A comparative study of technical indicator performances by stock sector

RSI, MACD, and Larry Williams %R applied to the Information Technology, Utilities, and Consumer Staples sectors.

CLAUDIUS SUNDLÖF

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Abstract

Technical indicators are used by experts in stock trading. The purpose of this report is to investigate whether or not some indicators perform better when applied to stocks of specific market sectors. The investigation was conducted by implementing one algorithm for each of three different technical indicators, Relative Strength Index, Moving Average Convergence-Divergence, and Larry Williams %R. Each algorithm considered one trading strategy. Three market sectors defined by the GICS were included in the tests, Consumer Staples, Utilities, Information Technology. For each of these sectors at least one stock from each industry were tested. Results suggest that the performance of the Relative Strength Index indicator may be related to the sector of the stock to which it is applied, while %R showed no such indication, and MACD showed only a slight performance deviation between sectors. Further and more in-depth studies are required to confirm the results and conclusions drawn in this report.
Sammanfattning

Tekniska indikatorer används av aktieexperten. Rapportens syfte är att undersöka om vissa indikatorer fungerar bättre då de appliceras på aktier från vissa specifika marknadssektorer. Undersökningen genomfördes genom att implementera en algoritm var för tre olika tekniska indikatorer, nämligen Relative Strength Index, Moving Average Convergence-Divergence och Larry Williams %R. Varje algoritm hade en handelsstrategi. Tre marknadssektorer fastställda av GICS var inkluderade i testerna, nämligen Consumer Staples, Utilities och Information Technology. För varje sektor så testades åtminstone en aktie från varje industri. Resultaten pekar mot att Relative Strength Index kan fungera bättre beroende på vilken sektor man använder den på, medan resultaten för Larry Williams %R inte hade någon sådan indikation och resultaten för Moving Average Convergence-Divergence visade endast en liten skillnad mellan sektorerna. Vidare studier krävs för att fastställa resultaten och slutsatserna som har dragits i den här rapporten.
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1 Introduction

The stock market is a volatile entity, where each upswing and downswing can cost and earn investors millions of dollars. Market trend prediction has been attempted with varying degrees of success in many ways, including social media data mining [1], financial news analysis [2], and technical indicators [3]. Technical indicators will be discussed in this report.

Technical analysis and technical indicators rely on historical data to predict future prices, something that the Efficient Market Hypothesis suggests is impossible, as stock prices instantly reflect information available today [4]. If the Efficient Market Hypothesis holds true, price fluctuations would appear random as the availability of new information is inherently unpredictable. Research supporting the Efficient Market Hypothesis has been conducted by construction of genetic algorithms [5]. Even though research supports the Efficient Market Hypothesis, technical analysis and technical indicators remain popular tools for many investors, while others refrain from using technical analysis whatsoever [6].

It has been argued that group psychology greatly influences the movement of the market, creating rhythmic, patterned, price movements [6]. With appropriate use of technical analysis these movements become accurately predictable. Knowing which technical indicators are apt at describing movements pertinent to the stock (and the trading strategy used), is paramount to making a profit off of trading using technical analysis.

The stock market can be divided into different stock market sectors which consist of companies dealing within the same businesses. These stock market sectors themselves can be grouped into economic sectors, which consist of stock market sectors dealing within the same type of business e.g. services or raw materials.

1.1 Problem statement

The purpose of this thesis is to investigate whether or not certain technical indicators are better at predicting trend movements within some sectors than they are within others. The question to answer is thus: Do technical indicators perform differently when applied to stocks of different sectors?

Are certain technical indicators more well-suited for stocks belonging to certain sectors? I.e. do some indicators perform better when it comes to stocks belonging to e.g. the banking sector?

Having knowledge of which technical indicators to use based on intrinsic information belonging to a stock would make wading through the sea of indicators to find the most suitable ones smoother.

1.2 Previous research and scope

In this report, a small subset of technical indicators’ performances with regards to a subset of stock sectors was investigated. Due to time constraints and the fact that hundreds of technical indicators exist [7], an in-depth investigation of all indicators was not realistic. Previous research within the area of technical indicators is numerous, focus has however mainly been placed on creating trading algorithms using technical indicators in order to try and turn a profit [3] [8]. Little thought has been spent on the question of technical indicators having inherent qualities making them more suitable for stocks belonging to different sectors.
2 Background

The purpose of this chapter is to give the reader an understanding of what technical indicators are, and to introduce a few groups of technical indicators and popular indicators that could be interesting in future studies. Technical indicators used in the report are also described here. Beyond technical indicators the reader is also introduced to economic sectors and stock market sectors and their constituents.

2.1 Technical Indicators

A technical indicator is the result of mathematical computations based on a stock’s performance, the volume of trades and/or price fluctuations. Through technical analysis and technical indicators, stock trading and deciding whether to buy or sell is reduced to interpreting the output from chosen indicators. There are over 200 different technical indicators [7], this report will focus mainly on technical indicators that predict trends.

A selection of common technical indicators and their groupings are listed below [9]. Explanations and equations are shown for indicators discussed in this report. Other groups and indicators are listed due to their relevance within the use of technical indicators on the stock market today.

2.1.1 Volume

Volume is the amount of trades that have been performed within a given time period. When a stock is being traded actively, the volume of trades is also high.

On Balance Volume (OBV)

2.1.2 Moving Averages

A moving average is an average of a certain body of data, the term moving is used due to the fact that the average is calculated using only, for example, the last 10 days’ prices of a stock [9]. Thus the data moves forward with each new trading day.

Reference Envelope

2.1.3 Oscillators

Oscillators are indicators that fall within a bound range, e.g. zero and 100 [10]. The principal idea is that the closer the value of the indicator is to 100, the more certain the indicator is that a security is overbought. Likewise, as the indicator approaches 0, the indicator’s certainty that a security is oversold increases. Buy and sell signals may be generated during the respective periods.

Commodity Channel Index

Stochastic

Williams %R

Williams %R, developed by Larry Williams, is an oscillator that measures the latest close in relation to the stock’s price range over a set number of days [9]. The difference between today’s close and the price high for the set number of days is divided by the difference between the range’s high and the range’s low. The result is multiplied by -100, creating an upside down stochastics. The equation is as follows [11]:

\[
%R = \frac{\text{high}_{N\text{days}} - \text{close}_{\text{today}}}{\text{high}_{N\text{days}} - \text{low}_{N\text{days}}} \times -100
\]

Moving Average Convergence-Divergence (MACD)

The moving Average Convergence-Divergence indicator can be used to analyze periods ranging from
minutes to months, making the MACD indicator very versatile. The MACD indicator was developed by Gerald Appel and is calculated by subtracting the longer-term exponential moving average from the shorter-term exponential moving average of the tracked stock's prices. In general, the value of the indicator will rise if shorter-term trends are growing stronger, and decline if they are weakening. [12]

\[
\text{Simple Moving Average (SMA)} = \frac{\text{sum of period's closing prices}}{\text{period's length}}
\]

\[
\text{Weighting multiplier} = \frac{2}{\text{period's length} + 1}
\]

\[
\text{Exponential Moving Average (EMA)} = \left(\text{Close}_{\text{today}} - \text{EMA}_{\text{previous day}}\right) \times \text{multiplier} + \text{EMA}_{\text{previous day}} \quad [13]
\]

The first exponential moving average value is set to the simple moving average of the period. After the EMA has been calculated, MACD can be calculated.

\[
\text{MACD Line} = \text{EMA}_{12} - \text{EMA}_{26}
\]

\[
\text{Signal Line} = \text{EMA}_{\text{MACD Line}9 \text{ days}}
\]

\[
\text{MACD Histogram} = \text{MACD Line} - \text{Signal Line}
\]

The MACD line is the difference between the EMA of the past 12 days and the EMA of the past 26 days, the signal line calculates the EMA of the past 9 days of the MACD line in order to identify turns. The histogram is the difference between the MACD line and the signal line, turning positive when the MACD line is above the signal line, and negative when it is below.

Positive MACD line values indicate that the 12-day EMA is above the 26-day EMA, meaning that there is an upside momentum is increasing. Likewise, negative MACD line values indicate that the 12-day EMA is below the 26-day EMA and that downside momentum is increasing. [14]

**Relative Strength Index (RSI)**

The Relative Strength Index is a technical indicator, that, when combined with a stock’s bar chart, can indicate market turning points, market reversals, tops, and bottoms. RSI was developed by J. Welles Wilder and his original formula for calculating the RSI is as follows [15].

For the first calculation of RSI:

\[
RSI = 100 - \frac{100}{1 + \text{RS}}
\]

Where

\[
\text{RS} = \frac{\text{Average of 14 days' closes UP}}{\text{Average of 14 days' closes DOWN}}
\]

and

\[
\text{Average of 14 days' closes UP} = \text{sum of UP closes past 14 days divided by 14}
\]

\[
\text{Average of 14 days' closes DOWN} = \text{sum of DOWN closes past 14 days divided by 14}
\]

For every subsequent calculation RS is calculated like this:
\[ RS = \frac{\text{Previous average of UP closes} \times 13 + \text{today's UP close (if any)}}{\text{Previous average of DOWN closes} \times 13 + \text{today's up close (if any)}} \]

2.1.4 Wilder
Indicators constructed by J. Welles Wilder.

**Average Directional Index (ADX)**
**Commodity Selection Index**
**Directional Movement Index**
**Parabolic Swing Index**
**Relative Strength Index (RSI)**
See above section for explanation.

2.2 Economic Sectors
An economic sector is a division of the economy. An economy’s reliance on different sectors highlights the development of that economy [16]. The underlying reasons for dividing an economy into sectors are not very important for our report, but the sectors themselves are interesting when considering the grouping of Market Stock Sectors. They will thus be listed briefly, together with their industries [16]:

2.2.1 Primary Sector
Industries within the primary sector handle natural resources, examples below:
- **Agriculture, forestry and fishing**
- **Mining**

2.2.2 Secondary Sector
Industries related to manufacturing of products and processing of natural resources.
- **Construction**
- **Manufacturing**

2.2.3 Tertiary Sector
Industries related to providing services.
- **Transportation, electric, gas, and sanitary services**
- **Wholesale trade**
- **Retail trade**

2.2.4 Quaternary Sector
Industries dependent on knowledge as a resource.
- **Finance, insurance, and real estate**
- **Services**

2.3 Stock Market Sectors
There are 11 stock market sectors, these sectors are further divided into industry groups, industries, and sub-industries. Market sectors studied in this report will receive a more thorough explanation where all industries are defined, while other market sectors will be described and have their industries listed, as these sectors could prove interesting when conducting future research.
The Global Industry Classification Standard (GICS) defines the following sectors [17], their industries, and sub-industries [18]:

2.3.1 Energy Sector
Companies doing business related to exploration, production, refining, marketing, storage and transportation of oil, gas, coal or other consumable fuels. Providers of oil and gas equipment as well as services are also included. Spreads across the primary, secondary, and tertiary sectors.

The energy sector is divided into one industry group with the same name, and two industries, Energy Equipment & Services, Oil, Gas & Consumable Fuels.

2.3.2 Materials Sector
Minerals and mining companies, producers of steel. Manufacturers of chemicals, construction materials, metals, glass, paper, forest products and related products. Part of the primary and secondary sectors.

The materials sector is divided into one industry group with the same name, and five industries, Commodity Chemicals, Construction Materials, Containers & Packaging, Metals & Mining, Paper & Forest Products.

2.3.3 Industrials Sector
Includes manufacturers and distributors of capital goods, including aerospace and defense, building products, electrical equipment, machinery. Also includes companies that provide services such as transportation services, commercial and professional services including printing, environmental and facilities services, office services and supplies, security and alarm services, human resource and employment services, research and consulting services.

The industrials sector is divided into three industry groups, Capital Goods, Commercial & Professional Services, Transportation. These groups are further divided into 14 industries.

2.3.4 Consumer Discretionary Sector
Businesses which are the most sensitive to economic cycles belong to this sector. Service providers involved in hotels, restaurants and other leisure facilities, media production and services, as well as consumer retailing and services are included. Manufacturers of automobiles, household durable goods, leisure equipment and textures and apparel.

The consumer discretionary sector is divided into five industry groups, Automobiles & Components, Consumer Durables & Apparel, Consumer Services, Media, Retailing. These groups are further divided into 12 industries.

2.3.5 Consumer Staples Sector
Businesses that are less sensitive to economic cycles. Manufacturers, distributors and retailers of food, drug retailing companies, beverages and tobacco, as well as producers of non-durable household goods and personal products. The consumer staples sector thus spreads across the primary sector, the secondary sector and the tertiary sector.

The consumer staples sector is divided into three industry groups, Food & Staples Retailing, Food, Beverage & Tobacco, Household & Personal Products.

Sub-industry definitions are included only for sectors outlined in 3.1. Several definitions are straight quotes from the referenced document.
Food & Staples Retailing consists of one industry with the same name, further consisting of four sub-industries:

i. **Drug Retail** – Owners and operators of primarily drug retail stores and pharmacies.
ii. **Food Distributors** – Distributors of food products to companies as opposed to consumers directly.
iii. **Food Retail** – Owners and operators of primarily food retail stores.
iv. **Hypermarkets & Super Centers** – Owners and operators of hypermarkets and super centers selling not only food but a wide-range of consumer staple products. Does not include retailers classified in sub-industries Food Retail or Drug Retail.

**Food, Beverage & Tobacco** consists of three industries, Beverages, Food Products, Tobacco, further consisting of seven sub-industries.

**Beverages:**

i. **Brewers** – Producers of beer and malt liquor. Brewers not classified in the Restaurants sub-industry are included.
ii. **Distillers & Vintners** – “Distillers, vintners and producers of alcoholic beverages not classified in the Brewers Sub-Industry.”
iii. **Soft Drinks** – “Producers of non-alcoholic beverages including mineral waters. Excludes producers of milk classified in the Packaged Foods Sub-Industry.”

**Food Products:**

i. **Agricultural Products** – Producers of agricultural products. Crop growers, plantation owners and companies that produce and process foods. Excludes companies that package and market food products classified in the Packaged Foods sub-industry as well as companies classified in the Forest Products sub-industry.
ii. **Meat, Poultry & Fish** (actually discontinued as of March 28 2002)
iii. **Packaged Foods & Meats** – “Producers of packaged foods including dairy products, fruit juices, meats, poultry, fish and pet foods.”

**Tobacco:**

i. **Tobacco** – Manufacturers of tobacco products.

2.3.6 Health Care Sector
Companies involved in the providing of health care, manufacture and distribute health care equipment and supplies, health care technology. Also includes companies manufacturing, marketing, and developing pharmaceuticals and biotechnology products.

The health care sector is divided into two industry groups, Health Care Equipment & Services, Pharmaceuticals, Biotechnology & Life Services, containing six industries.

2.3.7 Financials Sector
Companies involved in matters relating to banks and financial matters such as consumer finances, asset managements, insurances. Also includes real estate companies.

The financials sector is divided into four industry groups, Banks, Diversified Financials, Insurance, Real Estate, composed of nine industries of which one is discontinued.
2.3.8 Information Technology Sector

Companies that manufacture and distribute technology hardware and equipment, as well as developers of software and information technology services. The information technology sector spreads across the secondary, tertiary and quaternary sectors.

The information technology sector is divided into three industry groups, Software & Services, Technology Hardware & Equipment, Semiconductors & Semiconductor Equipment, which are then divided into nine industries, further divided into 19 sub-industries.

Software & Services consists of three industries, Internet Software & Services, IT Services, Software, further divided into six sub-industries.

Internet Software & Services:

i. Internet Software & Services – Companies that derive a majority of their profits from online advertising. Providers of internet services including online databases and interactive series, and companies marketing and developing internet software.

IT Services:

i. IT Consulting & Other Services – Companies involved in providing information technology consulting and information management services, and/or information technology and systems integration services not classified in the Data Processing & Outsourced Services or Internet Software & Services sub-industries.

ii. Data Processing & Outsourced Services – “Providers of commercial electronic data processing and/or business process outsourcing services. Includes companies that provide services for back-office automation.”

Software:

i. Application Software – Companies developing and producing software designed for specialized applications. Enterprise and technical software included. Excludes companies classified in the Home Entertainment Software sub-industry, as well as companies producing systems or database software classified in the Systems Software sub-industry.

ii. Systems Software – “Companies engaged in developing and producing systems and database management software.”

iii. Home Entertainment Software – “Manufacturers of home entertainment software and educational software used primarily in the home.”

Technology Hardware & Equipment consists of five industries, Communications Equipment, Technology Hardware, Storage & Peripherals, Electronic Equipment, Instruments & Components, Office Electronics, Semiconductor Equipment & Products, of which the last two have been discontinued. Disregarding discontinued industry definitions, there are 10 sub-industries in total, of which four have been discontinued.

Communications Equipment:

i. Communications Equipment – “Manufacturers of communication equipment and products, including LANs, WANs, routers, telephones, switchboards and exchanges. Excludes cellular phone manufacturers classified in the Technology Hardware, Storage & Peripherals Sub-Industry.”

ii. Networking Equipment (discontinued)

iii. Telecommunications Equipment (discontinued)
Technology Hardware, Storage & Peripherals:

i. Computer Hardware (discontinued)

ii. Computer Storage & Peripherals (discontinued)

iii. Technology Hardware, Storage & Peripherals – “Manufacturers of cellular phones, personal computers, servers, electronic computer components and peripherals. Includes data storage components, motherboards, audio and video cards, monitors, keyboards, printers, and other peripherals. Excludes semiconductors classified in the Semiconductors Sub-Industry.”

Electronic Equipment, Instruments & Components:

i. Electronic Equipment & Instruments – “Manufacturers of electronic equipment and instruments including analytical, electronic test and measurement instruments, scanner/barcode products, lasers, display screens, point-of-sales machines, and security system equipment.”


iii. Electronic Manufacturing Services – Producers of electronic equipment mainly for OEMs.

iv. Technology Distributors – “Distributors of technology hardware and equipment. Includes distributors of communications equipment, computers & peripherals, semiconductors, and electronic equipment and components.”

Semiconductor & Semiconductor Equipment consists of one industry with the same name, further comprising two sub-industries.

Semiconductor & Semiconductor Equipment:

i. Semiconductor Equipment – Manufacturers of semiconductor equipment, as well as manufacturers of raw materials and equipment related to solar power and used in the Renewable Electricity sub-industry

ii. Semiconductors – Manufacturers of semiconductors and related products, solar modules and cells.

2.3.9 Telecommunication Services Sector

Companies providing services related to communication such as cellular services or fiber optic cable networks.

The telecommunication services sector contains one industry group of the same name, divided into two industries, Diversified Telecommunication Services, Wireless Telecommunication Services.

2.3.10 Utilities Sector

The utility sector encompasses utility companies, independent power producers, energy traders, and companies that generate and distribute electricity using renewable sources. The utilities sector fits into the tertiary sector of the economy.

The utilities sector is divided into one industry group with the same name, which is further divided into the five industries Electric Utilities, Gas Utilities, Multi-Utilities, Water Utilities, Independent Power and Renewable Electricity Producers. With the exception of the last industry, they all consist of one sub-industry bearing the same name.
Electric Utilities:

i. Electric Utilities – Companies that produce or distribute electricity.

Gas Utilities:

i. Gas Utilities – Companies mainly focused on distributing and transmitting natural and manufactured gas. Excludes companies primarily involved in gas exploration or production classified in the Oil & Gas Exploration & Production sub-industry, as well as companies classified in the Oil & Gas Storage & Transportation sub-industry.

Multi-Utilities:

i. Multi-Utilities – “Utility companies with significantly diversified activities in addition to core Electric Utility, Gas Utility and/or Water Utility operations.”

Water Utilities:

i. Water Utilities – “Companies that purchase and redistribute water to the end-consumer. Includes large-scale water treatment systems.”

Independent Power and Renewable Electricity Producers:

i. Independent Power Producers & Energy Traders – Independent Power Producers, Gas & Power Marketing & Trading Specialists and Integrated Energy Merchants. Excludes producers of electricity using renewable sources, as well as electric transmission companies and utility distribution companies defined in the Electric Utilities sub-industry.

ii. Renewable Electricity – Companies generating and distributing electricity produces using renewable sources. Excludes manufacturers of equipment used to generate electricity using renewable sources, in addition to companies involved in supplying technology, components, and services to companies belonging to the sub-industry.

3 Method

As both the collection of stock data and the implementation of technical indicators is relatively simple (albeit time consuming), the interesting part of our work is related to interpreting the output from individual indicators, and valuing their accuracy.

3.1 Choice of stocks

Before choosing stocks we first had to decide which sectors were going to be researched. The sectors Information Technology, Utilities, and Consumer Staples were chosen, they have some overlapping when it comes to economic sectors, but avoiding overlapping completely is difficult. Bloomberg lists sectors and allows grouping of stocks by industry [19]. At least one stock from each sector’s industries was chosen. The chosen stock was the one that Bloomberg named the top 30-day company in the industry, where stock history dated at least five years back. Twenty-one stocks in total were used in the study.

Some exceptions were made, arbitrarily Apple Inc. of the Technology, Hardware & Equipment industry and Swedish Match of the Tobacco industry were chosen. In the household products industry two stocks were chosen.
3.1.1 Information Technology sector

**Communications Equipment**
- Net Insight AB

**Electronic Equipment, Instruments & Components**
- Fingerprint Cards AB

**Internet Software & Services**
- Xing AG

**IT Services**
- Bechtle AG

**Semiconductors & Semiconductor Equipment**
- Imagination Group PLC

**Software**
- IAR Systems Group AB

**Software & Services**
- Bittium Oyj

**Technology, Hardware & Equipment**
- Apple Inc. (AAPL)

**Technology, Hardware, Storage & Peripherals**
- Wincor Nixdorf AG

3.1.2 Utilities sector

**Electric Utilities**
- Cleco Corp

**Gas Utilities**
- Aygaz AS

**Independent Power and Renewable Electricity Producers**
- Terna Energy SA

**Multi-Utilities**
- Acea Spa

**Water Utilities**
- Severn Trent

3.1.3 Consumer Staples sector

**Beverages**
- National Beverage Corp

**Food & Staples Retailing**
- The Fresh Market Inc

**Food Products**
- Premier Foods
3.2 Collection of stock data
Stock data was downloaded from finance.yahoo.com's historical data, using Yahoo's own download to spreadsheet option. For each day of trading, the data available is the opening price for the stock, the highest price of the day, the lowest price of the day, the closing price, the volume, and the adjusted closing value.

3.3 Interpreting stock data
Historical data downloaded from Yahoo is saved in the .csv format. In order to make sense of this data, a simple parser that creates an object for each date of data in the spreadsheet was constructed. This parser also added a new value to each object, "price change", in which the price difference between this day's closing price, and the previous day's closing price was saved.

3.4 Choice of indicators
RSI and MACD were chosen due to their popularity. Virtually every online service where stock prices can be monitored implements MACD [12]. Williams %R was chosen simply because it seemed interesting to us. Due to the amount of available indicators on the market and our time constraints, it would not be feasible to implement every single indicator available. Three indicators seemed reasonable given time restraints.

3.5 Applying technical indicators to stock data
Applying the chosen technical indicators to our data points was done by iterating through the output from our parser and applying the relevant algorithms. The resulting trades and their success ratios in addition to the monetary gain for each stock was compiled into tables. The average success rate was calculated by summing the success ratios for the stocks and dividing by the number of stocks.

Due to time limitations only one trading algorithm per indicator was implemented, even though more existed within our cited sources.

3.5.1 Relative Strength Index (RSI)
Using J. Welles Wilder's original algorithm, RSI was calculated. If the value is below 30, the stock's price is expected to rise shortly. Conversely, if the value is above 70, the price is expected to fall shortly. This is a simple way of interpreting data and measuring the accuracy of RSI.

"TOPS and BOTTOMS are indicated when the RSI goes above 70 or drops below 30...

...Tops and Bottoms: These are indicated when the Index goes above 70 or below 30. The Index will usually top out or bottom out before the actual market top or bottom, giving an indication that a reversal or at least a significant reaction is imminent." [15]

We decided to use this for our (very simple) RSI trading algorithm, we simply buy when the RSI goes below 30 and sell once it goes above 70. This leads to relatively few trades being made.
3.5.2 Moving Average Convergence-Divergence (MACD)

The creator of the MACD-indicator has a very clear technique for trading, so we followed his instructions to select which days to buy and which days to sell. The technique we chose is the following: whenever the signal line crosses above the MACD-line we buy, and when it crosses down below again, we sell.

“As a general rule, crossings of MACD from below to above its signal line can be taken as confirmations of buy signals originally indicated when changes in direction have taken place in MACD from down to up.” [12]

Other versions of this technique were also mentioned. For example, using different amount of days when calculating MACD depending on if you’re calculating a buy day or a sell day. But we decided to keep it simple.
3.5.3 Larry Williams %R

The method used for trading with Larry Williams was rather simple. When the %R crosses below -85%, the stock is considered oversold and we buy. When it crosses above -15% it’s considered overbought, and we sell.
4 Results

The results are presented in tables where the first column indicates the company of the stock's name. The second column indicates how many trades were made by our previously presented algorithms. The third and fourth columns indicate how many of the trades gained/lost money. The last column indicate how much money was made in total, including all trades.

### 4.1 Relative Strength Index

#### 4.1.1 Information Technology Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Insight AB</td>
<td>19</td>
<td>12(63%)</td>
<td>7</td>
<td>1SEK</td>
</tr>
<tr>
<td>Fingerprint Cards</td>
<td>21</td>
<td>12(57%)</td>
<td>9</td>
<td>112SEK</td>
</tr>
<tr>
<td>Xing AG</td>
<td>8</td>
<td>5(63%)</td>
<td>3</td>
<td>30EUR</td>
</tr>
<tr>
<td>Bechtle AG</td>
<td>10</td>
<td>4(40%)</td>
<td>6</td>
<td>-66EUR</td>
</tr>
<tr>
<td>Imagination G. P.</td>
<td>31</td>
<td>17(55%)</td>
<td>14</td>
<td>56GBP</td>
</tr>
<tr>
<td>IAR Systems G. A.</td>
<td>12</td>
<td>8(67%)</td>
<td>4</td>
<td>-123SEK</td>
</tr>
<tr>
<td>Bittium Oyj</td>
<td>13</td>
<td>8(62%)</td>
<td>5</td>
<td>-34EUR</td>
</tr>
<tr>
<td>Apple Inc.</td>
<td>27</td>
<td>16(59%)</td>
<td>11</td>
<td>-0USD</td>
</tr>
<tr>
<td>Wincor Nixdorf</td>
<td>13</td>
<td>9(69%)</td>
<td>4</td>
<td>31EUR</td>
</tr>
</tbody>
</table>

#### 4.1.2 Utilities Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleco Corp</td>
<td>24</td>
<td>23(96%)</td>
<td>1</td>
<td>38USD</td>
</tr>
<tr>
<td>Aygaz AS</td>
<td>25</td>
<td>18(72%)</td>
<td>7</td>
<td>-3TRY</td>
</tr>
<tr>
<td>Terna Energy SA</td>
<td>11</td>
<td>4(36%)</td>
<td>7</td>
<td>-5EUR</td>
</tr>
<tr>
<td>Acea Spa</td>
<td>16</td>
<td>11(69%)</td>
<td>5</td>
<td>-0EUR</td>
</tr>
<tr>
<td>Severn Trent</td>
<td>27</td>
<td>24(89%)</td>
<td>3</td>
<td>1544GBP</td>
</tr>
</tbody>
</table>

#### 4.1.3 Consumer Staples Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nat. Bev. Corp</td>
<td>22</td>
<td>17(77%)</td>
<td>5</td>
<td>17USD</td>
</tr>
<tr>
<td>The F. M. Inc</td>
<td>6</td>
<td>3(50%)</td>
<td>3</td>
<td>-8USD</td>
</tr>
<tr>
<td>Premier Foods</td>
<td>13</td>
<td>7(54%)</td>
<td>6</td>
<td>890GBP</td>
</tr>
<tr>
<td>HRG Group Inc</td>
<td>32</td>
<td>22(69%)</td>
<td>10</td>
<td>-6USD</td>
</tr>
<tr>
<td>Reckiktt B. G. PLC</td>
<td>30</td>
<td>27(90%)</td>
<td>3</td>
<td>3885GBP</td>
</tr>
<tr>
<td>Oriflame H. AG</td>
<td>12</td>
<td>7(58%)</td>
<td>5</td>
<td>775EK</td>
</tr>
<tr>
<td>Swedish Match</td>
<td>10</td>
<td>8(80%)</td>
<td>2</td>
<td>695EK</td>
</tr>
</tbody>
</table>

### 4.2 Moving Average Convergence-Divergence

#### 4.2.1 Information Technology Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Insight AB</td>
<td>146</td>
<td>92(63%)</td>
<td>54</td>
<td>-29SEK</td>
</tr>
<tr>
<td>Fingerprint Cards</td>
<td>146</td>
<td>93(64%)</td>
<td>53</td>
<td>220SEK</td>
</tr>
<tr>
<td>Xing AG</td>
<td>77</td>
<td>49(64%)</td>
<td>28</td>
<td>-11EUR</td>
</tr>
<tr>
<td>Bechtle AG</td>
<td>164</td>
<td>119(73%)</td>
<td>45</td>
<td>-56EUR</td>
</tr>
<tr>
<td>Imagination G. P.</td>
<td>197</td>
<td>118(60%)</td>
<td>79</td>
<td>126GBP</td>
</tr>
<tr>
<td>IAR Systems G. A.</td>
<td>180</td>
<td>127(71%)</td>
<td>53</td>
<td>875EK</td>
</tr>
<tr>
<td>Bittium Oyj</td>
<td>171</td>
<td>120(70%)</td>
<td>51</td>
<td>7EUR</td>
</tr>
<tr>
<td>Apple Inc.</td>
<td>333</td>
<td>198(59%)</td>
<td>135</td>
<td>71USD</td>
</tr>
<tr>
<td>Company</td>
<td>Trades</td>
<td>Successful</td>
<td>Unsuccessful</td>
<td>Gain/Loss</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------</td>
<td>------------</td>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Cleco Corp</td>
<td>294</td>
<td>180(61%)</td>
<td>114</td>
<td>9USD</td>
</tr>
<tr>
<td>Aygaz AS</td>
<td>140</td>
<td>82(56%)</td>
<td>58</td>
<td>-24TRY</td>
</tr>
<tr>
<td>Terna Energy SA</td>
<td>74</td>
<td>45(60%)</td>
<td>29</td>
<td>2EUR</td>
</tr>
<tr>
<td>Acea Spa</td>
<td>157</td>
<td>98(62%)</td>
<td>59</td>
<td>6EUR</td>
</tr>
<tr>
<td>Severn Trent</td>
<td>282</td>
<td>165(59%)</td>
<td>117</td>
<td>366GBP</td>
</tr>
</tbody>
</table>

### 4.2.3 Consumer Staples Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nat. Bev. Corp</td>
<td>683</td>
<td>488(71%)</td>
<td>195</td>
<td>41USD</td>
</tr>
<tr>
<td>The F. M. Inc</td>
<td>116</td>
<td>69(59%)</td>
<td>47</td>
<td>-3USD</td>
</tr>
<tr>
<td>Premier Foods</td>
<td>199</td>
<td>110(55%)</td>
<td>89</td>
<td>-1043GBP</td>
</tr>
<tr>
<td>HRG Group Inc</td>
<td>1095</td>
<td>837(76%)</td>
<td>258</td>
<td>168USD</td>
</tr>
<tr>
<td>Reckitt B. G. PLC</td>
<td>285</td>
<td>203(71%)</td>
<td>82</td>
<td>4800GBP</td>
</tr>
<tr>
<td>Oriflame H. AG</td>
<td>243</td>
<td>164(67%)</td>
<td>79</td>
<td>263SEK</td>
</tr>
<tr>
<td>Swedish Match</td>
<td>354</td>
<td>263(74%)</td>
<td>91</td>
<td>411SEK</td>
</tr>
</tbody>
</table>

### 4.3 Larry Williams %R

#### 4.3.1 Information Technology Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Insight AB</td>
<td>363</td>
<td>234(64%)</td>
<td>129</td>
<td>-32500GBP</td>
</tr>
<tr>
<td>Fingerprint Cards</td>
<td>334</td>
<td>216(65%)</td>
<td>118</td>
<td>1400GBP</td>
</tr>
<tr>
<td>Xing AG</td>
<td>158</td>
<td>105(66%)</td>
<td>53</td>
<td>117EUR</td>
</tr>
<tr>
<td>Bechtle AG</td>
<td>385</td>
<td>319(83%)</td>
<td>66</td>
<td>266EUR</td>
</tr>
<tr>
<td>Imagination G. P.</td>
<td>223</td>
<td>139(62%)</td>
<td>84</td>
<td>-187GBP</td>
</tr>
<tr>
<td>IAR Systems G. A.</td>
<td>474</td>
<td>345(73%)</td>
<td>129</td>
<td>-3335GBP</td>
</tr>
<tr>
<td>Bittium Oyj</td>
<td>488</td>
<td>372(76%)</td>
<td>116</td>
<td>-19EUR</td>
</tr>
<tr>
<td>Apple Inc.</td>
<td>728</td>
<td>488(67%)</td>
<td>240</td>
<td>51USD</td>
</tr>
<tr>
<td>Wincor Nixdorf</td>
<td>425</td>
<td>255(60%)</td>
<td>170</td>
<td>41EUR</td>
</tr>
</tbody>
</table>

#### 4.3.2 Utilities Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleco Corp</td>
<td>696</td>
<td>501(72%)</td>
<td>195</td>
<td>47USD</td>
</tr>
<tr>
<td>Aygaz AS</td>
<td>309</td>
<td>194(63%)</td>
<td>115</td>
<td>-29TRY</td>
</tr>
<tr>
<td>Terna Energy SA</td>
<td>170</td>
<td>105(62%)</td>
<td>65</td>
<td>2EUR</td>
</tr>
<tr>
<td>Acea Spa</td>
<td>304</td>
<td>192(63%)</td>
<td>112</td>
<td>5EUR</td>
</tr>
<tr>
<td>Severn Trent</td>
<td>173</td>
<td>115(66%)</td>
<td>58</td>
<td>1640GBP</td>
</tr>
</tbody>
</table>

#### 4.3.3 Consumer Staples Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nat. Bev. Corp</td>
<td>683</td>
<td>488(71%)</td>
<td>195</td>
<td>41USD</td>
</tr>
<tr>
<td>The F. M. Inc</td>
<td>116</td>
<td>69(59%)</td>
<td>47</td>
<td>-3USD</td>
</tr>
<tr>
<td>Premier Foods</td>
<td>199</td>
<td>110(55%)</td>
<td>89</td>
<td>-1043GBP</td>
</tr>
<tr>
<td>HRG Group Inc</td>
<td>1095</td>
<td>837(76%)</td>
<td>258</td>
<td>168USD</td>
</tr>
<tr>
<td>Reckitt B. G. PLC</td>
<td>285</td>
<td>203(71%)</td>
<td>82</td>
<td>4800GBP</td>
</tr>
<tr>
<td>Oriflame H. AG</td>
<td>243</td>
<td>164(67%)</td>
<td>79</td>
<td>263SEK</td>
</tr>
<tr>
<td>Swedish Match</td>
<td>354</td>
<td>263(74%)</td>
<td>91</td>
<td>411SEK</td>
</tr>
</tbody>
</table>
4.4 Success rates per sector
Besides summing all trades for the sectors, each sector’s average success rate is also included here.

4.4.1 Relative Strength Index

<table>
<thead>
<tr>
<th>Sector</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Success rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>154</td>
<td>91(59%)</td>
<td>63</td>
<td>52.8</td>
</tr>
<tr>
<td>Utilities</td>
<td>103</td>
<td>80(78%)</td>
<td>23</td>
<td>72.4</td>
</tr>
<tr>
<td>Consumer Staples</td>
<td>125</td>
<td>91(73%)</td>
<td>34</td>
<td>68.3</td>
</tr>
</tbody>
</table>

4.4.2 Moving Average Convergence-Divergence

<table>
<thead>
<tr>
<th>Sector</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Success rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>1544</td>
<td>1115(72%)</td>
<td>429</td>
<td>65.1</td>
</tr>
<tr>
<td>Utilities</td>
<td>947</td>
<td>570(60%)</td>
<td>377</td>
<td>59.6</td>
</tr>
<tr>
<td>Consumer Staples</td>
<td>1390</td>
<td>955(69%)</td>
<td>435</td>
<td>67.3</td>
</tr>
</tbody>
</table>

4.4.3 Larry Williams %R

<table>
<thead>
<tr>
<th>Sector</th>
<th>Trades</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Success rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>3578</td>
<td>2473(71%)</td>
<td>1105</td>
<td>68.4</td>
</tr>
<tr>
<td>Utilities</td>
<td>1652</td>
<td>1107(67%)</td>
<td>545</td>
<td>65.2</td>
</tr>
<tr>
<td>Consumer Staples</td>
<td>2975</td>
<td>2134(72%)</td>
<td>841</td>
<td>67.6</td>
</tr>
</tbody>
</table>

4.4.4 Combined results

![SUCCESS RATES](image)

Figure 4 Data from 4.4.1-3 compiled to show contrasts and similarities between indicators and sectors.

5 Discussion

5.1 Method discussion

5.1.1 Stocks
Stocks could have been chosen in any way, the method of choosing stocks used made the selection straightforward. Some exceptions were made. They should however, not have any great impact on
the results if the performance of an indicator in any way depends on the sector of the stock on which it is applied. The results gathered from excepted stocks do not stand out in the results. More stocks could have been chosen for each sector in order to produce more reliable results, likewise more sectors could also have been considered.

5.1.2 Technical Indicator implementation
To test how well the indicators did, we implemented a trading algorithm per indicator and tested them on the stock data from the different sectors. We later realized that we were really testing the chosen algorithm just as much as we had been testing the actual indicator. We could therefore not say that a higher gain for a specific indicator in a sector leads to that indicator being better to use in that specific sector. It would instead mean that that specific algorithm would be better to use in that sector. In order to produce more reliable and correct results a broader test of several trading strategies could have been done.

Our algorithms did not consider the profitability of each indicator, but merely their average positive trades. All positive trades are not created equal, in that some trades may yield profits in the range of zero to one percent, while other positive trades may have values in the tens. The same principle holds when considering negative trades, but we did not weigh trades in any way for simplicity’s sake. Perhaps the most illustrating example in our results would be the stock HRG Group Inc. and MACD (4.2.3), where 76% of all trades ended on a positive note, but the trades still resulted in a net loss of capital. Without considering fees incurred during real life trading using stock brokers.

5.2 Results discussion
The results in 4.4 showcase that the average success rate barely changed for different sectors when using %R, only slightly when using MACD, and significantly when using RSI. The RSI indicator could possibly be worse at predicting stock movements related to the IT-sector, which also happens to be the only stock-sector dealing with companies in the quaternary sector of our chosen sectors. Whether this indicates that RSI is bad at predicting stock movements for companies in the IT-sector, or for companies in the quaternary sector can not be determined from our results as simply one sector dealing in the quaternary sector was chosen. The results could also mean neither and point to some other weakness of RSI that both MACD and %R seem to be unaffected by, as their performances for the same sector were both consistent and good.

All indicators handled the Consumer Staples with a similar success rates. Utilities had a 12.8% gap between RSI at 72.4% and MACD at 59.6%, with %R placing almost in the middle of the two at 65.2%. The results here suggest that RSI performs better at predicting stocks in the Utilities sector, which as a market sector belongs to the tertiary economic sector. Just as with the IT-sector it is hard to draw any concrete conclusions without further testing.

6 Conclusion
In conclusion, our results suggest that the performance of RSI when using our specified trading strategy, indeed depends on which market sector is being considered. %R shows no clear indication of being better suited for either of the studied market sectors. MACD shows a slight inclination towards performance depending on sector. In order to conclusively answer our initial question “Do technical indicators perform differently when applied to stocks of different sectors?”, more sectors, stocks, and trading strategies should have been included in the tests.
References


