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Economic and Business cycle indicators

- Accuracy, reliability and consistency of Swedish indicators

Master's Thesis within Business Administration

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Abstract

Background: Economic and Business cycle indicators are used when predicting a country's Gross Domestic Products, GDP. During recent time, Purchasing Managers Index and its ability to signal changes in the economy have received attention. It provides inconsistent signals since the financial crisis in 2008. Decision makers in the society rely on macroeconomic forecast when implementing strategic decisions. It is therefore necessary for indicators to provide correct signals in relation to GDP. Previous research about indicators' stability is mostly conducted in the U.S. According to the authors' knowledge, scarce research has been made in Sweden. The area lacks observations where a wider range of indicators is included to get a broader perspective of the economy.

Purpose: The purpose of this study is to examine Swedish indicators and observe if they are stable and provide accurate, reliable and consistent signals in relation to GDP growth. Furthermore, the financial crisis in 2008 is used as a benchmark when observing stability and indicators' predictive ability.

Method: Ten indicators within the categories financial, survey-based and real economy indicators are selected. Quarterly data with a time period of maximum 1993-2013 are analyzed. The statistical tests conducted include Correlation, Cross-Correlation and Simple Linear Regression, an interaction term is also included to account for the financial crisis.

Conclusion: The results show that nine out of ten indicators are unstable. Purchasing Managers Index show largest changes compared to other indicators. Industry Production index is the best performing indicator. When it comes to the categories; survey-based, financial and real-economy indicators, no category overall provide stability.

Abbreviations and Definitions

GDP – Gross Domestic Product

OMXSPI – OMX Stockholm_PI

PMI – Purchasing Managers Index

CCI – Consumer Confidence Index

RTI – Retail Trade Index

IPI – Industry Production Index

SPI – Service Production Index

Economic indicators – indicators that reflect the total economic condition and provide signals about the health of the economy.

Business cycle indicators - economic indicator time series identified as either leading, coincident or lagging the corresponding movements of business cycles. These indicators measure the sensitivity of the economy's cyclical movements.

Leading indicators – give early signals of changes in the economy. They can predict beforehand when the economy is entering a recession or expansion phase.

Lagging indicators – give signals and provide information of economic change, after the actual change occurs.

Coincident indicators – follow the existing economy and confirm the economic state.

Volume index - is a measure of volume or quantity in relation to another point in time. It can represent the relative change from one time to another.

Diffusion index – measure change in economic activities and give signals indicating an economic expansion or recession. The signals are based on surveys from industries and the answers are averaged into a benchmark of economic change.

Procyclical – positively correlated with the overall state of the economy.

Countercyclical – negatively correlated with the overall state of the economy.

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1 Introduction

This chapter introduces the reader to the subject of this thesis. A background and problem discussion is provided, which lay ground for the purpose and research question of interest. In addition, delimitations and the outline for this thesis are presented.

After years of economic instability and financial crisis there is an increased attention towards the economic situation all over the world. In this context economic and business cycle indicators play an important role, since they provide information that state past, current and predict the future of a country's economy. Indicators contain information that can help understand and forecast business cycles. Elliott, Granger and Timmermann (2006) argue that knowing the economy's possible direction and events in advance will improve the process for decision makers. Government policy makers, economists, businessmen, investors, employees and consumers all rely on forecasts for future judgment and base their strategic decisions on this information (Zarnowitz, 1992). Therefore, it is important that economic indicators are reliable and provide accurate information in order for different players to interpret them correctly. In this thesis both economic and business cycle indicators is grouped under the name indicators.

Lately, the stability of Swedish indicators has been questioned. Research made by Boström (2013) at Danske Bank[1], discuss the trustworthiness and stability of two economic indicators in Sweden; Purchasing Managers Index (PMI) and National Institute of Economic Research (NIER) business confidence. The cause of concern is their deterioration during the last few years. After the financial crisis in 2008 there has been an increase in inconsistent signals between survey and actual data of production. On the contrary, Bahlenberg (2013) reports that the divergences in data are not remarkable and these numbers have appeared before. The different views mentioned above raise the question of how economic indicators should be interpreted in the future. The authors of this thesis are interested to see if Boström's argument is supported when observing a wider range of indicators.

Moore and Shiskin (1967) introduce a list of criteria that indicators should be evaluated on before they are selected for predicting the economy. Three of these will be observed in this study; "(1) economic significance in relation to business cycles, (2) statistical

[1] Danske Bank is one of the players in the financial market that look at economic indicators for analyzing the economic condition

adequacy, (3) consistency of timing during business cycles" (p. 8). Based on the evaluation criteria, Hoagland and Taylor (cited in Kauffman, 1999), present stability as an important factor for indicators. Stability is the absence of randomness in indicators' fluctuations compared to cyclical trends. When investigating consistent signals of indicators, they should follow the direction of the economy, GDP, in order to reflect the economic conditions.

In Sweden, GDP is published with a lag of 60 days after the end of each quarter. This data is also continuously revised and adjusted when new information is revealed (Statistics Sweden, 2014a). Therefore, there is an increased demand of forecasts, in order to explain the current situation and predict the direction of GDP. In this context, indicators are useful (Mitchell, 2009).

According to the authors of this thesis there is a lack of research about Swedish indicators. In order to analyse this further, the underlying hypothesis is to test whether Swedish indicators are stable over time. Furthermore, observe if stability changes before and after the financial crisis. For economist within the banking sector, among others, the generated findings could be important when making strategic decisions. In order to observe stability; Correct signal of up-and downturns in indicators compared to GDP is first graphed. Secondly, correlation and cross-correlation is implemented to observe where the direction and strength is strongest and get an understanding of indicators' lag structure. Thirdly, regression analysis of GDP against each indicator is performed to understand their explanatory power.

1.1 Background

As previously stated, indicators play an important role for different decision makers. According to Riksbank (2011) the Swedish Central Bank use macroeconomic forecasts based on economic indicators when regulating the benchmark rate. Their mission is to keep inflation at a low and stable level for maintaining financial stability. All major banks in Sweden have research departments that analyze macroeconomic trends, regionally, nationally and internationally. The information is combined to give a broader view of where the economy is heading. For instance, Danske Bank Research (2014a) publishes analysis in order to give their institutional and corporate clients a deeper insight into the economic situation. The aim of the research is to help companies in their decision making process and to achieve higher performance (Danske Bank Research, 2014b). Another example is Insurance Sweden, an organization that develops a competitive market for insurance companies within Sweden. They analyse macroeconomic changes and focus on long-term investments for the ability to dampen cyclical fluctuations. Insurance companies' role is to take over risks of individuals

and businesses and therefore need to know the economy in advance (Erlandsson, Friman & Ström, 2013). In addition, businesses look at predictions of the future economy to make decisions of employment and inventory needs (Zarnowitz, 1992).

Originally, Mitchell and Burns (1946; 1961) present a study of indicators. They introduce that indicators discover patterns of economic fluctuations which is defined as business cycles. In their first work they also list indicators according to their trustworthiness in relation to business fluctuations[2]. Furthermore, Mitchell and Burns (1946) identify movements in indicators with respect to their timing of business cycles, considered as leads and lags. This information is later used by Moore (1961) who divides indicators into groups of leading, coincident and lagging indicators.[3] The author argues that there are two perspectives and the user needs to decide which one to obtain; less in depth information about the business cycles or irregular in depth information at an early stage. Indicators are also categorized according to their attributes and performance. Drechsel and Scheufele (2010) define some categories of indicators; financial, survey-based, prices and wages, real economy and composite indicators. The strength of financial and survey-based indicators is their availability to give early signals of the real economic situation. Clemen (1989) observes combined indicators and states that when combining indicators into an index, this provide more accurate forecasts compared to using single indicators. Composite indicators are for many researchers synonyms with combined indicators.

Moore (1961) renews Mitchell and Burns' (1961) list of indicators, which is based on a study made from pre and post-war information. Indicators' ability to describe and predict movements in business cycles change, where some leading indicators show coincident characteristics after the war. A major finding is that indicators after the war often exclude business cycles turns, which generate errors. Other indicators included more business cycle turns compared to the real economy. When it comes to indicators' ability to signal an expansion or recession, Stock and Watson (2003a) conclude that every recession decline in a different way. Hence, indicators perform differently in each recession. Mitchell and Burns (1961) argue that this occur since indicators reflect different characteristics of economic activity. Therefore, different results of the same indicator can be obtained for different recessions in time.

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[2] This study later receives critique from Koopman (1947), who argue that the absence of a theoretical model in their findings is a disadvantage for the analysis of economic fluctuations.

[3] Moore (1961, p. 45) defines the classifications according to "their tendency to reach cyclical turns ahead of, about the same time as, or later than business cycle peaks and troughs".

1.2 Problem Discussion

What can be seen during recent time is that PMI's and NIER business confidence's stability has deteriorated, which has caused concern among economists. Boström (2013) and Bahlenberg (2013) have different perspectives of the seriousness of the problem. However, despite the disagreement, economists and analysts use the information on a daily basis when making strategic decisions.

A problem seen in previous research is ambiguous findings regarding indicators' stability. Most research has been conducted in the U.S. or with perspective of the U.S. economy. Scarce research has been made regarding Swedish indicators. However, the conducted research focuses mostly on the survey-based category and excludes other categories. Österholm (2014) publishes a research where the author observes the predictive ability of survey-based data in relation to Swedish GDP growth.

In Germany on the other hand, Drechsel and Scheufele (2010) observe a broader picture when predicting the economy. The authors focus on indicators within the categories; financial, survey, price and wages, real economy and composite indicators. With respect to this, it can be interesting to contribute in a similar manner, obtaining a Swedish perspective, by analysing a wide range of indicators.

An additional problem according to previous literature is that indicators' consistencies over time have been questioned. Boström (2013) see changes in PMI and NIER business confidence since the financial crisis in 2007-2008. Moore (1961) suggests that major events like wars change the economy and the stability of some economic indicators. Both war and financial crisis are sources of economic disruption. When considering financial crisis, a similar effect on indicator as seen in pre-and post-war information can be possible. When observing a number of indicators with the same time period, this makes it possible to compare results across indicators and categories.

1.3 Purpose

The purpose of this research is to empirically study selected Swedish economic and business cycle indicators' stability over time with respect to GDP growth. Stability is in this thesis defined as indicators ability to provide reliable, accurate and consistent signals of the economy's direction, GDP. The aim is to get a better understanding of indicators' ability to predict future movements in the economy. The effect of the financial crisis in 2008 will be used as a benchmark to see if there has been a change in indicators' ability to predict GDP growth.

1.4 Delimitations

The focus is on Swedish indicators', both economic and business cycle indicators, predictive ability against GDP. Ten indicators are selected with respect to the following criteria; the widespread use of economic indicators by different players in the market, important indicators according to previous studies and publicly available data. The authors have selected indicators that fulfil these criteria to get a broad perspective of the economy. The selected indicators are grouped into three categories; financial, survey-based and real economy indicators. The following indicators will be studied:

Table 1 - Categories and Perspectives

Category	Perspective	Indicator	Data availability
Financial indicators	Financial	Term Spread: 10-year Swedish Government bond less STIBOR T/N	1998(Q2)-2013
	Financial	Stock Market: OMXSPI	1993-2013
Survey-based indicators	Business cycle	Purchasing Managers Index	1994(M11)-2013
	Consumption	Consumer Confidence Index	1993-2013
	Consumption	Retail Trade Index	1993-2013
Real economy indicators	Labor market	Employment	2005-2013
	Labor market	Claims of unemployment	1993-2013
	Export	Export of goods	1993-2013
	Production	Industry Production Index	2000-2013
	Production	Service Production Index	2000-2013

Previous research of indicators in Sweden is limited; the literature focuses mostly on the U.S. and the overall European economy. Each country's economy behaves differently and the indicators can therefore behave in different ways depending on the chosen country. However, these differences will not be considered in this thesis. The empirical findings will be connected to the Swedish market and conclusions will be drawn with respect previous research conducted in other countries than Sweden. Furthermore, some areas within the literature have recently been updated while this is not the case for all previous literature. Therefore, some previous literature included does not study the modern economy today. However, this thesis tries to capture the most prominent work of previous publications. During the last few decades, statistical models have also been developed with attempts to improve the composition of indicators that indicate movements in business cycles. Examples of such models are the dynamic factor model and pooled indicator. However, these will not be included in this study. The financial crisis in 2008 will be used as a benchmark for stability. The sample period includes additional financial crisis, these will not be considered. Further consideration in relation to stationary and nonstationary time series are not made. A visual examination of the graphs shows no sign of stationary. This thesis will study stability in

indicators, however it will not examine if the cause of potential deterioration in stability is due to the economy or the underlying mechanism in the indicator.

1.5 Outline

This thesis is divided into sections as follow: in section 2, previous research within business cycles and stability of economic indicators are presented. In section 3, the underlying methodologies and methods for the conducted research are explained. In section 4, empirical findings and basic analysis are presented, and in section 5 the empirical findings and previous literature more in depth are discussed. Finally, in section 6 the authors make concluding remarks, present limitations of the study and give suggestions for future research.

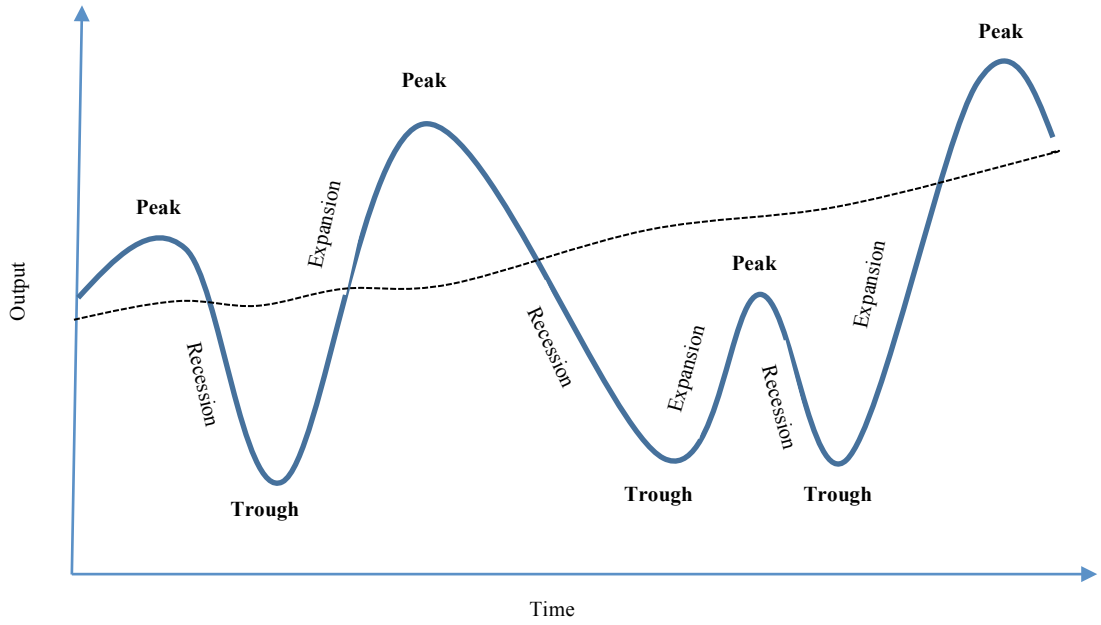
2 Theory and Previous Literature

In this section we present to the reader theories behind business cycles and its link to GDP. Furthermore, important milestones in the history and developments of economic and business indicators are presented. The aim of this section is to help the reader understand the context and use of indicators and their ability to signal economic changes and conditions. Different authors have tried to evaluate indicators, however scarce research has been conducted for some of the indicators.

2.1 Descriptive Information of Business Cycles

Business cycles are explained as the difference between actual GDP and the underlying trend. The underlying trend can be seen as potential GDP, which is obtained when the economy experiences full employment. The economy is in an expansion when actual GDP is above the underlying trend, and in a recession when actual GDP is below the trend. Turning points in the economy are named peaks and troughs, indicating the highest and lowest point that the economy can reach in the current economic condition (Fregert & Jonung, 2010). A whole business cycle is the period it takes for the economy to undergo both an expansion and recession, seen in figure 1. Furthermore, it can be seen as the economy's way to react to different disturbances, derived from both supply- and demand side. One example could be changes in production or changes in demand for investment goods (Dornbusch, Fischer, & Startz, 2011)

Figure 1 - Business Cycle



Source: Authors' own graph

One of the oldest and most basic uses of national accounts is to measure the growth of an economy. Gross Domestic Product, GDP summarises a country's economic position (Eurostat, 2012). GDP is the total value of all products and services that are produced within the borders of a country and are used in consumption, export and investment during a set period, normally one year. Foreign owned companies that produce goods within Sweden are included and domestic companies that produce goods abroad are excluded (Statistics Sweden, 2013a). A commonly used model in macroeconomics to describe GDP is defined as follow:

$$Y = C + I + G + N \qquad (2.1)$$

Y is the demand for output in a country; C stands for consumption spending by households; I reflect businesses and households investment spending; G is purchases of goods and services by the government; N stands for foreign demand of a country's net export. Indicators measure different economic factors and have therefore connection to the above formula (Dornbusch, Fischer, & Startz, 2011)

2.2 Business Cycle Theory

The most prominent work on business cycles is developed by Samuelson (1939) who combines different hypotheses into a coherent framework to describe market fluctuations. The theory is based on rigorous and mathematical approaches; the model is called multiplier-accelerator. This model shows that changes in purchasing power give rise to cyclical fluctuations. A basic description is that when purchase power rises, it leads to an increase in the multiplier-accelerator effect which initiates investment and generate further economic growth. When the economy experience maximum capacity, eventually production will slow down and investments fall. After a period of decline in production, various investments are made, which give rise to an upswing in the economy.

Keynes (2007) discusses ideas of how to dampen cyclical changes and points out the importance of striving to reach full employment. The author argues that there are no guarantee that produced goods will be required by consumers. Therefore unemployment can be a natural cause if there is lack in demand, especially during a downturn economic phase. Government spending should put underused savings into work in order to increase aggregated demand and hence economic activity. According to Keynes this would increase employment and decrease deflation.

Modern business cycle theory is based on two fundamental approaches; (1) there are predetermined elements in the economic cycle. The predetermined element makes GDP and economic indicators change in a low pace and the business cycles duration can last several

years. Therefore, no radical changes between subsequent quarters can be seen. (2) There are also random elements that can cause sudden events, which make the business cycle abruptly change direction (Fregert & Jonung, 2010).

To explain the two fundamental approaches, Frisch (1933) develops an impulse-propagation model. The economy is constantly exposed to external random disturbances, known as impulses. Different reasons why the disturbances appear can be increases in oil prices or changes in the worldwide economy. The economy's process of adapting to these disturbances is slow and takes time. The impulse describes the random events in the business cycle and the slow adapting process describes the predetermined elements. The impulse-propagation model is used to distribute the impulse signals over longer time cycles through slow dispersal mechanisms. The business cycles lengths increase when the dispersal mechanisms are slower.

Cyclical movements in business cycles are normally between three and eight years (Fregert & Jonung, 2010). However, Kondratieff and Stolper (1935), Kuznet (1961) and Juglar (1862) provide research and argue for cycles that stretch over longer time periods. Kondratieff and Stolper (1935) discover cyclical waves ranging from forty to sixty years. The authors study developments in wholesale prices, wages and interest rates by using a smoothing average technique when eliminating trends in the economic times series. Kuznet (1961) observes cycles ranging from fifteen until twenty-five years. The author implements a more qualitative approach when including both physical production and price variation of commodities. Juglar (1862) studies changes in industrial economies by observing changes in fixed capital investments and find cycles ranging between seven and eleven years. Most economists today refer to these Juglar cycles when talking about business cycles.

2.3 Economic Indicators

2.3.1 Financial indicators

The interest of using financial indicators when forecasting economic activity has been present ever since Mitchell and Burns (1961) introduced Dow Jones composite index of stock price as a leading indicator. Extensive research include and discuss financial variables' predictive ability and stability with respect to GDP growth, in different forms; term spread, stock price, dividends yield, interest and exchange rates (Stock & Watson, 2003b).

Stock and Watson (2003b) provide a literature review and empirical analysis of financial indicators. The authors find that instability is a common feature among financial indicators. Empirically, Stock and Watson (2003b) find that different financial indicators are

significant when marginally predicting GDP growth over different time periods. However, no financial indicator shows predictive ability over several sectors within different countries[4]. Financial indicators have good predictive power in one period while this is not always the case in the following periods. Term spread was the financial indicator that provided most stability over different time periods. The authors claim that financial indicators' instability generally come from economic shocks, part of random fluctuations and development in financial systems.

Term spread

Bernanke and Blinder (1992) as well as Estrella and Mishkin (1997) claim that term spread is closely connected to a country's pursued monetary policies. When tightening monetary policies, higher short-term rates can be seen which generates a lower term spread and economic slowdown, and vice versa. When term spread increases, a positive change in GDP is predicted for the future (Ang, Piazzesi & Wei, 2006; Wheelock & Wohar, 2009).

Extensive researches have been conducted with respect to the US economy. Among those Estrella and Hardouvelis (1991), Wheelock and Wohar (2009), and Bernanke and Blinder (1992) argue that term spread forecast GDP growth. Estrella and Mishkin (1997) confirm that this also is true for the Euro area. Wheelock and Wohar (2009) conclude that researchers most common view are that term spread provide forecasting abilities, six to twelve months ahead of GDP growth. Estrella and Mishkin (1997) on the other hand observe different countries and claim that term spread, on average, has a predictive ability between one and two years. Wheelock and Wohar (2009) argue that term spread generally provides more reliable predictions in terms of recessions compared to growth in business cycles. It has the ability to predict a possible slowdown one year in advance. Estrella and Hardouvelis (1991) found that term spread performs better forecasts compared to survey-based indicators.

Stock price - Stock market

According to Stock and Watson (2003b), stock prices have been considered a forecaster of GDP growth during a long time. The use of stock price as an indicator is considered valid in macroeconomics since future earnings on stocks are argued to reflect the current stock prices. Hence, it indicates investors' future expectations. Fisher and Merton (1984) argue that changes in stock prices both positive and negative, provide good forecasts. However, the

[4] Stock and Watson (2003b) study seven countries; Germany, Italy, France, the UK, the US, Canada and Japan for a time period of 40 years between 1959-1999.

majority of researchers claim the opposite. Both Drechsel and Scheufele (2010) and Stock and Watson, (2003b) argue that stock prices have shown empirically unstable results when predicting GDP. Estrella and Mishkin (1998) observe stock prices in relation to recessions. The authors' results show that it accurately predicts a recession, one to three quarters ahead its occurrence.

2.3.2 Survey-Based Indicators

Österholm (2014) claims that survey data in the NIER Business Tendency Survey has "informational value" (p.135) and can improve short-term forecasts of Swedish GDP growth. Hansson, Jansson and Löf (2005) highlight important factors for survey-based indicators' reliability in relation to GDP performance. Survey data is immediately available, have very few or no measurement errors and disregard the process of being revised.

Purchasing Managers' Index - PMI

An increased value in PMI shows that manager reports successful business surroundings and have positive predictions of the future. However, the index does not capture the difference in sizes between companies and its related circumstances, which can explain why economic shifts sometimes are overlooked by PMI. The index is publicly available the first day during the next month and its timeliness is valuable as a first indication of economic change. Furthermore, it is considered to be a leading indicator (Koenig, 2002).

Kauffman (1999) finds that PMI has high correlation to GDP and lags the overall business cycle. Harris (1991) indicates that GDP does not follow a smooth development pattern, therefore PMI often shows peaks when the economy is recovering, and it also shows many smaller peaks during an upward phase of the economy. Correct signals in relation to recessions occur between zero and twenty month ahead an upturn, however irregularity in this aspect is also seen. Many economists use PMI as a signal of change and put less weight on its leading ability. Harris (1991) makes a summary of previous research, the findings supports that PMI indicates up- and downturns in the economy. However, there is little evidence that PMI actually provide new information, which is not provided by other indicators.

Consumer Confidence Index – CCI

CCI's measure is based on economic optimism, expressed through consumers' attitudes in relation to savings and consumption. These attitudes affect the economic aggregated demand. When CCI increases, consumption grows and higher demand for goods and services is seen,

which affect GDP (Dornbusch et.al, 2011). According to Ludvigson (2004) survey questions in CCI relate to consumers' present situation and contain meaningful information. Hence, it is used as a benchmark for the current economic level. Taylor and McNabb (2007) show that CCI are procyclical and have a significant impact when predicting downturns in the economy. Authors such as Carroll, Fuhrer and Wilcox (1994) and Matsusaka and Sbordone (1995) analyze CCI to see if it provides additional information in relation to other economic indicators. The authors find that CCI has important explanatory power for fluctuations in GDP, even when other macroeconomic variables are considered. On the contrary, Al-Eyd, Barrell and Davis (2009) see decreasing predictability in CCI and question its reliability. Batchelor and Dua (1998) findings show that including CCI can increase the chance of discovering a recession and highlight its ability to see economic fluctuations.

Retail Trade Index - RTI

In the American market, Retail Trade Index investigates the dollar value of goods sold in the retail trade industry. Retail Sales Index is closely linked to Retail Trade Index and is observed by many economists. Its aggregated value makes up for two-thirds of the overall GDP. It reflects the current economic state, and therefore is included as a coincident indicator. Furthermore, it is also valuable when measuring the inflation rate (Winton & Ralph, 2011).

2.3.3 Real Economy

Banbura and Rüstler (2011) observe the relation between hard and soft data when forecasting short-term GDP growth in the Euro area. Soft data reflect expectations while hard data state what actually happens in real numbers. Survey data are included in the higher frequency data section and are categorized as soft data, while hard data observe specific mechanisms in GDP. Differences in lag structure impact the number of correct signals in relation to GDP. When ignoring lags of publications, hard data provide more information with precise signals. When including differences in lags, hard data decrease its relevance and soft data have a higher impact on the forecast.

Employment / Claims of Unemployment

Drechsel and Scheufele (2010) argue that labor market indicators can be useful when studying GDP growth. The authors discuss unemployment rate, employment and vacancies in the labor market as leading indicators. Banerjee, Marcellino and Masten (2005) especially point out the following indicators; unemployment rate, employment, claims of unemployment and hours worked to best forecast GDP growth.

The relationship between GDP and labor market is widely recognized. As previously stated in section 2.1, the unemployment output "gap" represents differences between potential and actual economic output. Furthermore, Potential output exists when the economy experiences full employment. When the unemployment rate rises, GDP declines and vice versa (Friedman & Wachter, 1974). The reason for this relationship to exist is that higher cost of unemployment is considered as productivity loss for a country. If people do not work, the country decreases its production levels and less tax is generated for the government (Dornbusch et.al., 2011). However, Galvin and Kliesen (2002) argue that this relationship tends to hold in recessions but not over the whole business cycle and is therefore not a reliable predictor of GDP growth. The reason is due to changes among some microeconomic variables. The number of people being employed or unemployed is affected by demographics, unemployment benefits as well as cultural and social structures in the society. Dornbusch et.al (2011) add inflexibility in labor markets, especially in Europe, as an effect on unemployment and thereby its relationship to GDP. Real wage changes tend to move slowly, there are often high costs included when firing employees; this tends to keep unemployment at higher levels. The labor market can therefore have an extensive effect on the economy in recessions due to reluctance of hiring people.

Stock and Watson (1999) argue that employment is strongly procyclical. Additionally the authors state that employment has a lag of about one quarter with respect to the business cycle. However, Stock and Watson (2003a) argue that employment serve as a coincident indicator.

Stock and Watson (1999) argue that new unemployment claims lead the business cycle. Stock & Watson (2003a) argue that claims of unemployment is and have been an early indicator of when the business cycle is entering a downward phase. According to Montgomery, Zarnowitz, Tsay and Tiao (1998) this economic indicator include valuable information and leading abilities since it signal what direction unemployment will take in the following months.

Export of Goods

In equation (2.1) in previous section, N in relation to GDP represents net export and can either have a positive or negative impact on GDP, depending on the country's export levels. Countries strive to increase the levels of production in order to generate a positive net export. The mechanism behind the ability to achieve a higher export is closely connected to a flexible exchange rate (Feenstra & Taylor, 2011).

Previous research among export and economic growth are divided into two sections. First, trade strategies and their effect on economic performance are examined, together with changed policies of export. Secondly, the relationship between increased levels of export and further economic growth are observed (Kavoussi, 1982). More emphasis in previous literature has been made with respect to the latter section. Tyler (1981) claims that understanding the importance of export can lead to increased investment levels in more effective sectors of the economy, thus generating improved productivity.

Karpaty and Kneller (2011) argue that Sweden's economic growth is largely due to internationalization through foreign invested capital and increasing levels of export. Some evidence confirms that there is a positive relationship between increased amount of exports and productivity. Furthermore, this generates benefits from large scale of production.

Industry Production Index/ Service Production Index

Production has through out history been used in various forms as indicators to predict the economic direction and GDP growth. Moore (1961) introduces manufacturing, new orders and durable goods, which is part of production as leading indicators for business cycles in the U.S. Banbura and Rüstler (2011) argue that since production indices (both industrial and service production) are based on real activity with real numbers, the availability of data is delayed. This can delay information about GDP, however, they give accurate signals of GDP.

Production consists of a process where inputs, like material, is transformed into output and is generated to products. The relationship between input and output depends partly on production technology. This is something that is rapidly developing, and it constantly changing the means of production efficiency (Rasmussen, 2013).

According to Hosley and Kennedy (1985) the industrial sector together with construction represent the main variation in output. By analyzing the industrial production, structural changes in the economy can be measured and clarified. The Industry Production Index therefore reveals detailed information on different components in industry sectors. Furthermore, the authors highlight a close relationship between growth in industrial production and the exchange rate as well as a country's trade deficit. A strong domestic currency and trade deficit commonly leads to growth in the industrial production sector.

Indices that measure service production have received increased attention during past decades. Moore (1991) discusses service industries and their increased economic importance. The reason for its increased importance is a rise in employment levels within the sector; hence it contributes more to GDP compared to previous decades. The author argues that growth

rates in indices based on service industries strongly move in the same direction as business cycles. Nowadays they have a complementary role in relation to industrial production when explaining countries' fluctuations in the total economic output, which determine the direction of short-term movements (OECD, 2007). Layton and Moore (1989) argue that the service sector is more stable compared to industry production especially during recessions since there is no need for inventory. Additionally, the authors discuss services to be based mainly on demand, whereas both demand and supply play an important role in industry production.

3 Methodology, Data and Descriptive Statistics

In this section the philosophical basis of the chosen research method will be presented. The authors will illustrate how the empirical methods will be conducted, including data gathering, data arrangement and statistical methods that will be used. This chapter will also conclude a section where validity, reliability and generalizability of this thesis are discussed.

3.1 Research Philosophy, Approach and Design

The research philosophy is connected to the knowledge development of the research. It reflects the way a specific research view the world. There are three main philosophies; positivism, realism and interpretivism in the current literature (Saunder, Lewis & Thornhill, 2012). This thesis will obtain positivism as a philosophical standpoint. According to Saunders et al. (2012) data is collected from reality and is analysed in order to see relation and common features. This information is considered as generalized laws for researchers. Through this philosophy, we aim to establish if there is stability between economic indicators and GDP.

Research approaches reflects the way theory is used, there are three different approaches; deduction, induction and abduction (Saunders et al., 2012). This study will be based on a deductive research approach. The selected approach will include some of the main characteristics that Saunders et al. (2012) define when explaining the deductive research. The approach first involves developing a hypothesis based on previous research, which is later tested. It tries to explain the relationship between variables, additionally it is generalised through selecting a large data set. It is also possible to conduct an abductive approach, where new theories are developed by identifying patterns based on explaining facts. However, this is not illustrated in this thesis since it is not in line with the purpose.

Research design, sometimes referred to research strategy, involves the structure, outline and framework of the research being conducted. Often the research is exploratory, descriptive or casual design, also called explanatory design (Cooper & Schnidler, 2011). For this study, a descripto-exploratory research design is most suitable. Saunders et al. (2012) argues that the use of this design will link descriptive and explanatory views together. Firstly through calculations describing the data and then by providing interpretations of the relationships. A quantitative research method with secondary data will be conducted. This research method investigates the relationship between variables (Stock & Watson, 2012).

3.2 Method

3.2.1 Selection of Data and Test Period

Ever since Mitchell and Burns (1961) introduced the first list of useful economic indicators, the list has been revised over the years. The authors of this thesis will use previous research as a compliment when deciding which indicators to study. Further information with respect to Sweden will be gathered from Statistics Sweden, they publish and provide information of the most frequently used indicators. In relation to this, further research will be conducted to see which indicators that are used by the Central Bank in Sweden, other major banks, institutions, the insurance sector and companies. Indicators will be selected from the following three categories; Financial, Survey-based and Real economy. Stock and Watson (1999) analyze a wider range of indicators and classifie them into different perspectives based on the economic sector they belong to. From their way of classifying indicators, similar perspectives will be implemented.

The sample period will be based on publically available data. GDP will be used as dependent variable and indicators as independent variables. The test will include a maximum of 20 years since GDP is available from the first quarter of 1993 until the last quarter of 2013. However, indicators have different introduction dates and variety of length. Therefore some indicators have shorter time periods and the data will be included since they first were published. Exports, Claims of Unemployment, CCI and RTI are included from 1993 and cover the whole time frame of 20 years. IPI, SPI, Employment, OMXSPI, Term Spread and PMI cover different shorter time periods.

3.2.2 Data Gathering

The authors gathered information from the original sources. Seasonally adjusted GDP, IPI, SPI, Export, Employment, CCI and RTI are collected from Statistics Sweden. Claims of Unemployment from Arbetsförmedlingen, OMXSPI from NASDAQ, Term spread from the Riksbank (the Swedish central bank) and PMI from Swedbank.

3.2.3 Independent Variables –Indicators

Financial Indicators

Term Spread is the difference between long-term and short-term interest rate on maturity debt. There are different types of measures for term spread that can be used. The most common measures are long-term government bond rate less three-month government bond and long-term government bond rate less overnight rate (Stock & Watson, 2003b). This thesis uses the latter, where 10-year Swedish Government Bond rate is taken minus STIBOR N/A.

OMXSPI includes all companies' shares in the stock market, listed on OMX Nordic Exchange Stockholm. It is an aggregated measure of the overall current value and changes of the stocks, combined into an index (The NASDAQ OMX Group Inc., 2014).

Survey-based Indicators

Purchasing Managers Index (PMI) is a qualitative survey where about 200 purchasing managers in the manufacturing industry in Sweden are interviewed. It reflects the companies' current condition and the purchasing managers' opinions of the near future, with respect to changes from the previous month. The aggregated information in relation to order intake (30 %), production (25 %), employment (20 %), supplier's delivery time (15 %) and inventory (10 %) are combined into a diffusion index (Swedbank, 2014).

Consumer Confidence Index (CCI) is part of the Economic Tendency Survey, where 1500 Swedish households are asked questions about their economy (NIER, n.d.). Four questions on participants' personal finances are averaged into representing CCI. Additionally, it includes participants' view of the current and future Swedish economy for up to 12 months ahead. Lastly, a question is asked if they think it is a good time to buy consumer goods (Statistics Sweden, 2014b).

Retail Trade Index (RTI) is published every month and reports total retail sales development. It is based on the total revenue, including taxes and excluding exports. The survey is one of the primary sources when it comes to calculating private consumption in GDP (Statistics Sweden, 2013b)

Real economy Indicators

Employment is the number of people employed, both men and women in the age of 15-74 years old. Permanent and temporary employment as well as self-employment is included. Employment is part of the Labour Force Survey (Statistics Sweden, 2014c).

Claims of Unemployment is when employers give an early redundancy notice employees within the companies. All claims of unemployment is collected and added for Sweden. However, companies only need to report reduction of employees when the number is at least five people. Therefore, the statistics do not include reductions less than five people (Arbetsförmedlingen, 2014).

Export includes the total value in Swedish Krona of all exported goods (Statistics Sweden, 2014c).

Industry Production Index (IPI) is a volume index designed to measure the industrial changes in the economy. It measures the industrial contribution to GDP between

two time periods. Data from mining, manufacturing, electricity, gas and heat are reported. IPI include three main data sources in the production sector; deliveries, hours worked and price changes (Statistics Sweden, 2013d).

Service Production Index (SPI) measures the growth of production within the service sector. SPI include data from trade, hotel and restaurants, transport, storage and communication, business services, education, health and care services and other services. The different components in SPI are selected based on consistency over time and cover a widespread of sectors (Statistics Sweden, 2008).

Table 2 - Comprehensive Picture of Indicators

Category	Perspective	Indicator	Data availability	Frequency gathered	Source	Measurement
Financial indicators	Financial	Term Spread: 10-year Swedish Government bond less STIBOR T/N	1998(Q2)-2013	Quarterly	The Riksbank	Percentage
	Financial	Stock Market: OMXSPI	1993-2013	Daily	Nasdaq	Volume Index, reference year 1995 =100 %
Survey-based indicators	Business cycle	Purchasing Managers' Index	1994(M11)-2013	Monthly	Swedbank	Diffusion index
	Consumption	Consumer Confidence Index	1993-2013	Monthly	Statistics Sweden	Average=100
	Consumption	Retail Trade Index	1993-2013	Monthly	Statistics Sweden	Volume index, reference year 2010=100 %
Real economy indicators	Labor market	Employment	2005-2013	Quarterly	Statistics Sweden	Real Numbers
	Labor market	Claims of unemployment	1993-2013	Quarterly	Arbetsförmedlingen	Real Numbers
	Export	Export of goods	1993-2013	Monthly	Statistics Sweden	Real Numbers
	Production	Industry Production Index	2000-2013	Quarterly	Statistics Sweden	Volume index, reference year 2010= 100 %
	Production	Service Production Index	2000-2013	Quarterly	Statistics Sweden	Volume index, reference year 2010= 100 %

3.2.4 Data Arrangement and Quality

The data chosen for this study have different underlying measures[5]. Indicators that are presented in volume indices are constructed in the same way but have different base periods. In order to make correct comparisons between GDP and index numbers[6], the base period will be changed (Aczel & Sounderpandian, 2009). GDP use the fourth quarter of 2012 as a base period, the indicators will therefore be transformed into the same period. The following formula will be used to change the base period for the indices:

$$New\ index\ value = \frac{Old\ index\ value}{Index\ value\ of\ new\ base} \times 100 \qquad (3.1)$$

[5] Index, Diffusion index, Real number and Percent.

[6] "Index number is a number that measures the relative change in a set of measurements over time", to construct a simple index, a base year is chosen and the index number is the percentage of the ratio between two values, the current value divided by the value of the base year, times 100 (Aczel & Sounderpandian, 2009, p 583)

The indicators that will be used are either released daily, monthly or quarterly. OMXSPI is released on a daily basis while Export, CCI, RTI and PMI are released monthly. IPI, SPI, Claims of Unemployment, Employment and Term Spread are released quarterly together with GDP. In order to compare economic indicators with GDP, the indicators released on a daily or monthly basis will be transformed into representing quarterly data. This procedure differs depending on the underlying measure. Export is release in real numbers on a monthly basis and will therefore be aggregated by adding together three months' data for each quarter. When consider indices, diffusion indices or survey-based measures, the last date or month in each quarter will be included. This facilitates the procedure of making direct comparisons. An alternative approach is to use three months average value in each quarter. However by doing so, important information about fluctuations in the indicators can be overlooked.

GDP growth measures the percentage change in GDP from one period to the next. Logarithmic Transformation, with natural logarithm, will be conducted on the data of indicators, while the percentage change for GDP will not include a logarithmic transformation. In developing economics it is common to use logarithmic transformation to get GDP growth (Stock & Watson, 2012). However, since Sweden is considered a developed country, it is said not to experience exponential growth. Therefore the growth will not include a logarithmic transformation.

$$\Delta y_t = LN\left(\frac{y_t}{y_{t-1}}\right) \qquad (3.2)$$ [7]

When observing a diffusion index[8], the absolute change in relation to the previous period is already measured. Hence, errors will appear if this data is transformed into representing percentage change. Therefore, the absolute number of diffusion index will be used, without any changes. Previous literature considers the absolute level of the spread, the same will be considered here.

[7] $\Delta y_t = LN\left(\frac{y_t}{y_{t-1}}\right) = LN\, y_t - LN\, y_{t-1}$

[8] A diffusion index ranges between 0-100. 50 defines no change (50 percent of the firms/industries experience decrease and the other 50 percent an increase) (Getz & Ulmer, 1990).

Table 3 - Data Transformation

Variable	New measurement arrangement	Transformation
GDP growth	Percent	Level
Financial indicators		
Term Spread	Percent spread	Level
OMXSPI	Volume index, reference year 2012Q4=100 %	Δln
Survey-based indicators		
Purchasing Managers' Index	Diffusion index	Level
Consumer Confidence Index	Average=100	Δln
Retail Sales Index	Volume index, reference year 2012Q4=100 %	Δln
Real economy indicators		
Employment	Real Numbers	Δln
Claims of unemployment	Real Numbers	Δln
Export of goods	Real Numbers	Δln
Industry Production Index	Volume index, reference year 2012Q4=100 %	Δln
Service Production Index	Volume index, reference year 2012Q4=100 %	Δln

3.3 Statistical methods

3.3.1 Correlation and Cross-Correlation

To examine the chosen economic indicators' change associated to GDP growth, correlation between these will be tested. Correlation is a non-unit measurement that indicates the strength and direction of an association between two variables. The measure of correlation is expressed as values between -1 and 1. The value of 0 indicates no association between variables, -1 indicates a maximum negative relationship and 1 show a maximum positive relationship (Stock & Watson, 2012). This test will provide information of the linear relationship between indicators and GDP growth. A high positive correlation will indicate that two variables move in the same direction, whereas the opposite is true for a negative correlation.

Cross-correlation is an extension of correlation that is used to study similarities in waves for time series that have cyclical movements. Cross-correlation measure the correlation between two time series when one of them either lead or lag, X_{t-1} or X_{t+1}. It is useful to determine how indicators signals are correlated with respect to lag structure for an up- or downturn movement in GDP growth (Chatfiels, 2004). This test will also give information of specific indicators and their ability to serve as leading, coincident or lagging indicator. Cross-correlation is beneficial as a measurement since its relation to trends does not need to be considered. The test can be implemented regardless of stationary or non-stationary in time series (Taylor & McNabb, 2007).

3.3.2 4 quarters moving average - MA (4)

There can be irregular patterns in time series, which decrease consistency and show irregular movements. Sometimes a visual understanding of a plotted time series can be difficult to

interpret. When smoothing the time series using a moving average, the picture gets clearer. The idea behind the concept is that large irregular movements at any point in time will generate less effect if they are averaged together with four quarters, totally representing a year. The seasonal effects are combined and shown through one seasonal moving average. (Newbold, Carlson, & Thorne, 2013).

A visual interpretation of the plotted graphs will be made under the section empirical findings. After this, a decision will be made if some of the indicators need to be adjusted with moving average. For these indicators, these values will be used in addition to the original data in the Correlation and Cross-Correlation tables.

3.3.3 Regression Models

The purpose of this thesis includes testing if economic indicators' predictive ability has changed, after the financial crisis, in relation to GDP growth. First a simple linear regression model (3.3) will be conducted. It shows the relationship between the dependent and independent variable with respect to the whole time period. β_0 is where it intercept Y_t and β_1 indicate the slope of the line. Later, an additional regression model will be included with an interaction term of a continuous variable multiplied with a binary variable, representing the time period after the start of the financial crisis (Aczel & Sounderpandian, 2009).

$$Y_t = \beta_0 + \beta_1 X_t + u_t \qquad (3.3)$$

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 (X_t \times D) + u_t \qquad (3.4)$$

The above-mentioned tests will be conducted for each economic indicator. The binary variable D, also named dummy variable, is denoted 0 for the time period before the financial crisis and 1 from the second quarter of 2008 until the end of the test period. Focus is to examine the indicators' explanatory power in relation to GDP.

The level of significance in the tested variables measures the probability that the true beta value lies within a specific confidence interval. The standard significant values are 1%, 5% and 10%. If the p-value falls below the chosen significance level, H_0 will be rejected. A significant level of 10 % equals the probability that the true coefficient value lies within a 90 % confidence interval; a similar interpretation can be made for other levels of significance (Aczel & Sounderpandian, 2009).

R^2 shows how much of the dependent variable that is explained by the independent variable. It could also be used to describe how well the regression line and data coincide. R^2 is always between 0 and 1 and its interpretation is made in percentage. When more independent variables are added to the equation, R^2 increases. To adjust for this increase, adjusted R^2 can

be observed when different numbers of independent variables are included (Aczel & Sounderpandian, 2009).

3.3.4 Consistent and Opposite Signals

To observe if the indicator give correct or opposite signals in relation to GDP. A function is used that show signal 1 if the indicator move in the same direction as GDP does. It signals 0 when the indicator moves in the opposite direction. However, when it comes to PMI and Term Spread, a positive change in PMI is above 50 while a negative change is below 50. Term Spread indicates a positive change when the absolute level has increased from the previous quarter. A negative change can be seen when it decreased from the previous quarter.

3.3.5 Validity, reliability and generalizability

To ensure that correct data have been used, the secondary data is collected from original sources. Furthermore, all data are checked twice to ensure accuracy. Cooper and Schnidler (2011, p.280) define reliability as "accuracy and precision of a measurement procedure". With respect to this, reliability empirical findings are conducted. The study intends to measure stability and the conducted tests capture the changes in indicators. The statistical tests are performed to observe stability and the underlying hypothesis can therefore be answered. This ensures validity by measuring what is intended to measure (Cooper & Schnidler, 2011). The authors want to highlight the possibility that the empirical findings in this thesis may not be subject to generalizability if similar tests will be conducted with different samples. The reason for this is findings in previous literature, where no consensus has been made with respect to indicators' stability. When it comes to practicality and usefulness, the concluded result provided a first overview of indicators' stability. However, it can be considered that users of the empirical findings in this thesis conduct a deeper research on the specific indicator of interest before it is implemented in the decision-making processes.

4 Empirical Findings

In this section empirical findings in form of tables and graphs will be presented based on the selected methods in previous section. Descriptive text to illustrate the tables and graphs is included, in addition to some basic analysis of what can be seen. This section is divided into sub-sections based on the different statistical methods used; Correlation and Cross-Correlation, Visual interpretation with Graphs and Correct/Opposite Signals, and finally Regressions. Tables and graphs are the authors own construction based on the collected data.

When interpreting the empirical findings, the authors use the terms reliable, accurate and consistent, in order to analyse stability. Accuracy is used to describe indicators' explanatory power, R^2. To check for reliability, the correct and opposite graphs are observed to see if the indicator moves in the same direction as GDP. Lastly, consistency is used to observe if indicators follow GDP's direction over time. Here indicators' significance in the regression models is analysed.

4.1 Correlation and Cross-correlation

Table 4 illustrates correlation between GDP growth and each indicator. Exports of goods and SPI, show seasonal fluctuations (see graphs 15 and 20 respectively, in section 4.2). Therefore, these time series are adjusted with four quarter moving average. The table below includes the moving average correlation to show its enhanced correlation when adjusted for seasonal movements.

Table 4 - Correlation

Independent variable	Correlation	Correlation MA*
Financial indicators		
Term Spread	0.448	
OMXSPI	0.164	
Survey-based indicators		
PMI	0.593	
CCI	0.053	
RTI	0.099	
Real economy indicators		
Employment	0.110	
Claims of unemployment	-0.356	
Export of goods	0.228	0.562
IPI	0.717	
SPI	0.053	0.571

GDP growth as dependent variable
*Moving Average (4)

Term Spread, PMI, and IPI show relatively high positive correlation with GDP growth. This means that changes in indicators follow changes in GDP. IPI is the economic indicators that best follow GDP growth by 71,7 %. Claims of unemployment indicate a negative correlation,

which is consistent with the findings presented by Friedman & Wachter (1974), when unemployment decrease, GDP growth increase. OMXSPI, CCI, RTI, Employment, Export of goods and SPI show low positive correlation, hence low relationship with GDP growth. No distinctions in correlation within the different categories Financial, Survey-based and Real Economy indicators are seen. When moving average of Exports of goods and SPI are included, they show higher correlation.

In table 5 cross-correlations are presented between GDP growth and each indicator. The leading quarter is shown under each negative lag, while the lagging quarter is shown under each positive lag. The quarter with the highest positive correlation is marked in bold for each indicator. However, for Term Spread, the lowest number is marked.

Table 5 - Cross-Correlation between GDP growth and Independent variables

Independent variable	**Cross-correlation - Lag (Quarter)**								
	+4	+3	+2	+1	0	-1	-2	-3	-4
Financial Indicators									
Term Spread	-0.337	-0.168	-0.038	0.137	0.448	**0.580**	0.503	0.439	0.069
OMXSPI	-0.045	-0.211	0.030	-0.005	0.164	**0.360**	0.347	0.274	0.203
Survey-based Indicators									
PMI	0.001	0.176	0.322	0.495	**0.593**	0.519	0.257	-0.006	-0.196
CCI	-0.179	-0.327	-0.063	-0.114	0.053	0.297	**0.349**	0.301	0.208
RTI	-0.107	-0.021	0.150	0.005	0.099	**0.201**	0.162	0.106	0.210
Real economy Indicators									
Employment	-0.259	-0.365	-0.260	-0.099	0.110	0.403	**0.500**	0.491	0.215
Claims of unemployment	0.176	-0.001	0.186	-0.042	**-0.356**	-0.289	-0.287	-0.232	-0.121
Export of goods	-0.082	0.092	0.117	0.188	**0.228**	0.122	0.117	-0.029	-0.043
Export of goods MA*	0.093	0.310	0.548	**0.589**	0.562	0.404	0.152	-0.058	-0.228
IPI	-0.029	0.089	0.299	0.632	**0.717**	0.410	0.203	-0.031	-0.277
SPI	-0.033	-0.003	0.021	**0.127**	0.053	0.036	-0.023	0.064	-0.024
SPI MA*	0.204	0.382	0.605	**0.649**	0.571	0.402	0.272	-0.055	-0.237

GDP growth as dependent variable

*Moving Average (4)

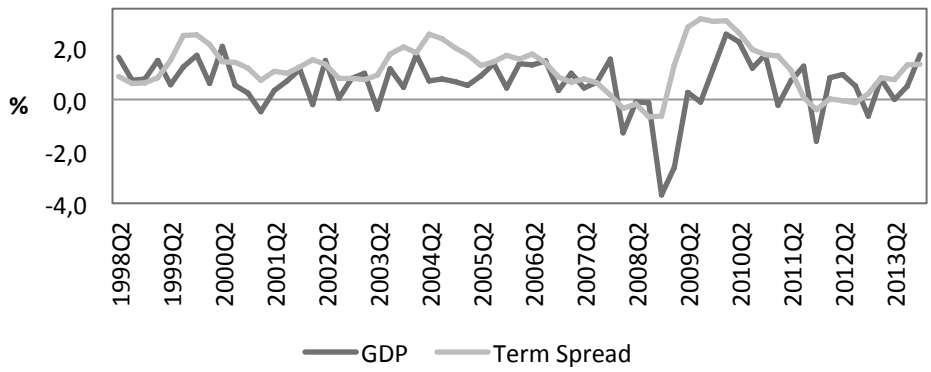
From table 5 it can be seen that Term Spread, OMXSPI, CCI, RTI, Employment has highest positive correlation during leading quarters. PMI, Claims of unemployment, Exports of goods, and IPI have the highest correlation when they coincide with the same quarter as GDP growth. No leading or lagging abilities can be seen. SPI show highest correlation when it lags by one quarter. Interesting to notice is that both trend adjusted Export and SPI show higher correlation when they lag one quarter. Within Financial indicators, both Term Spread and OMXSPI, leads by one quarter. Within survey-based indicators, two out of three indicators

lead, CCI by two quarters and RTI by one quarter. When it comes to Real economy indicators, the only indicator that lead is Employment.

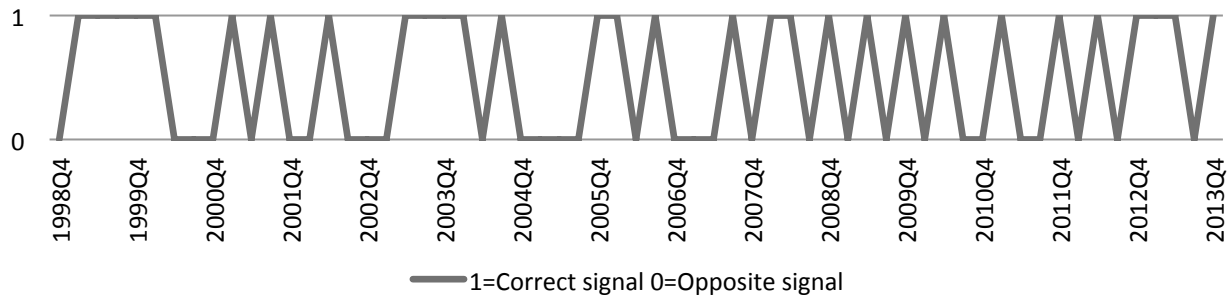
4.2 Visual Interpretation

In this sub-section GDP growth is graphed against the percentage change in each indicator, between subsequent quarters. Exceptions are made for Term spread and PMI, they are graphed in actual levels as stated in section 3. Each indicator's graph is followed by another representing indicators' correct and opposite signals in relation to the direction of GDP. These graphs are based on the highest correlation value of each indicator in the Cross-Correlation test, table 5, presented in subsection 4.1. To get a visual interpretation of movements in GDP and indicators before any data changes are made see appendix 8.1. It graphs the development over time, in real numbers. The financial crisis, starting in year 2008, has a negative impact on GDP, this is commonly seen in all graphs. All ten economic indicators have correctly been able to indicate the economic downturn.

Graph 1 - Percentage Change in GDP - Term Spread



Graph 2 - Correct and Opposite Signals - GDP - Term Spread t-1

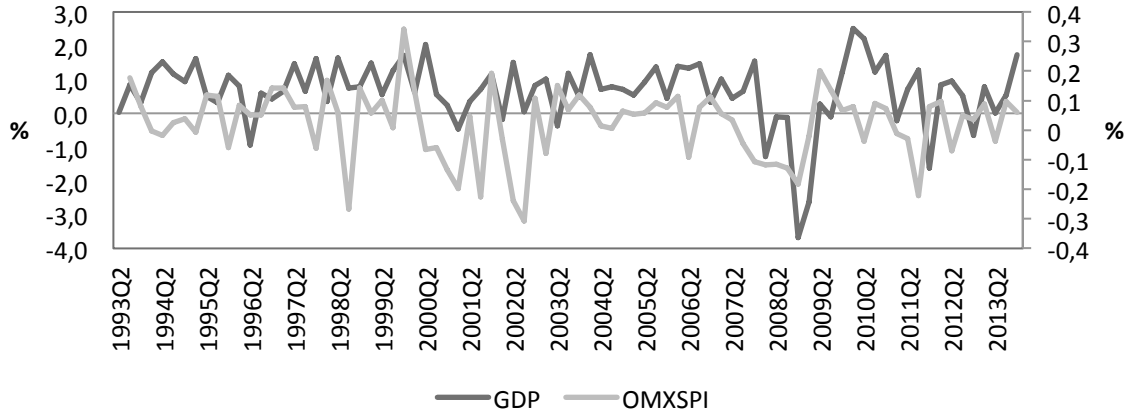


Correct signals overall: 49 % (30/61)
Correct signals after the financial crisis: 47 % (14/23)

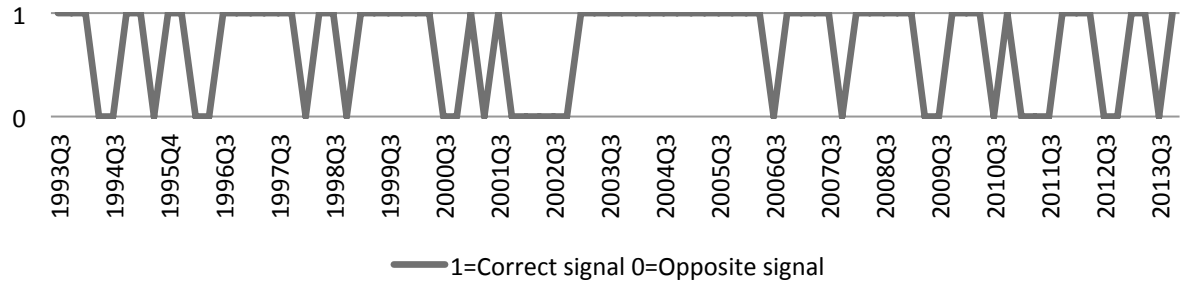
Graph 1 show that Term spread increases (larger spread) after 2008. Before 2008 it was relatively stable, its volatility increases during the last few years. GDP is somewhat more

volatile since the financial crisis, but not to the same extent as Term spread. In graph 2, Term Spread provides correct signals during several subsequent quarters earlier on. However, after the financial crisis, more shifts between subsequent quarters can be seen.

Graph 3 - Percentage Change in GDP - OMXSPI



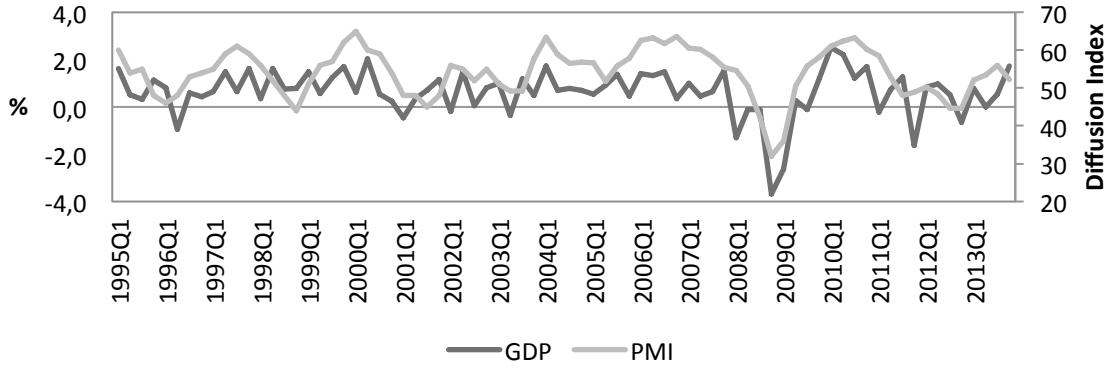
Graph 4 - Correct and Opposite Signals - GDP - OMXSPI t-1



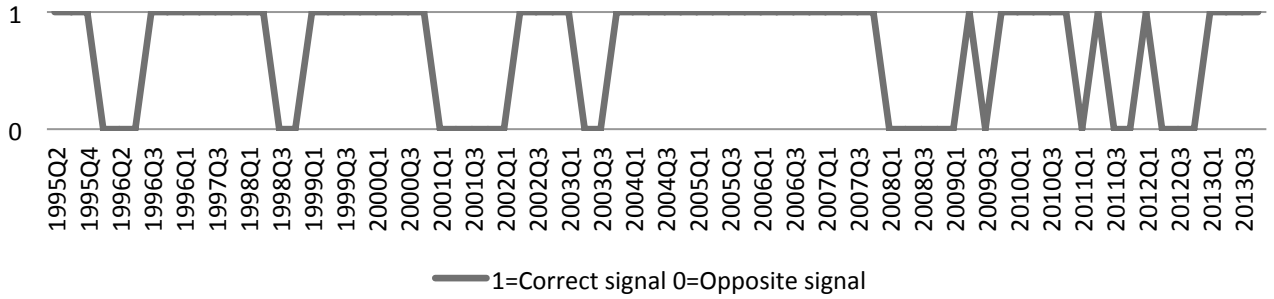
Correct signals overall: 68 % (56/82)
Correct signals after the financial crisis: 61 % (14/23)

OMXSPI appears to be more volatile compared to GDP, when observing graph 3. The reason for this can be that the stock market is said to reflect investors' market expectations. Hence, the behavioural aspect of investors can affect OMXSPI. Additionally, the indicator adjust relatively fast to changes in economic conditions. GDP react more slowly to change, therefore less volatility is seen. During most quarters, OMXSPI changes before GDP, which confirms the cross-correlation test, table 5 that OMXSPI show leading abilities. Graph 4 indicates that OMXSPI has a stable pattern between 2003 until 2006. However, before and after this period, instability is seen.

Graph 5 - Percentage change in GDP – PMI



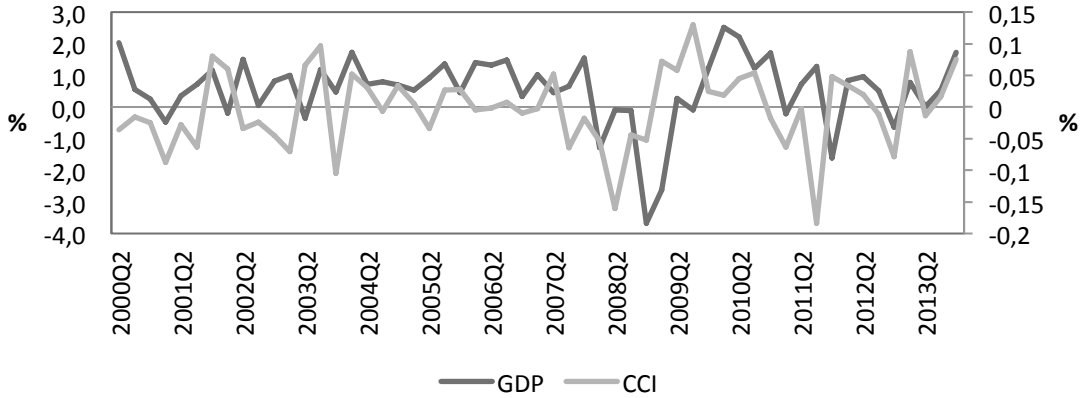
Graph 6 - Correct and Opposite Signals - GDP - PMI



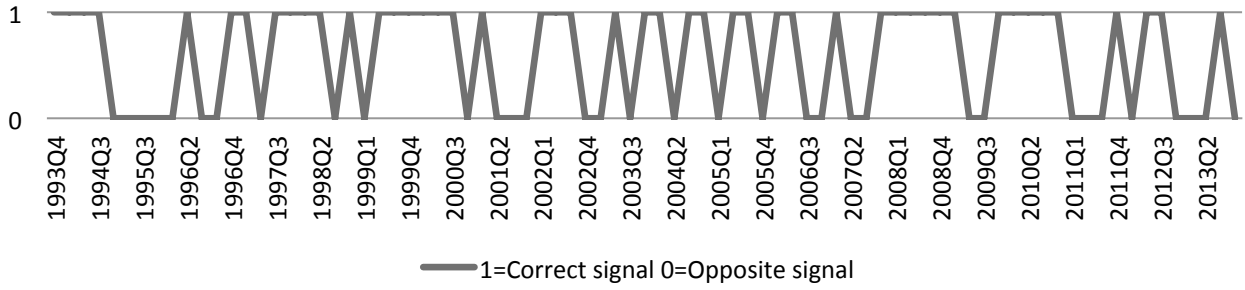
Correct signals overall: 67 % (51/76)
Correct signals after the financial crisis: 52 % (12/23)

In graph 5, PMI seems to be less volatile compared to GDP. Additionally PMI lies above 50 during many quarters, indicating beliefs of a prosperous economy. In graph 6, PMI is relatively stable. However, after the financial crisis in 2008 it lacks the ability to provide correct signals to the same extent compared to previous years. This confirms Boström's (2013) statement that something seems to make PMI unstable after the financial crisis.

Graph 7 - Percentage Change in GDP – CCI



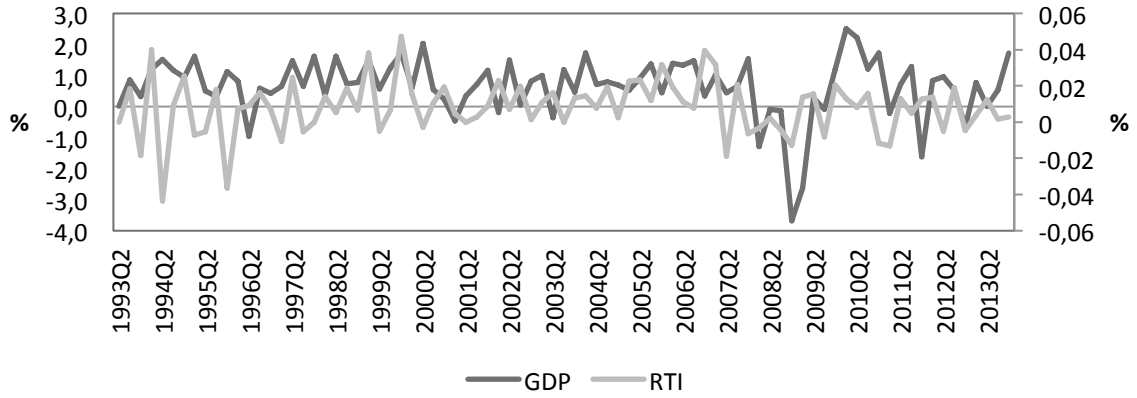
Graph 8 - Correct and Opposite Signals – GDP - CCI t-2



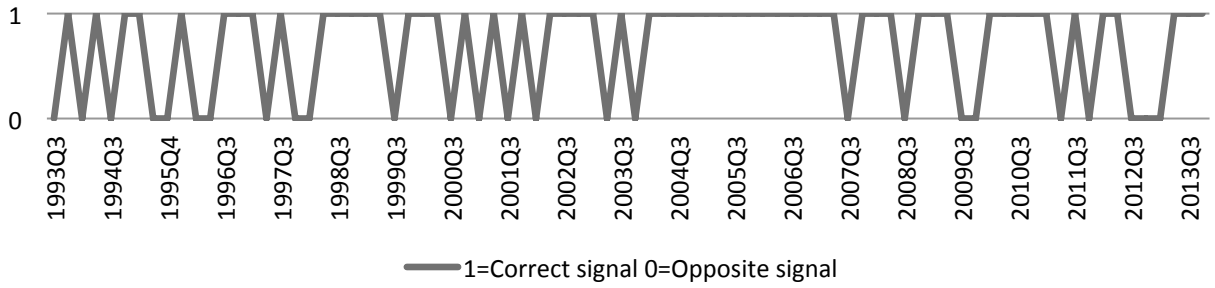
Correct signals overall: 58 % (47/81)
Correct signals after the financial crisis: 56 % (13/23)

Graph 7 displays that most of the time, CCI seem to change in the same direction as GDP. It also confirms the cross-correlation in table 5 that CCI has leading abilities with two quarters in respect to GDP growth. However, when observing graph 8, a distinct pattern that provides leading abilities of two quarters cannot be seen. The reason for this could be that CCI do not always lead by two quarters.

Graph 9 - Percentage change in GDP - RTI



Graph 10 - Correct and Opposite Signals - GDP - RTI t-1

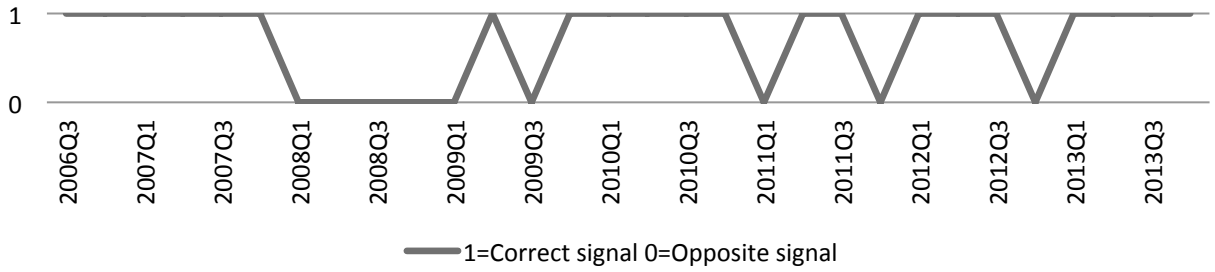


Correct signals overall: 69 % (56/81)
Correct signals after the financial crisis: 65 % (15/23)

In graph 9, RTI is more volatile compared to GDP. It also moves quite extensively between each quarter. However, during the financial crisis in 2008 the indicator moves less compared to the overall period. GDP on the other hand show larger changes during this period. When observing signals in graph 10, the indicator show more correct signals during the latter ten years compared to the first ten years, especially between 2003-2007. Therefore, the leading characteristics of one quarter are relatively accurate during the latter period, while it cannot be confirmed for the first ten years.

Graph 11 - Percentage Change in GDP - Employment

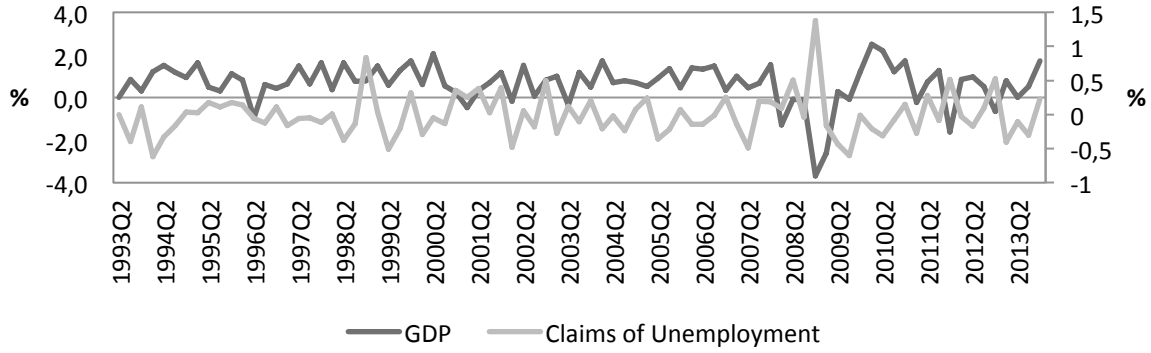
Graph 12 - Correct and Opposite Signals - GDP - Employment t-2



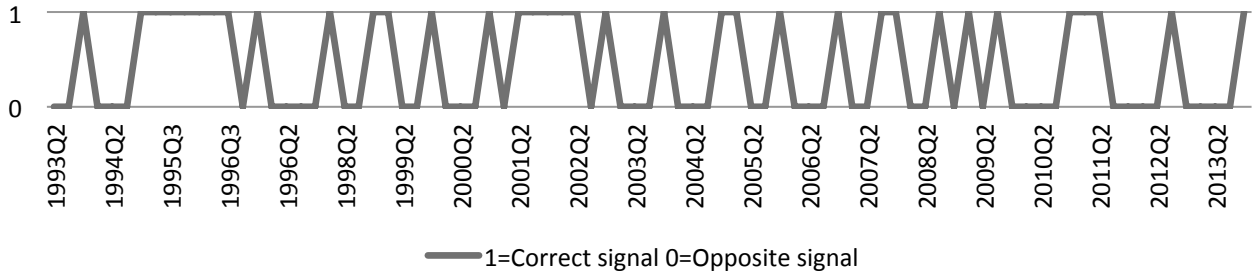
Correct signals overall: 70 % (21/30)
Correct signals after the financial crisis: 65 % (15/23)

Graph 11 shows that GDP and Employment move quite well in the same direction. The graph also confirms the cross-correlation test in table 5, that employment leads GDP. This can also be seen in graph 12 where the indicator is relatively stable and show many correct signals when it leads by two quarters. Employment did however not provide correct signals during 2008.

Graph 13 - Percentage Change in GDP - Claims of Unemployment



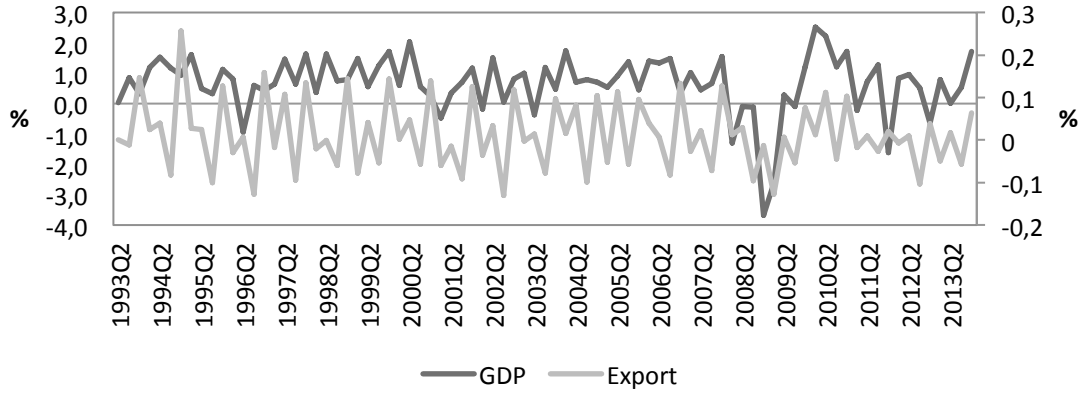
Graph 14 - Correct and Opposite signals GDP – Claims Of Unemployment



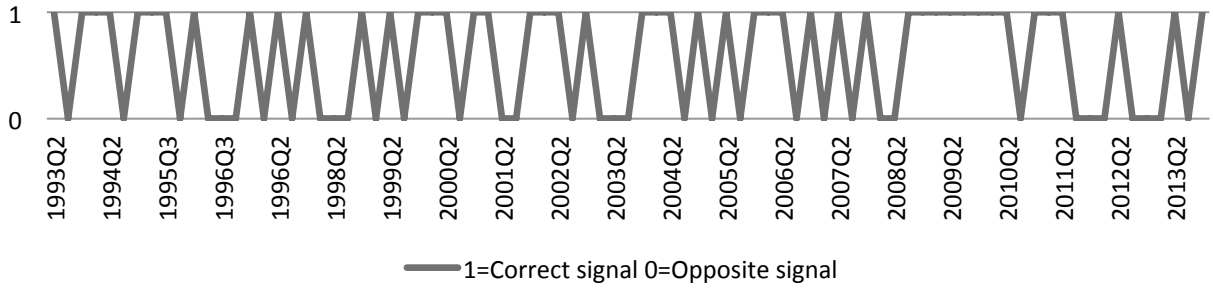
Correct signals overall: 42 % (35/83)
Correct signals after the financial crisis: 35 % (8/23)

Claims of unemployment change in opposite direction of GDP. This is confirmed through a negative linear relationship in the correlation test from table 4. This can also be seen in graph 13 where claims of unemployment rise when GDP decreases. No consistency can be seen in graph 14.

Graph 15 - Percentage Change in GDP - Export



Graph 16 - Correct and Opposite Signals - GDP - Export



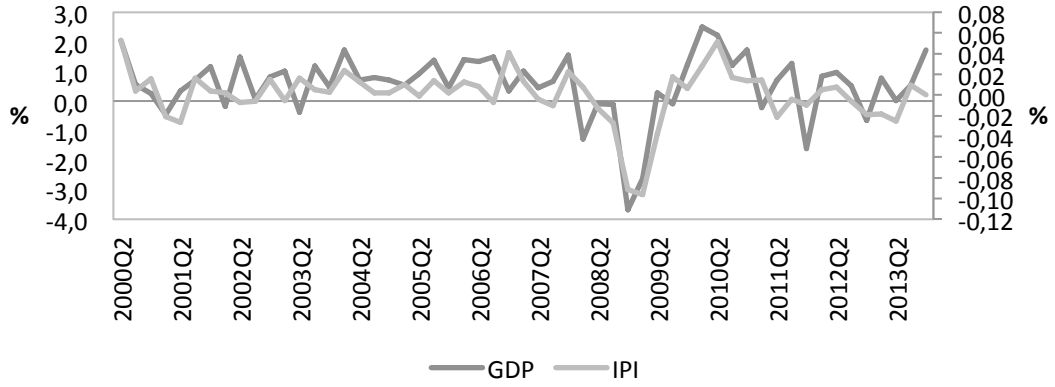
Correct signals overall: 57 % (47/83)
Correct signals after the financial crisis: 61 % (14/23)

Graph 17 - Trend Adjusted - 4 Months Moving Average

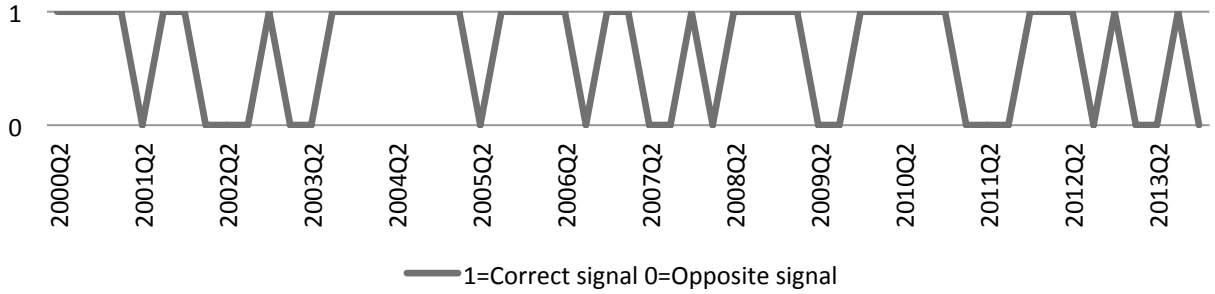
When it comes to Swedish Export, a seasonal pattern is seen in graph 15. The time series follows a yearly pattern consisting of high positive changes compared to the previous quarter. After that the change decreases in the subsequent quarter. A small increase follows and lastly a large decrease is seen. However, after the financial crisis in 2008, the pattern does not move with the same amplitude as it did before. In some quarters the previous pattern seem completely disrupted.

To smooth out the seasonal pattern in export a moving average of one year is conducted in graph 16. Here one can see that export follow GDP quite well. However in some quarters a lagging movement can be seen. When studying correct and opposite signals in graph 17, an interesting phenomenon is seen. From the financial crisis in 2008 export provide correct signals for two year. This suggests that export is a more reliable indicator during recession, since this is not supported during other time periods.

Graph 17 - Percentage Change GDP - IPI



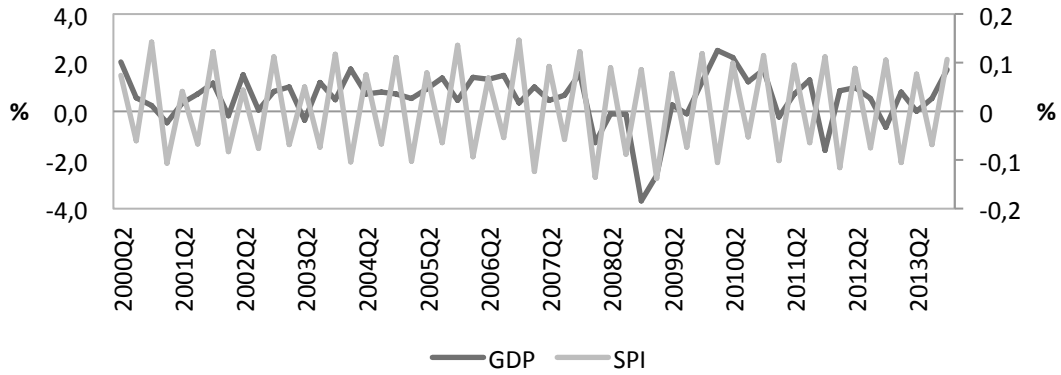
Graph 18 - Correct and Opposite Signals - GDP - IPI



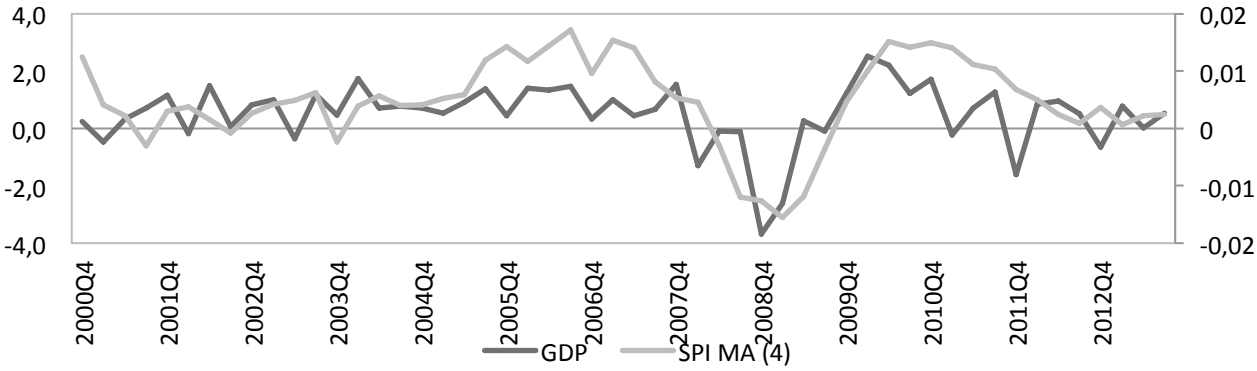
Correct signals overall: 64 % (35/55)
Correct signals after the financial crisis: 61 % (14/23)

Changes in IPI follow changes in GDP. On a few occasions IPI can be seen to move in the opposite direction, this is confirmed in both graph 18 and 19. From table 4 in the next section it is noticed that IPI correlates to a high extent with GDP, this can also be seen in the above graphs. In graph 19, IPI appear to be relatively stable, providing many correct signals compared to other indicators.

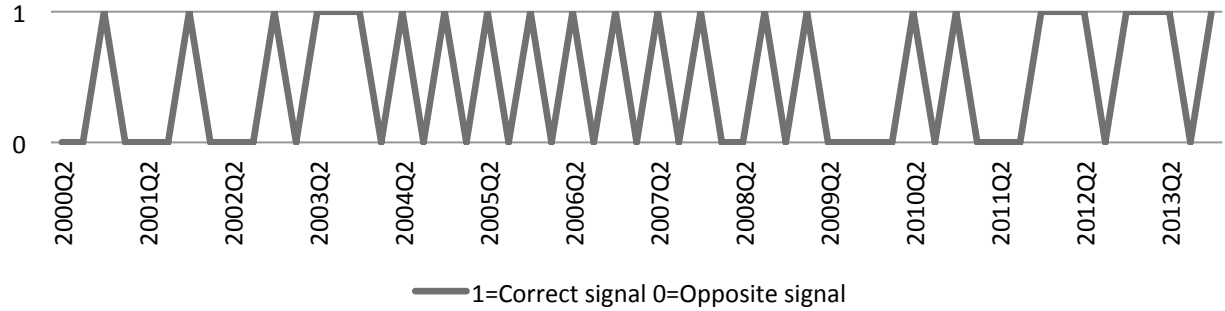
Graph 19 - Percentage Change in GDP - SPI



Graph 20 - Trend Adjusted – 4 Quarter Moving Average



Graph 21 - Correct and Opposite Signals - GDP - SPI t+1



Correct signals overall: 46 % (25/54)
Correct signals after the financial crisis: 48 % (11/23)

In graph 20, SPI show seasonal trends. Large positive changes each winter is followed by negative changes during spring. Positive changes during summers are seen, however, somewhat lower compared to winter season. When autumn appears, a negative change is seen again. A general reflection over the different seasonal patterns is higher demand during winter and summer periods. The service section experience higher workload in for instance skiing resorts while Swedish coasts experience more pressure during summer seasons. This pattern is consistent during the whole time period except for the winter season after the financial crisis. Here, the peak is at the same level as the surrounding summer season and extensively lower compared to previous winter seasons.

Moving average of four quarters is implemented on SPI to smooth out the seasonal effect; this can be seen in graph 21. In this graph 22, lagging characteristic of SPI is seen, which confirm the findings in table 5, cross-correlation test where SPI lag with on quarter.

4.3 Regression models

Table 6 shows ten simple linear regressions of GDP growth against each economic variable. Focus here is to examine if the economic indicators are significant and how much explanatory

power they provide in relation to GDP growth, adjusted R^2 is considered in the later section when an interaction term is included.

Table 6 - Simple Linear Regression

Independent variable	Intercept	Coefficient	F-stat	R^2	Adjusted R^2	N
Financial indicators						
Term Spread	-0.019	0.512***	15.100	0.201	0.188	62
	(0.201)	(0.132)				
OMXSPI	0.625	1.368	2.249	0.027	0.015	83
	(0.106)	(0.910)				
Survey-based indicators						
PMI	0.630	1.516	1.381	0.019	0.005	75
	(0.114)	(1.292)				
CCI	0.652	0.793	0.228	0.003	-0.010	83
	(0.106)	(1.660)				
RTI	0.608	6.195	0.798	0.010	-0.002	83
	(0.119)	(6.933)				
Real economy indicators						
Employment	0.475	2.204	0.390	0.012	-0.019	34
	(0.223)	(3.527)				
Claims of unemployment	0.644	-1.071***	11.732	0.127	0.116	83
	(0.0987)	(0.313)				
Export	0.622	2.688**	4.428	0.052	0.040	83
	(0.104)	(1.277)				
IPI	0.545	30.336***	55.946	0.514	0.514	55
	(0.103)	(4.056)				
SPI	0.553	0.600	0.149	0.003	-0.016	55
	(0.148)	(1.555)				

*** Significant at 0.01 level
** Significant at 0.05 level
* Significant at 0.1 level
Standard error within brackets
GDP growth as dependent variable

Term Spread, Claims of Unemployment and IPI are significant at a 1 % level, Export is significant at a 5 % level while OMXSPI, PMI, CCI, RTI, Employment and SPI are insignificant. The explanatory power, R^2 is higher for the indicators that show significance compared to those that are insignificant, where IPI have the highest explanatory power of 51,4 %. Interesting comparisons can be drawn from table 4 where Term Spread and IPI show high correlation. Here it is noticed that a stronger linear relationship generate more reliable information, they also provide accuracy, through relatively high R^2. Claim of Unemployment however has negative correlation but still high R^2 and is significant. OMXSPI, PMI, CCI, RTI, Employment and SPI have all low correlation except PMI but are insignificant in relation to GDP. These indicators, except PMI, has a weak relationship with GDP, therefore its interpretation alone do not provide any information in relation to GDP growth.

Table 7 shows regressions when lag structures are used instead of coincident time series. The reason for this is to see if the explanatory power and significance for these

indicators change compared to the table 6. The table below is based on each indicator's highest correlation from the Cross-Correlations, in table 5.

Table 7 - Simple Linear Regression Including Lag-Structure

Independent variable	Intercept	Coefficient	F-stat	R^2	Adjusted R^2	N
Term spread t-1	-0.205	0.663***	29.942	0.337	0.325	61
	(0.185)	(0.121)				
OMXSPI t-1	0.596	2.984***	11.918	0.130	0.119	82
	(0.101)	(0.864)				
CCI t-2	0.629	5.247***	10.980	0.122	0.111	81
	(0.102)	(1.584)				
RTI t-1	0.563	12.554*	3.355	0.040	0.028	82
	(0.118)	(6.854)				
Employment t-2	0.473	10.196***	10.008	0.250	0.225	32
	(0.205)	(3.223)				
SPI t+1	0.527	1.433	0.856	0.016	-0.003	54
	(0.148)	(1.550)				

*** Significant at 0.01 level
** Significant at 0.05 level
* Significant at 0.1 level
Standard error within brackets
GDP growth as dependent variable

Term Spread t-1, OMXSPI t-1, CCI t-2 and Employment t-2 are all significant at a 1% level. RTI t-1 is significant at a 10 % level and SPI t+1 is insignificant. Again the variables that show significance have higher explanatory power, however none with an R^2 above 33,7 %. When comparing numbers from table 7 with table 6, interesting results can be seen. Based on the lag structure, all indicators show higher R^2 compared to previous model. This indicates that they provide more information when they either lead or lag GDP growth. For example, Term Spread is still significant at a 1 % level. This means that Term spread is significant in both models. However, the regression model where Term Spread leads generates a better fit compared to when Term Spread coincide. To be more precise, term spread explain GDP growth better when it give leading signals. Furthermore, OMXSPI, CCI, RTI and Employment show significance when they lead by one or two quarters compared to table 6, where they all are insignificant. The above results can be interpreted as Term Spread, OMXSPI, CCI and Employment have leading abilities. SPI does not generate significance even when the lag structure is considered.

Table 8 includes an interaction term (dummy variable) for the financial crisis in 2008. There are different views of when the financial crisis actually occurred. The authors have therefore conducted a linear regressions test with an interaction binary variable for each quarter between 2008Q1-2009Q3. Highest overall R^2 is found in the second quarter of 2008. Therefore, 2008Q2 is chosen to represent the financial crisis.

Table 8 - Simple Linear Regression Including Interaction Term

Independent variable	Intercept	Coefficient	Coefficient Indicator*D	F-stat	R^2	Adjusted R^2	N
Financial indicators							
Term Spread	-0.063	0.590***	-0.131	7.821	0.210	0.183	62
	(0.209)	(0.165)	(0.165)				
OMXSPI	0.630	0.772	2.710***	1.921	0.046	0.022	83
	(0.106)	(1.022)	(2.158)				
Survey-based indicators							
PMI	-4.295	0.091***	-0.000	19.565	0.352	0.334	75
	(0.813)	(0.015)	(0.004)				
CCI	0.655	0.303	1.327	0.187	0.005	-0.020	83
	(0.107)	(2.099)	(3.448)				
RTI	0.603	4.948	11.200	0.576	0.014	-0.010	83
	(0.120)	(7.264)	(18.655)				
Real economy indicators							
Employment	0.482	7.381	-5.674	0.290	0.018	-0.045	34
	(0.226)	(12.109)	(12.680)				
Claims of unemployment	0.652	1.243	9.016***	5.912	0.129	0.107	83
	(0.101)	(1.347)	(3.392)				
Export	0.649	1.304	8.642**	5.595	0.123	0.101	83
	(0.101)	(1.351)	(3.399)				
IPI	0.627	14.479*	21.216**	32.481	0.555	0.538	55
	(0.106)	(8.164)	(9.585)				
SPI	0.553	1.102	-1.183	0.143	0.005	-0.033	55
	(0.149)	(2.064)	(3.164)				

*** Significant at 0.01 level
** Significant at 0.05 level
* Significant at 0.1 level
Standard error within brackets
GDP growth as dependent variable

Table 9 - Explanatory Power Comparing Table 6 and Table 8

Independent variable	Simple linear regression Adjusted R^2	Regression with Interaction dummy Adjusted R^2	Higher/Lower explanatory power*
Financial indicators			
Term Spread	0.188	0.183	Lower
OMXSPI	0.015	0.022	Higher
Survey-based indicators			
PMI	0.005	0.334	Much Higher
CCI	-0.010	-0.020	Higher
RTI	-0.002	-0.010	Higher
Real economy indicators			
Employment	-0.019	-0.045	Higher
Claims of unemployment	0.116	0.107	Lower
Export	0.040	0.101	Higher
IPI	0.514	0.538	Higher
SPI	-0.016	-0.033	Higher

*Higher = higher value in Regression with interaction dummy Adjusted R^2
Lower = lower value of Regression with interaction dummy Adjusted R^2

This section discusses table 8, however in the light of table 9, which includes a comprehensive understanding of explanatory changes. The coefficient of the interaction term for Term Spread and PMI show no significance, while the indicator coefficient is significant. Something has happened to these indicators; they describe, to a higher extent, the relationship

with GDP, before the financial crisis than afterwards. These indicators do not provide the same accuracy after the financial crisis. Adjusted R^2 have made a distinct increase in PMI in the regression model with interaction dummy variable while it is at somewhat lower level for Term Spread. Since R^2 for PMI increases this confirms that the latter regression model is better. Hence, PMI has not been stable during the chosen time period.

OMXSPI, Claims of Unemployment and Export show insignificant coefficients but the interaction dummy variable for each indicator is significant. Therefore, the three indicators do not provide general significance in relation to GDP, however after the financial crisis; the variables show a relationship with GDP. Furthermore, they explain the variation in GDP growth more consistently after the financial crisis compared to the whole time period. When an interaction term is included, OMXSPI and Export have higher R^2 while Claims of Unemployment indicate a lower R^2.

CCI, RTI and SPI in table 8 show no significance, this is still the same as in table 6, when no interaction term is included. The interpretation of this is that some indicators cannot describe GDP well during the whole time period and no improvement is seen after the financial crisis either. The only indicator that shows a significant indicator and interaction coefficient is IPI. Furthermore it also increases its explanatory power from 51,4 % to 53,8%, which is relatively high during the whole time period but still increases when an interaction term is included.

Again, lag structures based on the Cross-Correlation test are included. Table 10 show the coefficients of the lagged values when an interaction term is included. Below follows a discussion of the tests explanatory power and significance.

Table 10 - Lag Structure with Interaction Term

Independent variable	Intercept	Coefficient	Coefficient Indicator*D	F-statistic	R^2	Adjusted R^2	N
Term spread t-1	-0.212	0.676***	-0.022	14.733	0.337	0.314	61
	(0.194)	(0.153)	(0.154)				
OMXSPI t-1	0.610	1.535*	6.677***	12.676	0.243	0.224	82
	(0.095)	(0.914)	(1.942)				
CCI t-2	0.646	3.112	5.952*	7.320	0.158	0.136	81
	(0.101)	(1.950)	(3.259)				
RTI t-1	0.551	9.398	28.219	2.907	0.069	0.045	82
	(0.118)	(7.094)	(18.212)				
Employment t-2	0.487	22.019**	-13.003	5.747	0.284	0.234	32
	(0.205)	(10.613)	(11.128)				
SPI t+1	0.525	0.616	1.906	0.606	0.023	-0.015	54
	(0.149)	(2.061)	(3.145)				

*** Significant at 0.01 level
** Significant at 0.05 level
* Significant at 0.1 level
Standard error within brackets
GDP growth as dependent variable

Table 11 - Comparison Between Explanatory Power in Lag Structure from Table 7 and Table 10

Independent variable	Simple linear regression Adjusted R^2	Regression with Interaction dummy Adjusted R^2	Higher/Lower explanatory power*
Term spread t-1	0.325	0.314	Lower
OMXSPI t-1	0.119	0.224	Higher
CCI t-2	0.111	0.136	Higher
RTI t-1	0.028	0.045	Higher
Employment t-2	0.225	0.234	Higher
SPI t+1	-0.003	-0.015	Higher

*Higher = higher value in Regression with interaction dummy Adjusted R^2
Lower = lower value of Regression with interaction dummy Adjusted R^2

Term Spread t-1, and Employment t-2 show significant coefficients and insignificant coefficient interaction dummy variables. Here the same result of Term Spread is seen as when it is coincident in table 6 and 8. However, Adjusted R^2 is much higher when Term Spread lead compared to when it was coincident. CCI t-2 shows an insignificant coefficient but is significant for the interaction term. CCI t-2 indicates a relationship with GDP growth after the financial crisis. Previously it showed no significance and is therefore of no use when it explains GDP growth if it does not lead. However, OMXSPI t-1 has both significant values in the coefficient and coefficient of interaction term and its overall explanatory power has increased. RTI t-1 and SPI t+1 show no significance of either the coefficient or coefficient of the interaction term. In table 8 when lags are not included, the variables are also insignificant. Therefore the two variables do not provide guidance in relation to GDP growth. They might add value when a multiple regression model is consider, however this is not covered in this thesis.

All the above regressions only include one independent variable. Omitted variable bias can therefore be a cause due to overestimation or underestimation of each single indicator and its relationship to GDP growth. This is however not accounted for in this thesis.

5 Discussion

In this section the empirical findings will be discussed and analysed more in depth. The discussion will relate findings from theory and previous literature to the empirical results. This section is divided into three parts; Financial, Survey-based and Real economy indicators where the results are discussed with respect to each category and the included indicators.

5.1 Financial indicators

Term Spread and OMXSPI show leading abilities by one quarter. Financial indicators can therefore be used as leading indicators; similar evidence has previously been stated by Mitchell and Burns (1961). Graph 2 and Graph 4 indicate that Term Spread shows correct signals 50 % of the time while OMXSPI has a higher reliability and shows in total 70 % correct signals. Stock and Watson (2003b) state that financial indicators are unstable. Neither of the financial indicators is consistent as the indicators' significance changes. These results are also expected as financial indicators are highly affected by economic shocks.

Cross-correlation table 5 shows relatively high correlation between Term Spread and GDP, up to three quarters in advance. Wheelock and Wohar (2009) argue that Term Spread provides valid information six to twelve months in advance, however this cannot be supported here. Additionally, the empirical findings do not support Stock and Watson's (2003b) findings that Term Spread is the more stable compared to other financial indicators. Hence, it is an unstable indicator. However, when it leads by one quarter it has the second highest adjusted R^2, which implies that it provides good accuracy compared to most of the other indicators.

Estrella and Mishkin (1998) suggest that stock prices accurately predict recessions one to three quarters ahead the recession. Graph 4 shows that OMXSPI provides accurate signals one year before and after the financial crisis started in 2008, when it leads GDP by one quarter, which supports the previous literature. OMXSPI has a relatively low adjusted R^2 but the value doubles when the interaction term is included. Its connection to GDP is therefore low during the whole time period; however it becomes stronger after the recession. Since the relationship is not consistent for the test period as a whole, OMXSPI is unstable. This is consistent with Drechsel and Scheufele's (2010) and Stock and Watson's (2003b) findings that stock prices are unstable when predicting GDP. One reason for OMXSPI to provide better predictions in the period after the financial crises can be connected to investors' becoming more realistic during crisis. One possibility can be that investors to a higher extent

base decisions on the current economic condition, which increases the relationship between OMXSPI and GDP growth.

5.2 Survey-based indicators

When analysing survey-based indicators the empirical findings support to a high degree Drechsel and Scheufele's (2010) findings that survey-based indicators have leading abilities. Both CCI and RTI show these characteristics, while this cannot be supported for PMI. Survey-based indicators show no consistency in significance for the whole time, not even when the financial crisis is accounted for. Therefore, survey-based indicators are an unstable category.

People's perceptions of the current business environment and expectations for the future are included in survey based indicators. When these are incorrect and differ from the actual outcome, its relation to GDP growth cannot be supported. Since the empirical findings show that survey-based indicators are unstable, it can be interpreted as the reliability, accuracy and consistency in people's perceptions and expectations vary over time. This makes it difficult to trust survey-based indicators.

Moore (1961) mentions two informational perspectives that need to be considered; early but irregular in depth information or early signals, which contain little information. Survey-based indicators are seen as an unstable category; however they can still be of value since they are leading indicators. Hence, they support the first perspective Moore (1961) states.

The empirical findings support Boström (2013) that PMI no longer provides accurate signals, hence supported in all tests. PMI's coefficient is significant when including an interaction term. This indicates that it had a linear relation to GDP growth before the financial crisis. Adjusted R^2 also increased drastically in the model when an interaction term is included. This suggests that PMI previously was a good predictor of GDP growth, but this is no longer the case. A change in consistent signals after the financial crisis is seen in many of the tested indicators. However, no indicator changes in the same magnitude as PMI. This suggests that something specific within PMI has changed, and not only the overall economy and its relation to PMI.

CCI is significant in the linear regression model when it leads by two quarters. In table 11, when an interaction term is included, the coefficient is significant for the period after the financial crisis and the adjusted R^2 increases, even though it is still low. Hence, CCI leading with two quarters is a better predictor since the crisis started and provides information of

movements in GDP. This confirms Taylor and McNabb's (2007) and Batchelor and Dua's (1998) findings that it is a good predictor in economic downturns. It is expected that CCI has a relation to GDP growth, as consumption is part of aggregated GDP, seen in Dornbusch et al. (2011). Its close relationship during the crisis can indicate that consumers' role in the economy increase during this period. Therefore, consumers' expectations of future consumption impact GDP more during crisis compared to the overall business cycle. Even though it is a better predictor, its reliability after the financial crisis has not increased when observing correct and opposite signals in graph 8, hence CCI is an unstable indicator.

RTI shows low correlation to GDP and is most useful when it leads by one quarter. This rejects Winton and Ralph's (2011) view that it should be used as a coincident indicator. Empirically RTI is only statistically significant at a 10 % level in the simple linear regression model when it leads by one quarter, shown in table 7. This low significant level and insignificant levels of RTI in the other models indicate that changes in GDP statistically cannot be argued to have a relation to changes in RTI. Even though Winton and Ralph (2011) argue that values of retail sales makes up for a large fraction of GDP. RTI as an index cannot be argued to provide valuable information according to the empirical findings. Additionally, table 7 and 10 show large standard errors, indicating a high deviation from the sample mean. Hence, RTI is proven to be an unstable indicator.

5.3 Real economy indicators

Real economy indicators are coincident with GDP as they are based on hard data (Banbura & Rüstler, 2007). Three out of five indicators in this thesis confirm previous literature as Claims of unemployment, Export and IPI coincide with GDP. The first two are also statistically significant both during the whole time period and also for the coefficient of the interaction term, in the second model. IPI is however an exception and is significant for all coefficients in both regression models, which can indicate that it is relatively stable. However, stability of real economy indicators as a category is not justified, as Employment t-2, Claims of unemployment and Export, change when the interaction term is included. Banbura and Rünstler (2007) argue that when using hard data (real-economy data) information of current economic signals are more precise. However, when indicators are used for predicting soft data (survey-based data), their leading ability are more useful. This is confirmed in the empirical findings. Therefore, the user needs to have knowledge of each indicator and understand its usefulness during different time periods, to obtain an accurate result.

In the empirical findings, Employment shows leading ability by two quarters. However, this contradict Stock and Watson (1999;2003a) who argue that Employment is a coincident indicator and sometimes even lag. Graph 12 shows that employment is a relatively stable indicator when it comes to providing correct signals. Employment leading with two quarters is significant for the whole time period in the first regression model; the interaction term becomes insignificant in the second model. This suggests that it was a better predictor before the financial crisis but it is unstable during the overall time period. However, due to employment's relatively short sample period, the findings regarding the indicator can be questioned.

Claims of unemployment is significant both in the simple linear regression model and when an interaction term is included. This can suggest that the relationship shown in the first model comes from the data in quarters after the financial crisis. Furthermore, it has high statistical significance and Claims of unemployment has a stronger relationship with GDP after the financial crisis started. However, this suggests that it is an unstable indicator. Dorndusch et al. (2011) discuss that inflexibility often can be seen in the labor markets. The reason for a significant relationship between the labor market and GDP in this case can therefore depend on an increased flexibility during a recession. Claims of unemployment is more justified when businesses are experience slowdowns and losses and therefore becomes more flexible.

Export has a strong connection to GDP as it is part of the aggregated data included to compute GDP. Therefore, there are a relationship between GDP and Export (Feenstra and Taylor, 2011; Kavoussi, 1982). This is supported in the empirical findings where Export is statistically significant in the simple regression and for the coefficient of the interaction term in the latter model. Additionally, adjusted R^2 increases. This implies that the model's predictability increases when the period after the financial crisis is considered and export has therefore a stronger connection to GDP during this period. This is also something that is confirmed in graph 17, where it provides correct signals for two years after the crisis started, hence the indicator is unstable. Since Sweden is a country dependent to a high extent on exports, the empirical findings shows that this relationship is even more important to GDP during a recession.

IPI is the indicator that shows highest correlation with GDP and overall provides many correct signals. IPI is also the indicator with highest adjusted R^2. All coefficients are significant in both regression models. Hence, it should be considered a reliable and relatively stable indicator. The reason for IPI being the best performing indicator can be closely

connected to the fact that industrial production accounts for one of the main variations of a country's output, stated by Hosely and Kennedy (1985).

SPI is the worst performing indicator according to the empirical findings. No statistically significance relation to GDP is found, not even when it lags one quarter. With respect these findings SPI is an unstable indicator. This reject Layton and Moore's (1989) statement that SPI is more stable compared to IPI.

The purpose of this thesis is to examine if indicators are stable or not. The intention is not to explain what causes instability in indicators. Furthermore, not to prove if the indicators or the economy has changed since the financial crisis. However, all tested indicators, except IPI, show instability and have different relationships with GDP after the financial crisis. Based on the findings, the authors think that the economy has changed during recent time, which has affected the relationship between GDP and indicators. An exception is seen in PMI. However, further research needs to be conducted in order to confirm this.

Table 12 – Summary - Empirical findings of indicators

Financial indicators		
Term Spread	Unstable	Better predictions before the financial crisis started
OMXSPI	Unstable	Better predictions after the financial crisis started
Survey-based indicators		
PMI	Unstable	Sign. before the financial crisis, largest change of all indictors
CCI	Unstable	Better predictions after the financial crisis started
RTI	Unstable	Changes in RTI have low relations to GDP growth
Real economy indicators		
Employment	Unstable	Better predictions before the financial crisis started
Claims of unemployment	Unstable	Better predictions after the financial crisis started
Export	Unstable	Better predictions after the financial crisis started
IPI	Relatively stable	Highest correlation and explanatory power
SPI	Unstable	Worst performing indicator, no sign. to GDP

6 Conclusion

This section concludes the main findings from the conducted research. It fulfils the purpose of this thesis and answer concerns formulated in the background and problem discussion. Lastly, limitations are presented and suggestions of future research are made.

The authors examine stability in Swedish economic and business cycle indicators with respect to GDP growth. Ten indicators within the categories; financial, survey-based and real-economy indicators are analysed. Stability is studied by conducting tests that examine reliability, accuracy and consistency in signals compared to GDP growth. A comparison of stability is made before and after the financial crisis started in 2008. This research shows that nine out of ten indicators are unstable. IPI is the indicator that performed best and proves to be relatively stable over time. The conducted research confirms Boström's (2013) initial statement that PMI has shown inconsistent signals during resent time. In this study, PMI provides a bigger change over time compared to other indicators. This could be interpreted as something within the indicator has changed and not only the overall economic condition between PMI and GDP.

Based on the lag structure, leading and lagging generalizations can be made between categories. Financial and survey-based indicators lead economic changes, while real-economy indicators coincide and confirm the economy. SPI is an exception, showing lagging characteristics. PMI and Employment provide correct signals of GDP's direction 70 % of the time during the whole period, this confirms its reliability. Interesting results however, show that PMI made a distinct decrease after the financial crisis, again confirming Boström (2013) concerns. Overall, IPI provided most accurate and prominent results, showing an explanatory power of above 50 %. PMI's explanatory power made an extensive increase when accounting for the financial crisis. Generally, the explanatory power increases when indicators have leading or lagging abilities. The study concludes that financial indicators have higher accuracy compared to survey-based and real economy.

The only indicator that provides consistency during the whole time period is IPI. The other indicators relationship to GDP changes when accounting for the financial crisis. When Term Spread and Employment leads and PMI coincide, they indicate a stronger relationship to GDP before the financial crisis. However, a stronger relationship with GDP after the financial crisis is seen for OMXSPI and CCI when leading together with a coincident Export and Claims of Unemployment. Hence, these indicators perform better during recessions. SPI

shall be excluded when analysing economic changes in GDP since it does not have any relationship to GDP.

The conclusion drawn from this thesis is that some indicators are useful when analysing the overall economy, while others are better at predicting economic changes. However, an important issue is that most of them are not stable and cannot be trusted over longer time periods. Another important aspect is also to consider the advantages and disadvantages of using these indicators.

6.1 Limitations and Suggestions for Future Research

A limitation is the number of indicators in each category. The selected indicators accounts for different economic perspectives. They are based on precious literature, how useful they are for different players in the market and data availability, which adds credibility to the work. The number of indicators in each category is therefore not even; this can bias the results when making generalizations of each category. Comparisons are made between indicators that include different time frames. Based on the empirical findings, the relationship between the indicators and GDP change over time. Therefore, a direct comparison might give misleading information of their performance in relation to one another. Since the test period is limited to the data availability in GDP, it would be interesting to conduct a similar research in a few years including a larger sample size and observe if the same conclusions can be made.

Furthermore, for future research it would also be interesting to include two additional categories that Drechsel and Scheufele (2010) define: prices and wages indicators as well as composite indicators. Including a wider range of indicators in each category can provide a better picture of how indicators perform in relation to GDP. The aim of this thesis is to examine stability of indicators in Sweden. However, in the analysis and discussion section the authors argue whether it is the indicators or the economy that causes the relationship between them to become unstable. On interesting aspect would be to investigate this matter more into depth, and get a deeper knowledge of how these relationships changes over time. Additionally, Swedish indicators can be observed against other countries indicators to see their performance in relation to foreign indicators.

During the authors' research of previous literature, new ways of developing indicators have been noticed, mainly within the it-and technology area. By considering for instance Google-trends, economic changes can be predicted. If this new way of observing economic change becomes established, interesting comparisons could be made to see if the "old" or "new" way of indicating change provide consistent signals in relations to GDP growth.

7 References

Aczel, A.D., & Sounderpandian, J. (2009). *Complete Business Statistics 7th ed.* New York: McGraw-Hill/Irwin.

Al-Eyd, A., Barrell, R., & Davis, E.P. (2009). Consumer Confidence Indices and Short Term Forecasting of Consumption. *The Manchester School*, 77(1), 96-111.

Ang, A., Piazzesi, M., & Wei, M. (2006). What does the yield curve tell us about GDP growth?. *Journal of Econometrics,* 131(1), 359-403.

Arbetsförmedlingen. (2014) Varselstatistik. Retrieved May 10, 2014, from http://www.arbetsformedlingen.se/Om-oss/Statistik-prognoser/Varselstatistik.html

Bahlenberg, J. (2013). *Hårddata kommer korrelera bättre med indikatorer – Hansson.* Retrieved January 29, 2014, from https://www.avanza.se/placera/telegram/2013/12/18/ki-harddata-kommer-korrelera-battre-med-indikatorer-hansson.html

Banbura, A., & Rüstler, G. (2011). A Look Into the Factor Model Black Box: Publication Lags and the Role of Hard and Soft Data in Forecasting GDP. *International Journal of Forecasting,* 27(1), 333-346.

Banerjee, A., Marcellino, M., & Masten, I. (2005). Leading Indicators for Euro-area Inflation and GDP Growth. *Oxford Bulletin of Economics and Statistics,* 67, 785-813.

Batchelor, R., & Dua, P. (1998). Improving macro-economic forecasts: the role of consumer confidence. *International Journal of Forecasting,* 14(1), 71–81.

Bernanke, B.S., & Blinder, A.S. (1992). The Federal Funds Rate and the Channels of Monetary Transmission. *The American Economic Review,* 82(4), 901-921.

Boström, M. (2013). *Research Sweden – What do make of PMI?*. Retrieved January 20, 2014, from http://danskeresearch.danskebank.com/link/ResearchSwedenPMI031213/$file/Research_Sweden_PMI_031213.pdf

Carroll, C.D., & Fuhrer, J.C., & Wilcox, D. (1994). Does Consumer Sentiment Forecast Household Spending? If So, Why?. *The American Economic Review,* 84(5), 1397-1408.

Chatfiels, C. (2004). *The Analysis of Time Series 6th edition*. New York: Chapman & Hall/CRC.

Clemen, R.T. (1989). Combining forecast: A review and annotated bibliography. *International Journal of Forecasting*, 5(4), 559-583.

Cooper, D.R., & Schindler, P.S. (2011). *Business Research Methods, 11th ed.* New York: McGraw-Hill/Irwin.

Danske Bank Research. (2014a). *Research*. Retrived March 2, 2014, from http://danskebank.com/en-uk/ci/Products-Services/Markets/Research/Pages/research.aspx

Danske Bank Research. (2014b). *About Research.* Retrieved March 2, 2014 from http://www-2.danskebank.com/danskeresearch

Dornbusch, R., Fischer, S., & Startz, R. (2011). *Macroeconomics, 11th ed.* New York: McGraw-Hill Companies, Inc.

Drechsel, K, & Scheufele, R. (2010). Should we trust in leading indicators? Evidence from the recent recession. *IWH-Discussion Papers,* No 10.

Elliott, G., Granger, C. W. J., & Timmermann, A. (2006). *Handbook of Economic Forecasting, Vol 1.* Amsterdam: Elsevier.

Erlandsson, E., Friman, L. & Ström, K. (2013). *Omvärld i Förändring, Försäkringsbranchens Roll [pdf].* Retrieved March 4, 2014, from http://www.svenskforsakring.se/Global/Rapporter/SF_omvärld_A5_2013_web.pdf

Estrella, A., & Hardouvelis, G.A. (1991). The Term Structure as a Predictor of Real Economic Activity. *The Journal of Finance,* 46(2), 555-576.

Estrella, A., & Mishkin, F.S. (1997). The predictive power of the term structure of interest rates in Europe and the United States: Implications for the European Central Bank. *European Economic Review,* 41(7), 1375-1401.

Estrella, A., & Mishkin, F.S. (1998). Predicting U.S. Recessions: Financial Variables as Leading Indicators. *The Review of Economics and Statistics,* 80(1), 45-61.

Eurostat. (2012). *Nationalräkenskaper och BNP.* Retrieved March 9, 2014, from http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/National_accounts_and_GDP/sv

Feenstra, C.R., & Taylor, A.M. (2011). *International Trade, 2nd ed.* USA: Worth Publishers

Fisher, S., & Merton, R.C. (1984). Macroeconomics and Finance: The Role of the Stock Market. *NBER working paper series,* No. 1291.

Fregert, K & Jonung, L. (2010). *Makroekonomi – Teori, Politik och Institutioner.* Uppsala: Författarna och Studentlitteratur.

Friedman, B.M., & Wachter, M.L. (1974). Unemployment: Okun's Law, Labor Force, and Productivity. *The Review of Economics and Statistics,* 56(2), 167-176.

Frisch, R. (1933). Propagation Problems and Impulse Problems in Dynamic Economics. *Economic Essay in Honour of Gustav Cassel.* London: George Allen & Unwin Ltd.

Galvin, W.T., & Kliesen, K.L. (2002). Unemployment Insurance Claims and Economic Activity. *Federal Reserve Bank of St. Louis Review*, 84(3), 15-28.

Getz, P.M., & Ulmer, M.G. (1990). Diffusion indexes: a barometer of the economy. *Monthly Labor Review,* 113(4), 13-21.

Hansson, J., Jansson, P., & Löf, M. (2005). Business Survey Data: Do they help in forecasting GDP growth?. *International Journal of Forecasting,* 21(2), 377-389.

Harris, E.S. (1991). Tracing the Economy with the Purchasing Managers' Index. *FRBNY Quarterly Review,* Autumn, 61-69.

Hosley, J. D., & Kennedy, J.E. (1985). Revision of the Index of Industrial Production. *Federal Reserve Bulletin*, 71, 487-501.

Juglar C. (1862). Des Crises Commerciales et de leur retour périodique en France, en Angleterre et aux États-Unis. Paris: Guillaumin.

Karpaty, P., & Kneller, R. (2011). Demonstration or Congestion? Export Spillovers in Sweden. *Review of World Economics,* 147(1), 109-130.

Kauffman, R.G. (1999). Indicators Qualities of the NAPM Report on Business. *The Journal of Supply Chain Management,* 35(1), 29-37.

Kavoussi, R.M. (1982). Export Expansion and Economic Growth, Further Empirical Evidence. *Journal of Development Economics,* 14(1), 241-250.

Keynes, J.M. (2007) . *The General Theory of Employment, Interest and Money.*USA: Atlantic Publishers Distributors

Koenig, E.F. (2002). Using the Purchasing Managers' Index to Assess the Economy's strength and the Likely Direction of Monetary Policy. *Economic and Financial Policy Review*, 1(6), 1-14.

Kondratieff, N.D., & Stolper, W.F. (1935). The Long Waves in Economic Life. *The Review of Economics and Statistics*, 17(6), 105-115.

Koopman, T.J. (1947). Measurement without theory. *The Review of Economics and Statistics*, 29(3), 161-172.

Kuznets, S. (1961). Essays in the Quantitative Study of Economic Growth. *Economic Development and Cultural Change,* 9 (3), 225-248.

Layton, A.P., & Moore, G.M. (1989). Leading Indicators for the Service Sector. *Journal of Business and Economic Statistics*, 7(3), 379-386.

Ludvigson, S.C. (2004). Consumer Confidence and Consumer Spending. *Journal of Economic Perspectives*, 18(2), 29-55.

Matsusaka, J. G., & Sbordone, A. M. (1995). Consumer Confidence and Economic Fluctuations. *Economic Enquiry,* 33(2), 296–318.

Mitchell, J. (2009). Where are we now? The UK recession and nowcasting GDP growth statistical models. *National Institute Economic Review*, 209(1), 60-69.

Mitchell, W. C., & Burns, A.F. (1961). Statistical Indicators of Cyclical Revivals. In G.H. Moore (Ed.), *Business Cycle Indicators, vol 1,* (p. 162-183). Princeton: Princeton University Press for NBER.

Mitchell, W. C., & Burns, A.F. (1946). *Measuring Business Cycles.* New York: NBER.

Montgomery, A.L., Zarnowitz, V., Tsay, R.R., & Tiao, G.C. (1998). Forecasting the U.S. employment rate. *Journal of the American Statistical Association,* 93(442), 478-493.

Moore, G.H. (1961). Leading and Confirming Indicators of General Business Changes. In G.H. Moore (Ed.), *Business Cycle Indicators, vol 1,* (p. 45-109). Princeton: Princeton University Press for NBER.

Moore, G.H. (1991). New developments in leading indicators. In K. Lahiri and G.H. Moore (Eds.), *Leading economic indicators,* (p. 141-146), Cambridge: Cambridge University Press.

Moore, G.H. & Shiskin, J. (1967). An Explicit Scoring System for Business Cycle Indicators. In G.H. Moore & J. Shiskin (Eds.), *Indicators of Business Expansions and Contraction*, (p. 8-28). New York: Colombia University Press for NBER.

Nationalencyklopedin. (2014). *Konjunkturcykel.* Retrieved April 4, 2014, from http://www.ne.se/lang/konjunkturcykel

Newbold, P., Carlson, W.L., & Thorne B.M. (2013). *Statistics for Business and Economics 8th ed.* United Kingdom: Pearson Education.

NIER. (n.d.). *User guide to the Economic Tendency Survey [pdf]*. Retrieved March 8, 2014, from http://www.konj.se/download/18.2cabf50a141002857ee147b/User-Guide-Economic-Tendency-Survey.pdf

OECD. (2007). *Compilation Manual for an Index of Service Production [pdf]*. Retrieved March 9, 2014 from http://www.oecd.org/std/business-stats/37799074.pdf

Rasmussen, S. (2013). *Production Economics - The Basic Theory of Production Optimisation, 2nd ed.* Heidelberg: Springer.

Riksbank. (2011-09-30). *Makroindikatorer*. Retrieved January 30, 2014 from http://www.riksbank.se/sv/Statistik/Makroindikatorer/

Samuelson, P.A. (1939). A synthesis of the principle of acceleration and the multiplier. *Journal of Political Economy*, 47(6), 786–797.

Saunders, M., Lewis, P., & Thornhill A. (2012). *Research Methods for Business Students 6th ed.* Essex: Pearson Education Limited.

Statistics Sweden. (2008). *Bakgrundsfakta – Tjänsteproduktionsindex [pdf]*. Retrieved March 9, 2014, from http://www.scb.se/statistik/_publikationer/OV9999_2008A01_BR_X100BR0805.pdf

Statistics Sweden. (2013a). *Sveriges Ekonomi – Statistiskt perspektiv [pdf]*. Retrieved March 8, 2014 from http://www.scb.se/Statistik/_Publikationer/NR0001_2013K03_TI_A28TI1304.pdf

Statistics Sweden. (2013b). *Detaljhandelsindex (DHI)*. Retrieved April 7, 2014 from http://www.scb.se/sv_/Vara-tjanster/Index/Omsattning-och-handel/Detaljhandelsindex-DHI/

Statistics Sweden. (2014c). *Utrikeshandel med varor*. Retrieved May 10, 2014, from http://www.scb.se/sv_/Hitta-statistik/Statistik-efter-amne/Handel-med-varor-och-tjanster/Utrikeshandel/Utrikeshandel-med-varor/

Statistics Sweden. (2013d). *Industriproduktionsindex (IPI) [pdf]*. Retrieved April 25, 2014, from http://www.scb.se/Statistik/NV/NV0402/_dokument/NV0402_DO_2013.pdf

Statistics Sweden. (2014a). *National Accounts, quarterly and annual estimates*. Retrived April 2, 2014 from http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/National-Accounts/National-Accounts/National-Accounts-quarterly-and-annual-estimates/

Statistics Sweden. (2014b). *Economic Statistics - Consumer Tendency Survey*. Retrieved May 10, 2014, from http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Other/General-statistics/Economic-statistics/Aktuell-Pong/31243/EK0206eng/32258/

Statistics Sweden. (2014c). *Labour Force Survey*. Retrieved May 10, 2014, from http://www.scb.se/en_/Finding-statistics/Statistics-by-subjectarea/Labourmarket/Labour-force-surveys/Labour-Force-Survey-LFS/

Stock, J.H., & Watson, M.W. (1999). Business Cycle Fluctuations in US Macroeconomic Time Series. In J. Taylor & M. Woodford (Eds.), *Handbook of Macroeconomic, Vol 1A,* (p. 3-64). Amsterdam: Elsevier.

Stock, J.H., & Watson, M.W. (2003a). How Did Leading Indicators Forecasts Perform During the 2001 Recession?. *Economic Quarterly - Federal Reserve Bank of Richmond*, 89(3), 71-90.

Stock, J.H., & Watson, M.W. (2003b). Forecasting Output and Inflation: The Role of Asset Prices. *Journal of Economic Literature,* 41(3), 778-829.

Stock, J. H., & Watson, M. W. (2012). *Introduction to Econometrics 3rd ed.* New York: Person Education.

Swedbank. (2014). *Mål och metodik för Inköpschefsindex*. Retrieved January 31, 2014 from http://www.swedbank.se/omswedbank/analyser/samhallsekonomi/inkopschefsindex/inkopschefsindex,-mal-och-metodik/index.htm

Taylor, K., & McNabb, R. (2007). Business Cycles and the Role of Confidence: Evidence for Europe. *Oxford Bulletin of Economics and Statistics*, 69(2), 185-205.

The NASDAQ OMX Group Inc. (2014). OMX Stockholm_PI (OMXSPI) - Overview. Retrieved May 10, 2014, from https://indexes.nasdaqomx.com/Index/Overview/OMXSPI

Tyler, W.G. (1981). Growth and Export Expansion in Developing Countries: Some Empirical Evidence. *Journal of Development Economics,* 9(1), 121-130.

Winton, J., & Ralph, J. (2011) Measuring the accuracy of the Retail Sales Index. *Economic and Labour Market Review*, 5(2), 88.

Wheelock, D.C., & Wohar, M.E. (2009). Can the Term Spread Predict Output Growth and Recessions? A survey of the literature. *Federal Reserve Bank of St. Louis Review*, 91(5), 419-440.

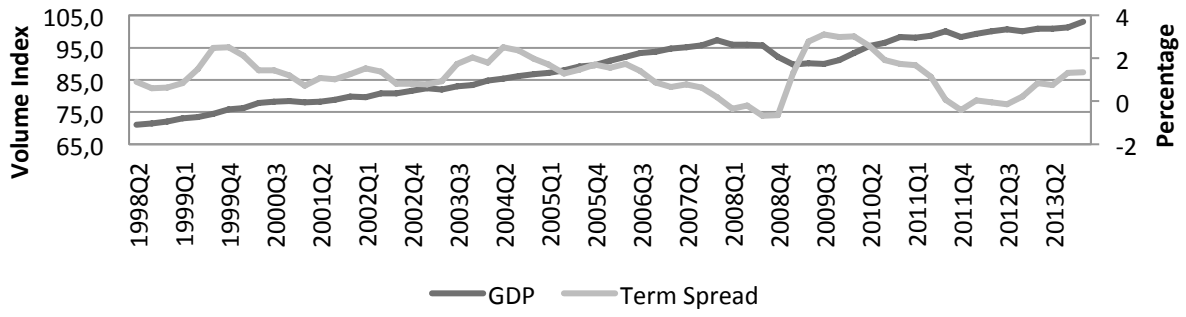
Zarnowitz, V. (1992). What is a business cycle?. In M. Belogina & M. Garfinkel (Eds.), *The Business Cycle: Theories and Evidence*, (p. 3-83). New York: Springer Netherlands.

Österholm, P. (2014). Survey data and short-term forecasts of Swedish GDP growth. *Applied Economics Letters*, 21(2), 135-139.

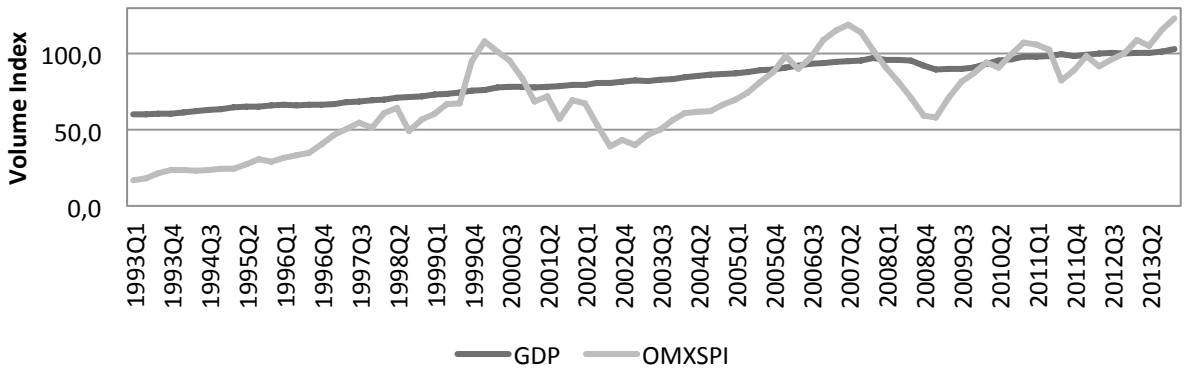
8 Appendix

8.1 Graphs before data transformations are conducted

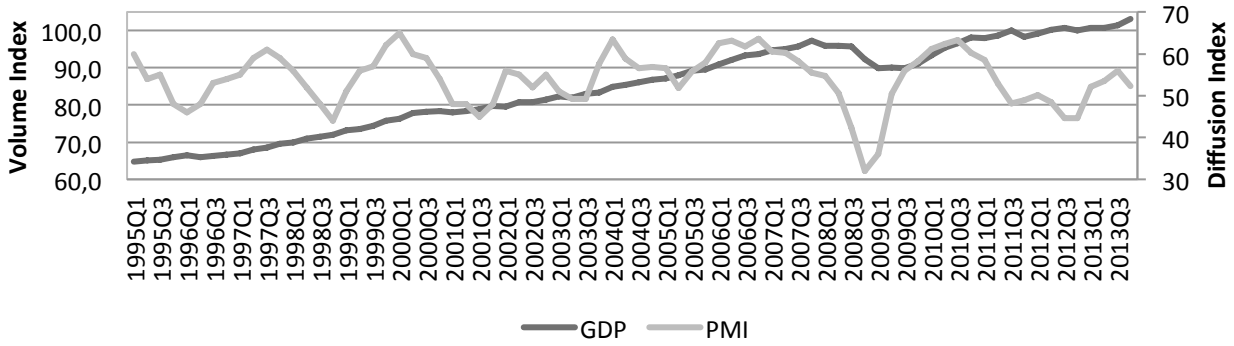
A. 1 - GDP and Term Spread



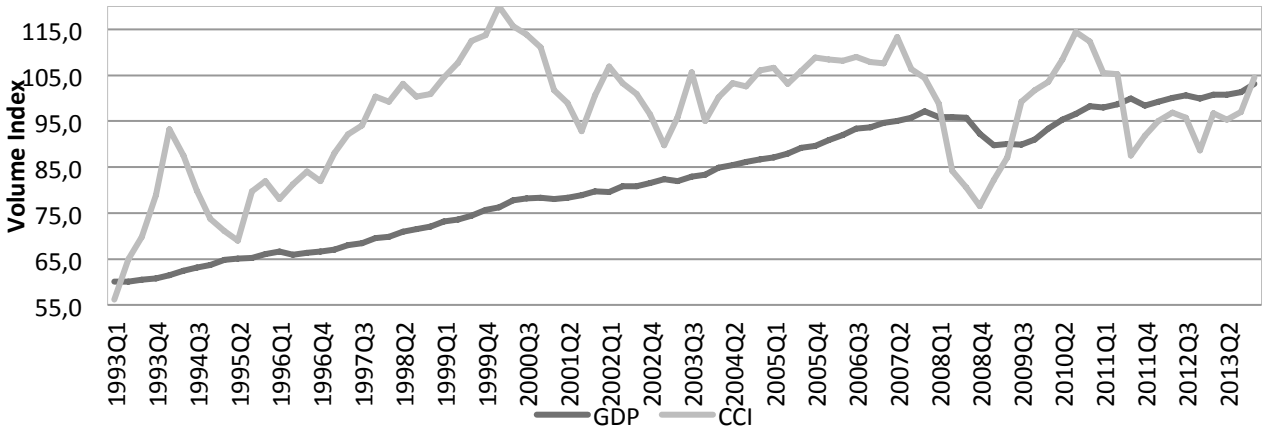
A. 2 - GDP and OMXSPI



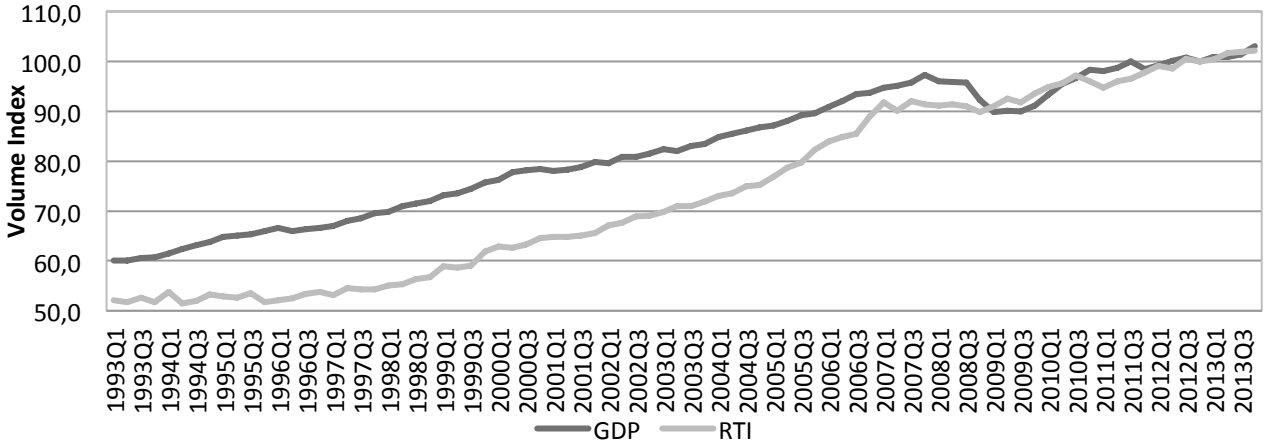
A. 3 - GDP and PMI



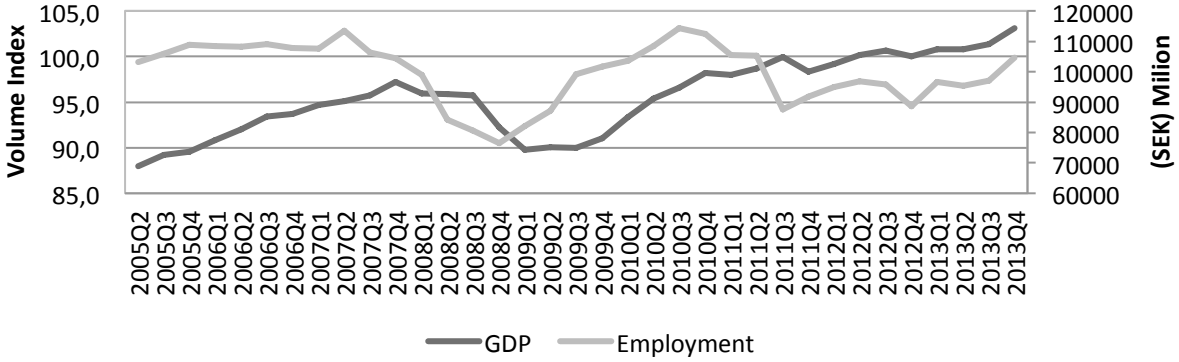
A. 4 - GDP and CCI



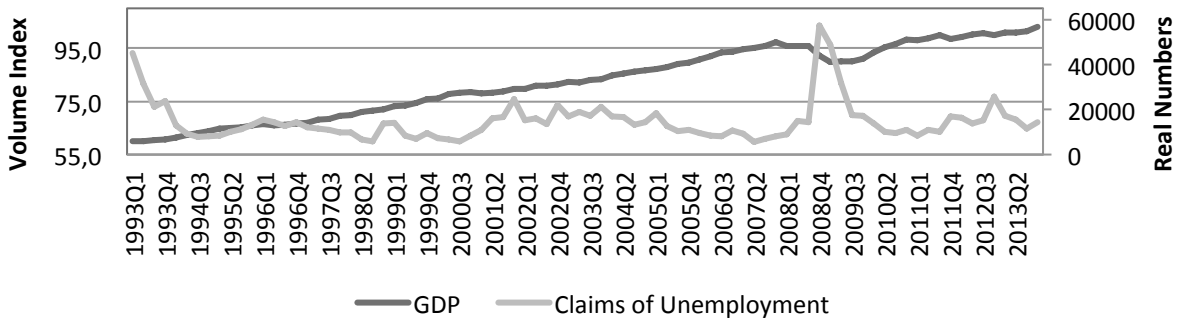
A. 5 - GDP and RTI



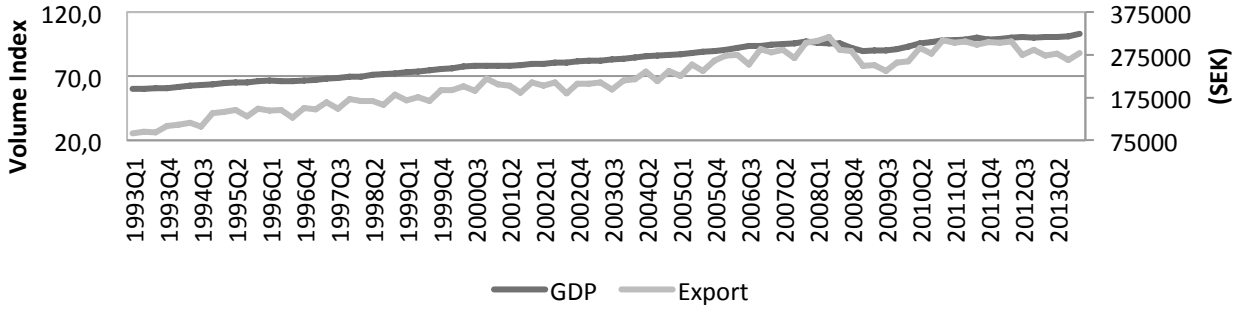
A. 6 - GDP and Employment



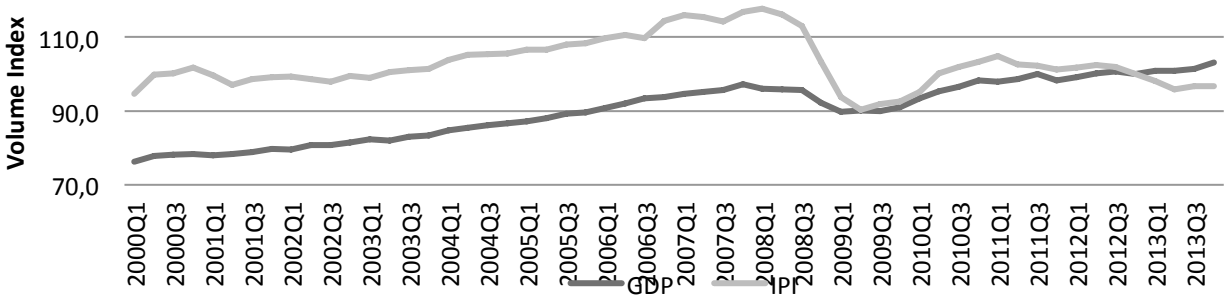
A. 7 - GDP - Claims of Unemployment



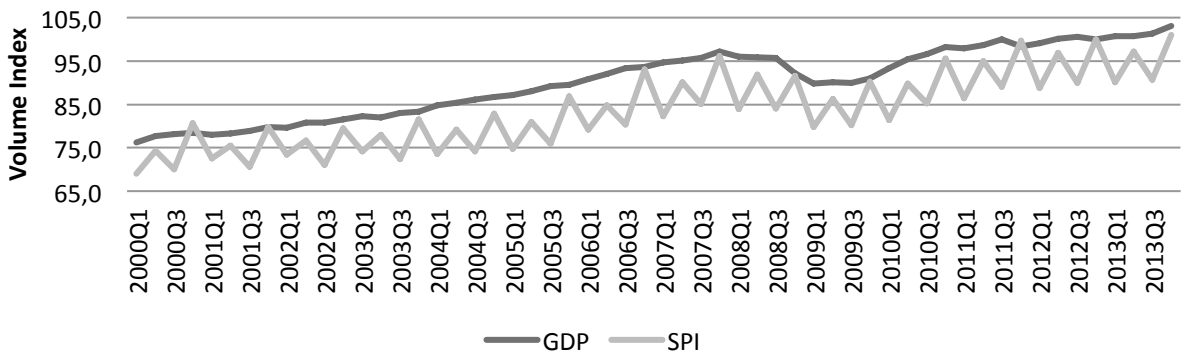
A. 8- GDP and Export



A. 9 - GDP and IPI

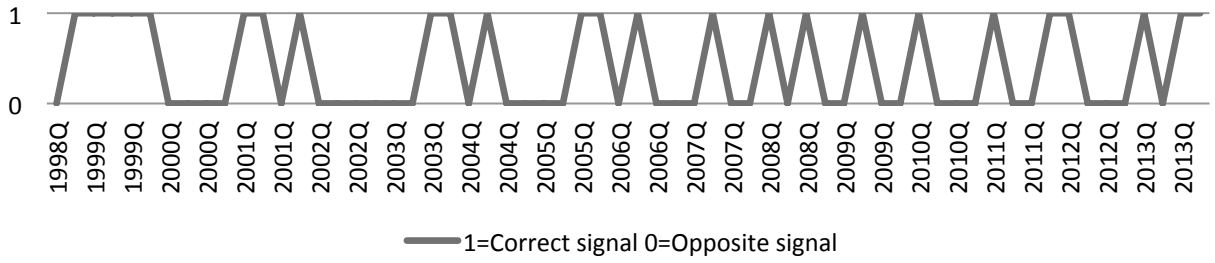


A. 10 - GDP and SPI

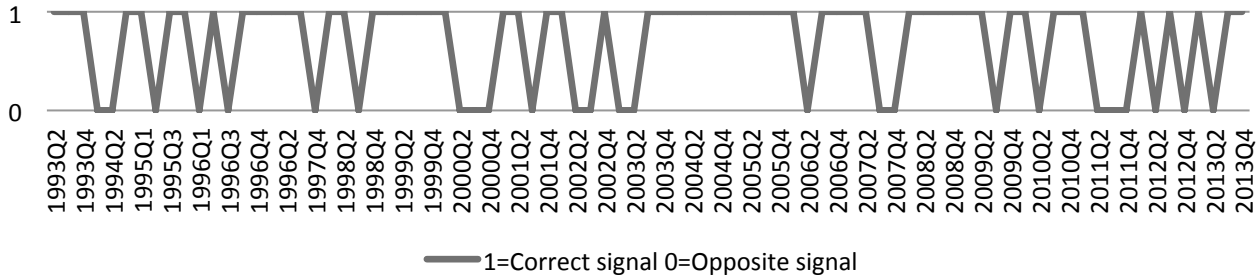


8.2 Correct and Opposite Signals

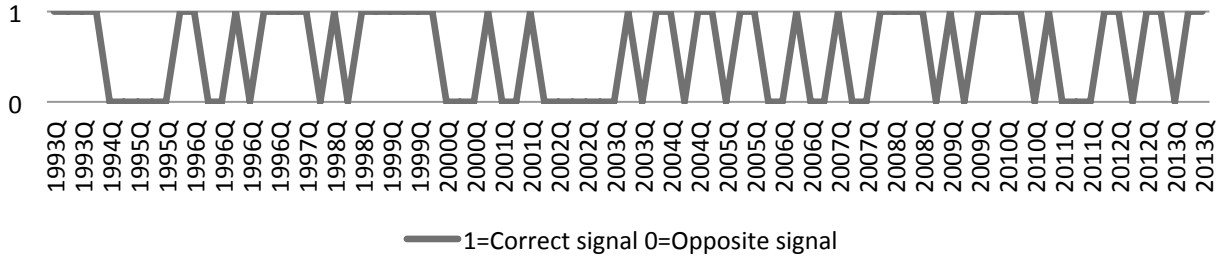
A. 11 - Correct and Opposite Signals GDP - Term Spread



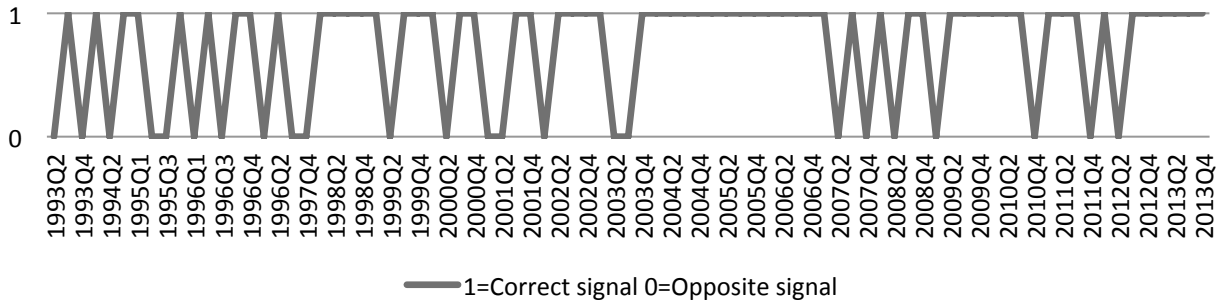
A. 12 - Correct and Opposite Signals GDP - OMXSPI



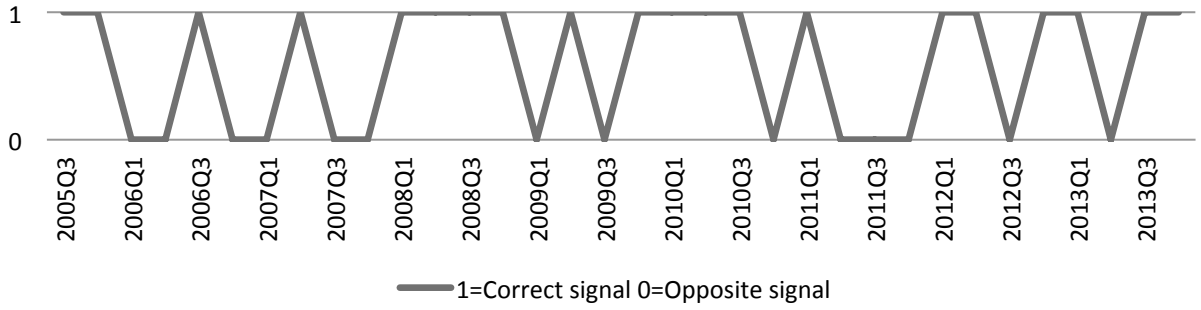
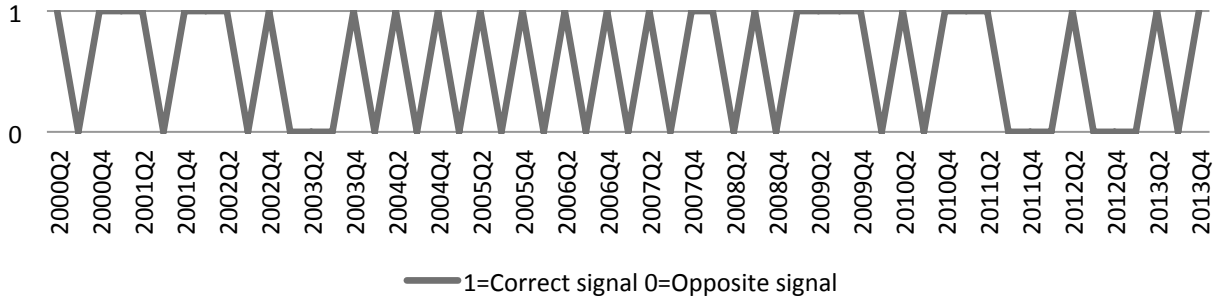
A. 13 - Correct and Opposite Signals GDP - CCI



A. 14 - Correct and Opposite Signals GDP - RTI



A. 15 - Correct and Opposite Signals GDP - Employment



A. 16 - Correct and Opposite Signals GDP - SPI