted results based on models, that he believes that the rigidity of data models and their remoteness a 'numbers in a machine' reduce their usefulness in forecasting, neutralising the presumed benefits of computerised intelligence.

According to Harding and Pagan (1999), it is an extraordinary feature of much of the modern academic literature that one can find papers which provide extensive accounts of the co-movements of consumption, investment, etc. but

which make little or no reference to the temporal characteristics of the series that might be taken to be aggregate economic activity, namely output.

As the data used by the confidence indexes and the South African Reserve Bank's Leading Indicator relies on historical information and events (Venter & Pretorius, 2004), an attempt will be made by this study to determine whether it is possible to create a 'Leading-Leading Indicator' to provide a flag that the more commonly used leading indicators may change in the short term. This will be done by creating a 'momentum' economic indicator, providing economists, and the market in general, with a more advanced warning that the market may be beginning to change. It would also provide economists with an earlier indicator of possible economic change.

Attempts will be made to determine whether the lag period, between changes in the confidence indexes, South African Reserve Bank's Leading Indicator and the newly created 'Leading-Leading Indicator', and real change to the economic indicators can be determined.

The recent economic boom in South Africa (Statistics South Africa, 2007) offers an opportunity to conduct investigations to confirm or to contradict any work that has been done previously, in South Africa and in other countries. It also offers an opportunity to determine whether the 'Leading-Leading Indicator' could be used in future to determine whether economic turnaround is about to occur.

2. THEORY & LITERATURE REVIEW

2.1 Introduction

According to Auerbach (1982), if the success of a specific approach to economic analysis can be measured by its longevity and continued popularity under a variety of environments, then the use in business cycle forecasting of leading indicators, as originally developed by Mitchell and Burns (1946) at the National Bureau of Economic Research in the United States of America, must stand near to the top of such successes. Since its introduction, the composite index of leading indicators has been widely monitored as a guide to future economic performance.

There has been a revival of interest in using leading indicators of economic activity to forecast a variety of economic time series (Emerson & Hendry, 1996). This seems to be partly a reaction to perceived forecasting failures by macro economic systems and partly due to developments in leading indicator theory (Emerson & Hendry, 1996).

2.2 The South African Economy

According to Rattso & Stokke (2007), South Africa was a growth machine in the 1960s, after which followed a long period of stagnation with sanctions and the apartheid struggle, followed by slow re-growth after the political transformation.

South Africa is a lot more developed than the rest of Sub-Saharan Africa (Hooke, 2001). Its economy is a lot more advance industrially, local businessmen are more sophisticated and the infrastructure is in better shape. South Africa received the lion's share of direct foreign investment in Africa and its stock exchange represents over 80 percent of the continent's market capitalisation (Hooke, 2001).

It would therefore be useful if various indicators could be used to assist in predicting future economic turnaround in South Africa.

2.3 Predicting Economic Turnaround

The information-gathering activities of brokerage firms and analysts are considered to be crucial to the efficient and smooth running of the financial markets (Lang *et al*, 2003 in Gilbert *et al*, 2006).

Recessions are important political, social and economic events (Stock & Watson, 1989). Periods of prolonged, widespread expansion provide opportunities to workers and consumers. The severe periods of contraction threaten governments and even forms of government. Thus the question becomes: "Is it possible to forecast those politically and socially important events that will come to be termed expansions and contractions and can these patterns be recognised in advance?" (Stock & Watson, 1989).

According to Dunn & Mirzaie (2006, pg 343), “Much effort has gone into the search for early signs of changes in economic activity. One focus has been on the role of consumer confidence indexes. Although these indexes have shown to have predictive power for changes in consumer spending, questions remain about how they work in this regard. Previous work has put attention on whether a change in consumer confidence can be a cause of changes in consumption or whether it reflects underlying changes in economic fundamentals that then cause consumption to change. If the latter explanation is correct, then the question becomes, what types of private information is confidence capturing that is not detectable in other published macro data?”

2.4 Business Cycles

The measurement and analysis of business cycles has been one of the core research topics in economics throughout the past century (Boehm & Summers, 1999). Although the underlying theories have changed, the central questions have remained, “What are the causes of fluctuations in economic activity?”, “What do we mean by ‘business cycles’?”, “How do we measure ‘economic activity’?” (Boehm & Summers, 1999).

Mitchell (1927) first formulated the most comprehensive and widely quoted definition of the business cycle. It was later modified slightly by Burns and Mitchell (1946) to read as follows: “Business Cycles are a type of fluctuation in the aggregate economic activity of nations that organise their work mainly in

business enterprises: A cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into the expansion phases of the next cycle; this sequence of change is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own." The Burns and Mitchell definition recognises three significant features of business cycles that are particularly relevant when determining reference turning points in the business cycle, namely duration, amplitude and scope.

Although the concept 'aggregate economic activity' is not clearly defined, this reference to the scope of the business cycle certainly does not imply some limited measure of economic activity. In fact, Moore (1980) states that no single index of economic activity has been found to be superior to any other. The definition states that expansions or contradictions occur "at about the same time in many economic activities". This illustrates the one common characteristic of business cycles, namely the high cyclical conformity or coherence of numerous variables, or the pervasive nature of business cycles (Moore & Zanowitz, 1984).

Accurate predictions of business cycle turning points of the business cycle would help investors to increase profits by allowing them to know when asset prices may reach a maximum or a minimum; producers could improve their

inventory planning and, if the selected leading indicator is a policy variable, it would assist policy-makers in understanding the time lag with which policy affects the real economy (Moolman, 2003).

Business cycle theory has evolved from the belief that cyclical fluctuations in the economy are caused by factors inherent in the economic system and, as such, the economy will forever move in a cycle, to theories that attribute the business cycle to random shocks that move the economy away from its full employment level (Khomo & Aziakpono, 2007).

Real business cycle theory is the latest attempt by economists at explaining cyclical fluctuations in the economy. (Khomo & Aziakpono, 2007). Real business cycle theorists believe that the business cycle would occur even if there were no monetary and financial disturbances and that countercyclical policy play no role at all (Chatterjee, 2000). This theory suggests that changes in productivity explain the cyclical movements in economic activity. Such productivity changes arise because of improvements in the technology and workers' skills. Real business cycle theory assumes that the important driver of the business cycle is the rate of change in technology that affects the supply side of the economy (Khomo & Aziakpono, 2007).

Each cycle consists of four phases: a lower turning point (trough), an expansion, an upper turning point (peak) and a contraction (Khomo & Aziakpono, 2007).

Pradhan (2001) summarises the 'stylised facts' (observations made consistently over a long period of time) of business cycles and some of these are listed below:

- Upswings and downswings caused by the business cycle affect the entire economy and not only a few industries.
- Business cycles follow a similar pattern (boom, slowdown, recession, recovery) but the length of each cycle is unknown and can not be predicted with certainty.
- Production data provides a good idea of the phase of the business cycle that the economy is in. For example, if production is rising, it can be inferred that the GDP will rise.
- A slowdown in GDP is normally preceded by a decline in the growth rate of money supply.
- Inflation responds to changes in the growth rate of money supply after a lag such that a reduction in money supply growth is followed by a decline in inflation after a period of time.
- A consistent rise in the stock market usually indicates that the economy will perform better in the near future.

- A large fluctuation in the GDP of large countries affects the GDP of their trading partners.

According to Harding and Pagan (1999), although called 'cycles', these patterns are better thought of as recurrences since they involve recurring phases of expansion and contraction that may have no finite periodicity.

Estrella and Mishkin's (1998) research indicated that the interest rate of a country outperforms other indicators for forecasting business cycle turning points beyond one quarter ahead.

2.4.1 Finding Turning Points

The detection and description of the classical and growth cycles is generally accomplished by first isolating turning points in the series, after which those dates are used to mark off periods of expansions and contractions (Harding & Pagan, 1999). Viewed in this light business cycle analysis involves pattern recognition techniques. This method does however assume that the analyst will need to wait until either a peak or a trough is reached before being able to predict economic change. This method therefore may result in a lag prediction of economic change.

2.4.2 Leading Indicators

The traditional role of the leading economic indicator has been to signal future recessions and recoveries (Stock & Watson, 1989). The coincident and leading economic indexes have been widely followed in business and government for decades, yet have received surprisingly little attention from academic economists (Stock & Watson, 1989).

The most well known predictors of turning points in economic activity are the series known as Leading Economic Indicators (Del Negro, 2001). The leading indicators were originally proposed in 1938 by Burns, Mitchell and their colleagues at the National Bureau of Economic Research on the basis of their tendency to lead the cycle, as the name suggests.

Leading economic indicators can provide an indication of the timing of business cycle turning points for sound economic reasons, as dictated by economic theory (Klein, 1997). Investors, consumers and governments may attempt to anticipate possible market changes or respond to market changes, which will change supply and demand conditions and influence the overall state of the economy, for instance, through building permits for new houses, real estate transactions, the number of new cars sold, percentage of people working overtime and so forth (Lindlbauer, 1997; Del Negro, 2001).

Traditionally, leading indicator evaluation has focused on five criteria – of which two are the most important. Firstly, leading indicator studies aim to investigate the general co-movement between the potential leading series and the series representing real economic activity. Secondly, consistency in the timing of turning points in the two series is investigated (Boschoff, 2005).

In addition to having a constant historical relationship with the business cycle, leading indicators have to be published in time to take advantage of the existing predictive content (Heathcotte & Apilado, 1974).

Theoretical work provides some guidance when choosing potential leading indicators, which should reflect fundamentals as well as any variable able to influence the market expectations. However it does not allow discrimination between competing indicators, nor does inable their respective weights to be determined (Burkart & Coudert, 2002).

According to Venter (2005), a composite business cycle indicator is compiled by integrating various economic indicators into a single indicator time series.

The first sign of a possible turning point in the business cycle is usually when the ‘composite leading business cycle indicator’ clearly changes direction for a period of at least six months. When the change in direction of the leading

indicator is followed by a similar change in direction in the composite coincident business cycle indicator for a period of at least six months, the likelihood of a turning point in the business cycle rises significantly (Venter, 2004).

A 'composite leading index' is constructed from series such as hours worked, changes in producer prices, building approvals, share prices, changes in profitability and price-cost ratios, which contain information anticipating movements in the coincident index (Venter, 2004).

Leading indicators have an advantage over more complex econometric models in that the index can be more readily understood and interpreted (Del Negro, 2001). Thus leading indicators have their origin in the continuing quest among forecasters for signs that supposedly will show ahead of time what is going to happen to the economy. A leading indicator is, therefore, any measure of the economy that moves in the same manner as the economy but does so several months ahead of the economy (Zarnowitz & Boschan, 1975).

It should be noted that no index of leading indicators can perform well if used mechanically and in isolation from other informational tools (van Rensburg, 1990). Good results can only be expected if the current behaviour of such an index is interpreted with experienced judgement and in the light of other evidence. Even then various external factors can occasionally distort the relations between the leading indicators and the contractions and expansions of

the economy. Moreover, structural change in the economy, such as major unanticipated shifts in the inflations rates, will affect these relationships. Continuous study of the indicators, not limited to any short list of series used in the composite index, is needed to keep track of such developments and make best use of the approach (van Rensburg, 1990).

2.4.2.1 South African Reserve Bank Leading Indicator

The South African Reserve Bank's Leading Indicator is based on the monthly data series on the composite leading indicator of the business cycle base year 1990 (Index baseline: 1990 = 100) as released by the South African Reserve Bank converted to quarterly average frequency. This data series is known as the official leading indicator of the South African business cycle (Pellissier, 2002).

According to Venter & Pretorius (2004), the South African Reserve Bank first published composite business cycle indicators in 1983.

The composite business cycle indicator of the South African Reserve Bank was constructed by integrating various individual economic time series into a single indicator series that mirrors the movement of and the turning points in the business cycle. The time series included in the composite business cycle indicators represent only a small sample of the total number of available

indicators portraying various aspects of economic activity (Venter & Pretorius, 2004).

The South African Reserve Bank distinguished three groups of business cycle indicators, namely those that change direction ahead of the business cycle (leading indicators), those that move more or less in conjunction with the business cycle (coincident indicators) and those that lag behind the business cycle (lagging indicators) (Venter & Pretorius, 2004).

The South African Reserve Bank's Leading Indicator consists of the following component time series (Venter & Pretorius, 2004):

- Opinion survey of volume of orders in manufacturing.
- Opinion survey of shares in relation to demand: Manufacturing and trade.
- Opinion survey of business confidence: Manufacturing, construction and trade.
- Composition leading business cycle indicator of major trading-partner countries: Percentage change over twelve months.
- Commodity prices in US dollars for a basket of South Africa's export commodities: Six-month smoothed growth rate.
- Real M1 money supply (deflated with the CPI): Siz-month smoothed growth rate.
- Prices of all classes of shares: Six-month smoothed growth rate.

- Number of residential building plans passed for flats, townhouses and houses larger than 80m^2.
- Interest rate spread: 10-year bonds less 91-day treasury bills.
- Gross operating surplus as a percentage of gross domestic product.
- Labour productivity in manufacturing: Six-month smoothed growth rate.
- Job advertisements in the Sunday Times newspaper: Six-month smoothed growth rate.
- Opinion survey of average hours worked per factory worker in the manufacturing sector.

According to Venter (2008), all of the components above are weighted equally, except for the two opinion survey time series which each have half weight (so, together they have the same weighting as each of the other components). One has to question therefore whether an opportunity exists to weight each of the components to allow a more accurate indication of the South African economy.

Although the published South African Reserve Bank's Leading Indicator follows the overall trend of the South African economy, as it is based on historical data, the indicator tends to actually become a 'lagging indicator'. Literature indicates that to date there has not been a method devised that may allow an actual 'leading indicator' characteristic.

2.4.3 Confidence Indexes

Confidence indicators, based on the aggregation of qualitative series derived from consumer and business surveys, have grown significantly in importance in the recent past (Carnazza & Parigi, 2003).

According to Laubscher (2003), the original aim of business tendency surveys was to obtain information on economic movements before the numerical (official) data became available, by making direct contact with the entrepreneur.

Van Sibbert *et* al (2006) also suggested that another measure of economic stability is business confidence. South Africa's economy over the past decade and a half has shown wild swings underlining its sensitivity to national and regional political developments (van Sibbert *et al*, 2006).

The Organisation for Economic Co-operation and Development (OECD) lists a number of qualities that business tendency survey data possesses (OECD Handbook, (2003), 65-66):

- Being highly relevant – measuring economic variables at the early stages of production, responding rapidly to economic changes and measuring expectations.
- Business survey data usually does not contain a trend and therefore has good cyclical behaviour characteristics.

- Business survey data is less erratic and usually final and not subject to revision after publication.
- Business tendency surveys measure unquantifiable magnitudes such as confidence levels, bottlenecks in production and other constraints, expectations, etc.

As the Business Confidence Index (BCI) measures the 'business mood', the index should provide leading information of economic conditions, as an optimistic business mood is likely to translate into increased stockpiling and fixed investment down the line, feeding into more lively general economic conditions (the converse would be true in the event of a pessimistic business mood) (Laubscher, 2003).

According to Boshoff (2005), "Linkages between the financial and real sectors of the economy have been studied extensively over the past twenty years to enhance business cycle forecasting on one hand and to improve portfolio allocation on the other."

Confidence factors play a prominent role in assessments by business cycle analysts of conjunctural developments (Santero & Westerlund, 1996). However, the subjective nature of confidence raises questions about the solidity of such assessments (Santero & Westerlund, 1996).

At a practical level, confidence cannot be observed or measured directly (Santero & Westerlund, 1996). Therefore any assessment of confidence must rely on indicators that are often partial, qualitative and subject to various interpretations (Santero & Westerlund, 1996). Sentiment measures are obtained from surveys capturing judgements on past, current and expected economic developments. Due to the subjective nature of the answers, the empirical relationship between sentiment indicators and economic variables is not clearly established (Santero & Westerlund, 1996). Empirically, sentiment indicators may strictly mirror movements in economic variables; they may lead to shifts in economic variables, follow them with some delay, or be completely unrelated (Santero & Westerlund, 1996).

According to Santero & Westerlund (1996), “Sentiment variables are most useful for economic analysis and forecasting when they lead cyclical economic movements.”

2.4.3.1 The Bureau of Economic Research

The Bureau of Economic Research (BER) was established in 1944 and has since its inception built both locally and internationally a solid reputation of its objective and authoritative economic research (Martin, 2007). Although it is part of the University of Stellenbosch, South Africa, it is an independent, self financing institution and us therefore not funded by government.

A core part of the BER's activities concerns the conducting of business tendency surveys (Martin, 2007). The integrity of the BER's business survey information is based on, amongst others, the organisation's more than fifty years of experience in conducting business surveys, continued application of international best practice and active participation in the bi-annual CIRET (Centre for International Research on Economic Tendency Surveys) conference and the close relation between BER qualitative and official quantitative data (Martin, 2007).

BER surveys are of a qualitative nature as opposed to official statistics from, for example, those of the South African Reserve Bank and StatsSa which are quantitative in nature (Martin, 2007).

The BER qualitative business surveys have several advantages compared to numeric (official) data which is normally released with a time lag (Martin, 2007). Not only do they reveal the current and up to date state of affairs in the real economy, but also provide unique information, such as business confidence, rating of business conditions and respondents' expectations for the next quarter for which no official figures are available (Martin, 2007).

2.4.3.2 Business Confidence Indexes

According to Pellissier (2002), 'business confidence' is one of the buzzwords in financial media and exercised by economic analysts to evaluate the current business climate of a country and unfortunately has no clear-cut definitional description. The question "confidence in what" remains unanswered. Conceptually, business confidence means the present mood or sentiment of business people (managers in business) in conducting their day-to-day business. Mood implies a "state of mind and feelings" and sentiment, a "tendency to be moved by feeling rather than reason". However both of these descriptions, being purely psychological in nature do not clarify what is meant by the term 'Business Confidence'.

Theoretically, and in the economic sense of the word, 'business confidence' can be described as the degree of sentiment towards risk-taking by business for whatever reason. The agent of business will only consider a high-risk venture if he evaluates the odds against the outcome, within the broader economic environment, to be in his favour. (Pellissier, 2002). The reaction of business people to the economic environment can thus be interpreted as being a function of their perceptions of prevailing business conditions and their expectations of future eventualities. The level of these two psychological identities of perceptions and expectations impacts directly on the human nature behaviour of business people and action taken by business can, to a large degree, be ascribed to the level of confidence. (Pellissier, 2002). This would come to light

in the tendency of high business confidence to increase private investment in fixed capital goods, which would eventually impact on economic growth (Pellissier, 2002).

The Bureau for Economic Research (BER) at Stellenbosch University, South Africa, has a long history of conducting business surveys (Kershoff, 2003). These business and consumer surveys, conducted amongst manufacturers, retailers, and consumers from all population groups in South Africa, are held in high esteem by South African businesses (Kershoff, 2003).

The business surveys are conducted quarterly by sending questionnaires to a panel of 3000 regular participants (Kershoff, 2003). The panel of participants is representative of the formal manufacturing, retail, building and financial sectors. Informal street vendors, emerging builders and unregistered businesses are not covered (Kershoff, 2003).

The consumer confidence surveys are conducted quarterly and are derived from personal at-home interviews of an area-stratified probability sample of 2500 households (Kershoff, 2003). The questionnaires consist of three questions – ideally there should be more questions, however adding additional questions makes the survey cost-prohibitive (Kershoff, 2003).

The questions are:

1. How do you expect the general economic position in South Africa to develop during the next 12 months? Will it improve considerably, improve slightly, deteriorate slightly, deteriorate considerably, or don't know?
2. How do you expect the financial position in your household to develop in the next 12 months? Will it improve considerably, improve slightly, deteriorate slightly, deteriorate considerably, or don't know?
3. What is your opinion of the suitability of the present time for the purchase of domestic appliances such as furniture, washing machines, refrigerators, etc? Do you think that for people in general it is the right time, the wrong time, neither a good nor a bad time? (Kershoff, 2003).

The measurement of business confidence is important as it reliably indicates the current and expected states of the economy. Kershoff (2000) claims that it is widely recognised that business peoples' subjective individual expectations play a key role in economic developments.

The Bureau for Economic Research (BER) measures business confidence on a scale of 0 to 100, where 0 indicates an extreme lack of confidence, 50 neutrality and 100 extreme confidence (Kershoff, 2000).

The business confidence index reveals a rating of business conditions at a particular point in time. Respondents do not have to compare the current situation with that of a year ago (Kershoff, 2000).

Business confidence tends to rise when the increase in business activity matches or surpasses previous expectations and the external environment (e.g. the political situation in South Africa, economic policy, the world economy) remains relatively stable (Kershoff, 2000).

However, the only way to measure confidence in business at a particular point in time is to survey business people. Official data is always ex-post and only available after a time lag. There is no evidence to prove that on the date of release of official statistics, this would also be the point in time of measuring current business confidence (Pellissier, 2002).

2.4.3.3 Consumer Confidence Indexes

According to Baumohl, 2005, “Happy consumers are good for business”. He goes on to state that happy consumers are more likely to shop, travel, invest and keep the economy on a roll. This is in contrast to unhappy consumers that, if the number of malcontents us large enough, can derail economic activity.

Consumer confidence is expressed as a net balance in contrast to business confidence, which is depicted as a percentage gross (Kershoff, 2000). The consumer confidence index therefore reveals the change in consumers' expectations, whereas the business confidence index indicates what the situation is at a specific point in time. Theoretically this index can vary between –100 and +100.

Low confidence indicates that consumers are concerned about the future. With such a frame of mind, consumers tend to cut spending to basic necessities such as food and services to free up income for debt repayment (Kershoff, 2000).

According to Roberts & Simon (2001), interest in consumer sentiment indexes jumped again in the early 1990s after a large decline in consumer sentiment, which appeared to coincide with the onset of the 1990 – 1991 recession in the United States. As soon as policy-makers announced that the recession was probably over, confidence appeared to bounce back. These events were widely interpreted as evidence that sentiment could play an independent role in driving recessions and subsequent recoveries.

A characteristic of much literature on consumer confidence indicators is that it takes for granted that 'confidence' is actually captured and quantified by a specific index, which is itself a somewhat arbitrary construction (Roberts & Simon, 2001).

According to Baumohl (2005, pp 86-87), consumer confidence surveys are not very good at predicting future household spending and that history has shown that the relationship between consumer confidence and spending is not a very close one, even though it is perfectly intuitive to think so. He goes on to say that the best advice is to "put less weight on what consumers tell pollsters about their expectations of the future and focus instead on what people are doing with their money right now. The strongest evidence of confidence can be found at one place – the cash register."

A six-month or nine-month moving average of consumer confidence levels has proven to be a somewhat better indication of future household spending (Baumohl, 2005, pp 86-87).

2.5 Literature Conclusion

The literature indicates that there is a need for economists to be able to predict economic turnaround as this allows governments, business and individuals to properly plan for the future. In addition to being able to plan for the future, governments are also able to implement fiscal policies that may minimise the negative effects of recession.

Although there is some literature regarding previous attempts to develop economic models to predict economic turnaround, and that the South African

Reserve Bank itself has developed a 'leading indicator', the authors indicate that many of these models tend to predict the change in economic activity too late.

There is no literature currently available indicating that a leading leading-indicator has successfully been developed for the South African economy, an opportunity therefore exists to conduct an exploratory study.

Should the results of this research indicate that there may be a means to predict economic turnaround earlier than the South African Reserve Bank's current 'leading indicator'; additional, more quantitative research should be done.

3. PROPOSITIONS

Zikmund (2003) describes a proposition as a statement concerned with the relationship among various concepts. Balnaves and Caputi (2001) describe correlational hypotheses as hypotheses that test two or more variables to determine if they are related. This study therefore used an independent variable of time, and the dependent variable being the various economic indicators.

This research focused on whether there was a positive correlation between the business and consumer indexes, the South African Reserve Bank's Leading Indicator and the proposed 'Leading-Leading indicator' with actual economic growth/recession based on GDP values.

Proposition 1: A positive correlation (correlation ≥0.75 (Santero & Westerlund, 1996) exists between 'Business Confidence Index' and real GDP growth across time.

Proposition 2: A positive correlation (correlation ≥0.75 (Santero & Westerlund, 1996) exists between 'Consumer Confidence' Index and real GDP growth across time.

Proposition 3: A positive correlation (correlation ≥0.75 (Santero & Westerlund, 1996) exists between the South African Reserve Bank's Leading Indicator and real GDP growth across time.

Proposition 4: A positive correlation (correlation ≥0.75 (Santero & Westerlund, 1996) exists between the proposed 'Leading-Leading Indicators' and real GDP growth across time.

4. PROPOSED RESEARCH METHODOLOGY AND DESIGN

4.1 Research Design

The primary purpose of this research was essentially to provide the initial testing of a concept of creating an economic leading indicator that will give an earlier indication of potential South African economic turnaround than that which the South African Reserve Bank's Leading Indicator currently does. It was envisaged that this research would provide a leading indicator' for a pending change of the South African Reserve Bank's official Leading Indicator and so would hopefully warn economists that the South African Reserve Bank's Leading Indicator is about to change either positively or negatively.

As this was exploratory research, the proposed methodology did not use complicated econometric models and calculations, but instead relied on basic calculus, applied in a novel and useful way, to calculate the rate of change of some of the indexes and 'leading indicators'. This methodology essentially calculated at what rate, or momentum, the South African Reserve Bank's Leading Indicator changed. Should this research have indicated that the proposed 'Leading Leading Indicator' potentially allowed the earlier prediction of economic change, further research using more robust econometric models should have been developed in subsequent research.

The research methodology however incorporated quantitative analysis of the results by determining whether the business and consumer confidence indexes, the South African Reserve Bank's Leading Indicator and the newly proposed

'Leading Indicator' were statistically correlated to the South African real GDP growth.

4.2 Units of Analysis

Balnaves & Caputi (2001) note that the unit of analysis chosen is important to the overall work as a well defined unit of analysis lends itself to the likelihood that the research findings may be generalised.

The proposed research used the following the units of analysis:

- The First National Bank / Bureau of Economic Research (FNB/BER) Consumer Confidence Index (CCI) obtained from the Bureau of Economic Research (BER).
- The Rand Merchant Bank / Bureau of Economic Research (RMB/BER) Business Confidence Index (BCI) obtained from the Bureau of Economic Research (BER).
- The South African Reserve Bank's Leading Indicator data obtained from the South African Reserve Bank.
- The proposed 'Leading-Leading Indicators' developed for this research.
- The real South African Gross Domestic Product (GDP) obtained from the South African Reserve Bank.

Due to time and resource constraints, the above data sources were used rather than acquiring all sources of raw data independently and then calculating the resulting indexes. This use of external secondary data does potentially increase

the risk of misinterpretation, however as the data can be considered to be reliable, this risk is minimised.

4.3 Population of Relevance

The population of relevance to be applied in this research project are the South African monthly indexes, indicators and economic values as defined above for the period from January 1978 to December 2007. This population provided sufficient data over a long time period.

4.4 Sampling Method

The nature of the available data restricts the sampling method that can be utilised for this research. The sampling method can therefore be described as a non-probability judgement sample (Buglear, 2005; Zikmund, 2003).

As the data required for this research was available through the work done by the University of Stellenbosch's Bureau for Economic Research, the South African Reserve Bank and Statistics South Africa, all data was obtained using a combination of the following:

- The University of Stellenbosch's Bureau of Economic Research (BER)
- First National Bank's Business Confidence Index
- Investec's Consumer Confidence Index
- Economic databases available from the South African Reserve Bank
- Economic databases available from Statistics South Africa.

4.5 Data Collection

The data for this research was obtained using publicly available databases placed onto the Internet website of the University of Stellenbosch's Bureau of Economic Research, the Internet website of the South African Reserve Bank and on the Internet website of Statistics South Africa.

4.6 Development of 'Leading-Leading Indicator (1)'

The main purpose of this research was to develop a 'Leading-Leading Indicator' that would have allowed economists to gain an early indication that the South African Reserve Bank's Leading Indicator may be changing.

The 'Leading-Leading Indicator' was calculated using simple calculus and relied on calculating the rate of change of the South African Reserve Bank's Leading Indicator across time.

It was assumed that should the rate of change of the South African Reserve Bank's Leading Indicator either being in to increase or decrease, a possibility existed that the 'Leading Indicator' itself may be changing; thereby suggesting that economic change may be taking place in the near future.

Previous work has relied on waiting until the South African Reserve Bank's Leading Indicator has reached a peak or a trough before signalling to the market that economic change is likely to occur, thereby delaying any early warning of change.

The 'Leading-Leading Indicator (1)' was therefore calculated as follows:

Step 1 – Calculate the growth rate of the South African Reserve Bank's Leading Indictor:

Calculate the growth rate of change across time of the South African Reserve Bank's Leading Indicator using simple calculus and gradients.

Variables:

$LI_{(x)}$ = Value of South African Reserve Bank's Leading Indicator at 'time (x)'

= Percentage Change of Index from 'month ($x-1$)' to 'month (x)'

$LI_{(x+1)}$ = Value of South African Reserve Bank's Leading Indicator at 'time ($x+1$)'

= Percentage Change of Index from 'month (x)' to 'month ($x+1$)'

Step 2 – Calculate the 'Leading-Leading Indicator (1)'

Calculate the rate of change of the growth rate across time of the South African Reserve Bank's Leading Indicator using simple calculus and gradients. This will be referred to as the 'Leading-Leading Indicator'.

$LLI_{(x)}$ = Leading-Leading Indicator at 'time (*x)*'

$LLI_{(x+1)}$ = Leading-Leading Indicator at 'time (*x + 1)'*

$LLI(1)_{(n+1)}$ = Growth rate of 'Leading-Leading Indicator' at time (*n + 1)*

= $LI_{(x+1)} / LI_{(x)}$

4.7 Development of 'Leading-Leading Indicator (2)

The 'Leading-Leading Indicator (2)' will therefore be calculated as follows:

Step 1 – Calculate the growth rate of the South African Reserve Bank's Leading Indictor:

Calculate the growth rate of change across time of the South African Reserve Bank's Leading Indicator using simple calculus and gradients.

Variables:

$LI_{(x)}$ = Value of South African Reserve Bank's Leading Indicator at 'time (*x)*'

= Percentage Change of Index from 'month ($x-1$)' to 'month (x)'

$LI_{(x+1)}$ = Value of South African Reserve Bank's Leading Indicator at 'time ($x+1$)'

= Percentage Change of Index from 'month (x)' to 'month ($x+1$)'

Step 2 – Calculate the 'Leading-Leading Indicator (2)'

Calculate the rate of change of the growth rate across time of the South African Reserve Bank's Leading Indicator using simple calculus and gradients. This will be referred to as the 'Leading-Leading Indicator'.

$LLI_{(x)}$ = Leading-Leading Indicator at 'time (*x)*'

$LLI_{(x+1)}$ = Leading-Leading Indicator at 'time (*x + 1)'*

$LLI(2)_{(n+1)}$ = Growth rate of 'Leading-Leading Indicator' at time (*n + 1)*

= $(LI_{(x+1)} - LI_{(x)}) / LI_{(x)}$

4.8 Determining the Correlation of the Confidence Indexes, the South African Reserve Bank Leading Indicator, the 'Leading Leading Indicator' and Real Economic Growth

Based on the research done by Santero and Westerlund (1996), the correlation coefficients of the business and consumer confidence indexes, the South African Reserve Bank's Leading Indicator, and the 'Leading Leading Indicator', with a single measure of output, real GDP, will be determined. The numbers of months lead and lag reported was limited to 12 months since it was assumed that the highest correlation will be found within this period before or after an observation point in time (Santero & Westerlund, 1996).

Following the recommendations made by Santero and Westerlund (1996), with a view to keeping the analysis simple, sophisticated statistical criteria was not used as a 'benchmark' for the significance of the correlation coefficients, but rather a correlation coefficient exceeding 0.75 was considered as "large".

As autocorrelation was likely to present problems when analysing these time-series analyses, various methods were used in an attempt to remove any autocorrelation. These methods will included:

- De-trending of the time series graph.
- Using the difference of squares to remove any autocorrelation.
- Using 'moving averages' in an attempt to smooth the results to avoid autocorrelation.

The above-mentioned methods were done using a statistical program called Statistica.

4.9 Determination of the Correlation Between the Various Economic Indicators and Real GDP Growth

It was determined whether there was any correlation between the 'Leading-Leading indicators' and real GDP growth at various times – should a positive correlation have occurred, one would have be able to assume that this positive correlation was due to the lag of the GDP growth and hence would have been able to provide information regarding the predictability of the 'Leading-Leading

Indicators' to determine a possible change in the South African Reserve Bank's Leading Indicator.

The simple correlation coefficient is a statistical measure of the covariation between two variables (Buglear, 2005). The correlation coefficient ranges from –1.0 to +1.0, depending on whether there is a positive or negative relationship between the two variables.

According to Zikmund (2003), it is important to remember that correlation does not measure causation. No matter how highly correlated two variables are to one another, it can not be determined using simple correlation statistics that one variable causes another variable to occur. Thus, high correlations do not provide for an inference of causality (Pindyck & Rubinfeld, 1976).

4.10 Graphical Examination

The following indicators were plotted against time:

- Real GDP growth.
- RMB/BER Business Confidence Index
- Investec/BER Consumer Confidence Index
- South African Reserve Bank' Leading Indicator
- Proposed 'Leading-Leading Indicator (1)'
- Proposed 'Leading-Leading Indicator (2)'

Based on the work done by Santero & Westerlund (1996), the various indicators and indexes were plotted graphically across time and against the real GDP growth. This visual inspection allowed the researcher to determine whether any obvious trends existed between the various indexes and the leading indicators and the actual economic growth rate during that period.

This graphical examination did however *not* provide quantitative proof of whether correlations actually existed between these variables.

4.11 Process of Data Analysis

The process of analysis used included both descriptive and inferential statistics to perform analysis on the data and on the various outputs. (Zikmund, 2003).

Zikmund (2003) also states that inferential statistics are used to make inferences or judgements about a population on the basis of a sample.

Inferential statistics were selected to make inferences about the population based on the sample by means of proposition testing.

4.12 Excluded Data

As the data to be used for this research is published monthly, there should not be many cases of data excluded from this research. There is however a possibility that, as the purpose of this research is to create a model for predicting early detection of economic change, and as the nature of models is to

provide a generalisation of probable outcomes, outlier data may be excluded to prevent unjustified reporting of results.

4.13 Proposition Testing

In order to prove or disprove each of the proposals of this research, the correlation between the 'leading indicators' and real GDP growth were compared. Should the correlation for the newly developed 'Leading-Leading indicators' have provided proof that economic change could be detected earlier than that showed by the South African Reserve Bank's Leading Indicator the research would have been considered successful.

The statistical method selected to determine if there is any correlation between the various indicators and real GDP growth was simple correlation.

4.14 Limitations of this Research

The primary limitation of this research was that all data used was limited to indicators and information relating to the South African economy. In addition to this, as all data used was obtained from institutions, the researcher relyied on secondary data. Zikmund (2003) and Buglear (2005) highlight the following restrictions of secondary data: in research, data may be outdated, or may not meet the specific requirements of the researcher, as the data was invariably collected for a different purpose to that of the researcher's intended purpose. The source of data therefore needs to be reliable and gathered without bias. The methodology used by the source to gather the data may not follow a

rigorous process that is repeatable and hence subsequent year's data may not be acceptable.

This study was therefore limited by the potential shortcomings in the accuracy of measurement of real GDP growth and the South African Reserve Bank's Leading Indicator.

5. RESULTS

5.1. Data

5.1.1 Determination of South African Gross Domestic Product (GDP) Change

The South African Gross Domestic Product (GDP) growth figures were obtained from The South African Reserve Bank. The figures obtained were monthly from 1978; however these figures were converted into quarterly averages to facilitate easier data manipulation and comparisons. See Appendix 1 for the converted results.

The results are presented as the percentage growth year-on-year for the quarter in question. These results were calculated as the average of the percentage GDP growth for the preceding 3-months.

5.1.2 Determination of RMB/BER Business Confidence Index

The RMB/BER Business Confidence Index was obtained from the Bureau of Economic Research at the University of Stellenbosch, South Africa. The results available were represented as year-on-year (Y-o-Y) quarterly figures from Quarter 1, 1980. Please refer to Appendix 2 for a summary of the results

5.1.3 Determination of FNB/BER Consumer Confidence Index

The FNB/BER Consumer Confidence Index was obtained from the Bureau of Economic Research at the University of Stellenbosch, South Africa. The results available were represented as Y-o-Y quarterly figures from Quarter 2, 1982. Please refer to Appendix 3 for these results.

5.1.4 Determination of South African Reserve Bank's Leading Indicator

The South African Reserve Bank's Leading Indicator was obtained directly from the South African Reserve Bank. The figures obtained were monthly values; however these figures were converted into Y-o-Y quarterly averages to facilitate easier data manipulation and comparisons. Please refer to Appendix 4.

5.1.5 Calculation of the Leading-Leading Indicator (1)

Using the South African Reserve Bank's Leading Indicator, the first of the proposed Leading-Leading Indicators was calculated. The calculation involved using simple calculus to calculate the rate of change of the South African Reserve Bank's Leading Indicator over time, and this was compared to GDP growth over the same period.

The calculation for this indicator was done using the following equation:

$$LLI(1) = LI_{(x+1)} / LI_{(x)}$$

Where: LLI(1) = Leading-Leading Indicator (1)

LI = South African Reserve Bank's Leading Indicator

x = Year 'x'

Using the calculation above, the figures in Appendix 5 were obtained.

5.1.6 Calculation of the Leading-Leading Indicator (2)

Using the South African Reserve Bank's Leading Indicator, the second of the proposed Leading-Leading Indicators was calculated. The calculation involved using simple calculus to calculate the rate of change of the

South African Reserve Bank's Leading Indicator over time, and this was compared to GDP growth over the same period.

The calculation for this indicator was done using the following equation:

$LLI(1) = (LI_{(x+1)} - LI_{(x)}) / LI_{(x)}$

Where: LLI(1) = Leading-Leading Indicator (1)

LI = South African Reserve Bank's Leading Indicator

x = Year '*x*'

Using the calculation above, the figures in Appendix 6 were obtained.

5.2 Graphical Examination

Based on the work done by Santero & Westerlund (1996), the following indicators and indexes were plotted graphically across time and against the GDP growth as reported by the South African Reserve Bank.

During the research, it was found that a number outliers existed in the data. As a result, outliers were removed from the data and the statistical analysis was repeated to determine whether any trends existed.

A summary of the graphical and accompanying statistical analysis is represented in Table 1.

Table 1: Summary of Graphs and Data Sources

Figure	Plot of:	See Appendices
1	RMB/BER BCI vs. GDP (Y-o-Y)	2 vs. 1
2	FNB/BER CCI vs. GDP (Y-o-Y)	3 vs. 1
3	SARB's LI vs. GDP (Y-o-Y)	4 vs. 1
4	Proposed Leading-Leading Indicator (1) (Original Data) vs. GDP (Y-o-Y)	5 vs. 1
5	Proposed Leading-Leading Indicator (1) (Outliers Removed) vs. GDP (Y-o-Y)	5 vs. 1
6	Proposed Leading-Leading Indicator (2) (Original Data) vs. GDP (Y-o-Y)	6 vs. 1
7	Proposed Leading-Leading Indicator (2) (Outliers Removed) vs. GDP (Y-o-Y)	6 vs. 1

5.2.1 RMB/BER Business Confidence Index

The RMB/BER Business Confidence Index was plotted against South African GDP growth for the period from the first quarter 1980 to the first quarter 2008.

A visual inspection was done to allow the researcher to determine whether any obvious trends existed between the RMB/BER Business Confidence Index and the South African GDP growth. The plots of the various indexes were tracked to determine whether they followed a similar trend.

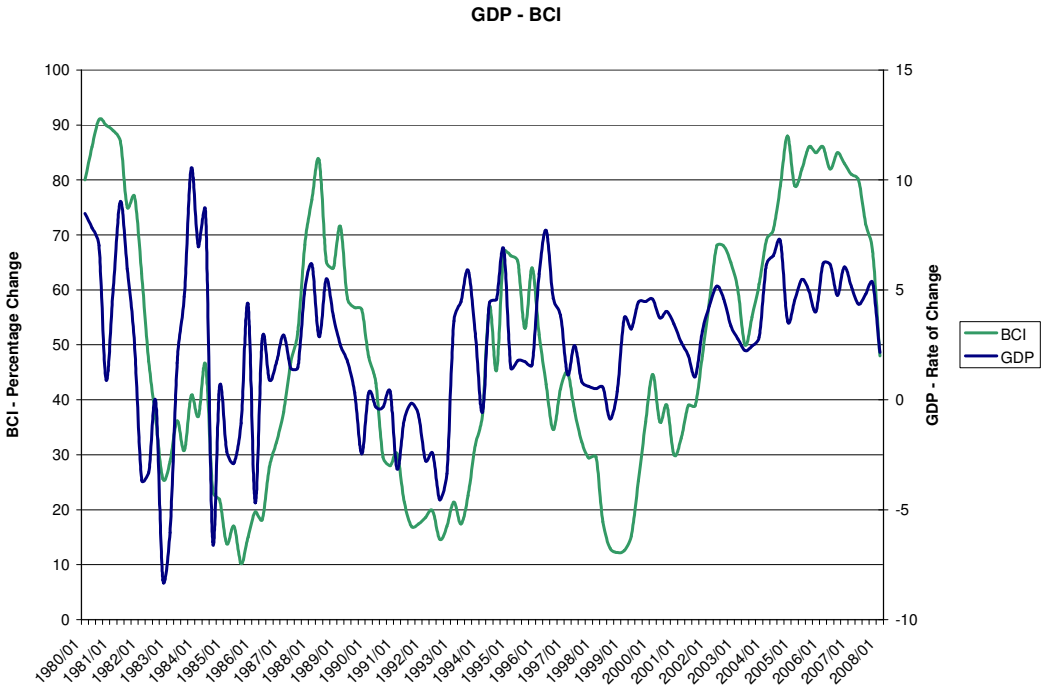

Figure 1:- Plot of RMB/BER Business Confidence Index against South African GDP Growth

Figure 1 indicates some correspondence between the patterns of the two series, and possibly some correlation between the RMB/BER Business Confidence Index and South African growth. The plot of GDP does seem to track the Business Confidence Index. It is however difficult to determine whether the Business Confidence Index is leading, lagging or coincident with the GDP growth.

5.2.2 FNB/BER Consumer Confidence Index

The FNB/BER Consumer Confidence Index was plotted against South African GDP growth for the period from the 1982, Quarter 2, to 2008, Quarter 1.

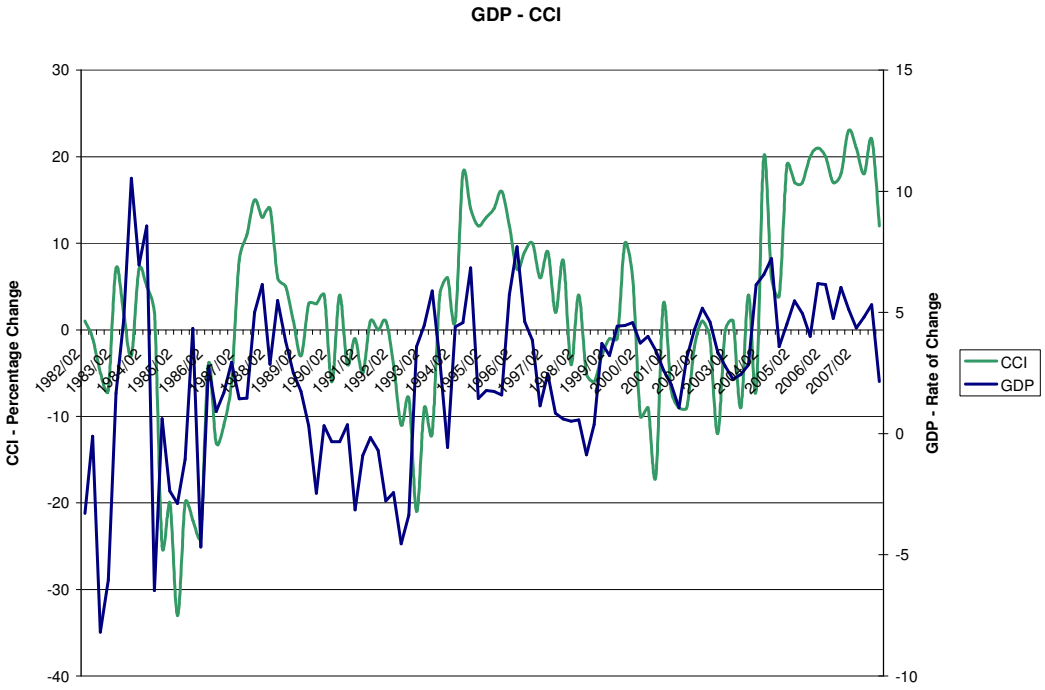

Figure 2:- Plot of FNB/BER Consumer Confidence Index against South African GDP Growth

A visual inspection was done to allow the researcher to determine whether any obvious trends existed between the FNB/BER Consumer Confidence Index and the South African GDP growth.

Once again, there does seem to be some correlation between the FNB/BER Consumer Confidence Index and South African growth (Figure 2). The plot of GDP does seem to track the Consumer Confidence Index. However, whether the Business Confidence Index is leading, lagging or coincident with the GDP growth is unclear.

5.2.3 South African Reserve Bank's Leading Indicator

The South African Reserve Bank's Leading Indicator was plotted against South African GDP growth for the period from the first quarter 1980 to the first quarter 2008 (Figure 3).

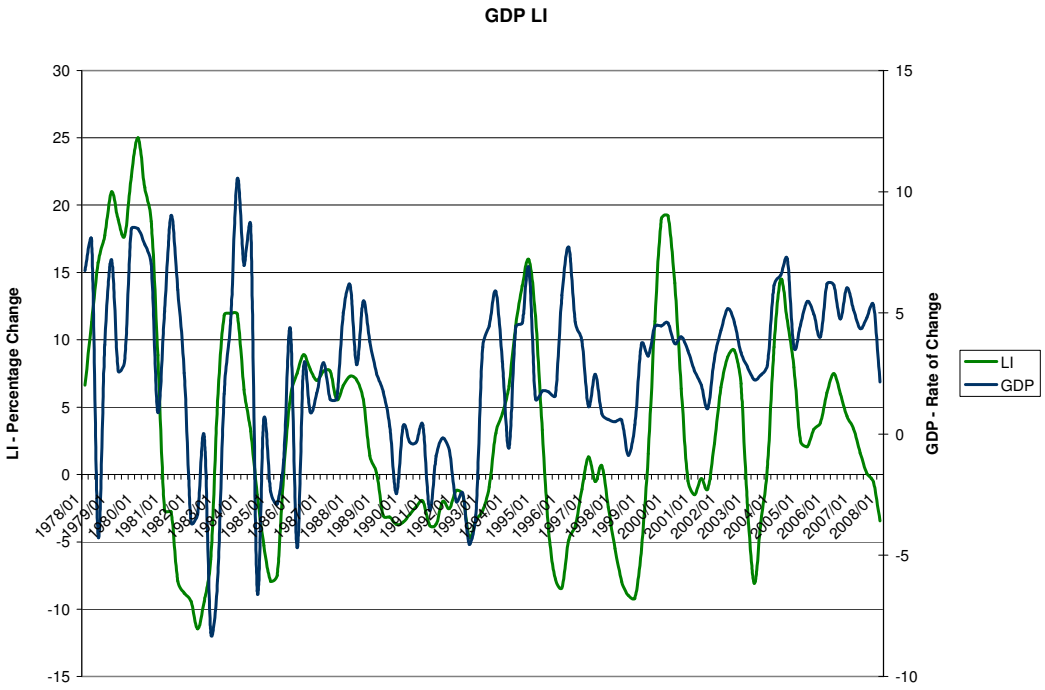

Figure 3:- Plot of the South African Reserve Bank's Leading Indicator against South African GDP Growth

Visual inspection to determine whether any obvious trends existed between the South African Reserve Bank's Leading Indicator and the South African GDP growth, showed that this graph is relatively volatile. It is difficult to determine whether the South African Reserve Bank's Leading Indicator leads or follows GDP growth. There does however appear to some correspondence or correlation between the South African Reserve Bank's Leading Indicator and GDP growth (Refer to Section 5.3 for the statistical analysis).

5.2.4 *Developed Leading - Leading Indicator (1)(Original Data)*

This Leading-Leading Indicator (1) (original data) was developed by the researcher using the methodology presented above. It was plotted against South African GDP growth for the period from the first quarter 1980 to the first quarter 2008.

A visual inspection was done to allow the researcher to determine whether any obvious trends existed between the researcher's Leading-Leading Indicator and the South African GDP growth.

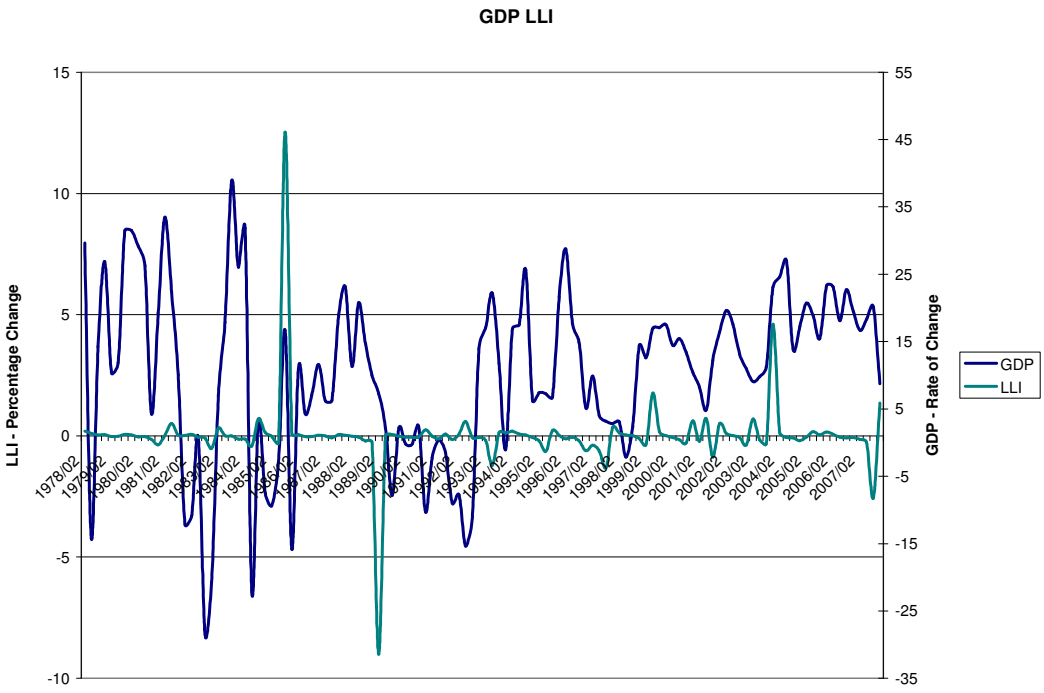

Figure 4:- Plot of the Proposed Leading-Leading Indicator (1) (Original Data) against South African GDP Growth

Visual inspection revealed no clear trend of correlation between the proposed Leading-Leading Indicator (1) and GDP growth. Statistical analysis was however done to confirm this (Refer to Section 5.3).

5.2.5 Developed Leading - Leading Indicator (1) (Outliers Removed)

Due to the fact that the raw data contained a number of outliers, these removed to allow a more accurate analysis of the graph, without the outliers obstructing obvious trends and patterns. This Leading-Leading Indicator (1) (Outliers Removed) was developed by the researcher using the methodology presented above. It was plotted against South African GDP growth for the period from the first quarter 1980 to the first quarter 2008.

A visual inspection was done to allow the researcher to determine whether any obvious trends existed between the researcher's Leading-Leading Indicator (1) (Outliers Removed) and the South African GDP growth.

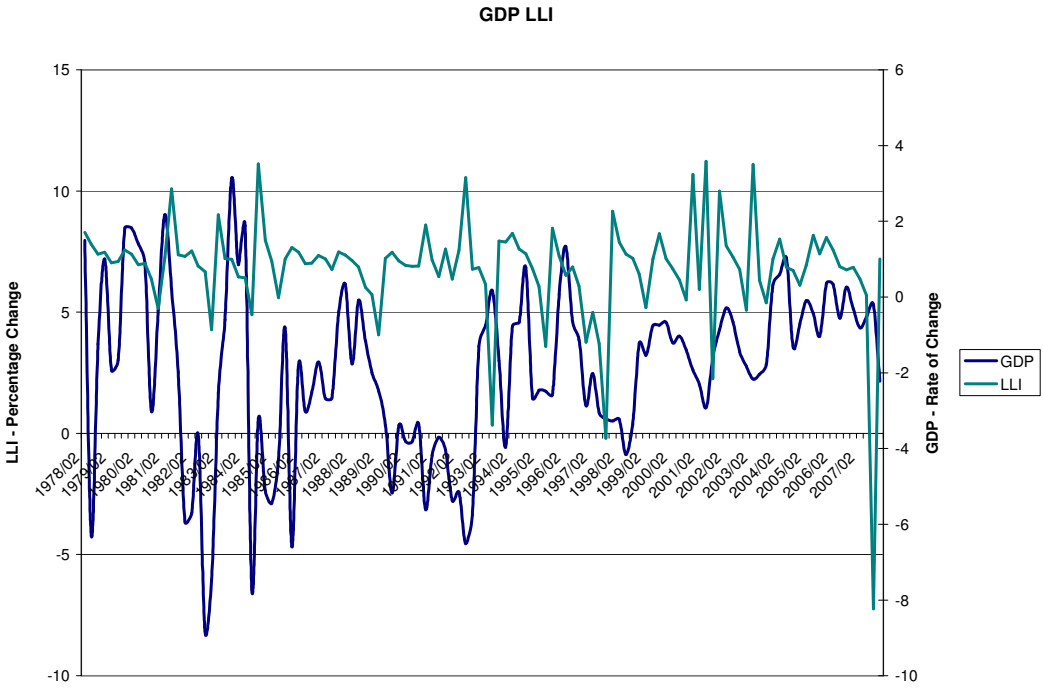

Figure 5:- Plot of the Proposed Leading-Leading Indicator (1) (Outliers Removed) against South African GDP Growth

Visual inspection revealed no clear trend of correlation between the proposed Leading-Leading Indicator (1) and GDP growth. Statistical analysis was however done to confirm this (Refer to Section 5.3).

5.2.6 *Developed Leading - Leading Indicator (2) (Original Data)*

This Leading-Leading Indicator (2) (Original Data) was developed by the researcher using the methodology presented above. It was plotted against South African GDP growth for the period from the first quarter 1980 to the first quarter 2008.

A visual inspection was done to allow the researcher to determine whether any obvious trends existed between the researcher's Leading-Leading Indicator (2) (Original Data) and the South African GDP growth.

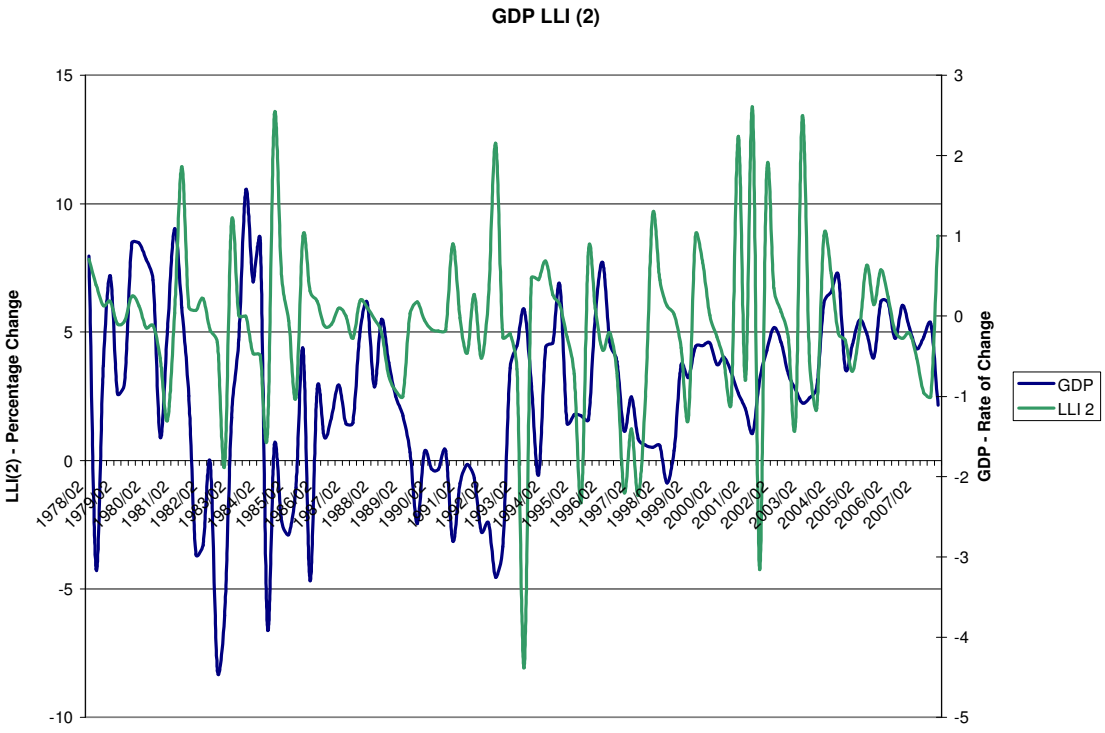

Figure 6:- Plot of the Proposed Leading-Leading Indicator (2) (Original Data) against South African GDP Growth

Visual inspection revealed no clear trend of correlation between the proposed Leading-Leading Indicator (2) and GDP growth. Statistical analysis was however done to confirm this (Refer to Section 5.3).

5.2.7 Developed Leading - Leading Indicator (1) (Outliers Removed)

This Leading-Leading Indicator (2) (Outliers Removed) was developed by the researcher using the methodology presented above. It was plotted against South African GDP growth for the period from the first quarter 1980 to the first quarter 2008.

A visual inspection was done to allow the researcher to determine whether any obvious trends existed between the researcher's Leading-Leading Indicator (2) (Outliers Removed) and the South African GDP growth.

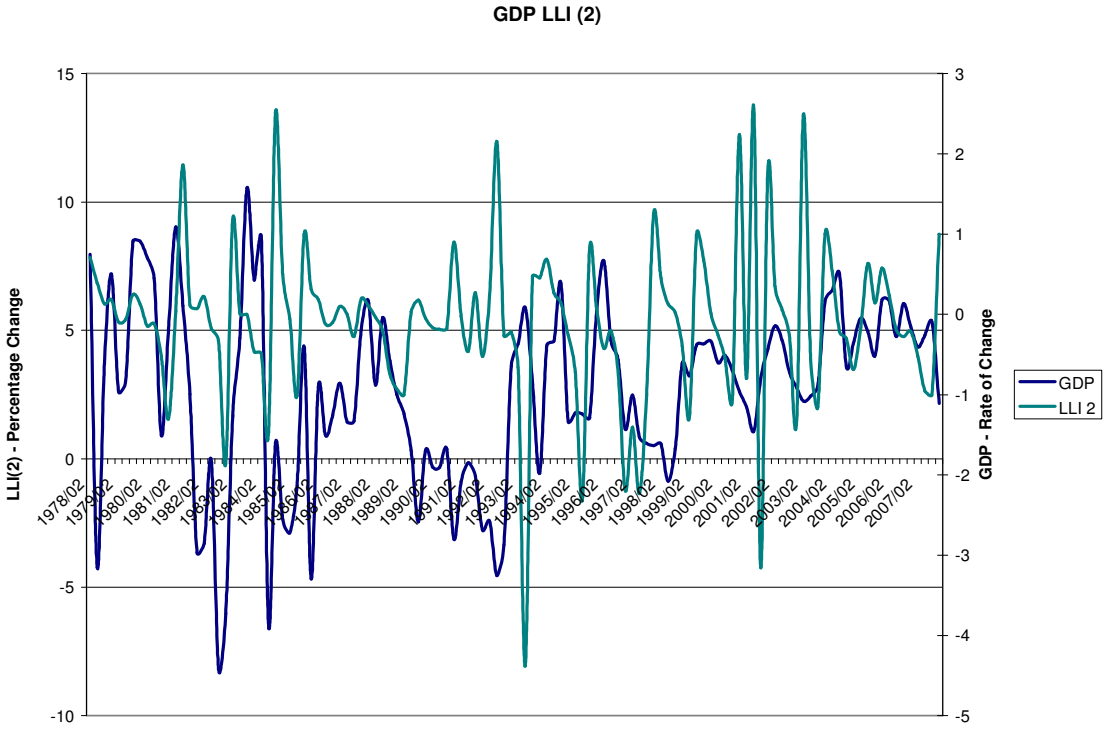

Figure 7:- Plot of the Proposed Leading-Leading Indicator (2) (Outliers Removed) against South African GDP Growth

Visual inspection revealed no clear trend of correlation between the proposed Leading-Leading Indicator (2) and GDP growth

5.3 Statistical Analysis

In order to determine whether there was any statistical evidence to support whether the various economic indicators researched in this paper were able to predict economic change in South Africa, a number of statistical analyses were done, using the data calculated in section 5.1.

5.3.1 Correlation Between GDP Growth and the Economic Indicators

Welman and Kruger (2001) explain that correlations such as the Pearson Product Moment correlation coefficient (r) are used to describe

relationships between variables. Correlations measure the extent to which changes in one variable are associated with changes in another variable.

In calculating correlations, however, it is assumed that the observations are independent. This required independence may not hold in the Year-on-year quarterly ratios presented in the previous tables and plotted in the previous figures. Initially, the correlation of each of the economic indicators was calculated against the South African GDP growth. The results are shown in Table 2. Thereafter, the researcher attempts to remove any serial or autocorrelation in the series, and thereafter provides the correlations between each series versus GDP Y-o-Y after removing autocorrelations.

Table 2:- Correlations Between the Economic Indicators and GDP Growth

	Business Confidence Index	**Consumer Confidence Index**	**SARB Leading Indicator**	**Proposed Leading-Leading Indicator (1)**	**Proposed Leading-Leading Indicator (2)**
GDP Change	0.53 ***	0.42 ***	0.49 ***	0.07	0.01

*** p<0.001

These results indicate that there significant correlation (p<0.001) between change in GDP and: the Business Confidence Index, Consumer Confidence Index and the South African Reserve Bank's Leading Indicator. However, the correlation coefficients obtained are lower that

those of 0.75 prescribed by Santero & Westerlund (1996). The results also indicate that there is no significant correlation between change in GDP and the 'Proposed Leading-Leading Indicator (1) and the 'Proposed Leading-Leading Indicator (2)', even when the outlying data is removed from the data set.

It is possible, however, that the significant correlations may be due to the presence of autocorrelation or serial correlation in some of the series.

The series were thus checked for autocorrelation so that more accurate correlation coefficients could be determined, and statistical evidence obtained showing that the economic indicators are predictors of economic change.

5.3.2 Autocorrelation Analysis – GDP (Y-o-Y)

Due to the potential for autocorrelation to occur with time-series, statistical analysis was done to determine whether this had in fact occurred.

Using Statistica, the GDP growth was checked for autocorrelation. The results are presented in Figures 8 and 9.

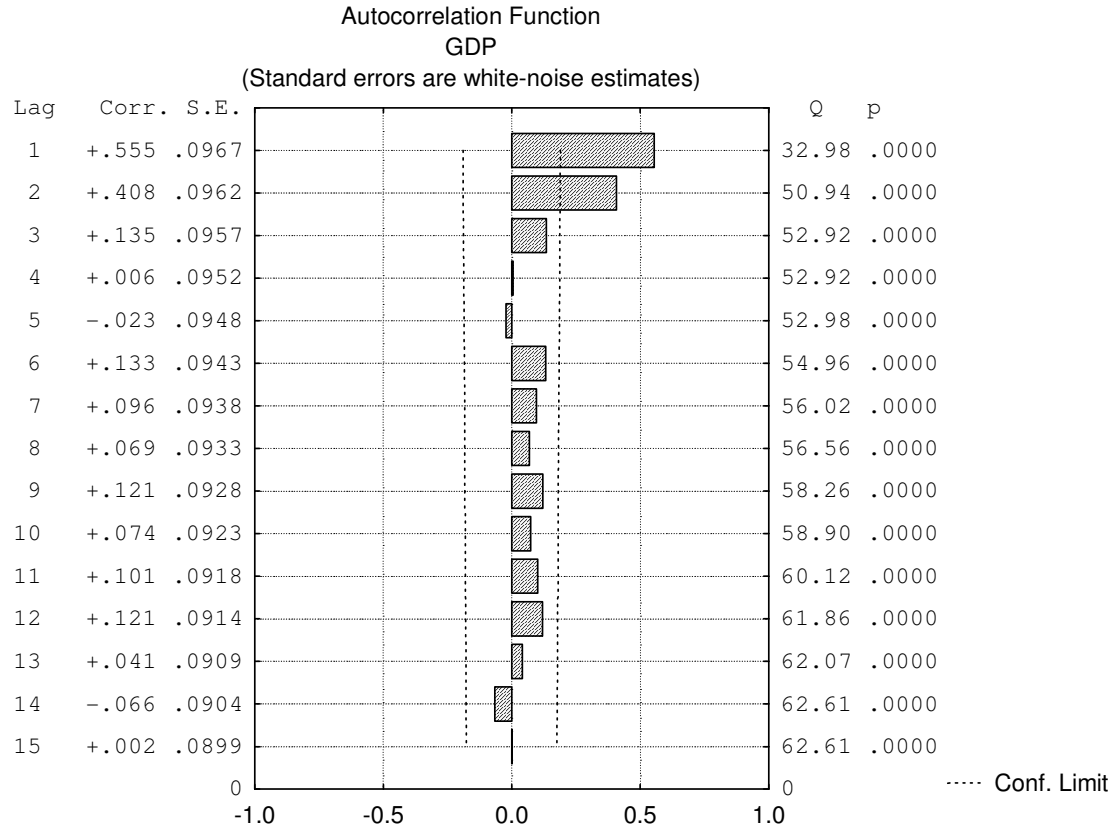

Figure 8: Autocorrelation Graph - GDP Growth (Y-o-Y)

The analysis above indicates that there is significant autocorrelation, particularly at lags 1 & 2.

In an attempt to reduce the autocorrelation, the data was re-run after modifying it to use the moving average. It was hoped that this would reduce the autocorrelation. The results are shown in Figure 9.

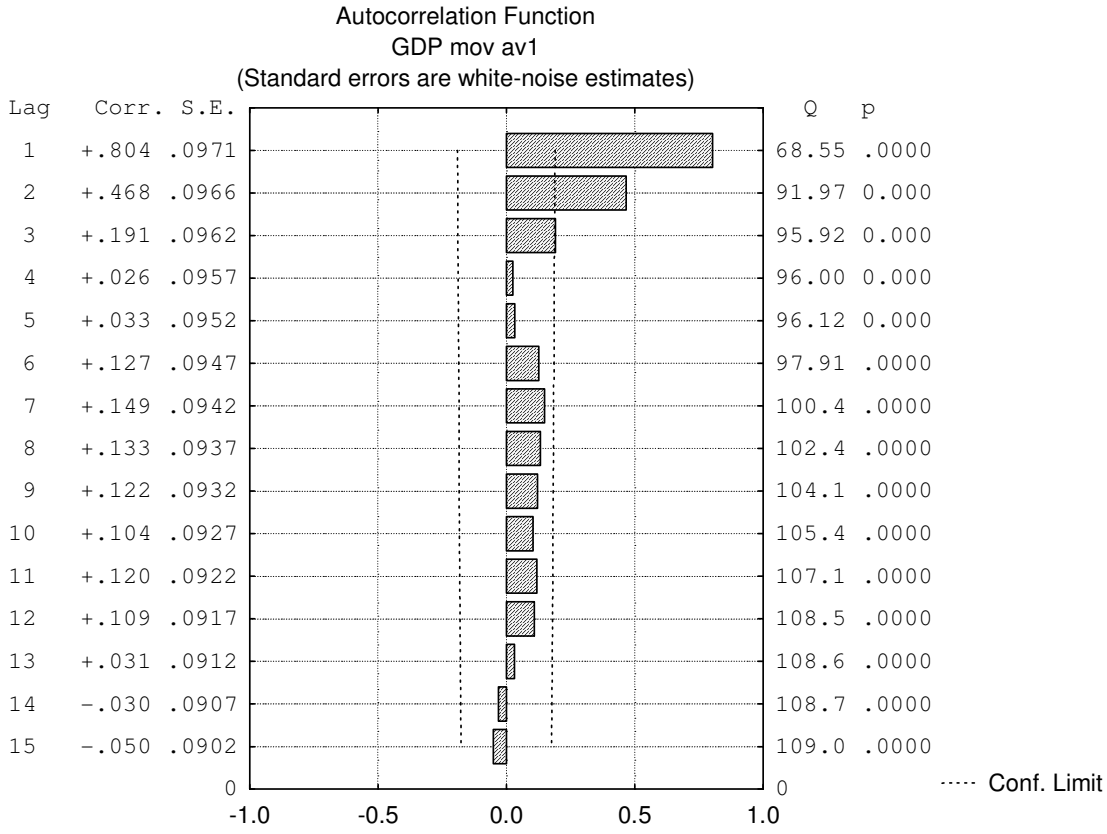

Figure 9: Autocorrelation Graph - GDP (Y-o-Y) (Moving Averages)

The analysis above indicates that there is still significant autocorrelation

In an attempt to reduce the autocorrelation, the data was re-run after modifying it to de-trend the data. It was hoped that this would reduce the autocorrelation. The results are shown in Figure 10.

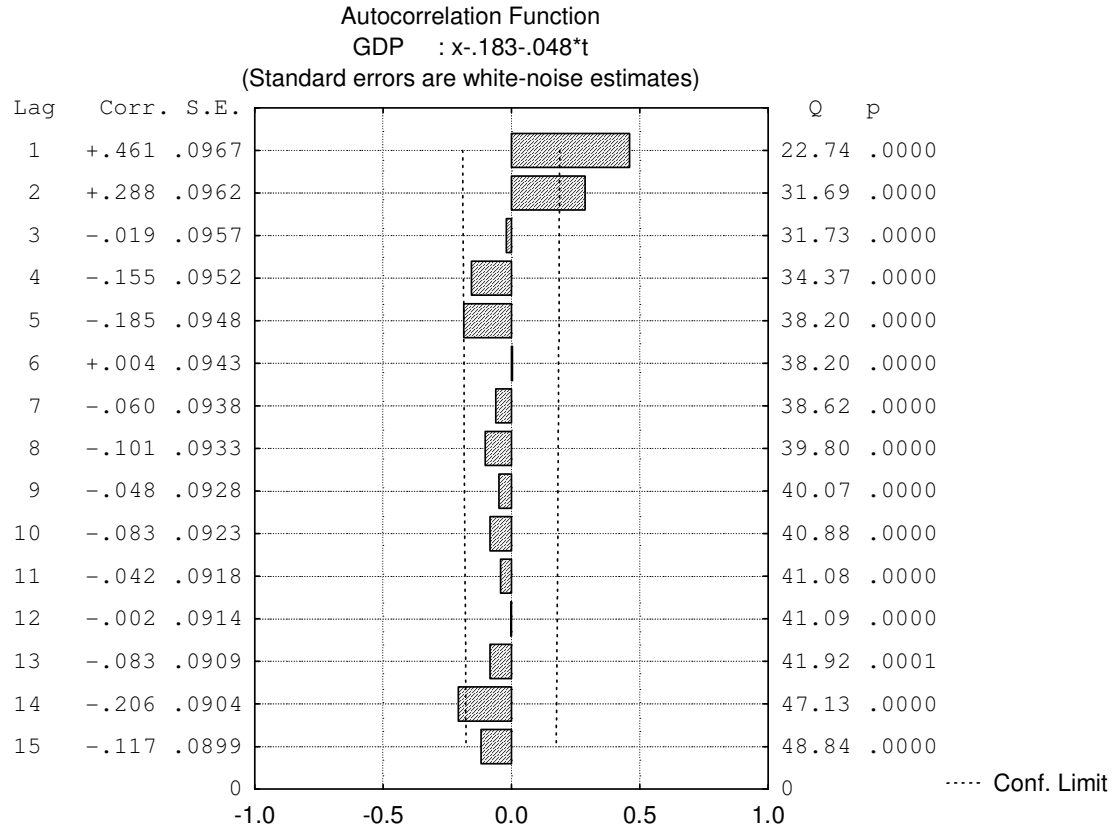

Figure 10:- Autocorrelation Graph - GDP (Y-o-Y) (De-Trended)

The analysis above indicates that there is still significant autocorrelation.

5.3.3 Autocorrelation Analysis – RMB/BER Business Confidence Index

Due to the potential for autocorrelation to occur with time-series, statistical analysis was done to determine whether this had in fact occurred.

Using Statistica, the RMB/BER Business Confidence Index was examined. The results are presented in Figures 11 and 12).

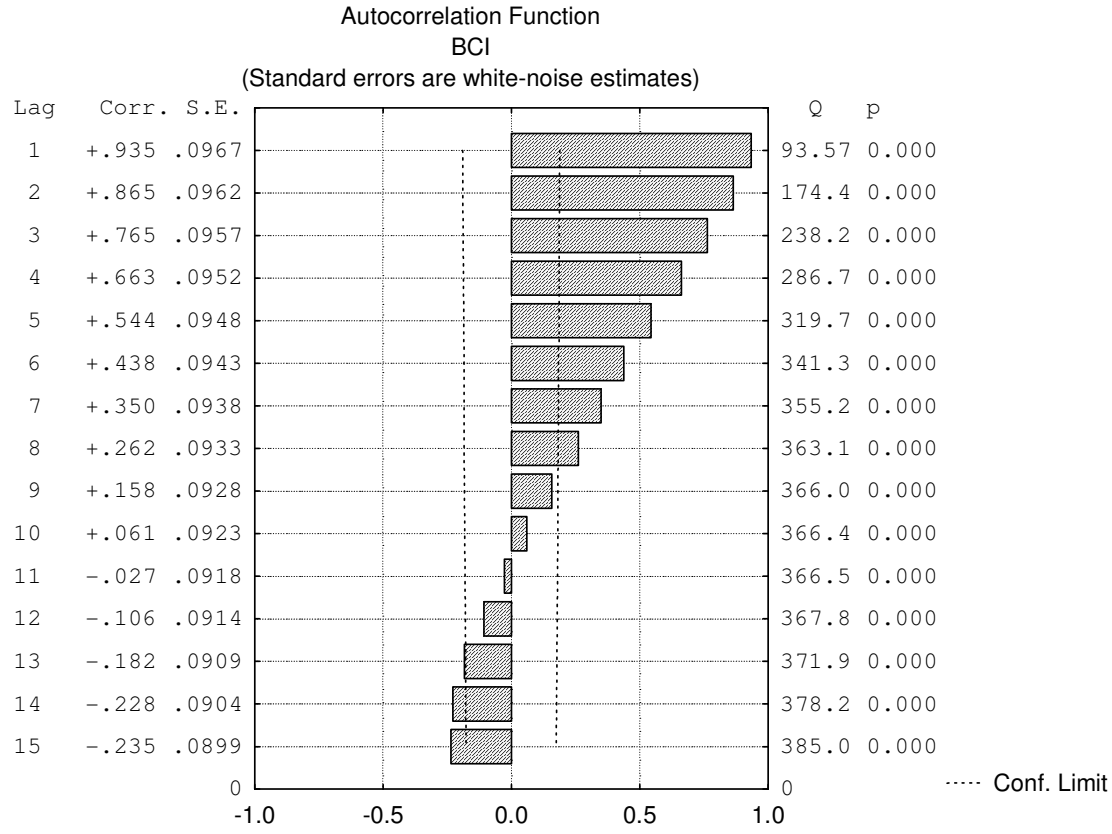

Figure 11: Autocorrelation Graph - Business Confidence Index

The analysis above indicates that there is still significant autocorrelation, particularly at lag 1.

In an attempt to reduce the autocorrelation, the data was re-run after modifying it using differences. It was hoped that this would reduce the autocorrelation. The results are shown in Figure 12.

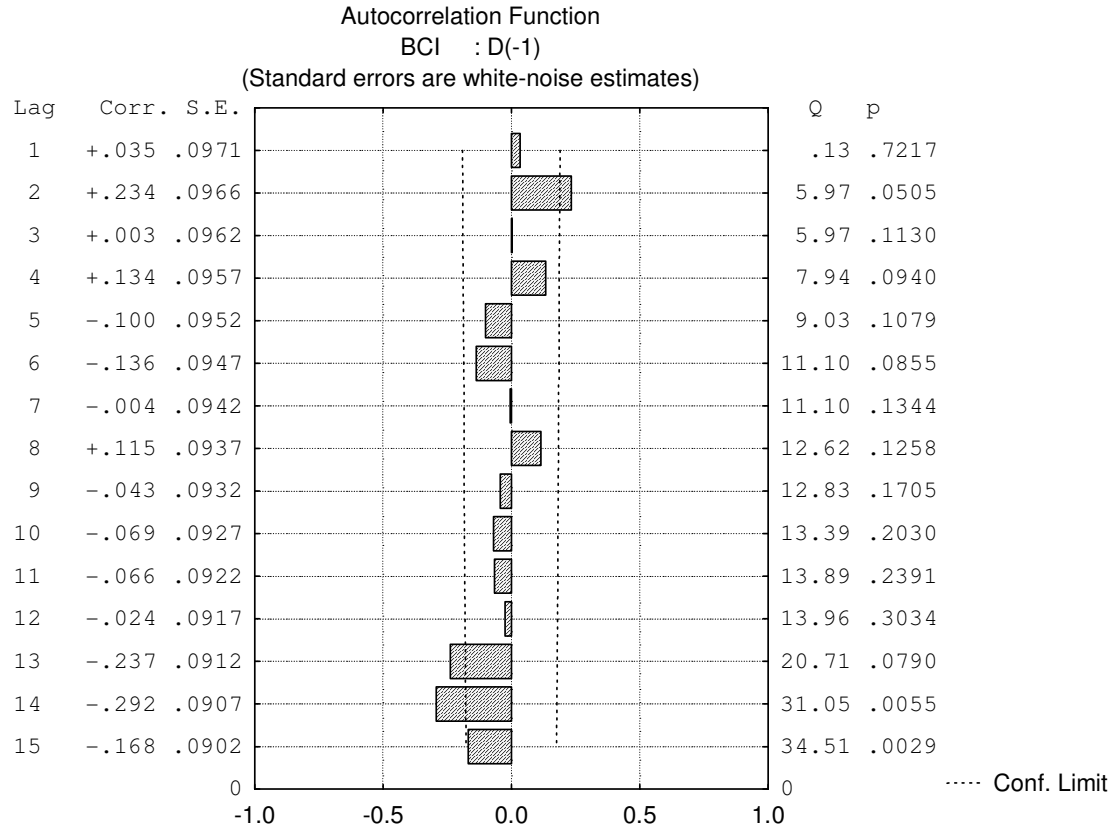

Figure 12:- Autocorrelation Graph - Business Confidence Index – Using Differences (1-Lag Phase Difference)

With one-lag phase difference, the autocorrelation has been largely removed, allowing a more accurate estimation of the correlation of the economic indicator.

5.3.4 Autocorrelation Analysis – FNB/BER Consumer Confidence Index

Using Statistica, analysis was done for the FNB/BER Consumer Confidence Index to determine whether there was autocorrelation.

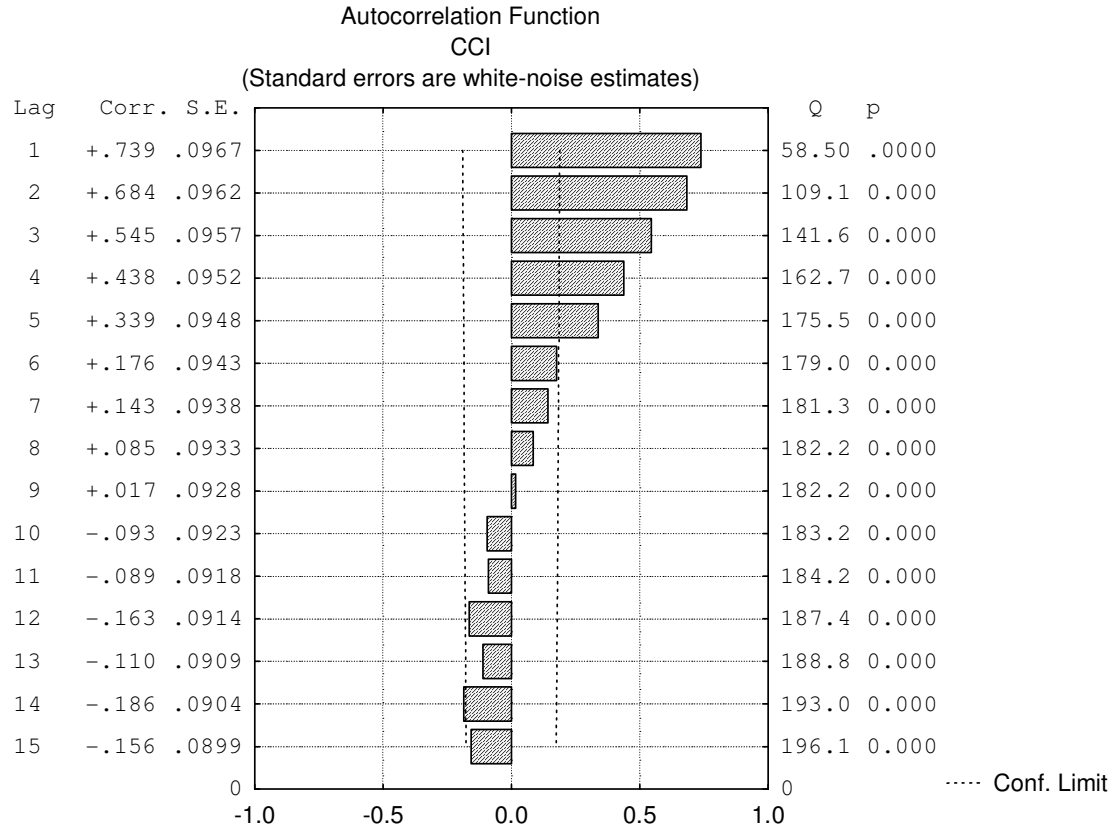

Figure 13:- Autocorrelation Graph - Consumer Confidence Index

The analysis above indicates that there is significant autocorrelation.

In an attempt to reduce the autocorrelation, the data was re-run. The results are shown in Figure 14.

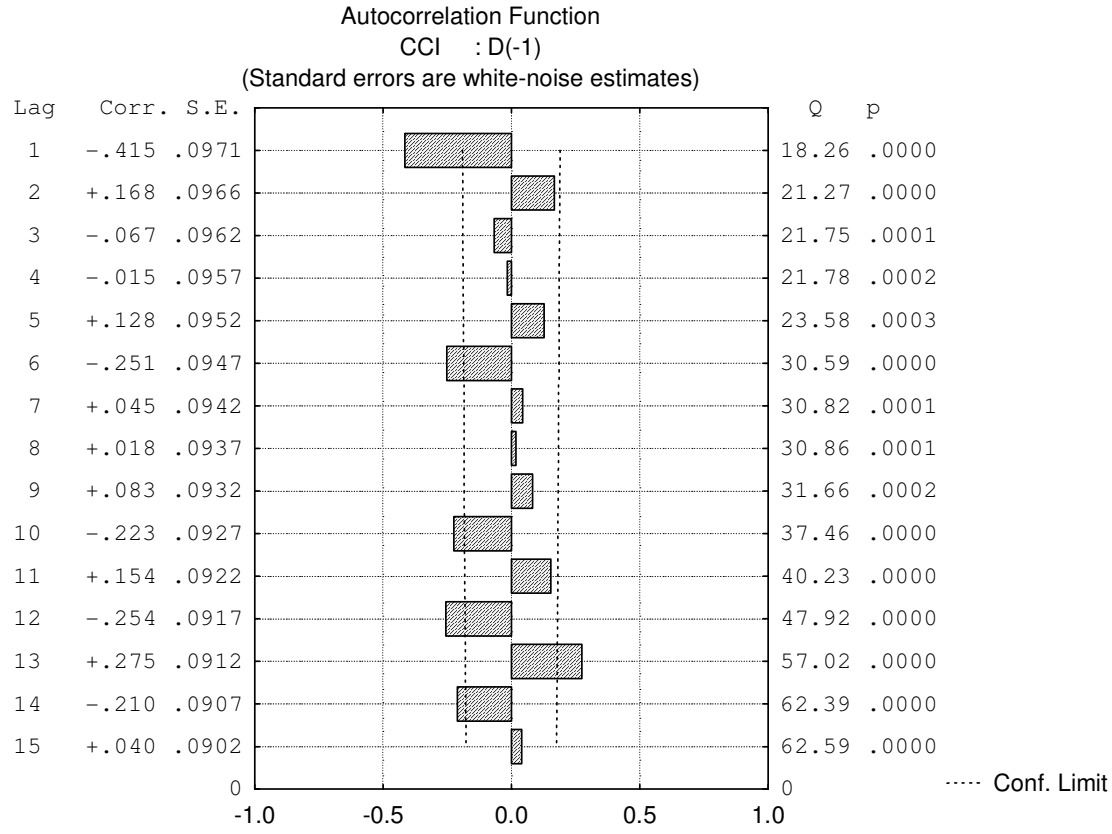

Figure 14:- Autocorrelation Graph - Consumer Confidence Index – Using Differences (1-Lag Phase Difference)

The analysis above indicates much reduced autocorrelation.

5.3.5 *Autocorrelation Analysis – South African Reserve Bank's Leading Indicator*

Using Statistica, analysis was done on the South African Reserve Bank's Leading Indicator to determine whether there was autocorrelation between these series.

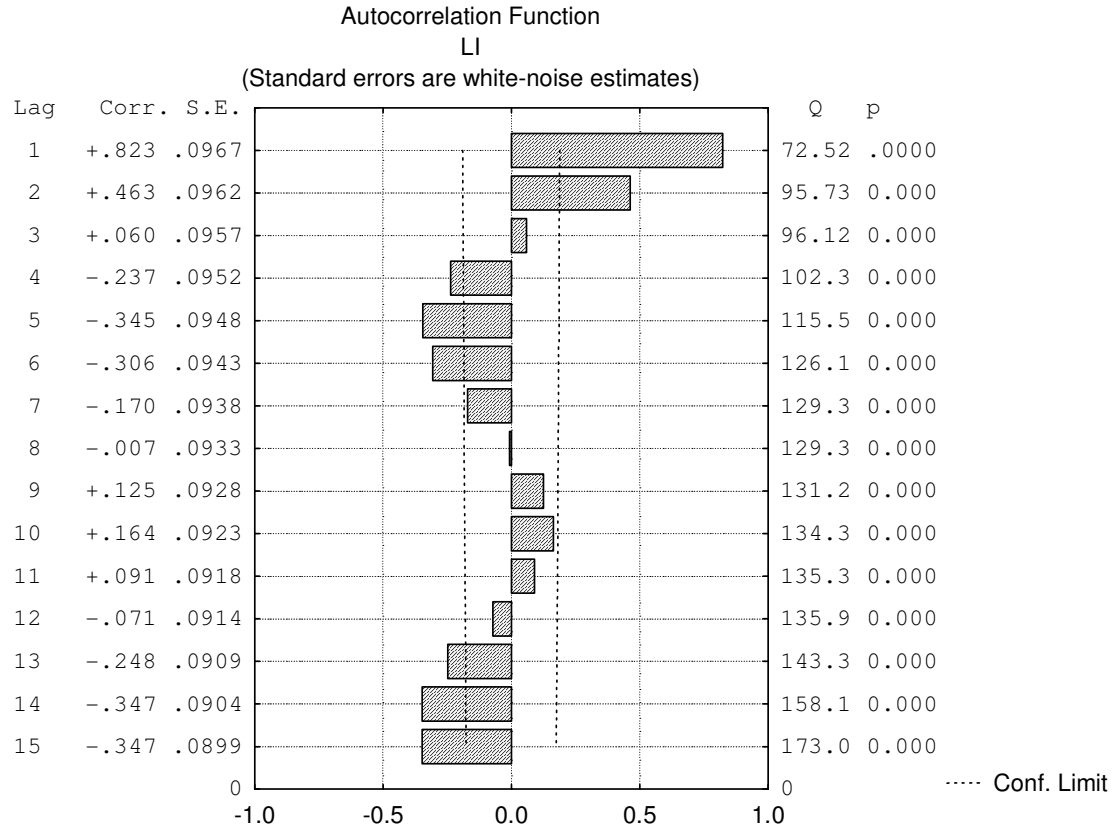

Figure 15:- Autocorrelation Graph - South African Reserve Bank's Leading Indicator

The analysis above indicates that there is significant autocorrelation, particularly at lag 1. The autocorrelation function for the Leading Indicator is still evident at lag 1. Further lagged periods, however showed little improvement in reducing the autocorrelations (Refer to Figure 16).

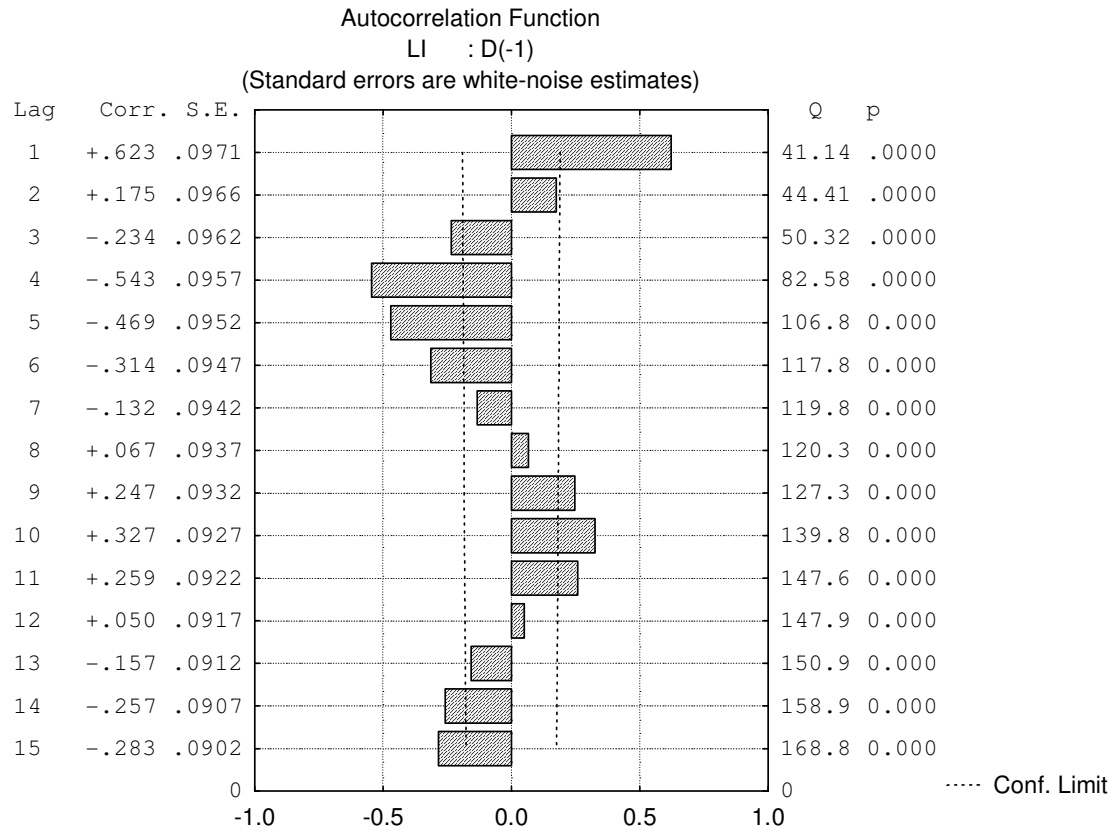

Figure 16:- Autocorrelation Graph - South African Reserve Bank's Leading Indicator – Differencing (1-Lag Phase Difference)

The analysis above indicates that there is still significant autocorrelation for each of the lag phases.

5.3.6 *Autocorrelation Analysis – Proposed Leading-Leading Indicator (1)*

Using Statistica, analysis was done on the proposed Leading-Leading Indicator (1) to determine whether there was autocorrelation.

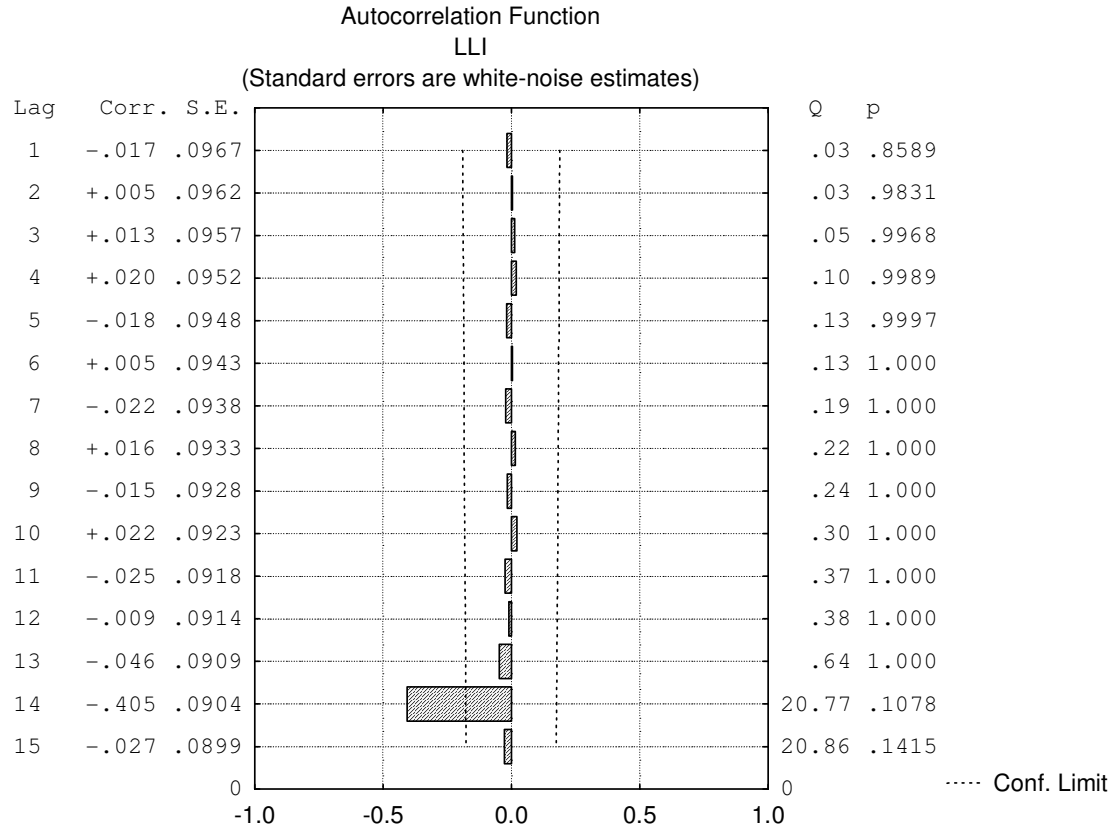

Figure 17:- Autocorrelation Graph - Proposed Leading-Leading Indicator (1)

The analysis above indicates that there is significant autocorrelation for each of the lag phases except for lag phases 3, 8, 9, 10, 11 and 12.

In an attempt to reduce the autocorrelation, the data was re-run after modifying it to using differencing to 14 lags. It was hoped that this would reduce the autocorrelation. The results are shown in Figure 18.

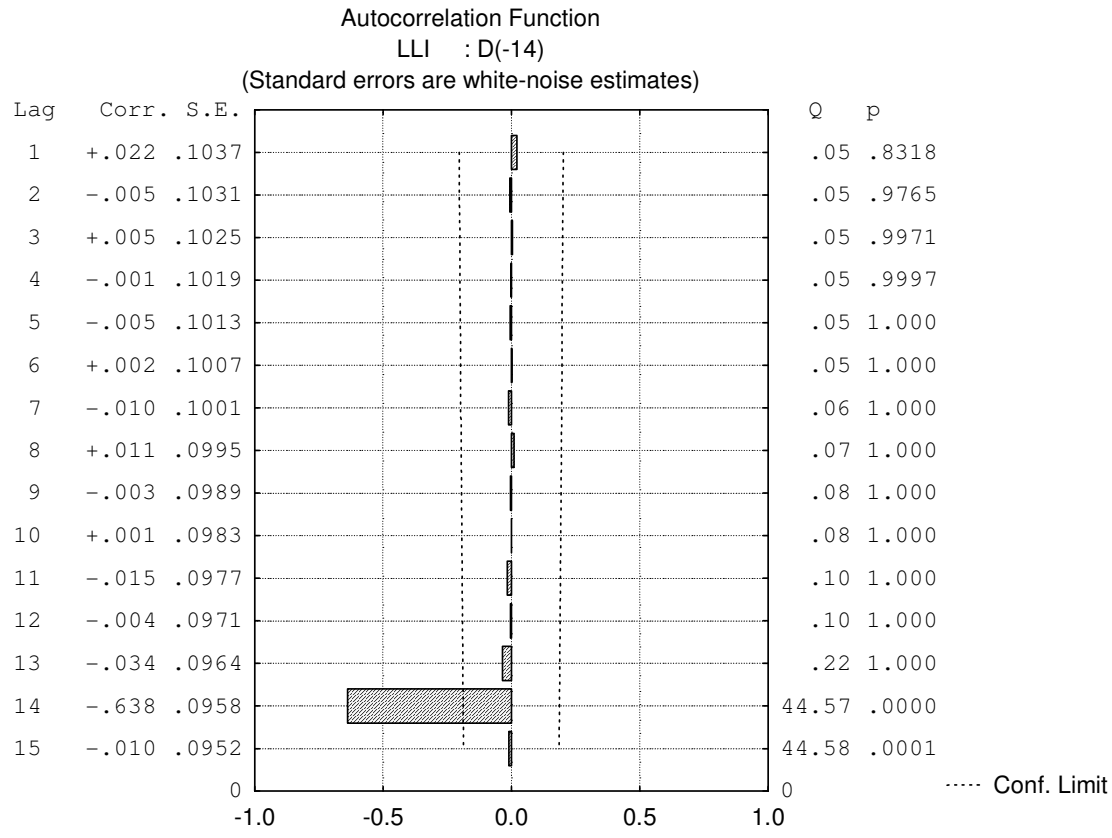

Figure 18:- Autocorrelation Graph – Proposed Leading-Leading Indicator (1) – Differenced (14-Lag Phase Difference)

The analysis above indicates that there is significant autocorrelation.

5.3.7 *Autocorrelation Analysis for the Proposed Leading-Leading Indicator (2)*

Using Statistica, analysis was done between GDP Growth and the proposed Leading-Leading Indicator (2) to determine whether there was autocorrelation between these series.

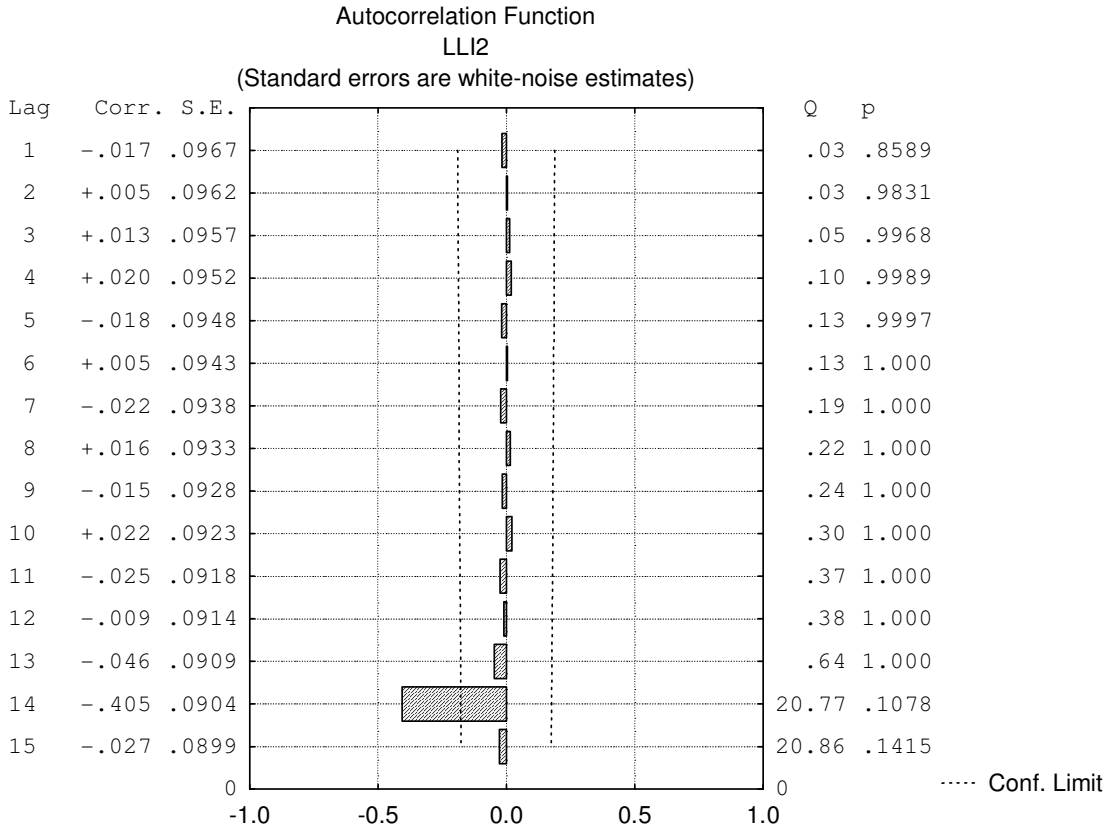

Figure 19:- Autocorrelation Graph - Proposed Leading-Leading Indicator (2)

The analysis above indicates that there is significant autocorrelation for each of the lag phases except for lag phase 14.

In an attempt to reduce the autocorrelation, the data was re-run after modifying it to using differencing to 14 lags. It was hoped that this would reduce the autocorrelation. The results are shown in Figure 20.

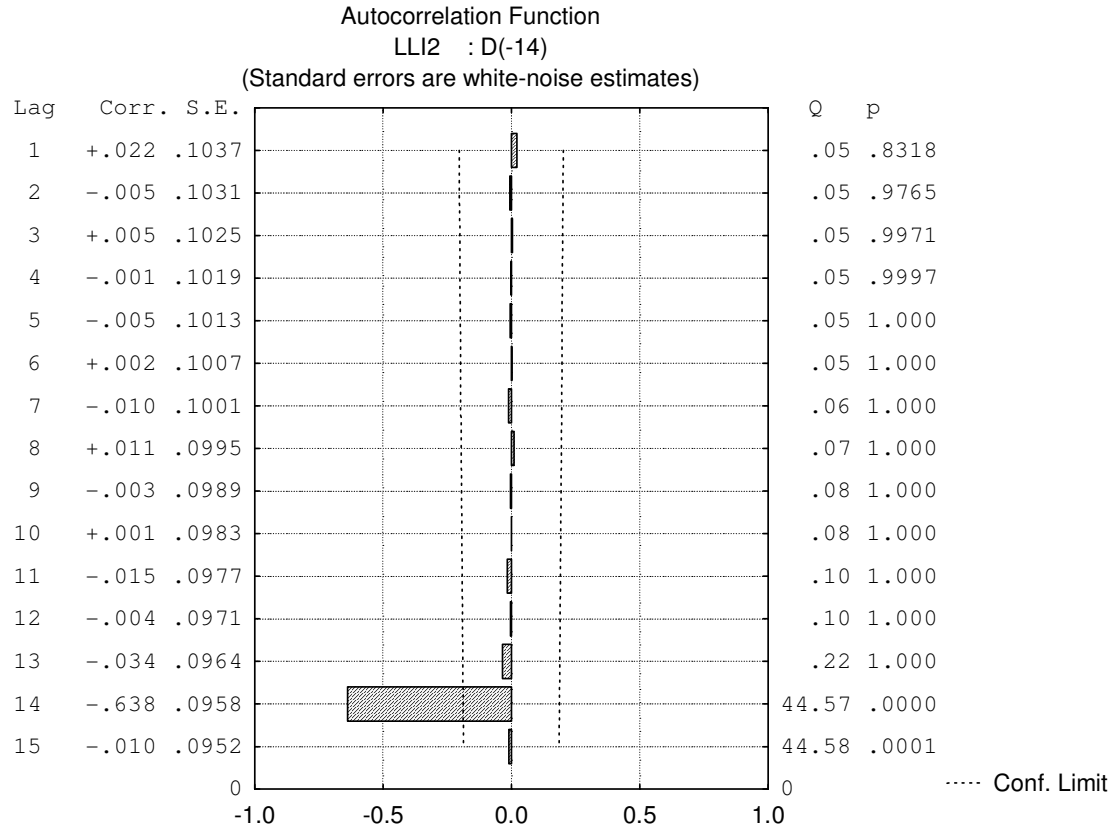

Figure 20:- Autocorrelation Graph – Proposed Leading-Leading Indicator (2) – Stepwise Regression (14 Lags)

The analysis above indicates that there is still a significant amount of autocorrelation for each of the lag phases. It was therefore deduced that the Proposed Leading-Leading Indicator (2) is not a good indicator of GDP change.

5.3.8 Summary of Correlation Coefficients

Following the attempted removal of autocorrelation between the variables, the correlation coefficient was determined. A summary of the correlation coefficients is displayed in Table 3.

Table 3:- Correlation Coefficients Between the Variables:

	GDP	GDP: – Detrended: Moving Average
BCI	0.53	0.43
CCI	0.42	0.35
LI	0.49	0.54
LLI(1)	0.07	0.00
LLI(2)	0.01	-0.06

Summary:

The 'Leading Leading Indicator (1)' and 'Leading Leading Indicator (2)' offered no predictive power of GDP growth.

6. DISCUSSION

6.1 Introduction

According to Del Negro (2001), popular discussion seems to neglect the fact that the leading indicators may suffer from some of the very same problems which affect the more complex econometric models. He continues to describe how the series representing the leading indicators were probably chosen on the basis of their ability to predict past recessions. Using econometric terms, they were chosen on the basis of their 'in-sample' performance – that is, their ability to predict, with hindsight, recessions that have already occurred. Whether the leading indicators are able to predict future recessions ('out-of-sample' performance) is a different matter. Indeed, one of the reasons the Leading Economic Indicator list is periodically revised is that each recession shows that some of the series were not good predictors after all.

The results shown in Section 5 indicate that, even though the Bureau of Economic Research and the South African Reserve Bank have presented conflicting reports to this research, the presented economic indicators generally do not seem to provide accurate predictions of economic change in South Africa.

Many of the economic indicators tested during this research showed some correlation with the South African GDP figures, however it was determined that much of this correlation may have been due to autocorrelation and not due to actual statistical correlation.

6.2 Research Propositions

6.2.1 Proposition 1:- A Positive Correlation Exists Between the RMB/BER Business Confidence Index and GDP Growth Across Time.

According to Kershoff (2000), the RMB/BER Business Confidence Index is a very good leading indicator of the overall business cycle in South Africa. He also says that the BER Business Confidence Index has proven itself historically as a useful indicator of economic growth and as a very good leading indicator of the South African business cycle.

Using visual interpretation, this appears to be true. If one compares the plot of Business Confidence and GDP growth in Figure 1, it appears as if the plot of BCI leads the plot of GDP. This would indicate that the BCI is a good predictor of change of GDP, and Kershoff (2000) could be justified in his findings.

However, Black (2004) explains that time series data which contain no trend or cyclical effects are said to be stationary, while time series data which display a trend or cyclical effect over time are considered non-stationary. Due to the trends in non-stationary data, autocorrelation usually results from regression analysis on the data. This would imply that there may have been some potential that the data used by Kershoff (2000) could have displayed autocorrelation effects. As a result of this, although graphically the Business Confidence Indicator appears to offer good predictive possibilities for economic growth, statistically there may be some additional work required to confirm that this is in

fact true. This additional analysis was done during this research and the relevant results are represented in Sections 5.3.2 to 5.3.7.

Gujarati (2003, p.442) defines autocorrelation as “correlation between members of a series of observations ordered in time (as in time series data) or space (as in cross-sectional data)”. As noted by Gujarati (2003) it is now common to refer to the terms autocorrelation and serial correlation synonymously, although some authors do make a distinction. Gujarati (2003, p.443) notes that some authors define autocorrelation as “lag correlation of a given series with itself”, while serial correlation could be defined as “lag correlation between two different series”. Similar to the use made by Gujarati (2003), this research will use the two terms synonymously.

Gujarati (2003) further explains that there are a number of reasons why autocorrelation may occur, some of the more important reasons being inertia in the time series (sluggishness in the data), excluded variables bias (incorrect variables used) and incorrect functional form (incorrect model).

Pellisser (2002) found that the BCI has leading properties, albeit in terms of causality the indicator tended to move towards a coincident rather than a leading relationship with the business cycle. Using statistical analysis, Pellisser (2002) found that a correlation coefficient of 0.65 was found when the complete period of 1975-Q1 to 2003-Q1 was analysed. Pellisser (2002) did however report that this correlation coefficient improved when the period from 1980 was considered. These results were fairly consistent with the correlation coefficient found during this research (Table 2).

Using graphical interpretation, Laubscher (2003) found that the average lead time of the Business Confidence Index at turning points of the South African business cycle was 8 months, similar to the lead time of the South African Reserve Bank's composite Leading Indicator. He did however report that the lead time at the peaks of the business cycle was longer than the lead time at the troughs of the business cycle. Although difficult to accurately interpret, this was consistent with the graphical interpretation made by the researcher of this paper using Figure 1.

Kershoff (2000) indicates that the BER does not cover the whole of the economy. The sectors surveyed in the compilation of the index are manufacturing, construction and trade. These sectors make up more than 40% of total GDP. This indicates that there may be room to improve the Business Confidence Index to include a greater number of sectors which may, in turn, improve the likelihood of a more statistically sound index for predicting economic change.

Kershoff (2000) does however indicate that the relationship between the Business Confidence Index and the overall GDP growth depends on the deviations caused by the behaviour of the other sectors of the economy. However, growth in the primary sectors is irregular but that of transport, finance, community services and general government is relatively stable. Thus he states that, as long as growth in the primary sectors does not deviate substantially from that of manufacturing, construction and trade sectors, the Business Confidence Index may be expected to give a good indication of overall GDP growth.

Kershoff (2000) also indicated that the relationship between the Business Confidence Index and the South African Reserve Bank's Leading indicator has a correlation coefficient, for the period 1975-Q1 to 1998-Q4, of 0.79. This shows a very good correlation between these two indexes. As the BER's confidence indexes are made publicly available earlier than many of the other economic indicators, assuming that the South African Reserve Bank's Leading Indicator is a good economic indicator for GDP growth, one could use the BER's indicators to predict changes in the economy without having to wait for official GDP estimates to be released.

One of the fundamental questions to be asked, assuming that the Business Confidence Index tracks the business cycle to some degree, is why would business confidence be able to predict economic growth?

The researcher proposes two possible scenarios:

- Increased business confidence may result in organisations deciding to invest capital to support growth initiatives in terms of increasing production capacity, aggressive corporate takeovers, expansion of product ranges and increasing staff headcounts. This in turn may lead to an increase in economic growth for the country. The opposite would obviously be true for a decrease in business confidence when organisational leaders may decide to delay planned capital expenditure on expansion programmes and reduce staff headcounts. The above would lead to a reduction in economic growth for the country. This would imply that business confidence is a leading factor to economic growth

and, hence, the Business Confidence Index is a leading indicator of the business cycle.

- An increase in the rate of economic growth may itself result in an increase in the business confidence of organisational leader. This may then lead to plans to invest capital to support growth initiatives in terms of increasing production capacity, aggressive corporate takeovers, expansion of product ranges and increasing staff headcounts. A possibility therefore exists that any increase in economic growth may actually act as a catalyst for additional economic growth. The opposite would then be true should the economy show signs of slowing down as this may result in a decrease in confidence of business leaders, resulting in less capital being spent on expansion plans. This in turn could lead to a further slowing down of the economy.

Provided that the criteria used to measure the Business Confidence Index accurately represent the true business confidence of a large proportion of the business sectors, business confidence should be a good indicator of the change of the business cycle.

Unfortunately, although the initial descriptive statistical analysis indicated that there was a correlation between GDP growth and the Business Confidence Index, once autocorrelation was taken into account, and attempts were unsuccessfully made to remove this autocorrelation, the Business Confidence Index proved to be a poor leading indicator of changes to the business cycle.

One of the potential reasons for this may be due to the fact that, although during the survey process businesspeople were asked how they felt about the future growth potential of their organisations, they make their decisions based on the current economic and political environment. This results in their future predictions actually representing current economic trends.

Summary:

The RMB/BER Business Confidence Index does not have a good statistical correlation to the GDP growth of South Africa and is therefore not a good predictor of changes to the business cycle.

Proposition 1 is therefore rejected.

6.2.2 Proposition 2:- A Positive Correlation Exists Between the FNB/BER Consumer Confidence Index and GDP Growth Across Time.

According to Kershoff (2000), the Consumer Confidence Index reveals the change in consumers' expectations, whereas the business confidence index indicates what the situation is at a specific point in time. It therefore gives an indication of whether consumers are feeling positive or negative about the economic environment of a country. He continues to say that households' expectations of a change in financial position used to correspond with changes in both the real disposable income and real wage rate.

Kershoff (2000) says that consumers' expectations of economic performance correspond closely with the economic growth rate. A change of consumer confidence can be attributed to many things. One approach is to analyse changes in the constituent parts of the index, namely how have consumers' expectations regarding the economic performance, their own financial position and the rating of the present time to buy durables changed respectively? Another method is to judge external developments, such as a drop in share prices, unexpected price surges of important consumer goods (for example food and petrol), political developments or big changes in economic policy. These may all impacted on consumer confidence.

When one interprets the plot represented in Figure 2, it indicates that consumer confidence does appear to track the business cycle. This would imply that the Consumer Confidence Index is a relatively good predictor of economic change. However it is difficult to easily determine whether the Consumer Confidence Index leads or lags actual GDP growth.

The statistical analysis reveals that, when simple correlation is done on the data, that there is some statistical correlation between GDP growth and the Consumer Confidence Index (Table 2). However, as mentioned previously, Black (2004) explains that time series data which contain no trend or cyclical effects are said to be stationary, while time series data which display a trend or cyclical effects over time are considered non-stationary. Due to the trends in non-stationary data, autocorrelation usually results from regression analysis on the data.

Various methods were employed, without success, in an attempt to remove this potential autocorrelation. Figures 13 and 14 show that, even when methods such as de-trending, moving averages and differencing were used to remove the potential autocorrelation that existed, it was not possible to get statistically relevant results.

Therefore, although graphically the Consumer Confidence Index seems to provide some predictive capability, statistically this indicator can not be used as a predictor of changes to the business cycle.

The question remains as to why economists and businesspeople consider consumer confidence as an economic predictor. The researcher has proposed two possible scenarios:

- An increase in consumer confidence may lead to increased household spending on items such as household white goods, electronic equipment and holidays. This in turn would lead to an increased demand for goods, encouraging manufacturers and distributors to increase their capacity and sales. This would lead to an increase in economic activity and GDP growth. The opposite would be true if consumers became less optimistic about the short to medium term future, resulting in fewer goods being purchased, leading to a reduction in economic demand and a slower rate of economic growth.

- An alternative to the above scenario would be that positive economic growth in a region would result in organisations being able to increase

wages and employ a greater number of people. This in turn would result in an increase in consumer confidence which would cause a greater demand for goods, feeding economic growth further.

But, according to Ellis (2005), the reason for the popularity of the Consumer Confidence Index is because its very name suggests that consumer confidence, or psychology, can be measured and that important insight into consumers' intentions for future spending can be gained. He suggests that there is value in evaluating and tracking the collective state of mind of consumers. He does however question whether this information is able to help predict consumer-spending trends.

Ellis (2005) continues to say that despite the forward-looking nature of the Consumer Confidence Index questions, when the results of these consumer sentiment polls are charted over several decades, vis-à-vis actual growth in consumer spending, they have little predictive value. He suggests that the reasons for this are simple:

- The process of asking consumers to look forward to predict their financial circumstances and spending plans appears, on the surface, to have forecasting value. However, answers to questions asked today will reflect today's attitudes. A consumer who responds optimistically to his / her current or future economic conditions and personal spending plans today is more than likely already spending at a favourable level. If, three months from now, that same consumer answers the same forward-looking questions in a more pessimistic manner, he/she would already

have reduced his/her current spending in response to the changes in conditions that lead to the more negative responses.

- There is, realistically, no reason to believe that consumers, individually or as a group, have more insight into the future than economists or businesspeople. Individual consumers, far from having a disciplined method for looking forward, are more likely to extrapolate current economic conditions. In other words, although the questions are predictive in nature, the respondents' attitudes and their spending, in effect, reflect conditions at the time of the asking.

Ellis (2005) states that, as with many of the economic inputs appearing in the press every day, the Consumer Confidence Index is presented with a certain degree of "reportorial solemnity". This, inaccurately, seems to validate its value in forecasting consumer demand without reporters providing empirical backing.

Summary:

The FNB/BER Consumer Confidence Index does not have a good statistical correlation to the GDP growth of South Africa and is therefore not a good predictor of changes to the business cycle.

Proposition 2 is therefore rejected.

6.2.3 Proposition 3:- A Positive Correlation Exists Between the South African Reserve Bank's Leading Indicator and GDP Growth Across Time.

The South African Reserve Bank's Leading Indicator was first compiled in 1983 (Van der Walt, 1983). Prior to the start of this research it was therefore assumed that the South African Reserve Bank's publicly released information closely could be used to predict business cycle change. According to Venter (2004) the composite leading business cycle indicator has consistently lead growth cycle turning points in the South African economy. Venter (2004) supports this by analysing a graphical representation of the South African Reserve Bank's Leading Indicator; however he does not seem to use statistical evidence to back up this statement.

When one analyses Figure 3, it is easy to see why researchers, who have used graphical interpretation exclusively, state that the South African Reserve Bank's Leading Indicator is a good predictor of economic change in South Africa.

As with the RMB/BER Business Confidence Index and the FNB/BER Consumer Confidence Index, statistical analysis of the data revealed that the South African Reserve Bank's Leading Indicator showed significant autocorrelation.

This research attempted to remove, or at least reduce, this autocorrelation using the variety of methods described in Figures 15 and 16 so that a more accurate analysis could be completed on the data. Unfortunately, none of these methods reduced the autocorrelation significantly.

Following this statistical analysis, it was concluded that the South African Reserve Bank's Leading Indicator is actually not a very good predictor of economic change in South Africa.

Although the published South African Reserve Bank's Leading Indicator has been shown to follow the overall trend of the South African economy, as it is based on historical data, the indicator tends to be a 'lagging indicator'. The literature in Section 2 indicates that, to date, there has not been a successful method devised that may allow an actual 'leading indicator' characteristic.

In 2004, the South African Reserve Bank realised that its Leading Indicator did not accurately offer a good leading indication of economic change. It stated that due to various structural changes in the economy or the identification of new economic indicators, there was a need to reassess the constituent time series of the composite business cycle indicators (Venter & Pretorius, 2004). During this process of reassessing the constituent time series, a number of indicators were removed from the composite index and a few were added. The South African Reserve Bank believed that these modifications allowed the composite leading indicator to exhibit a longer lead-time than the previous indicator at three of the four business cycle peaks and at two of the four cycle troughs. The report published by the South African Reserve Bank, indicating that these changes had improved the predicting capability of the South African Reserve Bank's Leading Indicator, used graphical interpretation to prove its reliability and did not take statistical or autocorrelation effects into account. Therefore, this researcher believes that these improvements may require additional statistical

evaluation before conclusive statements can be made about the reliability of the South African Reserve Bank's Leading Indicator in predicting economic growth.

It is therefore suggested that this indicator be re-evaluated using a methodology which is statistically more sound and which doesn't rely on graphical interpretation only.

Summary:

The South African Reserve Bank's Leading Indicator does not have a good statistical correlation with South Africa's GDP growth and is therefore not a good predictor of changes to the business cycle.

Proposition 3 is therefore rejected.

6.2.4 Proposition 4:- A Positive Correlation Exists Between The Proposed 'Leading-Leading Indicators' and Real GDP Growth Across Time.

Initially, the main purpose of this research was to create a leading indicator that would provide an earlier indicators being used currently. The logic behind this was based on the assumption that the current economic leading indicators were themselves accurate and relevant. Based on a large number of published articles and research, this assumption seemed to be sound.

When, however, during the final stages of the data analysis, the researcher discovered through quantitative analysis that much of the previously published

research may have in fact been flawed, it became clear that using the inflection point of one of the flawed indicators as the basis of the proposed leading-leading indicator would prove to be problematic.

By using the rate of change of the South African Reserve Bank's Leading Indicator as the basis of the proposed leading-leading indicator, the researcher was hoping to predict the change in the South African Reserve Bank's Leading Indicator, which in turn would predict a change in the South African economy. It was envisaged that this would give economists and businesspeople an earlier indication of probable economic change.

Unfortunately, not only because this research indicated that there was significant autocorrelation within the proposed Leading-Leading Indicator (1) and the proposed Leading-Leading Indicator (2) – see Figures 19 to 20 – but also because the research indicated that the South African Reserve Bank's Leading Indicator was a poor predictor of economic change, both the proposed Leading-Leading Indicators did not allow prediction of economic change.

This obviously posed a major problem for the researcher as the entire basis for the proposed leading-leading indicators was to determine the inflection point of the South African Reserve Bank's Leading Indicator, which would then provide economists and businesspeople with an indication that the South African Reserve Bank's Leading Indicator was about to change, extrapolating a possible change in the South African economy.

There are a number of possible reasons why the South African Reserve Bank's Leading Indicator does not offer a suitable, and accurate, prediction of the South African economy. The researcher would like to suggest some solutions:

- According to Venter (2008), the various series used for the South African Reserve Bank's composite Index is each given an equal rating in terms of its importance to the index, with the exception of the two opinion based surveys (i.e. the 'manufacturing business confidence' and the 'construction and trade business confidence' surveys). This implies that each series is as equally important as the others in indicating of whether the South African economy is going to grow or to shrink. This is a highly unlikely situation as, although a factor such as the number of new buildings is an important indication of whether the economy is growing, it really offers an historical look at the economy rather than a view into the future. For example, businesspeople are most likely to plan the building of new premises based on their current attitude towards the economy. When market shocks occur, such as the Eskom power shortage at the beginning of 2008, the very same decisions to invest in property cannot be undone. Therefore, even though the number of building plans passed remains high, and the South African Reserve Bank's Leading Indicator shows positive economic growth, the reality may be that the economy is actually in a state of decline. A more accurate weighting of the various series should therefore be considered, to allow a quicker response to the changing economic environment.

- Incorrect series are possibly being used in the South African Reserve Bank composite index. According to Ellis (2005), the most accurate

predictor of future economic change is a country or region's real wage growth. He defines 'real wages' as wages which are increased at a rate of at least inflation. He comments that, if one were to use the rate of change in consumers' real wages, an increase would lead to an increase in consumers' spending which, in itself, would lead to an improvement in the economy. To put it simply: "When it rains in consumer spending, it pours in the economy".

- Before any series is included in the South African Reserve Bank's composite index, it should be tested statistically for autocorrelation. There is no point including a series in the composite index if it does not provide statistical value to the index. This unfortunately seems to have been done with the current South African Reserve Bank's Leading Indicator, which has resulted in the indicator being statistically irrelevant as a predictor of economic change.

Summary:

Both the proposed Leading-Leading Indicators do not show good statistical correlations to the GDP growth of South Africa and are therefore not good predictors of changes to the business cycle.

Proposition 4 is therefore rejected.

7. CONCLUSION

Although the initial purpose of this research was to create a Leading-Leading Indicator for economic change in South Africa, based largely on the assumed accuracy of the South African Reserve Bank's Leading Indicator, actually it provided some insights into possible statistical errors contained in some of the well-known South African economic indicators.

This research showed that, while graphically it appears to be a good economic indicator, the RMB/BER Business Confidence Index is actually not a good predictor of economic change in South Africa. Although, ideally, one would assume that businesspeople have good insights into the future of the economy, this research questioned whether the businesspeople being interviewed for the purposes of this index actually had more insight into the economic future than the average citizen and whether their responses were in fact based on historical, rather than future knowledge. The research also showed that this index displayed significant autocorrelation. This implied that, even if the index appeared to be a good predictor graphically, it was a statistically poor predictor of economic change in South Africa.

When analysing the FNB/BER Consumer Confidence Index, this research showed that, as with the Business Confidence Index, graphical analysis depicted this index as a good economic predictor. However, this index also showed autocorrelation when statistically analysed. This indicated the index to be a poor predictor of economic change. The research also found that, while this index is touted as a leading indicator, due to the considered consumers' responses, which were based on current perceptions of the economy, it is in

fact more of a lagging indicator than a leading indicator. Various questions were therefore raised over whether this indicator really offers any value to economists and businesspeople in the prediction of the future South African economy.

Most surprising of all of the results obtained during this research, was the founding that the well-respected South African Reserve Bank's Leading Indicator also did not provide a good prediction of South African economic growth or decline. Although this indicator has been used for decades, it was found that the series being used by this composite index displayed high levels of autocorrelation. This index was found to display good predictive properties when the composite index was graphically compared to GDP growth. However, when analysed statistically, the composite index was found to be a poor predictor of economic change. Various suggestions were made as to why this may be the case. Additionally, various recommendations were made on how the composite index could possibly be improved to make it a more accurate and relevant leading indicator.

Following the indications that the South African Reserve Bank's Leading Indicator may not be as accurate in predicting economic change as assumed, the proposed Leading-Leading Indicators did not offer a solution in predicting economic change. The fact that both the proposed leading-leading indicators relied wholly on the South African Reserve Bank's Leading Indicator, and, that as the latter did not offer any predictive characteristics, neither did the two proposed indicators. This was indeed a disappointing result.

7.1 Future Research Ideas

Following the discovery that some of the most well-known leading economic indicators were statistically questionable in their ability to predict economic change, questions must be asked as to whether other indicators are also statistically poor predictors. A suggestion would be to also test other indicators to determine whether they really are as reliable as researchers have claimed.

In addition to the above, based on the work done by Ellis (2005), work should be done to determine if real wage growth could be used as a predictor of the business cycle in South Africa. Indications are that South African wages could be used to predict change.

Complicated econometric models are often used by economists to predict changes in the business cycle. Additional work could be done to determine whether more fundamental calculus could be used to track potential changes to the economy.

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9. APPENDICES:

Appendix 1:- South African GDP figures converted into quarterly averages

Date	Percentage Change (Y-o-Y)
1978 – Q2	7.957923
1978 – Q3	-4.23442
1978 – Q4	3.690575
1979 – Q1	7.187433
1979 – Q2	2.609284
1979 – Q3	3.019112
1979 – Q4	8.464779
1980 – Q1	8.474517
1980 – Q2	7.823813
1980 – Q3	7.025923
1980 – Q4	0.902113
1981 – Q1	5.061398
1981 – Q2	9.025769
1981 – Q3	5.949941
1981 – Q4	2.518986
1982 – Q1	-3.65433
1982 – Q2	-3.29613
1982 – Q3	-0.10225
1982 – Q4	-8.19175
1983 – Q1	-6.03245
1983 – Q2	1.671376
1983 – Q3	4.691456
1983 – Q4	10.53805
1984 – Q1	6.961777
1984 – Q2	8.572521
1984 – Q3	-6.46685
1984 – Q4	0.619873
1985 – Q1	-2.36188
1985 – Q2	-2.87699
1985 – Q3	-1.05175
1985 – Q4	4.346458
1986 – Q1	-4.68107
1986 – Q2	2.790353
1986 – Q3	0.90319
1986 – Q4	1.690136
1987 – Q1	2.941017
1987 – Q2	1.434079
1987 – Q3	1.4677
1987 – Q4	5.0017
1988 – Q1	6.148672

Date	Percentage Change (Y-o-Y)
1988 – Q2	2.870615
1988 – Q3	5.489181
1988 – Q4	3.809164
1989 – Q1	2.500371
1989 – Q2	1.74675
1989 – Q3	0.321762
1989 – Q4	-2.45245
1990 – Q1	0.320603
1990 – Q2	-0.32969
1990 – Q3	-0.33574
1990 – Q4	0.37177
1991 – Q1	-3.14394
1991 – Q2	-0.89952
1991 – Q3	-0.15507
1991 – Q4	-0.68647
1992 – Q1	-2.77368
1992 – Q2	-2.43102
1992 – Q3	-4.55114
1992 – Q4	-3.35578
1993 – Q1	3.590973
1993 – Q2	4.460164
1993 – Q3	5.883586
1993 – Q4	2.996509
1994 – Q1	-0.56875
1994 – Q2	4.410559
1994 – Q3	4.57549
1994 – Q4	6.845485
1995 – Q1	1.452732
1995 – Q2	1.787964
1995 – Q3	1.737776
1995 – Q4	1.587983
1996 – Q1	5.732197
1996 – Q2	7.705316
1996 – Q3	4.616879
1996 – Q4	3.848206
1997 – Q1	1.154096
1997 – Q2	2.469199
1997 – Q3	0.838207
1997 – Q4	0.605328
1998 – Q1	0.506496

Date	Percentage Change (Y-o-Y)
1998 – Q2	0.566887
1998 – Q3	-0.87378
1998 – Q4	0.387083
1999 – Q1	3.729409
1999 – Q2	3.221598
1999 – Q3	4.440548
1999 – Q4	4.471707
2000 – Q1	4.575831
2000 – Q2	3.73151
2000 – Q3	4.020781
2000 – Q4	3.446735
2001 – Q1	2.623044
2001 – Q2	2.014688
2001 – Q3	1.066567
2001 – Q4	3.11124
2002 – Q1	4.285909
2002 – Q2	5.172477
2002 – Q3	4.60489
2002 – Q4	3.369912
2003 – Q1	2.776612
2003 – Q2	2.244335
2003 – Q3	2.444722
2003 – Q4	2.840389
2004 – Q1	6.13983
2004 – Q2	6.559035
2004 – Q3	7.223758
2004 – Q4	3.590812
2005 – Q1	4.511154
2005 – Q2	5.47534
2005 – Q3	4.957621
2005 – Q4	4.018277
2006 – Q1	6.190087
2006 – Q2	6.155734
2006 – Q3	4.750773
2006 – Q4	6.039075
2007 – Q1	5.137744
2007 – Q2	4.351929
2007 – Q3	4.808453
2007 – Q4	5.322712
2008 – Q1	2.146959

Appendix 2:- RMB/BER Business Confidence Index

Date	Percentage Change (Y-o-Y)
1980 – Q1	80
1980 – Q2	86
1980 – Q3	91
1980 – Q4	90
1981 – Q1	89
1981 – Q2	87
1981 – Q3	75
1981 – Q4	77
1982 – Q1	63
1982 – Q2	47
1982 – Q3	37
1982 – Q4	26
1983 – Q1	29
1983 – Q2	36
1983 – Q3	31
1983 – Q4	41
1984 – Q1	37
1984 – Q2	46
1984 – Q3	23
1984 – Q4	22
1985 – Q1	14
1985 – Q2	17
1985 – Q3	10
1985 – Q4	15
1986 – Q1	20
1986 – Q2	18
1986 – Q3	28
1986 – Q4	32
1987 – Q1	38
1987 – Q2	47
1987 – Q3	52
1987 – Q4	68
1988 – Q1	76
1988 – Q2	84
1988 – Q3	65
1988 – Q4	64
1989 – Q1	72
1989 – Q2	58
1989 – Q3	57
1989 – Q2	58
1989 – Q3	57
1989 – Q4	56
1990 – Q1	48
1990 – Q2	43
1990 – Q3	30
1990 – Q4	28
1991 – Q1	30
1991 – Q2	21
1991 – Q3	17
1991 – Q4	17
1992 – Q1	19
1992 – Q2	20
1992 – Q3	15
1992 – Q4	17
1993 – Q1	21
1993 – Q2	17
1993 – Q3	23
1993 – Q4	32
1994 – Q1	37
1994 – Q2	57
1994 – Q3	45
1994 – Q4	67
1995 – Q1	66
1995 – Q2	65
1995 – Q3	53
1995 – Q4	64
1996 – Q1	52
1996 – Q2	43
1996 – Q3	35
1996 – Q4	42
1997 – Q1	45
1997 – Q2	38
1997 – Q3	32
1997 – Q4	29
1998 – Q1	30
1998 – Q2	18
1998 – Q3	13
1998 – Q4	12
1999 – Q1	13
1999 – Q2	15
1999 – Q3	25
1999 – Q4	36
2000 – Q1	45
2000 – Q2	36
2000 – Q3	39
2000 – Q4	30
2001 – Q1	33
2001 – Q2	39
2001 – Q3	39
2001 – Q4	48
2002 – Q1	58
2002 – Q2	68
2002 – Q3	68
2002 – Q4	65
2003 – Q1	60
2003 – Q2	50
2003 – Q3	55
2003 – Q4	61
2004 – Q1	69
2004 – Q2	71
2004 – Q3	79
2004 – Q4	88
2005 – Q1	79
2005 – Q2	82
2005 – Q3	86
2005 – Q4	85
2006 – Q1	86
2006 – Q2	82
2006 – Q3	85
2006 – Q4	83
2007 – Q1	81
2007 – Q2	80
2007 – Q3	72
2007 – Q4	67
2008 – Q1	48

Appendix 3:- FNB/BER Consumer Confidence Index

Date	Percentage Change (Y-o-Y)
1982 – Q2	1
1982 – Q3	-1
1982 – Q4	-5
1983 – Q1	-7
1983 – Q2	7
1983 – Q3	2
1983 – Q4	-3
1984 – Q1	7
1984 – Q2	5
1984 – Q3	2
1984 – Q4	-25
1985 – Q1	-20
1985 – Q2	-33
1985 – Q3	-20
1985 – Q4	-22
1986 – Q1	-24
1986 – Q2	-4
1986 – Q3	-13
1986 – Q4	-11
1987 – Q1	-6
1987 – Q2	8
1987 – Q3	11
1987 – Q4	15
1988 – Q1	13
1988 – Q2	14
1988 – Q3	6
1988 – Q4	5
1989 – Q1	1
1989 – Q2	-3
1989 – Q3	3
1989 – Q4	3
1990 – Q1	4
1990 – Q2	-6
1990 – Q3	4
1990 – Q4	-4

Date	Percentage Change (Y-o-Y)
1991 – Q1	-1
1991 – Q2	-5
1991 – Q3	1
1991 – Q4	0
1992 – Q1	1
1992 – Q2	-4
1992 – Q3	-11
1992 – Q4	-8
1993 – Q1	-21
1993 – Q2	-9
1993 – Q3	-12
1993 – Q4	4
1994 – Q1	6
1994 – Q2	1
1994 – Q3	18
1994 – Q4	14
1995 – Q1	12
1995 – Q2	13
1995 – Q3	14
1995 – Q4	16
1996 – Q1	12
1996 – Q2	7
1996 – Q3	9
1996 – Q4	10
1997 – Q1	6
1997 – Q2	9
1997 – Q3	2
1997 – Q4	8
1998 – Q1	-4
1998 – Q2	4
1998 – Q3	-5
1998 – Q4	-6
1999 – Q1	-3
1999 – Q2	-1
1999 – Q3	-1

Date	Percentage Change (Y-o-Y)
1999 – Q4	10
2000 – Q1	6
2000 – Q2	-10
2000 – Q3	-9
2000 – Q4	-17
2001 – Q1	3
2001 – Q2	-7
2001 – Q3	-9
2001 – Q4	-9
2002 – Q1	-2
2002 – Q2	1
2002 – Q3	-1
2002 – Q4	-12
2003 – Q1	0
2003 – Q2	1
2003 – Q3	-9
2003 – Q4	4
2004 – Q1	-7
2004 – Q2	20
2004 – Q3	6
2004 – Q4	4
2005 – Q1	19
2005 – Q2	17
2005 – Q3	17
2005 – Q4	20
2006 – Q1	21
2006 – Q2	20
2006 – Q3	17
2006 – Q4	18
2007 – Q1	23
2007 – Q2	21
2007 – Q3	18
2007 – Q4	22
2008 – Q1	12

Appendix 4:- South African Reserve Bank's Leading Indicator

Date	Percentage Change (Y-o-Y)
1978 – Q2	11.316
1978 – Q3	15.736
1978 – Q4	17.77
1979 – Q1	20.991
1979 – Q2	18.935
1979 – Q3	17.746
1979 – Q4	22.121
1980 – Q1	25.009
1980 – Q2	21.335
1980 – Q3	18.813
1980 – Q4	8.866
1981 – Q1	-2.662
1981 – Q2	-2.766
1981 – Q3	-7.909
1981 – Q4	-8.805
1982 – Q1	-9.427
1982 – Q2	-11.461
1982 – Q3	-9.405
1982 – Q4	-6.29
1983 – Q1	5.432
1983 – Q2	11.821
1983 – Q3	11.958
1983 – Q4	11.907
1984 – Q1	6.305
1984 – Q2	3.204
1984 – Q3	-1.505
1984 – Q4	-5.29
1985 – Q1	-7.925
1985 – Q2	-7.482
1985 – Q3	0.124
1985 – Q4	5.734
1986 – Q1	7.505
1986 – Q2	8.899
1986 – Q3	7.801
1986 – Q4	6.995
1987 – Q1	7.679
1987 – Q2	7.686
1987 – Q3	5.561
1987 – Q4	6.614
1988 – Q1	7.304

Date	Percentage Change (Y-o-Y)
1988 – Q1	7.304
1988 – Q2	7.017
1988 – Q3	5.566
1988 – Q4	1.406
1989 – Q1	0.098
1989 – Q2	-3.071
1989 – Q3	-3.158
1989 – Q4	-3.719
1990 – Q1	-3.538
1990 – Q2	-2.956
1990 – Q3	-2.403
1990 – Q4	-1.981
1991 – Q1	-3.764
1991 – Q2	-3.687
1991 – Q3	-1.993
1991 – Q4	-2.526
1992 – Q1	-1.195
1992 – Q2	-1.477
1992 – Q3	-4.654
1992 – Q4	-3.421
1993 – Q1	-2.673
1993 – Q2	-0.908
1993 – Q3	3.066
1993 – Q4	4.52
1994 – Q1	6.565
1994 – Q2	11.061
1994 – Q3	14
1994 – Q4	15.95
1995 – Q1	11.768
1995 – Q2	3.3
1995 – Q3	-4.287
1995 – Q4	-7.77
1996 – Q1	-8.405
1996 – Q2	-4.839
1996 – Q3	-3.831
1996 – Q4	-1.086
1997 – Q1	1.301
1997 – Q2	-0.528
1997 – Q3	0.651
1997 – Q4	-2.427

Date	Percentage Change (Y-o-Y)
1998 – Q1	-5.492
1998 – Q2	-7.952
1998 – Q3	-8.975
1998 – Q4	-9.164
1999 – Q1	-5.531
1999 – Q2	1.552
1999 – Q3	11.387
1999 – Q4	19.006
2000 – Q1	19.219
2000 – Q2	14.211
2000 – Q3	6.364
2000 – Q4	-0.464
2001 – Q1	-1.502
2001 – Q2	-0.3
2001 – Q3	-1.073
2001 – Q4	2.315
2002 – Q1	6.476
2002 – Q2	8.727
2002 – Q3	9.22
2002 – Q4	6.735
2003 – Q1	-2.308
2003 – Q2	-8.063
2003 – Q3	-3.533
2003 – Q4	0.538
2004 – Q1	9.468
2004 – Q2	14.511
2004 – Q3	11.4
2004 – Q4	7.968
2005 – Q1	2.472
2005 – Q2	2.062
2005 – Q3	3.364
2005 – Q4	3.842
2006 – Q1	6.055
2006 – Q2	7.493
2006 – Q3	6.009
2006 – Q4	4.336
2007 – Q1	3.404
2007 – Q2	1.611
2007 – Q3	0.071
2007 – Q4	-0.585
2008 – Q1	-3.445

Appendix 5:- Results of Leading-Leading Indicator (1) Calculations

Date	Rate of Change (M-o-M)
1978 – Q2	1.705538
1978 – Q3	1.390582
1978 – Q4	1.129246
1979 – Q1	1.181297
1979 – Q2	0.902065
1979 – Q3	0.937205
1979 – Q4	1.246493
1980 – Q1	1.130555
1980 – Q2	0.853097
1980 – Q3	1.705538
1980 – Q4	1.390582
1981 – Q1	1.129246
1981 – Q2	1.181297
1981 – Q3	0.902065
1981 – Q4	0.937205
1982 – Q1	1.246493
1982 – Q2	1.130555
1982 – Q3	0.881796
1982 – Q4	0.471272
1983 – Q1	-0.30025
1983 – Q2	1.039136
1983 – Q3	2.859272
1983 – Q4	1.113255
1984 – Q1	1.070666
1984 – Q2	1.215685
1984 – Q3	0.820659
1984 – Q4	0.668747
1985 – Q1	-0.86358
1985 – Q2	2.176295
1985 – Q3	1.011573
1985 – Q4	0.995731
1986 – Q1	0.529541
1986 – Q2	0.508208
1986 – Q3	0.876622
1986 – Q4	0.896641
1987 – Q1	1.097876
1987 – Q2	1.000864
1987 – Q3	0.72355
1987 – Q3	0.72355
1987 – Q4	1.189232

Date	Rate of Change (M-o-M)
1988 – Q1	1.104451
1988 – Q2	0.960653
1988 – Q3	0.793151
1988 – Q4	0.252712
1989 – Q1	0.069504
1989 – Q2	-31.4189
1989 – Q3	1.028216
1989 – Q4	1.17751
1990 – Q1	0.951434
1990 – Q2	0.835462
1990 – Q3	0.812996
1990 – Q4	0.824506
1991 – Q1	1.899881
1991 – Q2	0.979394
1991 – Q3	0.540643
1991 – Q4	1.267096
1992 – Q1	0.473184
1992 – Q2	1.235683
1992 – Q3	3.151373
1992 – Q4	0.73519
1993 – Q1	0.781288
1993 – Q2	0.33953
1993 – Q3	-3.37791
1993 – Q4	1.474311
1994 – Q1	1.452422
1994 – Q2	1.684883
1994 – Q3	1.265687
1994 – Q4	1.139326
1995 – Q1	0.737766
1995 – Q2	0.280443
1995 – Q3	-1.29915
1995 – Q4	1.812174
1996 – Q1	1.081815
1996 – Q2	0.575749
1996 – Q3	0.791701
1996 – Q4	0.28358
1997 – Q1	-1.19742
1997 – Q2	-0.40608
1997 – Q3	-1.23192
1997 – Q4	-3.72917

Date	Rate of Change (M-o-M)
1998 – Q1	2.262963
1998 – Q2	1.447901
1998 – Q3	1.12866
1998 – Q4	1.021068
1999 – Q1	0.603576
1999 – Q2	-0.28063
1999 – Q3	7.335951
1999 – Q4	1.669061
2000 – Q1	1.011188
2000 – Q2	0.739431
2000 – Q3	0.447795
2000 – Q4	-0.07293
2001 – Q1	3.236786
2001 – Q2	0.199548
2001 – Q3	3.581119
2001 – Q4	-2.15625
2002 – Q1	2.797647
2002 – Q2	1.347696
2002 – Q3	1.056467
2002 – Q4	0.730472
2003 – Q1	-0.34263
2003 – Q2	3.493892
2003 – Q3	0.43815
2003 – Q4	-0.15234
2004 – Q1	17.59228
2004 – Q2	1.532655
2004 – Q3	0.785627
2004 – Q4	0.698902
2005 – Q1	0.310238
2005 – Q2	0.834094
2005 – Q3	1.631813
2005 – Q4	1.142112
2006 – Q1	1.575865
2006 – Q2	1.237373
2006 – Q3	0.802011
2006 – Q4	0.72164
2007 – Q1	0.78504
2007 – Q2	0.473209
2007 – Q3	0.044117
2007 – Q4	-8.23324
2008 – Q1	5.887714

Appendix 6:- Results of Leading-Leading Indicator (2) Calculations

Date	Rate of Change (M-o-M)
1978 – Q2	0.705538
1978 – Q3	0.390582
1978 – Q4	0.129246
1979 – Q1	0.181297
1979 – Q2	-0.09794
1979 – Q3	-0.0628
1979 – Q4	0.246493
1980 – Q1	0.130555
1980 – Q2	-0.1469
1980 – Q3	-0.1182
1980 – Q4	-0.52873
1981 – Q1	-1.30025
1981 – Q2	0.039136
1981 – Q3	1.859272
1981 – Q4	0.113255
1982 – Q1	0.070666
1982 – Q3	-0.17934
1982 – Q4	-0.33125
1983 – Q1	-1.86358
1983 – Q2	1.176295
1983 – Q3	0.011573
1983 – Q4	-0.00427
1984 – Q1	-0.47046
1984 – Q2	-0.49179
1984 – Q3	-1.4697
1984 – Q4	2.514972
1985 – Q1	0.498054
1985 – Q2	-0.05594
1985 – Q3	-1.01661
1985 – Q4	45.12893
1986 – Q1	0.308891
1986 – Q2	0.185792
1986 – Q4	-0.10336
1987 – Q1	0.097876
1987 – Q2	0.000864
1987 – Q3	-0.27645
1987 – Q4	0.189232
1988 – Q1	0.104451
1988 – Q2	-0.03935

Date	Rate of Change (M-o-M)
1988 – Q3	-0.20685
1988 – Q4	-0.74729
1989 – Q1	-0.9305
1989 – Q2	-32.4189
1989 – Q3	0.028216
1989 – Q4	0.17751
1990 – Q1	-0.04857
1990 – Q2	-0.16454
1990 – Q3	-0.187
1990 – Q4	-0.17549
1991 – Q1	0.899881
1991 – Q2	-0.02061
1991 – Q3	-0.45936
1991 – Q4	0.267096
1992 – Q1	-0.52682
1992 – Q2	0.235683
1992 – Q3	2.151373
1992 – Q4	-0.26481
1993 – Q1	-0.21871
1993 – Q2	-0.66047
1993 – Q3	-4.37791
1993 – Q4	0.474311
1994 – Q1	0.452422
1994 – Q2	0.684883
1994 – Q3	0.265687
1994 – Q4	0.139326
1995 – Q1	-0.26223
1995 – Q2	-0.71956
1995 – Q3	-2.29915
1995 – Q4	0.812174
1996 – Q1	0.081815
1996 – Q2	-0.42425
1996 – Q3	-0.2083
1996 – Q4	-0.71642
1997 – Q1	-2.19742
1997 – Q2	-1.40608
1997 – Q3	-2.23192
1997 – Q4	-4.72917
1998 – Q1	1.262963

Date	Rate of Change (M-o-M)
1998 – Q2	0.447901
1998 – Q3	0.12866
1998 – Q4	0.021068
1999 – Q1	-0.39642
1999 – Q2	-1.28063
1999 – Q3	6.335951
1999 – Q4	0.669061
2000 – Q1	0.011188
2000 – Q2	-0.26057
2000 – Q3	-0.5522
2000 – Q4	-1.07293
2001 – Q1	2.236786
2001 – Q2	-0.80045
2001 – Q3	2.581119
2001 – Q4	-3.15625
2002 – Q1	1.797647
2002 – Q2	0.347696
2002 – Q3	0.056467
2002 – Q4	-0.26953
2003 – Q1	-1.34263
2003 – Q2	2.493892
2003 – Q3	-0.56185
2003 – Q4	-1.15234
2004 – Q1	16.59228
2004 – Q2	0.532655
2004 – Q3	-0.21437
2004 – Q4	-0.3011
2005 – Q1	-0.68976
2005 – Q2	-0.16591
2005 – Q3	0.631813
2005 – Q4	0.142112
2006 – Q1	0.575865
2006 – Q2	0.237373
2006 – Q3	-0.19799
2006 – Q4	-0.27836
2007 – Q1	-0.21496
2007 – Q2	-0.52679
2007 – Q3	-0.95588
2007 – Q4	-9.23324
2008 – Q1	4.887714