



COMILLAS
UNIVERSIDAD PONTIFICIA

ICAI

GRADO EN INGENIERÍA EN TECNOLOGÍAS INDUSTRIALES

TRABAJO FIN DE GRADO VISUAL TRADING SYSTEM BASED ON MOVING AVERAGES

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Madrid

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Fecha: 10/ 07/ 2019

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Fecha: 10/ 07/ 2019



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Julio de 2019

SISTEMA DE INVERSIÓN VISUAL BASADO EN MEDIAS MÓVILES

Autor: Rodicio Crespo, Maribel.

Director: Maté Jiménez, Carlos.

Director: Zamora Macho, Juan Luis.

Entidad colaboradora: ICAI – Universidad Pontificia Comillas.

RESUMEN DEL PROYECTO

Introducción

El objetivo de este proyecto es explorar el marco de los sistemas de información visual utilizando la técnica de las medias móviles. Así, poder identificar cómo se comportan los precios en función de la información obtenida de los promedios móviles.

Las decisiones financieras en inversiones no se toman al azar. Saber cómo invertir consiste en seleccionar la estrategia que da las órdenes correctas de cuándo: comprar, esperar o vender. El análisis técnico es una herramienta para desarrollar una toma de decisiones eficiente. Este, supone que todos los factores de una empresa, como los balances o su contexto económico, están incluidos en el precio y, por lo tanto, no son aleatorios y tienden a repetir su comportamiento a lo largo de los años. Las estrategias basadas en medias móviles son parte del análisis técnico.

Una media móvil se define como: "un promedio de período constante, generalmente de precios, que se calcula para cada intervalo de período del gráfico sucesivo". (Kirkpatrick y Dahlquist, 2010). Las medias móviles se utilizan para filtrar el ruido del precio para que la tendencia se pueda identificar fácilmente. Las tendencias se pueden clasificar en alcistas o bajistas, como se ve en el Gráfico 1. Dependiendo de la longitud de la media móvil, el precio se filtra más en el caso de medias móviles largas o menos en el caso de las más cortas.

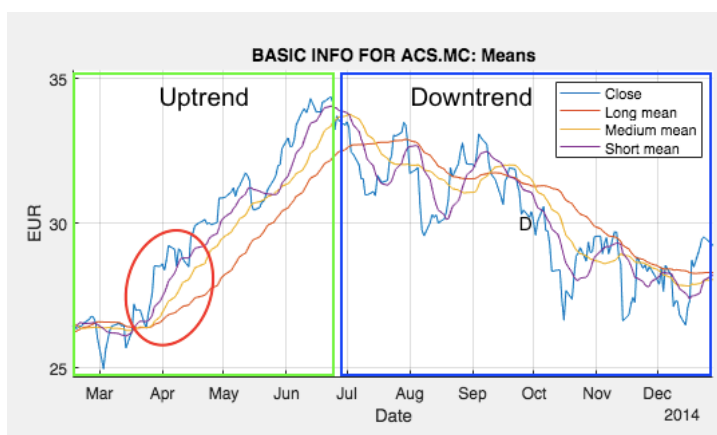


Gráfico Resumen 1: Precio y medias móviles

Las medias móviles son herramientas útiles para los inversores. Por lo general, se utilizan como señales de soporte y resistencia, por lo que los precios altos se encuentran con los niveles de resistencia y los precios bajos con las señales de soporte. Sin embargo, la técnica de crossovers es la más importante cuando se trabaja con medias móviles. Los cruces pueden clasificarse en dos: cruce de precio y cruce de medias móviles.

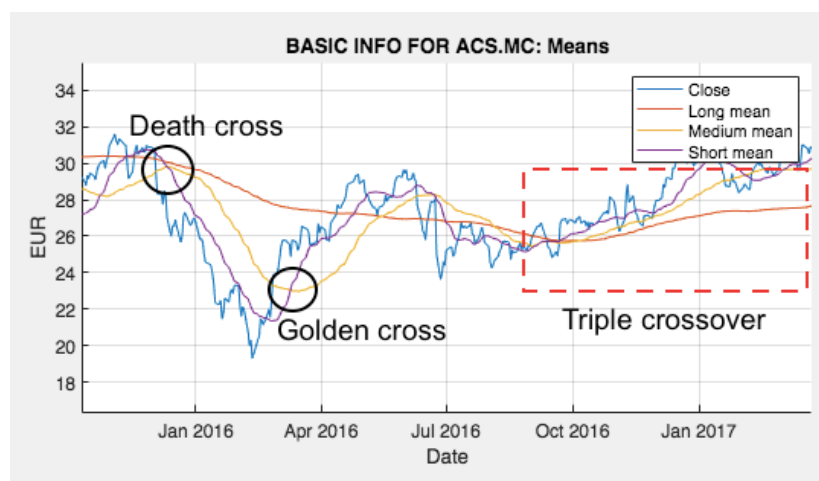


Gráfico Resumen 2: Cruces estrategia

La estrategia de cruce de precios indica posibles cambios de tendencia. Si el precio cruza por encima de una media móvil, señala una tendencia alcista y si cruza hacia abajo se toma como una señal de una tendencia bajista.

Las bases del cruce de medias móviles son las siguientes. Cuando la media móvil cruza una media más larga, significa que se está iniciando una nueva tendencia alcista, por lo que se considera una señal de entrada al mercado. Este tipo de cruce alcista se llama "cruz de oro". Para añadir seguridad a la señal de compra, se puede considerar el cruce de un media móvil corta por encima de dos más largas, llamado triple cruce. De la misma manera, una señal de venta se llama "cruz de la muerte" y se produce cuando una media móvil corta cruza bajo una o dos medias móviles más largas. Esta técnica se muestra en el Gráfico Resumen 2.

Metodología

Para facilitar el acceso a la información y hacer que el análisis de los datos sea más rápido, la aplicación de Bolsa de Valores ha sido desarrollada por el profesor Juan Luis Zamora Macho. Es una aplicación de Matlab, en la versión 2018b, que se desarrolló a partir de una recopilación de datos correspondientes a 1311 acciones de los últimos diez años.

Es una aplicación muy visual y fácil con la que trabajar. La combinación de gráficos y ventanas de texto permite lograr un alto conocimiento y comprensión de lo que está sucediendo. Además, la configuración de los parámetros y las condiciones se realiza de una manera muy intuitiva. Esta es la herramienta utilizada para primero realizar el análisis visual y, en segundo lugar, para la optimización de los parámetros.

Se ha realizado un análisis visual de las diferentes estrategias de inversión. El proyecto utiliza la estrategia de inversión basada en los cruces de medias móviles. Sin embargo, hay muchas estrategias de inversión diferentes que se pueden aplicar. El doble cruce o triple cruce, medias móviles cortas o largas. Para comparar y analizar las diferentes estrategias, se ha estudiado una selección de once acciones aplicando a todas las mismas estrategias y comparando los resultados entre sí en términos de rentabilidad, volatilidad, días en el mercado y fuera del mismo.

La muestra de acciones está formada por acciones con diferentes movimientos: movimiento lateral ligeramente bajista, movimiento lateral ligeramente alcista, tendencia decreciente y tendencia creciente. Para cada una de las acciones, las estrategias que se han estudiado son la 100-MA 50-MA 20-MA, la 200-MA 100-MA 50-MA, la 144-MA 89-MA 55-MA, la 200-MA 100-MA y el 100-MA 50-MA.

En primer lugar, se ha estudiado la relación de dos noticias, una positiva y otra negativa, con el precio. En segundo lugar, a través del desarrollo de un excel, se han obtenido los resultados de aplicar tanto la estrategia como su inversa. Finalmente, gracias al análisis visual de los gráficos de la estrategia de inversión y el precio con las medias móviles, se puede llegar a una conclusión sobre cuáles son las mejores estrategias y las peores.

Para clasificar las estrategias se sigue siempre el mismo criterio. Primero cualquier estrategia que obtenga rentabilidades negativas queda relegada a las últimas posiciones, así como aquellas estrategias que al ser aplicadas con las condiciones de compra y de venta invertidas obtienen mejor rentabilidad. Con esa selección realizada se prosigue a tomar como mejor estrategia aquella con mayor ratio rentabilidad- días en el mercado.

El proceso de optimización se divide en dos partes. La primera parte, utiliza algoritmos genéticos con la aplicación de trabajo de Matlab. Ha sido desarrollado por la alumna de ICAI, Marta Villagrán. Se han elegido cuatro valores para la optimización: Enagas, MasterCard Incorporated, Kraft Heinz Company y United Health Group. Los resultados de la optimización se han obtenido utilizando dos algoritmos: multiobjetivo y restringido.

El resultado del proceso de optimización son los meteparámetros, que son las medidas que logran los mejores resultados en términos de rentabilidad y baja racha negativa. Una vez que se conocen los metaparámetros, la segunda parte del proceso es la validación. En primer lugar, se realiza con la parte del tiempo que no se utilizó para la optimización. Este es el segmento llamado "Test". La validación consiste en analizar los resultados obtenidos al utilizar los metaparámetros de la optimización. Para una validación adicional, se consideran otros cuatro valores: Facebook, Visa, AbbVie y Abbott. Ahora, los metaparámetros se prueban tanto en la parte de optimización como en la de prueba. Obtener buenos resultados con diferentes valores a los utilizados en la optimización y en la parte de prueba es la mejor señal de rendimiento

Resultados

Del análisis visual de las cinco estrategias seleccionadas y realizadas para cada una de las acciones seleccionadas, los resultados se recogen en la Tabla Resumen 1. Se considera con un signo más, las estrategias en los tres primeros puestos de la

clasificación realizada para cada acción. Un menos para las estrategias en las dos últimas posiciones, consideradas como las peores con las que invertir. Un signo de exclamación simboliza que la estrategia no estaba dando las señales de compra / venta correctas, ya que la estrategia invertida obtuvo mejores resultados. La segunda tabla, muestra los ratios de las estrategias para poder vislumbrar cuál es la mejor estrategia.

La clasificación se hizo considerando malas estrategias aquellas con rentabilidades negativas y aquellas con mejores resultados con la estrategia inversa. Una vez hecha esta selección, el siguiente parámetro medido es el ratio rentabilidad días en el mercado. Cuanto mayor es el ratio, mejor es la estrategia.

SHARES	STRATEGIES				
	100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
ENG	+ !	- !	+ !	+ !	- !
ZOT	- !	+ !	+ !	- !	+
FB	+	+	- !	+	- !
MA	-	-	+	+	+
V	-	+	-	+	+
GE	- !	+ !	+ !	- !	+ !
ABBV	-	+	-	+	+
KHC	- !	+	+	- !	+
UNH	- !	+	+	- !	+
ABT	- !	+	- !	+	+
MRK	+	-	+	+	-

Tabla Resumen 1: Estrategias

SHARES	STRATEGIES				
	100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
ENG	-	-	-	-	-
ZOT	-	-	-	-	-
FB	6,0%	4,0%	2,1%	5,0%	4,0%
MA	9,8%	10,8%	12,6%	12,0%	13,6%
V	7,5%	9,3%	8,4%	10,0%	8,5%
GE	-	-	-	-	-
ABBV	2,5%	8,1%	4,0%	6,3%	10,4%
KHC		0,4%	1,3%		2,3%
UNH	2,1%	15,3%	14,7%	4,2%	14,4%
ABT	1,3%	9,8%	1,4%	2,6%	11,4%
MRK	7,3%	5,8%	7,1%	6,3%	5,8%
TOTAL	36,5%	63,5%	51,6%	46,4%	70,4%
MEAN	4,6%	7,9%	6,5%	5,8%	8,8%

Tabla Resumen 2: Ratio de las estrategias

Las estrategias que obtuvieron los peores resultados son las de 100-MA 50-MA 20-MA y 100-MA 50-MA. Las desventajas de estas dos estrategias son que generalmente caen en falsas alarmas y las órdenes de compra / venta suelen ser aleatorias ya que, en cuatro de las once acciones, la estrategia invertida obtuvo una mayor rentabilidad. Sin embargo, se considera que son buenas estrategias en los casos en los que el gráfico de precios varía considerablemente entre altos y bajos. La 100-MA 50-MA, es la estrategia más rápida.

Las mejores estrategias son la de 200-MA 100-MA 50-MA y 200-MA 100-MA. Son estrategias lentas, por lo que la principal desventaja es dar la orden de venta cuando ya ha habido una caída de precios. Los mejores resultados de esta estrategia se obtienen cuando el precio que se analiza no sufre grandes aumentos o disminuciones.

Se han formado cuatro grupos según las estrategias que resultan ser mejor para las acciones de cada compañía.

Group I



Gráfico Resumen 3: ENG.MC

Group II



Gráfico Resumen 4: GE

Group III



Gráfico Resumen 5: Visa

Group IV



Gráfico Resumen 6: Facebook

Las mejores estrategias de media móviles para las acciones del primer grupo son, en primer lugar, 144-MA 89-MA 55-MA, y luego las que dejan de lado la media móvil de 200 días, que son 100-MA 50-MA 20-MA y 100-MA 50-MA. Los cambios repentinos están ocurriendo constantemente y de manera constante. El problema de la media móvil de 200 días es que es demasiado lenta para reaccionar a estos cambios rápidos y el retraso hace que la estrategia pierda el momento adecuado para comprar y vender.

El segundo grupo está formado por acciones con movimiento lateral ligeramente bajista o tendencia decreciente. Las mejores estrategias son las de 200-MA 100-MA, 144-MA 89-MA 55-MA y 200-MA 100-MA 50-MA. La razón del fallo de las estrategias 100-MA 50-MA y 100-MA 50-MA 20-MA es que reaccionan demasiado rápido y filtran poco las falsas alarmas en las que puede parecer una operación rentable, pero terminan con rendimientos negativos.

El tercer grupo comprende aquellas compañías cuyos precios de acciones tienen una tendencia al alza o un movimiento lateral ligeramente alcista. La combinación de medias móviles que funciona mejor con este tipo de tendencia es la 200-MA 100-MA. El patrón que sigue todos los movimientos de precios es una tendencia ascendente y las variaciones de precios entre altos y bajos tienen distancias muy pequeñas. Debido a que los cambios en el precio ocurren en una distancia tan pequeña, pero siempre con una tendencia al alza, hace que sea mejor considerar el promedio móvil de 200 días.

Las mejores medias móviles para lograr buenos resultados para el cuarto grupo son el 100-MA 50-MA 20-MA y el 100-MA 50-MA. Cuando hay una caída repentina de los precios, las estrategias lentas como la de 200-MA 100-MA pierden la oportunidad de salir del mercado a tiempo para evitar mayores pérdidas.

Mediante la aplicación de algoritmos genéticos en el proceso de optimización, los metaparámetros obtenidos son: una estrategia de inversión de promedios móviles de longitudes 9-MA 7-MA 5-MA, utilizando un filtro de 0,29 y una ventana futura de 22.

Las tres validaciones se han llevado a cabo. Los resultados de este estudio han coincidido con los resultados de la optimización, que era el objetivo de la validación. Sin embargo, como el proceso de optimización se realiza con cuatro acciones que representan cada una de ellas un tipo de movimiento de precios o una tendencia (para evitar datos sesgados), la estrategia de inversión resultante no es la que para cada una de ellas logra los resultados más altos, sino la que es la mejor cuando solo se puede aplicar una estrategia a todas ellas.

Conclusiones

El análisis se realizó con el objetivo de aclarar si las estrategias más utilizadas o las percepciones generales sobre el análisis técnico con media móviles son correctas. En primer lugar, se confirma que, para aplicar la estrategia de medias móviles en largos períodos, las medias móviles cortas no proporcionan las mejores indicaciones. Este es el caso de la estrategia estudiada 40-MA 20-MA 10-MA que con un alto número de operaciones no logra una alta rentabilidad.

En segundo lugar, el promedio móvil de 200 días se ha corroborado como un fuerte indicador. Esta media móvil filtra el ruido del precio y evita las falsas alarmas. Además, su eficiencia ayuda a la estrategia 200-MA 100-MA 50-MA en el proceso de dar órdenes fiables de compra / venta. Esta estrategia, que es la más considerada por los inversores cuando usan medias móviles, se confirma como un indicador confiable y bueno.

Finalmente, se estudia la eficiencia de qué tipo de cruce usar. La orden de compra generalmente es al mismo tiempo para las estrategias de doble y triple cruce. Sin embargo, la señal de salida es más rápida para el triple cruce en los dos casos estudiados porque los dobles cruces elegidos están dejando de lado las medias móviles más cortas que son las que dan más dinamismo. El triple cruce, ya que tiene que cumplir tres restricciones para dar la orden de compra, es una estrategia más restringida con un mayor nivel de confianza en general. Al conocer estas características, los inversores pueden decidir qué tipo de crossover aplicar según sus objetivos establecidos.

El proceso de optimización proporciona una estrategia de inversión que logra los mejores resultados en rentabilidad con una baja racha negativa. Sin embargo, tratar de englobar acciones con diferentes patrones de precios, que pertenecen a diferentes industrias, sectores, mercados y monedas bajo la misma estrategia de inversión y lograr la mayor rentabilidad es casi imposible. Como se mostró en el capítulo de análisis visual, cada valor tiene diferencias que hacen que una estrategia sea más adecuada para algunas acciones que para otras. La baja eficiencia de los resultados que logra la optimización se debe al hecho de que la estrategia de inversión de 9-MA 7-MA 5-MA es la que mejor logra una alta rentabilidad y pocas franjas negativas para cada acción cuando se trata como un todo. Está claro que, cuando se estudian individualmente cada valor, los resultados resultan ser diferentes.

Otros estudios pueden centrarse en una optimización más especializada. Los grupos que se han obtenido del análisis visual representan un comienzo interesante para el desarrollo de estrategias de inversión óptimas que puedan alcanzar una mejor rentabilidad, ya que su aplicación es más restringida. También, es interesante la comparación de la estrategia de cruce de precio con media móvil para estudiar qué técnica funciona mejor.

Referencias

- [KIRK10] C. D. Kirkpatrick and J. R. Dahlquist, “The Complete Resource for Financial Market Technicians” Second Edition FT Press, 2010.

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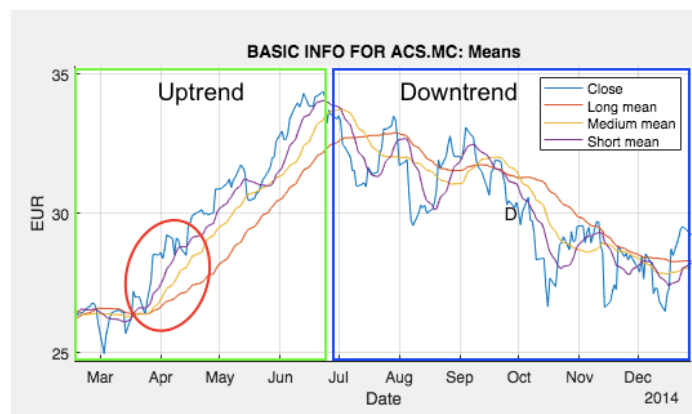
PROJECT SUMMARY

Introduction

This project is intended to explore the framework of visual information systems to trade using the technique of moving averages. The objective is to identify how prices behave based on the information obtained from the moving averages.

Financial decisions in investments are not taken randomly. Knowing how to trade consists on selecting the best strategy to give the right orders: buy, wait or sell. A tool to develop efficient decision-making is the technical analysis. It assumes that all the factors of a company like balance sheets or its economical context are included in the price and therefore, they are not aleatory so they tend to repeat their behavior through the years. The strategies based on moving averages are part of the technical analysis.

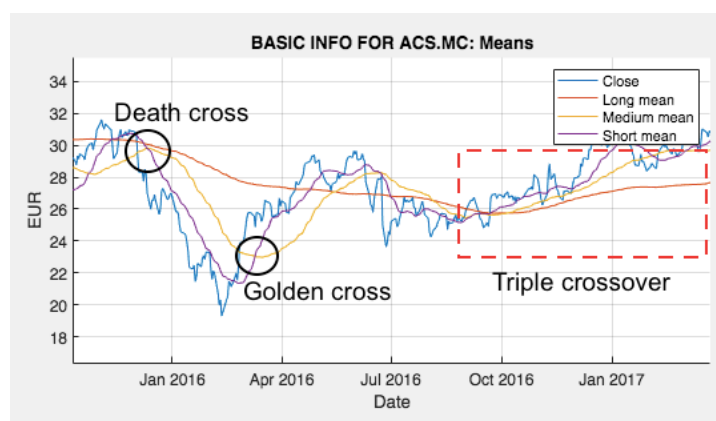
A moving average is defined as: “a constant period average, usually of prices, that is calculated for each successive chart period interval.” (Kirkpatrick and Dahlquist, 2010). Moving averages are used to filter the noise of the price so the trend can be easily identified. Trends can be classified in uptrend or downtrend, as seen in Graph 1. Depending on the length of the moving average, the price is filtered more in the case of long moving averages or less in the case of the shortest ones.



Graph Summary 1: ACS.MC Price and moving averages

Moving averages are useful tools for the investors. They are usually used as signals of support and resistance, so the price highs come across with the resistance levels and the price downs run into the support signals. However, the technique of crossovers is

the most important one when working with moving averages. Crossovers can be categorized in two: price crossover and moving average crossover.



Graph Summary 2: Crossovers

The price crossover strategy indicates possible trend changes. If the price crosses over a moving average it means a sign of an uptrend and if it crosses downwards it is taken as a signal of a downtrend.

The bases of the moving average crossover are the following. When a short-term or fast MA crosses over a longer or slower MA, it means that a new uptrend is starting so it is considered as a signal to entry the market. This kind of bullish breakout is commonly known as “golden cross”. To feel more secure about the buying signal, it can be considered the cross of a short MA over two longer ones, called the triple crossover. In the same way, a selling signal is called “death cross” and it occurs when a short MA crosses under one or two longer MAs. This technique is shown in Graph 2.

Methodology

To facilitate the access to information and make the analysis of data quicker the Stock Exchange Application has been developed by teacher Juan Luis Zamora Macho. It is a Matlab application, version 2018b, that was developed from a collection of data corresponding to 1311 shares of the last ten years.

It is a very visual and easy app to work with. The combination of the graphs and text windows allows to achieve a high knowledge and comprehension of what is happening. Besides, setting the parameters and the conditions is done in a very intuitive way. This is the tool used for firstly the visual analysis and secondly the optimization of the parameters.

A visual trading analysis of different investment strategies has been carried out. The project uses the investment strategy based on the moving averages crossovers. However, there are many different investment strategies that can be applied. Double crossover or triple crossover, short or long moving averages. To compare and analyse the different strategies, a selection of eleven shares have been studied by applying to all of them the same strategies and comparing the results in terms of profitability, volatility, days in the market and out of it.

The sample of shares is formed by shares with different movements: slightly bearish lateral movement, slightly bullish lateral movement, decreasing trend and increasing trend. For each of the shares, the strategies that have been studied are the 100-MA 50-MA 20-MA, the 200-MA 100-MA 50-MA, the 144-MA 89-MA 55-MA, the 200-MA 100-MA and the 100-MA 50-MA.

The classification has considered as bad strategies those whose profitability is negative and those whose inverted strategy profitability got higher profitability. Once this selection is done, the following step is to look at the ratio between profitability and days in the market. The higher the ratio the better the strategy.

The scheme showed in Figure Summary 1 presents the structure followed in the analysis. Firstly, it has been studied the relationship of two pieces of news, one positive and other negative, with the price. Secondly, through the development of an excel there have been obtained results when the strategy and the inverse one are applied. Finally, thanks to the visual analysis of the investment strategy graphs and the price and moving averages graphs, a conclusion of which are the best strategies and the worse ones can be reached.

The process of optimization is divided in two parts. The first part, uses genetic algorithms in the Matlab application. It has been developed by the ICAI student Marta Villagrán. Four values have been chosen for the optimization: Enagas, MasterCard Incorporated, Kraft Heinz Company and United Health Group. The results of the optimization have been obtained using two algorithms: multiobjective and constrained.

The output of the optimization process are the metaparameters that are the measures that achieve the best results in terms of profitability and low negative streak. Once the metaparameters are known, the second part of the process consists on the validation. Firstly, it is done with the part of time that wasn't used for the optimization. This is the called "Test" segment. The validation consists on analysing the results obtained when using the metaparameters of the optimization. For further validation, four other values are considered: Facebook, Visa, AbbVie and Abbott. Now, the metaparameters are tested in the optimization and test part. Obtaining good results with different values from the ones used in the optimization and in the test part is the best performance signal.

Results

Out of the visual analysis of the five strategies selected and done for each of the shares chosen, the results are collected in Table Summary 1. It is considered with a plus, the strategies in the top three of the classification done for each share. A minus for the strategies in the last two positions, considered to be the worse ones to trade with. An exclamation mark towards the sign symbolizes that that strategy was not giving the correct buying/selling signals as the inverted strategy obtained better results.

SHARES	STRATEGIES				
	100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
ENG	+ !	- !	+ !	+ !	- !
ZOT	-	+ !	+ !	- !	+
FB	+	+	- !	+	- !
MA	-	-	+	+	+
V	-	+	-	+	+
GE	- !	+ !	+ !	- !	+ !
ABBV	-	+	-	+	+
KHC	- !	+	+	- !	+
UNH	- !	+	+	- !	+
ABT	- !	+	- !	+	+
MRK	+	-	+	+	-

Table Summary 1: Strategies results

SHARES	STRATEGIES				
	100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
ENG	-	-	-	-	-
ZOT	-	-	-	-	-
FB	6,0%	4,0%	2,1%	5,0%	4,0%
MA	9,8%	10,8%	12,6%	12,0%	13,6%
V	7,5%	9,3%	8,4%	10,0%	8,5%
GE	-	-	-	-	-
ABBV	2,5%	8,1%	4,0%	6,3%	10,4%
KHC	-	0,4%	1,3%	-	2,3%
UNH	2,1%	15,3%	14,7%	4,2%	14,4%
ABT	1,3%	9,8%	1,4%	2,6%	11,4%
MRK	7,3%	5,8%	7,1%	6,3%	5,8%
TOTAL	36,5%	63,5%	51,6%	46,4%	70,4%
MEAN	4,6%	7,9%	6,5%	5,8%	8,8%

Table Summary 2: Strategies results

The strategies that obtained the worst results are the 100-MA 50-MA 20-MA and the 100-MA 50-MA. The drawbacks of these two strategies are that they usually fall in false alarms and the buying/selling orders turn out to be many times aleatory as in four of the eleven shares, the inverted strategy obtained higher profitability. However, they are considered to be good strategies in cases in which the price graph varies considerably between highs and lows. The 100-MA 50-MA is the quickest strategy.

The best strategies are the 200-MA 100-MA 50-MA and the 200-MA 100-MA. They are slow strategies so the main disadvantage is giving the selling order when there's a price fall. The best results of this strategy come when the price being analyzed does not suffer from big increases or decreases.

Four groups have been formed depending on the strategies that fit better with each company's shares.

Group I

Group II

Group III

Group IV



Graph Summary 3: ENG.MC



Graph Summary 4: GE



Graph Summary 5: Visa



Graph Summary 6: FB price

The first group best moving averages to apply are in first place the 144-MA 89-MA 55-MA, and then the ones that leave aside the 200-day moving average which are the 100-MA 50-MA 20-MA and the 100-MA 50-MA. Sudden changes are happening constantly and in a steady way. The problem of the 200-day moving average is that it is too slow to react to these quick changes and the lag makes the strategy lose the right time for buying and selling.

The second group is formed by shares with slightly bearish lateral movement or decreasing trend. The best strategies are the 200-MA 100-MA, the 144-MA 89-MA 55-MA and the 200-MA 100-MA 50-MA. The reason for the failure of the 100-MA 50-MA and the 100-MA 50-MA 20-MA is that these strategies react too quickly and they filter little the false alarms in which it may seem as a profitable operation but ends up with negative returns.

The third group comprehends those companies whose shares' prices have an increasing trend or a slightly bullish lateral movement. The combination of moving averages that works better with this kind of trend is the 200-MA 100-MA. The pattern that follows all the price movements is an upward sloping trend and the price variations between highs and lows have very small distances among them. Because of the changes in price occur in such a small distance but always with an upward trend it is always better to consider the 200-day moving average.

The best moving averages to achieve good results for the fourth group are the 100-MA 50-MA 20-MA and the 100-MA 50-MA. When there's a sudden fall of prices the slow strategies like the 200-MA 100-MA miss the chance to exit the market on time to avoid bigger losses.

Through the application of the genetic algorithms in the optimization process the metaparameters obtained are: a moving averages investment strategy of lengths 9-MA 7-MA 5-MA, using a filter of 0,29 and a future window of 22.

The three validations have been carried out. The results of these study have agreed with the results of the optimization, which was the objective of the validation. However, as the optimization process is done with four shares that represent each of them one type of price movement or trend to avoid biased data, the resulting investment strategy is not the one that for each of them achieves the highest results but the one that is the best when only one strategy can be applied to all of them.

Conclusions

The analysis was done with the aim of clarifying if the strategies more used or general perceptions about the technical analysis using moving averages were correct. Firstly, it is confirmed that for applying the strategy of moving averages in long periods, short moving averages don't provide the best indications. This is the case of the studied 40-MA 20-MA 10-MA strategy that with a high number of operations doesn't achieve high profitability.

Secondly, the 200-day moving average has been corroborated as a strong indicator. This moving average filters the price noise and avoids false alarms. Besides, its efficiency helps the 200-MA 100-MA 50-MA strategy in the process of giving trustworthy buying/ selling orders. This strategy, that is the one more considered by

investors when using moving averages, is confirmed to be a reliable and good trading indicator.

Finally, the efficiency of what kind of crossover to use is studied. The buying order is usually at the same time for both, the double and the triple crossover strategies. However, the exit signal is quicker for the triple-crossover in the both cases studied because the double-crossovers chosen are leaving aside the shortest moving averages that are the ones that give more dynamism. The triple-crossover, as it has to fulfill three constraints to give the buying order, is a more constrained strategy with higher level of reliance in general. Knowing these characteristics, investors can decide which kind of crossover to apply depending on their set objectives.

The optimization process provides an investment strategy that achieves the highest results in profitability with low negative streak. However, trying to englobe shares with different price patterns, that belong to different industries, sectors, markets and currencies under the same investment strategy and achieve the highest profitability is almost impossible. As it was showed in the visual analysis chapter, every value has differences that make a strategy more suitable to some shares than to others. The low efficiency of the results that the optimization achieves is due to the fact that the investment strategy of 9-MA 7-MA 5-MA is the one that best achieves high profitability and low negative streaks for every share when treated as a whole. It is clear that, when studied every value individually, the results turn out to be different.

Further studies can focus on a more specialized optimization. The groups that have been obtained out of the visual analysis represent an interesting start for the development of optimal investment strategies that can reach better profitability as their appliance is more restricted.

References

- [KIRK10] C. D. Kirkpatrick and J. R. Dahlquist, "The Complete Resource for Financial Market Technicians" Second Edition FT Press, 2010.

Visual trading system based on moving averages

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Chapter 1: Introduction and state of the art

1.1. Introduction and motivation

The main objective of this project is to explore the framework of the visual information systems to trade using moving averages and study the different moving averages strategies using as a tool the visual trading systems. It seeks to verify the exposed strategies and classify the behaviors of the averages. Because of the analysis, it is possible to identify how prices behave based on the information obtained from the moving averages and use it to know the start of trends and the exact moments to buy or sell.

Other aim of the project is the representation of moving averages of different lengths together with the quotes of different shares in a determined interval time for the realization of the visual analysis. Always with an analytical objective, observe the crosses of the moving averages to determine their growth and volatility. One last objective is the obtaining of clusters that produce the optimal profitability through the non-systematic analysis of the data.

The selection of this theme answers two circumstances. On the one hand, the interest of the information treated. There are many articles about which moving averages strategies should be used or what are the signals that are given by the moving averages. However, there is not a deep study that confirms if these theories are right or if there could be better strategies than the ones proposed until now. On the other hand, the Matlab tool has facilitated the access to the data and also, it has given dynamism to the analysis and the studies done as its output offers all the information necessary.

The fact of studying the moving averages as an investment strategy gives the advantages of exploring the efficiency of this trading method and it offers an insight of the results obtained if this technique was used.

The theme is related with the nowadays problem to choose which trading system to use when investing. Knowing how to trade consists on choosing the right strategy that gives the right orders: buy, wait or sell. A tool to develop efficient decision-making is the technical analysis and the system of trading with moving averages is part of it.

The information has been obtained out of a collection of past data of the last ten years of the most relevant international markets such as the IBEX35, the NASDAQ or the SP500 among others with the information about the shares' closing and opening price, currency and more useful data.

The election of the theme is basically because it is very interesting and attracting to verify or find a strategy that achieves to obtain positive profits whenever it is applied. A strategy that ensures that its buying orders are leading to earning profits and avoiding entering a fall in prices.

The project is divided in six chapters. The first one is the introduction and state of the art. The second chapter explains how the Matlab application works and how to use it for this project. Chapter three focuses on the visual analysis of different moving averages strategies. The fourth chapter explains the optimization. Chapter five contains the bibliography and the seventh the appendix.

1.2. State of the art

Financial decisions in investments are not taken randomly, at least if the person who is taking them is interested in not losing the money invested and hopefully earning some profits with the operation. That is why, there have been developed ways for taking financial decisions and they have been classified in two types. On the one hand, the fundamental analysis is the one that comprehends all the decisions based on the balance sheets and strategy of the companies as well as the political and economical context they are in. And on the other hand, the technical analysis assumes that all the previous factors are included in the price and therefore they are not random and they tend to repeat their behavior through the years. Hence the interest for analyzing past data to predict future behavior.

1.2.1. Visual trading and moving averages

A moving average is defined as: “a constant period average, usually of prices, that is calculated for each successive chart period interval.” (Kirkpatrick and Dahlquist, 2010).

$$SMA = \frac{\sum_{i=1}^N Price_i}{N}$$

Moving averages smooth the data, leaving aside the effect of short-term fluctuations and they are the tool used in the visual trading of this project. The visual trading consists of plotting different moving averages, analyzing their trends and applying the moving average strategy chosen.

There are different types of moving averages. The most commonly used ones are the Simple Moving Average (SMA) and the Exponential Moving Average (EMA). However, there are other kinds of moving averages such as the Linearly Weighted Moving Average (LWMA), the Wilder Method, the Geometric Average (GMA) or the Triangular Moving Average (TMA). The one that is used for this project is the Simple Moving Average (SMA). It is calculated as an “arithmetic moving average” (Kirkpatrick and Dahlquist, 2010, p.278). The difference between the EMA and the SMA is that the EMA is a weighted moving average, which means that it will weigh recent prices more strongly.

The SMA is usually calculated with the closing prices but it does not mean it cannot be calculated with the highs or lows. Once the moving average is calculated, it is plotted to proceed with the visual trading part. Thanks to the plotting of moving averages the trend is easily identified. But, what is the trend? James Chen in his article published in Investopedia defines the trend as “the general direction of a market or of the price of a security (2019)”. To use and analyze a trend it is necessary to differ uptrends from downtrends. “Uptrends connect a series of higher lows. Downtrends connect a series of lower highs.” (Chen, 2019). From this point the moving averages are used as tools and for different financial strategies that have been developed through the years.

1.2.2. The beginning of moving averages as a financial strategy:

Moving averages were used in different fields as a technique for smoothing data but it wasn't until Peter N. Hauran in the 1960s decided to use them as a financial trading instrument that they acquire relevance in the technical analysis. He used the exponential moving averages (EMA) to track the trajectory of missile and satellites. This led him to the thought of using the EMAs as a way of tracking the movements of the stock prices. The reason why he used EMAs was that the calculation of these ones required less processing power than the needed for obtaining the simple moving average (SMA). He knew that most of the financial analysts of the time didn't have access to computers so in order to make calculations easier, he also decided to use round-numbered smoothing constants, such as 1%, 2%, 5%, 10%, 20% and 50%. Hauran established that the choice of the smoothing constant had to be based on whether you wanted a faster or slower reaction. A 1% trend needs a greater amount of time to stabilize as it needs the data of the last 200 days, which corresponds to the nowadays called 200-day moving average.

In his book "Measuring Trend Values" he explains how to calculate the EMAs, how to analyze them and how to interpret them in order to know when to buy or sell. The strategy he set was to "treat the crossing of price down through the trend as a sell signal and up through the trend as a buy signal" (Hauran, 1968, p. 5), which is still used but with some improvements added.

A few years later, Sherman and Marian McClellan added their own insight to the strategy proposed by Hauran. They introduced the importance of calculating the difference between two different EMAs as an indicator, the so called "McClellan Oscillator". The trends would move to deeply negative levels for sharp declines in the stock market and waiting for the moment in which they turned positive meant missing a great chance of earning money.

To avoid the previous problem, the McClellan Oscillator set some indicators to know when to buy or sell without waiting for the trend to be positive or negative. "Seeing the 10% Trend move above the 5% Trend, even though both were still negative, gave advanced warning that a reversal had taken place. A side benefit of doing this was that they could detect extremely overbought or oversold conditions when the difference between these EMAs became very large". (McClellan, 2004). The use of a 5% and 10% trend corresponds with the timeframes of 19 day and 39 day periods.

There are two main conclusions about the use of the McClellan Oscillator. The first one consists on taking extreme values as a signal of an overbought or an oversold. The second conclusion is based on the sign of the oscillator. If it is positive, it means that money is coming to the market and if it is negative, it means that money is leaving the market. Nowadays the McClellan Oscillator is used but in conjunction with other technical indicators to distinguish better between true and false signals.

From this point on, moving averages have been considered as a technical indicator and used to smooth the data and determine when the trends are changing direction. Through the years some financial tools and strategies that use moving averages as the main indicator have been developed.

1.2.3. Financial tools and strategies based on moving averages.

Moving averages is a concept and a technic used in many different fields. The difference between the moving averages used in finance and the ones used in medicine or statistics is the way we interpret them and the way we use them.

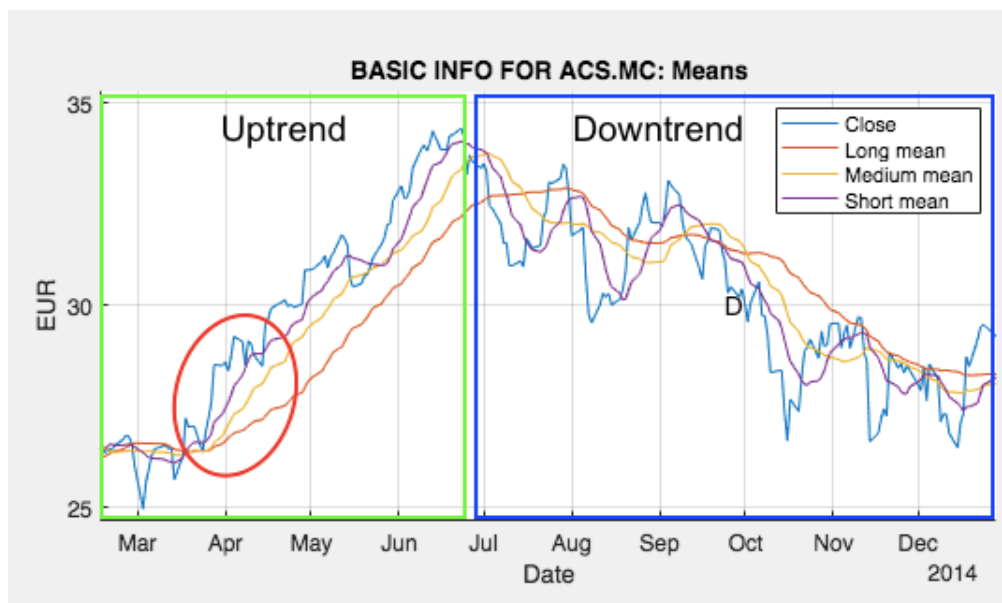
i) Tools

In finance, moving averages have been considered as a tool that can help recognize the trend and they can be taken as a support, resistance or stop-losses signals.

The trend is the most characteristic outcome that we obtain of using moving averages. Understanding the directions of trends is basic for any trader that wants to verify if “the market forces are working in your favor” as said by Murphy (2018). There are two types of trendlines depending on their positive or negative slope.

On the one hand, there is the uptrend that shows a tendency to continue heading upward, as it is shown in the first part, marked in green, of Graph 1. It means that the demand for a certain asset is greater than the supply and there is a tendency likely to continue that way.

On the other hand, a downtrend shows that there is a tendency to go down and it will keep falling. The final blue part of Graph 1, reflects a downtrend, represented by the three means. In this case, the supply of the asset is bigger than the demand and that is reflected on the negative slope of the trend.

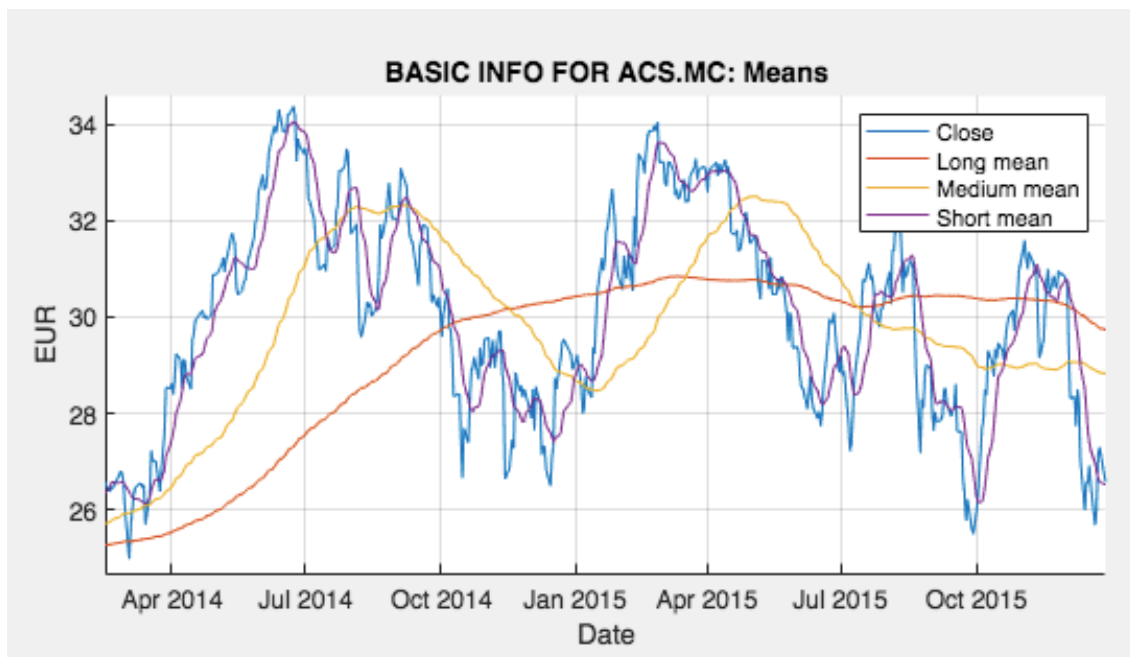


Graph 1: Close Price and 40 MA 20 MA 10 MA. ACS.MC.

Out of these two types of trends some conclusions can be done. For example, when facing a downtrend, the common thought is not holding a long-term position for that asset. As its trend is downwards sloping it is unlikely that any gain would be obtained, so the best is to quit and exit that position. Therefore, many traders consider that it is only worth holding a long position when the price of an asset trades above a moving

average. In Graph 1, it is circled in red, one period in which the previous explained condition happens.

It is also interesting to observe the way moving averages act as noise filters. The longer the window of the moving average the stronger is the reduction of the noise. In Graph 1, the long mean represented by the orange line corresponds to a 40 MA and is the one with less sudden highs and lows. It shows a steadier trend that develops leaving the perturbations aside. For example, in *Graph 2* it is represented a 200 MA, 70 MA and a 20 MA. The long mean, which is the orange line, smooths the price in such a strong way that loses some important movements. The short mean, is almost the same as the price. It filters some of the noise but it doesn't show a clear trend. Consequently, the 70 MA offers a view that provides a trend free of noise and sudden movements that don't provide any information and also, it is a trend that is close to the shape of the price.

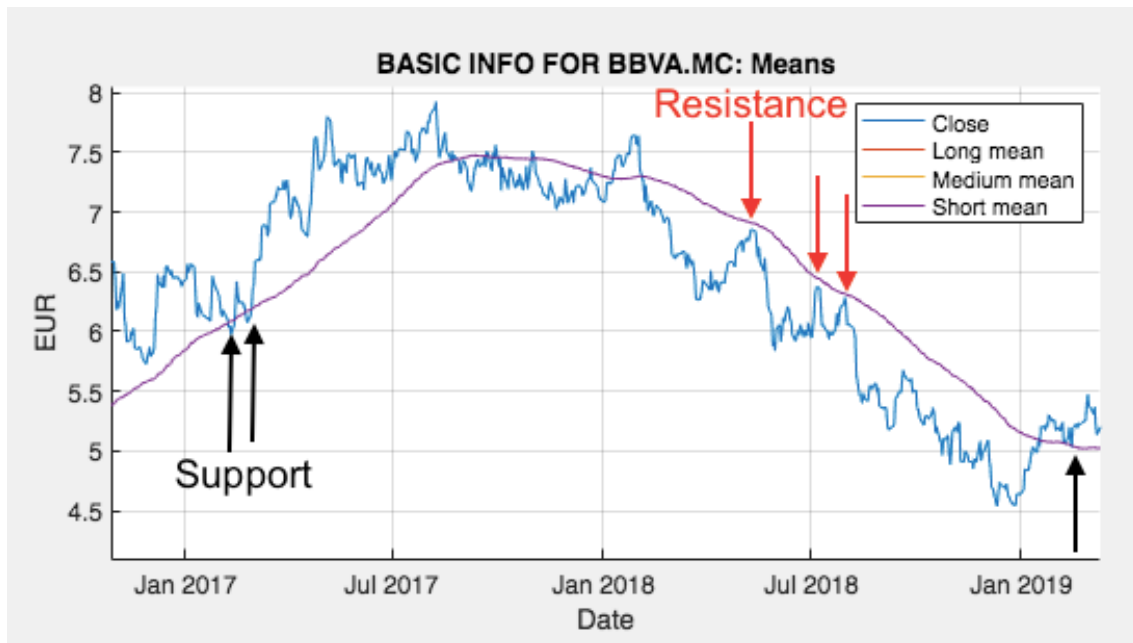


Graph 2: Close Price and 200 MA 70 MA 20 MA. ACS.MC.

Another use of the moving averages is treating them as price supports or resistances. Kirkpatrick and Dahlquist (2010) said that “a moving average often duplicates the trend line; therefore, it can be an easy trailing stop mechanism for determining when a position should be liquidated or reduced”. Therefore, supports and resistances act like barriers or limits and help delimitate an area in which the price is going to vary. The use of these moving averages tools is based on the belief that the price will not leave this area. This means that when it reaches the support or resistance trend it will change its direction. Supports are known also as “floor” because they prevent the price from falling. Resistances are known as “ceiling” because they set a limit for prices going higher. Traders, in order to know the significance of the price levels they are working with, look at: the number of touches, the time, the volume at certain price levels and if they are preceding the price move.

In *Graph 3*, it is shown how the 100 moving average acts in the first part as support and in the final part of the graph as resistance for the closing price. The touches of the

price with the moving average are marked in black when it corresponds to a “support touch” and in red when it is a “resistance touch”.



Graph 3: Close Price and 100 MA. BBVA.

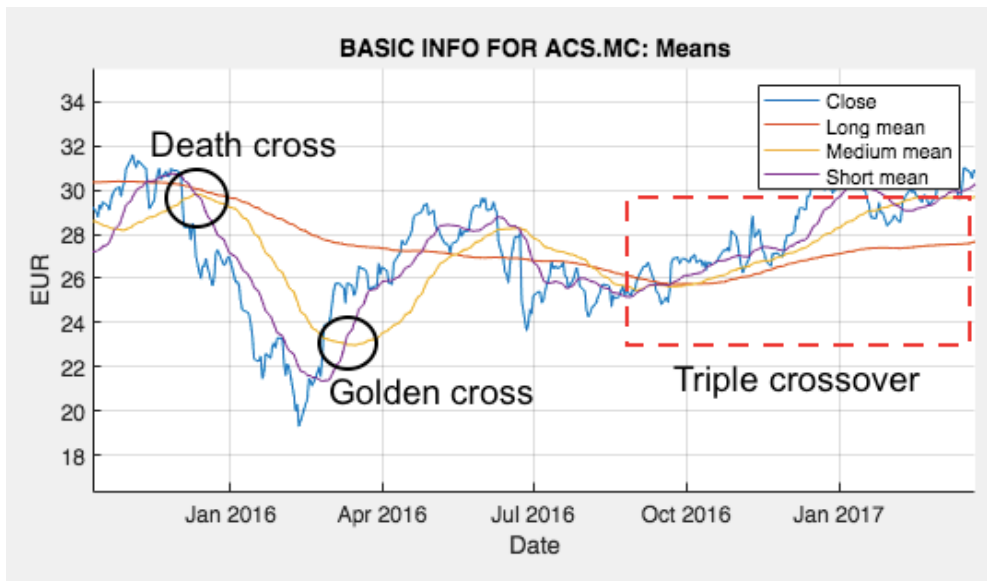
Finally, there is the stop-loss order which basically consists on setting a price limit. It is defined by Chen (2018) as an “order placed with a broker to sell a security when it reaches a certain price”. The main use of this tool is to protect investors from huge losses. Long-term investors use orders that correspond to bigger percentages like a 15% stop loss while short-term traders might use a 5%.

ii) Strategies

The technique of crossovers is the most important one when working with moving averages. Crossovers can be categorized in two: price crossover and moving average crossover.

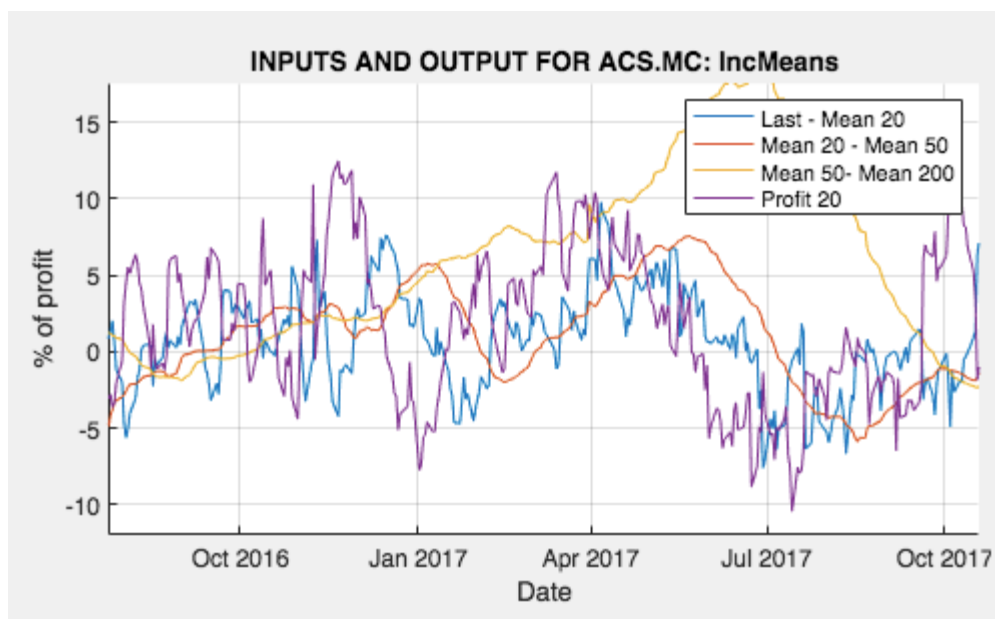
The price crossover strategy indicates possible trend changes. If the price crosses over a moving average it means a sign of an uptrend and if it crosses downwards it is taken as a signal of a downtrend. Both, uptrends and downtrends were explained before and the implications they have when investing.

The bases of the moving average crossover are the following. When a short-term or fast MA crosses over a longer or slower MA, it means that a new uptrend is starting so it is considered as a signal to entry the market. This kind of bullish breakout is commonly known as “golden cross”. As a way to feel more secure about the buying signal, it can be considered the cross of a short MA over two longer ones. In the same way, a selling signal is called “death cross” and it occurs when a short MA crosses under one or two longer MAs.



Graph 4: Close Price and 200 MA 50 MA 20 MA. ACS.MC.

The triple crossover in *Graph 4* happens around October of 2016. The app designed for the project works with the input called “IncMeans” and provides a representation like the one in *Graph 5*. This is explained in the “App description” chapter, but the important concept is that it plots the difference between the moving averages. It plots the last minus the short mean, the short mean minus the medium mean, the medium mean minus the long mean and the future profitability. In this way, when all the three differences are positive, it means an opportunity to buy and it is the signal of a triple crossover. In *Graph 5*, it can be seen how at the blue, orange and yellow line cross over the zero axe in the moment of the triple crossover.



Graph 5: IncMeans. Triple crossover. ACS.MC.

The main problem of this strategy are the false signals that may end up causing loses because of having to pay the buying and selling rates every time there is a signal to enter or exit the market.

To solve the previous problem, some investors use filters or envelopes. “Many investors may choose to wait until a security crosses above a moving average and is at least 10% above the average before placing an order.” (Murphy, 2018). Therefore, the outcome of using filters is a gain on the confidence of the investor as the number of false signals is reduced. The only downside to this strategy is that a part of gain is being given up so it is interesting using a filter that is not too big so it doesn't mean missing a lot of opportunities but wide enough not to lose money because of false signals.

Bands represent a solution to achieve in every moment the optimal wideness. Instead of being a fixed percentage, bands “adjust for the price volatility around the moving average.” (Kirkpatrick and Dahlquist, 2010). There are several uses for bands. The first one is for determining the beginning of trends. The strategy followed for this is to enter in the direction of the breakout whenever the outer edge of a band is trespassed. The other use is treating the moving averages as support and resistance tools. And the last one is using bands to observe price volatility.

1.2.4. Selection of moving averages

There are many points of view regarding the moving averages strategies. In the following parts, it is shown the strategies most used, as well as the general opinion and drawbacks that people usually see on the reliance on moving averages.

i) Basic MAs: 50, 100, 200.

Most traders agree on which are the three basic moving averages to work with. These are: the 50 MA, for the short term, the 100 MA, for the medium term and the 200 MA, for the long term. Maverick (2018) in an article said that “the more accurate a moving average is as a trend indicator, the more useful it is for traders and analysts”. This means that the optimum moving average is the one that will not be violated by price just because of any lag that may give a false signal. It should be also used to place a trailing stop and the price should be close to the MA so it can be used to make market entries. The combination of 50, 100 and 200 MA is the one considered to achieve better all the previous goals. However, this conclusion has been obtained by trial and error so this combination is not going to be the optimal moving average for every case.

ii) Other points of view

There are many different opinions about which is the best moving averages combination to get a better understanding of the market. There are many articles that agree on the convenience of using the 50, 100 and 200 MA, previously exposed. However, some investors have different opinions based on their previous experiences and preferences. The use of the 20, 50 and 100 MA together seems to be also a spread option. Other option is the combination of 20, 50 and 200 MA. Different opinions that need to be analyzed as all the theories are just based on the level of trust that investors have developed on the moving averages.

iii) The 89 day moving average

Some traders compare the use of an 89-day moving average to the 50 MA. Why concretely an 89 MA? The reason is just and only because it is a Fibonacci's number and it happens to give satisfying results. Fibonacci's numbers have been used to create many technical indicators like indicating support and resistance, the zone where the strong price wave may reach or predicting when the major price movements will occur. Pendergast (2009) in his article "How to Profit with Simple Moving Averages" confirms that an 89 MA does an "outstanding job of defining primary trends and support/resistance areas".

Khorram and Sheshmani of the University of Tehran carried out an investigation of the best moving averages to predict stock price in the Tehran stock exchange. To obtain the MAs with best results they used an Artificial Neural Network (ANN). Then they used a correlation-based filter to determine which of the 1-200 day moving averages were the ones with more frequency and selected those as the MAs more appropriated to predict the stock prices. The results indicated that the 5, 25, 48 and 89 day moving averages were the ones that lead to best results, being the 25 and 48 day moving averages the ones with more frequency according to the study developed. Again, the 89 MA appears as an interesting moving average to study.

iv) Short term inversions vs long term inversions

However, the selection of the moving averages mostly depends on the period length the trader is investing. That is why, for long-term inversions the 200 MA is the most used. It leaves out most of the noise and it is less susceptible to temporary fluctuations in price. And on the contrary, the use of 20 MA, 10 MA or 5 MA are for short-term trends because they react quickly to price changes and alert more often as signals appear frequently. If the interest of the investing is an even shorter period which could be for example the intraday investing, the moving averages recommended are 5, 8 and 13 taking again Fibonacci's numbers as reference. However, the intraday investing is not subject of this project that will be instead focus on longer periods of investing.

v) Investing.com

Investing.com provides his users with the data corresponding to the moving averages of lengths: 5, 10, 20, 50, 100, 200. The information provided is the value of each of the moving averages and then for each of them a buy-sell signal. Besides, there's the option of plotting the moving averages in the same chart as the price. As this website provides the information of these different day moving averages it can be assumed that many traders rely on them and therefore represent the most common moving averages.

It is true that many traders and investors consider moving averages a tool of great importance when they invest. However, as any method or technique, the use of moving averages as a technical financial indicator presents some difficulties and drawbacks and therefore people who are against the use of them.

vi) Trust or not the 200 MA

The 200-day moving average is usually used for the strategy of taking just the price and the moving average and considering a buying order the moment when the price crosses over the moving average. Many articles are coming out nowadays underestimating the ability of this moving average to provide benefits like the one of Hulbert titled “You can no longer trust the 200-day moving average as a stock-market indicator”. The 200-day moving average is also used in the wide-spread strategy of 200-MA 100-MA 50-MA. In the analysis it is studied if the efficiency of this moving average is imaginary or it can actually be trusted.

1.2.5. Drawbacks and open spots

The moving averages strategy is not a method that can be followed blindfolded as it is always right. Being aware of the limitations of moving averages helps the traders’ decision-making.

One of the biggest drawbacks of moving averages is that they are lagging indicators. They are only capable of analysing the past, so when it comes the time for taking decisions, they don’t offer a big insurance about if the decisions taken are going to be the right ones. This is a disadvantage common to all investment strategies because it is impossible to predict exactly what is going to happen in the future. There are factors that are beyond the reach of these strategies. Smith (2018) gives some examples of these possible unpredictable factors, like it is the appearance of new competitors, the change in demand for products in an industry or changes in the structure of a company.

“Although moving averages can help smooth out these trends, they can also hide the fact that the security is trending in an oscillatory pattern” (Smith, 2018).

Another problem are the false signals produced by the numerous trade signals. “Patience and enough capital to withstand a series of small losses until a trend develops”, that is the solution given by Kirkpatrick and Dahlquist, 2010. Filters and bands, as explained before also help, but they don’t eliminate all the false signals so traders must be aware of this risk.

Marwood (2016) summed up the difficulty when treating moving averages: “all moving averages are a trade-off between noise and lag”. Therefore, research should be focused on finding the right and optimal combination of moving averages that could help obtaining higher profits with low volatility. However, to achieve this, there are many questions and aspects that must be analysed. What factors influence the optimality of the moving averages investing strategy? Does it depend on the industry? Does it depend on the type of share analysed? What is the best combination of lengths of moving averages to obtain a good strategy? Is better to trust a double or triple moving averages crossover?

In order to try to answer all the previous questions there has been developed a tool. It is a Matlab application that through a data collection for the last ten years of the prices of 1311 shares, allows doing a visual analysis, comparing shares, studying different moving averages strategies and more. The description of this tool is explained in the following chapter.

Chapter 2: Application description

2.1. General information

The Stock Exchange Application is a Matlab application, version 2018b, developed by the teacher Juan Luis Zamora. It was developed from a collection of data corresponding to 1311 shares of the last 10 years. All the information collected is organized in the structure called “MARKET_DATA.mat”. The information kept in this structure is: ticker, company, sector, industry, stock exchange, currency, date, currency rates, and stock quotes corresponding to the opening, closing, high, low and volume price.

Before the development of the app, there were two main Matlab functions to work with. These functions are: DATA_WINDOW_GEN and PARAM_WINDOW_GEN. With the app, the characteristics of these two functions were integrated with other amount of functions that provide the final output displayed by the app. Instead of having to run every function for each of the shares, with the app the results and graphs are all displayed at once.

The objective of the app is to facilitate the access to the information and make the analysis of data quicker. It is a very visual and easy app to work with. The combination of the graphs and text windows allows to achieve a high knowledge and comprehension of what is happening. Besides, setting the parameters and the conditions is done in a very intuitive way. In the following section, all the tools and characteristics will be explained.

2.2. Tools

In the Image 1, it is shown a capture of the result of running the app. It counts with four main windows: stock and time selection, investment strategy, optimization and text information. It plots four graphs that collect and represent: the basic info, the inputs and output, the buy-sell signal and the investment strategy.

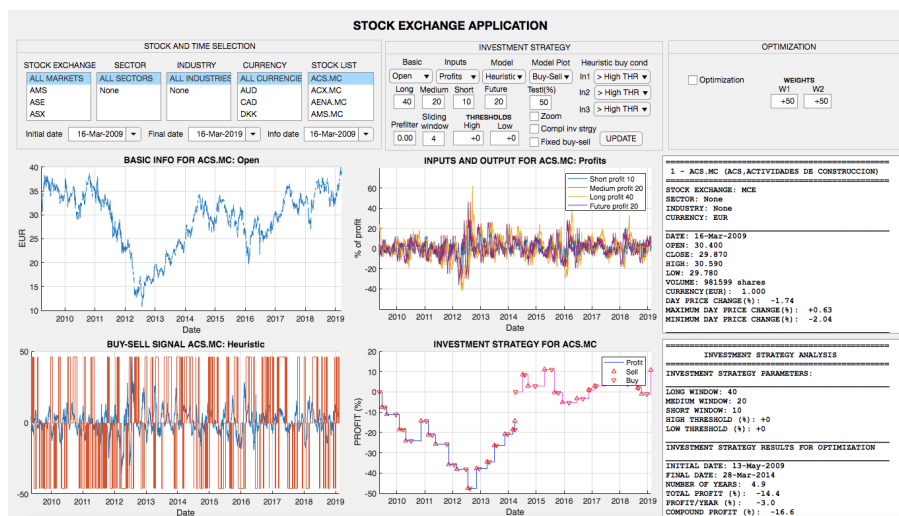


Image 1: Stock exchange application.

2.2.1. Stock and time selection

The Image 2 represents the display that the app offers to select the stock and time frame to work with.

Image 2: Stock and Time selection.

i) Stock selection

This tool acts like a filter of values. The data is differentiated depending on the market of the share, the sector, the industry and its currency. The stock list is composed of all the shares whose data has been collected for the last ten years. This filter helps finding the share that is wanted to be analysed in an easier way and allows to compare shares depending on its currency, sector, market or industry.

ii) Time selection

The windows “Initial date” and “Final date” refer to the interval in which all the information is analysed. The data obtained corresponds to an amount of 10 years, from 2009 to 2019. The use of this tool is to fix the interval that is required for the study and in which the investing strategy will be applied. Finally, there is an “Info date” option which allows to obtain further information of a specific day and that data will appear at the text window.

2.2.2. Investment strategy

The investment strategy is the part of the app in which the parameters are set. In the Image 3 is shown all the different options and conditions that can be applied, as well as choosing which investment strategy to apply.

Image 3: Investment strategy.

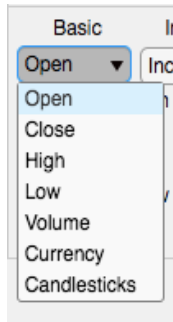
i) Basic

Image 4

The objective is that once a value is selected, all the basic information can be known. Considered as “basic information” is the knowledge of how has gone developing through the interval of time previously chosen opening price, the closing price, the highs and lows, the volume, the currency and the candlesticks (representation of the four daily prices). This display of option is shown in Image 4. All the information is represented in the graph allocated in the top left corner, which is shown in the Graph 6. The visualization of the development of prices is interesting for the evaluation of the investment strategy. The information of this first window is mainly informative, it doesn't interfere in the investment strategy but from this point the inputs are built.

I. First graph: Basic info

Graph 6: Basic info.

This representation was said to help in the evaluation of the investment strategy. This is because if the investment strategy doesn't add any value, when the price is growing it is normal that the strategy earns money and when the price is dropping it is expected to lose money. Therefore, an investment strategy that is working should amplify the price rises and mitigate the price drops. In this way, when the prices are falling the investment strategy will not invest, and on the contrary, when the prices are rising it will invest. The objective is that the plot of the investment strategy does not resemble the prices plot.

There is also the option of plotting the three moving averages selected for the strategy in this first graph together with the price. This tool is very useful, at least for the strategy analyzed in this project, as it allows checking if the investment decisions are being done correctly and also, it helps analyzing the behavior of each of the moving averages for each case.

ii) Inputs

All strategies being analysed are based on a prediction model. A prediction model can be considered as a “black box” that receives some inputs and tries to predict the future profitability in a selected number of days. The number of days can be changed in the window “Future”.

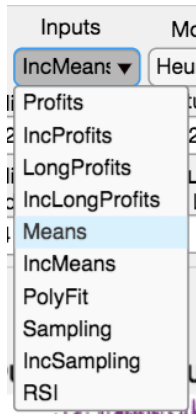


Image 5

Depending on that prediction, the investment strategy decides whether to buy, sell or do nothing. If the prediction foresees that it is not going to be money gaining, it is recommended to sell and if there are no losses it is advisable to buy. An easy prediction can be considering that if the sign of the prediction is positive, the strategy buys, and if it is negative, it sells.

The strategies offered in the application are: Profits, IncProfits, LongProfits, IncLongProfits, Means, IncMeans, PolyFit, Sampling, IncSampling and RSI. All of them are shown in the Image 5. The strategies used in this project are Means and IncMeans. For each strategy, there are three inputs and one output. In the case of Means, the three inputs are: the long, the medium and the short average. And for IncMeans, the inputs are the differences of the means. The output for all of them is the future profitability.

Long	Medium	Short	Future
40	20	10	20

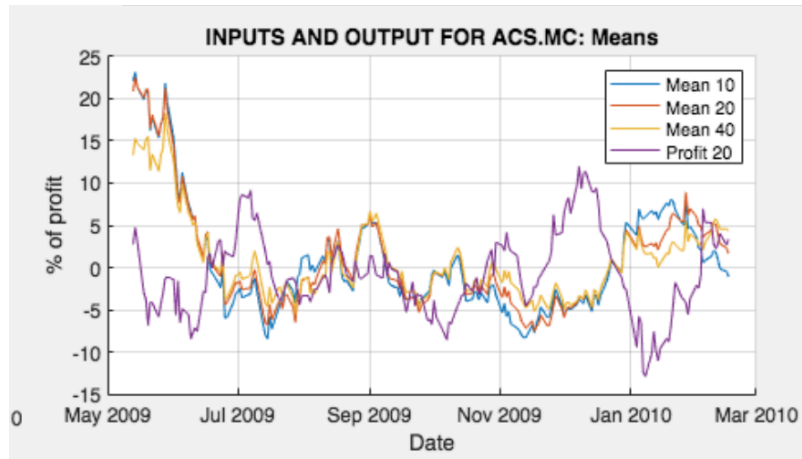
Image 6

iii) Long, Medium, Short and Future

In the panel shown in Image 6 the length of the window to do the average is set. In this case, it is set that the long mean is done in a period of 40 days, which represents the average of the profits of a purchase 40 days ago being sold today. The medium mean is set in 20 and it shows the average of the profitability of the last 20 days being bought 40 days ago. The short mean is 10 and shows the average of the profitability of the last 10 days being bought 40 days ago. The option “Future” was mentioned before, and it is for setting of the period length for the future profitability.

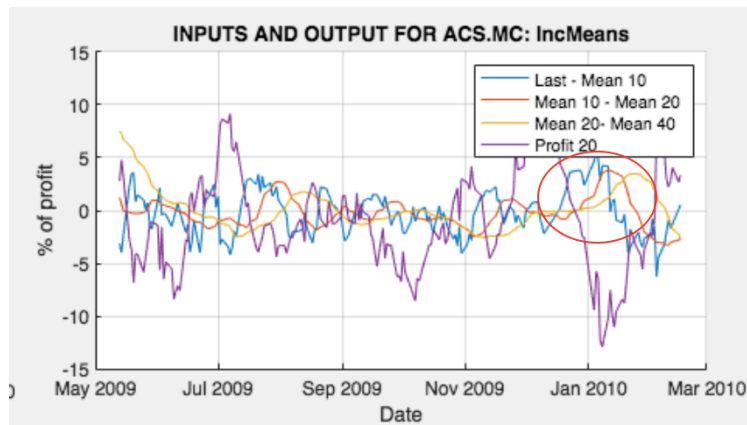
II. Second graph: Inputs and Output

Depending on the strategy, the Graph 7 plots the three inputs and output of the strategy selected. In the case of the input option “Means” the graph shows the three means: long, medium and short. The purple line represents the future profitability. In the graph the prices are normalized. This means that the app makes the difference between the price of a day and the purchase price 40 days ago (40 in this case but it is always of the length of the long window) divided by that price.



Graph 7: Inputs and output.

In Graph 8 it is represented the input option “IncMeans”. For example, the blue line represents “Last – Mean 10”. The meaning of this difference is the last profitability minus the average of the last 10 profitability always in the long window and purchasing it the first day of that window. The same applies for the other two differences. For the investment strategy, a buying condition can be to buy whenever the three differences of the means are positive. There is an example zone that achieves this, and it is the part marked inside the red circle.



Graph 8: Inputs and output.

iv) Model

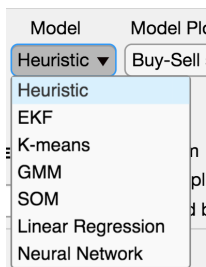


Image 7

There are two main options. The first one is using a prediction model. This includes EKF, clustering with K-means, GMM and SOM, lineal regression and neuronal network. There are more prediction models but these ones are used in the app and they can be seen in the Image 7. These models consist on establishing a mathematic relation between the three inputs and the prediction of the future profitability.

The other option is the heuristic method. Instead of creating a model, with the heuristic method the selling and buying conditions have to be set, it is not based on a prediction so the decision is based on a rational process.

v) Model Plot

Model plot is a dynamic menu. Depending on the model previously chosen, the menu of model plot changes and the third graph (bottom left) will have multiple different representations.

III. Third graph: Buy-Sell signal

For example, K-mean is a prediction model that creates clusters, and it tries to predict the blue line represented in Graph 9 with the prediction of the red one. When the prediction is positive, it is important that the original one, the blue line, is also positive. There are also other options related to the model of k-means, such as correlation, cluster tracking, cluster profit and cluster weighted profit, all of them shown in the display that can be seen in

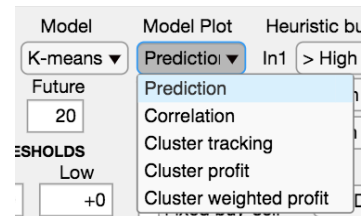
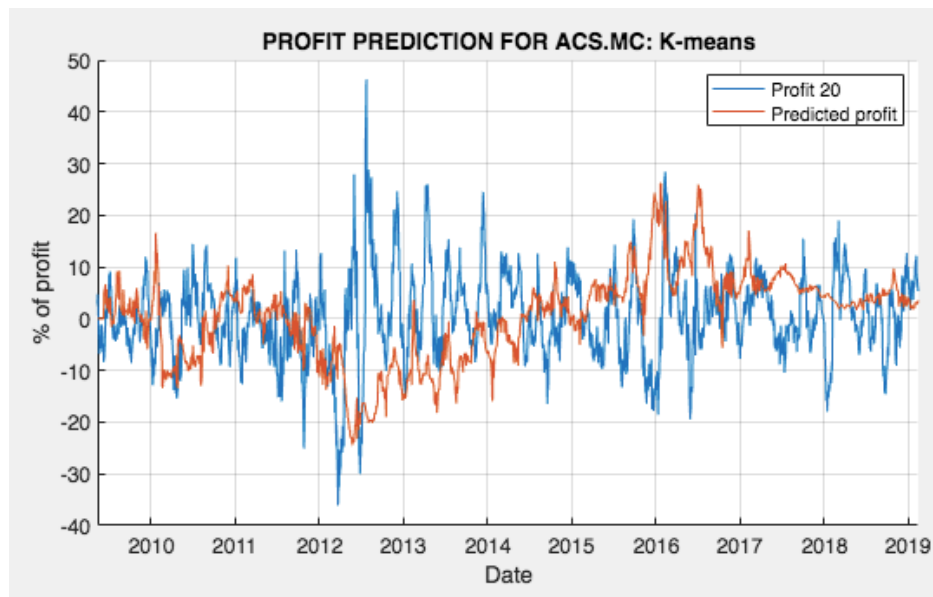


Image 8



Graph 9: Profit prediction K-means

The heuristic's model plot gives two options as shows the Image 9. The "Buy-Sell signal" represents when to sell/buy with a binary signal. A positive signal means a buying indication, a negative a selling order and 0 when it doesn't matter. The binary signal is represented in orange in the Graph 10.

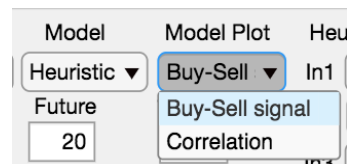
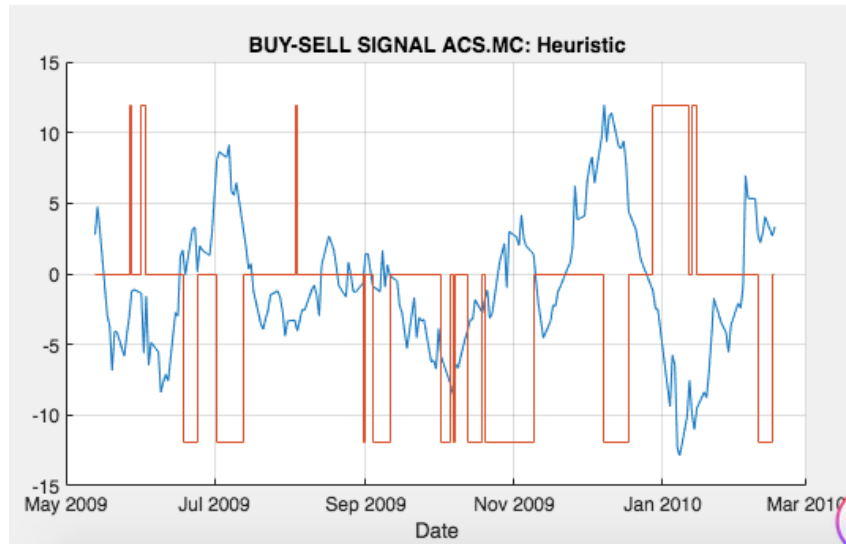
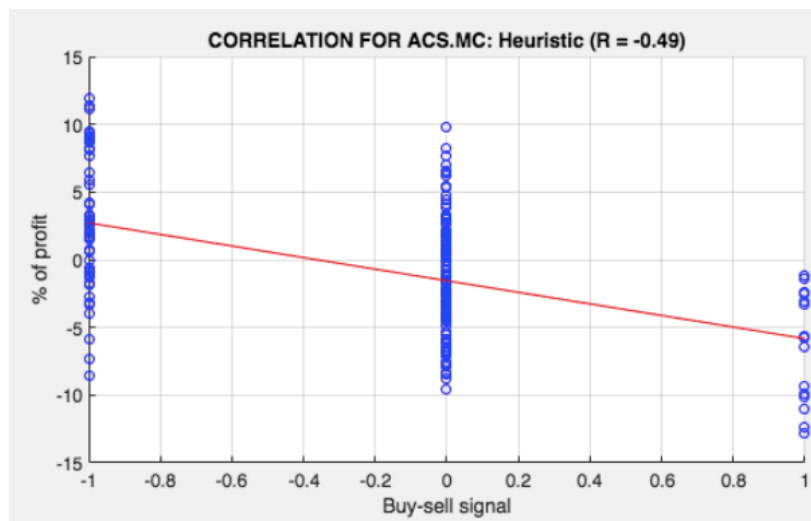


Image 9



Graph 10: Buy-Sell signal.

It can also be represented a correlation of the future profitability in order to check if there is a positive or negative correlation. In this case, Graph 11 represents the correlation and presents a $R = -0,49$. A high positive value is a good signal that the strategy is working well. If the correlation is a very negative value is not such a bad signal. It means that the strategy should be inverted. However, values close to 0 show that the buying/selling decisions are not often right.



Graph 11: Correlation.

vi) Heuristic buy condition

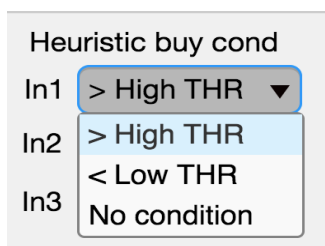


Image 10

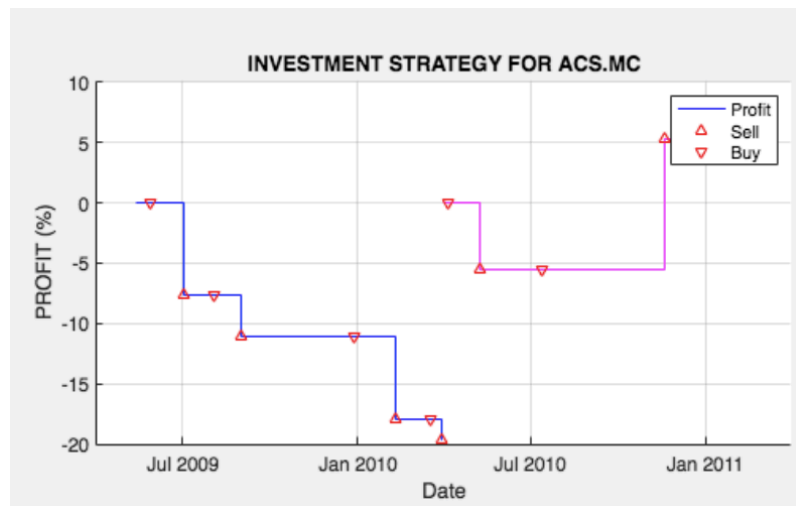
Int 1, Int 2 and Int 3 in Image 10 represent the buying conditions that can be set and that are related with the three inputs represented on the second graph. It can be set the buying condition when the input is higher to the high threshold, lower than the low threshold or the no condition that eliminates the buying condition. The heuristic method works with the threshold that are set. The three conditions

are an “&” condition not an “or”, which means that the three conditions have to be accomplished.

The thresholds can be changed and see how these changes affect the investment strategy.

IV. Fourth graph: Investment Strategy

Once the thresholds are fixed, the investment strategy is developed and plotted in the last graph situated in the bottom right corner and the representation is like the one in Graph 12. The triangles that are orientated upside represent a selling signal and downside indicate a buying entry. It starts in zero profits and it goes accumulating. It is separated in two parts. The first one is used for the optimization process and the second part of the data is processed to check that the optimization works, in a part called testing.



Graph 12: Investment strategy.

vii) Prefilter, Sliding window, Thresholds, Zoom, Complementary inversion strategy and Fixed buy-sell

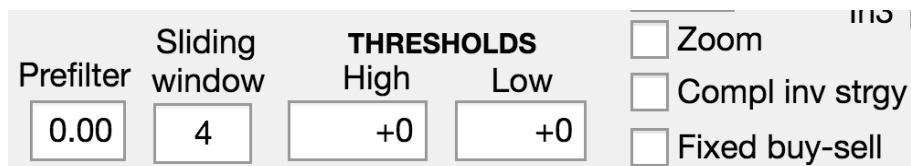


Image 11

- Prefilter: before building the inputs, they go through a filter. If the filter is equal to 0 it means that no filter is being applied. If the value is close to 1 it means that a very strong filter is being applied and the signal almost disappears. The use of the filter makes sense for certain models.
- Sliding window: it is used in the prediction models that need previous data for training. It sets the number of previous years to every day that it is used to

train the model. This is used for example in lineal regression models, but it has no use in the heuristic ones.

- Thresholds: in these windows the thresholds for the investment strategy previously commented are set. Depending on them the graph of the investment strategy shows significant differences.
- Zoom: tool used in all the four graphs to access the information plotted more closely.
- Complementary investment strategy: it inverts the investment strategy. This means that when it was supposed to buy it will give a sell signal and when it usually produced a sell indication it will convert it into a buying signal.
- Fixed by sell: it means that the inversion strategy can work in two ways. The first one is that both the buying and selling signals are considered. The other one is based on only considering the buying signals and selling every 20 days. As all the predictions are based on the future profitability of 20 days, it may have sense selling after that period of 20 days. In consequence, there is a bigger number of operations. In the heuristic model, its use has little sense as it doesn't use the future profitability.

2.2.3. Optimization

Optimization is the process that focuses on finding the combination of meta-parameters. The first part of the data is used for the optimization and the second one is used to check possible modifications. To choose the amount of data used for optimization there is a window in the investment strategy section called "Test (%)". It goes from 0% to a maximum of 50% of the data to be used in the testing part.

The optimization part of the application has been developed by the ICAI student Marta Villagrán. It is composed of four windows. The "Optimization" part is where the results of the optimization are displayed. The "Stock List" and the "Test", collect the values that are used for the process. The "Options" window is the one set before the optimization.

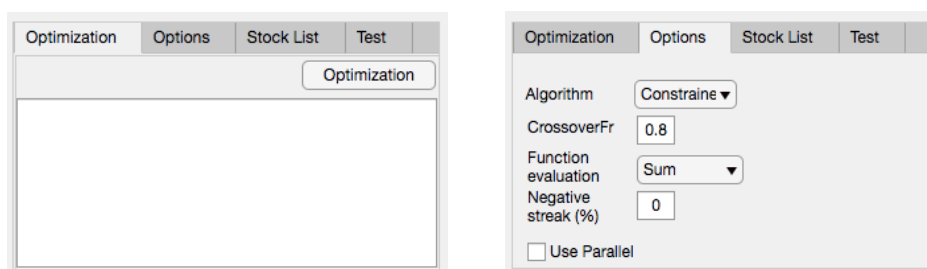


Image 12

The optimization is done with genetic algorithms. Once the inputs and the investment theory are selected, the conditions are set and the optimization button starts a process that obtains the meta-parameters of the long, medium and short moving averages as well as the future profitability window and the prefilter and thresholds.

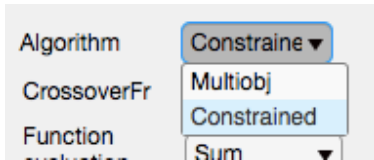


Image 13

Two algorithms can be used. The first one is the “Multiobjective” that maximizes the profitability and minimizes the negative streak with a weight.

The second option is using the “Constrained” algorithm. It optimizes the joint profitability of the four values but with a constraint, which is that the negative streak is not too big. The constraint is set in the “Negative streak” option and setting for example a 10% means that the negative streak is not wanted to be greater than a 10% of the total profitability, being the negative streak the one of the joint values.

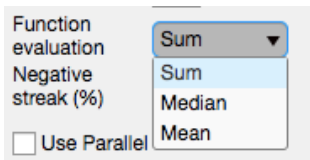


Image 14

The “Function evaluation” represents the different options of programming the objective function. The “Sum”, “Median” and “Mean” options are the different options of grouping the joint profitability of the values.

2.3. Text window

2.3.1. First text window

```

=====
1 - ACS.MC (ACS,ACTIVIDADES DE CONSTRUCCION)
=====
STOCK EXCHANGE: MCE
SECTOR: None
INDUSTRY: None
CURRENCY: EUR

DATE: 16-Mar-2009
OPEN: 30.400
CLOSE: 29.870
HIGH: 30.590
LOW: 29.780
VOLUME: 981599 shares
CURRENCY(EUR): 1.000
DAY PRICE CHANGE(%): -1.74
MAXIMUM DAY PRICE CHANGE(%): +0.63
MINIMUM DAY PRICE CHANGE(%): -2.04
    
```

Image 15

```

=====
CENTROIDS:
-1.43      -2.19      -2.27
-5.47      +0.28      +19.14
+1.07      +1.42      +18.38
-6.66      +1.85      +19.13
+3.72      +5.58      +4.87

=====
CLUSTER INFO
PPL(%) DSP(%) PRF(%) WPR(%) IVL(%) FVL(%) KPI
75.5  45.6  +0.5  +0.6  1.9  4.1  0.00
0.5   0.0  +3.1  +3.1  2.5  0.0  0.00
6.5   3.6  -3.3  -3.2  2.0  2.5  0.00
0.5   0.0  +4.8  +4.8  2.7  0.0  0.00
17.1  50.8  -5.5  -5.4  2.3  3.6  0.00

=====
CURRENT PARAMETER VECTOR INFO
PARAMETER VECTOR(%): [ +1.70  +3.33  -5.73]
DISTANCES(%): [ 7.2  26.1  24.2  26.3  11.0]
MEMBERSHIP(%): [39.9  11.1  11.9  11.0  26.2]
    
```

Image 16

The first text window makes a zoom in the information of a selected day. It shows the open, close, high, low and volume prices. Besides, it displays the currency, the day price change and the maximum and minimum price change, all last three in percentage. It is the case represented in Image 15. If the model is heuristic, in the properties of the prediction model will not display anything. For example, if it is working with k-means, the information of the clusters of that day is displayed, as happens in Image 16.

2.3.2. Second text window

```

=====
INVESTMENT STRATEGY ANALYSIS
=====
INVESTMENT STRATEGY PARAMETERS:
=====
LONG WINDOW: 40
MEDIUM WINDOW: 20
SHORT WINDOW: 10
HIGH THRESHOLD (%): +0
LOW THRESHOLD (%): +0
=====

```

Image 17

The text window of the down part shows the statistical data of the investment strategy. It is separated into three parts. Firstly, it appears the parameters with which the investment strategy has been done, like shown in Image . These parameters, for the case of Means and IncMeans, are the long, medium and short window, as well as the thresholds set as condition.

```

=====
INVESTMENT STRATEGY RESULTS FOR OPTIMIZATION
=====
INITIAL DATE: 13-May-2009
FINAL DATE: 28-Mar-2014
NUMBER OF YEARS: 4.9
TOTAL PROFIT (%): -25.1
PROFIT/YEAR (%): -5.1
COMPOUND PROFIT (%): -24.8
PASSIVE PROFIT (%): -24.0
NUMBER OF OPERATIONS: 20
NUMBER OF OPERATIONS/YEAR: 4.1
% OF POSITIVE OPERATIONS: 35.0
% OF NEGATIVE OPERATIONS: 65.0
MAXIMUM PROFIT (%): -8.4
MINIMUM PROFIT (%): -53.2
MAXIMUM PROFIT STREAK (%): +28.2
MINIMUM PROFIT STREAK (%): -44.8
AVERAGE PROFIT/OPERATION (%): -1.3

MAXIMUM PROFIT/OPERATION (%): +12.1
MINIMUM PROFIT/OPERATION (%): -10.3
AVERAGE OPERATION DURATION (days): 21.2
MAXIMUM OPERATION DURATION (days): 31
MINIMUM OPERATION DURATION (days): 19
ACTIVE OPERATION TIME (%): 17.0
COST OF BUY-SELL OPERATION (%): 1.0
OPERATIONS:
  Buy date   Sell date  Days  Profit(%)
11-Jun-2009 09-Jul-2009 20    -8.4
05-Aug-2009 02-Sep-2009 20    -5.1
04-Sep-2009 02-Oct-2009 20    -0.7
05-Oct-2009 02-Nov-2009 20    -6.8
19-Jan-2010 16-Feb-2010 20    -9.0
29-Apr-2010 27-May-2010 20   -10.3

```

Image 18

The second part, represents the results of the investment strategy of the period of time used for optimization and it can be seen in Image 18. It is indicated the initial date, when the strategy starts and the final date. The number of years between the initial and final date, the total profit as well as the profit per year and the compound profit. The total profit is made considering that there is always a purchase of one unit. However, the compound profit, considers that if there is a gain or a lose it accumulates and this makes that in the following investment the initial purchase will be higher or lower than one unit, amplifying the gains and losses.

It is also calculated the passive profit, which is the profit having bought in the initial date and having sold in the final date. This number is interesting to study if the investment strategy and all the buying/selling movements that carries are worth it. It is indicated the number

of operations, the number of operations per year, the percentage of positive and negative operations. Other information displayed is the maximum and minimum profit, the maximum and minimum profit streak, the average profit per operation, the maximum and minimum profit per operation and the average, maximum and minimum operation duration in days.

The active operation time is an interesting data because if two shares are being compared it is necessary to know how much time the capital is going to be retained with one share or the other. Then, the cost of buy-sell operation is considered as a 1%. This means that if the total profitability is negative but there is a big number of operations that negativity of profits is going in commissions to the bank and it is not reflecting loses in that share. Finally, there is a table indicating the buying and selling date, the number of days that lasts the process and the profit obtained.

The third and final part of this text window shows the same data as the one explained for optimization, but this time it is displaying the period that corresponds to the testing part.

Chapter 3: Visual trading analysis.

3.1. Introduction

The objective of this chapter is to analyze with the Matlab application and its visual output, different measures and indicators that allow comparing and determining which are the moving averages' lengths and combinations that achieve the best results. The database includes the information of 1311 shares. However, the analysis is going to be done with a selection of shares that correspond to different markets, currencies, industries and sectors. The shares have been grouped depending on the movements of each of them during the period analyzed. There are four well defined groups:

- Shares with slightly bearish lateral movement: The shares selected with this characteristic are Enagas, Zardoya and Facebook. If a share quotes for a certain time in a well-defined and bounded rank, it is considered that the share has lateral movement. In this case, it is a more pessimistic and declining tendency. It is shown in Graph 13 in which the 200 MA is acting as a resistance of the price and the lateral movement is bounded.



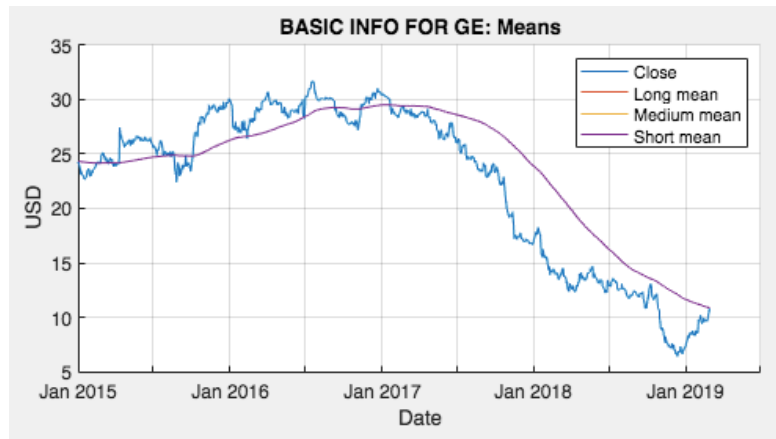
Graph 13: Price chart and 200 MA of Zardoya.

- Shares with slightly bullish lateral movement: The representative group of shares with this trend are: Mastercard Incorporated and Visa Inc. In this case, there is lateral movement but the trend is growing upwards. In the Graph 14, it is represented the price and the 200 MA. The price, even though it is increasing, fluctuates in a determined rank.



Graph 14: Price chart and 200 MA of Visa.

- Shares with decreasing trend: The selected shares are General Electric, AbbVie Inc and Kraft Heinz Company. In Graph 15, the 200 MA shows the trend of General Electric shares, which is clearly declining.



Graph 15: Price chart and 200 MA of General Electric.

- Shares with increasing trend: The last group is the one formed by United Health Group, Abbott Laboratories and Merck & Co. All of them have an upward trend like the one of United Health Group shown in the Graph 16.



Graph 16: Price chart and 200 MA of United Health Group.

The reason for choosing shares with different trends is no other but to avoid having a biased data. The analysis searches for a common conclusion, a combination of two or three moving averages of different lengths that provides an investment strategy with the best results for all the shares. However, what is considered as good results? What are the main indicators to determine the optimality?

3.1.1. Measures and indicators

The application works with a wide database and provides clear and organized results when certain conditions are applied. There are two conditions which are common to all the studied shares: the strategy and the period of time. The strategy is the one called in the application “IncMeans”, explained in detail in the description of the application. It

sets as buying signal the moment when all three differences between the moving averages are positive. The period of time studied doesn't vary, again to avoid possible biased data. It has been set from the 1 of January of 2015 to the 28 of February of 2018.

With the strategy and time set, the rest of conditions have got to be set and the results obtained are filed in an excel. For each set of conditions, it is analyzed: the buy signal, the buy price, the sell signal, the sell price, the pure profitability, the profits strategy, the number of days in the market, the dividends and the profitability with them and all the previous information by using the inverted strategy. The excel is filled out and indexes calculated are the following ones.

- Profitability: The profitability is the sum of the profits generated from the operations done. The strategy directly provides the profitability of every period in which the strategy agrees to buy. It is also included a 1% that corresponds to the buying/selling costs. The profitability of the strategy applied is done as the average of all the profitability.

$$Profitability\ in\ market = \frac{\sum_{i=1}^N (Profitability\ in\ market)_i}{N}$$

- Volatility: The volatility is the measure of how much does the profitability of a share change respect its average in a certain period. It can be measured by the variance or standard deviation. It has been done with the excel function "DESVEST" of the profitability calculated by the application.
- Days in the market: This is a measure that counts the number of days since the share was bought until it was sold. This is measured for every time the strategy gives a buying sign until the selling sign. The measure used to compare strategies is the average of all the periods previously obtained.

$$Days\ in\ the\ market = \frac{\sum_{i=1}^N (Days\ in\ the\ market)_i}{N}$$

In the Matlab application there is the option of "inverting the strategy". To check that the strategy is being useful, all the previous measures have been calculated inverting the strategy. If the profitability obtained in this reverse process is greater than the one obtained with the current strategy, the strategy is not considered.

$$Profitability\ in\ market > Profitability\ out\ market$$

Warren Buffett said that "our favorite holding period is forever". Thinking long term is one of the advices provided by the famous investor. However, the appearance of better investment opportunities or the possibility of needing the money invested, makes shorter holding periods more appealing to investors. Then, when evaluating the best investing strategy, it should be considered the holding period and value those strategies that

achieve the shortest. Nevertheless, the profits obtained must be considered. It cannot be valued better a strategy that shows the shortest holding periods but with low profits than one with larger periods and higher profits. Buying and selling shares has a price that must be considered as well, so the optimal strategy should be the one that provides a high ratio between profits and length.

The ratio calculated to relate the profitability and the days in market is:

$$\text{Optimality ratio (\%)} = \frac{\text{Profitability in the market}}{\text{Days in market}} * 100$$

The greater the optimality ratio, meaning the greater the profits or the smallest the average of the days in the market, the better the strategy. When the profits obtained are negative, this ratio has no effect. The best strategy is considered the one with the less negative profits and the less days in the market.

3.1.2. Strategies studied

In the state of art, it was presented the Golden-cross as a buying signal and the Death-cross for selling. Based on this consideration, the conditions set for the investment strategy in the application were to consider all three differences positive. The strategies that have been studied for each share considering the combination of three moving averages and the technique of crossovers are:

- 200-100-50 MA → The common moving average strategy. It is studied to see its efficiency, check if it is better than other techniques.
- 100-50-20 MA → Leaving aside the 200 MA is a way to see if its widespread use is actually a good measure of the market or if it is just a popular and not worthy indicator.
- 144-89-55 → Fibonacci's numbers. In the state of art it was introduced the concept of using this numbers as moving averages. The objective is to check if it is something to consider or just a belief.

Besides the study of the triple crossovers, it should also be studied if the “Golden-cross” is actually the one that gives the best buying signal to entry the market. To do so, the following analysis is done:

- 200-100 MA → The crossover of the 100 MA over the 200 MA is the buying signal, which means in the Matlab strategy of “IncMeans” that the difference between the medium minus the long moving average has to be positive to entry the market. More buying signals will appear as there is only one condition to achieve.

- 100-50 MA → The buying signal in this case is the crossover of the 50 MA over the 100 MA. Its analysis has the purpose of showing the efficiency of a simple crossover.

Applying moving averages of very short length does not make sense in this analysis as the period being studied is of four years approximately. For some of the shares, the analysis of them includes other specific techniques like the effect of applying a fixed buy-sell. With the shares, period of time, measures and strategies set, the following step is to proceed to the development of an excel that contains all the needed information.

3.1.3. Analysis structure

The analysis has been done by the development of an excel in which the data has been organized and studied. The structure followed for the analysis of the data is the one shown in Figure 1.

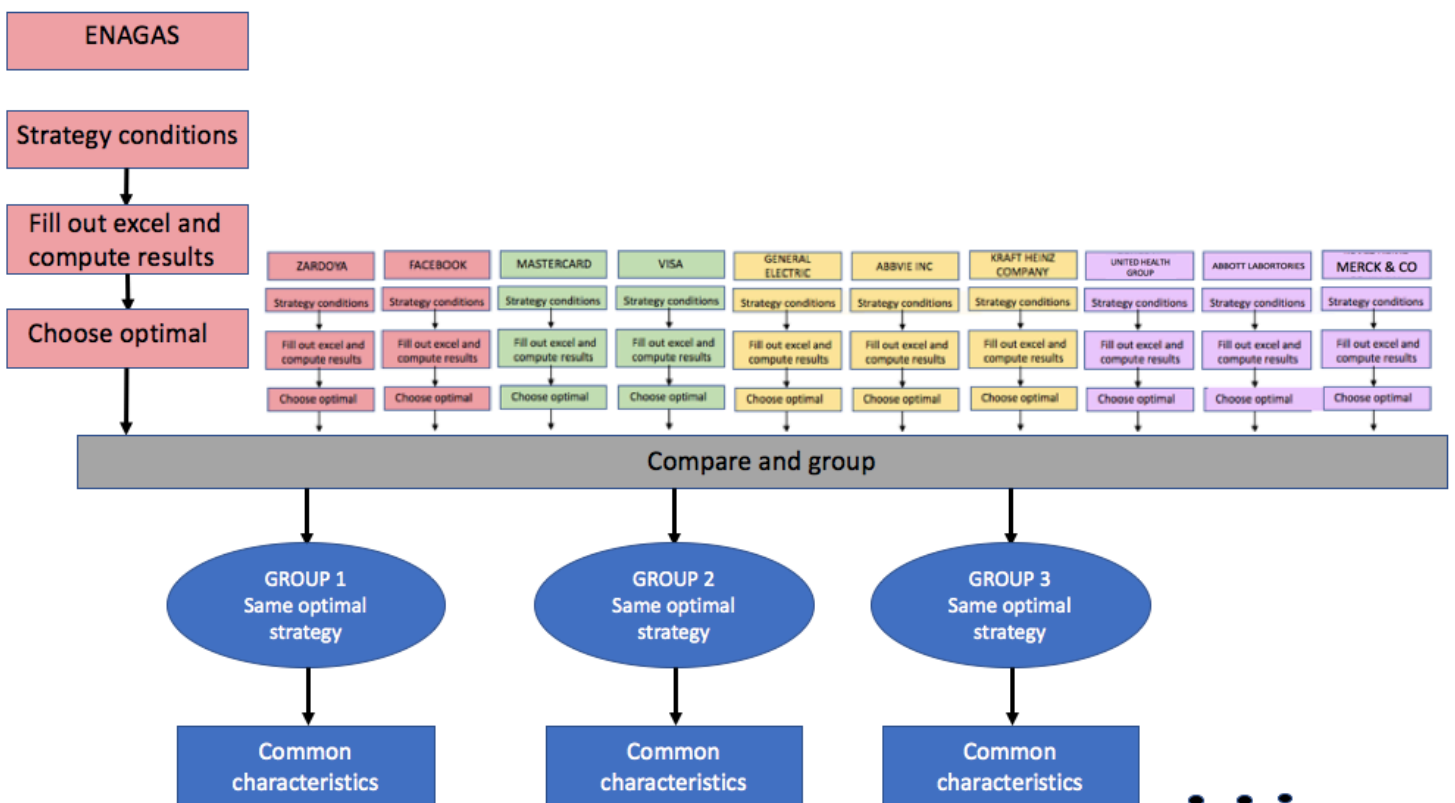


Figure 1: Analysis structure.

The starting point are the eleven shares. The ones colored in red represent the slightly bearish lateral movement shares, the ones in green symbolize the slightly bullish lateral movement shares, in yellow are the ones with decreasing trend and in purple the ones with increasing trend. For each of them the same procedure is followed. A set of different strategies are applied, like for example a strategy with the 200, 100 and 50 MA and other strategy with the 100, 50 and 20 MA.

Once the excel is filled out, measures that have been set as the ones to determine which strategy is better are calculated. This procedure is repeated for all the eleven shares

and once every share has the strategy that fixes better with the optimal conditions, conclusions can be done.

In the case of achieving a result in which all the shares agree on the same strategy, the analysis result is clear: that strategy is the one that should be applied when working with moving averages. However, it is more feasible that not all the shares coincide on the same conclusion. This case is shown in Figure 1. This part of the analysis consists on grouping the shares that have achieved the same or similar results. Once the groups are formed, the last step is to search common characteristics, among the shares of the same group, that may give the reasons why the strategy works better on them than on the others.

3.2. Analysis

3.2.1. ENAGAS

i) General information

General information	
Share	Enagas
Ticker	ENG
Industry	Natural Gas Utilities
Sector	Utilities
Market	MCE

Enagas S.A. shows a slightly bearish lateral movement. It is a company engaged in the gas transportation, present in many countries like Spain, Greece, Italy, Mexico, Chile and Peru. This company focuses on three areas, which are: gas transport, regasification and storage. (Investing.com)

Table 1: Enagas general information

Technical analysis is based on the belief that the price reflects all the information. This means that, changes in the environment in macroeconomic aspects or impacts on the industry of the share are shown in the price. In Graph 17, it is represented the price and the 200-day moving average, and it is marked the moments of two news published in the CincoDias online newspaper. In red is one that affects negatively and in green one that achieves a price increase. The impact of the news is reflected in the price.

"Enagás improves profits by 54% for the Chilean subsidiary "

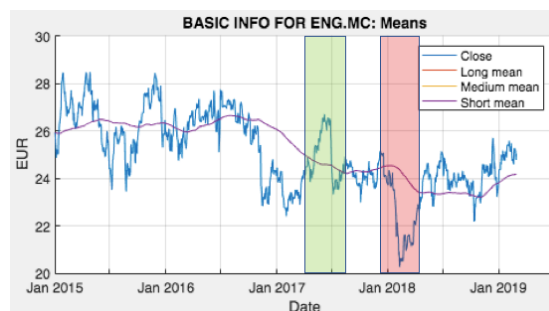
2017, April 25

The gas distributor Enagas has gained 156 million euros in the first three months of the year thanks to the contribution of the Chilean GNL Quintero. The operating result (Ebitda) has grown 16.9% to 242 million, also due to the effect of the Chilean. Total revenues totaled 342.6 million euros, representing a growth of 14.7%. (CincoDias, 2017)

"Harsh moment to invest in the electric and gas sector: less income and profitability"

2018, March 3

The ministry led by Álvaro Nadal is determined to cut the income received by electricity and gas companies. Such a cut in a regulated income and considered stable promises to have inevitable consequences in the profits of these companies. "The global environment was not in itself the most favorable for the sector but the regulatory change was not expected until 2020-2021"says Luis Padrón, an analyst at Ahorro Corporación. (Salobral, 2018).



Graph 17: Enagas: Price and 200 MA

ii) Data analysis

In Table 1 it is shown the summary of the results obtained from the application of the five investment strategies to the shares of Enagas. The rest of the data is kept in a more developed excel which is on the appendix.

The called “Profitability out of market” represents the profitability obtained if the strategy was inverted. As conclusion, for the analysis of this share, the strategies considered as unfeasible are the ones that present a greater profitability when the

ENAGAS: MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-3,8%	5,5%	2,3%	5,55%	68,3	87,3	-	0,5%	✗	✗

ENAGAS: MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-7,6%	11,4%	6,0%	8,41%	153,7	169,0	-	-1,0%	✗	✗

ENAGAS: MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-1,3%	5,2%	-0,7%	6,00%	63,6	66,7	-	-0,1%	✓	✗

ENAGAS: MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-2,9%	4,7%	0,9%	6,03%	68,2	75,8	-	0,0%	✗	✗

ENAGAS: MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-5,7%	9,5%	3,5%	6,60%	101,3	110,0	-	-3,8%	✗	✗

Table 2: Enagas strategy analysis conclusions.

inverted strategy is applied than when it is right applied. It means that the strategy is not working. In this case the strategies that have been left out are the 100-50-20 MA, the 200-100-50 MA, and the 100-50 MA. It is interesting to notice that the highest profitability of all is the one obtained with the 200-100-50 MA strategy but when it is applied the inverted way. The 100-50-20 MA strategy shows results very similar to the 100-50 MA, being slightly better the first one.

There is only one option left. The strategy that applied the moving averages of lengths 144-89-55 is the one that achieves better results. Its profitability in market is the highest one, the average number of days in the market is the lowest one. It also presents lower volatility, which is another aspect to take into account. Investors are interested in shares that present low volatility so the risks they have to assume are as low as possible.

Analysing the profitabilities obtained when applying dividends and comparing it to the profitability out of the market gives a less restrictive view of the feasible options. However, the profitability with dividends is not an indicator of a good strategy as the distribution of dividends is an external factor.

Optimality	Strategy
✓	144 MA - 89 MA - 55 MA
↓	100 MA - 50 MA
	100 MA -50 MA -20 MA
	200 MA - 100 MA
	200 MA - 100 MA - 50 MA
✗	

Table 2: Enagas conclusion

The conclusion is represented in Table 2, showing the strategy with better results to the one with worse ones.

These results are based on the conclusions obtained with the visual analysis.

iii) Visual analysis

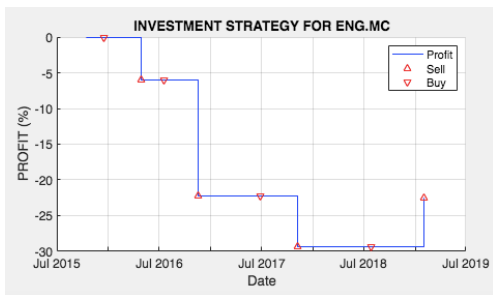
Graph information	
Initial price	26,185
Final price	25,05
Maximum price	28,48
Minimum price	20,28
Holding strategy	-5,3%

Table 3: Enagas graph information

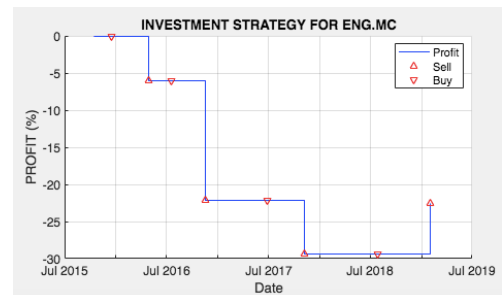
In Graph 17, located on the left side, represent the price of the share for the period selected. It is the line colored in blue. The basic information that can be subtracted is: the initial price, the final price, the maximum price and the minimum price. It is all collected in Table 3. It can be observed that there is almost no difference between the initial and the final values, both closer to the maximum price obtained than to the minimum. However, the final price is lower than the initial, so a holding strategy gives negative profits. The profitability obtained is lower than any of the ones resulted from applying any of the strategies. This is a good signal, as it means that the strategy is useful.

It was considered that four out of the five strategies were not working towards useful buying/selling orders. In order to know which of this strategies is working better, their investment strategies graphs are studied and compared.

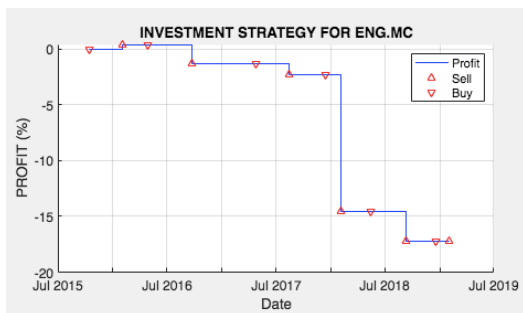
The one with less negative profits accumulation is the 100-MA 50-MA strategy. The strategies that include the 200-day moving average are the ones that obtain the highest negative accumulation of profits. Therefore, those strategies are considered like the worse ones in this case.



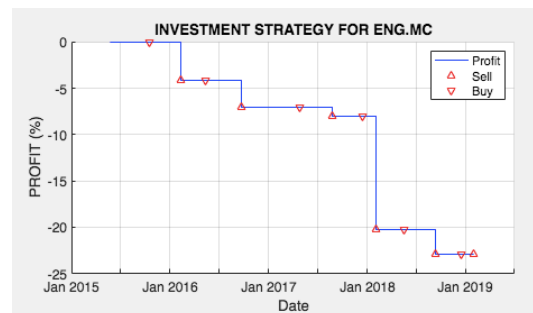
Graph 18: Enagas 200-MA 100-MA investment strategy



Graph 19: Enagas 200-100-50 MA investment strategy



Graph 20: Enagas 100-MA 50-MA investment strategy



Graph 21: Enagas 100-MA 50-MA 20-MA investment strategy

The unfeasibility of so many strategies can be caused by the lateral movement of the price. It seems to be almost impossible for the moving averages to leave all the noise aside and the false alarms.

3.2.2. ZARDOYA.MC

i) General information

General information	
Share	Zardoya
Ticker	ZOT
Industry	Misc. Capital Goods
Sector	Capital Goods
Market	MCE

Zardoya Otis SA is a company engaged in the design, installation and maintenance of elevators and escalators., among other products offered in their portfolio. (Investing.com)

The effect of a positive and negative facts is analyzed in the Graph 22 that represents the price fluctuations and the 200-day moving average.

Table 4: Zardoya general information

"Zardoya Otis: solvency against falling sales"

2015, March 2

Axesor gives the company an AA- rating with a stable trend. The net fall of the group's turnover in the last five years is 123.8 million; well, the loss of income experienced by the new sale in that period is 76.1 million and has gone from representing 13.3% to only 5.3% of the turnover. In contrast, net exports (discounted sales to its subsidiaries in Portugal and Morocco) improved by 21.7% last year, reaching 152.7 million euros, and 89.4% higher than the 2010 data . (CincoDias, 2015).

"Zardoya Otis denigrated his competitors in elevators "

2018, November 12

The TS ratifies the fine imposed by the Competition in 2013, in the same case, in the Spanish subsidiary of the largest elevator manufacturer in the world with 2,845,362 euros. The reason for the sanction was that the company sent letters to its customers assuring that their competitors use defective materials in their elevators. (Granda, 2018).

The impact of the fine imposed to Zardoya is clearly reflected in the price with a drastic drop at the end of 2018. The 200-day moving average is not capable of anticipating sudden changes like the one produced by the ratification of the penalty.



Graph 22: Zardoya price and 200-MA

ii) Data analysis

Considering that Zardoya's price share presents a lateral movement slightly bearish, it is not surprising that none of the strategies achieves to obtain positive profitability, as seen in Table 5.

ZARDOYA (ZOT.MC): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-8,8%	13,5%	-4,7%	18,51%	144,0	211,3	-	-4,0%	✗	✗

ZARDOYA (ZOT.MC): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-3,3%	0,00%	-13,0%	4,95%	222,0	273,0	-	0,2%	✓	✗

ZARDOYA (ZOT.MC): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-4,8%	0,00%	-15,2%	-15,15%	224	333,0	-	0,4%	✓	✗

ZARDOYA (ZOT.MC): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-5,3%	11,45%	-5,2%	8,02%	91,8	96,8	-	-3,7%	✗	✗

ZARDOYA (ZOT.MC): 200 MA-100 MA										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-2,4%	1,34%	-12,1%	5,47%	134,0	192,3	-	1,4%	✓	✗

Table 5: Zardoya's moving averages strategies

To evaluate the strategies, the one that obtains the highest profitability, that is the less negative one, in the less number of days in the market, is taken as the best strategy. In this case, it is the one based on the cross of two moving averages, the 200-MA and the 100-MA. Leaving the short moving average (50-MA) out of the strategy constraints achieves better results. However, the triple crossover of the 200-MA, 100-MA and 50-MA is not such a bad option as well.

The worse strategies to follow are the ones that leave aside the 200-day moving average. Not only their profitability is negative but the profitability of the inverted strategy is greater than the normal one as well, meaning that not applying the strategy is better.

The average number of days is considerably small, knowing that the strategy has been applied for four years and the longest that it stays in the market is for less than a year. This is also related to the bearish movement. The 200-MA 100-MA strategy stays the shortest in the market.

The volatility, also an important factor to consider, is zero in the case of the triple crossover strategy, as there is only one buying/selling operation. When dividends are applied, the 144-MA 89-MA 55-MA achieves positive profitability but it is not a reliable fact, as the gain of dividends doesn't depend on the investment strategy.

Optimality	Strategy
✓	200 MA - 100 MA - 50 MA
↓	200 MA - 100 MA
↓	144 MA - 89 MA - 55 MA
↓	100 MA - 50 MA
✗	100 MA - 50 MA - 20 MA

Table 6: Zardoya conclusion

The 200-MA 100-MA or the 200-MA 100-MA 50-MA are two equally good options that achieve to anticipate and give trustworthy buying/selling orders.

iii) Visual analysis

In the following graphs the investment strategy of the 200-MA 100-MA 50-MA, Graph 23, and the 200-MA 100-MA, Graph 24, are represented.



Graph 23: Zardoya 200-MA 100-MA 50-MA



Graph 24: Zardoya 200-MA 100-MA

The profits are plotted in a way that they go accumulating since the first buying operation. When analyzing Table 5, the maximum average profitability was the one offered by the 200-MA 100-MA strategy. However, in the left graph, the profitability accumulated by the 200-MA 100-MA 50-MA is higher. In the strategy of the triple crossover, as there are three constraints that bound the buying/selling decisions, only one operation happens and its profitability is -3,3%. The other strategy accumulates, in two operations, a profitability of -5,5%. At the end, this last strategy seems to be worse, as the loss is higher. In Graph 25, it can be seen how both strategies work.



Graph 25: Price and 200-MA 100-MA 50-MA

Graph information	
Initial price	8,887
Final price	7,35
Maximum price	12,09
Minimum price	5,9
Holding strategy	-18,3%

Table 7: Zardoya's graph information

Here the triple crossover strategy achieves to identify well the buying moment but, it fails to alert about the proper time to sell, as it takes too long to recognize it. The strategy based on the cross of only two moving averages has as main drawback that it is perturbed by false alarms as shown on the circled part in the Graph 25. Also, it goes a little late in advising both, the buying and selling moments. That is why, it can be said that the 200-MA 100-MA 50-MA strategy is better in this share.

In this case a holding strategy wouldn't have reported good profitability as the initial price is higher than the final price. This profitability is calculated on Table 7.

3.2.3. FACEBOOK

i) General information

General information	
Share	Facebook
Ticker	FB
Industry	Computer Services
Sector	Technology
Market	NMS

Facebook, Inc. is a company that includes Facebook, Instagram, Messenger, WhatsApp and Oculus. The main objective of this company and its products is to enable people to communicate, share, and inform through mobile devices, computers and other surfaces. (Investing.com)

Facebook is an international company that up today counts with 2.2 thousand million active users. A big company entails that any change, even small ones, that affects its behavior, sector, economy or marketing is translated in a huge impact.

“The benefit of Facebook increases 71% in the second quarter.” 2017, July 26

As expected by analysts, Facebook, the social network founded by Mark Zuckerberg, closed the second quarter of the year with a profit that grew again at record rates. Thus, the group announced on Wednesday the closing of the US market. UU A benefit of 3,890 million dollars, 71% more than in the same period last year. (CincoDias, 2017).

The increase in the benefits of the year is a factor that encourages investors to buy more shares of Facebook. This effect is shown in the increase colored in green in Graph 26.

“Zuckerberg will appear in Brussels for massive data filtering” 2018, May 16

The founder of Facebook, Mark Zuckerberg, will appear soon before the European Parliament. As revealed in The New York Times and The Observer, Cambridge Analytica used data to develop psychological profiles of voters, which allegedly sold to the campaign of the current US president, Donald Trump, during the 2016 elections and the British campaign. in favor of the "brexit" prior to the referendum in June of the same year. (CincoDias, 2018).

Big scandals like the one just presented affect in every way the company. Not only the company’s popularity and acceptance is affected but its market value as well.



Graph 26: Facebook price and 200-MA

ii) Data analysis

Facebook’s average profitability of its shares using all five strategies is positive. There is a win situation applying any of the moving averages theories. The results of the analysis of the shares price and the effect of the moving averages is shown in Table 9.

FACEBOOK (FB): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	14,3%	27,10%	3,1%	11,20%	239,3	62,7	6,0%		✓	✓
FACEBOOK (FB): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	14,4%	65,76%	13,4%	18,31%	362,5	50,5	4,0%		✓	✓
FACEBOOK (FB): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	8,1%	51,41%	16,7%	21,85%	377,5	63,5	2,1%		✗	✓
FACEBOOK (FB): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	7,7%	9,48%	1,9%	9,48%	154,3	52,3	5,0%		✓	✓
FACEBOOK (FB): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	14,4%	65,76%	15,2%	15,77%	362,5	50,5	4,0%		✗	✓

Table 9: Facebook moving averages strategies.

Based on the idea that if the average return obtained with the investment strategy is lower than that obtained with the inverse one, it is considered that the strategy is not contributing for a better understanding of the market or a profitable investment. The 144-MA 89-MA 55-MA and the 200-MA 100-MA are therefore out of consideration.

The 200-MA 100-MA 50-MA obtains the highest profitability but with an outrageous volatility. Furthermore, among the remaining three strategies it is the one with lowest profitability/days in market ratio.

All the strategies have an average number of days in the market of approximately one year. The only exception is the 100-MA 50-MA strategy that stays in average for half a year. The volatility of this strategy is relatively small, meaning that in every operation done the profitability obtained is almost the same value.

The 100-MA 50-MA 20-MA strategy is the one with highest profitability/days-in-the-market ratio. Therefore, it is the strategy that best achieves a balance between the average profitability and the number of days that the investor has to keep his money invested. It has higher volatility than the one previously explained, so the profitability that is obtained in every operation varies in a wider range.

Optimality	Strategy
✓ ↓ ✗	100 MA - 50 MA - 20 MA
	100 MA - 50 MA
	200 MA - 100 MA - 50 MA
	200 MA - 100 MA
	144 MA - 89 MA - 55 MA

Table 10: Facebook conclusion

The conclusion of the strategies that best achieve good results for the shares of Facebook is shown in Table 10.

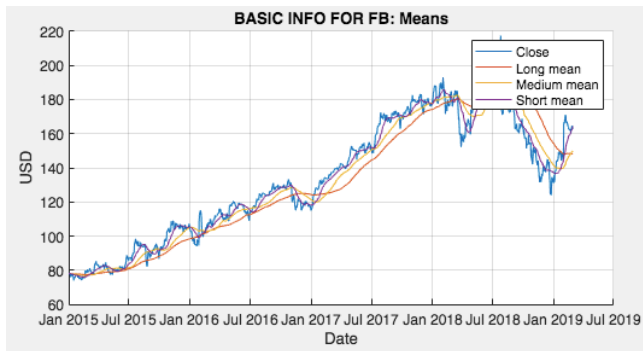
iii) Visual analysis

Graph information	
Initial price	78,02
Final price	162,81
Maximum price	217,5
Minimum price	74,05
Holding strategy	107,7%

Table 11: Facebook graph information

With the holding strategy, the profitability achieved is enormous. However, the volatility of the prices that the investor has to face through the whole process is also huge, and it is not easy to hold for such a long time in moments when there is a free fall in the prices.

The strategies considered as the best one and the worse one are now visually analyzed to understand what is determining the efficiency of the strategies.



Graph 27: Facebook price and 100-MA 50-MA 20-MA



Graph 28: Facebook 100-MA 50-MA 20-MA investment strategy

In Graph 27 and Graph 28 it is represented the strategy 100-MA 50-MA 20-MA, that was considered the one with better results. In the Graph 29 and Graph 30 it is represented the strategy 200-MA and 100-MA, that was the less effective. Even though, the profitability of the first operation in the 200-MA 100-MA is higher than in the 100-MA 50-MA 20-MA, as its buying/selling condition is slower, the first strategy works better because it achieves to give the exit signal in a moment when the losses were not too high.



Graph 29: Facebook price and 200-MA 100-MA



Graph 30: Facebook 200-MA 100-MA investment strategy

Looking at Graph 29 can be concluded that the 200-day moving average is filtering the price movements so much that fails to identify the buying/selling moments. That is why this strategy has only two operations in the total period analysis, as seen in the right graph. The first operation achieves high profits, by a basically holding strategy as it stays in the market for 632 days. As the prices have an upward trend, this strategy works until the time that a sudden change happens and prices drop. The cross of the 200-MA 100-MA is too slow to identify efficiently these losses.

3.2.4. MASTERCARD INCORPORATED

i) General information

General information	
Share	Mastercard Inc
Ticker	MA
Industry	Consumer Financial Services
Sector	Financial
Market	NYQ

Table 12: MasterCard Inc general information

MasterCard Incorporated is a technology company that aims to connect consumers, merchants, businesses and financial institutions across the world by enabling them to use electronic forms of payment. It is composed of three brands: MasterCard, Maestro and Cirrus. Mastercard is the second greatest card paying system in the European economic context. (Investing.com).

News effect analysis:

“MasterCard acquires 92.4% of VocaLink 'fintech' from London” 2016, July 26

The acquisition of financial companies (dedicated to the creation of technological solutions) by large financial brands continues. In this case, today it was MasterCard's turn to announce the signing of an agreement, which is still subject to regulatory approval, to obtain 92.4% of VocaLink Holdings Limited. (CincoDias, 2016).

This new is just one of the many that have collaborated to the upward tendency of the price since the middle of 2016. An upward trend reflects the accumulation of actions and measures that affect positively to the company's shares.

“The EC fined Mastercard with 570 million euros for preventing free competition” 2019, January 22

The European Commission (EC) has imposed a € 570 million fine on MasterCard for obstructing traders' access to more advantageous cross-border card payment services offered by banks established anywhere in the single market. (CincoDias, 2016)

MasterCard was “artificially” raising the costs of the card payments. This is against the EU antitrust rules and affected negatively consumers. The price drop in the Graph 31 may have been affected by this fact.



Graph 31: MasterCard Inc price and 200-MA.

ii) Data analysis

Carrying out the analysis of MasterCard shares through the years leads to the results shown in Table 13. All, the five strategies that have been applied, fulfill the two basic conditions to consider a strategy worthy. They achieve positive profits and the profits obtained using the strategy are greater than the outcome of applying the inverse one.

MASTERCARD INCORPORATED (MA): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	25,8%	65,34%	8,0%	7,12%	262,3	46,3	9,8%	30,0%	✓	✓

MASTERCARD INCORPORATED (MA): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	87,2%	0,00%	-	-	804,0	-	10,8%	105,2%	✓	✓

MASTERCARD INCORPORATED (MA): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	110,7%	0,00%	-	-	882,0	-	12,6%	108,2%	✓	✓

MASTERCARD INCORPORATED (MA): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	26,9%	63,32%	4,2%	5,16%	224,3	38,3	12,0%	26,9%	✓	✓

MASTERCARD INCORPORATED (MA): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	49,0%	76,16%	2,9%	0,00%	360,5	105	13,6%	51,4%	✓	✓

Table 13: MasterCard moving averages strategies.

When looking at the average number of days that the investor has to stay in the market to work with a specific strategy, the 200-MA 100-MA 50-MA and the 144-MA 89-MA- 55-MA have to be underlined. They are acting almost as a holding strategy, as they stay in the market for more than two years. However, they are adding value as they send a selling signal in the moment that prices start to drop.

The volatility is measured to define the variability of the profitability obtained in each operation. A strategy of one operation shows zero volatility. The consideration of a good volatility is one that shows the lowest possible one. In this case, the lowest volatilities are the ones of the the 200-MA 100-MA 50-MA and the 144-MA 89-MA-55-MA. The next ones are quite high, meaning that in one operation may achieve high profits and in the next not. It reflects low reliability on the strategies.

The strategy that achieves a better profitability/days-in-market ratio is the one of the 200-MA 100-MA. High profitability by holding one year. It is not the one with the highest profitability or the lowest number of days in the market, but the ratio between the two measures highlights that it is the most interesting strategy in this case.

Optimality	Strategy
✓	200 MA - 100 MA
↓	144 MA - 89 MA - 55 MA
	100 MA - 50 MA
	200 MA - 100 MA - 50 MA
	100 MA -50 MA -20 MA
✗	

Table 14: MasterCard conclusion

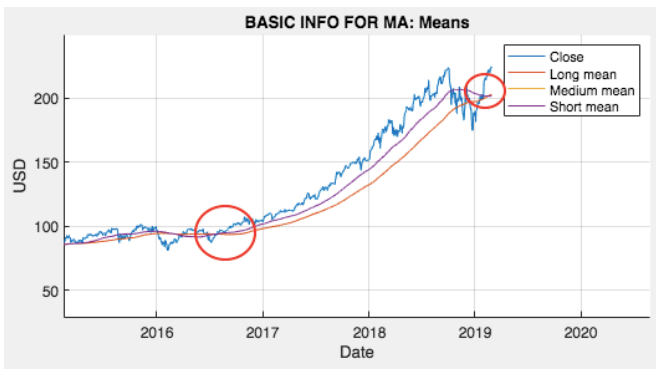
In this case, the five strategies are adding value, which means that they are doing a good job analyzing the market and helping to obtain high profitability. However, if they had to be ranked from the best one to the worse one the order would be the one showed in Table 14.

iii) Visual analysis

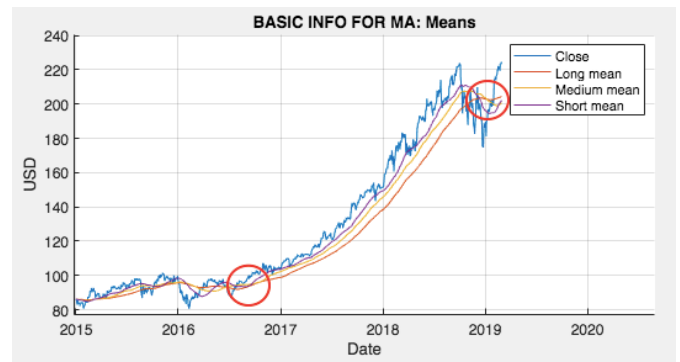
Graph information	
Initial price	86,16
Final price	244,57
Maximum price	31,66
Minimum price	6,45
Holding strategy	182,9%

Table 15: MasterCard graph

The holding strategy, as the trend is upward, achieves better profitability than any of the strategies exposed. It is a risky technique and the problem is never knowing when to sell. There is no kind of indicator to this, just hold in the market and wait until there is a gain. Investors may have a small part of their money invested like this, but the rest is needed for the buying/selling opportunities that are guided by investment strategies.



Graph 32: MasterCard price and 200-MA 100-MA



Graph 33: MasterCard price and 144-MA 89-MA 55-MA



Graph 34: MasterCard 200-MA 100-MA investment strategy



Graph 35: MasterCard 144-MA 89-MA 55-MA

Very similar strategies, profitability accumulated is almost the same. The 200-MA 100-MA may have as drawback the false buying signals of the initial part. That is what makes this strategy have high volatility. However, the buying moment is better identified by this strategy as seen in Graph 32, in the top left corner. The drop on prices at the end is not detected by any of the strategies and the selling signal can be considered to be late in both.



Graph 36: Mastercard investment strategy 100-MA 50-MA 20-MA

In Graph 36 is plotted the investment strategy that obtained the worse results, the 100-MA 50-MA 20-MA. Surely, the length of these three moving averages is too short so it is too easily perturbed by false alarms, that at the end, make the investor end up with losses.

3.2.5. VISA

i) General information

General information	
Share	Visa Inc
Ticker	V
Industry	Business Services
Sector	Services
Market	NYQ

Table 16: Visa general information.

Visa Inc. is a technology company that focuses on connecting consumers, merchants, financial institutions, businesses and government entails to electronic payment. (Investing.com)

The trend of the price plotted in Graph 37, shows a slightly bullish lateral movement, so the 200-MA acts like a resistance. The behavior of the price is affected by many facts, among them these two pieces of news, one positive and one negative.

“Visa partners with an Israeli startup to offer financing to SMEs” 2018, August 9

The Visa company announced on Wednesday an investment and partnership agreement with the Israeli startup Behalf, with the mission of supporting the growth of SMEs through easy access to capital and financing. (Vega, 2018)

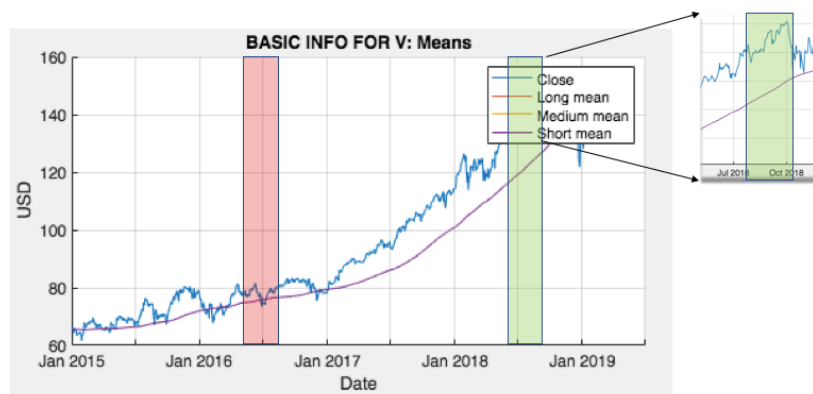
In Graph 37 it can be seen an increase in the tendency of the price and one of the factors that may have produced this raise is the partnership with the Israeli startup.

“Companies question their British headquarters” 2016, June 30

Visa, Easyjet or some technology companies are other companies that have put in doubt the continuity of their offices or data centers in the United Kingdom.

Technology companies can see how the long-awaited digital single market in the European Union is truncated by the departure of the United Kingdom from the EU framework. (Jimenez and Larrouy, 2016)

The Brexit is an example of an external factor that affects companies, in this case because Visa has its headquarters in London, and that it is out of the company’s control.



Graph 37: Visa price and 200-MA

ii) Data analysis

The price behavior is very similar to the one of MasterCard. Both with a slightly bullish lateral movement, all the strategies achieve high profitability and all give correct and trusty buying/selling signals. In Table 17 the results of applying the five investment strategies are collected.

VISA: MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	20,6%	44,72%	7,0%	8,31%	274,0	38,3	7,5%	24,8%	✓	✓

VISA (V): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	77,2%	0,00%	-	-	826,0	-	9,3%	79,7%	✓	✓

VISA (V): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	74,0%	0,00%	-2,2%	0,00%	881	1,0	8,4%	41,1%	✓	✓

VISA (V): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	36,9%	63,99%	2,6%	7,52%	367,0	37,3	10,0%	35,3%	✓	✓

VISA (V): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	32,5%	44,41%	4,9%	0,00%	381,0	64,0	8,5%	35,5%	✓	✓

Table 17: Visa moving averages strategies.

The 100-MA 50-MA 20-MA is the strategy with the worst results. The profitability obtained is the lowest of all and the average days in market is also the smallest. These facts, together with a high volatility, are signals of a strategy difficult to trust, with little control over false alarms.

As in the case of MasterCard, the 200-MA 100-MA 50-MA and the 144-MA 89-MA 55-MA strategies only carry out one buying and one selling operation. These strategies have to fulfill three constraints in order to produce a buying order. They are slower to recognize the moment to enter, but when they give the order, obtaining profits is highly guaranteed.

Finally, there are the two strategies that are based on the crossover of only two moving averages. In the visual analysis is studied if it's better the one with low volatility and low ratio or the one with higher ratio but higher volatility as well.

Optimality	Strategy
✓ ↓ ✗	200 MA - 100 MA - 50 MA
	200 MA - 100 MA
	100 MA - 50 MA
	144 MA - 89 MA - 55 MA
	100 MA - 50 MA - 20 MA

Table 18: Visa conclusion

The classification is done thinking only in the maximum profitability obtained in the minimum number of days, so investors can use their money in other investment opportunities.

There is not a wide difference between the first three strategies. Their investment strategy and the buying/selling optimality is studied in the following part.

iii) Visual analysis

Graph information	
Initial price	65,55
Final price	147,22
Maximum price	150,8
Minimum price	61,6
Holding strategy	123,6%

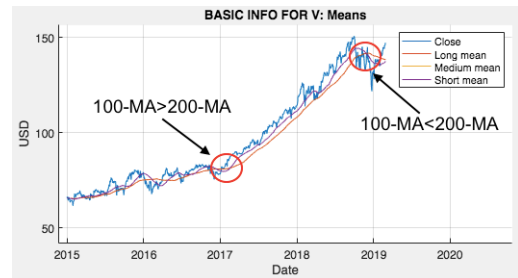
Table 19: Visa graph information

The profitability by holding is, like with MasterCard shares and not surprisingly, the best way to obtain higher profitability through the year. This is only for shares with a bullish tendency, and again it is a strategy that may produce big losses if the selling opportunity is skipped.

To confirm the strategy classification previously done, the three best strategies are studied through the graphs of the price, moving averages and investment strategy.

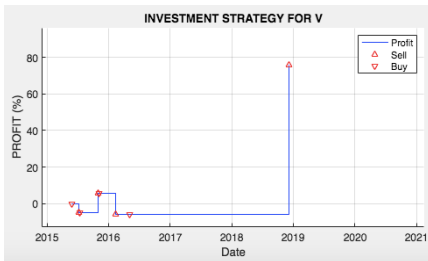


Graph 38: Visa price and 200-MA 100-Ma 50-MA



Graph 39: Visa price and 100-MA 50-MA

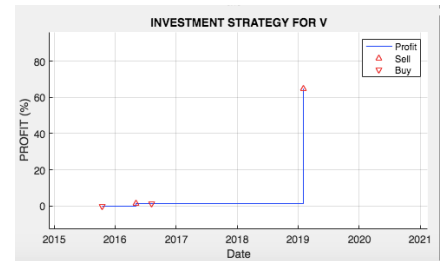
There are two perspectives observed in these graphs: the behavior of a strategy of two moving averages and the one based on a triple crossover. Always the last one is more constrained, and in this case, it gives the buying order the first one. That is good as it achieves to buy the shares for a lower price. The one that lasts more in noticing that it is time to sell is the 200-MA 100-MA strategy. That is why its accumulated profits are lower than the other two. The buying/ selling moments set by the strategies are circled in their corresponding graphs.



Graph 40: Visa 100-MA 50-MA investment strategy



Graph 41: Visa 200-MA 100-MA 50-MA investment strategy



Graph 42: Visa price and 200-MA 100-MA investment strategy

The profits accumulation of the first two strategies is the same. It is true that the 100-MA 50-MA strategy has some operations at the beginning that don't bring positive results. It may be the case in which there is actually a profitable operation opportunity but the profits obtained don't offset the buying/selling costs. Both strategies can be considered equally good. The 200-MA 100-MA investment strategy in Graph 42 is checked to be less interesting than the other two as the profits accumulation is lower and the volatility is higher, as well as the number of operations.

3.2.6. GENERAL ELECTRIC

i) General information

General information	
Share	General Electric
Ticker	GE
Industry	Misc. Capital Goods
Sector	Capital Goods
Market	NYQ

Table 20: General Electric general information.

General Electric Company is a global digital industrial company. The products offered by the company go from aircraft engines, power generation and oil and gas production to medical imaging and financial and industrial products. (Investing.com). General Electric is a company present in more than 100 countries.

The Graph 43 plots the price and 200-MA and shows initially a steady trend slightly increasing but since 2017 it starts to decline. That is why, this company has been selected to represent shares with decreasing trend.

“Convert natural gas into electricity without spending water” 2015, June 5

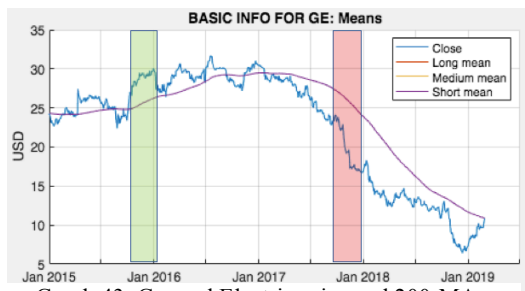
General Electric develops for Cepsa the first turbine that generates thermal energy in dry. Instead of throwing it into the atmosphere, oil refineries often recycle surplus gas from their processes to generate their own electricity. In this way, they reduce their operating costs and emissions. (Otiniano, 2015)

General Electric achieved to increase the energetic efficiency, decrease the maintenance interval periods and reduction of contaminant elements with this innovative process.

“General Electric cuts the dividend by 50% and collapses on Wall Street” 2017, November 14

The industrial group General Electric has announced on Monday a restructuring plan that implies a 50% cut in its dividend. The measure, which will take effect in December, will lower the profit per share from \$ 0.24 to \$ 0.12. It is the third time in 110 years, after the Great Depression and the financial crisis, that the company cuts dividends. General Electric drops 7% since the opening of Wall Street. (CincoDias, 2016)

This is just one of the many news that announced the downtrend that faces General Electrics. The cut in dividends cuts profits dramatically and leads to layoffs and closings of subsidiaries.



Graph 43: General Electric price and 200-MA

ii) Data analysis

General electric is the first company analyzed whose shares prices show a decreasing trend. None of the strategies achieves to obtain positive profitability but all of them are working. A strategy is considered to not be “working” in the case in which the inverse method gains higher profitability than the set strategy.

GENERAL ELECTRIC: MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-6,1%	2,86%	-16,2%	49,10%	114,0	194,7	-	-1,9%	✓	✗

GENERAL ELECTRIC: MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-10,5%	0,00%	-69,2%	0,00%	391,0	421,0	-	-3,5%	✓	✗

GENERAL ELECTRIC: MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-7,5%	0,00%	-21,3%	71,49%	362,0	244,5	-	-0,5%	✓	✗

GENERAL ELECTRIC: MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-6,2%	4,28%	-10,1%	29,17%	54,6	93,8	-	-4,9%	✓	✗

GENERAL ELECTRIC: MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	CONCLUSION	IN > 0
	-3,7%	0,00%	-69,2%	0,00%	405	421,0	-	-3,5%	✓	✗

Table 21: General Electric moving averages strategies.

The strategy with best profitability is the one that is less negative, given the fact that all the strategies have negative profitability. The fact that none of the strategies achieve to obtain positive profitability means that the moving averages are acting as false signals. To better understand the behavior of the strategies and decide which is acting better the visual analysis is carried out first than the decision making.

iii) Visual analysis

Graph information	
Initial price	24,298
Final price	10,88
Maximum price	31,66
Minimum price	6,45
Holding strategy	-56,2%

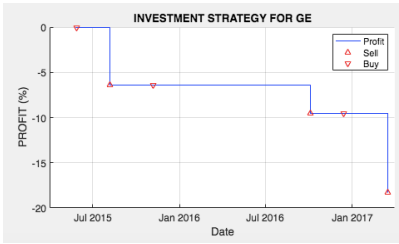
Table 22: General electric graph information

The shares of General Electric started in 2015 with an upward trend. However, right at the beginning of 2017 the trend changed and the prices of the shares entered a downward trend. Therefore, a holding strategy through the four years of study, obtains deep negative profits.

The strategy of moving averages that sets a selling signal the closest to the maximum price, is the most useful one to understand the behavior of these shares. To see which one achieves this goal better, the graphs of all the investment strategies are analyzed.

All the graphs show the profits accumulation through the four years studied. It is different to the average profitability of the strategy, computed in the Table 22, because the average profitability is calculated to know how many profits does this strategy usually obtain. However, with the graphs, the accumulation of profits achieves to give a better sense of the total gain.

Chapter 3: Visual trading analysis



Graph 44: GE 100-MA 50-MA 20-MA



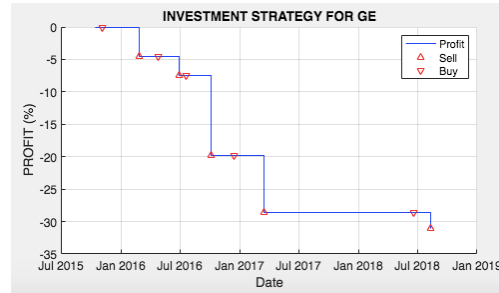
Graph 45: GE 200-MA 100-MA 50-MA



Graph 46: GE 144-MA 89-MA 55-MA



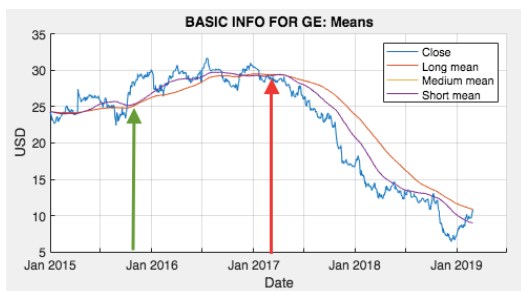
Graph 47: GE 200-MA 100-MA



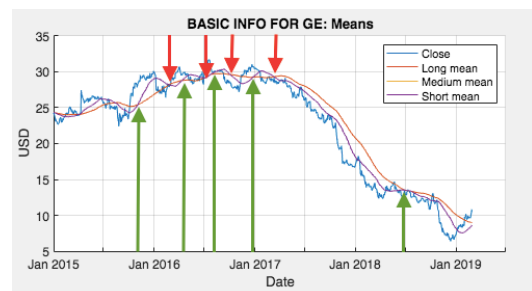
Graph 48: GE 100-MA 50-MA

The strategies that end up with the most negative profits are the 100-MA 50-MA and also, the 100-MA 50-MA 20-MA. The following ones are the 200-MA 100-MA 50-MA and the 144-MA 89-MA 55-MA

The strategy of 200-MA 100-MA is the most effective one. The accumulation of negative profits is the smallest compared to all the other strategies. It only enters the market once so the volatility is zero. To understand better what is happening and why the profitability varies from one strategy to another, the price and moving averages of the best and the worst strategies are plotted.



Graph 49: GE price and 200-MA 100-MA



Graph 50: GE price and 100-MA 50-MA

Optimality	Strategy
✓	200 MA - 100 MA
	144 MA - 89 MA - 55 MA
↓	200 MA - 100 MA - 50 MA
	100 MA - 50 MA - 20 MA
✗	100 MA - 50 MA

Table 23: GE conclusion

starts to decline more drastically. The 100-MA 50-MA is way too susceptible to false alarms. The trend never really gets to take off, so it stays in a bounded range before declining and all the operations start and end too quickly.

The buying signals are represented with the green arrows and the selling ones in red. The reason why the 200-MA 100-MA strategy is that it buys when the price is almost at its maximum, because it is a slow strategy. However, the selling signal is correctly done as it is done before the trend

3.2.7. ABBVIE INC

i) General information

General information	
Share	Abbvie Inc
Ticker	ABBV
Industry	Biotechnology & drugs
Sector	Healthcare
Market	NYQ

Table 24: AbbVie general information.

AbbVie Inc, research-based biopharmaceutical company. The aims of the company are the discovery, development, manufacture and sale of a range of pharmaceutical products. This company was initially part of the Abbot Laboratories. However, on October 19, 2011, Abbot Laboratories decide to split and specialized in diversified products while AbbVie focused on

research-based pharmaceutical manufacturer. The Graph 51 corresponds to the price of the shares of Abbvie and its decreasing trend.

“Humira's Sales Will Decline -- and It's Fantastic News for AbbVie” 2018, June 13

The company's top-selling drug, Humira, will begin to face biosimilar competition in Europe later this year. In early 2023, biosimilars to Humira will hit the U.S. market. Sales for Humira are expected to decrease by 3% annually through 2024. As a result, EvaluatePharma thinks Humira will still rank as the No. 1 best-selling drug in the world seven years from now, despite lower revenue. That's good -- even fantastic -- news for AbbVie.

The expectations of Humira being the number one selling drug reinforces the investment and shares of the company.

“California Sues AbbVie Over Alleged Arthritis Drug Kickbacks” 2018, September 18

California’s insurance regulator is suing AbbVie Inc., alleging that the pharmaceutical giant gave illegal kickbacks to health-care providers in order to keep patients on its blockbuster rheumatoid arthritis drug Humira. Humira is one of the world’s biggest-selling medications. AbbVie’s shares dropped after the news of the lawsuit, falling 2.9 percent to close at \$92.61 in New York. (Langreth, 2018).

Scandals like the previous one always produce deterioration of the company’s image and also, as said in the article, it produces a fall of the shares.



Graph 51: AbbVie price and 200-MA

ii) Data analysis

AbbVie is another case in which the trend is decreasing. However, this time, the strategies achieve to obtain positive profits. Also, the condition of the inverted strategy being worse than the normal one is fulfilled.

ABBVIE INC (ABBV): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	3,7%	20,31%	-1,4%	9,91%	150,0	81,5	2,5%	9,9%	✓	✓

ABBVIE INC (ABBV): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	44,7%	0,00%	-5,5%	16,90%	549,0	121,5	8,1%	53,7%	✓	✓

ABBVIE INC (ABBV): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	11,2%	50,77%	-4,1%	17,54%	282,5	158,5	4,0%	20,0%	✓	✓

ABBVIE INC (ABBV): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	8,1%	18,37%	-0,2%	11,85%	127,5	63,2	6,3%	13,6%	✓	✓

ABBVIE INC (ABBV): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	28,3%	23,19%	-9,8%	3,39%	271,5	141,5	10,4%	32,0%	✓	✓

Table 25: AbbVie moving averages strategies

The strategies that leave aside the 200-MA are the ones that get the worse results. The 100-MA 50-MA 20-MA buying/selling signals are not the ones to follow as the average profitability per operation is the lowest of all the strategies. Then the 144-MA 89-MA 55-MA, that has the highest volatility, so using this strategy is not a reliable fact for obtaining profits in any operation that is done. It is more a sometimes it might obtain high profitability with the operation but the other half of times not.

The 100-MA 50-MA strategy is considered to be the third better strategy, because compared to the past two, this one obtains a higher profitability/ days-in-market ratio. Its volatility is not too high, so it is not a bad option to use this strategy to rely on when investing in a company whose shares have similar behaviour to the AbbVie ones.

The best strategy is the 200-MA 100-MA, leaving aside the 50-MA. Basically, the difference between taking into account the 50-MA is that the days in the market is longer than if it is not considered. Both good strategies to rely on, the 200-MA 100-MA 50-MA has zero volatility but only because there is only one operation done.

Optimality	Strategy
✓ ↓ ✗	200 MA - 100 MA
	200 MA - 100 MA - 50 MA
	100 MA - 50 MA
	144 MA - 89 MA - 55 MA
	100 MA - 50 MA - 20 MA

Table 26: AbbVie conclusion.

Therefore, the classification of the strategies would be the one indicated in Table 26. In this case, it's been clear which are the best strategies. However, the middle differentiation between the 144-MA 89-MA 55-MA and the 100-MA 50-MA, is not so clear. The visual analysis is used as a tool to clarify this aspect.

iii) Visual analysis

Graph information	
Initial price	65,44
Final price	79,41
Maximum price	123,2
Minimum price	48,3
Holding strategy	20,3%

Table 27: AbbVie graph information

Using a holding strategy works for the share of AbbVie Inc. However, the final price corresponds to a moment in which the prices were falling, so selling later would have mean less profits or even losses. The interesting fact, would have been to sell near the maximum price. A strategy that achieves that, and besides, stays away from false alarms, is the one that should be always applied.

The best strategy, 200-MA 100-MA in Graph 52, has as main advantage that it recognizes the buying signal of the most profitable operation vary anticipated if compared to the other strategies plotted in Graph 53 and Graph 54.



Graph 52: AbbVie price and 200-MA 100-MA

Both strategies at the beginning of the analysis have buying indications that only lead to losses. The difference is that for the 144-MA 89-MA 55-MA, those losses are bigger and therefore, the profits accumulation in the following operation has to be bigger. In the main gaining operation, both have similar profitability, so their capacity to recognize signals is alike.



Graph 53: AbbVie price and 100-MA 50-MA



Graph 54: AbbVie price and 144-MA 89-MA 55-MA



Graph 55: : AbbVie 100-MA 50-MA investment strategy



Graph 56: AbbVie 144-MA 89-MA 55-MA investment strategy

3.2.8. KRAFT HEINZ COMPANY

i) General information

General information	
Share	Kraft Heinz Company
Ticker	KHC
Industry	Food Processing
Sector	Consumer/ Non-Cyclical
Market	NMS

Table 28: Kraft Heinz Company general information

The Kraft Heinz Company is a food and beverage company. It is an international company with reach to United States, Canada and Europe.

The 2nd of July, 2015 the fusion between Kraft and Heinz was completed. The merge was announced in march of 2015 and the expectations of it are explained in the first new.

“Heinz and Kraft merge and create the fifth largest food group” 2015, March 25

The companies estimate that the merger will allow cost savings from 2017 of 1,500 million dollars annually. Heinz is present in 50 countries and its annual turnover is around 4,200 million dollars. Kraft employs more than 22,000 people and annually invoices about 18,000 million dollars. The Kraft Heinz Company, will reach a turnover of 28,000 million dollars.(Ortín, 2015)

“Kraft Heinz will lay off 5,150 people and close six factories in the US and Canada” 2017, May 5

It foresees a process cost of 2,000 million. Kraft Heinz prepares a significant cut in the company's production and salary costs, after the merger between the two companies has been completed. The food group plans to lay off 13% of the workforce, which means releasing 5,150 employees. (CincoDias)

As seen in the Graph 57, it seems that since the previous event, Kraft Heinz Company has not been able to recover and go back to his initial state. Instead, it has entered a decreasing tendency difficult to stop.



Graph 57: Kraft Heinz Company price and 200-MA

ii) Data analysis

Kraft Heinz Company's shares in the period studied, present a declining trend. However, all the strategies achieve better results than if they were applied the other way around.

KRAFT HEINZ COMPANY (KHC): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-2,8%	10,55%	-9,4%	18,73%	116,3	106,8	-	6,9%	✓	✗

KRAFT HEINZ COMPANY (KHC): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	1,1%	0,00%	-45,8%	0,00%	311,0	377,0	0,4%	5,1%	✓	✓

KRAFT HEINZ COMPANY (KHC): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	4,3%	0,00%	-19,2%	36,27%	331,0	209,0	1,3%	10,3%	✓	✓

KRAFT HEINZ COMPANY (KHC): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	-3,1%	10,08%	-13,3%	21,02%	98,0	135,0	-	-0,8%	✓	✗

KRAFT HEINZ COMPANY (KHC): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	7,1%	0,00%	-20,7%	35,50%	313,0	198,5	2,3%	13,9%	✓	✓

Table 29: KHC moving averages strategies.

The two strategies that have negative returns, the 100-MA 50-MA and the 100-MA 50-MA 20-MA, are out of all consideration. In other cases in which all the returns were negative, it was analyzed which was the one that obtained the least negative returns. In this case, since there are two strategies with this negative data, in order to classify them, we resort to the visual analysis and the profit accumulation graph that is described in the following section.

The 200-MA 100-MA is once again the strategy that obtains the highest profitability. It achieves the least number of days in the market, the highest profitability and zero volatility. Perfect conditions to trust this strategy, whenever it gives the order to buy or sell, the probability of obtaining positive profits is really high.

The next strategy that seems to be more reliable is the 144-MA 89-MA 55-MA. This consideration is based on the profitability/days-in-market ratio. And not by far, with similar gains there is the 200-MA 100-Ma 50-MA.

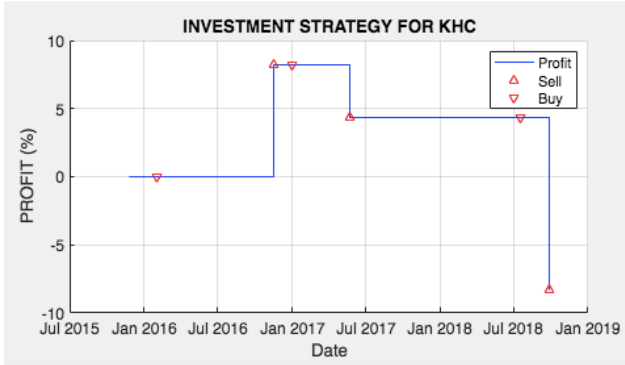
iii) Visual analysis

Graph information	
Initial price	72,96
Final price	32,2
Maximum price	96,6
Minimum price	32,2
Holding strategy	-56,9%

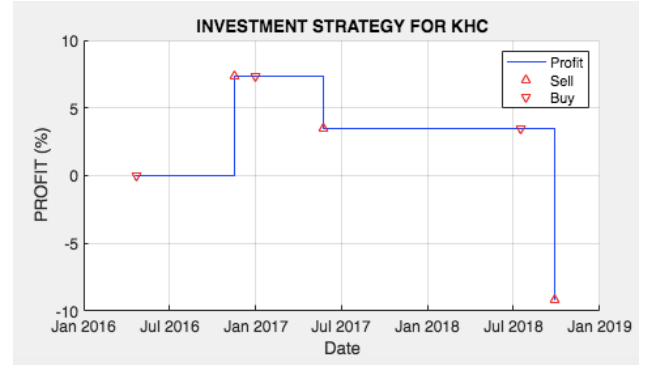
The holding strategy in a company whose shares are facing a decreasing trend is never a good option. The time for recovery of the losses is unknown and it can mean a loss of money forever. It is good that the strategies are achieving positive profits when facing a decreasing trend, because it means that they are actually working and giving valuable information.

Table 30: KHC graph information.

To decide which strategy of the ones with negative profits is better, it is plotted their profit accumulation graphs. (Graph 58 and Graph 59). The difference between them is almost non-existent, so it is considered better the strategy of 100-MA 50-MA 20-MA because the average profitability obtained is less negative than the one from applying the 100-MA 50-MA.



Graph 58: KHC price and 100-MA 50-MA 20-MA



Graph 59: KHC price and 100-MA 50-MA

Comparing these previous strategies with the 200-MA 100-MA to see why they are not working as they should, the conclusions obtained are the following. The 100-MA 50-MA is quicker so there are more buying/selling signals that at the end don't give profitability as expected. A calmer and slower strategy like the 200-MA 100-MA achieves to be more reliable, with less operations that means less buying/selling costs and more profitable.



Graph 60: KHC price and 200-MA 100-MA



Graph 61: KHC price and 100-MA 50-MA

Therefore, the conclusion of the strategies applied for the Kraft Heinz Company are the ones showed in Table 31.

Optimality	Strategy
<p style="text-align: center;"> ✓ ↓ ✗ </p>	200 MA - 100 MA
	144 MA - 89 MA - 55 MA
	200 MA - 100 MA - 50 MA
	100 MA - 50 MA - 20 MA
	100 MA - 50 MA

Table 31: KHC conclusion,

3.2.9. UNITED HEALTH GROUP

i) General information

General information	
Share	UnitedHealth Group Inc
Ticker	UNH
Industry	Insurance
Sector	Financial
Market	NYQ

UnitedHealth Group Incorporated is a health and well-being company. It is divided in four specialized segments, which are: UnitedHealthcare, OptumHealth, OptumInsight and OptumRx. (Investing.com)

Table 32: UnitedHealth general information

The company has been ranked 6th on the 2019 Fortune 500. It is a company

that up today carries out an increasing price trend as it is shown in Graph 62, as well as its 200-day moving average.

“UnitedHealth shares rise after posting a 28% rise in third-quarter profit, raises 2018 forecast”
2018, October 16

UnitedHealth reported better-than-expected third-quarter earnings and revenue, driven by higher membership growth for its health insurance plans. Shares of UnitedHealth rose 4 percent in premarket trading following the report. It was up more than 3 percent in midmorning trade. UnitedHealth, with a market cap of more than \$250 billion, has seen its shares rise more than 18 percent so far this year.(Lovelace, 2018)

The announcement of profit raises boosts the trust and encourages traders to keep investing in the shares of this company.

“UnitedHealth 2015 profit slides on \$720 million insurance exchange loss”

2016, January 19

Driven by a \$720 million loss on its individual exchange product, UnitedHealth Group on Tuesday reported a \$6.8 billion profit in 2015, down \$238 million over its 2014 profit.

The company said it would consider exiting the insurance exchange market because of the poor performance of the product. (Morse, 2016)



Graph 62: UnitedHealth price and 200-MA

ii) Data analysis

None of the strategies has negative profits. However, this fact may be due to the upward trend that the shares' price of United Health Group have.

UNITED HEALTH GROUP (UNH): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	3,1%	13,02%	12,0%	3,73%	149,8	32,4	2,1%	9,1%	✗	✓

UNITED HEALTH GROUP (UNH): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	108,6%	0,00%	4,4%	0,00%	709,0	83,0	15,3%	114,6%	✓	✓

UNITED HEALTH GROUP (UNH): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	55,9%	68,31%	9,0%	0,00%	379,0	124,0	14,7%	54,1%	✓	✓

UNITED HEALTH GROUP (UNH): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	7,1%	11,89%	9,5%	5,28%	168,5	30,4	4,2%	11,6%	✗	✓

UNITED HEALTH GROUP (UNH): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	53,6%	77,78%	4,4%	0,00%	371,5	83,0	14,4%	55,7%	✓	✓

Table 33: United Health Group moving averages strategies.

There are two strategies that directly shouldn't be considered. These are the 100-MA 50-MA 20-MA and the 100-MA 50-MA. The profitability that these two strategies obtain is totally arbitrary because, when the strategy is applied considering its buying/selling conditions inverted, the profitability is higher. Besides, these strategies are far behind the other three ones in terms of average profitability.

Once in the group of feasible strategies, the profitability of the 200-MA 100-MA is the smallest one. It cannot be considered as a bad strategy as the ones before explained, but its volatility is too high, so the indications given by this combination of moving averages cannot be taken as a secure strategy to obtain profits out of its application.

The 144-MA 89-MA 55-MA crossover indications achieve high profitability in average, but it also has high volatility and the average number days in market is the highest one. These two drawbacks are the ones that make the 200-MA 100-MA 50-MA, the most known combination of moving averages, the most effective to get high profitability.

For the short time that the investor is in the market the strategy achieves a high profitability and with zero volatility, since only one operation is carried out. The confidence and probability, that when applying these conditions gains are obtained, are very high.

Optimality	Strategy
✓	200 MA - 100 MA - 50 MA
	144 MA - 89 MA - 55 MA
	200 MA - 100 MA
	100 MA - 50 MA
✗	100 MA -50 MA -20 MA

Table 34: United Health Group conclusion.

Therefore, the conclusion of the ranking of strategies for the United Health Group is clarified and can be seen in Table 34. In order to check and understand better the reasons why the 200-MA 100-MA 50-MA strategy is obtaining such good results, it is analysed and compared with the other strategies in the visual analysis.

iii) Visual analysis

Graph information	
Initial price	101,09
Final price	250,08
Maximum price	286,3
Minimum price	101,09
Holding strategy	146,4%

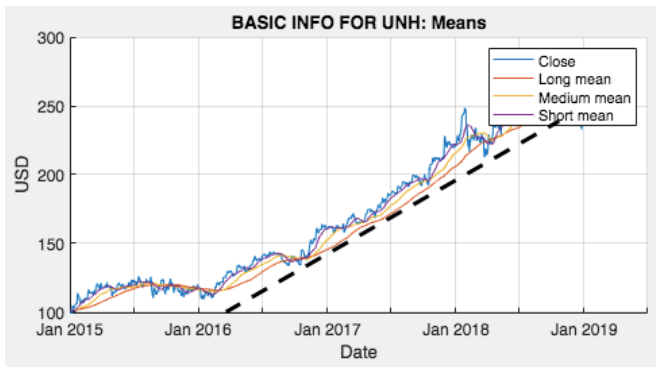
Table 35: UNH graph information



Graph 63: UNH price

In Graph 63, the price growth through the years has been plotted. Because of the upward trend, a holding strategy obtains high profitability, but as always this gain is not based on any strategy.

It is curious to notice how even when applying a strategy that is based on similar conditions, as it is the triple crossover, the length of the moving averages makes such a huge difference.

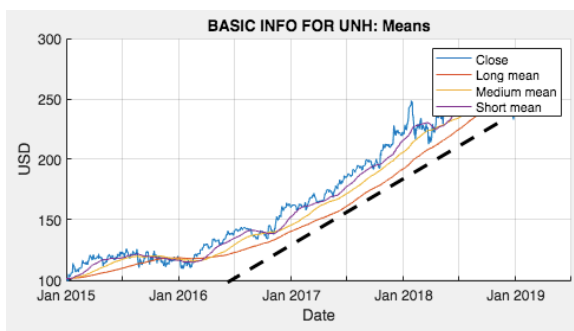


Graph 64: UNH price and 100-MA 50-MA 20-MA



Graph 65: UNH 100-MA 50-MA 20-MA investment strategy

On the one hand, when the 100-MA 50-MA 20-MA strategy is applied, the margin between each of these moving averages among them and with the price is way too small. This small range, showed in Graph 64, among them produces to give the entrance signal to many operations that don't contribute with positive profits. That is why this strategy obtains such bad results.



Graph 66: UNH price and 200-MA 100-MA 50-MA



Graph 67: UNH 200-MA 100-MA 50-MA investment strategy.

On the other hand, the 200-MA 100-MA 50-MA strategy achieves to enlarge the distance among the price and the moving averages, so the buying/selling orders don't occur as frequently and without foundation as before.

3.2.10. ABBOTT LABORATORIES

i) General information

General information	
Share	Abbott Laboratories
Ticker	ABT
Industry	Medical Equipment & Supplies
Sector	Healthcare
Market	NYQ

Abbott Laboratories is engaged in the discovery, development and sale of a range of healthcare products, as Investing.com defines. It is segmented in four parts depending on the products produced: Established pharmaceutical, diagnostic, nutritional and vascular products.

Table 36: Abbott laboratories general information

It is the part of the company that remains from the separation of the research branch AbbVie, done on October 19, 2011.

“Grifols extends a contract with Abbot of 646 million euros” 2015, July 20

Grifols and Ortho Clinical Diagnostics have extended for 5 years the contract signed with Abbot for the production of antigens for immune diagnostic reagents, according to Spanish company, which has pointed out that the new contract has a value of 700 million dollars (646 million euros). Initially, the contract ended in 2021, while now it is extended until 2026.

The extension of the contract acts as an insurance of the prosperity of the company, manig the investment on the same very attractive.

“Abbott’s No Good, Very Bad M&A Week” 2016, August 26

Abbott Laboratories has announced two large acquisitions over the last year. In recent days, both deals have become major land mines. In January, it unveiled a \$5.8 billion acquisition of Alere, which makes medical tests. Alere has been subjected to a series of regulatory inquiries over foreign sales practices, which caused its annual financial report to be delayed. Even though some of those investigations were known before the deal was signed, Abbott has since appeared to have buyer’s remorse.(Picker, 2016)

The acquisition of Alere didn’t go as well as it was planned but thanks to a posterior sale of Abbott’s eye surgery unit, the company recovered as seen in the Graph 68.



Graph 68: Abbott price and 200-MA

ii) Data analysis

All the strategies obtain positive profitability in average. However, there are two strategies that achieve extremely good results.

ABBOTT LABORATORIES (ABT): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	2,2%	37,13%	12,7%	8,61%	166,8	84,7	1,3%	8,1%	✗	✓

ABBOTT LABORATORIES (ABT): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	56,9%	0,00%	1,9%	0,00%	580,0	243,0	9,8%	67,6%	✓	✓

ABBOTT LABORATORIES (ABT): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	2,9%	34,63%	13,0%	2,62%	206,0	132,0	1,4%	6,4%	✗	✓

ABBOTT LABORATORIES (ABT): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	3,1%	24,90%	7,6%	7,74%	118,0	48,0	2,6%	6,2%	✗	✓

ABBOTT LABORATORIES (ABT): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	34,3%	38,33%	-0,9%	0,00%	302,0	239,0	11,4%	36,5%	✓	✓

Table 37: Abbott laboratorios strategies

These strategies are the 200-MA 100-MA 50-MA, with the best results, high profitability and volatility equal to zero and the 200-MA 100-MA. In both the 200-day moving average is used and the importance of the presence of this moving average has to be highlighted.

Three out of the five strategies applied, show no consistency to obtain higher profitability when you have a sales order than when you have a purchase order. This leaves the strategies of 100-MA 50-MA 20-MA, 144-MA 89-MA 55-MA and 100-MA 50-MA out of consideration for the study of the best strategy with moving averages. Within these three strategies, their movements are analyzed with the following graphs and they are compared with the strategy of 200-MA 100-MA 50-MA.

iii) Visual analysis

As happened with the United Health Group shares, the distance among the moving averages and with the price movements is too small in the case of the three strategies that are not working.

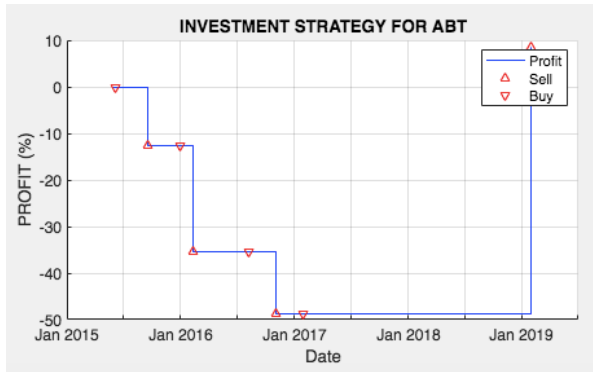


Graph 69: Abbott price and 100-MA 50-MA 20-MA

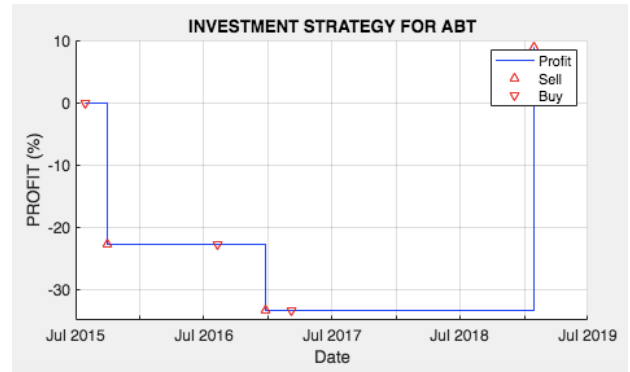


Graph 70: Abbott price and 200-MA 100-MA 50-MA

The investment strategies of the ones that don't work properly are compared to the strategy with best results.



Graph 71: Abbott 100-MA 50-MA investment strategy



Graph 72: Abbott 100-MA 50-MA 20-MA investment strategy



Graph 73: Abbott 144-MA 89-MA 55-MA investment strategy



Graph 74: 200-MA 100-MA 50-MA investment strategy

The common factor that can be drawn in common from the three graphs is that the buying and selling movements make it resemble the price form. However, the strategy that is interesting is the one that least resembles the shape of the price chart.

Graph information	
Initial price	45,02
Final price	77,33
Maximum price	77,33
Minimum price	36,34
Holding strategy	70,8%

Table 38: Abbott graph information

Obtaining high profitability with the holding method is a common characteristic of the shares that have an increasing trend through the years.

Buying when the shares' price is close to the minimum price and selling when it is close to the maximum one is the strategy that any investor wants to find. The strategies that achieve the previous goal are ordered to the one that best gets it to the worse.

Optimality	Strategy
✓ ↓ ✗	200 MA - 100 MA - 50 MA
	200 MA - 100 MA
	100 MA - 50 MA
	144 MA - 89 MA - 55 MA
	100 MA - 50 MA - 20 MA

Table 39: Abbott conclusion

3.2.11. MERCK & CO

i) General information

General information	
Share	Merck & Company Inc
Ticker	MRK
Industry	Biotechnology & Drugs
Sector	Healthcare
Market	NYQ

Table 40: Merck & Co general information.

Merck & Co. Inc is a global healthcare company. The company offers vaccines, prescription medicines, biological therapies and animal health products. (Investing.com)

It is one of the biggest pharmaceutical companies in the world and one of the main drivers of research in this field. The Graph 75 shows the price shares increasing trend. There

are some external factors that may interfere in the trend followed by the price. Two of these external events are now explained.

“The new materials re-launch the centenary Merck”

2016, March 8

The company billed 12,800 million in 2015, 13% more than last year, which was its historical record. The production of new Merck materials, such as liquid crystal and diodes for the screens of different devices, has benefited from the boost in demand from manufacturers of smart phones and televisions. The division of high-performance materials, which also includes nanotechnology and materials for integrated circuits, grew by 24% to 2,600 million. (Simón, 2016)

Expectancies linked to innovation and introduction of new ideas or in this case new products and technology, are usually linked to a company that is well consolidated.

“The 'biotech' suffer the truth of Trump”

2016, December 8

Criticisms of drug prices affect values because they are justified. The US president-elect said on Wednesday he does not like drug prices, and biotech shares fell by 4%. The net prices of pharmaceutical products in the US rose 2.8% last year. It is a slower pace than the galloping one in recent years, but it is still much higher than inflation. (Cyran, 2016)

In this case, it is demonstrated how bad publicity affects the company’s shares. The drop shown in the graph is not very harmful to the company but nevertheless it is a fact that affects it negatively.



Graph 75: Merck & Co price and 200-MA

ii) Data analysis

Positive profitability is achieved with the guidance of any of the strategies. It is also checked that all of them are working and their buying/selling signals are well-founded.

MERCK & CO (MRK): MA-100 MA-50 MA-20										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	11,8%	16,52%	-9,2%	6,51%	160,7	222,0	7,3%	12,4%	✓	✓

MERCK & CO (MRK): MA-200 MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	12,0%	8,70%	4,7%	6,36%	207,5	205,5	5,8%	14,6%	✓	✓

MERCK & CO (MRK): MA-144 MA-89 MA-55										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	14,8%	7,85%	-2,2%	6,01%	208,0	222,5	7,1%	17,9%	✓	✓

MERCK & CO (MRK): MA-100 MA-50										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	IN > OUT	IN > 0
	10,0%	19,44%	2,1%	14,43%	159,0	116,3	6,3%	11,9%	✓	✓

MERCK & CO (MRK): MA-200 MA-100										
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends	CONCLUSION	IN > 0
	12,0%	8,70%	4,7%	6,36%	207,5	205,5	5,8%	14,6%	✓	✓

Table 41: Merck & Co moving averages strategies.

There are not big differences between one strategy and another. The average profitability for all of them is in the range from 10% to 15%. The volatility also varies in a small range and the number of days in the market in average is around half-year for all the strategies.

Optimality	Strategy
✓	100 MA -50 MA -20 MA
↓	144 MA - 89 MA - 55 MA
	100 MA - 50 MA
	200 MA - 100 MA - 50 MA
✗	200 MA - 100 MA

Table 42: Merck & Co conclusion

Although all the strategies obtain good results, they can be classified based on the profitability/days-in-market ratio as it is shown in Table 42.

It is interesting that, in this case, the 100-MA 50-MA 20-MA strategy comes out as the one that obtains the

best results, when in the analysis of the other two companies' shares with upward movement, the results obtained indicated this strategy as incompatible. To study why now this strategy has turned out to be the most efficient one, it is done a visual analysis of the investment strategies.

iii) Visual analysis

Graph information	
Initial price	56,79
Final price	80,62
Maximum price	80,62
Minimum price	48,45
Holding strategy	41,0%

Table 43: Merck & Co graph information



Graph 76: Merck & Co price.

The holding strategy gets profits as it is buying at a price close to the minimum one and selling at the maximum possible.

The five graphs bellow

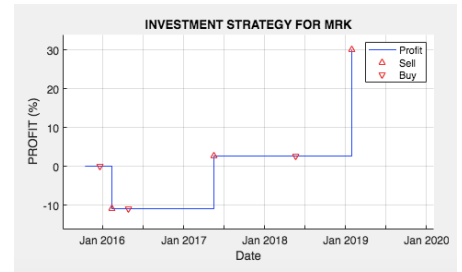
represent the profit accumulation obtained with the application of each strategy. It is interesting to notice that while the 100-MA 50-MA 20-MA and the 100-MA 50-MA get the highest profitability, they have operations in which the profits are negative. These strategies are easily perturbed and when applying them, the results are not guaranteed to be always beneficial, hence the higher volatility.



Graph 77: Merck & Co 100-MA 50-MA 20-MA investment strategy



Graph 78: Merck & Co 144-MA 89-MA 55-MA investment strategy



Graph 79: Merck & Co 100-MA 50-MA investment strategy

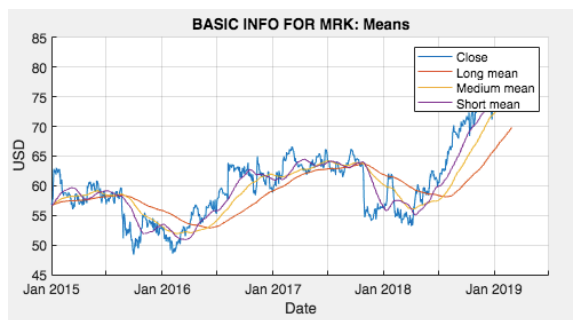


Graph 80: Merck & Co 200-MA 100-MA 50-MA investment strategy

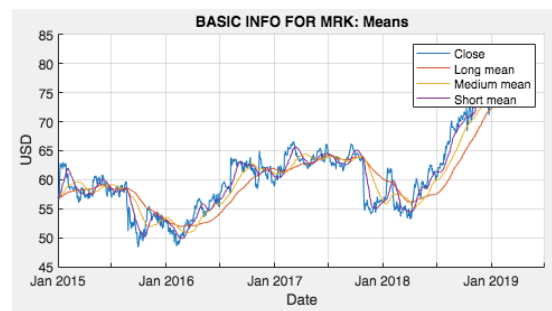


Graph 81: Merck & Co 200-MA 100-MA investment strategy

Therefore, in this case the strategies that leave aside the 200-day moving average are working better but it seems that it is just a matter of coincidences more than by own efficiency. In Graph 83, the 100-MA 50-MA 20-MA is quicker and there are more crossover signals. This make sense with the investment strategies graphs as they resemble more the movement of the price while the 200-MA 100-MA 50-MA, as it is slower and filters the information more the number of operations ordered is lower and the investment strategy plotted is not so alike the price graph.



Graph 82: Merck & Co price and 200-MA 100-MA 50-MA



Graph 83: Merck & Co price and 100-MA 50-MA 20-MA

Chapter 4: Optimization.

4.1. Introduction

The optimization achievement is based on the use of the Matlab Stock Exchange Application, whose performance was explained in Chapter 2. It is a process that focuses on finding the combination of metaparameters that give the best results in terms of profitability and negative streak. To do so, the process can be divided in two parts: optimization and validation.

The optimization section focuses on the use of the application. Through the utilization of genetic algorithms, the program starts a computing process that finalizes with the obtaining of the optimal metaparameters for the values chosen. In this study the values selected to run the optimization are: Enagas, MasterCard Incorporated, Kraft Heinz Company and United Health Group.

The second part of this chapter focuses on the validation of the results obtained with the optimization. It can be considered as if there were two types of validation. The first one is done with the same values of the optimization. Their first part of the data is used for the optimization and the second one is used for the test. This is a temporary validation. The second type of validation is done with different values. The chosen ones in this study have been: Facebook, Visa, AbbVie and Abbott. The validation in this case is done with both data sections, the optimization and the test.

Making the validation consists on checking the efficiency of the metaparameters. To measure it, the profitability and the negative streak are studied and compared with the results obtained out of the visual analysis on Chapter 3.

4.2. Results

The Matlab application provides two ways to obtain the best set of metaparameters. Both are genetic algorithms that seek to generate high-quality solutions to the optimization process.

4.2.1. Multiobjective

This algorithm maximizes the profitability and minimizes the negative streak with a weight. The results that have been obtained are:

- i) Negative streak = 10%

Optimization analysis:

- The optimization lasted: 84,04 minutes.
- Maximum profit: 35,2

Metaparameters:

- Long window: 9
- Medium window: 7
- Short window: 5
- Future window: 22
- High threshold: 0
- Low threshold: 0
- Filter: 0,29

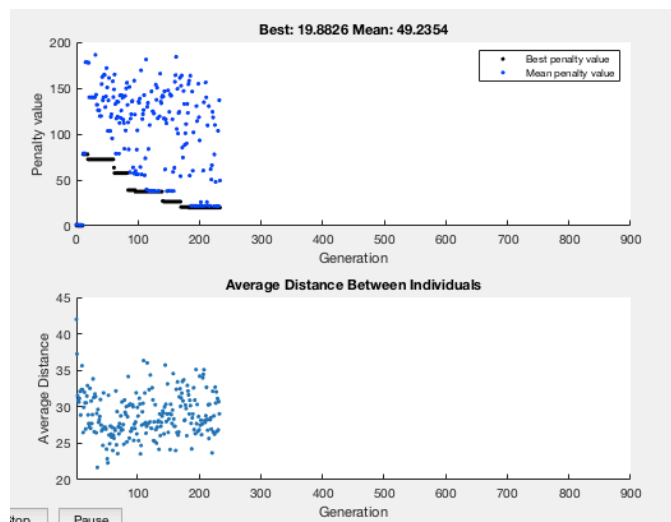
ii) Negative streak = 30%

Optimization analysis:

- The optimization lasted: 145,41minutes.
- Maximum profit: -8,5

Metaparameters:

- Long window: 7
- Medium window: 6
- Short window: 5
- Future window: 28
- High threshold: 0
- Low threshold: 0
- Filter: 0,28



Optimization Image 1

4.2.2. Constrained

This algorithm optimizes the joint profitability of the four values but with a constraint, which is that the negative streak is not too big. The constraint is set in the “Negative streak” option and setting it, for example, in a 10%, means that the negative

streak is not wanted to be greater than a 10% of the total profitability, being the negative streak the one of the joint values. The results of the optimization have been:

i) Negative streak = 10%

Optimization analysis:

- The optimization lasted: 108,77 minutes.
- Maximum profit: -137,4

Metaparameters:

- Long window: 16
- Medium window: 7
- Short window: 6
- Future window: 6
- High threshold: 0
- Low threshold: 0
- Filter: 0,31

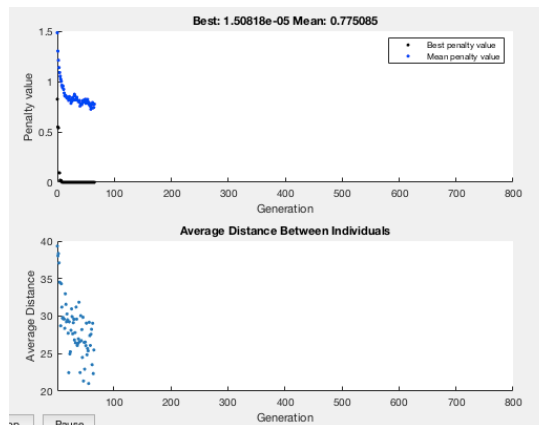
ii) Negative streak = 30%

Optimization analysis:

- The optimization lasted: 42,83 minutes.
- Maximum profit: -134,5

Metaparameters:

- Long window: 20
- Medium window: 17
- Short window: 6
- Future window: 12
- High threshold: 0
- Low threshold: 0
- Filter: 0,33



Optimization Image 2

As the maximum profit obtained with the constrained function is lower than the one of the multiobjective function, the validation is going to be done with the metaparameters obtained in the multiobjective.

4.3. Validation

4.3.1. 9-MA 7-MA 5-MA analysis

The first validation is done with the same values used in the optimization but in a different period. The results for the four shares are shown in Table 51. It has been calculated the profitability, volatility and days in the market when the strategy is applied and compared to the inverse strategy results.

The shares chosen for the optimization belong each of them to a different type of price trend, so the process is not biased.

ENAGAS: MA-9 MA-7 MA-5			
RESULTS	Profitability in market	Volatility in market	Average days in market
	-0,5%	4,3%	26,07
	Profitability out market	Volatility out market	Average days out market
	0,4%	6,7%	25,27

MASTERCARD INCORPORATED (MA): MA-9 MA-7 MA-5			
RESULTS	Profitability in market	Volatility in market	Average days in market
	1,9%	6,8%	34,92
	Profitability out market	Volatility out market	Average days out market
	4,0%	3,3%	25,67

KRAFT HEINZ COMPANY (KHC): MA-9 MA-7 MA-5			
RESULTS	Profitability in market	Volatility in market	Average days in market
	-6,6%	4,0%	26,27
	Profitability out market	Volatility out market	Average days out market
	-5,0%	7,8%	28,58

UNITED HEALTH GROUP (UNH): MA-9 MA-7 MA-5			
RESULTS	Profitability in market	Volatility in market	Average days in market
	-0,3%	4,2%	24,53
	Profitability out market	Volatility out market	Average days out market
	3,1%	5,7%	26,07

Table 44: Validation

The strategy that is being validated is the 9-MA 7-MA 5-MA. The length of the moving averages is very short, and as it was demonstrated in the visual analysis chapter, the shorter the moving average the more is influenced by small changes. Therefore, the number of operations is high, with low average of time in the market, which is interesting for investors because of the availability of the money in shorter periods.

The investment strategy can be seen in Graph 98. The price movements are shown in the left graph and it can be observed that both graphs are very similar. This investment

strategy is reproducing almost every movement of the price, which is not an attractive aspect of a strategy.

Besides in Table 51, the profitability that it is obtained when the strategy is applied the inverse way is many times higher. This means that the strategy is not adding any value and the profitability that it is achieved is more likely to be due to aleatory factors rather than to the effectiveness of the strategy.



Graph 84: KHC Price



Graph 98: KHC 9-MA 7-MA 5-MA investment strategy

The next validation uses different values to the ones considered for the optimization, in order to check if it is actually working. The shares that are being analyzed are: Facebook, Visa, AbbVie and United Health Group. The strategy has been applied considering the period of time with a 50% for optimization and a 50% for the test. The percentage of time for optimization is the same one considered when the metaparameters were calculated.

FACEBOOK (FB): MA-9 MA-7 MA-5			
OPTIMIZATION RESULTS	Profitability in market	Volatility in market	Average days in market
	1,9%	6,5%	31,83
RESULTS	Profitability out market	Volatility out market	Average days out market
	4,4%	7,8%	26,67

FACEBOOK (FB): MA-9 MA-7 MA-5			
TEST RESULTS	Profitability in market	Volatility in market	Average days in market
	-2,5%	7,5%	30,77
RESULTS	Profitability out market	Volatility out market	Average days out market
	-0,2%	7,1%	24,85

VISA: MA-9 MA-7 MA-5			
OPTIMIZATION RESULTS	Profitability in market	Volatility in market	Average days in market
	2,3%	6,3%	30,50
RESULTS	Profitability out market	Volatility out market	Average days out market
	1,7%	6,5%	25,92

VISA: MA-9 MA-7 MA-5			
TEST RESULTS	Profitability in market	Volatility in market	Average days in market
	1,9%	6,2%	38,09
RESULTS	Profitability out market	Volatility out market	Average days out market
	3,1%	2,5%	24,00

ABBVIE INC (ABBV): MA-9 MA-7 MA-5			
OPTIMIZATION RESULTS	Profitability in market	Volatility in market	Average days in market
	-3,9%	7,4%	29,08
RESULTS	Profitability out market	Volatility out market	Average days out market
	1,3%	10,3%	28,15

ABBVIE INC (ABBV): MA-9 MA-7 MA-5			
TEST RESULTS	Profitability in market	Volatility in market	Average days in market
	-0,6%	6,8%	25,62
RESULTS	Profitability out market	Volatility out market	Average days out market
	0,9%	10,2%	24,36

UNITED HEALTH GROUP (UNH): MA-9 MA-7 MA-5			
OPTIMIZATION RESULTS	Profitability in market	Volatility in market	Average days in market
	2,9%	7,9%	31,00
RESULTS	Profitability out market	Volatility out market	Average days out market
	-0,6%	11,7%	29,73

UNITED HEALTH GROUP (UNH): MA-9 MA-7 MA-5			
TEST RESULTS	Profitability in market	Volatility in market	Average days in market
	2,7%	5,1%	32,92
RESULTS	Profitability out market	Volatility out market	Average days out market
	2,4%	4,4%	23,64

Table 45: Optimization validation

Table 46: Test Validation

Table 45 shows the results of applying the 9-MA 7-MA 5-MA with a filter of 0,29 in the optimization period. The average profitability that it is obtained is not very high, considering the results achieved with other strategies. The profitability that results of

the application of the inverse strategy is higher many times to the one of the proper strategy.

The results seen in Table 46 correspond to the validation done for the testing period and agree with the other two phases of validation. The application of the metaparameters obtained in the optimization process has in the three validation steps approximately the same results. It means that the optimization was not biased. The validation objective is to check that the strategy gets the results that were expected when the optimization was done. The three tables show that the validation process agrees with the optimization results. However, the results are not as interesting as expected.

Trying to englobe shares with such different price patterns, that belong to different industries, sectors, markets and currencies under the same investment strategy is not possible. As it was showed in the visual analysis chapter, every value has differences that make a strategy more suitable to some shares than to others. The low efficiency of the results that the optimization achieves is due to the fact that the investment strategy of 9-MA 7-MA 5-MA is the one that best achieves high profitability and low negative streaks for every share. When studied every value individually, the results turn out to be different.

Chapter 5: Conclusions and further studies

5.1. Visual analysis conclusions

5.1.1. Strategies analysis

Out of the previous analysis of the five strategies selected and done for each of the shares chosen, the results are collected in Table 44. It is considered with a plus, the strategies in the top three of the classification done for each share. A minus for the strategies in the last two positions, considered to be the worse ones to trade with. An exclamation mark towards the sign symbolizes that that strategy was not giving the correct buying/selling signals as the inverted strategy obtained better results or if the profitability obtained is negative.

SHARES	STRATEGIES				
	100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
ENG	+ !	- !	+ !	+ !	- !
ZOT	- !	+ !	+ !	- !	+
FB	+	+	- !	+	- !
MA	-	-	+	+	+
V	-	+	-	+	+
GE	- !	+ !	+ !	- !	+ !
ABBV	-	+	-	+	+
KHC	- !	+	+	- !	+
UNH	- !	+	+	- !	+
ABT	- !	+	- !	+	+
MRK	+	-	+	+	-

Table 47: Strategies conclusions

The classification has considered as bad strategies those whose profitability is negative and those whose inverted strategy profitability got higher profitability. Once this selection is done, the following step is to look at the ratio between profitability and days in the market. The higher the ratio the better the strategy. The ratio results are exposed in Table 48.

SHARES	STRATEGIES				
	100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
ENG	-	-	-	-	-
ZOT	-	-	-	-	-
FB	6,0%	4,0%	2,1%	5,0%	4,0%
MA	9,8%	10,8%	12,6%	12,0%	13,6%
V	7,5%	9,3%	8,4%	10,0%	8,5%
GE	-	-	-	-	-
ABBV	2,5%	8,1%	4,0%	6,3%	10,4%
KHC		0,4%	1,3%		2,3%
UNH	2,1%	15,3%	14,7%	4,2%	14,4%
ABT	1,3%	9,8%	1,4%	2,6%	11,4%
MRK	7,3%	5,8%	7,1%	6,3%	5,8%
TOTAL	36,5%	63,5%	51,6%	46,4%	70,4%
MEAN	4,6%	7,9%	6,5%	5,8%	8,8%

Table 48: Strategies ratios

Through the analysis of the shares, some behaviors of the moving averages common in all the cases, have been observed and when thinking which is the best strategy to follow, these observations should be taken into consideration.

i) 100-MA 50-MA 20-MA

After doing the analysis of the eleven companies' shares, this strategy has turned out to be the one with worst results. It is a strategy that is useful in very specific moments and its buying/selling orders turn out to be many times aleatory as in four of the eleven shares, the inverted strategy obtained higher profitability.

It gave the best results in Facebook and Merck & Co. The similarity between these two is that the changes in price are very accentuated. This strategy is the quickest one to identify changes and give the buying/selling orders the first. This is good for the case previously explained but usually it ends up giving orders that don't end up giving profits. Those orders are considered as false alarms and the less number of false alarms the better the strategy.

ii) 200-MA 100-MA 50-MA

This strategy has turned out to be one of the most reliable ones. Only once it was considered that its orders were valueless and it appears to be useful for any type of price trend. It is a slow strategy but the consideration of the 50-MA helps to give dynamism to the strategy. It obtains better results if the price being analyzed does not suffer from big increases or decreases.

iii) 144-MA 89-MA 55-MA

Not a bad option. That is the conclusion that can be obtained out of the study of this strategy through the different cases. Useful for some of the strategies, but not for all. It represents a middle term between the 200-MA 100-MA 50-MA and the 100-MA 50-MA 20-MA. But it is not a moving average that gives the best results or with the lowest volatilities, so it is not either the most reliable one.

iv) 100-MA 50-MA

Through the analysis it has been checked that this strategy doesn't usually obtain good results. It is true that it is considerably better when compared to its triple crossover version, the 100-MA 50-MA 20-MA strategy. Even though it is not considered as a feasible strategy in four cases, in the other ones it is always in the top three options of best strategies. Therefore, it is important to discern when to use this kind of strategy for its good performance.

It is the quickest strategy so as the 100-MA 50-MA 20-MA, it also presents the problem of the false alarms. For price graphs that vary considerably between highs and lows it is a good strategy. However, for a price that goes slightly up and down, the strategy doesn't achieve to obtain good results.

v) 200-MA 100-MA

This strategy is considered to be the best one in more occasions than any of the other strategies. Shares like General Electric, AbbVie, Kraft Heinz Company or MasterCard if trusted the 200-MA 100-MA, the profitability obtained would be the highest. It is a slow strategy, it doesn't usually fall into false alarms. However, when it is necessary to exit the market quickly because of a huge drop in the shares' market price, this strategy is the last one to give the selling order.

5.1.2. Common strategies and group forming

Depending on the strategies that fit better with each company's shares, four groups can be formed and study the characteristics that the components of each group have in common.

i) Group I

The first group is composed by Enagas and Merck & Co. With the previous analysis, it can be said that for companies whose shares present a behavior similar to these two, the best moving averages to apply are in first place the 144-MA 89-MA 55-MA, and then the ones that leave aside the 200-day moving average which are the 100-MA 50-MA 20-MA and the 100-MA 50-MA.

GROUP	SHARES	RESULTS				
		STRATEGIES				
		100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
1	ENG	+ !	- !	+	+ !	- !
1	MRK	+	-	+	+	-

Table 49: Group I characteristics

Even though these two companies have different price movements, Enagas has a slightly bearish lateral movement and Merck & Co has an increasing trend, both agree on the same combination of moving averages. The 144-MA 89-MA 55-MA is the best one for Enagas while the 100-MA 50-MA 20-MA is the one that makes the most profitability when working with Merck & Co. Both prefer the triple crossover technique and the price behavior of each of them can be seen in Graph 84 and Graph 85.



Graph 85: Enagas price.



Graph 86: Merck & Co price.

In both graphs, sudden changes are happening constantly and in a steady way. The problem of the 200-day moving average is that it is too slow to react to these quick changes and the lag makes the strategy lose the right time for buying and selling.

Enagas is a company that belongs to the industry of natural gas utilities and Merck & Co. belongs to the biotechnology and drugs industry. Therefore, the industry to which the company belongs to is not a determinant factor.

ii) Group II

The second group is formed by shares with slightly bearish lateral movement or decreasing trend. In the study done, this group is formed by Zardoya, General Electric and Kraft Heinz Company. The strategies with moving averages that achieve better results in terms of profitability, days in the market and volatility are the 200-MA 100-MA, the 144-MA 89-MA 55-MA and the 200-MA 100-MA 50-MA.

GROUP	SHARES	RESULTS				
		STRATEGIES				
		100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA
2	ZOT	- !	+	+	- !	+
2	GE	-	+	+	-	+
2	KHC	-	+	+	- !	+

Table 50: Group II characteristics.

It is remarkable that the 100-MA 50-MA is failing in two out of the three cases, so it shouldn't be used in these cases. The common factor of the shares of these companies is that their prices are decreasing and to obtain profits out of a downward trend the investment strategies have to be highly trusted.



Graph 87: Zardoya price



Graph 88: General Electric price



Graph 89: Kraft Heinz Company price

The reason for the failure of the 100-MA 50-MA and the 100-MA 50-MA 20-MA is that these strategies react too quickly and they filter little the false alarms in which it may seem as a profitable operation but ends up with negative returns.

The most useful strategy is the 200-MA 100-MA except for Zardoya that achieves better results with the application of the 200-MA 100-MA 50-MA. The need of a third constraint is understood to be a way to avoid possible buying orders produced by the ups and downs that the price suffers at the beginning.

iii) Group III

The third group comprehends those companies whose shares' prices have an increasing trend or a slightly bullish lateral movement.

GROUP	SHARES	RESULTS					
		STRATEGIES					
		100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA	
3	V	-	+	-	+	+	
3	ABBV	-	+	-	+	+	
3	ABT	- !	+	- !	+	+	
3	UNH	- !	+	+	- !	+	
3	MA	-	-	+	+	+	

Table 49: Group III characteristics

The combination of moving averages that works better with this kind of trend is the 200-MA 100-MA, followed by the triple-crossover of the previous ones and including the 50-MA.



Graph 90: Visa price



Graph 91: AbbVie price



Graph 92: Abbott price



Graph 93: United Health Group price



Graph 94: MasterCard price

The pattern that follows all the price movements is an upward sloping trend and the price variations between highs and lows have very small distances among them.

Because of the changes in price occur in such a small distance but always with an upward trend it is always better to consider the 200-day moving average. The reasons are that, this moving average is slow and it is as well a good filter for all the noise of the little changes that occur.

Using the 100-MA 50-MA 20-MA gives the order of entering many operations, as these moving averages filter less and are too close among them and the price movements. The result of doing many operations for these cases translates into negative profitability and bad results out of its application.

iv) Group IV

This last group is only composed by the shares of Facebook. It can be compared to the shares of group IV, as the price graph is alike to those in that group. However, in this case the best moving averages to achieve good results are the 100-MA 50-MA 20-MA and the 100-MA 50-MA. The only common strategy to both groups is the 200-MA 100-MA 50-MA.

GROUP	SHARES	RESULTS					
		STRATEGIES					
		100-MA 50-MA 20-MA	200-MA 100-MA 50-MA	144-MA 89-MA 55-MA	100-MA 50-MA	200-MA 100-MA	
4	FB	+	+	- !	+	- !	

Table 50: Group IV characteristics

When Facebook was analyzed more deeply, the main problem presented by the 200-MA 100-MA strategy is that it failed to recognized the final price drop and the losses were enormous. However, the ones with good results, carried out more operations achieving high profitability and they were quick to recognize the price fall.



Graph 95: Facebook Price

The conclusion can be that when there's a sudden fall of prices the slow strategies like the 200-MA 100-MA miss the chance to exit the market on time to avoid bigger losses.

5.1.3. Verification of the most spread strategies

i) Efficiency of the 200-100-50 moving averages

In most of the articles found about moving averages, the 200-MA 100-MA 50-MA is the strategy usually recommended. In order to check if this widespread assumption is true, the shares previously presented have been compared and with the study done it can be said that this strategy is truly a good one to trust and rely on. It has been seen that it is not the optimal for every case, but clearly it is almost impossible to find a moving average strategy combination that works for every shares' company.

ii) Double-crossover Vs triple-crossover

Which is better, a double-crossover or a triple-crossover strategy? There is not a clear answer to this question. In the strategies analyzed it can be compared the results obtained from the 200-MA 100-MA with the 200-MA 100-MA 50-MA and the ones from the 100-MA 50-MA with the 100-MA 50-MA 20-MA.

The buying order is usually at the same time for both, the double and the triple crossover strategies. However, the exit signal is quicker for the triple-crossover in the both cases studied because the double-crossovers chosen are leaving aside the shortest moving averages that are the ones that give more dynamism.

Depending on the price behavior it is more convenient to focus in one type of crossover or the other. The triple-crossover, as it has to fulfill three constraints to give the buying order, is a more constrained strategy with higher level of reliance in general.

iii) The 200-day moving average

The use of this length of moving average has turned out to be very important in the cases in which there are not drastic changes while the price goes up, so when there's a sudden drop the selling order is effective and the losses are small but when the price only falls momentarily, this moving average filters that movement and it is not consider as a selling signal.

iv) Shorter moving averages

In the analysis, the strategies with short moving averages were left aside. The decision of leaving them apart was based on the length of the period studied. When trading intraday, the interesting lengths of moving averages are much shorter than for the long trading systems. Nevertheless, in Table 49 it is checked the profitability and volatility obtained by a strategy of shorter moving averages than the ones used in the analysis.

Comparing the results obtained by this strategy with the ones previously analyzed, the first factor is the lower average days in the market. As the moving averages are shorter, the buying/selling orders occur more frequently because of the more dynamism of these moving averages, as it can be seen in Graph

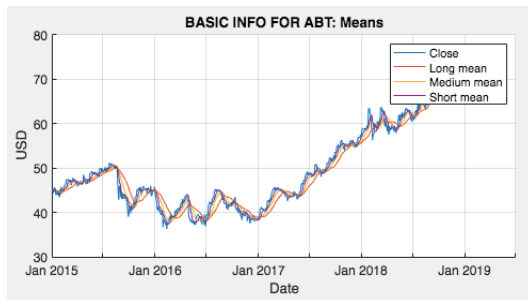
ZARDOYA (ZOT.MC): MA-40 MA-20 MA-10						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	-0,9%	7,2%	2,3%	7,21%	41,9	38,2

VISA: MA-40 MA-20 MA-10						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	0,9%	6,6%	3,2%	4,50%	54,1	27,8

ABBVIE INC (ABBV): MA-40 MA-20 MA-10						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	-3,0%	12,3%	3,0%	4,83%	48,0	29,06

ABBOTT LABORTORIES (ABT): MA-40 MA-20 MA-10						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	0,2%	7,6%	2,2%	5,75%	50,6	29,13

Table 53: 40-MA 20-MA 10-MA strategy



Graph 96: Abott price and 40-MA 20-MA 10-MA



Graph 97: Abott investment strategy 40-MA 20-MA 10-MA

The 40-MA 20-MA 10-MA doesn't obtain good results. For none of the shares the strategy gets higher profitability being applied than doing the inversed one. This has been considered through the analysis as a negative factor and the strategy is not considered trustworthy. The moving averages doesn't filter any of the price's noise and the result is an investment strategy that orders to buy every time that the price grows, as seen in Graph 96.

v) Other strategies

The analysis has been done with a selection of five strategies, chosen because of their fame among investors or because it was interesting to compare and study their behavior. In Table 50, it is shown the results of applying the 100-MA 60-MA 40-MA strategy, which are similar to the 100-MA 50-MA 20-MA.

ZARDOYA (ZOT.MC): MA-100 MA-60 MA-40						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	-3,9%	14,5%	-3,4%	16,81%	90,3	165,75

VISA: MA-100 MA-60 MA-40						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	8,7%	20,9%	7,8%	7,58%	162,8	36,40

ABBVIE INC (ABBV): MA-100 MA-60 MA-40						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	-1,8%	11,8%	2,8%	7,42%	65,2	39,45

ABBOTT LABORTORIES (ABT): MA-100 MA-60 MA-40						
RESULTS	Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market
	7,6%	15,2%	-0,3%	10,21%	159,8	95,67

Table 54: 100-MA 60-MA 40-MA strategy

However, the combinations of moving averages to apply as an investment strategy are uncountable and it would be almost impossible to arrive to a conclusion about the best strategy by doing the analysis that has been carried out. The optimization process is carried out and it searches for the metaparameters that achieve the best result.

5.2. Optimization

As it was said at the beginning, the purpose of relying on an investment strategy is to take financial decisions in certain investments in a way that is well-founded and not aleatory. That is why through the visual analysis, the strategies were compared to the use of the inverted buying/selling conditions. Testing that the results of a strategy are giving profitability because of the reliance on the constraints and conditions set is the best way to prove a strategy as a good investment indicator.

The conclusion of the visual analysis ended with the division of the values studied in four groups. When investing, the shares can be categorized in one of those four groups and apply then the strategies that have been considered for each group to be better.

The previous chapter worry was based on the need of finding a way to carry out an optimization process that through iterations or in this case using genetic algorithms, outputs the best strategy to be applied for all values. The visual analysis can be done for a limited number of strategies, as it is a slow analysis process and the moving averaged combinations for different strategies are infinite. The expectancy of the optimization process was to give a final solution that could always be applied and trusted.

However, the results of the analysis of the strategy proposed by the metaparameters obtained, is not the optimal one for each of the shares, but it is for the overall. The results of the optimization, show that it is a process that should be applied in a more restrictive way. The search of a technical analysis strategy based on the use of moving averages that every time that it is applied to any joint of shares, achieves high profitability is almost impossible. The optimization process has developed a way to find the common strategy that gets high profitability and low negative streak for the overall of the shares that the optimization is applied.

The optimization process can be applied to specific groups that share common characteristics. However, the results of this study are close to the ones of the optimization previously done. It has been checked for group II and group IV, if the optimization metaparameters were different or achieve better results, as the shares studied were considered to achieve good results for similar strategies.

For group II, the strategy that the optimization proposes is 8-MA 6-MA 5-MA with a future window of 26 and a filter of 0.25. And for group IV a strategy of 15-MA 14-MA 8-MA with a future window of 18 and a filter of 0.45. The results are almost the same to the strategy studied and validated, that is why it has not been carried out a study of each of them.

Further studies can focus on the appliance of the optimization to groups of shares that, like it was done on the visual analysis, share characteristics and optimal strategies for high efficiency on the investments. It is also interesting doing a study focused on comparing the strategy based on the cross of the moving average with the price with the strategies of this project. Other study field is the different optimization processes that can be developed and the results obtained, all in the search of that strategy that can achieve the best results every time that it is applied.

Chapter 6: Bibliography.

- [CINC15] CincoDias, “Zardoya Otis: solvencia contra la caída de ventas”, March 2015.
- [CINC15] CincoDias, “Grifols amplía un contrato con Abbot de 646 millones de euros”, July 2015.
- [CINC16] CincoDias, “Zuckerberg comparecerá en Bruselas por la filtración masiva de datos”, May 2016
- [CINC16] CincoDias, “MasterCard se hace con el 92,4% de la ‘fintech’ londinense VocalLink”, July 2016.
- [CINC17] CincoDias, “The benefit of Facebook increases 71% in the second quarter”, July 2017.
- [CINC17] CincoDias, “Las empresas ponen en duda sus sedes británicas”, November 2017.
- [CINC17] CincoDias, “Kraft Heinz despedirá a 5.150 personas y cerrará seis fábricas en EE UU y Canadá”, May 2017.
- [CINC17] CincoDias, “Enagás mejora un 54% beneficios por la filial chilena”, April 2017.
- [CINC18] CincoDias, “Así denigraba Zardoya Otis a sus competidores”, November 2018.
- [CINC19] CincoDias, “La CE multa a Mastercard con 570 millones euros por impedir la libre competencia”, January 2019.
- [CYRA16] R. Cyran, “Las ‘biotech’ sufren la verdad de Trump”, CincoDias, December 2016.
- [HAYE19] A. Hayes, “Moving Average”, Investopedia, June 2019.
- [JIME16] M. Jiménez, “Las empresas ponen en duda sus sedes británicas”, CincoDias, June 2016.
- [KIRK10] C. D. Kirkpatrick and J. R. Dahlquist, “The Complete Resource for Financial Market Technicians” Second Edition FT Press, 2010.
- [LANG18] R. Langreth, “California Sues AbbVie Over Alleged Arthritis Drug Kickbacks”, Bloomberg, September 2018.
- [LOVE18] B. Lovelace, “UnitedHealth shares rise after posting a 28% rise in third-quarter profit, raises 2018 forecast”, CNBC, October 2018.
- [MARW15] J. Marwood, “Which is the best moving average? Test results reveal the truth”, JB MARWOOD, November 2015.
- [MCCL04] McClellan Financial Publications, Inc, “Technical analysis in Los Angeles in the 1960s and 1970s”, May 2004.

- [MITC19] C. Mitchell, “Trend”, Investopedia, April 2019.
- [MITC19] C. Mitchell, “Fibonacci Numbers and Lines Definition and Uses”, Investopedia, February 2019.
- [MORS16] S. Morse, “UnitedHealth 2015 profit slides on \$720 million insurance exchange loss”, Healthcare finance, January 2016.
- [ORTI15] A. Ortín, “Heinz y Kraft se fusionan y crean el quinto mayor grupo de alimentación”, CincoDias, March 2015.
- [OTIN15] C. Otiniano, “Convertir gas natural en electricidad sin gastar agua”, CincoDias, June 2015.
- [SALO18] N. Salobral, “Duro panorama para invertir en el sector eléctrico y del gas: menos ingresos y rentabilidad”, CincoDias, March 2018.
- [SIMO16] A. Simón, “Los nuevos materiales relanzan a la centenaria Merck”, CincoDias, March 2016.
- [SMIT19] K. Smith, “The 7 pitfalls of moving averages”, Investopedia, June 2019.
- [SPEI18] K. Speights, “Humira's Sales Will Decline -- and It's Fantastic News for AbbVie”, The Montley Fool, June 2018.
- [VEGA16] J.A. Vega, “Visa se alía con una startup israelí para ofrecer financiación a pymes”, CincoDias, July 2016.

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7.1. Shares analysis

7.1.1. Enagas

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
ENAGAS: MA-100 MA-50 MA-20												
OUT	ENG	100 50 20	11-jun-15	25,295	15-oct-15	26,7	5,55%			4,8%	90	
IN	ENG	100 50 20	15-oct-15	26,7	9-feb-16	25,65	-3,93%	0,528	-3,0%	-4,1%	81	
OUT	ENG	100 50 20	9-feb-16	25,65	11-may-16	26,315	2,59%			2,6%	64	
IN	ENG	100 50 20	11-may-16	26,315	23-sept-16	26,125	-0,72%	2,376	7,3%	-2,9%	97	
OUT	ENG	100 50 20	23-sept-16	26,125	25-Apr-2017	24,24	-7,22%			-7,6%	149	
IN	ENG	100 50 20	25-Apr-2017	24,24	24-Aug-2017	24,59	1,44%	0,834	3,9%	-0,9%	86	
OUT	ENG	100 50 20	24-Aug-2017	24,59	15-Dec-2017	25,005	1,69%			1,0%	81	
IN	ENG	100 50 20	15-Dec-2017	25,005	2-feb-18	21,75	-13,02%	0,584	-11,7%	-12,2%	32	
OUT	ENG	100 50 20	2-feb-18	21,75	16-may-18	23,95	10,11%			9,0%	70	
IN	ENG	100 50 20	16-may-18	23,95	10-sept-18	24,16	0,88%	0,876	3,5%	-2,6%	83	
OUT	ENG	100 50 20	10-sept-18	24,16	17-Dec-2018	25,02	3,56%			4,0%	70	
IN	ENG	100 50 20	17-Dec-2018	25,02	31-Jan-2019	25,43	1,64%	0,612	3,1%	0,0%	31	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-3,8%		5,5%		2,3%		5,55%		68,3	87,3	-	0,5%
ENAGAS: MA-200 MA-100 MA-50												
IN	ENG	200 100 50	17-Dec-2015	27,265	17-nov-16	23,23	-14,80%	2,904	-5,1%	-18,7%	236	
OUT	ENG	200 100 50	17-nov-16	23,23	28-jun-17	25,585	10,14%			11,9%	155	
IN	ENG	200 100 50	28-jun-17	25,585	16-nov-17	23,935	-6,45%	0,834	-4,2%	-8,3%	101	
OUT	ENG	200 100 50	16-nov-17	23,935	08-Aug-2018	24,24	1,27%			0,0%	183	
IN	ENG	200 100 50	08-Aug-2018	24,24	31-Jan-2019	25,43	4,91%	0,612	6,4%	4,1%	124	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-7,6%		11,4%		6,0%		8,41%		153,7	169,0	-	-1,0%

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ENAGAS: MA-144 MA-89 MA-55											
OUT	ENG	144 89 55	28-jul-15	25,44	25-sept-15	25,53	0,35%			-3,3%	43
IN	ENG	144 89 55	25-sept-15	25,53	1-feb-16	26,95	5,56%	0,528	6,6%	6,6%	89
OUT	ENG	144 89 55	1-feb-16	26,95	20-Apr-2016	27,35	1,48%			0,1%	55
IN	ENG	144 89 55	20-Apr-2016	27,35	23-sept-16	26,125	-4,48%	1,584	0,3%	-4,4%	112
OUT	ENG	144 89 55	23-sept-16	26,125	27-Apr-2017	24,275	-7,08%			-9,2%	151
IN	ENG	144 89 55	27-Apr-2017	24,275	15-Aug-2017	24,385	0,45%	0,834	2,9%	2,5%	77
OUT	ENG	144 89 55	15-Aug-2017	24,385	27-oct-17	24,185	-0,82%			-4,1%	53
IN	ENG	144 89 55	27-oct-17	24,185	24-nov-17	23,645	-2,23%		-3,2%	-2,1%	20
OUT	ENG	144 89 55	9-nov-17	24,135	20-Dec-2017	24,065	-0,29%			-1,4%	29
IN	ENG	144 89 55	20-Dec-2017	24,065	2-feb-18	21,75	-9,62%		-10,6%	-9,6%	29
OUT	ENG	144 89 55	2-feb-18	21,75	14-may-18	24,65	13,33%			9,9%	68
IN	ENG	144 89 55	14-may-18	24,65	13-sept-18	24,04	-2,47%	0,876	0,1%	-3,3%	88
OUT	ENG	144 89 55	13-sept-18	24,04	18-Dec-2018	24,4	1,50%			2,8%	68
IN	ENG	144 89 55	18-Dec-2018	24,4	31-Jan-2019	25,43	4,22%		3,2%	0,9%	30
RESULTS		Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends		
		-1,3%	5,2%	-0,7%	6,00%	63,6	66,7	-	-0,1%		
ENAGAS: MA-100 MA-50											
OUT	ENG	100 50	14-oct-15	26,505	11-nov-15	27,045	2,04%			2,1%	20
IN	ENG	100 50	15-oct-15	26,7	4-feb-16	26,55	-0,56%	0,528	0,4%	0,4%	78
OUT	ENG	100 50	4-feb-16	26,55	28-Apr-2016	26,57	0,08%			-3,3%	58
IN	ENG	100 50	28-Apr-2016	26,57	23-sept-16	26,125	-1,67%	2,376	6,3%	-1,7%	106
OUT	ENG	100 50	23-sept-16	26,125	24-Apr-2017	24,39	-6,64%			-8,4%	148
IN	ENG	100 50	24-Apr-2017	24,39	14-Aug-2017	24,295	-0,39%		-1,4%	-1,0%	79
OUT	ENG	100 50	14-Aug-2017	24,295	15-Dec-2017	25,005	2,92%			1,8%	89
IN	ENG	100 50	15-Dec-2017	25,005	2-feb-18	21,75	-13,02%	0,584	-11,7%	-12,2%	32
OUT	ENG	100 50	2-feb-18	21,75	16-may-18	23,95	10,11%			9,0%	70
IN	ENG	100 50	16-may-18	23,95	10-sept-18	24,16	0,88%	0,876	3,5%	-2,6%	83
OUT	ENG	100 50	10-sept-18	24,16	17-Dec-2018	25,02	3,56%			4,0%	70
IN	ENG	100 50	17-Dec-2018	25,02	31-Jan-2019	25,43	1,64%	0,612	3,1%	0,0%	31
RESULTS		Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends		
		-2,9%	4,7%	0,9%	6,03%	68,2	75,8	-	0,0%		
ENAGAS: MA-200 MA-100											
OUT	ENG	200 100	14-oct-15	26,505	17-Dec-2015	27,265	2,87%			4,8%	46
IN	ENG	200 100	17-Dec-2015	27,265	29-Apr-2016	26,605	-2,42%	0,528	-1,5%	-6,0%	92
OUT	ENG	200 100	29-Apr-2016	26,605	19-jul-16	27,27	2,50%			1,2%	57
IN	ENG	200 100	19-jul-16	27,27	17-nov-16	23,23	-14,81%		-15,8%	-16,2%	87
OUT	ENG	200 100	17-nov-16	23,23	28-jun-17	26,665	14,79%			11,9%	155
IN	ENG	200 100	28-jun-17	26,665	6-nov-17	24,165	-9,38%	0,834	-7,2%	-7,2%	93
OUT	ENG	200 100	6-nov-17	24,165	26-jul-18	23,62	-2,26%			-3,8%	182
IN	ENG	200 100	26-jul-18	23,62	31-Jan-2019	25,43	7,66%	0,612	9,3%	6,8%	133
RESULTS		Profitability in market	Volatility in market	Profitability out of market	Volatility out of market	Average days in market	Average days out market	Ratio	Profitability dividends		
		-5,7%	9,5%	3,5%	6,60%	101,3	110,0	-	-3,8%		

Table Appendix 1: Enagas

7.1.2. Zardoya

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
ZARDOYA (ZOT.MC): MA-100 MA-50 MA-20												
OUT	ZOT	100 50 20	29-jun-15	9,592	4-nov-15	10,974	14,41%			15,1%	92	
IN	ZOT	100 50 20	4-nov-15	10,974	2-feb-16	8,848	-19,37%	0,242	-18,17%	-18,3%	62	
OUT	ZOT	100 50 20	2-feb-16	8,848	29-mar-17	8,64	-2,35%			-7,5%	298	
IN	ZOT	100 50 20	29-mar-17	8,64	16-feb-18	8,88	2,78%	0,720	10,11%	0,8%	226	
OUT	ZOT	100 50 20	16-feb-18	8,88	31-Jan-2019	6,915	-22,13%			-21,6%	244	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-8,8%		13,5%		-4,7%		18,51%		144,0	211,3	-	-4,0%
ZARDOYA (ZOT.MC): MA-200 MA-100 MA-50												
OUT	ZOT	200 100 50	2-feb-16	8,848	18-may-17	8,41	-4,95%			-9,5%	331	
IN	ZOT	200 100 50	18-may-17	8,41	29-mar-18	8,18	-3,73%	0,33	0,19%	-3,3%	222	
OUT	ZOT	200 100 50	29-mar-18	8,18	31-Jan-2019	6,915	-16,46%			-16,5%	215	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-3,3%		0,00%		-13,0%		4,95%		222,0	273,0	-	0,2%

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ZARDOYA (ZOT.MC): MA-144 MA-89 MA-55												
OUT	ZOT	144 89 55	12-Aug-2015	9,583	3-may-17	8,61	-10,15%			-13,1%	442	
IN	ZOT	144 89 55	3-may-17	8,61	16-mar-18	8,25	-4,18%	0,48	0,39%	-4,8%	224	
OUT	ZOT	144 89 55	16-mar-18	8,25	31-Jan-2019	6,915	-16,18%			-17,2%	224	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-4,8%		0,00%		-15,2%		-15,15%		224	333,0	-	0,4%
ZARDOYA (ZOT.MC): MA-100 MA-50												
OUT	ZOT	100 50	14-oct-15	10,375	11-nov-15	10,703	3,16%			3,6%	20	
IN	ZOT	100 50	4-nov-15	10,974	2-feb-16	8,848	-19,37%		-20,4%	-18,3%	62	
OUT	ZOT	100 50	2-feb-16	8,848	23-sept-16	8,45	-4,50%			-9,0%	166	
IN	ZOT	100 50	23-sept-16	8,45	21-oct-16	7,81	-7,57%	0,2338	-5,8%	-8,6%	20	
OUT	ZOT	100 50	21-oct-16	7,81	6-feb-17	7,82	0,13%			0,5%	76	
IN	ZOT	100 50	6-feb-17	7,82	16-feb-18	8,88	13,55%		12,6%	9,2%	263	
OUT	ZOT	100 50	16-feb-18	8,88	27-jun-18	8,485	-4,45%			-4,3%	90	
IN	ZOT	100 50	27-jun-18	8,485	27-jul-18	8,215	-3,18%	0,24	-1,4%	-3,6%	22	
OUT	ZOT	100 50	27-jul-18	8,215	31-Jan-2019	6,915	-15,82%			-16,7%	132	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-5,3%		11,45%		-5,2%		8,02%		91,8	96,8	-	-3,7%
ZARDOYA (ZOT.MC): 200 MA-100 MA												
OUT	ZOT	200 100	14-oct-15	10,375	4-feb-16	9,013	-13,13%			-13,9%	79	
IN	ZOT	200 100	4-feb-16	9,013	12-Apr-2016	8,955	-0,64%	0,2308	0,9%	-1,4%	46	
OUT	ZOT	200 100	12-Apr-2016	8,955	18-may-17	8,41	-6,09%			-6,0%	283	
IN	ZOT	200 100	18-may-17	8,41	29-mar-18	8,18	-2,73%	0,48	2,0%	-3,3%	222	
OUT	ZOT	200 100	29-mar-18	8,18	31-Jan-2019	6,915	-15,46%			-16,5%	215	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-2,4%		1,34%		-12,1%		5,47%		134,0	192,3	-	1,4%

Table Appendix 2: Zardoya

7.1.3. Facebook

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market		
FACEBOOK (FB): MA-100 MA-50 MA-20													
IN	FB	100 50 20	25-jun-15	88,86	31-Dec-2016	115,05	29,47%	-	-	40,0%	384		
OUT	FB	100 50 20	31-Dec-2016	115,05	2-feb-17	133,23	15,80%	-	-	10,4%	21		
IN	FB	100 50 20	2-feb-17	133,23	23-feb-18	178,99	34,35%	-	-	17,0%	266		
OUT	FB	100 50 20	23-feb-18	178,99	9-jun-18	189,1	5,65%	-	-	8,7%	74		
IN	FB	100 50 20	9-jun-18	189,1	15-sept-18	162,32	-14,16%	-	-	-14,0%	68		
OUT	FB	100 50 20	15-sept-18	162,32	30-Jan-2019	144,19	-11,17%	-	-	-9,8%	93		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
	14,3%		27,10%		3,1%		11,20%		239,3		62,7	6,0%	
FACEBOOK (FB): MA-200 MA-100 MA-50													
IN	FB	200 100 50	17-oct-15	97,54	24-Apr-2018	165,84	70,02%	-	-	60,9%	632		
OUT	FB	200 100 50	24-Apr-2018	165,84	11-jul-18	203,54	22,73%	-	-	26,3%	54		
IN	FB	200 100 50	11-jul-18	203,54	20-nov-18	131,55	-35,37%	-	-	-32,1%	93		
OUT	FB	200 100 50	20-nov-18	131,55	30-Jan-2019	144,19	9,61%	-	-	0,004	47		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
	14,4%		65,76%		13,4%		18,31%		362,5		50,5	4,0%	

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FACEBOOK (FB): MA-144 MA-89 MA-55												
IN	FB	144 89 55	30-jul-15	96,99	04-Apr-2018	156,11	60,95%	-	-	44,4%	674	
OUT	FB	144 89 55	04-Apr-2018	156,11	7-jul-18	203,23	30,18%	-	-	32,1%	66	
IN	FB	144 89 55	7-jul-18	203,23	31-oct-18	146,22	-28,05%	-	-	-28,3%	81	
OUT	FB	144 89 55	31-oct-18	146,22	30-Jan-2019	144,19	-1,39%	-	-	1,2%	61	
RESULTS		Profitability in market	Volatility in market	Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
		8,1%	51,41%	16,7%		21,85%		377,5		63,5	2,1%	
FACEBOOK (FB): MA-100 MA-50												
IN	FB	100 50	17-oct-15	97,54	3-mar-16	109,95	11,72%	-	-	18,3%	93	
OUT	FB	100 50	3-mar-16	109,95	02-Apr-2016	116,06	4,56%	-	-	-1,9%	21	
IN	FB	100 50	02-Apr-2016	116,06	31-Dec-2016	115,05	-1,87%	-	-	9,3%	190	
OUT	FB	100 50	31-Dec-2016	115,05	2-feb-17	133,23	14,80%	-	-	10,4%	21	
IN	FB	100 50	2-feb-17	133,23	23-feb-18	178,99	33,35%	-	-	17,0%	266	
OUT	FB	100 50	23-feb-18	178,99	9-jun-18	189,1	4,65%	-	-	8,7%	74	
IN	FB	100 50	9-jun-18	189,1	15-sept-18	162,32	-15,16%	-	-	-14,0%	68	
OUT	FB	100 50	15-sept-18	162,32	30-Jan-2019	144,19	-12,17%	-	-	-9,8%	93	
RESULTS		Profitability in market	Volatility in market	Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
		7,7%	9,48%	1,9%		9,48%		154,3		52,3	5,0%	
FACEBOOK (FB): MA-200 MA-100												
IN	FB	200 100 50	17-oct-15	97,54	24-Apr-2018	165,84	69,02%	-	-	60,9%	632	
OUT	FB	200 100 50	24-Apr-2018	165,84	11-jul-18	203,54	21,73%	-	-	26,3%	54	
IN	FB	200 100 50	11-jul-18	203,54	20-nov-18	131,55	-36,37%	-	-	-32,1%	93	
OUT	FB	200 100 50	20-nov-18	131,55	30-Jan-2019	144,19	8,61%	-	-	4,0%	47	
RESULTS		Profitability in market	Volatility in market	Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
		14,4%	65,76%	15,2%		15,77%		362,5		50,5	4,0%	

Table Appendix 3: Facebook

7.1.4. MasterCard Incorporated

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
MASTERCARD INCORPORATED (MA): MA-100 MA-50 MA-20												
IN	MA	100 50 20	28-may-15	92,59	1-oct-15	90,12	-2,67%	0,16	-3,49%	-5,5%	88	
OUT	MA	100 50 20	1-oct-15	90,12	18-nov-15	98,07	8,82%			13,7%	34	
IN	MA	100 50 20	18-nov-15	98,07	6-feb-16	82,76	-15,61%	0,19	-16,42%	-18,0%	54	
OUT	MA	100 50 20	6-feb-16	82,76	12-may-16	96,41	16,49%			10,2%	66	
IN	MA	100 50 20	12-may-16	96,41	01-Dec-2018	201,07	108,56%	2,26	109,90%	100,9%	645	
OUT	MA	100 50 20	01-Dec-2018	201,07	30-Jan-2019	199,24	-0,91%			0,0%	39	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	25,8%		65,34%		8,0%		7,12%		262,3		46,3	
MASTERCARD INCORPORATED (MA): MA-200 MA-100 MA-50												
IN	MA	200 100 50	18-nov-15	98,07	30-Jan-2019	199,24	103,16%	2,97	105,19%	87,2%	804	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	87,2%		0,00%		0,0%		0,00%		804,0		-	
MASTERCARD INCORPORATED (MA): MA-144 MA-89 MA-55												
IN	MA	144 89 55	30-jul-15	96,73	30-Jan-2019	199,24	105,98%	3,13	108,21%	110,7%	882	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	110,7%		0,00%		0,0%		0,00%		882,0		-	
MASTERCARD INCORPORATED (MA): MA-100 MA-50												
OUT	MA	100 50	17-oct-15	97,64	18-nov-15	98,07	0,44%			7,1%	22	
IN	MA	100 50	18-nov-15	98,07	6-feb-16	82,76	-15,61%	0,19	-16,42%	-18,0%	54	
OUT	MA	100 50	6-feb-16	82,76	6-may-16	96,19	16,23%			8,9%	62	
IN	MA	100 50	6-may-16	96,19	03-Aug-2016	95,25	-0,98%	0,19	-1,78%	-0,7%	61	
OUT	MA	100 50	03-Aug-2016	95,25	14-sept-16	99,39	4,35%			3,5%	29	
IN	MA	100 50	14-sept-16	99,39	30-nov-18	196,66	97,87%	2,07	98,95%	99,3%	558	
OUT	MA	100 50	30-nov-18	196,66	30-Jan-2019	199,24	1,31%			-2,8%	40	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	26,9%		63,32%		4,2%		5,16%		224,3		38,3	
MASTERCARD INCORPORATED (MA): MA-200 MA-100												
IN	MA	200 100	17-oct-15	97,64	29-mar-16	91,24	-6,55%	0,19	-7,36%	-4,9%	110	
OUT	MA	200 100	29-mar-16	91,24	25-Aug-2016	95,53	4,70%			2,9%	105	
IN	MA	200 100	25-Aug-2016	95,53	30-Jan-2019	199,24	108,56%	2,4	110,08%	102,8%	611	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	49,0%		76,16%		2,9%		0,00%		360,5		105	

Table Appendix 4: MasterCard Incorporated

7.1.5. Visa

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
VISA: MA-100 MA-50 MA-20												
IN	VISA	101 50 20	2-jun-15	69,11	10-jul-15	67,05	-3,0%		-3,98%	-4,4%	27	
OUT	VISA	102 50 20	10-jul-15	67,05	18-jul-15	70,88	5,7%			11,7%	20	
IN	VISA	103 50 20	18-jul-15	70,88	13-feb-16	70,42	-0,6%	0,14	-1,45%	-6,1%	145	
OUT	VISA	104 50 20	13-feb-16	70,42	12-may-16	77,3	9,8%			11,9%	61	
IN	VISA	105 50 20	12-may-16	77,3	11-Dec-18	137,88	78,4%	1,88	79,80%	72,2%	650	
OUT	VISA	108 50 20	11-Dec-18	137,88	30-Jan-2019	135	-2,1%			-2,6%	34	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	20,6%		44,72%		7,0%		8,31%		274,0	38,3	7,5%	24,8%
VISA (V): MA-200 MA-100 MA-50												
IN	VISA	200 100 50	17-oct-15	76	30-Jan-2019	135	77,6%	2,30	79,65%	77,2%	826	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	77,2%		0,00%		0,0%		0,00%		826,0	-	9,3%	79,7%
VISA (V): MA-144 MA-89 MA-55												
IN	VISA	144 89 55	30-jul-15	96,73	30-Jan-2019	135	39,6%	2,415	41,06%	74,0%	881	
OUT	VISA	144 89 55	30-Jan-2019	135	31-Jan-2019	137,6	1,9%			-2,2%	1	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	74,0%		0,00%		-2,2%		0,00%		881	1,0	8,4%	41,1%
VISA (V): MA-100 MA-50												
OUT	VISA	100 50	30-oct-15	78,51	17-oct-15	76	-3,2%			4,1%	20	
IN	VISA	100 50	17-oct-15	76	13-feb-16	70,42	-7,3%	0,14	-8,16%	-8,4%	81	
OUT	VISA	100 50	13-feb-16	70,42	6-may-16	77,36	9,9%			9,2%	57	
IN	VISA	100 50	6-may-16	77,36	08-Dec-2018	137,11	77,2%	1,875	78,66%	82,1%	653	
OUT	VISA	100 50	08-Dec-2018	137,11	30-Jan-2019	135	-1,5%			-5,6%	35	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	36,9%		63,99%		2,6%		7,52%		367,0	37,3	10,0%	35,3%
VISA (V): MA-200 MA-100												
IN	VISA	200 100	17-oct-15	76	6-may-16	77,36	1,8%	0,28	1,16%	1,1%	138	
OUT	VISA	200 100	6-may-16	77,36	06-Aug-2016	80,14	3,6%			4,9%	64	
IN	VISA	200 100	06-Aug-2016	80,14	30-Jan-2019	135	68,5%	1,875	69,79%	63,9%	624	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	32,5%		44,41%		4,9%		0,00%		381,0	64,0	8,5%	35,5%

Table Appendix 5: Visa

7.1.6. General Electric

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
GENERAL ELECTRIC: MA-100 MA-50 MA-20												
IN	GE	100 50 20	28-may-15	26,462	07-Aug-2015	25,029	-5,4%	0,23	-5,55%	-6,4%	50	
OUT	GE	100 50 20	07-Aug-2015	25,029	6-nov-15	28,5	13,9%			12,1%	64	
IN	GE	100 50 20	6-nov-15	28,5	5-oct-16	28,365	-0,5%	0,92	1,75%	-3,1%	229	
OUT	GE	100 50 20	5-oct-16	28,365	14-Dec-2016	30,519	7,6%			12,2%	49	
IN	GE	100 50 20	14-Dec-2016	30,519	17-mar-17	28,606	-6,3%	0,48		-8,8%	63	
OUT	GE	100 50 20	17-mar-17	28,606	30-Jan-2019	8,558	-70,1%			-72,9%	471	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-6,1%		2,86%		-16,2%		49,10%		114,0	194,7	-	-1,9%
GENERAL ELECTRIC: MA-200 MA-100 MA-50												
IN	GE	200 100 50	6-nov-15	28,5	27-may-17	26,394	-7,4%	1,4	-3,48%	-10,5%	391	
OUT	GE	200 100 50	27-may-17	26,394	30-Jan-2019	8,558	-67,6%			-69,2%	421	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-10,5%		0,00%		-69,2%		0,00%		391,0	421,0	-	-3,5%
GENERAL ELECTRIC: MA-144 MA-89 MA-55												
OUT	GE	144 89 55	12-sept-15	23,99	28-nov-15	29,192	21,7%			29,3%	54	
IN	GE	144 89 55	28-nov-15	29,192	9-may-17	27,952	-4,2%	1,4	-0,45%	-7,5%	362	
OUT	GE	144 89 55	9-may-17	27,952	30-Jan-2019	8,558	-69,4%			-71,8%	435	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-7,5%		0,00%		-21,3%		71,49%		362,0	244,5	-	-0,5%

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GENERAL ELECTRIC: MA-100 MA-50													
OUT	GE	100 50	17-oct-15	27,865	14-nov-15	29,115	4,5%				8,7%	20	
IN	GE	100 50	6-nov-15	28,5	26-feb-16	28,106	-1,4%	0,46	-0,77%		-4,5%	75	
OUT	GE	100 50	26-feb-16	28,106	26-Apr-2016	29,5	5,0%				3,7%	41	
IN	GE	100 50	26-Apr-2016	29,5	28-jun-16	28,192	-4,4%	0,23	-4,65%		-2,9%	44	
OUT	GE	100 50	28-jun-16	28,192	27-jul-16	30,26	7,3%				6,5%	20	
IN	GE	100 50	21-jul-16	31,519	5-oct-16	28,365	-10,0%	0,23	-10,28%		-12,4%	53	
OUT	GE	100 50	5-oct-16	28,365	14-Dec-2016	30,519	7,6%				12,2%	49	
IN	GE	100 50	14-Dec-2016	30,519	17-mar-17	28,606	-6,3%	0,48	-5,70%		-8,8%	63	
OUT	GE	100 50	17-mar-17	28,606	19-jun-18	12,692	-55,6%				-59,9%	316	
IN	GE	100 50	19-jun-18	12,692	11-Aug-2018	12,279	-3,3%	0,12	-3,31%		-2,4%	38	
OUT	GE	100 50	11-Aug-2018	12,279	30-Jan-2019	8,558	-30,3%				-31,5%	117	
RESULTS		Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
		-6,2%		4,28%		-10,1%		29,17%		54,6	93,8	-	-4,9%
GENERAL ELECTRIC: MA-200 MA-100													
IN	GE	200 100 50	17-oct-15	27,865	27-may-17	26,394	-5,3%	1,4	-1,25%		-3,7%	405	
OUT	GE	200 100 50	27-may-17	26,394	30-Jan-2019	8,558	-67,6%				-69,2%	421	
RESULTS		Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
		-3,7%		0,00%		-69,2%		0,00%		405	421,0	-	-3,5%

Table Appendix 6: General Electric

7.1.7. AbbVie

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market			
ABBVIE INC (ABBV): MA-100 MA-50 MA-20														
IN	ABBV	100 50 20	28-may-15	67,38	19-sept-15	61,22	-9,14%	0,51	-9,39%	-15,9%	80			
OUT	ABBV	100 50 20	19-sept-15	61,22	29-Apr-2016	61,2	-0,03%			-2,1%	153			
IN	ABBV	100 50 20	29-Apr-2016	61,2	28-oct-16	61,46	0,42%	1,14	1,29%	8,3%	127			
OUT	ABBV	100 50 20	28-oct-16	61,46	07-Jan-2017	63,79	3,79%			5,8%	48			
IN	ABBV	100 50 20	07-Jan-2017	63,79	29-jun-18	92,42	44,88%	4,23	50,51%	30,2%	371			
OUT	ABBV	100 50 20	29-jun-18	92,42	22-Aug-2018	98,05	6,09%			6,0%	37			
IN	ABBV	100 50 20	22-Aug-2018	98,05	22-sept-18	95,37	-2,73%	0,96	-2,75%	-7,7%	22			
OUT	ABBV	100 50 20	22-sept-18	95,37	30-Jan-2019	77,47	-18,77%			-15,1%	88			
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market		Ratio	Profitability dividends
	3,7%		20,31%		-1,4%		9,91%		150,0		81,5		2,5%	9,9%
ABBVIE INC (ABBV): MA-200 MA-100 MA-50														
OUT	ABBV	200 100 50	05-Dec-2015	55,44	1-jul-16	61,91	11,67%			6,5%	143			
IN	ABBV	200 100 50	1-jul-16	61,91	6-sept-18	95,19	53,76%	0,57	53,68%	44,7%	549			
OUT	ABBV	200 100 50	6-sept-18	95,19	30-Jan-2019	77,47	-18,62%			-17,4%	100			
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market		Ratio	Profitability dividends
	44,7%		0,00%		-5,5%		16,90%		549,0		121,5		8,1%	53,7%

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ABBVIE INC (ABBV): MA-144 MA-89 MA-55													
IN	ABBV	144 89 55	30-jul-15	70,77	17-oct-15	56,53	-20,12%	0,51	-20,40%	-24,7%	56		
OUT	ABBV	144 89 55	17-oct-15	56,53	18-jun-16	60,4	6,85%			8,3%	168		
IN	ABBV	144 89 55	18-jun-16	60,4	27-jun-18	92,12	52,52%	5,37	60,41%	47,1%	509		
OUT	ABBV	144 89 55	27-jun-18	92,12	30-Jan-2019	77,47	-15,90%			-16,5%	149		
RESULTS		Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
		11,2%		50,77%		-4,1%		17,54%		282,5	158,5	4,0%	20,0%
ABBVIE INC (ABBV): MA-100 MA-50													
OUT	ABBV	100 50	17-oct-15	56,53	05-Jan-2016	57,61	1,91%			7,3%	53		
IN	ABBV	100 50	05-Jan-2016	57,61	11-feb-16	52,72	-8,49%	0,57	-8,50%	-11,5%	26		
OUT	ABBV	100 50	11-feb-16	52,72	29-Apr-2016	61,2	16,08%			6,5%	54		
IN	ABBV	100 50	29-Apr-2016	61,2	28-oct-16	61,46	0,42%	1,14	1,29%	8,3%	127		
OUT	ABBV	100 50	28-oct-16	61,46	07-Jan-2017	63,79	3,79%			5,8%	48		
IN	ABBV	100 50	07-Jan-2017	63,79	28-Apr-2018	98,73	54,77%	4,23	60,40%	32,6%	328		
OUT	ABBV	100 50	28-Apr-2018	98,73	13-jul-18	95,61	-3,16%			0,1%	52		
IN	ABBV	100 50	13-jul-18	95,61	23-Aug-2018	97,64	2,12%		1,12%	2,8%	29		
OUT	ABBV	100 50	23-Aug-2018	97,64	30-Jan-2019	77,47	-20,66%			-20,8%	109		
RESULTS		Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
		8,1%		18,37%		-0,2%		11,85%		127,5	63,2	6,3%	13,6%
ABBVIE INC (ABBV): MA-200 MA-100													
IN	ABBV	200 100	17-oct-15	56,53	17-nov-15	60,01	6,16%		5,16%	11,9%	21		
OUT	ABBV	200 100	17-nov-15	60,01	25-jun-16	59,86	-0,25%			-7,4%	152		
IN	ABBV	200 100	25-jun-16	59,86	24-jul-18	89,4	49,35%	6,33	58,92%	44,7%	522		
OUT	ABBV	200 100	24-jul-18	89,4	30-Jan-2019	77,47	-13,34%			-12,2%	131		
RESULTS		Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
		28,3%		23,19%		-9,8%		3,39%		271,5	141,5	10,4%	32,0%

Table Appendix 7: AbbVie Inc

7.1.8. Kraft Heinz Company

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
KRAFT HEINZ COMPANY (KHC): MA-100 MA-50 MA-20												
OUT	KHC	100 50 20	26-feb-16	74,96	31-mar-16	78,9	5,26%			3,6%	23	
IN	KHC	100 50 20	3-feb-16	75,97	17-nov-16	82,4	8,46%	1,75	9,77%	8,3%	201	
OUT	KHC	100 50 20	17-nov-16	82,4	30-Dec-2016	87,93	6,71%			7,6%	29	
IN	KHC	100 50 20	30-Dec-2016	87,93	23-may-17	91,18	3,70%	1,2	4,06%	-3,9%	98	
OUT	KHC	100 50 20	23-may-17	91,18	17-jul-18	62,64	-31,30%			-32,9%	289	
IN	KHC	100 50 20	17-jul-18	62,64	26-sept-18	55,66	-11,14%	0,625		-12,7%	50	
OUT	KHC	100 50 20	26-sept-18	55,66	30-Jan-2019	46,88	-15,77%			-15,9%	86	
RESULTS		Profitability in market	Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
		-2,8%	10,55%		-9,4%		18,73%		116,3	106,8	-	6,9%
KRAFT HEINZ COMPANY (KHC): MA-200 MA-100 MA-50												
IN	KHC	200 100 50	6-may-16	82,97	01-Aug-2017	87,46	5,41%	0,575	5,10%	1,1%	311	
OUT	KHC	200 100 50	01-Aug-2017	87,46	30-Jan-2019	46,88	-46,40%			-45,8%	377	
RESULTS		Profitability in market	Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
		1,1%	0,00%		-45,8%		0,00%		311,0	377,0	0,4%	5,1%

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KRAFT HEINZ COMPANY (KHC): MA-144 MA-89 MA- 55												
OUT	KHC	144 89 55	9-feb-16	71,22	15-mar-16	77,57	8,92%			6,5%	24	
IN	KHC	144 89 55	15-mar-16	77,57	7-jul-17	82,82	6,77%	3,55	10,34%	4,3%	331	
OUT	KHC	144 89 55	7-jul-17	82,82	30-Jan-2019	46,88	-43,40%			-44,8%	394	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	4,3%		0,00%		-19,2%		36,27%		331,0	209,0	1,3%	10,3%
KRAFT HEINZ COMPANY (KHC): MA-100 MA-50												
IN	KHC	100 50	21-Apr-2016	77,92	16-nov-16	81,14	4,13%	1,175	4,64%	7,4%	146	
OUT	KHC	100 50	16-nov-16	81,14	30-Dec-2016	87,93	8,37%			8,9%	30	
IN	KHC	100 50	30-Dec-2016	87,93	23-may-17	91,18	3,70%	1,2	4,06%	-3,9%	98	
OUT	KHC	100 50	23-may-17	91,18	17-jul-18	62,64	-31,30%			-32,9%	289	
IN	KHC	100 50	17-jul-18	62,64	26-sept-18	55,66	-11,14%	0,625	-11,15%	-12,7%	50	
OUT	KHC	100 50	26-sept-18	55,66	30-Jan-2019	46,88	-15,77%			-15,9%	86	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	-3,1%		10,08%		-13,3%		21,02%		98,0	135,0	-	-0,8%
KRAFT HEINZ COMPANY (KHC): MA-200 MA-100												
OUT	KHC	200 100	21-Apr-2016	77,92	19-may-16	81,98	5,21%			4,4%	20	
IN	KHC	200 100	4-may-16	78,68	01-Aug-2017	87,46	11,16%	2,975	13,94%	7,1%	313	
OUT	KHC	200 100	01-Aug-2017	87,46	30-Jan-2019	46,88	-46,40%			-45,8%	377	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	7,1%		0,00%		-20,7%		35,50%		313,0	198,5	2,3%	13,9%

Table Appendix 8: Kraft Heinz Company

7.1.9. United Health Group

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
UNITED HEALTH GROUP (UNH): MA-100 MA-50 MA-20												
IN	UNH	100 50 20	18-jun-15	119,74	30-sept-15	114,22	-4,61%	0,5	-5,19%	-7,5%	72	
OUT	UNH	100 50 20	30-sept-15	114,22	18-Dec-2015	119,22	4,38%			8,3%	56	
IN	UNH	100 50 20	18-Dec-2015	119,22	5-feb-16	114,2	-4,21%		-4,21%	-9,2%	32	
OUT	UNH	100 50 20	5-feb-16	114,2	29-mar-16	128,92	12,89%			13,3%	35	
IN	UNH	100 50 20	29-mar-16	128,92	13-oct-16	135,1	4,79%	1,25	5,76%	5,6%	139	
OUT	UNH	100 50 20	13-oct-16	135,1	18-nov-16	150,77	11,60%			15,6%	26	
IN	UNH	100 50 20	18-nov-16	150,77	03-Apr-2018	217,2	44,06%	4,25	46,88%	23,3%	342	
OUT	UNH	100 50 20	03-Apr-2018	217,2	19-may-18	244,64	12,63%			15,1%	34	
IN	UNH	100 50 20	19-may-18	244,64	15-Jan-2019	248,06	1,40%	2,7	2,50%	3,2%	164	
OUT	UNH	100 50 20	15-Jan-2019	248,06	30-Jan-2019	267,34	7,77%			7,8%	11	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	3,1%		13,02%		12,0%		3,73%		149,8	32,4	2,1%	9,1%
UNITED HEALTH GROUP (UNH): MA-200 MA-100 MA-50												
OUT	UNH	200 100 50	05-Dec-2015	117,7	07-Apr-2016	128,03	8,78%			4,4%	83	
IN	UNH	200 100 50	07-Apr-2016	128,03	30-Jan-2019	267,34	108,81%	8,7	114,61%	108,6%	709	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	108,6%		0,00%		4,4%		0,00%		709,0	83,0	15,3%	11461,0%

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UNITED HEALTH GROUP (UNH): MA-144 MA-89 MA- 55													
IN	UNH	144 89 55	30-jul-15	121,52	2-oct-15	116,61	-4,04%	0,5	-4,63%	7,6%	45		
OUT	UNH	144 89 55	2-oct-15	116,61	01-Apr-2016	128,9	10,54%			9,0%	124		
IN	UNH	144 89 55	01-Apr-2016	128,9	30-Jan-2019	267,34	107,40%	8,2	112,76%	104,2%	713		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
	55,9%		68,31%		9,0%		0,00%		379,0		124,0	14,7%	54,1%
UNITED HEALTH GROUP (UNH): MA-100 MA-50													
OUT	UNH	100 50	17-oct-15	119,98	18-Dec-2015	119,22	-0,63%			2,1%	43		
IN	UNH	100 50	18-Dec-2015	119,22	3-feb-16	113,88	-4,48%		-5,48%	-5,0%	30		
OUT	UNH	100 50	3-feb-16	113,88	29-mar-16	128,92	13,21%			8,3%	37		
IN	UNH	100 50	29-mar-16	128,92	12-oct-16	134,75	4,52%	1,25	4,49%	7,0%	138		
OUT	UNH	100 50	12-oct-16	134,75	18-nov-16	150,77	11,89%			14,1%	27		
IN	UNH	100 50	18-nov-16	150,77	03-Apr-2018	217,2	44,06%	4,25	45,88%	23,3%	342		
OUT	UNH	100 50	03-Apr-2018	217,2	19-may-18	244,64	12,63%			15,1%	34		
IN	UNH	100 50	19-may-18	244,64	15-Jan-2019	248,06	1,40%	2,7	1,50%	3,2%	164		
OUT	UNH	100 50	15-Jan-2019	248,06	30-Jan-2019	267,34	7,77%			7,8%	11		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
	7,1%		11,89%		9,5%		5,28%		168,5		30,4	4,2%	11,6%
UNITED HEALTH GROUP (UNH): MA-200 MA-100													
IN	UNH	200 100	17-oct-15	119,98	05-Dec-2015	115,85	-3,44%	0,5	-4,03%	-1,4%	34		
OUT	UNH	200 100	05-Dec-2015	115,85	07-Apr-2016	127,33	9,91%			4,4%	83		
IN	UNH	200 100	07-Apr-2016	127,33	30-Jan-2019	267,34	109,96%	8,2	115,40%	108,6%	709		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
	53,6%		77,78%		4,4%		0,00%		371,5		83,0	14,4%	55,7%

Table Appendix 9: United Health Group

7.1.10. Abott

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
ABBOTT LABORATORIES (ABT): MA-100 MA-50 MA-20												
IN	ABT	100 50 20	4-jun-15	48,86	18-sept-15	44,24	-9,46%	0,24	-9,96%	-12,6%	74	
OUT	ABT	100 50 20	18-sept-15	44,24	31-Dec-2015	45,27	2,33%			8,0%	72	
IN	ABT	100 50 20	31-Dec-2015	45,27	10-feb-16	37	-18,27%	0,26	-18,69%	-22,9%	27	
OUT	ABT	100 50 20	10-feb-16	37	05-Aug-2016	44,81	21,11%			22,6%	123	
IN	ABT	100 50 20	05-Aug-2016	44,81	2-nov-16	39,05	-12,85%	0,26	-13,27%	-13,3%	62	
OUT	ABT	100 50 20	2-nov-16	39,05	28-Jan-2017	41	4,99%			7,4%	59	
IN	ABT	100 50 20	28-Jan-2017	41	30-Jan-2019	69,69	69,98%	2,235	74,43%	57,4%	504	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	2,2%		37,13%		12,7%		8,61%		166,8	84,7	1,3%	8,1%
ABBOTT LABORATORIES (ABT): MA-200 MA-100 MA-50												
OUT	ABT	200 100 50	22-oct-15	42,2	8-oct-16	42,97	1,82%			1,9%	243	
IN	ABT	200 100 50	8-oct-16	42,97	30-Jan-2019	69,69	62,18%	2,76	67,61%	56,9%	580	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	56,9%		0,00%		1,9%		0,00%		580,0	243,0	9,8%	67,6%
ABBOTT LABORATORIES (ABT): MA-144 MA-89 MA-55												
IN	ABT	144 89 55	30-jul-15	51,06	29-sept-15	39,06	-23,50%	0,24	-24,03%	-22,8%	42	
OUT	ABT	144 89 55	29-sept-15	39,06	09-Aug-2016	45,02				11,1%	217	
IN	ABT	144 89 55	09-Aug-2016	45,02	24-Dec-2016	38,42	-14,66%	0,26	-15,08%	-10,7%	97	
OUT	ABT	144 89 55	24-Dec-2016	38,42	7-mar-17	45,13				14,8%	47	
IN	ABT	144 89 55	7-mar-17	45,13	30-Jan-2019	69,69	54,42%	2,235	58,37%	42,3%	479	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	2,9%		34,63%		13,0%		2,62%		206,0	132,0	1,4%	6,4%

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ABBOTT LABORATORIES (ABT): MA-100 MA-50												
OUT	ABT	100 50	17-oct-15	42,22	22-Dec-2015	44,04	4,31%			7,7%	45	
IN	ABT	100 50	22-Dec-2015	44,04	10-feb-16	37	-15,99%	0,26	-16,40%	-19,9%	33	
OUT	ABT	100 50	10-feb-16	37	25-may-16	37,97	2,62%			1,8%	73	
IN	ABT	100 50	25-may-16	37,97	23-jun-16	38,74	2,03%		1,03%	-2,1%	20	
OUT	ABT	100 50	23-jun-16	38,74	05-Aug-2016	44,81	15,67%			20,9%	34	
IN	ABT	100 50	05-Aug-2016	44,81	2-nov-16	39,05	-12,85%	0,26	-13,27%	-13,3%	62	
OUT	ABT	100 50	2-nov-16	39,05	25-Jan-2017	40,31	3,23%			4,9%	56	
IN	ABT	100 50	25-Jan-2017	40,31	2-jun-17	46,1	14,36%	0,265	14,02%	7,0%	89	
OUT	ABT	100 50	2-jun-17	46,1	19-jul-17	48,74	5,73%			2,9%	32	
IN	ABT	100 50	19-jul-17	48,74	30-Jan-2019	69,69	42,98%	1,705	45,48%	43,6%	386	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	3,1%		24,90%		7,6%		7,74%		118,0		48,0	
Ratio		Profitability dividends										
2,6%		6,2%										
ABBOTT LABORATORIES (ABT): MA-200 MA-100												
IN	ABT	200 100	17-oct-15	42,22	14-nov-15	43,96	4,12%	0,24	3,69%	7,2%	20	
OUT	ABT	200 100	22-oct-15	42,2	4-oct-16	42,55	0,83%			-0,9%	239	
IN	ABT	200 100	4-oct-16	42,55	30-Jan-2019	69,69	63,78%	2,76	69,27%	61,4%	584	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	34,3%		38,33%		-0,9%		0,00%		302,0		239,0	
Ratio		Profitability dividends										
11,4%		36,5%										

Table Appendix 10: Abbott Laboratories

7.1.11. Merck & Co.

Analysis	Share	Moving average	Buy signal	Buy price	Sell signal	Sell price	Pure profitability %	Dividend	Dividend profitability %	Profits strategy %	Days in market	
MERCK & CO (MRK): MA-100 MA-50 MA-20												
IN	MRK	100 50 20	28-may-15	59,46	28-jul-15	56,99	-4,15%	0,45	-4,40%	-5,5%	42	
OUT	MRK	100 50 20	28-jul-15	56,99	27-Apr-2016	56,04	-1,67%			-4,6%	189	
IN	MRK	100 50 20	27-Apr-2016	56,04	18-may-17	63	12,42%	1,86	14,74%	13,5%	267	
OUT	MRK	100 50 20	18-may-17	63	23-may-18	58,45	-7,22%			-13,8%	255	
IN	MRK	100 50 20	23-may-18	58,45	30-Jan-2019	73,23	25,29%	1,51	26,87%	27,4%	173	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	11,8%		16,52%		-9,2%		6,51%		160,7	222,0	7,3%	12,4%
MERCK & CO (MRK): MA-200 MA-100 MA-50												
OUT	MRK	200 100 50	17-oct-15	51,48	15-jun-16	56,25	9,27%			9,2%	165	
IN	MRK	200 100 50	15-jun-16	56,25	27-jul-17	61,8	9,87%	1,87	12,19%	5,8%	281	
OUT	MRK	200 100 50	27-jul-17	61,8	19-jul-18	62,94	1,84%			0,2%	246	
IN	MRK	200 100 50	19-jul-18	62,94	30-Jan-2019	73,23	16,35%	1,03	16,99%	18,1%	134	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	12,0%		8,70%		4,7%		6,36%		207,5	205,5	5,8%	14,6%
MERCK & CO (MRK): MA-144 MA-89 MA-55												
OUT	MRK	144 89 55	28-Aug-2015	54,95	17-jun-16	55,88	1,69%			2,1%	202	
IN	MRK	144 89 55	17-jun-16	55,88	7-jul-17	63,1	12,92%	1,87	15,27%	9,2%	265	
OUT	MRK	144 89 55	7-jul-17	63,1	23-jun-18	61,47	-2,58%			-6,4%	243	
IN	MRK	144 89 55	23-jun-18	61,47	30-Jan-2019	73,23	19,13%	1,51	20,59%	20,3%	151	
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market	Average days out market	Ratio	Profitability dividends
	14,8%		7,85%		-2,2%		6,01%		208,0	222,5	7,1%	17,9%

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MERCK & CO (MRK): MA-100 MA-50													
OUT	MRK	100 50	17-oct-15	51,48	19-Dec-2015	51,64	0,31%			5,6%	44		
IN	MRK	100 50	19-Dec-2015	51,64	13-feb-16	49,03	-5,05%		-6,05%	-11,0%	37		
OUT	MRK	100 50	13-feb-16	49,03	27-Apr-2016	56,04	14,30%			14,4%	50		
IN	MRK	100 50	27-Apr-2016	56,04	18-may-17	63	12,42%	1,86	14,74%	13,5%	267		
OUT	MRK	100 50	18-may-17	63	23-may-18	58,45	-7,22%			-13,8%	255		
IN	MRK	100 50	23-may-18	58,45	30-Jan-2019	73,23	25,29%	1,51	26,87%	27,4%	173		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
	10,0%		19,44%		2,1%		14,43%		159,0		116,3	6,3%	11,9%
MERCK & CO (MRK): MA-200 MA-100													
OUT	MRK	200 100 50	17-oct-15	51,48	15-jun-16	56,25	9,27%			9,2%	165		
IN	MRK	200 100 50	15-jun-16	56,25	27-jul-17	61,8	9,87%	1,87	12,19%	5,8%	281		
OUT	MRK	200 100 50	27-jul-17	61,8	19-jul-18	62,94	1,84%			0,2%	246		
IN	MRK	200 100 50	19-jul-18	62,94	30-Jan-2019	73,23	16,35%	1,03	16,99%	18,1%	134		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	Ratio	Profitability dividends
	12,0%		8,70%		4,7%		6,36%		207,5		205,5	5,8%	14,6%

Table Appendix 11: Merck & Co

7.2. 40-MA 20-MA 10-MA7.2.1. Zardoya

Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market		
1.- ZARDOYA (ZOT.MC): MA-40 MA-20 MA-10								
IN	ZOT	40 20 10	27-feb-15	20-Apr-2015	-7,6%	34		
IN	ZOT	40 20 10	20-jul-15	25-Aug-2015	-11,6%	26		
IN	ZOT	40 20 10	19-oct-15	07-Dec-2015	-4,9%	35		
IN	ZOT	40 20 10	4-mar-16	14-jun-16	2,1%	70		
IN	ZOT	40 20 10	1-sept-16	22-nov-16	4,2%	58		
IN	ZOT	40 20 10	01-Dec-2016	2-feb-17	1,8%	44		
IN	ZOT	40 20 10	23-feb-17	30-jun-17	13,0%	88		
IN	ZOT	40 20 10	19-oct-17	14-Dec-2017	-3,4%	40		
IN	ZOT	40 20 10	08-Jan-2018	5-feb-18	-8,4%	20		
IN	ZOT	40 20 10	10-Apr-2018	27-jun-18	4,2%	55		
IN	ZOT	40 20 10	23-jul-18	20-Aug-2018	-6,3%	20		
IN	ZOT	40 20 10	31-Aug-2018	9-oct-18	-2,9%	27		
IN	ZOT	40 20 10	20-Dec-2018	31-Jan-2019	8,3%	28		
OUT	ZOT	40 20 10	20-Apr-2015	20-jul-15	-4,6%	64		
OUT	ZOT	40 20 10	25-Aug-2015	19-oct-15	6,1%	39		
OUT	ZOT	40 20 10	07-Dec-2015	4-mar-16	-10,2%	62		
OUT	ZOT	40 20 10	14-jun-16	1-sept-16	-5,0%	57		
OUT	ZOT	40 20 10	14-sept-16	24-oct-16	5,7%	28		
OUT	ZOT	40 20 10	22-nov-16	20-Dec-2016	12,0%	20		
OUT	ZOT	40 20 10	2-feb-17	6-mar-17	6,0%	22		
OUT	ZOT	40 20 10	15-mar-17	12-Apr-2017	10,8%	20		
OUT	ZOT	40 20 10	30-jun-17	19-oct-17	-3,3%	79		
OUT	ZOT	40 20 10	14-Dec-2017	16-Jan-2018	3,2%	20		
OUT	ZOT	40 20 10	30-Jan-2018	10-Apr-2018	0,5%	48		
OUT	ZOT	40 20 10	27-jun-18	25-jul-18	7,0%	20		
OUT	ZOT	40 20 10	16-Aug-2018	17-sept-18	3,0%	22		
OUT	ZOT	40 20 10	9-oct-18	20-Dec-2018	-8,7%	52		
OUT	ZOT	40 20 10	28-Dec-2018	28-Jan-2019	11,6%	20		
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market	
	-0,9%		7,2%		2,3%		7,21%	
							Average days in market	Average days out market
							41,9	38,2

Table Appendix 12: Zardoya 40-MA 20-MA 10-MA

7.2.2. Visa: 40-MA 20-MA 10-MA

VISA: MA-40 MA-20 MA-10							
IN	ZOT	40 20 10	3-mar-15	30-Apr-2015	-3,8%	41	
IN	ZOT	40 20 10	21-may-15	19-jun-15	-5,3%	20	
IN	ZOT	40 20 10	3-jul-15	26-Aug-2015	0,0%	37	
IN	ZOT	40 20 10	17-oct-15	24-Dec-2015	7,0%	47	
IN	ZOT	40 20 10	25-mar-16	21-jun-16	3,9%	60	
IN	ZOT	40 20 10	14-jul-16	4-nov-16	2,9%	80	
IN	ZOT	40 20 10	10-nov-16	09-Dec-2016	-0,9%	20	
IN	ZOT	40 20 10	16-Dec-2016	14-jun-17	9,1%	122	
IN	ZOT	40 20 10	15-jun-17	06-Dec-2017	7,3%	121	
IN	ZOT	40 20 10	14-Dec-2017	10-feb-18	-3,8%	39	
IN	ZOT	40 20 10	1-mar-18	29-mar-18	-7,3%	20	
IN	ZOT	40 20 10	21-Apr-2018	12-oct-18	14,1%	121	
IN	ZOT	40 20 10	9-nov-18	15-Dec-2018	-7,1%	24	
IN	ZOT	40 20 10	23-Jan-2019	30-Jan-2019	-3,7%	6	
OUT	ZOT	40 20 10	30-Apr-2015	29-may-15	4,4%	20	
OUT	ZOT	40 20 10	10-jun-15	14-jul-15	3,9%	23	
OUT	ZOT	40 20 10	26-Aug-2015	17-oct-15	5,8%	37	
OUT	ZOT	40 20 10	24-Dec-2015	25-mar-16	-8,9%	62	
OUT	ZOT	40 20 10	21-jun-16	20-jul-16	1,1%	20	
OUT	ZOT	40 20 10	4-nov-16	16-Dec-2016	3,7%	29	
OUT	ZOT	40 20 10	14-jun-17	18-jul-17	-0,1%	23	
OUT	ZOT	40 20 10	06-Dec-2017	05-Jan-2018	3,7%	20	
OUT	ZOT	40 20 10	10-feb-18	13-mar-18	7,2%	20	
OUT	ZOT	40 20 10	24-mar-18	24-Apr-2018	3,7%	20	
OUT	ZOT	40 20 10	12-oct-18	9-nov-18	8,9%	20	
OUT	ZOT	40 20 10	21-nov-18	23-Jan-2019	4,9%	40	
RESULTS	Profitability in market	Volatility in market	Profitability out of market		Volatility out of market	Average days in market	Average days out market
	0,9%	6,6%	3,2%		4,50%	54,1	27,8

Table Appendix 13: Visa 40-MA 20-MA 10-MA

7.2.3. AbbVie: 40-MA 20-MA 10-MA

ABBVIE INC (ABBV): MA-40 MA-20 MA-10								
IN	ZOT	40 20 10	14-mar-15	20-Aug-2015	12,1%	110		
IN	ZOT	40 20 10	4-nov-15	15-Dec-2015	-16,1%	28		
IN	ZOT	40 20 10	11-mar-16	22-jun-16	4,8%	71		
IN	ZOT	40 20 10	6-jul-16	2-sept-16	0,3%	42		
IN	ZOT	40 20 10	11-nov-16	13-Jan-2017	-2,2%	42		
IN	ZOT	40 20 10	4-mar-17	13-may-17	-1,0%	49		
IN	ZOT	40 20 10	9-jun-17	02-Aug-2017	-4,5%	37		
IN	ZOT	40 20 10	2-sept-17	24-mar-18	25,6%	139		
IN	ZOT	40 20 10	19-may-18	27-jun-18	-11,2%	26		
IN	ZOT	40 20 10	16-Aug-2018	14-sept-18	-6,5%	20		
IN	ZOT	40 20 10	5-oct-18	2-nov-18	-19,1%	20		
IN	ZOT	40 20 10	17-nov-18	19-Dec-2018	-6,2%	20		
IN	ZOT	40 20 10	29-Dec-2018	30-Jan-2019	-15,5%	20		
OUT	ZOT	40 20 10	27-mar-15	25-Apr-2015	10,6%	20		
OUT	ZOT	40 20 10	20-Aug-2015	4-nov-15	-7,9%	53		
OUT	ZOT	40 20 10	15-Dec-2015	11-mar-16	2,6%	59		
OUT	ZOT	40 20 10	19-mar-16	19-Apr-2016	6,1%	20		
OUT	ZOT	40 20 10	22-jun-16	21-jul-16	6,8%	20		
OUT	ZOT	40 20 10	2-sept-16	11-nov-16	0,2%	49		
OUT	ZOT	40 20 10	24-nov-16	23-Dec-2016	4,8%	20		
OUT	ZOT	40 20 10	13-Jan-2017	4-mar-17	3,9%	34		
OUT	ZOT	40 20 10	13-may-17	13-jun-17	2,8%	20		
OUT	ZOT	40 20 10	02-Aug-2017	2-sept-17	6,0%	23		
OUT	ZOT	40 20 10	24-mar-18	19-may-18	10,1%	39		
OUT	ZOT	40 20 10	27-jun-18	16-Aug-2018	4,5%	35		
OUT	ZOT	40 20 10	5-sept-18	5-oct-18	-0,6%	22		
OUT	ZOT	40 20 10	13-oct-18	17-nov-18	0,2%	25		
OUT	ZOT	40 20 10	15-Dec-2018	23-Jan-2019	1,4%	24		
OUT	ZOT	40 20 10	29-Jan-2019	30-Jan-2019	-4,2%	2		
RESULTS	Profitability in market	Volatility in market	Profitability out of market		Volatility out of market		Average days in market	Average days out market
	-3,0%	12,3%	3,0%		4,83%		48,0	29,06

Table Appendix 14: AbbVie Inc 40-MA 20-MA 10-MA

7.2.4. Abbott Laboratories: 40-MA 20-MA 10-MA

ABBOTT LABORATORIES (ABT): MA-40 MA-20 MA-10							
IN	ZOT	40 20 10	3-mar-15	2-may-15	-2,6%	43	
IN	ZOT	40 20 10	28-may-15	22-Aug-2015	-5,7%	61	
IN	ZOT	40 20 10	29-oct-15	05-Jan-2016	-0,1%	45	
IN	ZOT	40 20 10	29-mar-16	3-may-16	-8,4%	25	
IN	ZOT	40 20 10	6-jul-16	7-sept-16	4,3%	44	
IN	ZOT	40 20 10	12-nov-16	13-Dec-2016	-1,7%	20	
IN	ZOT	40 20 10	15-Dec-2016	14-Apr-2017	5,5%	82	
IN	ZOT	40 20 10	6-jun-17	05-Aug-2017	-0,9%	43	
IN	ZOT	40 20 10	2-sept-17	06-Dec-2017	6,8%	65	
IN	ZOT	40 20 10	14-Dec-2017	10-feb-18	-2,8%	39	
IN	ZOT	40 20 10	10-mar-18	10-Apr-2018	-7,9%	20	
IN	ZOT	40 20 10	28-Apr-2018	22-Dec-2018	19,9%	165	
IN	ZOT	40 20 10	23-Jan-2019	30-Jan-2019	-3,4%	6	
OUT	ZOT	40 20 10	2-may-15	2-jun-15	6,2%	20	
OUT	ZOT	40 20 10	17-jun-15	16-jul-15	5,5%	20	
OUT	ZOT	40 20 10	22-Aug-2015	29-oct-15	-6,9%	47	
OUT	ZOT	40 20 10	05-Jan-2016	29-mar-16	-11,3%	57	
OUT	ZOT	40 20 10	3-may-16	6-jul-16	4,4%	44	
OUT	ZOT	40 20 10	7-sept-16	12-nov-16	-1,9%	48	
OUT	ZOT	40 20 10	24-nov-16	23-Dec-2016	0,3%	20	
OUT	ZOT	40 20 10	28-Dec-2016	1-feb-17	1,5%	23	
OUT	ZOT	40 20 10	14-Apr-2017	6-jun-17	2,6%	35	
OUT	ZOT	40 20 10	05-Aug-2017	2-sept-17	2,4%	20	
OUT	ZOT	40 20 10	06-Dec-2017	05-Jan-2018	5,8%	20	
OUT	ZOT	40 20 10	10-feb-18	13-mar-18	10,6%	20	
OUT	ZOT	40 20 10	27-mar-18	28-Apr-2018	0,5%	23	
OUT	ZOT	40 20 10	5-may-18	5-jun-18	9,8%	20	
OUT	ZOT	40 20 10	22-Dec-2018	24-Jan-2019	3,2%	20	
RESULTS	Profitability in market	Volatility in market	Profitability out of market		Volatility out of market	Average days in market	Average days out market
	0,2%	7,6%	2,2%		5,75%	50,6	29,13

Table Appendix 15: Abbott Laboratories 40-MA 20-MA 10-MA

7.3. 100-MA 60-MA 40-MA7.3.1. Zardoya

Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market			
ZARDOYA (ZOT.MC): MA-100 MA-60 MA-40									
IN	ZOT	100 60 40	28-oct-15	21-Jan-2016	59	-20,7%			
IN	ZOT	100 60 40	23-mar-17	24-Aug-2017	107	4,8%			
IN	ZOT	100 60 40	5-sept-17	2-feb-18	105	4,1%			
OUT	ZOT	100 60 40	29-jun-15	28-oct-15	87	12,7%			
OUT	ZOT	100 60 40	21-Jan-2016	23-mar-17	302	-7,6%			
OUT	ZOT	100 60 40	24-Aug-2017	21-sept-17	20	6,6%			
OUT	ZOT	100 60 40	2-feb-18	31-Jan-2019	254	-25,1%			
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market	Average days in market	Average days out market
	-3,9%		14,5%		-3,4%		16,81%	90,3	165,75

Table Appendix 16: Zardoya 100-MA 60-MA 40-MA

7.3.2. Visa

VISA: MA-100 MA-60 MA-40												
IN	V	100 60 40	28-may-15	26-Aug-2015	63	-2,7%						
IN	V	100 60 40	28-Aug-2015	10-feb-16	113	-9,1%						
IN	V	100 60 40	27-may-16	28-jun-16	21	-6,1%						
IN	V	100 60 40	30-jun-16	29-mar-18	439	38,1%						
IN	V	100 60 40	05-Apr-2018	18-Dec-2018	178	23,3%						
OUT	V	100 60 40	26-Aug-2015	17-oct-15	37	5,8%						
OUT	V	100 60 40	10-feb-16	27-may-16	75	19,6%						
OUT	V	100 60 40	28-jun-16	27-jul-16	20	5,7%						
OUT	V	100 60 40	29-mar-18	28-Apr-2018	21	8,9%						
OUT	V	100 60 40	18-Dec-2018	30-Jan-2019	29	-1,2%						
RESULTS	Profitability in market		Volatility in market		Profitability out of market		Volatility out of market		Average days in market		Average days out market	
	8,7%		20,9%		7,8%		7,58%		162,8		36,40	

Table Appendix 17: Visa 100-MA 60-MA 40-MA

7.3.3. AbbVie

ABBVIE INC (ABBV): MA-100 MA-60 MA-40							
IN	ABBV	100 60 40	28-may-15	2-sept-15	68	-12,8%	
IN	ABBV	100 60 40	11-mar-16	18-oct-16	153	6,8%	
IN	ABBV	100 60 40	12-nov-16	14-feb-17	62	-3,0%	
IN	ABBV	100 60 40	4-mar-17	24-may-17	56	-3,5%	
IN	ABBV	100 60 40	10-jun-17	02-Aug-2017	36	-4,6%	
IN	ABBV	100 60 40	2-sept-17	24-mar-18	139	25,6%	
IN	ABBV	100 60 40	19-jun-18	24-jul-18	24	-11,6%	
IN	ABBV	100 60 40	28-Aug-2018	2-oct-18	24	-3,6%	
IN	ABBV	100 60 40	04-Dec-2018	11-Jan-2019	25	-9,1%	
OUT	ABBV	100 60 40	2-sept-15	11-mar-16	131	-7,3%	
OUT	ABBV	100 60 40	29-mar-16	29-Apr-2016	23	1,5%	
OUT	ABBV	100 60 40	18-oct-16	19-nov-16	24	5,4%	
OUT	ABBV	100 60 40	24-nov-16	29-Dec-2016	23	6,6%	
OUT	ABBV	100 60 40	14-feb-17	15-mar-17	20	7,6%	
OUT	ABBV	100 60 40	24-may-17	22-jun-17	20	7,8%	
OUT	ABBV	100 60 40	02-Aug-2017	2-sept-17	23	6,0%	
OUT	ABBV	100 60 40	24-mar-18	19-jun-18	59	5,1%	
OUT	ABBV	100 60 40	24-jul-18	28-Aug-2018	25	9,1%	
OUT	ABBV	100 60 40	22-sept-18	04-Dec-2018	50	4,4%	
OUT	ABBV	100 60 40	07-Dec-2018	30-Jan-2019	36	-15,1%	
RESULTS	Profitability in market	Volatility in market	Profitability out of market		Volatility out of market	Average days in market	Average days out market
	-1,8%	11,8%	2,8%		7,42%	65,2	39,45

Table Appendix 18: AbbVie 100-MA 60-MA 40-MA

7.3.4. Abbott Laboratories

ABBOTT LABORATORIES (ABT): MA-100 MA-60 MA-40							
IN	ABT	100 60 40	28-may-15	22-Aug-2015	61	-5,7%	
IN	ABT	100 60 40	14-jul-16	30-nov-16	97	-5,1%	
IN	ABT	100 60 40	20-Jan-2017	04-Apr-2018	302	23,8%	
IN	ABT	100 60 40	15-may-18	30-Jan-2019	179	17,2%	
OUT	ABT	100 60 40	22-Aug-2015	14-jul-16	224	-11,9%	
OUT	ABT	100 60 40	30-nov-16	20-Jan-2017	34	3,5%	
OUT	ABT	100 60 40	04-Apr-2018	15-may-18	29	7,4%	
RESULTS	Profitability in market	Volatility in market	Profitability out of market		Volatility out of market	Average days in market	Average days out market
	7,6%	15,2%	-0,3%		10,21%	159,8	95,67

Table Appendix 19: Abbott Laboratories 100-MA 60-MA 40-MA

7.4. Dividends

ACCION	Fecha exdividendo	Dividendo	Fecha de pago	Rendimiento
ZOT.MC	13.10.2015	0,2435	13.10.2015	2,22%
ZOT.MC	11.01.2016	0,2417	11.01.2016	2,45%
ZOT.MC	11.04.2016	0,2308	11.04.2016	2,73%
ZOT.MC	06.10.2016	0,2338	10.10.2016	3,01%
ZOT.MC	06.01.2017	0,2369	10.01.2017	2,96%
ZOT.MC	06.04.2017	0,24	10.04.2017	2,65%
ZOT.MC	06.10.2017	0,24	10.10.2017	2,56%
ZOT.MC	08.01.2018	0,24	10.01.2018	2,93%
ZOT.MC	06.04.2018	0,24	10.04.2018	2,87%
ZOT.MC	06.07.2018	0,24	10.07.2018	3,06%
ZOT.MC	08.01.2019	0,32	10.01.2019	4,39%
ZOT.MC	08.04.2019	0,32	10.04.2019	4,65%
GE	19.02.2015	0,23	27.04.2015	-
GE	18.06.2015	0,23	27.07.2015	-
GE	17.09.2015	0,23	26.10.2015	3,02%
GE	17.12.2015	0,23	25.01.2016	3,25%
GE	25.02.2016	0,23	25.04.2016	3,04%
GE	16.06.2016	0,23	25.07.2016	2,96%
GE	15.09.2016	0,23	25.10.2016	2,91%
GE	22.12.2016	0,24	25.01.2017	3,26%
GE	23.02.2017	0,24	25.04.2017	3,47%
GE	15.06.2017	0,24	25.07.2017	3,88%
GE	15.09.2017	0,12	25.10.2017	2,71%
GE	26.12.2017	0,12	25.01.2018	3,15%
GE	23.02.2018	0,12	25.04.2018	3,52%
GE	15.06.2018	0,12	25.07.2018	3,82%
GE	14.09.2018	0,01	25.10.2018	0,55%
GE	19.12.2018	0,01	25.01.2019	0,39%
GE	26.02.2019	0,01	25.02.2019	0,38%
GE	08.03.2019	0,01	25.04.2019	0,39%

MA	07.01.2015	0,16	09.02.2015	-
MA	07.04.2015	0,16	08.05.2015	-
MA	07.07.2015	0,16	10.08.2015	-
MA	07.10.2015	0,16	09.11.2015	0,65%
MA	06.01.2016	0,19	09.02.2016	0,86%
MA	06.04.2016	0,19	09.05.2016	0,83%
MA	06.07.2016	0,19	09.08.2016	0,75%
MA	05.10.2016	0,19	09.11.2016	0,73%
MA	05.01.2017	0,22	09.02.2017	0,83%
MA	05.04.2017	0,22	09.05.2017	0,71%
MA	05.07.2017	0,22	09.08.2017	0,62%
MA	05.10.2017	0,22	09.11.2017	0,59%
MA	08.01.2018	0,25	09.02.2018	0,59%
MA	06.04.2018	0,25	09.05.2018	0,50%
MA	06.07.2018	0,25	09.08.2018	0,46%
MA	05.10.2018	0,25	09.11.2018	0,50%
MA	08.01.2019	0,33	08.02.2019	0,62%
MA	08.04.2019	0,33	09.05.2019	0,54%
ABBV	13.01.2015	0,49	13.02.2015	-
ABBV	13.04.2015	0,51	15.05.2015	-
ABBV	13.07.2015	0,51	14.08.2015	-
ABBV	13.10.2015	0,51	16.11.2015	-
ABBV	13.01.2016	0,57	16.02.2016	4,26%
ABBV	13.04.2016	0,57	16.05.2016	3,81%
ABBV	13.07.2016	0,57	15.08.2016	3,51%
ABBV	12.10.2016	0,57	15.11.2016	3,74%
ABBV	11.01.2017	0,64	15.02.2017	4,15%
ABBV	11.04.2017	0,64	15.05.2017	3,59%
ABBV	12.07.2017	0,64	15.08.2017	3,32%
ABBV	12.10.2017	0,64	15.11.2017	2,86%
ABBV	11.01.2018	0,71	15.02.2018	2,54%
ABBV	12.04.2018	0,96	15.05.2018	3,94%
ABBV	12.07.2018	0,96	15.08.2018	4,03%
ABBV	12.10.2018	0,96	15.11.2018	4,63%
ABBV	14.01.2019	1,07	15.02.2019	5,32%
ABBV	12.04.2019	1,07	15.05.2019	5,49%
V	11.02.2015	0,48	03.03.2015	-
V	13.05.2015	0,12	02.06.2015	-
V	12.08.2015	0,12	01.09.2015	-
V	10.11.2015	0,14	01.12.2015	0,75%
V	17.02.2016	0,14	01.03.2016	0,69%
V	11.05.2016	0,14	07.06.2016	0,72%
V	17.08.2016	0,14	06.09.2016	0,68%
V	16.11.2016	0,165	06.12.2016	0,80%
V	15.02.2017	0,165	07.03.2017	0,74%
V	17.05.2017	0,165	06.06.2017	0,68%
V	16.08.2017	0,165	05.09.2017	0,61%
V	16.11.2017	0,195	05.12.2017	0,63%
V	15.02.2018	0,21	06.03.2018	0,68%
V	17.05.2018	0,21	05.06.2018	0,60%
V	16.08.2018	0,21	04.09.2018	0,61%
V	15.11.2018	0,25	04.12.2018	0,74%
V	14.02.2019	0,25	05.03.2019	0,62%
V	16.05.2019	0,25	04.06.2019	0,62%
V	07.06.2019	0,82	28.06.2019	2,05%
KHC	23.07.2015	0,55	31.07.2015	-
KHC	12.11.2015	0,575	20.11.2015	3,22%
KHC	21.12.2015	0,575	15.01.2016	3,15%
KHC	16.03.2016	0,575	08.04.2016	2,89%
KHC	25.05.2016	0,575	08.07.2016	2,70%
KHC	24.08.2016	0,6	07.10.2016	2,72%
KHC	30.11.2016	0,6	16.12.2016	2,65%
KHC	01.03.2017	0,6	17.03.2017	2,68%
KHC	17.05.2017	0,6	16.06.2017	2,77%
KHC	16.08.2017	0,625	15.09.2017	3,32%
KHC	16.11.2017	0,625	15.12.2017	3,48%
KHC	08.03.2018	0,625	23.03.2018	4,43%
KHC	17.05.2018	0,625	15.06.2018	4,22%
KHC	16.08.2018	0,625	14.09.2018	4,42%
KHC	15.11.2018	0,625	14.12.2018	5,18%
KHC	07.03.2019	0,4	22.03.2019	4,93%

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UNH	11.03.2015	0,375	24.03.2015	-
UNH	11.06.2015	0,5	24.06.2015	-
UNH	09.09.2015	0,5	22.09.2015	-
UNH	02.12.2015	0,5	15.12.2015	1,82%
UNH	09.03.2016	0,5	22.03.2016	1,45%
UNH	15.06.2016	0,625	28.06.2016	1,74%
UNH	07.09.2016	0,625	20.09.2016	1,80%
UNH	30.11.2016	0,625	13.12.2016	1,56%
UNH	08.03.2017	0,625	21.03.2017	1,39%
UNH	15.06.2017	0,75	27.06.2017	1,55%
UNH	07.09.2017	0,75	19.09.2017	1,41%
UNH	30.11.2017	0,75	12.12.2017	1,33%
UNH	08.03.2018	0,75	20.03.2018	1,23%
UNH	15.06.2018	0,9	26.06.2018	1,40%
UNH	06.09.2018	0,9	18.09.2018	1,31%
UNH	30.11.2018	0,9	13.12.2018	1,36%
UNH	08.03.2019	0,9	19.03.2019	1,51%
ABT	13.01.2015	0,24	13.02.2015	-
ABT	13.04.2015	0,24	15.05.2015	-
ABT	13.07.2015	0,24	15.08.2015	-
ABT	13.10.2015	0,24	15.11.2015	2,14%
ABT	13.01.2016	0,26	16.02.2016	2,70%
ABT	13.04.2016	0,26	16.05.2016	2,67%
ABT	13.07.2016	0,26	15.08.2016	2,56%
ABT	12.10.2016	0,26	15.11.2016	2,70%
ABT	11.01.2017	0,265	15.02.2017	2,40%
ABT	11.04.2017	0,265	15.05.2017	2,28%
ABT	12.07.2017	0,265	15.08.2017	2,03%
ABT	12.10.2017	0,265	15.11.2017	1,93%
ABT	11.01.2018	0,28	15.02.2018	1,92%
ABT	12.04.2018	0,28	15.05.2018	1,76%
ABT	12.07.2018	0,28	15.08.2018	1,68%
ABT	12.10.2018	0,28	15.11.2018	1,54%
ABT	14.01.2019	0,32	15.02.2019	1,69%
ABT	12.04.2019	0,32	15.05.2019	1,68%

MRK	12.03.2015	0,45	08.04.2015	-
MRK	11.06.2015	0,45	08.07.2015	-
MRK	11.09.2015	0,45	07.10.2015	-
MRK	11.12.2015	0,46	08.01.2016	3,67%
MRK	11.03.2016	0,46	07.04.2016	3,34%
MRK	13.06.2016	0,46	08.07.2016	3,13%
MRK	13.09.2016	0,46	07.10.2016	2,97%
MRK	13.12.2016	0,47	09.01.2017	2,84%
MRK	13.03.2017	0,47	07.04.2017	2,95%
MRK	13.06.2017	0,47	10.07.2017	3,00%
MRK	14.09.2017	0,47	06.10.2017	3,45%
MRK	14.12.2017	0,48	08.01.2018	3,13%
MRK	14.03.2018	0,48	06.04.2018	3,25%
MRK	14.06.2018	0,48	09.07.2018	3,07%
MRK	14.09.2018	0,48	05.10.2018	2,66%
MRK	14.12.2018	0,55	08.01.2019	3,02%
MRK	14.03.2019	0,55	05.04.2019	2,81%
ENG.MC	2-jul-15	0,78	-	-
ENG.MC	17-dic-15	0,528	-	-
ENG.MC	30-jun-16	0,792	-	-
ENG.MC	1-jul-16	0,792	-	-
ENG.MC	5-jul-16	0,792	-	-
ENG.MC	20-dic-16	0,556	-	-
ENG.MC	3-jul-17	0,834	-	-
ENG.MC	19-dic-17	0,584	-	-
ENG.MC	3-jul-18	0,876	-	-
ENG.MC	17-dic-18	0,612	-	-
FB	-	-	-	-

Table Appendix 20: Dividends

7.5. Optimization

7.5.1. Temporary validation

ENAGAS: MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	ENG	9-MA 7-MA 5-MA	9-feb-17	15-mar-17	-0,9%	24
TEST IN	ENG	9-MA 7-MA 5-MA	23-mar-17	27-Apr-2017	0,2%	23
TEST IN	ENG	9-MA 7-MA 5-MA	4-may-17	13-jun-17	5,4%	28
TEST IN	ENG	9-MA 7-MA 5-MA	27-jun-17	29-Aug-2017	-8,7%	45
TEST IN	ENG	9-MA 7-MA 5-MA	4-sept-17	4-oct-17	-5,8%	22
TEST IN	ENG	9-MA 7-MA 5-MA	13-oct-17	16-nov-17	-2,3%	24
TEST IN	ENG	9-MA 7-MA 5-MA	29-nov-17	03-Jan-2018	-3,1%	22
TEST IN	ENG	9-MA 7-MA 5-MA	22-feb-18	27-mar-18	3,2%	23
TEST IN	ENG	9-MA 7-MA 5-MA	29-mar-18	22-may-18	7,3%	35
TEST IN	ENG	9-MA 7-MA 5-MA	7-jun-18	18-jul-18	0,6%	29
TEST IN	ENG	9-MA 7-MA 5-MA	01-Aug-2018	31-Aug-2018	-0,5%	22
TEST IN	ENG	9-MA 7-MA 5-MA	5-sept-18	5-oct-18	-4,1%	22
TEST IN	ENG	9-MA 7-MA 5-MA	8-oct-18	23-nov-18	1,9%	34
TEST IN	ENG	9-MA 7-MA 5-MA	28-nov-18	02-Jan-2019	-4,1%	22
TEST IN	ENG	9-MA 7-MA 5-MA	08-Jan-2019	29-Jan-2019	2,7%	16
RESULTS	Profitability in market		Volatility in market		Average days in market	
	-0,5%		4,3%		26,07	
TEST OUT	ENG	9-MA 7-MA 5-MA	23-Jan-2017	3-mar-17	-0,4%	29
TEST OUT	ENG	9-MA 7-MA 5-MA	15-mar-17	18-Apr-2017	6,3%	22
TEST OUT	ENG	9-MA 7-MA 5-MA	24-Apr-2017	25-may-17	5,6%	22
TEST OUT	ENG	9-MA 7-MA 5-MA	13-jun-17	18-jul-17	-10,2%	25
TEST OUT	ENG	9-MA 7-MA 5-MA	25-jul-17	4-sept-17	3,3%	29
TEST OUT	ENG	9-MA 7-MA 5-MA	11-sept-17	13-oct-17	-0,5%	24
TEST OUT	ENG	9-MA 7-MA 5-MA	24-oct-17	29-nov-17	0,7%	26
TEST OUT	ENG	9-MA 7-MA 5-MA	20-Dec-2017	22-feb-18	-16,4%	43
TEST OUT	ENG	9-MA 7-MA 5-MA	21-mar-18	24-Apr-2018	8,9%	22
TEST OUT	ENG	9-MA 7-MA 5-MA	22-may-18	21-jun-18	1,5%	22
TEST OUT	ENG	9-MA 7-MA 5-MA	5-jul-18	06-Aug-2018	-1,4%	22
TEST OUT	ENG	9-MA 7-MA 5-MA	16-Aug-2018	8-oct-18	-1,3%	37
TEST OUT	ENG	9-MA 7-MA 5-MA	15-oct-18	14-nov-18	9,5%	22
TEST OUT	ENG	9-MA 7-MA 5-MA	23-nov-18	08-Jan-2019	-0,8%	29
TEST OUT	ENG	9-MA 7-MA 5-MA	23-Jan-2019	29-Jan-2019	1,1%	5
RESULTS	Profitability out market		Volatility out market		Average days out market	

Table Appendix 21: Enagas 9-MA 7-MA 5-MA

MASTERCARD INCORPORATED (MA): MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	MA	9-MA 7-MA 5-MA	24-Jan-2017	15-mar-17	1,9%	35
TEST IN	MA	9-MA 7-MA 5-MA	04-Apr-2017	11-may-17	0,1%	26
TEST IN	MA	9-MA 7-MA 5-MA	31-may-17	1-jul-17	-3,0%	23
TEST IN	MA	9-MA 7-MA 5-MA	14-jul-17	2-sept-17	1,0%	36
TEST IN	MA	9-MA 7-MA 5-MA	12-sept-17	17-nov-17	7,4%	48
TEST IN	MA	9-MA 7-MA 5-MA	28-nov-17	29-Dec-2017	-2,1%	22
TEST IN	MA	9-MA 7-MA 5-MA	06-Jan-2018	10-feb-18	0,9%	24
TEST IN	MA	9-MA 7-MA 5-MA	16-feb-18	24-mar-18	1,7%	25
TEST IN	MA	9-MA 7-MA 5-MA	07-Apr-2018	28-jun-18	19,7%	57
TEST IN	MA	9-MA 7-MA 5-MA	10-jul-18	10-oct-18	4,9%	65
TEST IN	MA	9-MA 7-MA 5-MA	24-oct-18	24-nov-18	-7,8%	22
TEST IN	MA	9-MA 7-MA 5-MA	04-Dec-2018	26-Jan-2019	-2,1%	36
RESULTS	Profitability in market		Volatility in market		Average days in market	
	1,9%		6,8%		34,92	
TEST OUT	MA	9-MA 7-MA 5-MA	2-feb-17	7-mar-17	5,1%	22
TEST OUT	MA	9-MA 7-MA 5-MA	15-mar-17	26-Apr-2017	0,5%	29
TEST OUT	MA	9-MA 7-MA 5-MA	11-may-17	23-jun-17	2,2%	30
TEST OUT	MA	9-MA 7-MA 5-MA	4291700,0%	11-Aug-2017	2,1%	28
TEST OUT	MA	9-MA 7-MA 5-MA	2-sept-17	5-oct-17	7,0%	22
TEST OUT	MA	9-MA 7-MA 5-MA	17-nov-17	20-Dec-2017	1,2%	22
TEST OUT	MA	9-MA 7-MA 5-MA	23-Dec-2017	27-Jan-2018	6,1%	22
TEST OUT	MA	9-MA 7-MA 5-MA	10-feb-18	17-mar-18	10,5%	24
TEST OUT	MA	9-MA 7-MA 5-MA	24-mar-18	3-may-18	8,0%	27
TEST OUT	MA	9-MA 7-MA 5-MA	28-jun-18	10-Aug-2018	2,3%	30
TEST OUT	MA	9-MA 7-MA 5-MA	10-oct-18	9-nov-18	-0,1%	22
TEST OUT	MA	9-MA 7-MA 5-MA	21-nov-18	08-Jan-2019	2,8%	30
RESULTS	Profitability out market		Volatility out market		Average days out market	
	4,0%		3,3%		25,67	

Table Appendix 22: MasterCard Incorporated 9-MA 7-MA 5-MA

KRAFT HEINZ COMPANY (KHC): MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	KHC	9-MA 7-MA 5-MA	13-may-17	15-jun-17	-1,1%	22
TEST IN	KHC	9-MA 7-MA 5-MA	19-jul-17	22-Aug-2017	-4,3%	24
TEST IN	KHC	9-MA 7-MA 5-MA	15-sept-17	17-oct-17	-5,1%	22
TEST IN	KHC	9-MA 7-MA 5-MA	2-nov-17	13-Dec-2017	-1,2%	28
TEST IN	KHC	9-MA 7-MA 5-MA	25-Jan-2018	1-mar-18	-14,8%	24
TEST IN	KHC	9-MA 7-MA 5-MA	06-Apr-2018	22-may-18	-5,0%	32
TEST IN	KHC	9-MA 7-MA 5-MA	1-jun-18	4-jul-18	-5,3%	23
TEST IN	KHC	9-MA 7-MA 5-MA	10-jul-18	28-Aug-2018	-8,6%	35
TEST IN	KHC	9-MA 7-MA 5-MA	15-sept-18	17-oct-18	-7,8%	22
TEST IN	KHC	9-MA 7-MA 5-MA	24-oct-18	24-nov-18	-9,6%	22
TEST IN	KHC	9-MA 7-MA 5-MA	05-Dec-2018	26-Jan-2019	-9,8%	35
RESULTS	Profitability in market		Volatility in market		Average days in market	
	-6,6%		4,0%		26,27	
TEST OUT	KHC	9-MA 7-MA 5-MA	26-Apr-2017	27-may-17	-3,2%	23
TEST OUT	KHC	9-MA 7-MA 5-MA	15-jun-17	19-jul-17	-10,7%	23
TEST OUT	KHC	9-MA 7-MA 5-MA	26-jul-17	15-sept-17	-8,1%	36
TEST OUT	KHC	9-MA 7-MA 5-MA	22-sept-17	2-nov-17	-1,2%	29
TEST OUT	KHC	9-MA 7-MA 5-MA	13-Dec-2017	25-Jan-2018	-3,6%	28
TEST OUT	KHC	9-MA 7-MA 5-MA	31-Jan-2018	06-Apr-2018	-21,5%	45
TEST OUT	KHC	9-MA 7-MA 5-MA	21-Apr-2018	1-jun-18	2,7%	28
TEST OUT	KHC	9-MA 7-MA 5-MA	9-jun-18	12-jul-18	10,7%	22
TEST OUT	KHC	9-MA 7-MA 5-MA	19-jul-18	22-Aug-2018	-4,1%	24
TEST OUT	KHC	9-MA 7-MA 5-MA	28-Aug-2018	6-oct-18	-5,8%	28
TEST OUT	KHC	9-MA 7-MA 5-MA	16-oct-18	05-Dec-2018	-3,9%	35
TEST OUT	KHC	9-MA 7-MA 5-MA	08-Dec-2018	11-Jan-2019	-10,7%	22
RESULTS	Profitability out market		Volatility out market		Average days out market	
	-5,0%		7,8%		28,58	

Table Appendix 23: KHC 9-MA 7-MA 5-MA

UNITED HEALTH GROUP (UNH): MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	UNH	9-MA 7-MA 5-MA	31-Jan-2017	21-mar-17	3,0%	34
TEST IN	UNH	9-MA 7-MA 5-MA	06-Apr-2017	9-may-17	1,5%	22
TEST IN	UNH	9-MA 7-MA 5-MA	27-may-17	4-jul-17	2,4%	25
TEST IN	UNH	9-MA 7-MA 5-MA	22-jul-17	23-Aug-2017	-1,7%	22
TEST IN	UNH	9-MA 7-MA 5-MA	2-sept-17	14-oct-17	-5,5%	29
TEST IN	UNH	9-MA 7-MA 5-MA	21-oct-17	25-nov-17	2,7%	24
TEST IN	UNH	9-MA 7-MA 5-MA	30-nov-17	03-Jan-2018	-1,3%	22
TEST IN	UNH	9-MA 7-MA 5-MA	09-Jan-2018	10-feb-18	-7,7%	23
TEST IN	UNH	9-MA 7-MA 5-MA	22-feb-18	27-mar-18	-7,2%	23
TEST IN	UNH	9-MA 7-MA 5-MA	06-Apr-2018	10-may-18	4,0%	24
TEST IN	UNH	9-MA 7-MA 5-MA	16-may-18	28-jun-18	4,8%	30
TEST IN	UNH	9-MA 7-MA 5-MA	12-jul-18	25-Aug-2018	2,8%	32
TEST IN	UNH	9-MA 7-MA 5-MA	1-sept-18	13-oct-18	-3,6%	29
TEST IN	UNH	9-MA 7-MA 5-MA	9-nov-18	13-Dec-2018	-2,5%	22
TEST IN	UNH	9-MA 7-MA 5-MA	17-Jan-2019	26-Jan-2019	3,4%	7
RESULTS	Profitability in market		Volatility in market		Average days in market	
	-0,3%		4,2%		24,53	
TEST OUT	UNH	9-MA 7-MA 5-MA	21-Jan-2017	3-mar-17	6,4%	28
TEST OUT	UNH	9-MA 7-MA 5-MA	21-mar-17	21-Apr-2017	-1,0%	22
TEST OUT	UNH	9-MA 7-MA 5-MA	9-may-17	9-jun-17	1,9%	22
TEST OUT	UNH	9-MA 7-MA 5-MA	4-jul-17	09-Aug-2017	0,1%	25
TEST OUT	UNH	9-MA 7-MA 5-MA	19-Aug-2017	3-oct-17	0,8%	30
TEST OUT	UNH	9-MA 7-MA 5-MA	14-oct-17	30-nov-17	13,6%	32
TEST OUT	UNH	9-MA 7-MA 5-MA	22-Dec-2017	30-Jan-2018	6,0%	24
TEST OUT	UNH	9-MA 7-MA 5-MA	1-feb-18	20-mar-18	-6,8%	32
TEST OUT	UNH	9-MA 7-MA 5-MA	27-mar-18	27-Apr-2018	11,7%	22
TEST OUT	UNH	9-MA 7-MA 5-MA	10-may-18	12-jun-18	7,3%	22
TEST OUT	UNH	9-MA 7-MA 5-MA	28-jun-18	31-jul-18	0,0%	22
TEST OUT	UNH	9-MA 7-MA 5-MA	25-Aug-2018	2-oct-18	0,8%	25
TEST OUT	UNH	9-MA 7-MA 5-MA	13-oct-18	14-nov-18	6,6%	22
TEST OUT	UNH	9-MA 7-MA 5-MA	21-nov-18	17-Jan-2019	-3,8%	37
RESULTS	Profitability out market		Volatility out market		Average days out market	
	3,1%		5,7%		26,07	

Table Appendix 24: UNH 9-MA 7-MA 5-MA

7.5.2. Validation

FACEBOOK (FB): MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
OPT IN	FB	9-MA 7-MA 5-MA	24-Jan-2015	03-Apr-2015	9,6%	48
OPT IN	FB	9-MA 7-MA 5-MA	15-Apr-2015	10-jun-15	-9,7%	39
OPT IN	FB	9-MA 7-MA 5-MA	24-jun-15	04-Aug-2015	11,3%	28
OPT IN	FB	9-MA 7-MA 5-MA	4-sept-15	16-oct-15	2,6%	29
OPT IN	FB	9-MA 7-MA 5-MA	20-oct-15	05-Dec-2015	10,9%	33
OPT IN	FB	9-MA 7-MA 5-MA	30-Jan-2016	12-mar-16	-3,6%	29
OPT IN	FB	9-MA 7-MA 5-MA	18-mar-16	21-may-16	4,3%	45
OPT IN	FB	9-MA 7-MA 5-MA	28-may-16	18-Aug-2016	1,5%	56
OPT IN	FB	9-MA 7-MA 5-MA	30-Aug-2016	1-oct-16	1,7%	23
OPT IN	FB	9-MA 7-MA 5-MA	8-oct-16	9-nov-16	-5,4%	22
OPT IN	FB	9-MA 7-MA 5-MA	24-nov-16	29-Dec-2016	-2,3%	23
OPT IN	FB	9-MA 7-MA 5-MA	10-Jan-2017	19-Jan-2017	2,2%	7
RESULTS	Profitability in market		Volatility in market		Average days in market	
	1,9%		6,5%		31,83	
OPT OUT	FB	9-MA 7-MA 5-MA	5-feb-15	10-mar-15	9,9%	22
OPT OUT	FB	9-MA 7-MA 5-MA	03-Apr-2015	19-may-15	-7,3%	31
OPT OUT	FB	9-MA 7-MA 5-MA	10-jun-15	14-jul-15	12,1%	23
OPT OUT	FB	9-MA 7-MA 5-MA	04-Aug-2015	4-sept-15	-6,5%	23
OPT OUT	FB	9-MA 7-MA 5-MA	1-oct-15	31-oct-15	19,1%	22
OPT OUT	FB	9-MA 7-MA 5-MA	05-Dec-2015	30-Jan-2016	2,8%	37
OPT OUT	FB	9-MA 7-MA 5-MA	11-feb-16	18-mar-16	9,1%	25
OPT OUT	FB	9-MA 7-MA 5-MA	07-Apr-2016	7-may-16	3,2%	22
OPT OUT	FB	9-MA 7-MA 5-MA	21-may-16	2-jul-16	-2,5%	29
OPT OUT	FB	9-MA 7-MA 5-MA	18-Aug-2016	23-sept-16	5,4%	25
OPT OUT	FB	9-MA 7-MA 5-MA	1-oct-16	24-nov-16	-0,3%	38
OPT OUT	FB	9-MA 7-MA 5-MA	06-Dec-2016	10-Jan-2017	7,3%	23
RESULTS	Profitability out market		Volatility out market		Average days out market	
	4,4%		7,8%		26,67	

FACEBOOK (FB): MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	FB	9-MA 7-MA 5-MA	27-Jan-2017	22-mar-17	4,9%	37
TEST IN	FB	9-MA 7-MA 5-MA	31-mar-17	19-may-17	-3,3%	34
TEST IN	FB	9-MA 7-MA 5-MA	31-may-17	1-jul-17	-3,4%	23
TEST IN	FB	9-MA 7-MA 5-MA	14-jul-17	19-Aug-2017	1,3%	26
TEST IN	FB	9-MA 7-MA 5-MA	8-sept-17	27-oct-17	2,0%	35
TEST IN	FB	9-MA 7-MA 5-MA	2-nov-17	05-Dec-2017	-6,3%	22
TEST IN	FB	9-MA 7-MA 5-MA	13-Dec-2017	18-Jan-2018	-4,3%	23
TEST IN	FB	9-MA 7-MA 5-MA	27-Jan-2018	8-mar-18	-6,0%	27
TEST IN	FB	9-MA 7-MA 5-MA	14-mar-18	3-jul-18	9,9%	77
TEST IN	FB	9-MA 7-MA 5-MA	10-jul-18	18-Aug-2018	-13,0%	29
TEST IN	FB	9-MA 7-MA 5-MA	1-sept-18	6-oct-18	-10,0%	24
TEST IN	FB	9-MA 7-MA 5-MA	9-nov-18	22-Dec-2018	-13,0%	29
TEST IN	FB	9-MA 7-MA 5-MA	08-Jan-2019	26-Jan-2019	8,9%	14
RESULTS	Profitability in market		Volatility in market		Average days in market	
	-2,5%		7,5%		30,77	
TEST OUT	FB	9-MA 7-MA 5-MA	22-mar-17	26-Apr-2017	1,2%	24
TEST OUT	FB	9-MA 7-MA 5-MA	19-may-17	23-jun-17	4,4%	24
TEST OUT	FB	9-MA 7-MA 5-MA	1-jul-17	16-Aug-2017	9,0%	31
TEST OUT	FB	9-MA 7-MA 5-MA	19-Aug-2017	5-oct-17	0,4%	32
TEST OUT	FB	9-MA 7-MA 5-MA	27-oct-17	29-nov-17	4,2%	22
TEST OUT	FB	9-MA 7-MA 5-MA	02-Dec-2017	05-Jan-2018	2,6%	22
TEST OUT	FB	9-MA 7-MA 5-MA	18-Jan-2018	23-feb-18	-2,5%	25
TEST OUT	FB	9-MA 7-MA 5-MA	8-mar-18	10-Apr-2018	-12,0%	22
TEST OUT	FB	9-MA 7-MA 5-MA	3-jul-18	09-Aug-2018	-5,2%	26
TEST OUT	FB	9-MA 7-MA 5-MA	18-Aug-2018	26-sept-18	-11,3%	26
TEST OUT	FB	9-MA 7-MA 5-MA	6-oct-18	9-nov-18	-5,2%	24
TEST OUT	FB	9-MA 7-MA 5-MA	14-nov-18	18-Dec-2018	-0,6%	22
TEST OUT	FB	9-MA 7-MA 5-MA	22-Dec-2018	26-Jan-2019	12,1%	23
RESULTS	Profitability out market		Volatility out market		Average days out market	
	-0,2%		7,1%		24,85	

Table Appendix 25: Facebook 9-MA 7-MA 5-MA

VISA: MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
OPT IN	V	9-MA 7-MA 5-MA	15-Jan-2015	25-mar-15	12,1%	47
OPT IN	V	9-MA 7-MA 5-MA	09-Apr-2015	6-jun-15	-1,3%	41
OPT IN	V	9-MA 7-MA 5-MA	27-jun-15	12-Aug-2015	8,0%	31
OPT IN	V	9-MA 7-MA 5-MA	5-sept-15	05-Dec-2015	14,6%	63
OPT IN	V	9-MA 7-MA 5-MA	3-feb-16	12-mar-16	-6,4%	27
OPT IN	V	9-MA 7-MA 5-MA	22-mar-16	28-Apr-2016	4,7%	26
OPT IN	V	9-MA 7-MA 5-MA	18-may-16	18-jun-16	0,5%	22
OPT IN	V	9-MA 7-MA 5-MA	15-jul-16	20-Aug-2016	-0,7%	26
OPT IN	V	9-MA 7-MA 5-MA	31-Aug-2016	1-oct-16	-0,2%	22
OPT IN	V	9-MA 7-MA 5-MA	7-oct-16	8-nov-16	-2,0%	22
OPT IN	V	9-MA 7-MA 5-MA	15-nov-16	29-Dec-2016	-2,4%	30
OPT IN	V	9-MA 7-MA 5-MA	06-Jan-2017	19-Jan-2017	0,3%	9
RESULTS	Profitability in market		Volatility in market		Average days in market	
	2,3%		6,3%		30,50	
OPT OUT	V	9-MA 7-MA 5-MA	25-mar-15	28-Apr-2015	1,1%	23
OPT OUT	V	9-MA 7-MA 5-MA	5-may-15	27-jun-15	2,5%	38
OPT OUT	V	9-MA 7-MA 5-MA	12-Aug-2015	23-sept-15	-6,8%	29
OPT OUT	V	9-MA 7-MA 5-MA	30-sept-15	30-oct-15	18,2%	22
OPT OUT	V	9-MA 7-MA 5-MA	05-Dec-2015	3-feb-16	-7,5%	39
OPT OUT	V	9-MA 7-MA 5-MA	11-feb-16	22-mar-16	5,8%	27
OPT OUT	V	9-MA 7-MA 5-MA	28-Apr-2016	28-may-16	0,8%	22
OPT OUT	V	9-MA 7-MA 5-MA	15-jun-16	16-jul-16	0,6%	22
OPT OUT	V	9-MA 7-MA 5-MA	02-Aug-2016	1-sept-16	2,4%	22
OPT OUT	V	9-MA 7-MA 5-MA	17-sept-16	21-oct-16	3,5%	24
OPT OUT	V	9-MA 7-MA 5-MA	2-nov-16	14-Dec-2016	-1,8%	29
OPT OUT	V	9-MA 7-MA 5-MA	29-Dec-2016	19-Jan-2017	1,0%	14
RESULTS	Profitability out market		Volatility out market		Average days out market	
	1,7%		6,5%		25,92	

VISA: MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	V	9-MA 7-MA 5-MA	27-Jan-2017	17-mar-17	5,7%	34
TEST IN	V	9-MA 7-MA 5-MA	04-Apr-2017	20-may-17	-1,9%	33
TEST IN	V	9-MA 7-MA 5-MA	31-may-17	1-jul-17	-3,6%	23
TEST IN	V	9-MA 7-MA 5-MA	14-jul-17	30-Aug-2017	0,7%	33
TEST IN	V	9-MA 7-MA 5-MA	13-sept-17	17-nov-17	4,5%	47
TEST IN	V	9-MA 7-MA 5-MA	30-nov-17	3-feb-18	2,2%	44
TEST IN	V	9-MA 7-MA 5-MA	17-feb-18	24-mar-18	-1,0%	24
TEST IN	V	9-MA 7-MA 5-MA	07-Apr-2018	28-jun-18	16,3%	57
TEST IN	V	9-MA 7-MA 5-MA	10-jul-18	11-oct-18	6,7%	66
TEST IN	V	9-MA 7-MA 5-MA	24-oct-18	24-nov-18	-3,5%	22
TEST IN	V	9-MA 7-MA 5-MA	04-Dec-2018	26-Jan-2019	-5,0%	36
RESULTS	Profitability in market		Volatility in market		Average days in market	
	1,9%		6,2%		38,09	
TEST OUT	V	9-MA 7-MA 5-MA	25-Jan-2017	25-feb-17	6,5%	22
TEST OUT	V	9-MA 7-MA 5-MA	17-mar-17	19-Apr-2017	-1,3%	22
TEST OUT	V	9-MA 7-MA 5-MA	20-may-17	27-jun-17	2,5%	25
TEST OUT	V	9-MA 7-MA 5-MA	1-jul-17	10-Aug-2017	2,9%	27
TEST OUT	V	9-MA 7-MA 5-MA	30-Aug-2017	3-oct-17	3,6%	23
TEST OUT	V	9-MA 7-MA 5-MA	17-nov-17	20-Dec-2017	0,9%	22
TEST OUT	V	9-MA 7-MA 5-MA	23-Dec-2017	27-Jan-2018	6,1%	22
TEST OUT	V	9-MA 7-MA 5-MA	3-feb-18	17-mar-18	0,7%	29
TEST OUT	V	9-MA 7-MA 5-MA	24-mar-18	28-Apr-2018	6,3%	24
TEST OUT	V	9-MA 7-MA 5-MA	28-jun-18	31-jul-18	3,1%	22
TEST OUT	V	9-MA 7-MA 5-MA	01-Aug-2018	31-Aug-2018	6,3%	22
TEST OUT	V	9-MA 7-MA 5-MA	11-oct-18	10-nov-18	1,6%	22
TEST OUT	V	9-MA 7-MA 5-MA	21-nov-18	08-Jan-2019	1,2%	30
RESULTS	Profitability out market		Volatility out market		Average days out market	
	3,1%		2,5%		24,00	

Table Appendix 26: Visa 9-MA 7-MA 5-MA

ABBVIE INC (ABBV): MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
OPT IN	ABBV	9-MA 7-MA 5-MA	28-Jan-2015	7-mar-15	-6,9%	27
OPT IN	ABBV	9-MA 7-MA 5-MA	18-mar-15	5-may-15	3,1%	33
OPT IN	ABBV	9-MA 7-MA 5-MA	21-may-15	29-jul-15	4,8%	47
OPT IN	ABBV	9-MA 7-MA 5-MA	06-Aug-2015	10-sept-15	-15,7%	24
OPT IN	ABBV	9-MA 7-MA 5-MA	23-sept-15	24-oct-15	-15,8%	23
OPT IN	ABBV	9-MA 7-MA 5-MA	3-nov-15	04-Dec-2015	-6,5%	22
OPT IN	ABBV	9-MA 7-MA 5-MA	24-Dec-2015	3-feb-16	-8,4%	26
OPT IN	ABBV	9-MA 7-MA 5-MA	20-feb-16	23-mar-16	0,3%	22
OPT IN	ABBV	9-MA 7-MA 5-MA	31-mar-16	6-may-16	5,3%	26
OPT IN	ABBV	9-MA 7-MA 5-MA	10-may-16	11-jun-16	-4,2%	23
OPT IN	ABBV	9-MA 7-MA 5-MA	1-jul-16	19-Aug-2016	4,4%	34
OPT IN	ABBV	9-MA 7-MA 5-MA	23-sept-16	1-nov-16	-10,1%	27
OPT IN	ABBV	9-MA 7-MA 5-MA	11-nov-16	18-Jan-2017	-1,3%	44
RESULTS	Profitability in market		Volatility in market		Average days in market	
	-3,9%		7,4%		29,08	
OPT OUT	ABBV	9-MA 7-MA 5-MA	23-Jan-2015	25-feb-15	-4,7%	22
OPT OUT	ABBV	9-MA 7-MA 5-MA	7-mar-15	09-Apr-2015	4,1%	22
OPT OUT	ABBV	9-MA 7-MA 5-MA	5-may-15	23-jun-15	5,7%	34
OPT OUT	ABBV	9-MA 7-MA 5-MA	29-jul-15	23-sept-15	-17,7%	39
OPT OUT	ABBV	9-MA 7-MA 5-MA	26-sept-15	3-nov-15	7,1%	26
OPT OUT	ABBV	9-MA 7-MA 5-MA	17-nov-15	24-Dec-2015	-6,1%	26
OPT OUT	ABBV	9-MA 7-MA 5-MA	12-Jan-2016	20-feb-16	-5,7%	27
OPT OUT	ABBV	9-MA 7-MA 5-MA	17-mar-16	19-Apr-2016	5,2%	22
OPT OUT	ABBV	9-MA 7-MA 5-MA	6-may-16	1-jul-16	2,3%	39
OPT OUT	ABBV	9-MA 7-MA 5-MA	19-Aug-2016	23-sept-16	-3,5%	24
OPT OUT	ABBV	9-MA 7-MA 5-MA	5-oct-16	11-nov-16	1,5%	27
OPT OUT	ABBV	9-MA 7-MA 5-MA	23-nov-16	28-Dec-2016	4,0%	23
OPT OUT	ABBV	9-MA 7-MA 5-MA	18-Jan-2017	19-Jan-2017	-0,5%	2
RESULTS	Profitability out market		Volatility out market		Average days out market	
	1,3%		10,3%		28,15	

ABBVIE INC (ABBV): MA-9 MA-7 MA-5						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	ABBV	9-MA 7-MA 5-MA	10-feb-17	23-mar-17	5,7%	28
TEST IN	ABBV	9-MA 7-MA 5-MA	11-Apr-2017	13-may-17	-3,8%	23
TEST IN	ABBV	9-MA 7-MA 5-MA	1-jun-17	6-jul-17	7,4%	24
TEST IN	ABBV	9-MA 7-MA 5-MA	22-jul-17	1-nov-17	21,6%	71
TEST IN	ABBV	9-MA 7-MA 5-MA	7-nov-17	30-Dec-2017	2,5%	37
TEST IN	ABBV	9-MA 7-MA 5-MA	10-Jan-2018	10-feb-18	6,2%	22
TEST IN	ABBV	9-MA 7-MA 5-MA	17-feb-18	22-mar-18	-1,6%	22
TEST IN	ABBV	9-MA 7-MA 5-MA	19-Apr-2018	31-may-18	14,0%	29
TEST IN	ABBV	9-MA 7-MA 5-MA	19-jun-18	20-jul-18	-7,2%	22
TEST IN	ABBV	9-MA 7-MA 5-MA	03-Aug-2018	5-sept-18	1,5%	22
TEST IN	ABBV	9-MA 7-MA 5-MA	2-oct-18	2-nov-18	-17,7%	23
TEST IN	ABBV	9-MA 7-MA 5-MA	9-nov-18	15-Dec-2018	-1,3%	24
TEST IN	ABBV	9-MA 7-MA 5-MA	29-Dec-2018	26-Jan-2019	-10,7%	19
RESULTS	Profitability in market		Volatility in market		Average days in market	
	-0,6%		6,8%		25,62	
TEST OUT	ABBV	9-MA 7-MA 5-MA	21-Jan-2017	23-feb-17	0,5%	22
TEST OUT	ABBV	9-MA 7-MA 5-MA	23-mar-17	2-may-17	-1,2%	27
TEST OUT	ABBV	9-MA 7-MA 5-MA	13-may-17	15-jun-17	2,1%	22
TEST OUT	ABBV	9-MA 7-MA 5-MA	6-jul-17	11-Aug-2017	-5,2%	26
TEST OUT	ABBV	9-MA 7-MA 5-MA	19-Aug-2017	30-sept-17	25,9%	29
TEST OUT	ABBV	9-MA 7-MA 5-MA	1-nov-17	02-Dec-2017	3,7%	22
TEST OUT	ABBV	9-MA 7-MA 5-MA	30-Dec-2017	17-feb-18	11,1%	33
TEST OUT	ABBV	9-MA 7-MA 5-MA	6-mar-18	19-Apr-2018	-18,8%	31
TEST OUT	ABBV	9-MA 7-MA 5-MA	31-may-18	10-jul-18	-5,5%	27
TEST OUT	ABBV	9-MA 7-MA 5-MA	20-jul-18	21-Aug-2018	7,1%	22
TEST OUT	ABBV	9-MA 7-MA 5-MA	28-Aug-2018	2-oct-18	-3,6%	24
TEST OUT	ABBV	9-MA 7-MA 5-MA	13-oct-18	14-nov-18	0,7%	22
TEST OUT	ABBV	9-MA 7-MA 5-MA	24-nov-18	29-Dec-2018	4,0%	23
TEST OUT	ABBV	9-MA 7-MA 5-MA	11-Jan-2019	26-Jan-2019	-7,8%	11
RESULTS	Profitability out market		Volatility out market		Average days out market	
	0,9%		10,2%		24,36	

Table Appendix 27: AbbVie 9-MA 7-MA 5-MA

ABBOTT LABORTORIES (ABT): MA-200 MA-100 MA-50						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
OPT IN	ABT	9-MA 7-MA 5-MA	15-Jan-2015	25-mar-15	14,5%	47
OPT IN	ABT	9-MA 7-MA 5-MA	11-Apr-2015	4-jun-15	-2,2%	37
OPT IN	ABT	9-MA 7-MA 5-MA	20-jun-15	11-Aug-2015	3,3%	35
OPT IN	ABT	9-MA 7-MA 5-MA	10-oct-15	17-nov-15	11,9%	26
OPT IN	ABT	9-MA 7-MA 5-MA	20-nov-15	23-Dec-2015	-6,2%	22
OPT IN	ABT	9-MA 7-MA 5-MA	19-feb-16	30-Apr-2016	2,0%	50
OPT IN	ABT	9-MA 7-MA 5-MA	18-may-16	18-jun-16	-2,6%	22
OPT IN	ABT	9-MA 7-MA 5-MA	24-jun-16	16-Aug-2016	16,2%	36
OPT IN	ABT	9-MA 7-MA 5-MA	23-sept-16	1-nov-16	-5,5%	27
OPT IN	ABT	9-MA 7-MA 5-MA	12-nov-16	24-Dec-2016	-2,0%	29
OPT IN	ABT	9-MA 7-MA 5-MA	05-Jan-2017	19-Jan-2017	2,1%	10
RESULTS	Profitability in market		Volatility in market		Average days in market	
	2,9%		7,9%		31,00	
OPT OUT	ABT	9-MA 7-MA 5-MA	25-mar-15	25-Apr-2015	2,0%	22
OPT OUT	ABT	9-MA 7-MA 5-MA	1-may-15	20-jun-15	3,9%	35
OPT OUT	ABT	9-MA 7-MA 5-MA	11-Aug-2015	10-oct-15	-21,5%	43
OPT OUT	ABT	9-MA 7-MA 5-MA	15-oct-15	20-nov-15	18,4%	26
OPT OUT	ABT	9-MA 7-MA 5-MA	04-Dec-2015	19-feb-16	-18,0%	51
OPT OUT	ABT	9-MA 7-MA 5-MA	12-mar-16	14-Apr-2016	7,2%	22
OPT OUT	ABT	9-MA 7-MA 5-MA	30-Apr-2016	2-jun-16	-2,0%	22
OPT OUT	ABT	9-MA 7-MA 5-MA	10-jun-16	13-jul-16	10,4%	22
OPT OUT	ABT	9-MA 7-MA 5-MA	16-Aug-2016	23-sept-16	-7,9%	27
OPT OUT	ABT	9-MA 7-MA 5-MA	1-oct-16	12-nov-16	-1,3%	30
OPT OUT	ABT	9-MA 7-MA 5-MA	24-nov-16	05-Jan-2017	2,1%	27
RESULTS	Profitability out market		Volatility out market		Average days out market	
	-0,6%		11,7%		29,73	

ABBOTT LABORTORIES (ABT): MA-200 MA-100 MA-50						
Analysis	Share	Moving average	Buy signal	Sell signal	Profits strategy %	Days in market
TEST IN	ABT	9-MA 7-MA 5-MA	31-Jan-2017	16-mar-17	8,7%	31
TEST IN	ABT	9-MA 7-MA 5-MA	05-Apr-2017	18-may-17	-7,1%	30
TEST IN	ABT	9-MA 7-MA 5-MA	1-jun-17	1-jul-17	5,1%	22
TEST IN	ABT	9-MA 7-MA 5-MA	18-jul-17	23-sept-17	0,2%	48
TEST IN	ABT	9-MA 7-MA 5-MA	26-sept-17	1-nov-17	4,7%	26
TEST IN	ABT	9-MA 7-MA 5-MA	11-nov-17	18-Jan-2018	0,7%	44
TEST IN	ABT	9-MA 7-MA 5-MA	26-Jan-2018	24-mar-18	-3,9%	40
TEST IN	ABT	9-MA 7-MA 5-MA	21-Apr-2018	23-jun-18	9,6%	44
TEST IN	ABT	9-MA 7-MA 5-MA	11-jul-18	14-Aug-2018	4,2%	24
TEST IN	ABT	9-MA 7-MA 5-MA	18-Aug-2018	11-oct-18	8,0%	37
TEST IN	ABT	9-MA 7-MA 5-MA	2-nov-18	19-Dec-2018	1,8%	31
TEST IN	ABT	9-MA 7-MA 5-MA	01-Jan-2019	26-Jan-2019	0,0%	18
RESULTS	Profitability in market		Volatility in market		Average days in market	
	2,7%		5,1%		32,92	
TEST OUT	ABT	9-MA 7-MA 5-MA	24-Jan-2017	24-feb-17	12,5%	22
TEST OUT	ABT	9-MA 7-MA 5-MA	16-mar-17	22-Apr-2017	-3,1%	26
TEST OUT	ABT	9-MA 7-MA 5-MA	27-Apr-2017	1-jun-17	-1,2%	24
TEST OUT	ABT	9-MA 7-MA 5-MA	30-jun-17	18-Aug-2017	-1,5%	34
TEST OUT	ABT	9-MA 7-MA 5-MA	23-sept-17	25-oct-17	9,4%	22
TEST OUT	ABT	9-MA 7-MA 5-MA	1-nov-17	02-Dec-2017	0,2%	22
TEST OUT	ABT	9-MA 7-MA 5-MA	05-Dec-2017	06-Jan-2018	2,4%	22
TEST OUT	ABT	9-MA 7-MA 5-MA	18-Jan-2018	21-feb-18	-0,7%	23
TEST OUT	ABT	9-MA 7-MA 5-MA	24-mar-18	28-Apr-2018	-1,8%	24
TEST OUT	ABT	9-MA 7-MA 5-MA	23-jun-18	27-jul-18	3,7%	23
TEST OUT	ABT	9-MA 7-MA 5-MA	14-Aug-2018	15-sept-18	3,4%	23
TEST OUT	ABT	9-MA 7-MA 5-MA	11-oct-18	10-nov-18	3,1%	22
TEST OUT	ABT	9-MA 7-MA 5-MA	16-nov-18	01-Jan-2019	1,3%	29
TEST OUT	ABT	9-MA 7-MA 5-MA	05-Jan-2019	26-Jan-2019	5,7%	15
RESULTS	Profitability out market		Volatility out market		Average days out market	
	2,4%		4,4%		23,64	

Table Appendix 28: Abbott 9-MA 7-MA 5-MA

