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DIRECTORS' DEALINGS: AN ANALYSIS OF THEIR PREDICTIVE POWER

SUPERVISOR

PROFESSOR ALBERTO ROVERATO
UNIVERSITY OF PADOVA

CO-SUPERVISOR

TIM JECK
ENTREPRENEURIAL INVESTMENT PARTNERSHIP

MASTER CANDIDATE

MATTEO ZANDEGIACOMO ORSOLINA

STUDENT ID

2053843

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Abstract

This thesis conducts an in-depth examination of directors' dealings, specifically exploring the potential for predicting future fluctuations in share prices based on the nature of these transactions. Directors' dealings are analysed in isolation as well as in conjunction with buybacks and transactions executed by prominent investors. A comprehensive dataset of 1,773,971 dealings are crawled from various online sources, employing techniques ranging from a basic web request to rudimentary Natural Language Processing (NLP) methods. Building upon an existing database of buybacks, it is proved that there is a surge in dealings immediately after the announcement date of a buyback. Subsequently, an assessment is made on whether directors' dealings confer an advantage for traders following them, comparing share price movements over a two-year period against the MSCI World index. Due to the challenge of comparing companies with very different market capitalizations, alternative indexes are introduced, each serving as a benchmark for companies in a different market capitalization range. In the majority of instances, the median of the percentage points of out-performance relative to the respective indexes proves that a majority of dealings produces an advantage for the director, particularly in the case of share purchases, especially over the long term (two years post-dealing). Conversely, sales of shares by a director yield less conclusive results, with some cases exhibiting a median below zero, indicating that a significant portion of directors are not selling at the right moment. An analogous analysis is conducted, focusing on dealings executed in the thirty days after a buyback announcement. In this scenario, it is observed that the percentage points of out-performance generally fall below the values observed when considering all directors' dealings. After splitting the dealings by country, an examination to identify the country where directors tend to achieve the most significant gains is conducted. Purchases executed by directors in the United States and Honk Kong emerge as particularly favourable. Finally, a research is conducted to identify the top-performing directors who stand out in both purchases and sales, possibly leading to a list of names that, if closely monitored, could have potentially yielded substantial returns.

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Listing of acronyms

CEO	Chief Executive Officer
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
IRR	Internal Rate of Return
JSON	JavaScript Object Notation
MSCI	Morgan Stanley Capital International
NLP	Natural Language Processing
NYSE	New York Stock Exchange
OTCPK	Over-The-Counter PinK
PDF	Portable Document Format
SEHK	Stock Exchange Hong Kong
URL	Uniform Resource Locator
USD	United States Dollar

1

Introduction

Stock markets have changed a lot in the last years. Although they may still have offices in their respective locations, most of the transactions are nowadays executed online, and the strategies followed by the investors are continuously changing, thanks to the fact that a click is enough to buy or sell thousands of euros worth of shares. In order to take care of these new possibilities many new laws were introduced, in order to keep the market as fair as possible. In particular, one of the main aspects to worry about, is whether the company itself and its managers may use some information not divulged to the public in order to make some extra gains for themselves. This thesis mainly focuses on what are generally called directors' dealings or managers' transactions, that is the purchase or sale of shares of a company done by managers of that same company.

1.1 STOCK MARKET

The term stock market is generally used to refer to the whole amount of sellers and buyers of shares, which is the amount of ownership claims on a business. There are many stock exchanges in the world, and in each one of them it is possible to trade shares of most businesses in the world, although each company has a primary listing in a specific stock exchange. However, the laws governing the transaction and the requirements will depend on the judicial system of both the country where the transaction is executed and the country where the

company has its primary listing. That makes it even more complicated to understand whose responsibility it is, in case of illegal actions.

1.2 DIRECTORS' DEALINGS

The main subject of this thesis are directors' dealings. They are the transactions executed by the directors of listed companies, in which they buy or sell shares of the company they work in. Since these transactions are executed by a director of the company, who should know the company better than most outsiders, it is required according to most jurisdictions that the director notifies its transaction to a competent authority, who will divulge the information to the public.

This procedure has been introduced in order to make the stock market as fair as possible, in order to avoid managers to trade to their advantage and making them gain extra money without anyone on the outside knowing anything about that.

1.3 RESEARCH QUESTIONS

Although there are some laws used to limit the power of directors, they may still try to have extra gains by trading shares of their company. This thesis main purpose is to understand whether directors are actually able to use their knowledge in order to gain something from the oscillations of the share price.

Follows a brief discussion of each one of the main questions this thesis tries to address.

TEMPORAL DISTRIBUTION

The first question that arises is whether directors' dealings are distributed uniformly throughout the year or if the temporal vicinity to some other event in the company (for example a buyback, or a new big investor) may cause a peak of dealings.

COMPANY PERFORMANCE AFTER A DIRECTOR DEALING

An analysis of how the share price of a company changes after a director dealing is performed, in particular whether there is an over or under-performance of the share price compared to some different financial indices, in order to understand if the director was right in executing

their transaction or not. Different time frames are going to be considered up to two years after the directors' dealing date.

COMPANY PERFORMANCE AFTER A DIRECTOR DEALING IN PROXIMITY OF A BUYBACK

A similar approach was followed in order to see if the results are improved when a dealing is executed immediately after a buyback. Since they could be considered two signals of the well-being of a company.

DIRECTORS DEALINGS BY COUNTRY

Finally, an analysis on whether directors' dealings perform better in some countries compared to others is done. Specifically, the question is whether a country such as the United States that has the main stock exchanges and where most of the biggest companies in the world are based, has directors that are better suited not only in their job as managers, but also in obtaining extra gains for themselves.

1.4 ORGANIZATION

This thesis is going to be divided into five chapters. After this introduction, firstly there is going to be a discussion of the theoretical aspects in Chapter 2, required to properly understand the problem and some previous studies on the subject. After that, a description of how the data was obtained and cleaned is presented in Chapter 3. Following that, a discussion of the methods used to analyse the data and why the results are statistically relevant is given in Chapter 4. The proper discussion of the analysis and of what is discovered is found in Chapter 5. Finally a conclusion is presented in Chapter 6.

2

Background

2.1 DIRECTORS' DEALINGS

2.1.1 DIRECTORS' DEALINGS AND INSIDER TRADING

In general, a directors' dealing is a transaction executed by an insider or by a person closely related to them on the shares of the company where the insider has a managerial responsibility. Unfortunately, this definition cannot be considered completely correct and it may change in different countries. In fact, in some countries are considered insiders people who possess a big amount of shares as well (starting from 3%, usually), even if they don't actually have any role in managing the company itself. There is also no distinction between various possible levels of managers, and they could be the Chief Executive Officer (CEO) of the company or just the director of a department of the company. Their knowledge of the company varies greatly, but they are both required to follow the same rules.

Furthermore, people closely related to the director are also included. Generally, family members of a director are referred with this definition. They are obviously included in order to avoid the director to use their knowledge without using their name.

In most countries, all the people included in the definition of director are required to notify whenever they execute a transaction, in order to make the market as fair as possible, avoiding directors to keep their privileged information for themselves. Usually there is a requirement to file the notification in the five working days following the transaction. The notification should

be sent to a competent office which will make the information available to the public.

Around the world, methods to control directors have been introduced at different times. The United States introduces the first laws immediately after the market crash of 1929 [1], making them the first country in the world, followed by the United Kingdom which introduced their first rules in 1980. After that various other countries introduced new regulations in their effort to control the phenomenon, with the European Union introducing a directive to harmonise the sanction and the scope of directors' dealings laws [2].

The main reasons such controls have been introduced is to avoid insider trading [3]. Insider trading is the illegal practice of trading using insider information which, if made available to the public, would significantly change the share price. Insider trading is generally a risk for any manager, because if the judicial system find them guilty, apart from a fine, they risk to lose all of their reputation, since it would appear they are more interested in earning money through trading, rather than helping a company grow.

The scope of these laws slightly change among countries. For example, in the European Union any transaction executed while in possession of privileged information is considered illegal, while in the United States only people who actually work in the company or are in possession of a large amount of shares are considered as such.

The penalties also vary a lot from country to country. In the United States and in the European Union insiders risk going to prison, although in the latter there is a maximum time of four years. In the United Kingdom imprisonment was introduced after 20 years in which only fines were adopted without being able to dissuade insiders to perform such transactions [4]. In China, on the other hand, companies were allowed to trade in the Hong Kong stock market only from 2005, and since then, only fines are used as a punishment, causing insider trading to still be a frequent practice.

Although all around the world many laws exist in order to avoid insider trading, there are many people claiming that it should be legal, especially in the United States. The main voice in this direction is Milton Friedman, economics Nobel laureate, who said in 1970 that "You should want more insider trading, not less. You want to give the people most likely to have knowledge about deficiencies of the company an incentive to make the public aware of that." According to his view, allowing directors to perform insider trading increases the chances for a fair market, since the people who know the most about their company will help moving the share price to its right price.

2.1.2 PREDICTIVENESS OF DIRECTORS' DEALINGS

Some studies regarding directors' dealings have already been performed in the past. One of the first in the field, published in 1986 by Seyhun [5], brings evidence that substantial purchases by directors in the United States are generally followed by abnormal results by the share price of the company compared to the market. This out-performance generally lasts for several months. On the other hand, sales are not as informative.

Another study executed in 2001 by Lakonishok and Lee [6] confirms the results. While purchases are generally followed by positive returns, sales are not consistently returned by negative returns, reinforcing the idea that not all managers' transactions are equally informative.

In more recent years, other studies have been introduced, focusing not only on the United States but also on Europe, thanks to the new regulations forcing directors to notify their transactions as the US had already been doing. The study by Kaspar and Güttler [7] focuses only on the short term, in order to check if there were abnormal returns after only a few days. What they managed to find is that only in some countries there are actual abnormal returns, and they can mostly be seen when directors are buying new shares. When it comes to selling shares, there is no correlation.

Another study executed by Dickgießer [8] only on the German stock market gives the conclusion that it is very unlikely to obtain good results following a director and the reason that was found was due to reputational risks in using their privileged information. In fact, according to them, directors were mostly trading immediately after the company had divulged to the public information that could actually change the price of shares, in order for them to avoid legal repercussions, but missing the opportunity to gain more. If they had traded before the announcement, they would have obtained such results.

2.2 BUYBACKS

A buyback is the operation of reacquiring stock from share-holders by the company itself. A company may have various reasons to do so and the effects may vary, but usually the company will then delete the purchased shares by the market. This procedure will reduce the total number of outstanding shares and will give more value to the remaining shares. The investor who did not sell their shares during this buyback could generally expect higher earning per share, in the instance of equal earnings every year. Since the buyback could potentially significantly

change the share price, the company is generally obliged to notify their intention to proceed with a buyback, in order for all the interested parties to be ready for such an event.

As proved by Reintjes [9], there is in fact a minority of companies that significantly outperform the market when performing buybacks, proving that in some instances such operation boosts the share price. Without a notification, the company could buy shares without the investors know and they may be more willing to sell their shares, making it easier for the company get their shares back, at the expenses of other investors. But the fact that the notification is required could persuade other investors to buy shares for themselves, in order to get the such advantages, boosting the share price due to the high demand from both investor and the company itself.

2.2.1 DIRECTORS' DEALINGS AND BUYBACKS

Since it is expected for the earning per share to increase, it is not uncommon for other investor to buy shares for themselves during the buyback, in order to take advantage of that. Since directors are not allowed to purchase shares of their own company before the buyback announcement, because they would be using some privileged information that could potentially significantly change the share price, they may be among the ones trying to buy afterwards.

If a directors' dealing is notified immediately before a buyback announcement it is probably been done by a director who was not aware of the buyback itself. Otherwise, that could easily be interpreted as an attempt to gain as much as possible using information that was not given to the public yet, going against the insider trading regulations of most of the countries.

Another possible correlation between directors' dealings and buybacks, which is unfortunately difficult to prove, is the chance that a buyback was announced in order for a director who is in possession of a large amount of shares to easily sell them, since selling many shares in the stock market would have been otherwise very challenging. This is clearly an illegal and unprofessional procedure, which could cause harm to the directors involved if discovered both on a legal and reputational level, but happening on closed doors is generally not possible to find proofs of that.

2.3 INVESTOR TRANSACTIONS

When an investor purchases an amount of shares higher than a certain percentage point (generally 3% or 5%), such investor is required to notify their transaction. The same happens when there is the opposite case of a director selling their shares and going below the benchmark. This is notified because it informs that there is a new investor who holds many shares, making them relevant in the decision making of the company.

While being useful in giving this information to all the other investors, this notification does not tell the whole story. For example an investor could go from owning 2.99% of the company to 3.01% or from 0% to 10% and not all countries require them to specify the amount of the change. At the same time, if a director moves from 3% to 20%, they are not always required to notify anything. Some countries may require them to notify it as they were insiders, while other countries do not require anything of them.

2.3.1 INVESTOR TRANSACTIONS AND DIRECTORS DEALINGS

The notification of an investor transaction can be generally seen as a signal of trust or distrust. In the first situation, a person is deciding to invest a big amount of money in the company, possibly boosting the share price because of their interest in buying, and other people may decide to buy because they may think the investor really trust the company in order to invest such amount.

On the other hand, when the investor notifies they are not in the big investor group, it may be a signal they do not trust the company anymore, and they prefer to take the money back, causing the share price to drop. This may convince other investors to go away from the company, not trusting it anymore since one of their big investors just went away.

Directors are expected to reason in the same way. Unless they are one of the top managers of the company, actually knowing all that is going on, they may start to feel unsure about the company and decide to leave. At the same time, the opposite thing may happen, when an investor sees the top management of the company buying or selling their own shares and feel it is a signal for them to do the same thing.

2.3.2 INVESTOR TRANSACTIONS AND BUYBACKS

A buyback could potentially be followed by an investor transaction going in both directions. An investor could try to buy shares of the company after a buyback announcement for similar reasons as the directors. This way they would have more earnings supposing the company was actually able to retrieve as many shares as possible for the market. However, at the same time, an investor may decide to use the buyback to sell their shares. They may have been willing to sell their shares for some time, but they could not find anyone willing to buy so many shares. A buyback would be the solution, since the company itself would be willing to buy all their shares.

2.4 FINANCIAL INDICES

In order to be able to understand if a company is performing better or worse than the market, it is useful to have some terms of comparison. Around the world many indices have been created for this job. Arguably the most famous one is the MSCI World [10], an index created combining the performance of more than 1500 constituent companies from 23 developed market countries. Its aim is to capture the market behaviour of the main markets, covering around the 80% of the market capitalizations of these countries.

Due to the huge varieties of companies that are included to define this index, it is not always a good idea to use it for comparisons. When focusing on the top companies for market capitalization the Dow Jones Global Titans 50 [11] is probably the best choice. It is defined as an adjusted index representing 50 of the biggest and most reliable companies in the world. Using this index instead of the MSCI World is helpful for understanding whether the biggest companies in the world are performing differently than expected, especially since a bigger company is generally more stable.

For smaller companies than the ones used to defined the MSCI World Index a good comparison can be made using respectively the MSCI World Midcap Index [12] and MSCI World Smallcap Index [13]. The former one partially overlaps with the MSCI World Index and it represents around the 15% of the total market capitalization of the same 23 countries with developed markets. The MSCI World Smallcup Index, on the other hand, represents the 15% below the previous one.

For even smaller companies, the Russell Microcap Index [14] is used. It is created using only the American segment of companies covering a range of capitalizations sufficiently small to rep-

resent the 2% of companies below the smallcap range. It consists of a total of 2, 000 companies. For even smaller companies there is no reliable index able to represent their performance. Smaller companies are more prone to fluctuations and the share price may change drastically very easily, making it difficult to compare to an index. This is the same reason for which there is no reliable microcap index with companies from outside of Europe. The fluctuations are too strong and it is not possible to use such companies. In the United States there is a larger amount of companies and it is easier for the organizations developing the index to keep the right companies into consideration.

Follows a table summarising the main features of each index for future reference.

Dow Jones Global Titans 50	Mega market capitalizations
MSCI World	Large market capitalizations
MSCI World Midcap	Medium market capitalizations
MSCI World Smallcap	Small market capitalizations
Russell Microcap Index	Micro market capitalizations
None	Nano market capitalizations

Table 2.1: Indices used as reference for different market capitalizations.

3

Data Procurement and Sources

In this chapter, the computational methods used to retrieve, store and elaborate the data are going to be discussed. The problems encountered during this process will also be explained.

3.1 CRAWLING METHODS

Two main methods have been used to crawl the data, depending on the website used. Follows a brief description of each one of them.

3.1.1 HTTP REQUEST

An HTTP request is a procedure used to retrieve data from a website thanks to the request made by a client to the host located on a server, in order to access the information of the server itself. In order for the client to execute the request, the URL of the wanted resource is required. There are various types of request that can be done. Follows a description of the only two types that have been used during this thesis:

- GET. It is the simplest HTTP request type. It corresponds to just retrieving what can be found on a server. Requesting a certain URL from that server gives the information that can be found on it.

- POST. It is the submission of data to a server, in order to be returned specific information. For example, the POST request is used when some options need to be chosen or specified from inside the website itself.

In most of this thesis, the GET request is used.

The request methods are very useful when the data can be found in a website in tabular form, because when accessing a new page, the variables are going to be stored in exactly the same position. Generally, the entire webpage is going to be retrieved as a JSON file, which can be easily converted to a dictionary object in Python, and all the variables are going to be accessed in the exact same way for each new page. The main issue with it is the fact that there is often a dictionary inside of a list inside of a dictionary and so on, requiring many trials before getting the right combination to retrieve each wanted variable. Clearly, every website has a different combination.

3.1.2 NLP METHODS

In some websites, it was required to access a PDF file and to read the information from there. The most convenient way to get the data was to find a pattern in the text. Most of the PDF files from a certain website were in the same format, so when looking, for example, for the name of the director, it was possible to search in the file for the words *InsiderName*, and retrieve everything afterwards up to the new line symbol. This way, it was possible to retrieve the name of the insider from each file. Some other variables required more work to find the right way to get the wanted information, using more parameters.

In general, this is a pretty easy method that can be used when reading a file in which there is no grid laying behind it, since using actual keywords it is possible to find the information. At the same time, it may not work if the words used change in different documents or if there is some specific case. For example, using the insider name case, if the insider has a very long name, requiring two lines to write it all, the crawled name is going to be only the first part of it, making the data wrong.

Differently from the HTTP request case, where a JSON file was retrieved, in this case a very long string is obtained, which is generally more chaotic and more prone to errors.

3.2 ORIGIN OF THE DATA

In this thesis, the main focus are the transactions executed by directors in several different countries. For each country, the data was retrieved from a different website. Not all the countries were making the same data available, and in some cases it was required to find alternative solutions, in order to make the analysis coherent.

The variables that were downloaded are as follow. Just a few of them are going to be used in the following analysis, however all of them were important in the realization of a database of transaction that could be used for further study.

- Insider Name. The name of the director who performed the transaction.
- Company Name. The name of the company the director is part of.
- Filing Date. The date at which the transaction report was filed.
- Trade Date. The date at which the transaction was executed.
- Ticker. The symbol which is supposed to uniquely identify a company.
- Position. The position the director covers in the company.
- Trade Type. Whether the transaction is a purchase, a share, or something else. The transactions which are not purchase nor shares have been excluded.
- Price. The price of the share when the transaction was executed.
- Volume. The amount of shares that were traded.
- Value. The total value of the transaction, that is the product of price and volume.
- Owned. The amount of shares owned by the director after the execution of the transaction.
- Delta Owned. The change in percentage of the shares owned by a director during a transaction.

Not all these variables were available for all the countries. The only data that was possible to crawl in all of them were Company Name, Insider Name, Filing Date, Trade Type, Price and Volume. Follows a brief description of each website.

3.2.1 UNITED STATES OF AMERICA

Data regarding directors from the USA was retrieved from the website Openinsider [15], which crawls daily all new transactions notified to the United States Securities and Exchange Commission [16] and insert them in a tabular form for an easier view. Since it was possible to research on specific dates, companies or insiders, and all the relevant information was returned in a table, to retrieve the data was enough to use an HTTP request iterating over all the pages, running day by day. The website was very informative, providing all the variables presented in Section 3.2. Being the first country whose data has been crawled, the variables found here have been used considered as the basic parameters for every director dealing. With data going from July 2003 to February 2023, for a total of 1,145,643 transactions.

3.2.2 UNITED KINGDOM

The data for transactions from the United Kingdom was retrieved from the website ajbell.co.uk [17]. The website is a crawler, retrieving data from the London Stock Exchange [18] website, where directors are required to notify their transactions. The data was presented again in a tabular form, with all the relevant information inserted in a tidy way, making it possible to run the code using HTTP request methods. Although the website was not letting search for directors or for date, it was possible going back in time to retrieve all the transactions. In fact, the website contains all the transactions in a table, divided 50 by 50. Iterating on all the pages, going back in time transaction by transaction till the oldest stored in the AJBell database, going from January 2000 to April 2023, for a total of 92,238 transactions.

3.2.3 GERMANY

The website used to crawl data about directors in Germany was Finanzen [19]. The website is a crawler which retrieves the information from EQS News [20] and Presstext [21]. Directors in Germany are required to notify their transactions to either one of the two websites. In the used crawler, data was presented going back in time, and in order to get the needed information it was required to enter a new page for each transaction. For this reason an HTTP request has to be sent twice, one from the page containing all the transactions, where the links for each trade is found. Once in the new page, a second HTTP request is sent for each transaction, in order

to retrieve all the data. The website does not contain all the variables in 3.2. Ticker, position, value, owned and delta owned were not available, although value was easily computed given price and volume. Anyway, the missing information is not among the most important variables. The crawled trades go from May 2005 to May 2023, giving in total 57,473 transactions.

3.2.4 ITALY

In order to download the information regarding the transactions executed by directors in Italy, there was no available crawler online, therefore the data was downloaded directly from the website of Borsa Italiana [22], where the official documents signed by directors are available. The data was inserted into a table containing only the name of the company, the filing date and a link to download the actual PDF file signed by the director himself. First of all, an HTTP request was sent in the page with the table, in order to obtain the link. Once the link was retrieved, the file was download, read and saved as a string to be analysed through NLP methods. Unfortunately, since the files were in a few different formats, many controls had to be introduced, in order to avoid as many errors as possible. Furthermore, when going back in time, many scanned documents appeared, which were not possible to be analyzed through this method. The main problem were the numerical values, like the volume, the price and the value, since there was no specific key word kept near them and the main controls were about the length of the number, the presence of dots and commas, and on whether the symbol could be found. Furthermore, no data could be found for the variables ticker, owned and delta owned, while the position variable could only be found at times. In the end, it was only possible to have data going from July 2016 to May 2023, for a total of 11,277 was reputed relevant.

3.2.5 NETHERLANDS

The website used to retrieve data for the Netherlands was AFM [23], the website of the Dutch Authority for the Financial Markets. It is an official website and not a crawler, and in this case the data is presented in a tabular form. An HTTP request is sent to obtain the information from the table, containing one transaction each row with some basic information. From it, a link was obtained to another page containing more details about the transaction and through a second HTTP request it was possible to retrieve all of it. Ticker, owned and delta owned are the only variables that it was not possible to obtain. The transactions crawled go from Decem-

ber 2005 to May 2023, with 10,578 transactions.

3.2.6 SWEDEN

The official website of the Finansinspektionen [24], the supervisory authority that monitors companies in the Swedish financial market, is used to crawl directors' dealings. The data is again presented in a tabular form, requiring to enter another webpage for each transaction in order to retrieve all the data needed, but since all the pages are in the same format, automating an HTML request was the solution. 22,112 transactions are crawled, going from July 2016 to May 2023.

3.2.7 HONG KONG

Notifications of directors' dealings in Hong Kong are found in the website of the Hong Kong Exchanges and Clearing [25], which is the authority that regulates directors' dealings. The website allows various methods of research, but the choice was to run it day by day, and crawl all the transactions in each day. Once a day was researched, an HTTP request was sent in order to retrieve all the data. Most of the data is already available in this page, but in order to save the filing date as well, it was necessary to enter on another page and send another HTTP request. The only information that was not available on this website among the variables being looked for was the change own. The crawled transactions go from February 2002 to June 2023 and there are 434,650 of them.

3.3 DATA CLEANING

Once all the data is crawled, a further test is needed, in order to avoid any errors in the following analysis. These errors may have happened because of two main reasons.

First issue may have been a wrong data entered in the website. Generally, the manager who executed the transaction is required to notify it to a competent authority through some document. It is not known how the data in the document is inserted in tabular form in the different websites, maybe through some automation able to read the file, or it is possible there is a person copying the information into the website. If some country uses the second way, there is

an increased chance of typos, causing an error in the downloaded data. Furthermore, the error may have been caused by the director themselves, since they may have wrote something inaccurately.

Another possible problem is when a director buys or sells shares at a favourable price, due to some previous agreement between the director and the company. This kind of transaction is not uncommon, and it would bias the analysis, since the main objective is to understand if somebody copying the transaction would obtain abnormal returns. But somebody copying the transaction would not be allowed to buy and sell at the favourable price the director is. For this reason, directors who are trading at a share price different from the market one should be excluded.

In order to be certain the data is actually informative, a cross check has been done with the data obtained from S&P CapitalIQ [26], one of the most reliable websites containing, among many other things, the share price day by day of most companies in the stock market. If the crawled price was outside the price range the company was in the specific date of the transaction, then that transaction was not included in the analysis. Furthermore, if the share price of the company was not found in the S&P CapitalIQ database, again the data was not included. The reason behind that is the fact that the absence of the data on the day would mean there is no available data for the company in the future either, making it not possible to analyse the future oscillations of the share price for a comparison with the indices.

In order to be able to check the correctness of the data, the CapitalIQ plug-in for Excel has been used. All the variables of the transactions were inserted in Excel, and given the name of the company a univocal identifier for the company used in the CapitalIQ server was found. Given the identifier, it was possible to access a lot of information about the company. For example, the ticker of the company could be retrieved, the industry the company works in, the share price at any given date, the number of shares the company put in the market, the total market capitalization of the company, and much more. In order to execute the analysis, the data obtained this way was the share price on the day of the transaction, in order to do the comparison previously explained, as well as the share price at various different times after that, in order to check how it changed in the future. This procedure deleted part of the data that was previously found. Table 3.1 contains the data before and after this procedure for each country.

Country	Transactions crawled	Transactions cleaned
United States of America	1, 145, 643	932, 606
United Kingdom	92, 238	85, 412
Germany	57, 473	37, 120
Italy	11, 277	9, 928
Netherlands	10, 578	8, 971
Sweden	22, 112	15, 798
Hong Kong	434, 650	310, 676
Total	1, 773, 971	1, 400, 521

Table 3.1: Total number of transactions.

As it can be seen, some countries seem to have lost many of their transactions. Some of the transactions that have been lost are due to the lack of data for that specific company, or due to some typo in the name of the company that made it not possible for CapitalIQ to retrieve any identifier. In fact, many companies, especially for countries that are usually not taken much into consideration from a financial perspective, did not have the share price historical data, making it not possible to include such transactions. That is the case of Hong Kong, which started to be globally recognised and considered later than the other countries, so most of the transactions, especially the older ones, just have no data that could be used.

In the end, after taking into consideration all of that, the 79% of all the transactions originally crawled made it to the final analysis. Of these transactions, the 64% of them were executed in one of the United States stock markets. In Section 5.1, more insight is going to be given about that.

4

Methodology

In this chapter a brief explanation of how the analysis is going to work is given. As the analysis aims to explain whether director dealings allow directors to gain abnormal returns by buying and selling at the right moment, two different paths are followed.

4.1 HYPOTHESIS TESTING

First thing that is going to be analysed, is the temporal distribution of director dealings, especially in relation to relevant announcements by the company, such as a buyback announcement or an investor transaction. The goal is to check whether after such events, there may be a peak, and if there is, it must be proven significant. The hypothesis which is going to be tested in this part of the analysis is going to be:

The number of transactions in the week immediately afterwards the relevant event is significantly above the average number of transactions per week in the year before and after the event itself.

Several similar tests are going to be ran for purchases and sales separately and for the various types of event. The null hypothesis against which the test is done does not expect any significant peak.

Afterwards, a comparison is going to be ran between the behaviour of a company after a director dealing and the market, according to various different indices. Both the mean and median should be tested on whether the company is outperforming the market. In this case, two different tests are used to check the mean and the median, and in the case of a director purchase mean and median are tested for overperforming the market, while when directors are selling, these values are tested to check if the market is performing better. The hypothesis are going to be:

The average (or median) points of outperformance of the companies with respect to the corresponding market index is significantly above (or below) 0.

Mean and median are going to be tested separately since in some instances they are significantly different the one from the other. Furthermore, the tests are going to be done with the company and market data at 2 years after the transaction, due to the main interest from an investment point of view to get returns on the long run. The null hypothesis in this cases is clearly the opposite, i.e. the mean (or median) are not significantly above (or below).

4.2 STATISTICAL TESTS

Two different tests are going to be used to check if the hypothesis are correct. A brief description of each one of them is given, also explaining why it is a good choice in the specific instance.

4.2.1 ONE-SAMPLE T-TEST

The one sample t-test is a statistical hypothesis test used to determine whether the mean of a sample is different from a given value, providing evidence to reject the null hypothesis [27]. In the specific case considered now, the null hypothesis is that the mean of the sample is not significantly different from the given value. The requirements to perform a t-test are as follows:

- Independence. Each data point must be independent from the others.
- Continuity. The data should be continuous, not categorical.
- Random. The data should be obtained from a random sample of the population.
- Normally distributed. The data should be normally distributed within the population. Since the sample used is generally big, reaching almost one million data points in some instances, so the central limit theorem assures this requirement.

If these assumptions are confirmed, a t-test can be computed as:

$$t = \frac{\bar{x} - \mu}{\frac{S}{\sqrt{N}}}$$

\bar{x} is the computed average of the sample, μ is the given mean, S is the standard deviation and N is the sample size. From the t value obtained it is possible to obtain a p-value. If such p-value is smaller than 0.05, the null hypothesis is going to be rejected in favour of the alternate hypothesis.

4.2.2 ONE-SAMPLE WILCOXON SIGNED-RANK TEST

Since mean and median are often not equal, a t-test cannot work if the aim is to check separately the two of them. The t-test can be useful for proving the mean is significantly different from a given value, but if the median is different, a non parametric test is required, especially a test such as the Wilcoxon signed-rank test [28] that is able to help in case the sample is skewed. The assumption of this test are:

- Continuity. The data should be continuous, not categorical.
- Random. The data should be obtained from a random sample of the population.

The test computes the differences between the values of the sample and the given median, and assigning for each rank the corresponding sign. Through this algorithm a p-value is going to be obtained, rejecting the null hypothesis and proving that the median is significantly above (or below) the given value, i.e. 0, in case such value is smaller than 0.05.

5

Analysis

First thing to be discussed in this chapter, is going to be some descriptive statistics, in order to get some more understanding of the data. After that, the main questions presented in Section 1.3 will be given an answer, showing what has been found analysing the data.

5.1 DESCRIPTIVE STATISTIC

5.1.1 DISTRIBUTION OF COUNTRIES

The first thing to be checked is the distribution by country. As previously seen, the great majority of director dealings come from the United States. They are followed, at a great distance, firstly by Hong Kong, then by the United Kingdom. After that, all the other European countries are lined up, with many less transactions to be found. One of the main reasons for this is the fact that some of the European countries had their first transactions recorded later than the US. As an example, Italy only had their first transaction to be crawled in 2016.

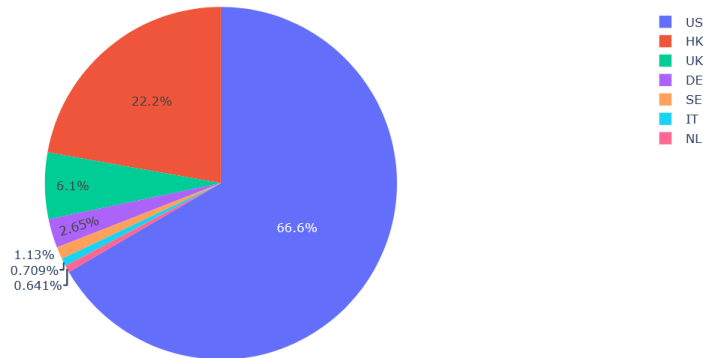


Figure 5.1: Pie chart of the number of transactions executed in each country.

DISTRIBUTION OF EXCHANGE MARKETS

Since in the same countries there may be few different exchange markets, it can be interesting to check which markets are the primary listing for the most busy companies with transactions. As shown in Figure 5.2, the first, third, fourth, seventh and tenth are all American stock markets, where different kinds of companies have their main listing. The New York Stock Exchange (NYSE) is actually the first stock exchange in the world for market capitalization, and it is shown here that it is also the first one in the world according to the number of transactions executed by directors in companies listed in it.

The Stock Exchange Hong Kong (SEHK) is the second one of this list. The percentage of companies that have their primary listing there and the percentage of transactions executed in Hong Kong is different. This can be explained by the fact that there may have been directors dealings executed in Hong Kong for companies that do not have their primary listing in Hong Kong. Another interesting thing to be noticed is the presence of the Over-The-Counter PinK sheets (OTCPK) [29]. Those are companies not listed in any major stock exchange, but that can be traded anyway over-the-counter, on a decentralized market, usually not having all the requirements physical markets have on the companies that want to be listed in them. The plot shows that there is a 6% of transactions executed on such companies. Those are generally smaller companies, which accept to be traded on a broker-dealer network.

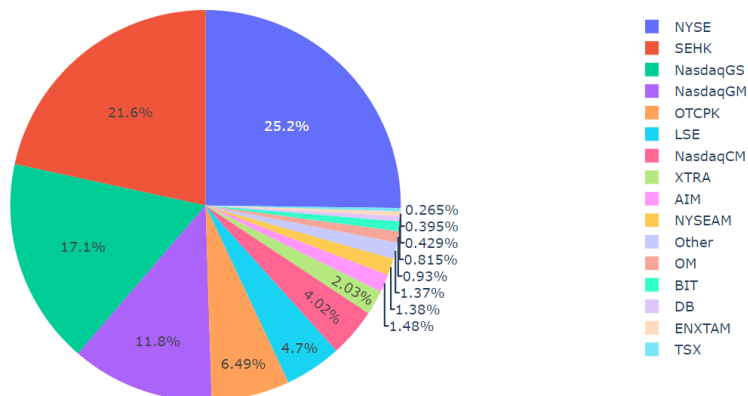


Figure 5.2: Pie chart of the number of transactions executed on companies in each market exchange.

5.1.2 DISTRIBUTION AMONG YEARS

While plotting the distribution of transactions over the years, it is possible to notice an increase of director dealings throughout the years, starting from the year 2004 (the first complete year with transactions from the United States and Hong Kong) till the year 2007. 2008 seems to have slightly less transactions, then 2009 is definitely under-performing compared to the previous years. This is certainly caused by the 2008 crisis. Many people and many directors lost their faith in the financial possibilities and maybe most of their money, so it makes sense that there are less transactions, even by directors. Afterwards, the number of transactions started to increase again, till 2021, when the peak was reached, surpassing the peak of 2007. However, since some countries have only been crawled starting from the years 2015/2016, there is more data that can cause the peak. In fact, removing Netherlands, Sweden and Italy, it would seem the peak is slightly below the 2008 crisis. Therefore, it seems that there are not yet as many director dealings as before the crisis.

5.1.3 DISTRIBUTION OF INDUSTRIES

In the whole dataset of transactions, according to CapitalIQ, there are in total 159 possible primary industries the company whose directors traded are in. Considering the frequency of trades in each one of them, it is possible to notice that there are only three industries above the 3% mark in term of director dealings executed within them, and these are regional banks,

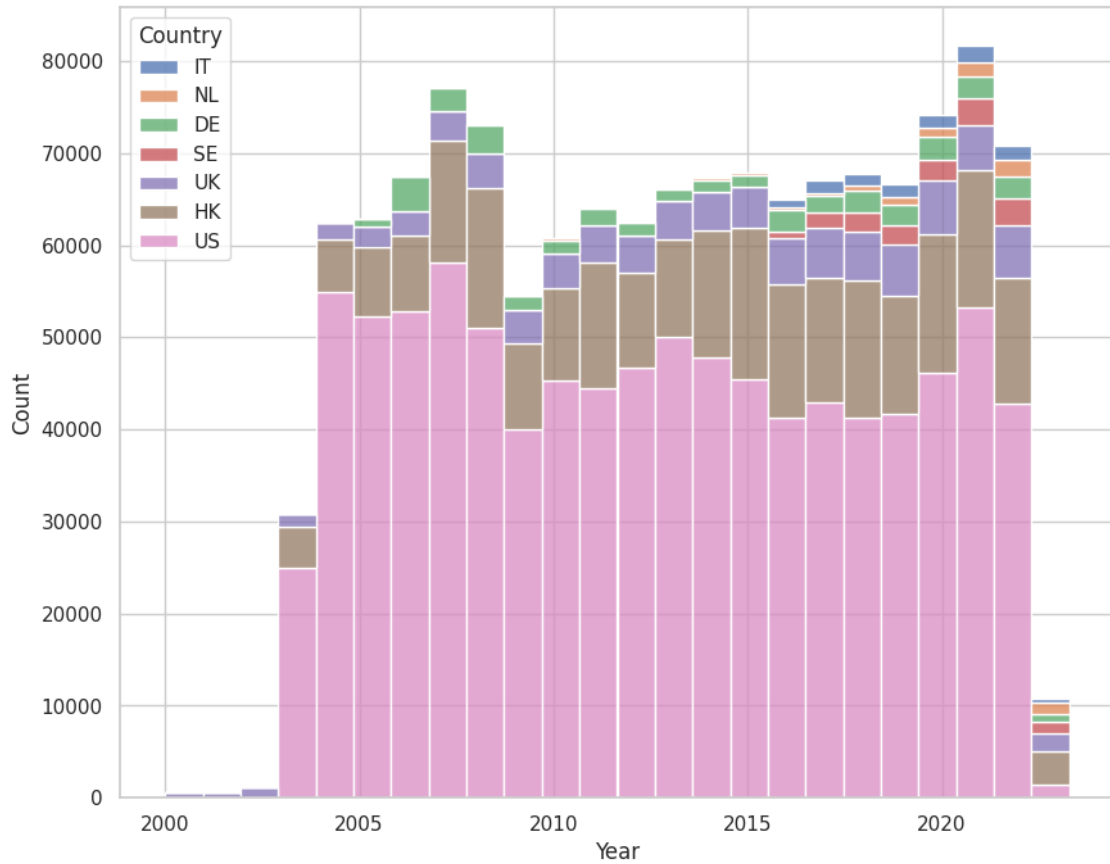


Figure 5.3: Distribution of the transactions throughout the years, with the colours changing according to the country in which the transaction was executed.

biotechnology and application software. Afterwards, the percentage goes quickly down, and 124 industries are sharing the 64.1% of the dataset, as shown in Figure 5.4. It is certainly possible to say that some sectors have more transactions than others, but at the same time, it is unlikely something happening only with director dealings. The top ones are just sectors with a lot of companies and a lot of work being done.

5.1.4 DISTRIBUTION OF MARKET CAPITALIZATIONS

As explained in Section 2.4, some indices are introduced in order to be able to make a comparison with companies of various possible sizes. Such indices are:

- Dow Jones Global Titans 50, for the mega companies, which in this thesis are going to

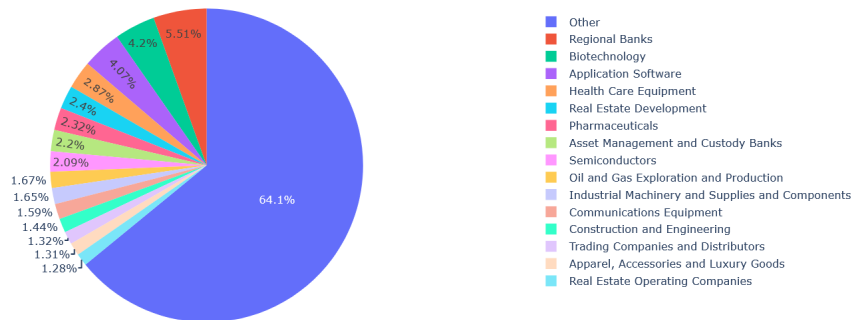


Figure 5.4: 15 industries with the most director dealings, all the others are inserted together as 'Others'.

be those with a market capitalization of above 200 billion dollars USD.

- MSCI World, which is going to be the comparison for large companies, whose market capitalization is between 10 billion and 200 billion USD.
- MSCI World Midcap, comparison for middle companies with a market capitalization between 2 billion and 10 billion USD.
- MSCI World Smallcap, used with small companies, having a market capitalization between 300 million and 2 billion USD.
- Russel Microcap Index, the comparison for micro companies, which have a market capitalization between 50 million and 300 million USD.
- None for nano companies with a market capitalization below the 50 million USD

Follows, in Figure 5.5, the distribution of transactions in companies according to their market capitalization. Apparently, most of the transactions are executed by directors of companies in the small range. The mega range is very small in comparison to the others, but it makes sense, considering the fact that there is only a handful of companies with such a big market capitalization. However, in a big company there are generally more directors than in a very small one, hence there are still a total of 13,914 transactions in this range.

5.2 TEMPORAL DISTRIBUTIONS

Director dealings may happen all year around, depending on my factors. The director may just believe in the company and buy shares or may just have too many shares or they are in need of

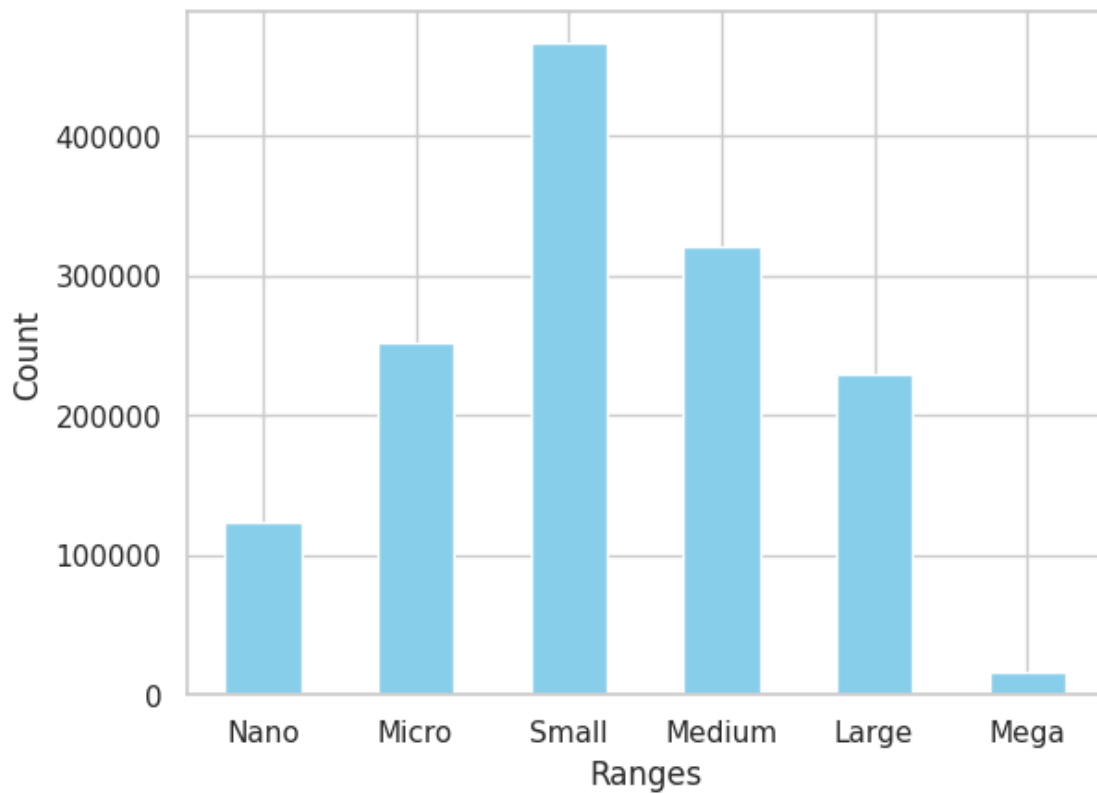


Figure 5.5: Number of transactions executed in companies in each market capitalization category.

money and they sell. However, under certain circumstances, a director is more likely to trade their shares. For example, a director is generally not allowed to trade immediately before an important announcement to the public, because this way they would be using some relevant information, hence incurring in insider trading. Such announcements could be a change in the board of directors, the announcement of some new product by the company, the publication of financial statements, or the announcement of a buyback or of a big investment by a private. In the next subsections, there is going to be an analysis on whether a director is more likely to trade immediately after a buyback announcement or an investor transaction. For each one of them, there is going to be a separate analysis for purchases and sales of shares by a director, since they would have different meanings.

5.2.1 DIRECTOR DEALINGS IN PROXIMITY OF BUYBACKS

After a buyback is announced, many transactions are expected. In fact, if a director is selling or buying shares, it is probably due to the buyback itself, since in a certain way it is causing a change of the status quo. If directors are buying shares after a buyback, it may be because they are trying to earn as much as possible from the buyback itself, since it is supposed to increase the value of the shares. On the other hand, a director who is selling their shares, may be doing so thanks to the buyback, since it would be an easy way to sell many shares directly to the company, without waiting for somebody else to try and buy them.

The case of a director purchase immediately after a buyback is considered first. Figure 5.6 shows the difference of weeks between the date of a buyback announcement (which is the value 0) and the date of a purchase by a director in the same company. The null hypothesis in this situation is that the peak following the buyback announcement is not significantly different from the mean. However, through a t-test it is proven that the peak is indeed significantly different than the mean of the sample.

It is important to notice that the director dealings executed in the same day as the buyback announcement are not going to be included in any way in the analysis, since it is not possible to know if the director executed the transaction before or after the announcement itself.

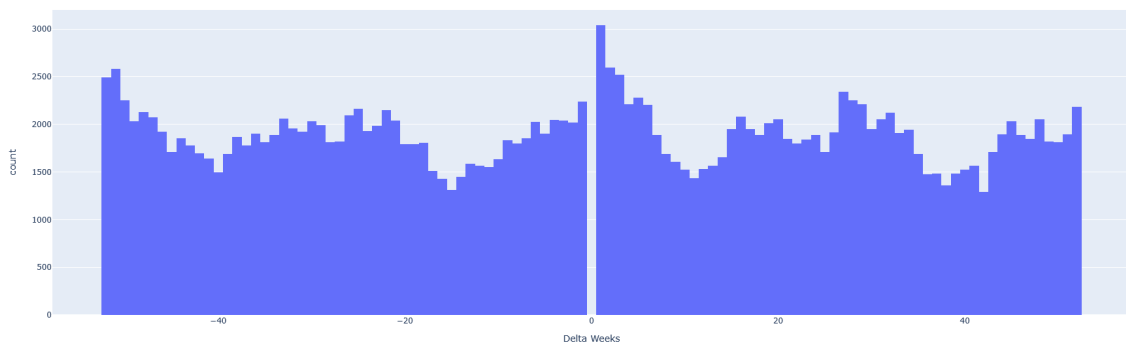


Figure 5.6: Distribution of director purchases in the year preceding and following a buyback announcement.

This proves that directors tend to purchase much more immediately after a buyback announcement, hoping to gain from the following deletion of shares from the stock market, gaining more from the dividends and hoping for an increase in the share price.

Immediately before the buyback announcement a minimum could be expected, since the directors shouldn't be allowed to trade using their privileged knowledge if that could significantly

change the share price, and a buyback could certainly do so. But the week immediately before is not significantly different from the mean, and that could be explained by the fact that not all the directors know about the upcoming buyback, but only the top directors, hence the average director could be trading normally. On the other hand, it could also be possible that some directors with this knowledge may be buying shares, even if that is illegal, hoping for nobody to notice, especially in markets such as the Hong Kong one where directors do not risk very much even if they are caught doing so.

The opposite case is going to be considered now. Directors may also be willing to sell their shares as soon as a buyback is announced. As Figure 5.7 shows, in the weeks following it, there is a peak of sales. Again, the null hypothesis is that the value of the peak is not significantly different from the average of the sample, but through a t-test it is proven that both the first and second week are much above the average, and the result is certainly significant.

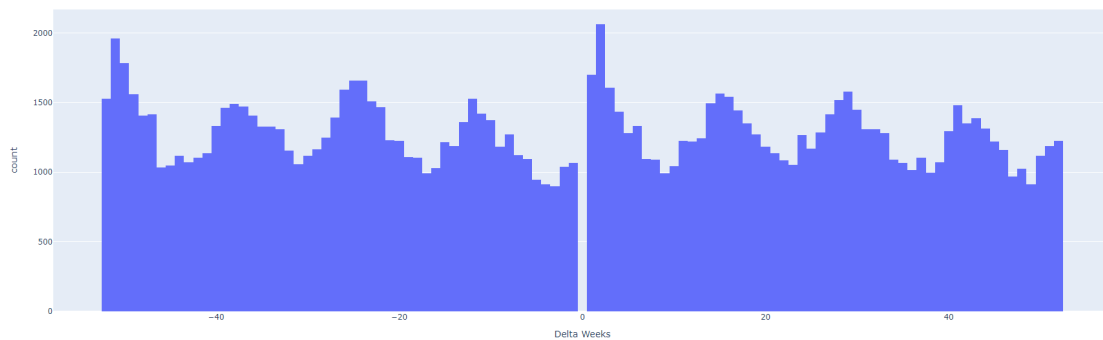


Figure 5.7: Distribution of director sales in the year preceding and following a buyback announcement.

Directors may be willing to sell for two main reasons. First one is the great amount of shares in their possession, and a buyback would allow them to get rid of them very easily. Furthermore, it is not uncommon for the company to do a fixed-price buyback, buying their shares at a fixed price that is above the market value. If a director does not believe the company will reach that value in the future, it would be a very good opportunity to earn something by it.

5.2.2 DIRECTOR DEALINGS IN PROXIMITY OF INVESTOR TRANSACTIONS

A similar analysis could be done checking for a correlation between the date of an investor transaction. Two cases are going to be analyzed: whether there is a peak of director purchases after an investor purchase and whether there is a peak of director sales after an investor sale. Checking for purchases after investor sales and for sales after director purchases does not seem to be

interesting, since there would be no hypothesis to be proven in this specific case. However, the graph is going to be shown anyway for completeness.

First case is the purchase of shares by a director immediately after an investor purchase. In Figure 5.8 a peak can be clearly found in the week following the investor transaction. The null hypothesis is the same as in the previous paragraph, i.e. the number of transactions in the week following an investor purchase is not significantly different from the average number of purchases in all the other weeks of the sample. Thanks to a t-test it was proven that the number of transactions is significantly different, and there is a clear peak immediately after the event.

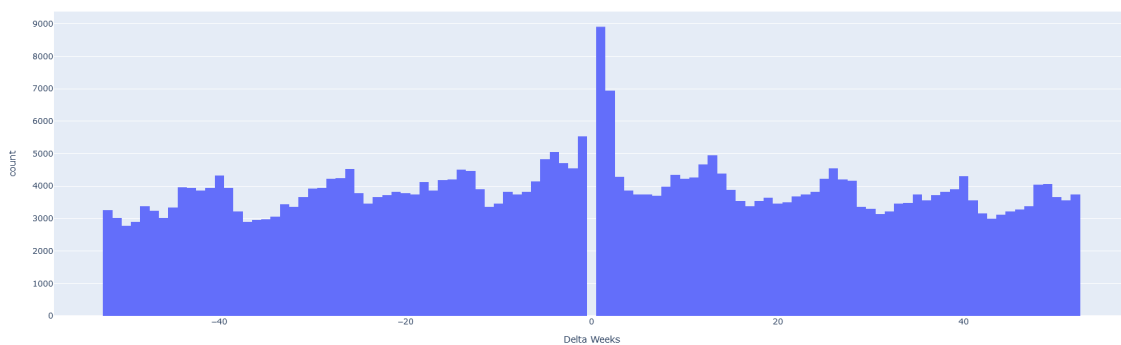


Figure 5.8: Distribution of director purchases in the year preceding and following an investor purchase.

It is proven that directors tend to buy as well when they see a big investor buying shares. The logic in that is probably the fact that seeing someone investing such a big amount of money in the company makes them believe it will help the share price to increase in the future. One reason is the fact that other people may decide to follow such a big investor, who certainly decides to invest in something after a good analysis of advantages and risks in it, and the director may be buying just to sell as soon as people stop being so interested in buying, since the boost may have stopped. Another reason may be that the directors believe that such an investor is going to bring value to the company itself and make it grow, thanks to their investment.

Next case is the situation in which directors are selling after an investor sale. Figure 5.9 shows that there is a peak immediately after the investor transaction. Considering the null hypothesis that the number of director sales in the week following an investor sale is not significantly different from the average, it is proven through a t-test for this hypothesis to be wrong, and the peak is indeed significant.

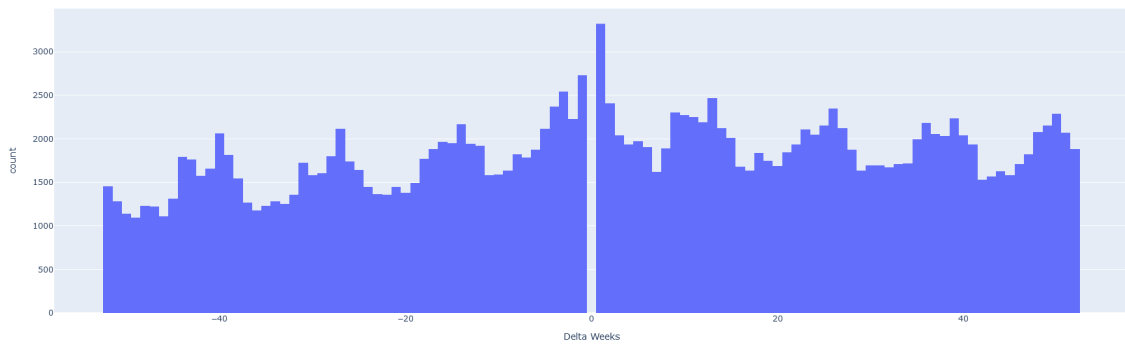
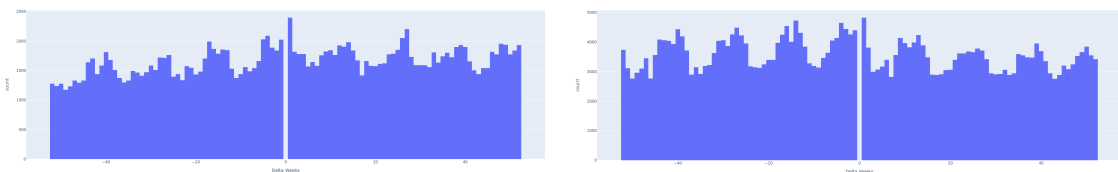


Figure 5.9: Distribution of director sales in the year preceding and following an investor sale.

This result shows that directors increase their sales in the week after a big investor decides to leave (or reduce the number of shares in) the company. This may be due to the fact that they may think the investor is leaving because he does not trust the company to give them earnings anymore or because they are simply scared that an investor leaving may lead other people to leave as well. Hence, in order to avoid to lose too much money, they are just selling their shares as long the share price is high enough.

Now the cross cases are going to be briefly considered. A peak in director purchases can be clearly seen in the week immediately after an investor sale. At the same time, a peak in director sales can be found after an investor purchase, even if less evident. In these cases, no specific reason can be found for these peaks. The most probable scenario is that the investor transaction made the market react with many transactions and directors where in the middle of it without even considering the investor transaction in the first place. However, nothing more can be said about these specific instances.



(a) Distribution of director purchases around investor sales **(b)** Distribution of director sales around investor purchases

Figure 5.10: Distributions of director dealings in the year preceding and following an investor transaction in the case of transactions being the opposite.

5.3 INDICES COMPARISON

After considering some temporal distributions and checking possible reasons for directors to buy and sell their shares, the following question is whether a director dealing is actually giving directors extra gains. Checking if the share price increased in the years following a transaction is generally not a good idea when trying to determine the effectiveness of director dealings because on average the market grows by 8% every year. Therefore, taking a big number of random transactions, the average return after one year would be close to 8%.

Taking this 8% return would be a better approximation to reality, in order to understand if a transaction gave better returns than the market average, but taking a constant would be problematic as well, because the market may have better or worse years, being the 8% just an average over the last few decades [30]. For this reason, it is better to make a comparison with some indices that may be able to better represent the reality of the market day by day. In order to do so, indices that are based on the market are used as a comparison, and the most commonly used is the MSCI World.

As shown in Figure 5.11, companies seem to outperform the market, and the outperformance increases with time. It is also interesting to notice that the mean is above the median, meaning that there are some directors that are performing much better than the others, thus increasing the mean much more.

A similar analysis could be done with sales executed by directors in Figure 5.12. However, the companies are outperforming the market again. For the director to gain more than they would have staying in the company, it would have made sense for the market to outperform the company, since that would mean the director understood when to sell before the company started losing value, but that does not seem the case. However, this does not mean that the directors were not able to gain money through these sales, because it is certainly possible for the company to have been growing for some time, and it just did not stop this growth once the director went out.

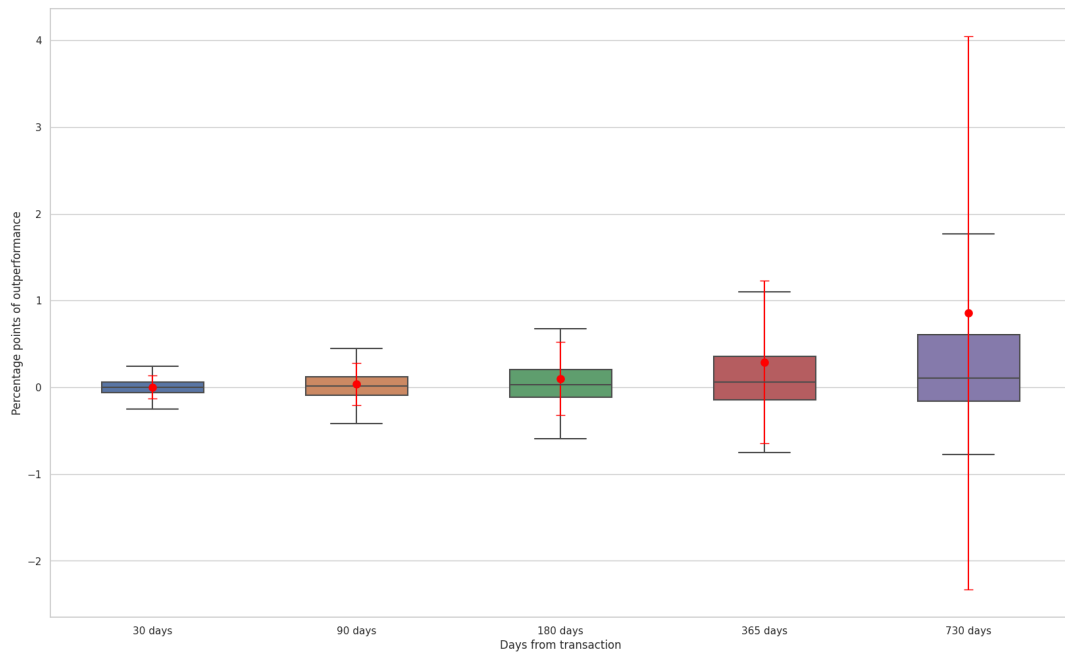


Figure 5.11: Percentage points of outperformance between the company share price change after a director purchase and the MSCI World index at different time frames. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

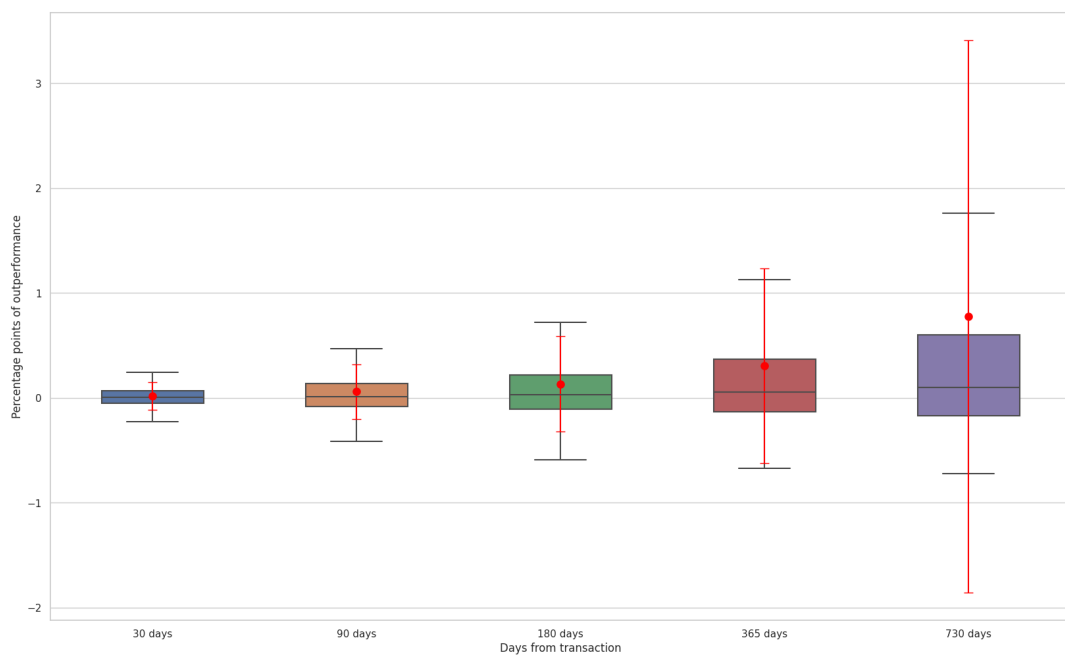


Figure 5.12: Percentage points of outperformance between the company share price change after a director sale and the MSCI World index at different time frames. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

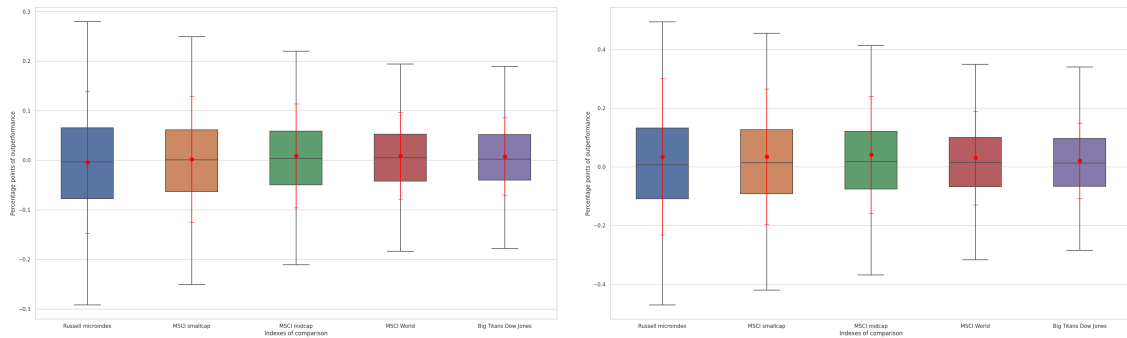
However, there is a problem with the analysis ran. Different chunks of market could behave differently from each other. The MSCI World index uses many companies in order to analyse how the market changes, but it is mainly weighted according to the market capitalization of the companies. For this reason, smaller companies are not fairly represented by this index. Furthermore, smaller companies are more likely to change enormously their share price in very little time while bigger companies are able to change only at a slower rate. In order to avoid such errors, the other indices presented in Section 2.4 are going to be used. A different index is going to be used for each market capitalization range presented in Section 5.1.4. No index is going to be used for the smallest companies, due to the lack of an index able to follow their movements. The percentage points of outperformance at different times are going to be shown, for comparison sake, although the main focus is put on the results after two years, since investors are generally more interested on the long run.

The comparison between director purchases and indices is going to be shown first in Figure 5.13 and Figure 5.14. According to the results, small companies are the ones which tend to move more from their respective index, while the biggest ones tend to stay closer to the 0 value, although there appear to be share prices which greatly outperform the Dow Jones Big Titans index as well. Furthermore, mean and median seem to diverge from 0 for smaller companies as well. Testing the values of mean and median through t-tests, the null hypothesis, that mean and median are not significantly above 0 at different time frames, is proven wrong once enough time has passed. These values are significantly different from 0, thus proving the purchases to be generally effective.

This is very important, because this means that if directors are copied just after they notify their transactions, after two years there is a positive return compared to the market, thus making it a profitable investment.

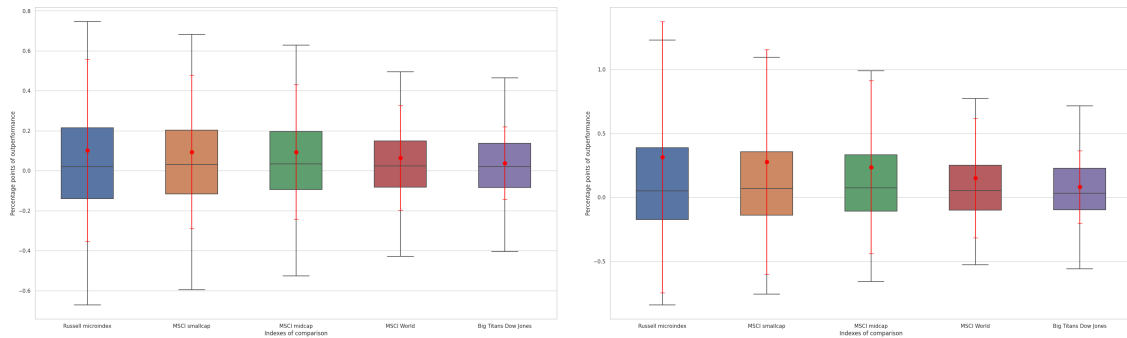
An analogous analysis is ran for the sales executed by directors. This time the null hypothesis is going to be that mean and median are not significantly below 0 at the various time frames. The same times are going to be considered and the same divisions for market capitalization. In order for sales to be giving extra gains to directors, the median and mean are expected to be below 0, since the market would be outperforming the market.

Considering Figure 5.15 and Figure 5.16 it is clear that the results are not as good as they were for the purchases. It often seems like the company is still outperforming the market after the director sale, in none of the cases the null hypothesis can be proven wrong through t-tests and



(a) Percentage points of outperformance at 30 days from purchase

(b) Percentage points of outperformance at 90 days from purchase



(c) Percentage points of outperformance at 180 days from purchase

(d) Percentage points of outperformance at 365 days from purchase

Figure 5.13: Percentage points of outperformance between the company share price after a director purchase and the various indices for each market capitalization group and at different time frames. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

as such it is possible to confirm that director sales are not able to predict the future changes of the market.

It is relevant to underline the fact that the results obtained are not saying that directors are not gaining money by selling their shares when they do, because it is possible for the directors to have previously purchased their shares at a very good time. Then they may just sell once the share price has already increased, without actually considering the future possibilities of the company. However, it is relevant to notice that this may not apply for an investor, who should not follow directors, according to this analysis.

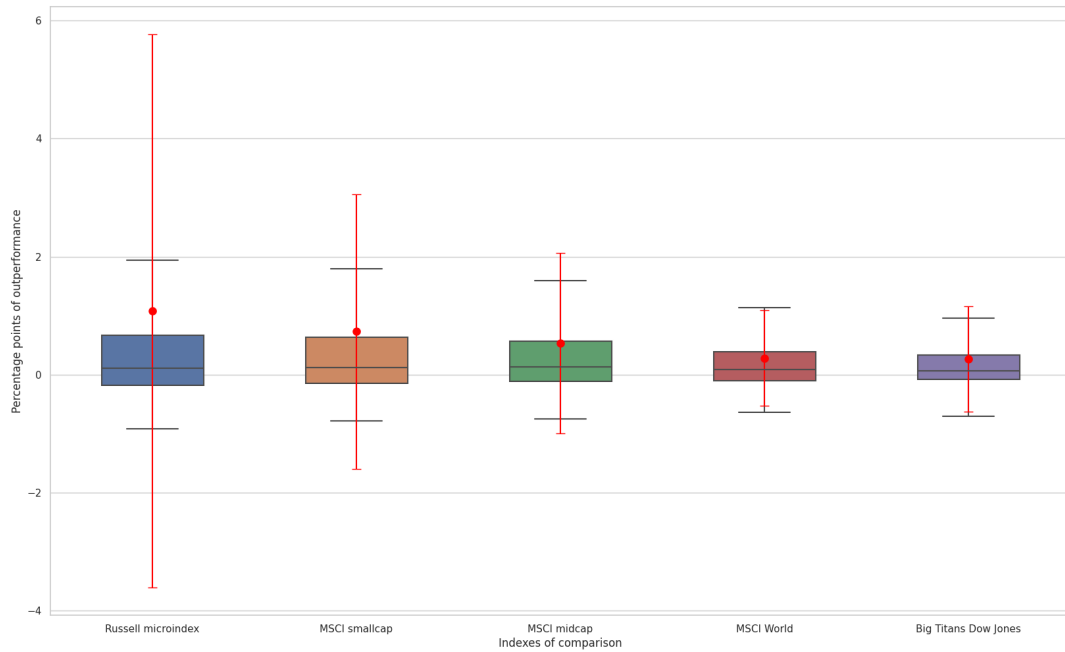


Figure 5.14: Percentage points of outperformance between the company share price after a director purchase and the various indices at 730 days from the transaction. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

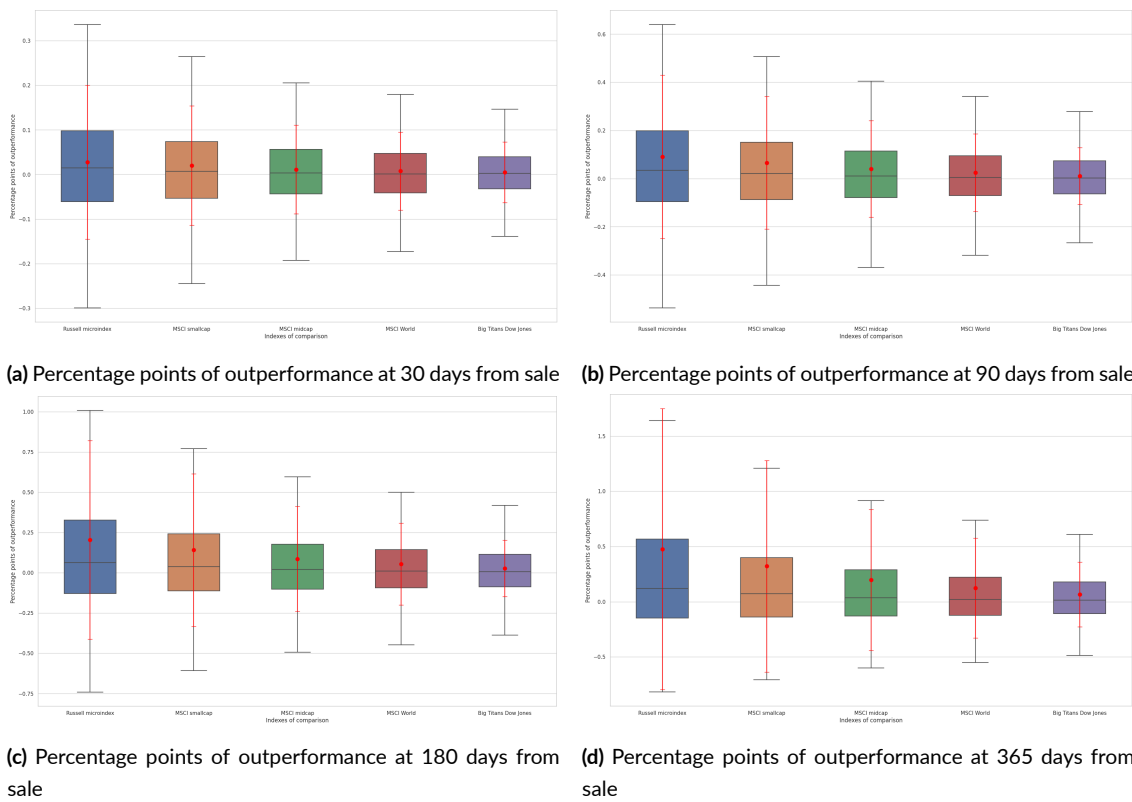


Figure 5.15: Percentage points of outperformance between the company share price after a director sale and the various indices for each market capitalization group and at different time frames. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

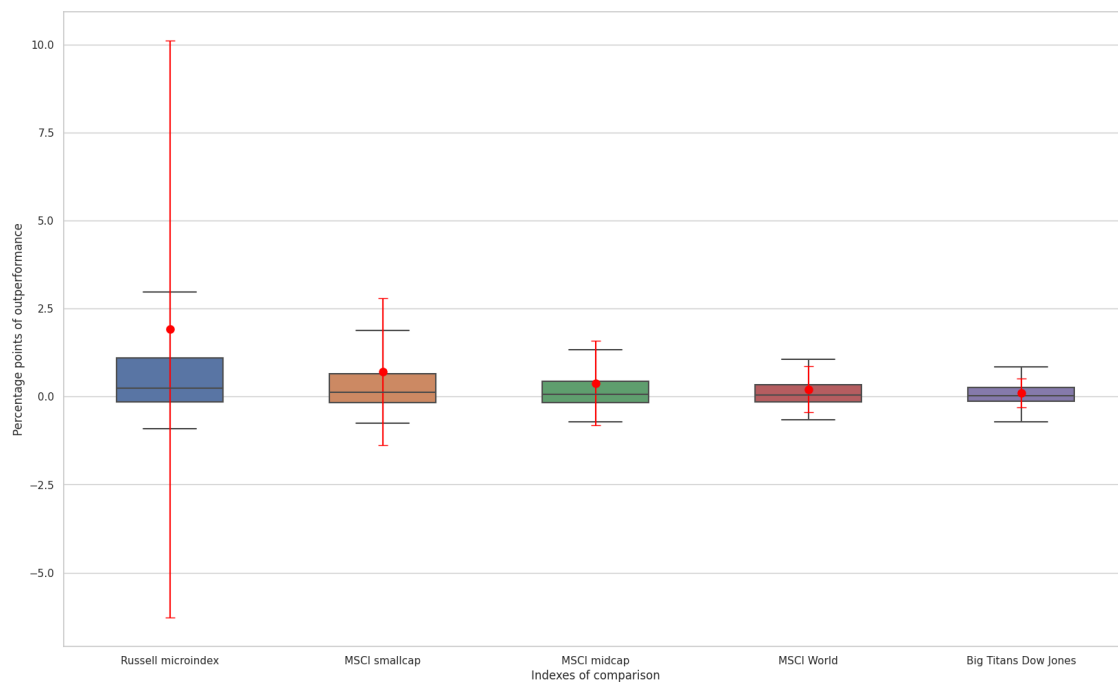


Figure 5.16: Percentage points of outperformance between the company share price after a director sale and the various indices at 730 days from the transaction. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

5.4 INDICES COMPARISON AFTER BUYBACKS

Since buybacks have already proven to give some insight regarding the behaviour of the share price in the months and years following the announcement (as proven by Reintjes [9]), it is interesting to check whether the presence of both a buyback and a director dealing is able to give an even stronger signal. In order to do so, the database of buybacks already used in Section 5.2.1 is merged with the database of director dealings, including only the director dealings being done in the 30 days following a buyback announcement in their same company.

Since it was proven that buybacks are able to make the company outperform the market, it would be especially interesting to check whether a director purchase is giving a stronger signal thanks to the help of a buyback, rather than a director sale. The latter case is particularly problematic to consider, since it was already proven that director sales are not able to produce significant results, and a buyback would be pushing for the sale to be even less significant. The case is going to be considered anyway for the sake of completeness. The analysis is ran again dividing the sample into different sizes of market capitalization, in order to have a better index

of comparison.

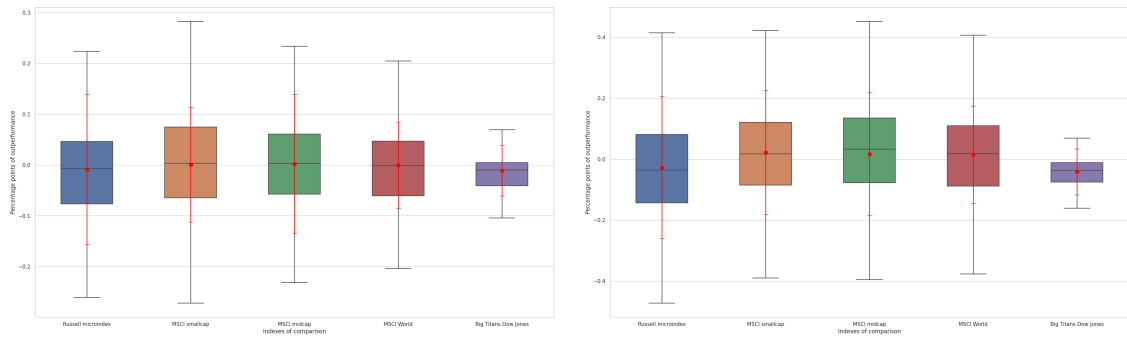
The number of transactions included in this analysis is going to be smaller than before, since for each buyback, only the transactions in the 30 days following it are going to be included. However, due to the big dataset of data crawled, this new reduced sample is going to have enough data to make the analysis significant. For each category, the number of transactions included is as presented in Table 5.1

Market capitalization size	Number purchases	Number sales
Nano	368	68
Micro	1,663	563
Small	3,783	1,920
Medium	3,417	2,621
Large	2,595	2,059
Mega	584	143
Total	12,407	7,374

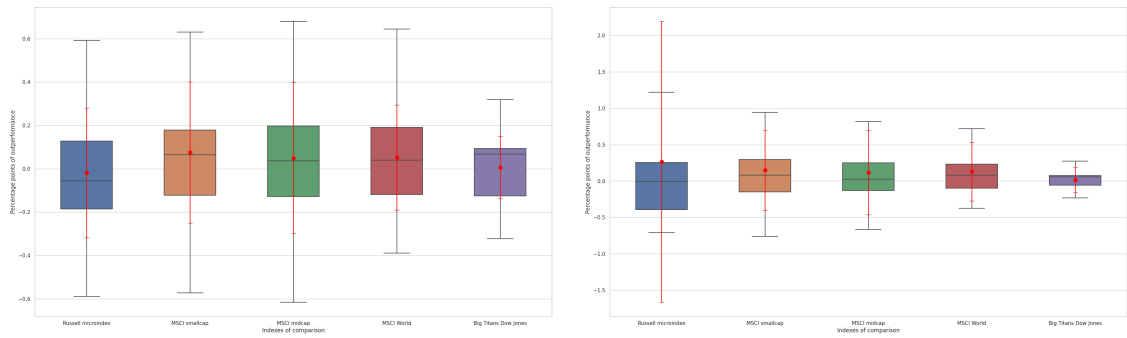
Table 5.1: Total number of transactions executed in the 30 days after a buyback announcement.

First thing one can notice, is the fact that the total number of transaction is extremely reduced compared to all those that were crawled. Only the 0.6% of the original sample is made of transactions executed in the month following a buyback announcement. It is also particularly interesting to notice that the number of sales has been reduced the most. In particular, only 0.5% of the sales are done after a buyback announcement, while 0.67% of the purchases are in this time period. This fact may be caused by the fact that in the period following a buyback announcement, directors tend to buy shares, rather than selling them, although as seen in Section 5.2.1 there is a peak of sales as well in the week after the announcement.

The category containing the nano-companies is not going to be included due to the lack of a proper index able to represent their market, so the very few transactions in this category are not going to negatively influence the outcome. The mega-companies have very few transactions as well, although in percentage it is the category that lost the least number of transactions. They are going to be included in the analysis anyway.



(a) Percentage points of outperformance at 30 days from purchase (b) Percentage points of outperformance at 90 days from purchase



(c) Percentage points of outperformance at 180 days from purchase (d) Percentage points of outperformance at 365 days from purchase

Figure 5.17: Percentage points of outperformance between the company share price after a director purchase (executed in the 30 days following a buyback announcement) and the various indices for each market capitalization group and at different time frames. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

Considering director purchases after a buyback, only the median of the three central cases, that is for small, medium and large companies, is significantly above 0, while the mean is significantly above 0 for all the categories apart for the mega-companies (according respectively to Wilcoxon test and t-test), as can be graphically seen in Figure 5.18. Only large companies seem to have comparable results concerning mean and median after two years, in the case only including transactions after buyback announcements and the general case. For all the other categories of companies, the results obtained are below the values obtained in the previous section. This proves that buybacks and director dealings, although able to give evidence regarding the fact that the company is going to outperform the market, when together do not make such prediction more significant. However, checking the difference in the values of median and mean gives some interesting insight, as in Table 5.2.

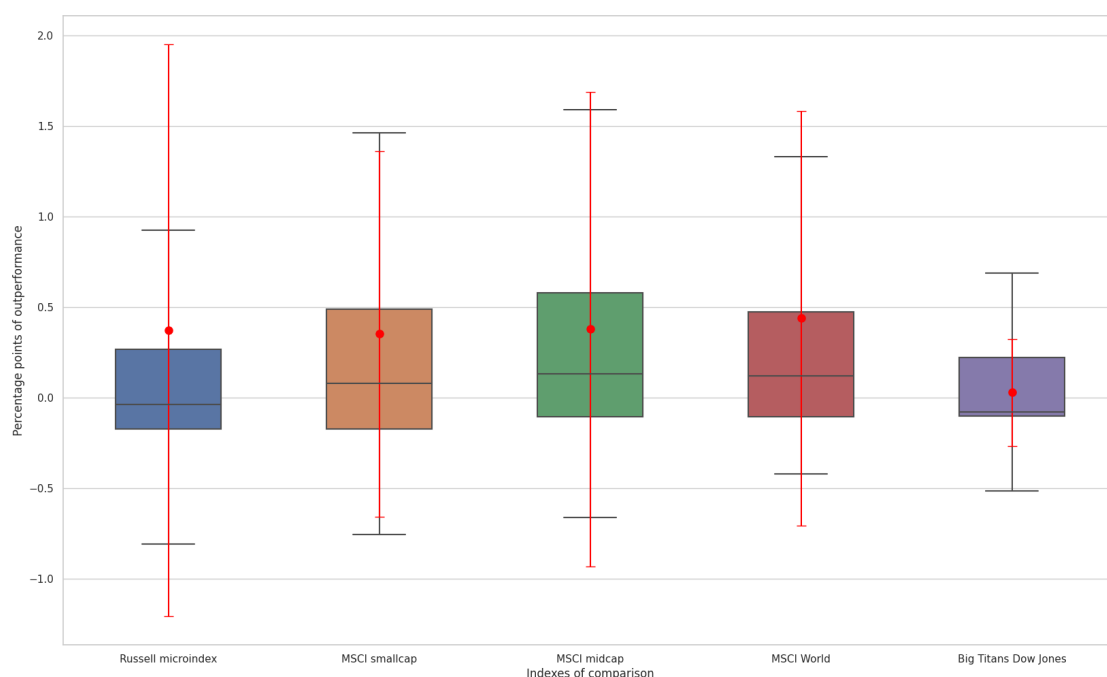


Figure 5.18: Percentage points of outperformance between the company share price after a director purchase (executed in the 30 days following a buyback announcement) and the various indices at 730 days from the transaction. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

Market capitalization size	Mean	Mean after buyback	Median	Median after buyback
Micro	1.08	0.37	0.11	-0.04
Small	0.73	0.35	0.12	0.08
Medium	0.53	0.38	0.13	0.13
Large	0.28	0.44	0.09	0.12
Mega	0.27	0.03	0.06	-0.08

Table 5.2: Mean and median of the percentage points of outperformance after 730 days from the transaction in the case including all transactions and the case only including purchases in the 30 days following a buyback announcement.

The only case in which the purchases executed in the month following the buyback gave better results, was for large companies. This is also the only case in which it is actually interesting to check if mean and median are significantly different from the general case. Through a t-test for the mean and a Wilcoxon test for the median, it is proven that the values obtained are indeed significant. This proves that only in this specific instance buybacks and director dealings are

able to give stronger evidence for the upcoming results by the company with respect to the rest of the market.

The same analysis is done for sales in the month immediately following a buyback announcement. Again, a comparison between mean and median of this specific case and the general one is shown in Table 5.3. In this case, the presence of the buyback announcement, is an indicator of the fact that companies are not able to outperform the market as well as they would. However, being this the case of sales, it would actually make more sense from the director perspective if the market was growing more than the company itself. It is interesting to notice that the median for mega companies is below 0, however it is not far enough to make it significant according to the t-test ran, hence not even in this case it is possible to say that sales have a median significantly below 0.

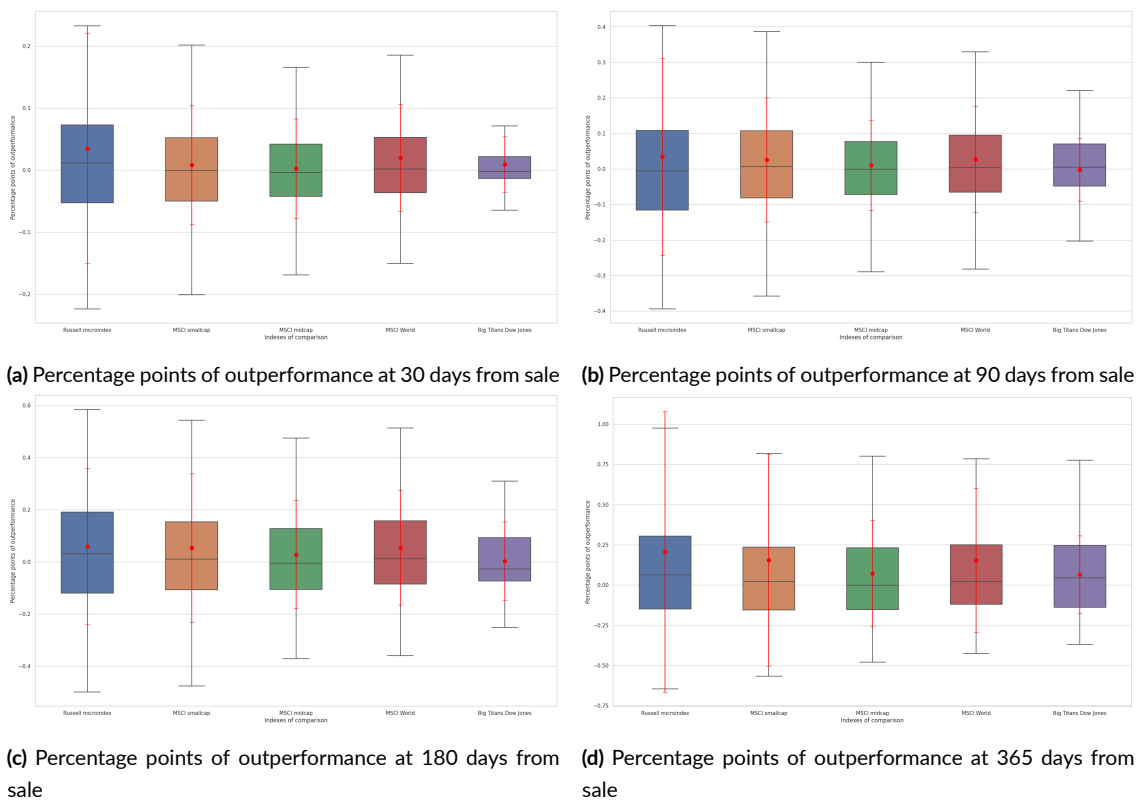


Figure 5.19: Percentage points of outperformance between the company share price after a director sale (executed in the 30 days following a buyback announcement) and the various indices for each market capitalization group and at different time frames. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

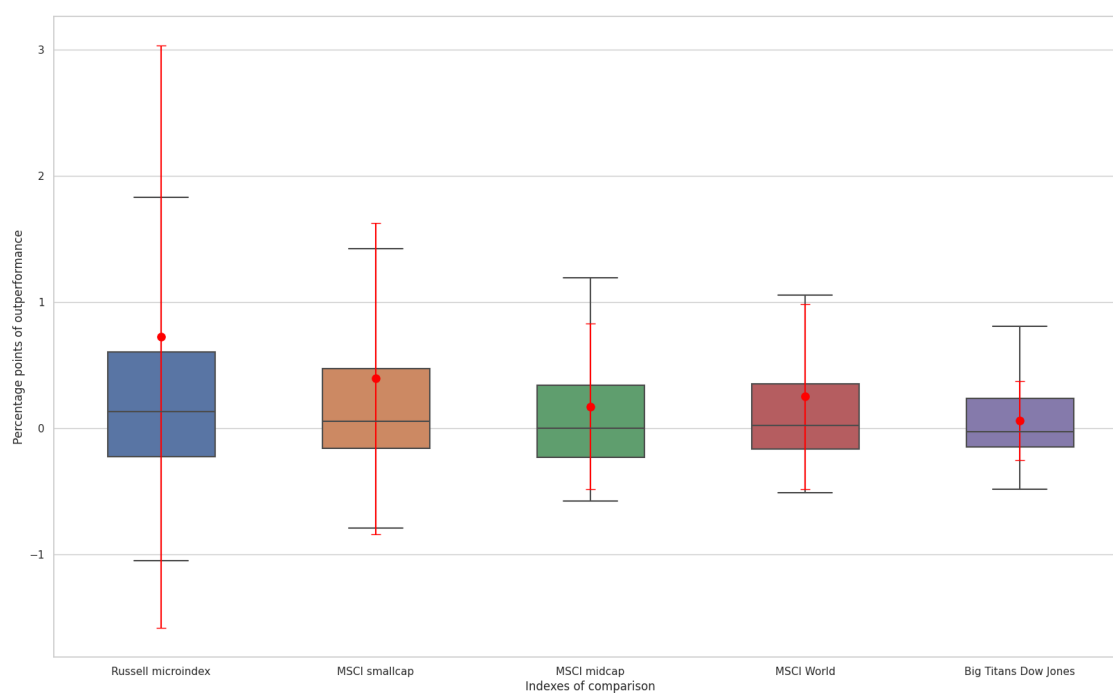


Figure 5.20: Percentage points of outperformance between the company share price after a director sale (executed in the 30 days following a buyback announcement) and the various indices at 730 days from the transaction. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

Market capitalization size	Mean	Mean after buyback	Median	Median after buyback
Micro	1.91	0.72	0.24	0.13
Small	0.71	0.39	0.12	0.05
Medium	0.38	0.17	0.06	0.00
Large	0.21	0.25	0.04	0.02
Mega	0.10	0.06	0.03	-0.03

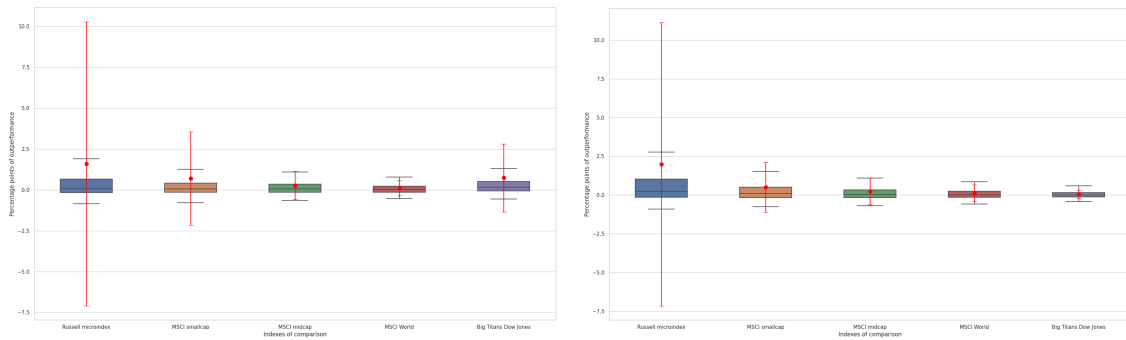
Table 5.3: Values of mean and median after 730 days from the transaction in the case including all transactions and the case only including sales in the 30 days following a buyback announcement.

5.5 ANALYSIS BY COUNTRY

Next follows an analysis by country, in which for each one of them it is going to be checked which category of company better behaves and also if some country is reacting differently to director dealings. In order to avoid too many graphs for each country, only the out-performance after two years is going to be shown for purchases and sales.

5.5.1 UNITED STATES OF AMERICA

The American market is the biggest one and it includes most of the transactions of the sample, therefore the results are expected to be at least similar to the ones obtained in the general case. As can be seen in Figure 5.21, the Russell microindex is abundantly surpassed both in median and average, although the average is much more above the 0. In the general case, it was possible to notice that smaller companies were performing much better than the bigger ones, although in the purchase case in the United States, it is possible to notice that the biggest companies, the ones that have the Big Titans Dow Jones index as a reference, are actually performing at the same level as the small companies, while medium and large companies are not as good. Through proper significance tests, all of the medians and means are significantly above the value of 0. When considering the sales, all of the means are above 0, but for the mega companies, the median is actually below 0 and the result is proven to be significant thanks to the Wilcoxon signed-rank test. In the USA it appears that on a median level, directors of mega companies are actually able to sell at the right time. Unfortunately, on an average level, it does not work.



(a) Percentage points of outperformance at 730 days from purchase

(b) Percentage points of outperformance at 730 days from sale

Figure 5.21: Percentage points of outperformance between the company share price after a director transaction and the various indices at 730 days from the transaction, only for US. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

5.5.2 UNITED KINGDOM

First interesting thing to notice in the United Kingdom is the lack of transactions in the mega range. Only a handful of sales is executed within a company big enough, so this range is not going to be considered due to the lack of data. When looking at the other ranges, especially at the

micro range, it can be noticed the fact that it is not as varied as it was in the United States. The whiskers are slightly bigger, but not even close to how big they were in the US case. Through the two statistical tests, means and medians of the out-performance points of percentage are proven to be significantly above the 0 for purchases, while none of them is proven to be below 0 when it comes to sales.

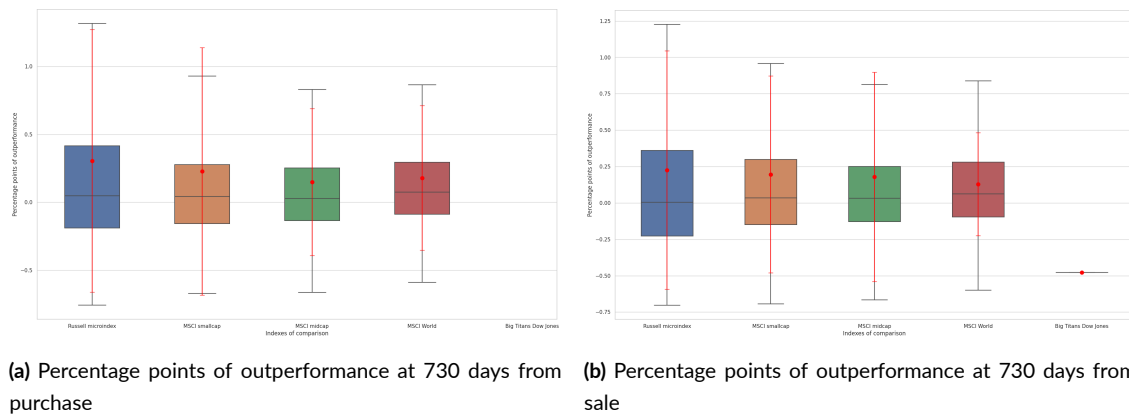
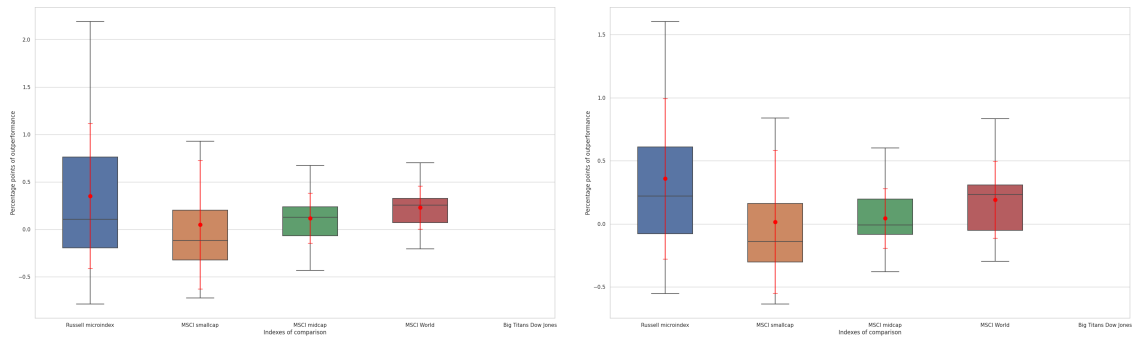


Figure 5.22: Percentage points of outperformance between the company share price after a director transaction and the various indices at 730 days from the transaction, only for UK. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

5.5.3 ITALY

Italy has no transaction for a mega company in it. Only micro to large companies are therefore included in the analysis. For purchases, the MSCI smallcap index is able to outperform Italian companies when it comes to the median, while the mean is doing slightly better than the index. In the end, only micro, middle and large companies have a median significantly above the 0, while the mean is significantly above this value for all the market ranges.

For sales, both the smallcap and the midcap indices are outperforming the companies in their range when considering the median, and through a Wilcoxon test, they are both significantly below 0. When considering the mean, however, none of the market ranges obtain results able to significantly outperform the companies.

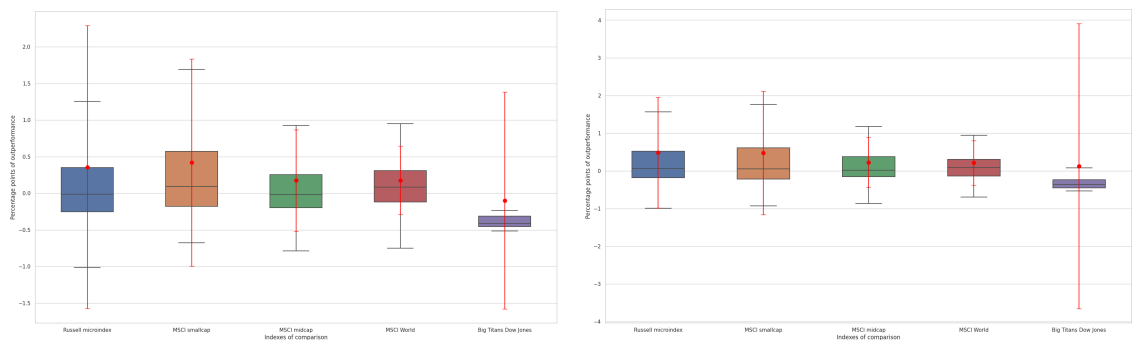


(a) Percentage points of outperformance at 730 days from purchase (b) Percentage points of outperformance at 730 days from sale

Figure 5.23: Percentage points of outperformance between the company share price after a director transaction and the various indices at 730 days from the transaction, only for Italy. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

5.5.4 GERMANY

Differently from the two previous countries, Germany has again some transactions executed in the mega category. As in The United Kingdom and Italy, there is not much difference in the boxplots between small and big companies, at least not as much as in the United States. The only difference that can be noticed for the various company sizes is that the biggest companies show very small whiskers, while the standard deviation is much bigger, showing some extremes in the sample. This can be seen in Figure 5.24



(a) Percentage points of outperformance at 730 days from purchase (b) Percentage points of outperformance at 730 days from sale

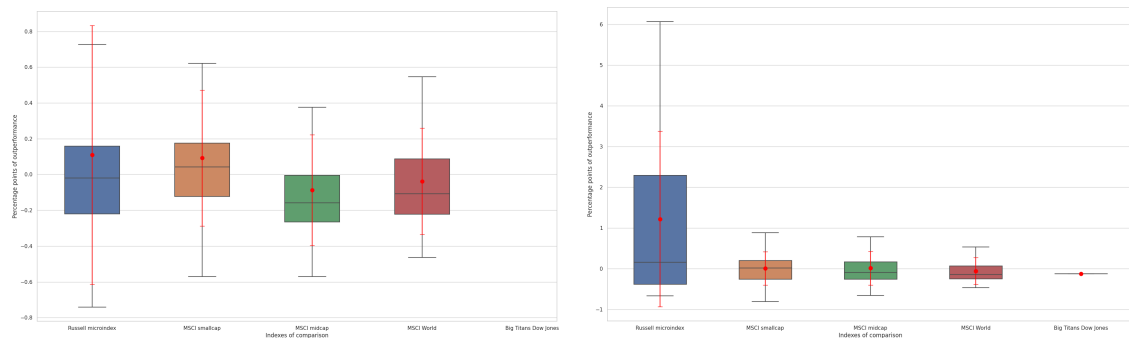
Figure 5.24: Percentage points of outperformance between the company share price after a director transaction and the various indices at 730 days from the transaction, only for Germany. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

When considering the purchases, only the medians of small and large companies are proven to be significantly above the 0 through the Wilcoxon test, while the means for all of the categories, with the exception of the mega companies, are again significantly above 0 according to the t-test. Directors in the biggest companies are those struggling the most to outperform the market.

Analysing the sales, none of the means can be proven to be significantly below 0, while the median for mega companies is the only one which is significant when proving wrong the null hypothesis. However, since for both purchases and sales the biggest companies seem to be underperforming the market, this fact may not be correlated with the directors, it is just that such companies traded in the German stock market are not able to be competitive.

5.5.5 NETHERLANDS

The Netherlands show again a lack in transactions executed within mega companies. Just a few of them are available among the sales. The boxplots can be seen in Figure 5.25. When considering purchases by directors, only the median of the outperformance of the companies in the smallcap range are significantly above 0, while both the mean of microcap and smallcap are significantly above 0. Considering the sales, both the median of middle and large companies after a director dealing is significantly below 0, and only the mean of large companies is below.

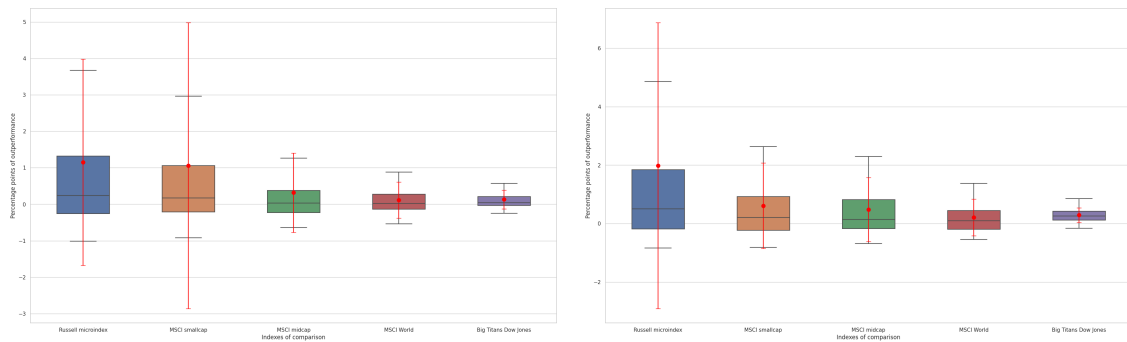


(a) Percentage points of outperformance at 730 days from purchase (b) Percentage points of outperformance at 730 days from sale

Figure 5.25: Percentage points of outperformance between the company share price after a director transaction and the various indices at 730 days from the transaction, only for the Netherlands. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

5.5.6 SWEDEN

In Sweden transactions by directors in mega companies can be found more frequently than in the other European markets previously shown. The results are very similar to those found in the general case, with both purchases and sales that are always followed by an overperformance by the company on their respective indices. In fact, 2 years after a purchase, all means and medians are significantly above 0 according to their respective tests, while 2 years after a sale, no mean or median is found to be significantly below 0.



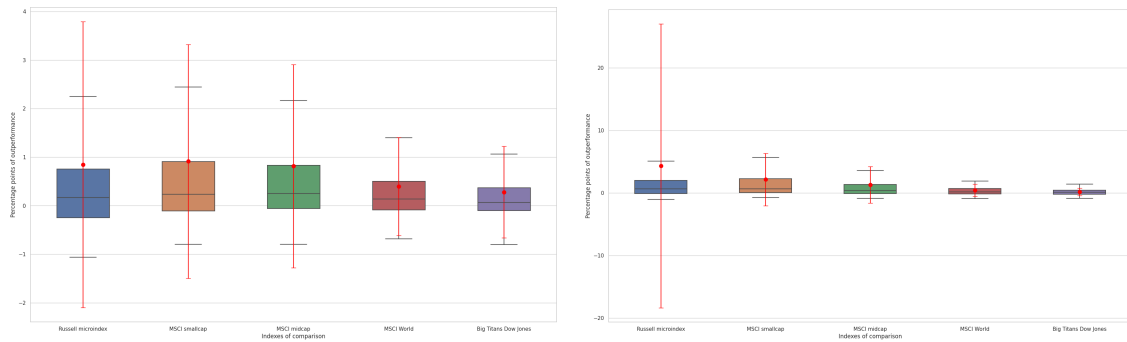
(a) Percentage points of outperformance at 730 days from purchase

(b) Percentage points of outperformance at 730 days from sale

Figure 5.26: Percentage points of outperformance between the company share price after a director transaction and the various indices at 730 days from the transaction, only for Sweden. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

5.5.7 HONG KONG

Finally, Hong Kong is very similar to what already said for Sweden. It is again significantly above 0 in both mean and median when it comes to consider companies outperformance compared to the market after a purchase, while it is never significantly below 0 whenever it is studied what happens following a sale, thus not being able to prove the null hypothesis wrong and knowing that director sale when they know it is the most convenient to do so.



(a) Percentage points of outperformance at 730 days from purchase (b) Percentage points of outperformance at 730 days from sale

Figure 5.27: Percentage points of outperformance between the company share price after a director transaction and the various indices at 730 days from the transaction, only for Hong Kong. Outliers are not included in the image for clarity. Red dot and red line show respectively the mean and the standard deviation for each sample.

5.5.8 NUMERICAL COMPARISON BETWEEN COUNTRIES

In this section, the values of mean, median and standard deviation for each country and category is going to be presented in the following tables. Table 5.4 contains the values for the purchases while Table 5.5 shows the values for sales. Almost always the value of the mean is above the value of the median, showing the fact that there are generally some outliers which are increasing the mean, sometimes very much above the median.

Here it is clear again that smaller companies tend to outperform their respective index the most, especially in the United States, where a very big standard deviation can be found. This proves the fact that there are many outliers that are able to perform extremely better, making them enormously profitable. Interestingly enough, Hong Kong has the biggest standard deviation for sales in the microcap range, but for purchases such value is much smaller. In general, after a sale in Hong Kong the companies seem to be performing much better than after a purchase.

Country		Microcap	Smallcap	Midcap	Largecap	Megacap
United States	mean	1.58	0.70	0.27	0.11	0.74
	median	0.11	0.06	0.05	0.02	0.16
	standard deviation	8.69	2.86	0.86	0.46	2.08
United Kingdom	mean	0.31	0.23	0.15	0.18	/
	median	0.05	0.04	0.03	0.07	/
	standard deviation	0.97	0.91	0.54	0.53	/
Italy	mean	0.35	0.05	0.12	0.23	/
	median	0.10	-0.12	0.13	0.26	/
	standard deviation	0.76	0.68	0.26	0.23	/
Germany	mean	0.36	0.42	0.18	0.18	-0.10
	median	-0.01	0.09	-0.02	0.08	-0.41
	standard deviation	1.93	1.41	0.69	0.47	1.48
Netherlands	mean	0.11	0.09	-0.09	-0.04	/
	median	-0.02	0.04	-0.16	-0.11	/
	standard deviation	0.72	0.38	0.31	0.30	/
Sweden	mean	1.16	1.06	0.32	0.12	0.13
	median	0.24	0.17	0.03	0.03	0.04
	standard deviation	2.83	3.92	1.08	0.50	0.26
Hong Kong	mean	0.84	0.91	0.81	0.40	0.28
	median	0.16	0.23	0.25	0.13	0.06
	standard deviation	2.94	2.41	2.09	1.01	0.94

Table 5.4: Values of mean, median and standard deviation after 730 days from a director purchase in each country.

Country		Microcap	Smallcap	Midcap	Largecap	Megacap
United States	mean	1.98	0.49	0.24	0.13	0.04
	median	0.22	0.08	0.03	0.01	-0.01
	standard deviation	9.14	1.61	0.86	0.54	0.27
United Kingdom	mean	0.23	0.19	0.18	0.13	-0.48
	median	0.00	0.04	0.03	0.06	-0.48
	standard deviation	0.82	0.68	0.72	0.35	0.00
Italy	mean	0.36	0.02	0.04	0.19	/
	median	0.22	-0.14	-0.01	0.23	/
	standard deviation	0.64	0.57	0.24	0.31	/
Germany	mean	0.49	0.48	0.23	0.21	0.12
	median	0.06	0.05	0.01	0.09	-0.36
	standard deviation	1.47	1.64	0.66	0.59	3.78
Netherlands	mean	1.22	0.01	0.01	-0.05	-0.12
	median	0.16	0.01	-0.09	-0.14	-0.12
	standard deviation	2.16	0.41	0.42	0.33	0.00
Sweden	mean	1.98	0.61	0.48	0.22	0.29
	median	0.51	0.21	0.15	0.09	0.26
	standard deviation	4.89	1.46	1.10	0.63	0.25
Hong Kong	mean	4.32	2.15	1.33	0.44	0.19
	median	0.64	0.68	0.41	0.19	0.10
	standard deviation	22.70	4.18	2.93	0.96	0.60

Table 5.5: Values of mean, median and standard deviation after 730 days from a director sale in each country.

5.6 FINDING THE BEST DIRECTORS

The analysis done up to now shows that for purchases directors are generally able to produce results better than the market. However, sales are not able to produce the opposite result. From a practical point of view, it is not possible to obtain extra gains by following each and every transaction notified, because it would be an overwhelming number of them. If a decision to follow director dealings was taken, it would be necessary to understand which ones to follow.

There are various possible ways to do so. Follows a brief description of each one of them, with their respective pros and cons.

5.6.1 OUTLIERS

As a consequence of the analysis ran and using the results obtained, a possible way to find the best directors to copy can be by taking the best outliers obtained. For each group of companies, the directors who are among the best 5% outliers for purchases and sales may be saved. The most interesting ones would be those who are able to get in both groups of outliers, and possibly have most of their transactions in them.

An issue this method has is the fact that a very small number of directors can be found. A good alternative could be to consider separately the directors among the best outliers for purchases and sales, in order to see if there are directors that may be very good only in one of the two cases. More specifically, it would be interesting to find some directors who are very good at purchasing, because the price would be expected to increase afterwards. Even if no director able to notify the right moment to sell could be found, after a good notification of a purchase it would be expected to have an increase in the share price afterwards anyway.

Considering the opposite case would be more challenging, because even if there is a good director who knows when to sell, there is no guarantee the purchase is going to be effective, and it could happen for the director to sell immediately after the purchase. In particular, considering the analysis in this thesis, it is evident that selling at the right time is very difficult for insiders as well, therefore it is important to pay even more attention when considering these situations.

5.6.2 SELL PRICE TO BUY PRICE RATIO

An alternative method to understand who are the best directors is through a simple ratio between the sale price and buy price of a director, weighted on the volume of the transaction. This way it is possible to understand who are the directors who historically actually managed to gain the most. The main problem of this method is the lack of a time reference. In fact, most directors are actually buying many years in advance, and after ten or twenty years they start to sell their shares, once the company has grown enough. Although this method worked for the specific director, it may not work for someone trying to copy their transactions, because it is going to take a lot of time and there is no actual guarantee it is going to work, because there are certainly many directors who buy their own shares when the company is young, but is then not

able to grow. Furthermore, a director who started in a company when it was very young and keep working in it for many years when it grew, is not likely to become a director in another very small company.

However, if directors are found that are actually trading a lot in their company, and are able to get a good sell price to buy price ratio, they would be insiders who are actually able to understand the company. Copying them would certainly be profitable.

5.6.3 MONEY MULTIPLE

It corresponds to the total cash inflow divided by the total cash outflow [31]. In order to compute this value, it is required to include the number of shares the director still owns, and multiply it by the current share price. This method has the clear disadvantage of considering as current price a value that is not actually relevant. In fact, the share price may have gone down in the specific time at which the computation is executed. The director may be keeping their shares because they are sure the price is going to increase in the future. However, the money multiple for this specific director is going to be pretty low. This method also does not keep into consideration the time between transactions.

However, the main advantage of this method is that it allows to keep a record day by day on the director, if the money multiple is continuously computed, because it is going to change every day, according to the share price.

5.6.4 INTERNAL RATE OF RETURN

The internal rate of return (IRR) [32] is the annual rate of growth that an investment is expected to generate. This is the main method which takes into consideration time. When computing it, the value of the transaction and the number of days between transactions are required. This way, if the time between the purchase and sale is short, the IRR is going to be bigger. The result obtained this way is a percentage value, which should be as big as possible in order to be valuable. However, this computation loses the magnitude of the transaction of the director. A director investing more money in their shares is an indicator of how much the director believes in their transaction, therefore the absence of this reference could cause doubts.

All of these methods can be useful in some instances, but none of them is able to give the full picture of the investments done by directors. A good starting point could be to choose the one the investor believes to be the most relevant, and from that check if the other results seem good

as well. Furthermore, an analysis of only the past behaviour of directors is not able to give the full picture.

The market is always changing, and a director who was able to earn a lot in the past may not be able to adapt to the new conditions of the market. Some industries may not be going very well, and a good director working in a company whose industry is failing may not be a good director anymore. It is also important to notice that the analysis of the financial statements is of fundamental importance.

Taking all these facts into consideration is what may lead an investor to a good investment.

6

Conclusion

6.1 ARE DIRECTOR DEALINGS INFORMATIVE?

Directors dealings are transactions used by many directors all over the world. They trade their own shares because they believe that doing so they are able to gain extra money. However, as any form of investment, it may go that way or it may not work at all. Through the analysis presented in this thesis it was possible to see that in some instances, directors are more likely to gain quite a lot, while in other occasions they appear to be losing money.

It is important to notice that since the analysis is ran on a big dataset, it was only possible to consider mean and median, in order to get an idea of what happens generally speaking. However, in each one of the cases analysed, there were many directors who were able to gain a lot of money through their transactions and many directors who lost a lot of money.

Looking at the actual results, it was possible to notice that most directors who purchase shares are gaining with respect to the market, if they wait long enough before selling their shares. However, after a director is selling their shares, the share price of the company cannot generally be seen to decrease. This may be caused by many reasons. One possibility is the fact that directors are only trying to monetize on the shares they own, not being interested in further growth by the company, since the price already went up enough. Otherwise, it is possible that a director just received some shares as a payment, but he was not interested in keeping them and just sold them as soon as he was given them. None of these cases actually prove the fact that directors do

not believe in the future of the company, they just show the fact that they may have different priorities.

When directors are buying, it is a different story, since they are actually investing their money and they are likely not to have them back any time soon, so they must be sure about what they are doing and that may be this risk may be the reason purchases are generally predicting the future growth of the company.

6.2 FUTURE STUDIES

Future studies might focus firstly on investor transactions. First thing should be an analysis of their predictive power by themselves. Afterwards it may be interesting (if investor transactions are proven to be predictive) to put director dealings and investor transactions together and check if the presence of the two of them together is able to give more predictive power. The study would work in a similar fashion as the analysis of director purchases and buybacks done in Section 5.4. Analysing the three signals together would be the following step, in order to see if buybacks, director dealings and investor transactions are able to give more information regarding the company.

Another interesting aspect would be to increase the number of countries where this analysis is ran. Only a small amount of them is now considered, but there are many more interesting countries, with important companies listed in them. Japan and South Korea in Asia, Australia in Oceania, Brazil and Canada in America. They may produce very different results due to completely different laws and different cultures in which director dealings may be perceived differently.

Lastly, director dealings are still a controversial subject due to their relation with insider trading. New laws may be used in the future due to different possible interpretations by future governments. For this reason, new and completely different results may be achieved through the same analysis done in this thesis.

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