



VNIVERSITAT  VALÈNCIA

VNIVERSITAT  VALÈNCIA  Facultat d' Economia

Department of Financial and Actuarial Economics

Doctoral Program in Quantitative Finance and Economy

STUDY OF MARKET ANOMALIES IN EQUITY OFFERINGS

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AGRAÏMENTS

Una Tesi Doctoral és un projecte especial en molts sentits. Un dels que la fa un poc més sorprenent és que, encara que és un projecte personal, és també el resultat de la participació, directa o indirecta, de moltes circumstàncies i persones diferents, sense les quals el resultat podria ser molt diferent. Aquestes paraules són un xicotet i sincer homenatge a totes aquestes persones que, en algun moment del projecte, han participat i deixat una singular empremta que, d'una manera o d'un altra, ha millorat aquest treball, i què per tant s'ha de reconèixer.

En primer lloc, vull agrair especialment al Director d'aquesta Tesi Doctoral, el professor Óscar Carchano Alcina, per tota la seua ajuda i el seu suport incondicional al llarg d'aquests anys, i especialment per la confiança que ha mostrat tant en mi com en aquest projecte des del primer moment. El seu coneixement i domini sobre aquest tema, tant a nivell teòric com pràctic ha quedat patent durant tot el temps, i sempre s'ha esforçat per transmetre-me'l. Si el principal objectiu d'una Tesi Doctoral és aprendre, puc dir amb convicció que he après molt al seu costa, i que ha estat un plaer treballar junts aquests anys.

També vull agrair al professor Ángel Pardo Tornero, coordinador del programa de Doctorat en Finances i Economia Quantitatives, a la professora Maria Julia Suso López i al professor Eusebio Cristóbal González Baixauli, directors del Departament d'Economia Financera i Actuarial de la Facultat d'Economia. Durant aquest projecte he tingut molts dubtes i problemes diferents, i tots els he pogut solucionar gràcies a la seua ajuda i la seua paciència amb mi. També vull agrair a tots els membres del Departament d'Economia Financera i Actuarial, així com al personal de la secretaria en particular, i de la Universitat de València en general. No puc oblidar agrair a tots els alumnes dels graus en Economia i en Negocis Internacionals, als que he tingut la sort de impartir docència. Ha estat un plaer treballar junt a tots ells i formar part d'aquesta institució durant aquests anys, i espere poder tornar en un futur proper.

Durant aquest projecte, també he tingut la sort de comptar amb la inestimable ajuda de professors com Jose Emilio Farinós Viñas, del Departament de Finances Empresarials de la Universitat de València, Jesús Ruíz Andújar, del Institut Complutense d'Anàlisi Econòmica de la Universitat Complutense de Madrid, i de Federico Platania, del Institut Supérieur de Gestion. L'ajuda de tots ells ha esdevingut fonamental per a aquesta Tesis, i per això firmen el primer, segon i tercer capítol de la Tesi respectivament. També vull agrair les aportacions de totes les persones que, d'alguna manera o altra, ja siga comentant el meu treball en diferents congressos o avaluant els articles enviats a revistes, han contribuït a la millora d'aquest treball. Puc nomenar als professors Juan Carlos Matallín Sáez, Abdoukarim Idi Cheffou, Juan-Ángel Jiménez-Martín, Pierre Ngon A Mbara i Yanmin Shao.

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Totes les persones, companys de treball o amistats, entre molts altres, mereixen ser reconeguts en aquestes pàgines. Fins la més xicoteta aportació, ja siga com a ajuda concreta o com a ànims, ha sigut fonamental. El meu sincer graïment també va per a tots ells.

No puc finalitzar els graïments sense nomenar a tots els companys del sindicat d'estudiants SAÓ, amb els quals he tingut el plaer de treballar per millorar les condicions de tots els estudiants de la Universitat de València en general, i dels estudiants de doctorat en particular. Tant si la meua aportació ha sigut més gran o més petita, és un honor pensar que he pogut ajudar a que futures persones tinguen l'oportunitat de dur a terme els seus projectes en les millors condicions possibles.

Finalment, vull finalitzar aquesta secció agraint al nostre Estat del Benestar, a tots els que aportem per fer-lo possible, i a tots els que treballem per millorar-lo i defensar-lo. Sense aquest sistema molt probablement jo no hauria pogut estudiar tant com he pogut, i el que ara són èxits no haurien sigut sinó somnis inassolibles. Sé que, com jo, milers d'estudiants han pogut complir els seus somnis gràcies a aquestes institucions, i estic convençut de què els beneficis per a nosaltres com a individus, i per a la societat en general, són molt més que superiors que el que individualment aportem. Humilment, estic convençut de què aquesta Tesi Doctoral és una prova més de l'èxit de l'Estat del Benestar, i un argument més per a treballar per millorar-lo i defensar-lo.

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INTRODUCTION

Study of market anomalies in equity offerings

SEASONED EQUITY OFFERINGS

A brief approach

In order for companies to effectively pursue their intended economic activities, having adequate resources is imperative. These resources, collectively referred to as the company's capital, play a vital role in financing its operations, compensating all contributing factors, and sustaining ongoing activity. Typically, companies generate resources by offering their goods or services in the market, allowing them not only to remunerate their factors of production but also to utilize any surplus for further growth and expansion. This common scenario highlights how capital enables companies to not only meet their obligations but also to continually thrive and extend their reach.

However, companies want or need to have more resources available or more quickly than those obtained through their activity. This need may arise due to unforeseen events that require a greater amount of capital, or due to the company's desire to undertake new investments or expand its business. On these occasions, the firm seeks new sources of financing. The most common of those is the issuance of debt, which allows to raise financing from creditors with which it will be able to achieve its objectives, and which it will have to pay back to them within a certain period, together with a certain interest rate.

Nevertheless, there are many other sources through which the company can obtain financing, from other equally traditional ones as well as some that have been emerging in recent years (such as crowdfunding or similar). One of them consists of arranging an equity offering. In this process, instead of issuing debt, the company in question issues shares that can be bought by investors. In this way, the firm acquires additional financing, the main difference being that it does not have to be paid back. Investors, as compensation, become owners of a part of the company, expecting to obtain future profits through the possible dividends distributed, or through the increase in the value of their shares.

These processes imply that a higher number of shares are issued in the markets and that, therefore, the company's capital stock is divided into a greater number of parts. This can be seen as negative for investors who originally held shares, since their percentage of participation after the equity offering will be lower than that which they had in the first instance. To avoid this situation, the company may decide (although it is not required to do so) to carry out the equity offering by means of the issue of Preferential Subscription Rights. These financial assets must be used to obtain the new shares according to a ratio determined by the company (i.e., a certain number of rights allow a certain number of shares to be obtained) and are delivered first to the

owners of shares so that, if they exercise them, they can obtain the number of shares necessary to maintain their percentage of participation in the firm. On the other hand, they can also sell them on the market and give other investors access to these new shares.

In equity offerings made by means of subscription rights, investors who wish to acquire new shares must make a series of payments. First, they must pay the price at which the subscription rights are listed on the market. In addition, they may also have to pay a certain price (issue price) for each new share acquired, in what are known as "monetary" equity offerings. However, there are issues in which this payment is not required, and these are known as "released" equity offerings. On the other hand, in monetary offerings exists the possibility that a sufficient percentage of shares will not be acquired, and therefore the process may fail. To avoid this, some issuing firms reach agreements with other companies or financial institutions, which undertake to acquire the remaining shares when this happens. In this case, we would be talking about "insured" equity offerings.

Returning to equity offerings in general, these are carried out through procedures that are prolonged over time. During this period, a series of events take place and are published as the process progresses through its different phases. These events may be different depending on the equity offering and the country in which it takes place, although in most cases a series of events common to all of them can be observed. Some examples of these events would be the announcement of the equity offering itself, its approval by the General Shareholders' Meeting or the listing of the new shares. When the equity offering is carried out by means of subscription rights, there are other common events such as the beginning and end of the subscription period for these financial assets, or the publication of the results of the equity offering.

Although the explanation developed up to this point can be applied to most equity offerings that can be found in the markets, in these processes we can find a very wide variety, since each one may have a set of particularities that make it stand out from others. In addition, this variety becomes greater when considering the different regulations in force in the different countries that one decides to observe. Finally, there are more varieties of equity offerings than those discussed in this introduction, that have not been considered in this study, such as initial share offerings.

Equity offerings as a source of anomalies

As can be seen from the explanations given in the previous section, equity offering is a very complex process that can have many effects both on the company that carries it out and on the market. If these effects are strong enough, they can generate anomalies that the market could not be able to correct by itself. And this situation can come from at least two different sources.

First, in the specific case of equity offerings that issue subscription rights, there are two simultaneous ways to obtain the same shares during a specific period. These would be:

1. To directly buy the shares already in circulation.
2. Buy subscription rights and exercise them to obtain the new shares when they are in circulation.

Since these two different ways exist, it is logical to think that the final price paid for each share must be the same for both. If this does not happen, some investors who detect this market failure may consider strategies that exploit this price differential. If this differential is sufficiently large (at least, if it exceeds the costs and commissions related to the operations of this strategy), we would be facing an arbitrage opportunity and, therefore, a market anomaly.

This last anomaly would be limited to equity offerings with subscription rights, although other possible sources common to all these processes can be found. As mentioned above, during the period in which an equity offering is developed, different events occur as the different phases of these processes are completed. The publication of these events implies the release of a lot of information to the markets, which may influence it. Sometimes these events can generate systematic effects which, if known by investors, could be exploited by means of strategies designed for this purpose, allowing them to obtain a higher profit than that offered by the market. This is also a source of anomalies and is common to all equity offerings.

Knowing the possible situations in which, within the framework of equity offerings, significant market anomalies may arise, it is of interest to analyze the actual situations that may arise, and to verify whether they have occurred and in what proportion. In addition, it would also be of interest to know whether there are certain territories or circumstances in which this type of anomalies has a stronger component or occur more frequently, as well as whether there are any factors related to the equity offering itself or to the issuing company that affect the likelihood of any of these situations occurring.

DISSERTATION EVOLUTION AND OBJECTIVES

This Doctoral Thesis analyzes the possible anomalies that may occur in the financial markets in the context of equity offerings made by companies, defining these anomalies as explained in the previous section. For this purpose, equity offerings made by companies around the world between the years 2000 and 2020, both included, will be analyzed using, among other factors, the main characteristics of these processes and of the issuing companies, as well as the price series for the shares of these companies, for the subscription rights and for the main stock market indexes of each of the countries included.

This research work consists of four chapters, developed over four to five years of study in the PhD Program in Quantitative Finance and Economics in the Department of Financial and Actuarial Economics at the University of Valencia. The titles of the chapters are as follows:

1. Arbitrage opportunities and event impacts on Spanish rights issues.
2. Detecting, characterising and predicting arbitrage opportunities in international rights issues.
3. On abnormal returns in events link to international seasoned equity offerings.
4. On the relationship between ESG scores and market efficiency in equity issues.

The work on this Doctoral Thesis begins even before the start of the PhD studies. Throughout the Master in Banking and Quantitative Finances of the University of Valencia, he already started working on his master's thesis which, after being presented at the XVII workshop in Banking and Quantitative Finances, will be extended and will become the first chapter of this Doctoral Thesis. This first chapter analyzes the two anomalies previously described for the Spanish market, applying an arbitrage strategy, and analyzing its results, and using the Event Study methodology to study the short- and long-term effects of these events on the financial markets. This last analysis was possible thanks to the help of Professor José Emilio Farinós Viñas, from the Department of Business Finance at the University of Valencia. The PhD studies officially begin in November 2019, and are carried out simultaneously with a job in a consulting firm. One year later, and after receiving a grant for the recruitment of predoctoral research staff (ACIF 2020) financed by the *Generalitat Valenciana* and the *European Social Fund*, I join the University of Valencia as a predoctoral researcher in training in October 2020. Shortly after, in November 2020 the first chapter is presented at the 20th edition of the Management International Conference (MIC, Koper, 2020). Finally, after several attempts, this chapter was published in the journal *Applied Economics Letters*.

Once the two possible anomalies for the Spanish market had been analyzed, it was decided that the second and third chapters would attempt to replicate and extend these analyses to all equity offerings for which information was available. The second chapter would focus on possible arbitrage opportunities in equity offerings issuing subscription rights, while the third chapter would focus on the possible effects on the markets of the different events.

For the second chapter, the first step was to analyze the different regulations that apply to these processes in different countries, considering the characteristics that could imply relevant changes in the strategies to be applied to exploit these possible arbitrations. During the work on this chapter, a three-month research stay was carried out at the *Complutense Institute of Economic Analysis*, which belongs to the *Complutense University of Madrid*, by Professor Jesús Ruiz Andújar and financed thanks to the grant program for pre-doctoral fellowships in research centers outside the Valencian Community (CIBAFP 2022), from the *Generalitat Valenciana* and the *European Social Fund*. Thanks to his extensive knowledge of econometrics, it was possible to develop and apply a series of models to better understand the factors that can explain the emergence of these arbitrage opportunities, but also to predict their occurrence. Once completed, this work was presented at the II Quantitative Finance and Economics Thesis Workshop (Bilbao 2022) and at the 30th edition of the Finance Forum (Málaga, 2023), as well as at its PhD Mentoring Day. Valuable feedback was obtained from these presentations, which served to polish the work for its publication attempt.

Regarding the third chapter, the sample to be analyzed was significantly expanded by including in the study all possible equity offerings, and not only those in which subscription rights were issued. In addition, the number of different events to which the different analyses were applied was also expanded. This chapter also included an international research stay at the Institut Supérieur de Gestion (ISG) in Paris (France), led by Professor Federico Platania, and financed thanks to the grant program for pre-doctoral fellowships in research centers outside the Valencian Community (CIBAFP 2023), from the *Generalitat Valenciana* and the *European Social Fund*. Thanks to the knowledge of the professor in charge of the stay regarding financial markets and their analysis, it was possible to optimize the methodology applied to study the effects of the different events, also including a set of robustness checks. Once completed, this work was presented at the ISG Lab n° 9 (Paris 2023) and at the III Quantitative Finance and Economics Thesis Workshop (Valencia 2023). Valuable feedback was obtained from these presentations, which served to polish the work for its publication attempt.

During the work in the second and third chapters, when testing with different factors to explain the anomalies detected in both studies, it was detected that the environmental and social commitment and behavior of the companies, and the level of development of the countries, could influence the appearance of these anomalies. These findings motivated the creation of a fourth chapter focused on analyzing the relationship between these variables and the appearance or not of arbitrage opportunities, restricting the sample to those processes for which the necessary information was available to measure this type of behavior. This analysis, more focused on a specific aspect, is shorter than the others, although it is of sufficient quality to become the fourth chapter of the doctoral thesis. In addition, once completed, it was presented at the 3rd annual conference of the Academy of Sustainable Finance, Accounting, Accountability and Governance (ASFAAG, Valencia 2023).

All this work was carried out simultaneously with other activities. Firstly, as a predoctoral researcher in training, I had the opportunity to teach hours in different undergraduate subjects at the University of Valencia, which I was able to take full advantage of. Specifically, I was able to teach 90 hours in English in the subject *Financial Risk Management* (35914) of the Degree in International Business, 30 hours in the subject *Final Degree Project* (36130, co-directing in collaboration with other teacher) and 60 hours (30 in English and 30 in Valencian) in the subject *Finance* (36119), the latter two of the Degree in Economics. In addition, we also attended different training courses on topics related to research and teaching, including participation in the III Program of Teaching Update (PAD) of the University of Valencia. In addition, for the subject 35914- *Financial Risk Management*, a set of teaching materials were developed, both for theory and practice, which were awarded in the Fernando Sapiña prices to teaching materials in Valencian and English, in its 2022 call, granted by the *University of Valencia*.

EMPIRICAL DATA

In order to carry out this study, a very large amount of information has been obtained and organized, including historical price series as well as characteristics of the equity offerings and the companies that have made them. In all the chapters, this information has been organized to create large databases that could be used to extract new analyses different from those carried out in this Doctoral Thesis. To ensure the greatest possible coherence, most of the information comes from the same source, the *Thomson Reuters Refinitif Database*, to which I have had access thanks to the Department of Financial and Actuarial Economics of the University of Valencia, and which has been fundamental in the development of this project. However, some series and specific data have had to be obtained from different sources or have been compiled manually (which happens mainly in Chapter I). A detailed explanation of the data obtained, and their origin, is given below.

Regarding the price series, daily data has been available from the year 2000 to 2020, both included, for all the necessary series. These include the shares of the issuing companies, their trading volume, subscription rights (when available), the main stock market indexes and the 10-year Treasury Bills of each country. In addition, the size (SMB) and value (HML) series of the 3-factor model have been needed and are from Kenneth French's website. Regarding the price series, adjusted prices and the closing price have always been used, since no significant differences have been found when using the opening, maximum or minimum prices of each session.

Another set of relevant information comes from the issuing companies. This group includes data such as the country and continent in which the company is located, its economic and business sector, the type of market in which it is listed or whether it is listed in the main stock market index of its country. In addition, the degree of commitment to environmental and social aspects is also available, measured through the ESG score calculated and provided by Thomson Reuters. This score ranges from 0 (worst) to 100 (best) and is translated into levels D (from 0 to 25), C (from 25 to 50), B (from 50 to 75) and A (from 75 to 100). Finally, this section also includes the level of development of the country in which the company is located, information that comes from the World Bank and which, according to the country's Net Product, classifies it between a "low", "medium-low", "medium-high" and "high" level of development, although in this work the "medium-low" and "medium-high" levels have been merged into a single "medium" level. It should be noted that this information corresponds to the time at which the company carried out the equity offering and that, for some factors, the same company could have different values depending on the process being analyzed.

Finally, there is the information from the characteristics of the equity offerings, which is the largest and most relevant set of information. This includes data on whether subscription rights are issued, the matching ratio between old and new shares and how it is calculated (which refers to how many subscription rights are obtained for each old share, and how many are necessary to obtain one new share), as well as whether the equity offering is monetary or unpaid (whether or not one must pay to subscribe for the new shares) or whether or not it is secured or unsecured. Also included here would be the different objectives that the company wants to achieve with the financing obtained, or the different events that took place, and the date on which they occurred. In Chapter I, all this information was obtained manually, analyzing the prospectuses of the equity offerings and the relevant facts published by the *Comisión Nacional de Mercado de Valores* (CNMV) for most companies, and by *BME MTF Equity* for small companies.

SUMMARY OF THE CHAPTERS

As has been explained throughout this introduction, this Doctoral Thesis aims to study the appearance of market anomalies in the framework of equity offerings carried out by companies around the world, as well as to try to explain the factors that may affect, positively or negatively, their appearance. To this end, the process that is carried out is: (i) analyze the existence of arbitrage opportunities or significant event effects in Spanish equity offerings; (ii) transfer the analysis of arbitrage opportunities to companies around the world, taking into account their particularities, and try to explain and even predict them; (iii) transfer the analysis of event effects to companies around the world, taking into account their particularities, and using different methodologies to strengthen the results; and (iv) check whether the environmental and social commitment of companies can reduce the market anomalies that they may suffer in their equity offerings.

Chapter I is entitled "**Arbitrage opportunities and event impacts on Spanish rights issues**" and consists of an analysis of the two market anomalies described above focused on the Spanish market. An arbitrage strategy is applied to each of the equity offerings detected and a short-term Event Study is carried out to analyze the effects of six different events, as well as a long-term Event Study to detect possible anomalies that persist over time. These analyses are also performed by grouping the sample into different subgroups formed according to certain characteristics of the offering or the issuing company. The results point to the existence of these anomalies, especially in the case of arbitrage opportunities.

Chapter II is entitled "**Detecting, characterising and predicting arbitrage opportunities in international rights issues**" and consists of extending the analysis of arbitrage opportunities performed in Chapter I to all possible equity offerings with subscription rights, including many countries in the sample. In these cases, country-specific regulations and particularities must be considered when determining how to apply such an arbitrage strategy. In addition, a set of models are also estimated to try to detect the factors that best explain the anomalies detected, and another set of binary response models to try to predict their occurrence within the sample. The results obtained again demonstrate the existence of these anomalies, detecting in which territories they are more common and which factors can explain them. Moreover, the prediction models proposed for many of them have a significant success rate.

Chapter III is entitled "**On abnormal returns in events link to international seasoned equity offerings**" and consists of extending the analysis made in Chapter I on the effects that different events may have on the markets to the largest possible sample of equity offerings, also including those that do not issue subscription rights. This analysis is carried out by means of an Event Study, although in this case two reference models are used instead of one, and the event window does not only include the day of the event, but also the days before and after the event. In addition, a methodology such as a robustness check is also applied. These methodologies are applied for the full sample and for subgroups depending on different factors, but also for subgroups corresponding to the countries and events included in the analysis. The results obtained are in line with those of the previous chapters, since they show the existence of market anomalies, being able to see more clearly in which circumstances (factors, territories, or events) they occur with greater intensity.

Finally, Chapter IV is entitled "**On the relationship between ESG scores and market efficiency in equity issues**" and consists of a more focused analysis of the relationship between arbitrage opportunities and the company's behavior and commitment to social and environmental aspects, as well as the country's level of development. To this end, the sample is limited to those companies for which an ESG score is available, and the outcome of the arbitrage strategies applied in their equity offerings is analyzed, both by means of statistical tests and by means of a model approach. The results support the hypothesis that companies with a higher ESG score are associated with a lower frequency of arbitrage opportunities, and therefore seem to benefit from greater market efficiency. These results are replicated, although in a weaker manner, when reviewing the relationship with the level of development.

Chapter 1

Arbitrage opportunities and event impacts on Spanish rights issues

1.1 INTRODUCCION AND LITERATURE REVIEW

Equity issues, specifically those in which Preferential Subscription Rights (PSRs) are issued, have been analyzed both in terms of the possible existence of arbitrage opportunities, as in **Marzal and Montes (2000)**, as well as the effects on the company's subsequent performance, as in **Guirao (2001)**, **Pastor-Llorca and Martín-Ugedo (2004)**, **Riaño, Ruiz and Santamaría (2006)**, **Riaño, Ruiz and Santamaría (2007)**. Also noteworthy is the study by **Ramírez and Cabestre (2010)**, dedicated to analyzing the consequences of the listing of the new shares. However, the literature, neither carry out both analyses jointly nor assess specific characteristics of these processes (size, dilutive or not, monetary or released, and insured or not) in its analysis in order to demonstrate in which types of processes arbitrage is more likely to occur. This is the objective of the present study, with the addition of being the first to include companies listed on an alternative stock exchange.

To carry out this study, focused on Spanish companies, a strategy will be applied to exploit possible arbitrage opportunities arising from differences in the price formation between the company's shares and subscription rights. This strategy will have two versions, considering whether it is possible to take short positions in the company concerned or not. On the other hand, the event study methodology will be used to analyze whether these processes generated significant short- and long-term effects. Our results suggest that arbitrage opportunities do exist and that they do not disappear over time, being clearer in small and illiquid companies.

1.2) DATA

The period analyzed extends from 2000 to 2020, including 395 rights issues carried out by 111 Spanish companies. From these processes, different characteristics have been identified, both specific to the company (whether it is listed on the Continuous Market (MC), on the Alternative Stock Market (MAB) or it is a constituent of the IBEX35) and specific to the process,¹ such as whether it is *Dilutive* (new shares represent at least 50% of the old ones), *Monetary* (payment required for subscribing new shares) and *Insured* (in the monetary, if the company can ensure its success). On the other hand, a total of 1,963 events have been analyzed (as it is shown in Table 1-1). All price series are from *Thomson Reuters Refinitiv* database. Time series contains adjusted prices, and events have been obtained from the websites of the Spanish stock market

¹ In October 2020, the MAB was renamed BME MTF Equity. Spanish small companies have been listed since then in the so-called BME Growth segment of BME MTF Equity. Nevertheless, we have kept the original name as it was the one in force during the period under analysis

regulator *Comisión Nacional del Mercado de Valores* (CNMV) for IBEX and MC companies, and from the *BME Growth* for MAB companies. Finally, the data used for the SMB and HML factors are from *Kenneth French's Data Library*,² while the risk-free interest rate corresponds to that of the one-year treasury bill of Spain from the website of the *Bank of Spain*.

1.3) METHODOLOGY

1.3.1) Arbitrage Opportunities.

The strategy to be exploited consists of acquiring a new share through subscription rights and selling one of the already listed shares (a strategy that could be called "Direct Arbitrage"). This would consist of selling one share and acquiring the necessary subscription rights to, through these, acquire a new share. To carry out these operations, it is necessary to know the share and the right prices on the dates when both assets are traded simultaneously. It is also necessary to know the issue rate, which is the sum of the nominal value and the issue premium (if any) of the subscription rights, and the number of rights required to acquire a new share.

The price at which a new share can be bought with the rights in a rights issue can be computed as follows:

$$P_{Stock_Right,i,t} = \frac{(P_{Right,i,t} \cdot n_{Old,i} + (Nominal_i + Premium_i) \cdot n_{New,i} * 1_{Monetary})}{n_{New,i}} \quad [1.1]$$

1.3.1.i). Existence of short positions for all companies – Strategy I.

The strategy described below assumes that it is possible to take short positions in the share. The percentage difference between buying the shares of the company i at time t through the rights, with respect to the price at which they are quoted on the market, has been calculated according to the following expression:

$$Differential_{i,t} = \frac{P_{Stock,i,t} - P_{Stock_Right,i,t}}{P_{Stock_Right,i,t}} \quad [1.2]$$

where $P_{Stock,i,t}$ and $P_{Stock_Right,i,t}$ are respectively the quoted price of the share and the PSD, and $n_{Old,i}$ indicates the number of rights to acquire $n_{New,i}$ new shares. In order to obtain the net

² Since data for these factors are not available for Spain, we employ series of European companies considering the integration of Spanish and European regulation and markets, and because Spanish companies are included in these factors.

spread, the costs arising from the transactions that have to be carried out to implement such a strategy should be applied.

1.3.1.ii) No short positions for all companies – Strategy II.

If there is no possibility of taking short positions on the assets side, the arbitrage strategy detailed above could not be carried out. The alternative strategy would be to buy the shares through the PSRs and sell the new shares at the closing price of the day they start trading. In order to check whether this operation is profitable on average, the price of the shares on the day on which the new shares began to be quoted are compared with the average of the theoretical prices of the new shares calculated for each day on which the PSRs were quoted, obtaining the gross spread as follows:

$$Differential = \frac{P_{Stock,i,t_6} - \sum_{t=1}^{\tau} \frac{P_{Stock_Right,i,t}}{\tau}}{\sum_{t=1}^{\tau} \frac{P_{Stock_Right,i,t}}{\tau}} \quad [1.3]$$

where τ is the total number of days the PSRs were listed, and t_6 is the day the company's new shares began trading. It has not always been possible to clearly identify the start date of trading of the new shares, so less results will be shown for this strategy.

1.3.1.iii) Estimation of the effect of commissions.

Without a correct estimation of the effect of the expenses and commissions that may be incurred when executing an arbitrage strategy, its result cannot be considered valid, since the result of the former could eliminate the potential benefit of the latter. However, this exercise is not simple, and can be done in different ways and approaches. In this paper, as a basis, it has been decided to make a conservative estimate of these costs.

In order to make this estimate, we simulated the execution of this arbitrage strategy in those rights issues in which a positive result was identified. Each of the legs of the strategy has been carried out through a different broker, with the purchase of rights and subsequent sale of shares through *Renta 4 Banco*, and CFD trading through *IG*. The investment made, adding the purchase price of rights, the share subscription price and the margins required for short positions, would be a maximum of €100,000. Once the positions to be taken in each of these strategies have been defined, all the movements to be made and the commissions that would be charged are simulated, using the tables and information provided by both entities.

The estimated effect of the commissions that will be used for the calculations will be the percentage that all these commissions represent on the simulated result of the strategy. For Strategy I, the estimated result is 2.16%. With respect to Strategy II, without the commissions corresponding to CFD trading, the estimated result is 0.96%. In both strategies, the net spread will be obtained as the gross spread (calculated following the procedure in the two previous sections, as appropriate) minus the estimated effect of the corresponding commissions. Using the price series obtained for both the share and the rights, these expressions will be applied to the first ten days of trading of the subscription rights (in Spain, rights usually trade for eleven days), and we will consider that an arbitrage opportunity has existed when the net return (after applying commissions and expenses) is positive.

1.3.1.iv) Detection and filtering of outliers.

In calculating the net returns, a set of excessively high results were obtained which, although not too many, their magnitude could affect some of the tests performed, especially those related to the mean. Because of this, it has been decided to eliminate these results from the sample.

To detect and filter outliers, we used the "Median Absolute Deviation" (MAD) methodology, described in **Leys et. al. (2013)**. To carry out this procedure, the median of the returns is obtained, and a new series is obtained as the absolute value of the difference between these values and the median obtained. The *MAD* parameter is obtained by multiplying the median of the new series by the *b* parameter. This is:

$$MAD = b \cdot M(|NR_i - M(NR)|) \quad [1.4]$$

where *M* represents the median of the containing series, while the parameter *b* is equal to the inverse of the 0.75 quartile of the original return series.

Once the *MAD* parameter has been obtained, an outlier is defined as any return that exceeds, in absolute value, the median of the original series plus 2.5 times the *MAD*. In other words, net returns that meet the following equation will not be considered outliers:

$$M(NR) - 2,5 \cdot MAD < NR_i < M(NR) + 2,5 \cdot MAD \quad [1.5]$$

1.3.1.v) Statistical tests applied:

Once the series of returns were obtained, and having eliminated those considered as Outliers, a series of tests were carried out. These tests consist of a parametric test on the mean (t-Student) and a non-parametric test on the median (Wilcoxon). In both cases, the final result will

be a P-Value. We will consider the factor of interest to be significant if the P-Value is less than 0.1, and not significant otherwise.

With respect to the **t-Student test**, the null hypothesis that the mean of the series is equal to 0 is tested against its alternative hypothesis. This is:

$$\begin{aligned} H_0: \mu &= 0 \\ H_1: \mu &\neq 0 \end{aligned}$$

where μ is the mean of the series. To do this, the t-statistic is obtained, which is calculated as follows:

$$t = \frac{\mu}{\sigma} \sqrt{n}$$

where σ is its standard deviation, and n is its size. The P-value is obtained by comparing the absolute value of the t -statistic with a t-Student distribution, with $(n - 1)$ degrees of freedom.

Regarding to the **Wilcoxon (1945) test**, the null hypothesis that the median of the series is equal to 0 is tested against its alternative hypothesis. This is:

$$\begin{aligned} H_0: M &= 0 \\ H_1: M &\neq 0 \end{aligned}$$

where M is the median of the series. To carry out this test, first the absolute values of the returns are calculated and ordered from lowest to highest, assigning each number a rank according to the position they occupy. After this, the T^+ and T^- parameters are obtained as the sum of the ranks corresponding to positive and negative returns, respectively, and the T parameter is calculated as the difference between positive and negative (this is, $T = T^+ - T^-$).

Using the normal approximation defined in **Bellera et. al. (2010)**, the W statistic, whose distribution under H_0 is that of a normal standard, can be obtained as follows:

$$T \sim^a N \left(0, \sqrt{\frac{n(n+1)(2n+1)}{6}} \right) \quad W = \frac{T}{\sqrt{\frac{n(n+1)(2n+1)}{6}}} \sim^a N(0,1)$$

Finally, the P-Value will be obtained by comparing the W -statistic obtained with the normal standard distribution.

1.3.2) Short-Term Event Study.

1.3.2.i). Events

The Event Study technique is going to be used to test if certain relevant event produced abnormal returns (both positive and negative). For this study six events related to rights issues are selected, summarised in the following list:

1. *Announcement of the rights issues.*
2. *Approval of the process by the General Shareholders' Meeting.*
3. *First day of trading of the Subscription Rights.*
4. *Last day of trading of the Subscription Rights.*
5. *Publication of the results of the offering.*
6. *Day when new shares start trading*

1.3.2.ii). Calculation of Abnormal Returns.

Once these events have been detected, it will be analysed whether they caused abnormal returns. To estimate the CAPM model, data corresponding to the 250 days prior to the last day of analysis (30 days away from the day of the first event) is used. The data corresponding to the 30 days prior to the event are not used to avoid contamination of the estimation. The IBEX-35 will be the market portfolio. Abnormal returns $AR_{i,t}$ of the company i at time t will be obtained as follows:

$$\widehat{AR}_{i,t} = R_{i,t} - \widehat{R}_{i,t} \quad [1.6]$$

where $\widehat{R}_{i,t}$ is the expected return according to the model taken into consideration. Then we will use the CAPM model of **Sharpe (1964)** and **Lintner (1965)**, whose econometric expression is defined below:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \quad [1.7]$$

where $R_{i,t}$ and $R_{m,t}$ are, respectively, the daily return of firm i and the daily return of a market index at time t , respectively, and α_i and β_i are the coefficients estimated by the model for each company, and $R_{f,t}$ is the daily return of the Spanish Treasury Bills.³ After estimating the

³ This series is formed from data obtained from the Bank of Spain.

parameters of model [7] in the estimation period (not contaminated period), we estimate the expected return as in [8]:

$$\widehat{R}_{i,t} = R_{f,t} + \widehat{\alpha}_i + \widehat{\beta}_i(R_{m,t} - R_{f,t}) \quad [1.8]$$

1.3.2.iii) Hypothesis to test.

The aim is to analyse the significance of these returns according to which event they correspond. Therefore, they are going to be classified according to this criterion, until six sets of returns are formed, to which the contrasts defined below will be applied. Then, we will test the Null Hypothesis (H_0) that these events do not generate abnormal returns. To do so, firstly we will apply the **Student t-statistical**. Secondly, the non-parametric rank test (**Wilcoxon (1945)**), will also be applied, because by making a contrast on the median, this test reduces the effect of outliers. Both tests are explained at section 1.2.a.v). Finally, a bootstrapping will be performed to obtain a confidence interval for the average abnormal return. To construct this interval, a new sample is constructed by random sampling with replacement. With the new simulated sample, we obtain the value of its corresponding t-statistic. From the sample obtained by repeating this process 999 times, the values corresponding to its 2.5% ($t_{2.5}$) and 97.5% ($t_{97.5}$) percentiles are extracted to form the lower (L) and upper (U) limits of the confidence interval as follows:

$$L = \mu - t_{97.5} \cdot \frac{\sigma}{\sqrt{n}}; \quad U = \mu - t_{2.5} \cdot \frac{\sigma}{\sqrt{n}} \quad [1.9]$$

where μ , σ and n are, respectively, the mean, standard deviation, and size of the original series.. The abnormal return will be considered as not significant when the lower band is negative, and the upper band is positive, significant and negative when the value of both bands is negative, and significant and positive when the value of both bands is positive.

1.3.3) Long-Term Event Study.

Abnormal long-run performance is estimated using a formal assessment model. Since, unlike studies of short-term events, a crucial aspect is to control adequately for risk in the estimation of expected returns, we use both the CAPM model of **Sharpe (1964)** and **Lintner (1965)** (expression [1]), and the three-factor model of **Fama and French (1993)** (expression [2]). However, it is also used an extended model which includes an illiquidity risk factor based on the illiquidity measure proposed by **Amihud (2002)** (expression [3]). We will use these models to analyse the performance of a portfolio, constructed each calendar month including companies that in previous 12 months made a rights issue.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p(R_{m,t} - R_{f,t}) + \varepsilon_{p,t} \quad [1.10]$$

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p(R_{m,t} - R_{f,t}) + s_pSMB_t + h_pHML_t + \varepsilon_{p,t} \quad [1.11]$$

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p(R_{m,t} - R_{f,t}) + s_pSMB_t + h_pHML_t + i_pILLIQ_t + \varepsilon_{p,t} \quad [1.12]$$

where $R_{p,t}$ is the weighted return in calendar month t of the portfolio, $R_{f,t}$ is the return in month t of the treasury bills, $R_{m,t}$ is the monthly return of the IBEX 35. SMB_t and HML_t are the **Fama and French (1993)** factors, and $ILLIQ_t$ is the illiquid factor, built as detailed in **Martínez et al. (2005)**. The estimation of the constant (α_p) allows us to contrast the null hypothesis that the average abnormal monthly return of the portfolio formed by companies in the sample is zero, thus indicating the absence of bad behaviour. To do so, we will use a Student-t statistical test over this parameter.

1.4. RESULTS

1.4.1) Arbitrage Opportunities

Table 1·2 explains the acronyms used in the following tables and figures. Figures 1·1 and 1·2 show, on an aggregate and daily basis respectively, the distribution of the results obtained. Figures 1·3 and 1·4 show the mean and median of the daily net results, while Figures 1·5 to 1·24 show the histogram of net returns for strategies I and II. Finally, Tables 1·3, 1·4, 1·5 and 1·6 show the mean and median returns obtained and the results of the tests.

Considering an arbitrage opportunity as a positive net return, we can see from the tables and histograms of returns that such anomalies can be detected, and that they appear to occur in virtually all of the groups constructed. Moreover, when analysing day by day, we can see that these anomalies usually persist over time. Also noteworthy is the presence of such high net returns that they should be considered as outliers.

In aggregate terms, however, all the averages and medians calculated are negative and, in many cases, significant. Nonetheless, the case of dilutive rights issues stands out, in which the mean remains positive for many days and when aggregating results.

Finally, no significant differences appear to be found between the results of Strategy I and Strategy II. However, this also indicates that these arbitrages could be exploited without the need to have short positions in the issuing company's shares.

The results obtained can be summarized as follows:

- i. As in **Marzal and Montes (2000)**, the strategy leads sometimes to positive net returns over the entire rights trading period. Theoretically, one would expect that, upon detection of arbitrage, investors would push prices until the arbitrage is eliminated.
- ii. High costs estimated lead to median returns always negative. When applying the tests, these median returns are usually significant. On the contrary, in some cases the benefits of arbitration outweigh these costs.

1.3.2) Short-Term Event Study

Tables 1·7 and 1·8 summarize the results of the short-term abnormal returns. In general terms, abnormal returns associated with the start of trading of new shares are negative, while those associated with the start and end of trading of PSRs, as well as the announcement of results, are positive. Our results suggest that this behavior occur at the beginning and end of the PSR listing and, to a lesser extent, at the beginning of the listing of the new shares. As shown in Figures 1·25 to 1·30, the histograms of anomalous returns support these conclusions.

1.3.3) Long-Term Event Study

Table 1·9 shows the results for the long-term event study. There are significant changes between model estimates when moving from the CAPM to the Fama and Frech three-factor model, and that adding the illiquidity factor does not seem to imply a significant change. Regarding the results, we find significant and positive anomalous returns in equity offerings by MAB companies, and significant and negative returns in the dilutive processes.

1.5. CONCLUSIONS

This is the first joint search for arbitrage opportunities between shares and rights and the event study of anomalous returns for the rights issues events in the Spanish market. It also adds two novelties: it includes the Alternative Stock Market and assess four specific characteristics of these processes to demonstrate in which arbitrage is more likely to appear.

The results obtained suggest that, in certain cases, there are arbitrage opportunities that do not disappear during the whole rights trading period, leading a continuous market inefficiency. This result is surprising because two reasons: opportunity remains after it has been detected and overcomes the high costs estimated.

Moreover, these discrepancies are not explained by the usual market factors, so these abnormal returns are free from the typical risk factors.

We found that it is more likely to find arbitrage opportunities in small companies, diluted, monetary and non-insured, although none of the average positive returns are statistically significant. These results are more evident in illiquid companies or companies where it is not possible to take short positions.

Acknowledgement

This work was supported by the Valencian Government and the European Social Fund (grant number ACIF/2020/109), and by the Spanish Ministry of Science and Innovation (Grant PGC2018-093645-B-I00 funded by MCIN/AEI/10.13039/501100011033 and by “ERDF A way of making Europe”).



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1.5 ANNEX

Table 1-1 Total of relevant dates analysed by event and group of rights issue.

	Announcement	Meeting	Start	End	Result	Quotation	Total
Total	364	222	394	394	309	280	1.963
IBEX	135	71	139	139	133	126	743
MC	192	105	207	207	132	114	957
MAB	37	46	48	48	44	40	263
Dilutives	40	39	45	45	41	38	248
Not Dilutives	324	183	349	349	268	242	1.715
Monetary	107	92	123	123	116	94	655
Released	257	130	271	271	193	186	1.308
Insured	27	19	29	29	29	22	155
Not Insured	337	203	365	365	280	258	1.808

NOTES: Table 1 shows the total number of dates analysed in the short-term Event Study, by event and for each group of rights issues. It should be noted that the only events for which data are available for all the processes analysed are the start and end of the listing of pre-emptive subscription rights. For the rest, it was not always possible to identify the date on which some of the events occurred.

Table 1·2 Explanation of acronyms.

Category	Name	Code	<u>Explanation</u>
By Group	Total	Total	Includes all rights issues analysed.
	IBEX	IBEX	Includes only rights issues by companies listed on the IBEX-35 index.
	MC	MC	Includes only rights issues carried out by companies listed on the Spanish Continuous Market (and not listed on the IBEX-35 index).
	MAB	MAB	Includes only rights issues by companies listed on BME MTF EQUITY (previously known as <i>Mercado Alternativo Bursátil</i> (MAB)).
	Dilutives	DIL	Includes only rights issues in which the ratio of new shares to old shares is equal to or higher than 50%.
	Not Dilutives	nDIL	Includes only rights issues in which the ratio of new shares to old shares is lower than 50%.
	Monetary	MON	Includes only rights issues in which payment is required for the subscription of new shares.
	Released	REL	Includes only rights issues in which payment is not required for the subscription of new shares.
	Insured	INS	Includes only monetary rights issues where the issuing company is able to guarantee the success of the process.
	Not Insured	nINS	Includes only not monetary rights issues, or the monetary ones where the issuing company is not able to guarantee the success of the process.
By Strategy	Strategy I	I	The net returns have been obtained by applying Strategy I (assumes that it is always possible to take short positions in the shares of the issuing company).
	Strategy II	II	The net returns have been obtained by applying Strategy II (assumes that it is not possible to take short positions in the shares of the issuing company).

Figure 1·1 Number of net average returns by strategy, group and sign.

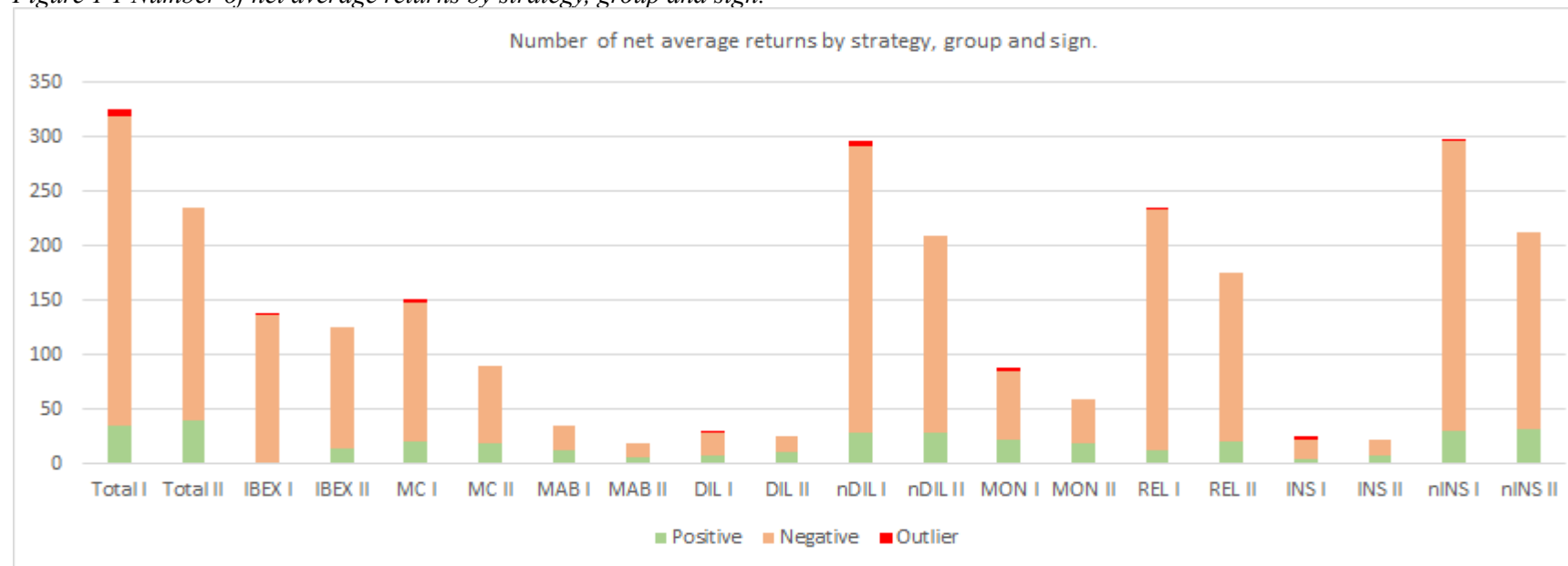
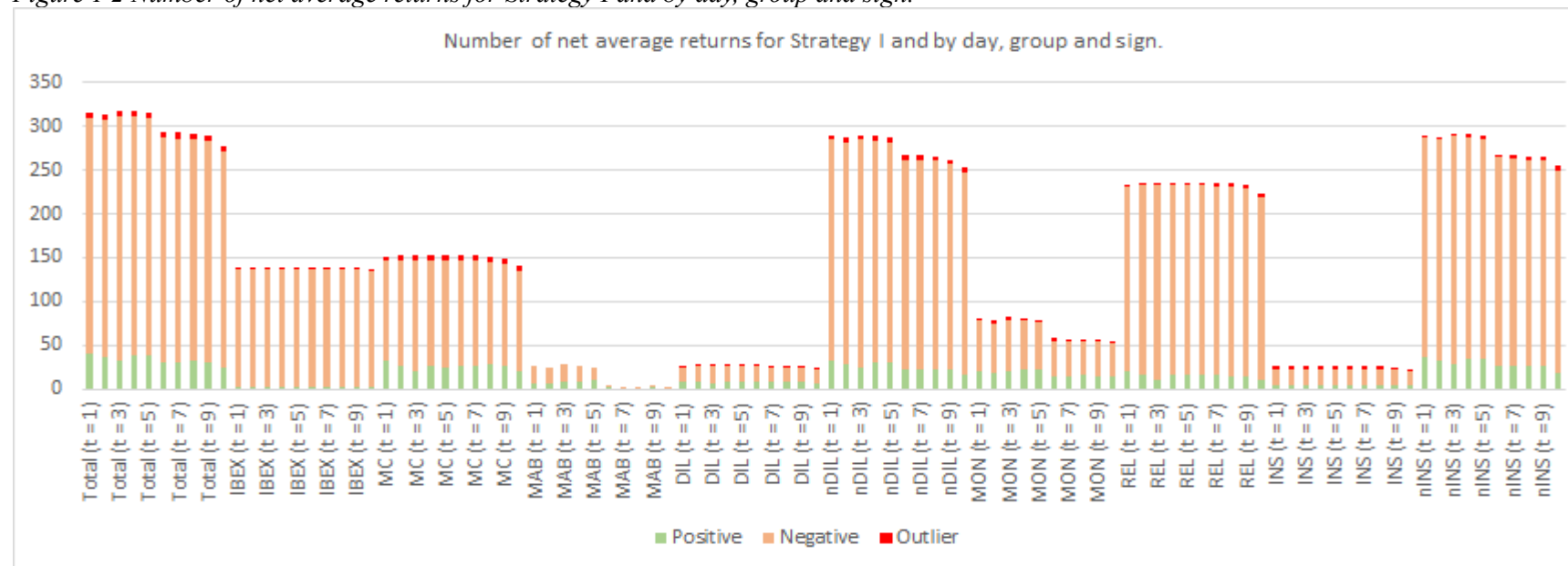


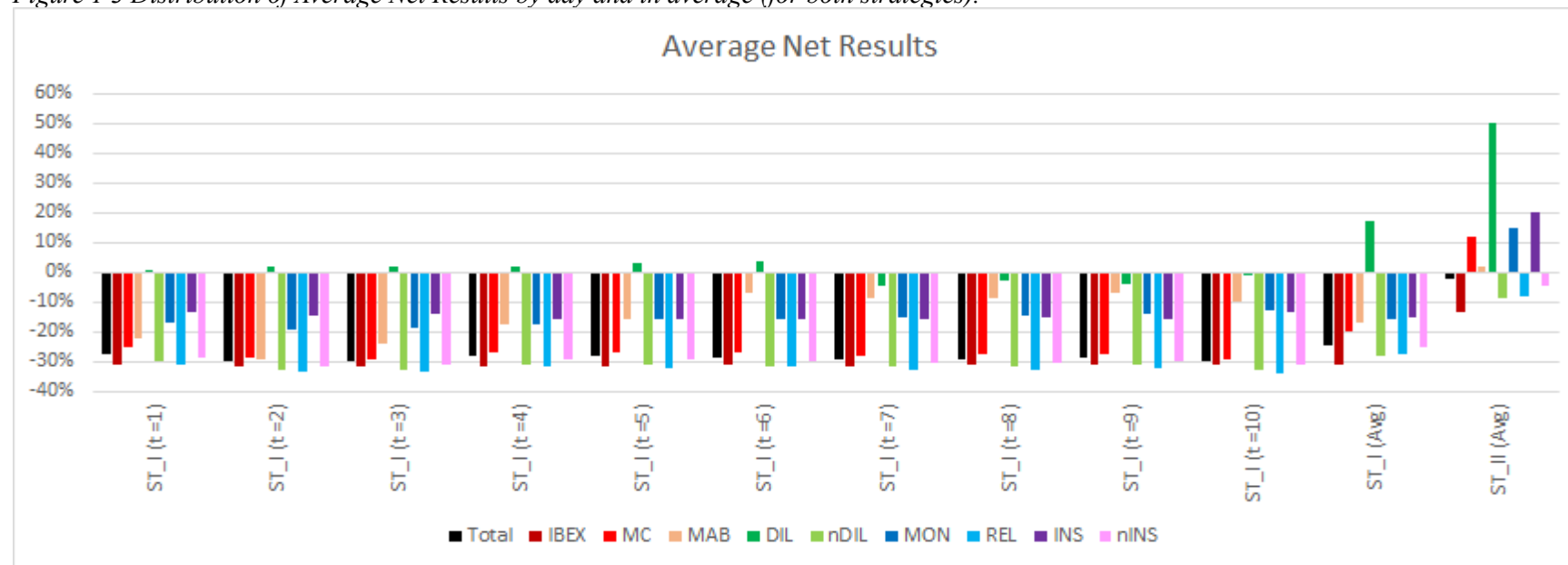
Figure 1·2 Number of net average returns for Strategy I and by day, group and sign.



NOTES: Figure 1·1 shows, for each strategy and group of rights issue, the total number of processes for which the average outcome is positive, negative, or those whose profitability has been considered as an outlier. Figure 1·2 shows the same, although it focuses on strategy I and shows the average outcome on each of the days analysed.

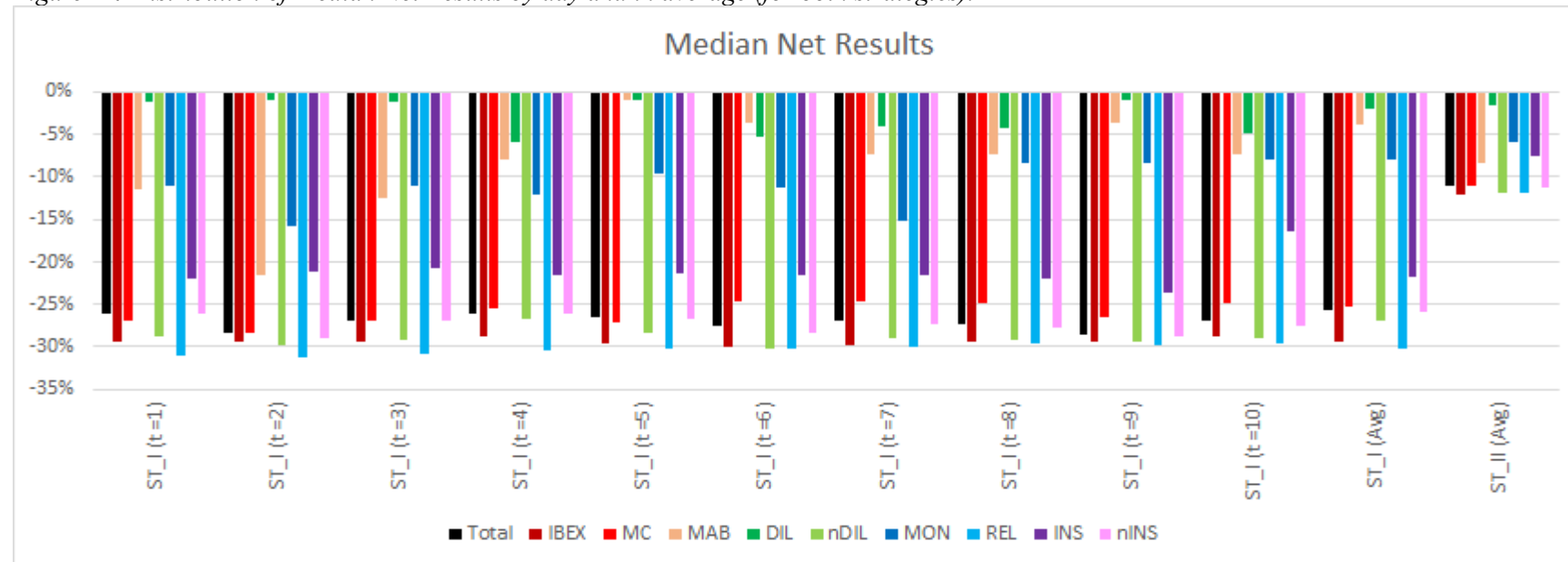
In summary, it can be seen that there are not many differences between strategies I and II (taking into account that the number of results available for strategy II is lower), and that on average the positive results, although small in number, are persistent over time.

Figure 1·3 Distribution of Average Net Results by day and in average (for both strategies).



NOTES: Figure 1·3 shows the daily average results obtained in each of the groups on each of the days analysed (for strategy I only), as well as the aggregated result for strategies I and II. Figure 1·4 replicates this analysis but showing the Median of the results instead of the average.

Figure 1·4 Distribution of Median Net Results by day and in average (for both strategies).



In summary, both the means and medians are, in almost all cases, negative. However, the positive means observed in the group of outliers do point to the possible existence of arbitrage opportunities in some of these processes.

Figure 1·5 Histogram of Net Returns (Total - I).

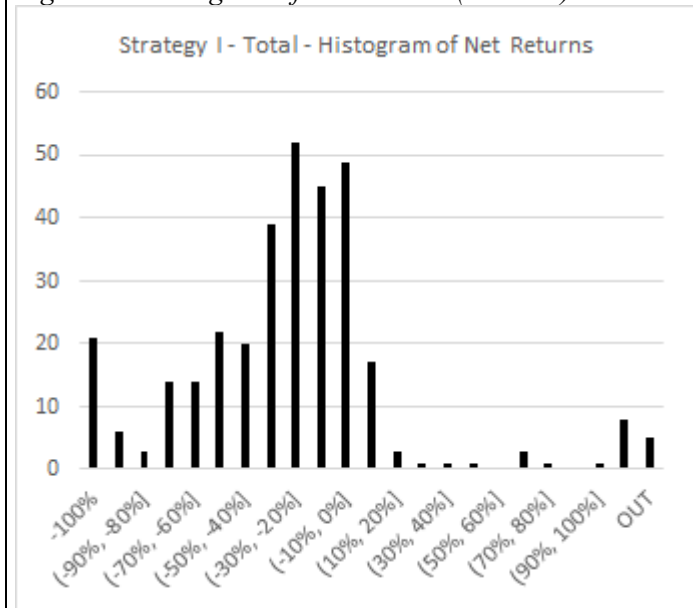


Figure 1·6 Histogram of Net Returns (IBEX - I).

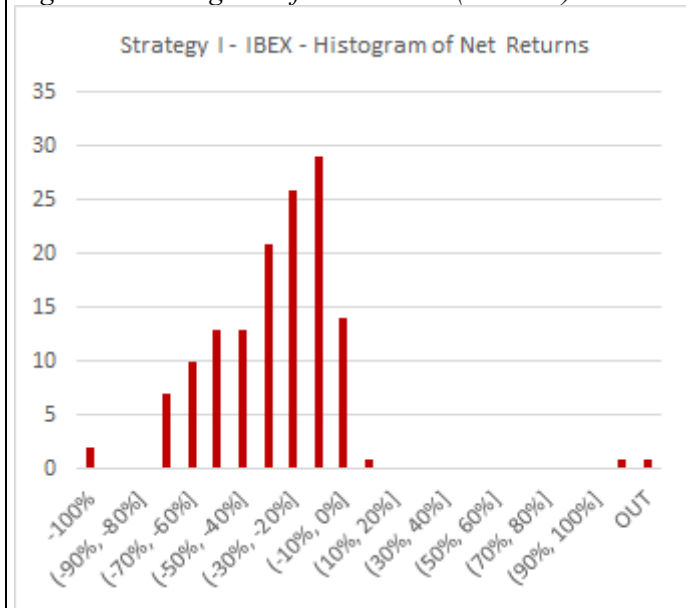


Figure 1·7 Histogram of Net Returns (MC - I).

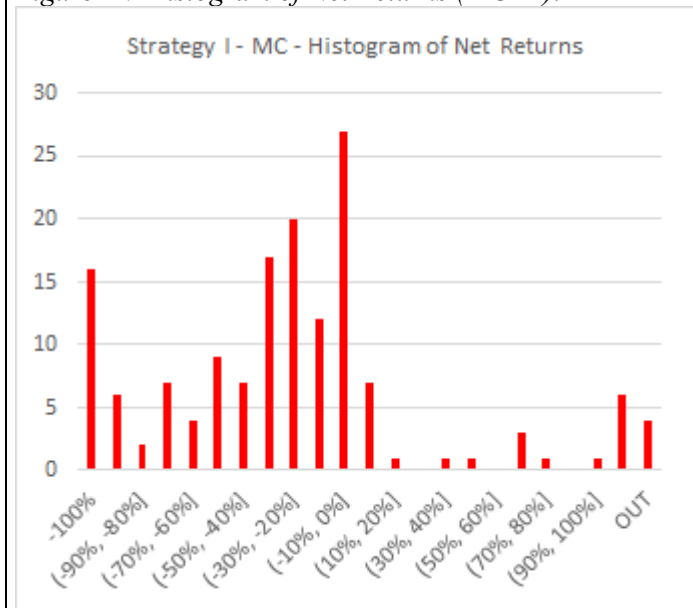
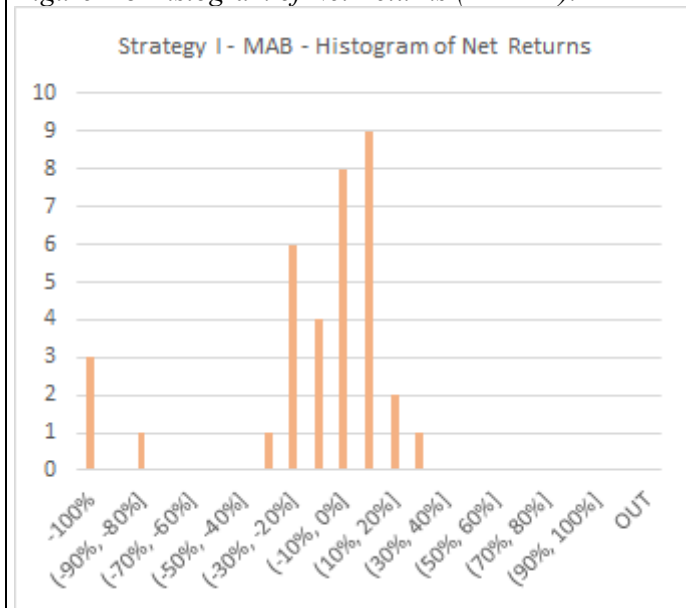


Figure 1·8 Histogram of Net Returns (MAB - I).



NOTE: Figures 1·5 to 1·14 show the Histogram of average net return for the set of rights issues, as well as for each of the subgroups constructed (calculated on the basis of Strategy I). The net returns considered as outliers are also included as a separate value.

We can observe how, in practically all groups, the majority of net returns obtained are negative. However, positive net returns can be found in all groups, which indicates that there have been arbitrage opportunities in these processes.

Although the behaviour of the return is very similar among the groups, some particularities can be observed. Specifically, it can be seen that in the IBEX and MAB groups of companies there have been practically no positive returns, while in the dilutive ones more opportunities can be observed.

Many of the outliers seem to be found in monetary and especially dilutive processes, while there are none when the issuers are IBEX or MAB companies.

Figure 1-9 Histogram of Net Returns (DIL - I).

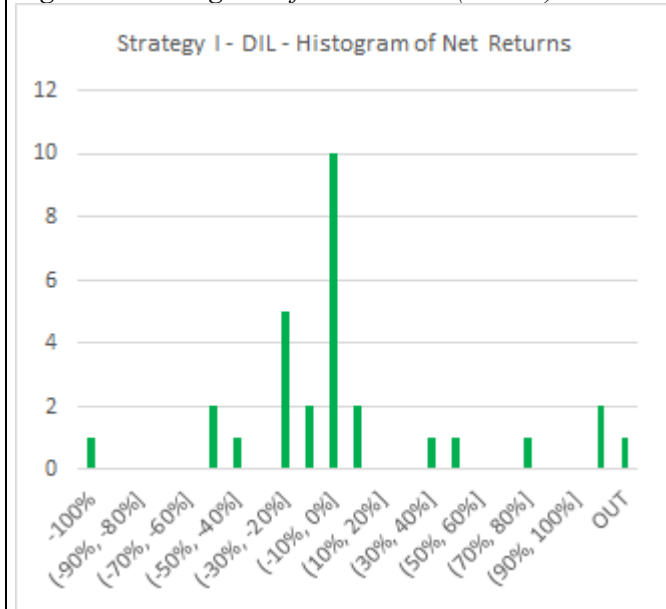


Figure 1-10 Histogram of Net Returns (nDIL - I).

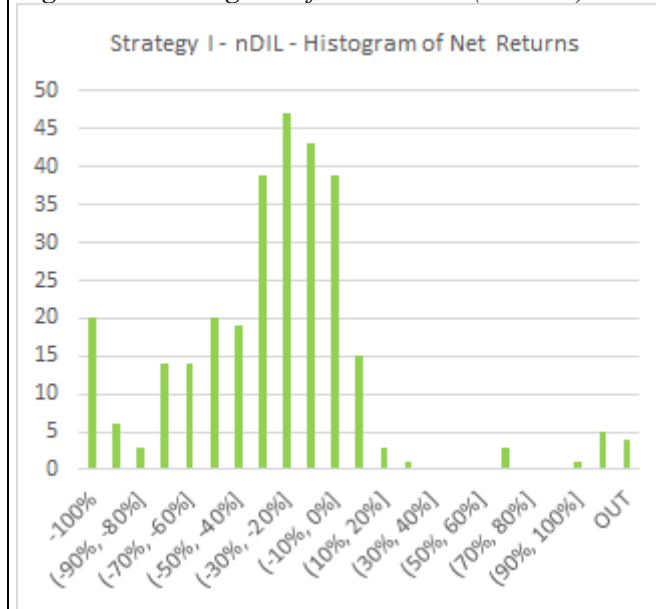


Figure 1-11 Histogram of Net Returns (MON - I).

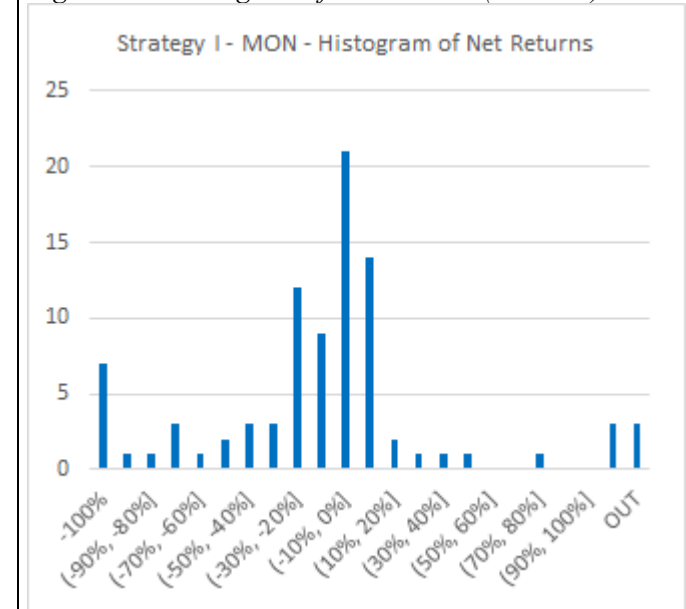


Figure 1-12 Histogram of Net Returns (REL - I).

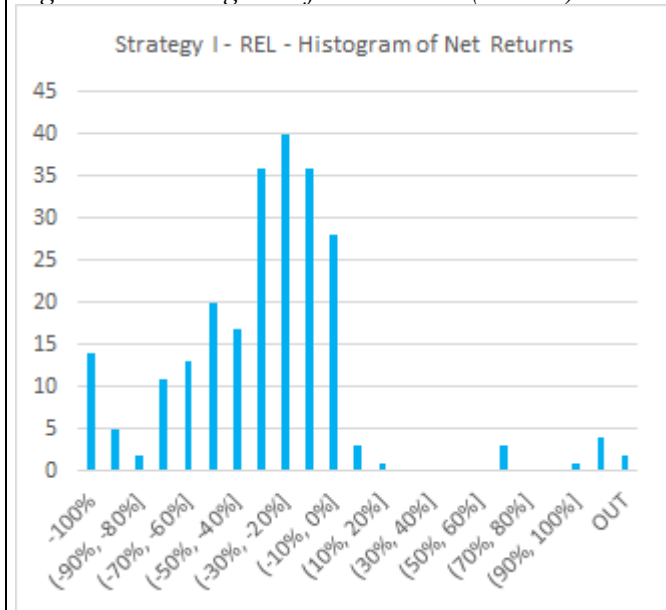


Figure 1-13 Histogram of Net Returns (INS - I).

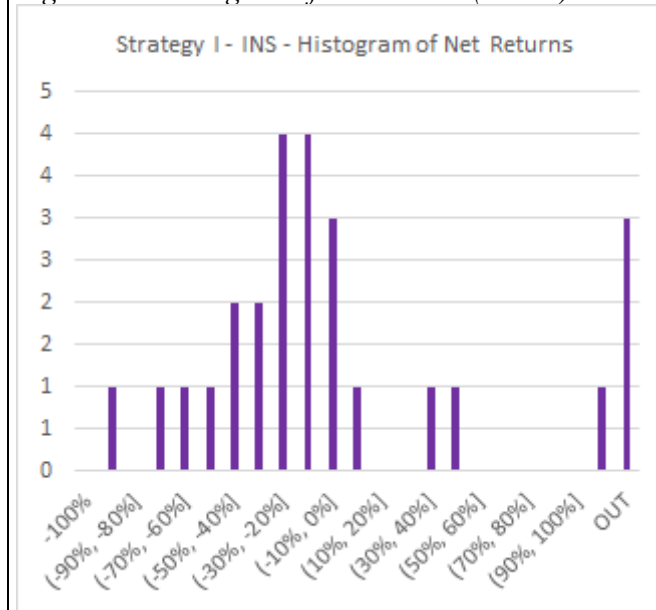


Figure 1-14 Histogram of Net Returns (nINS - I).

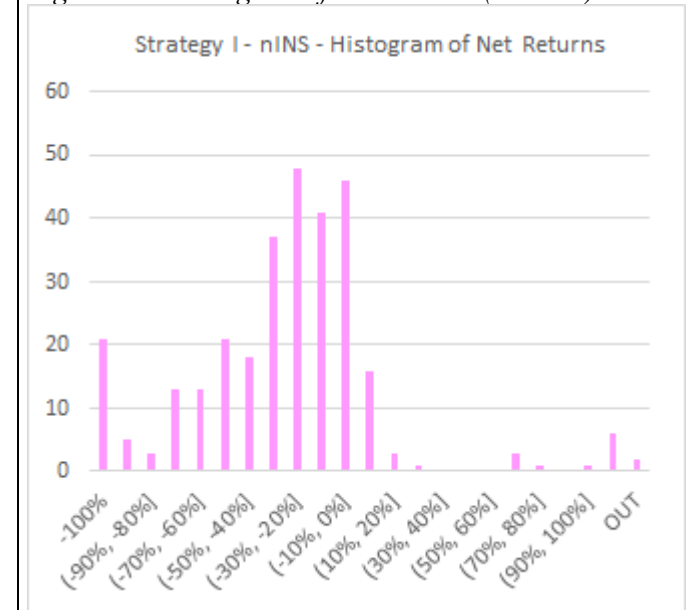


Figure 1-15 Histogram of Net Returns (Total - II).

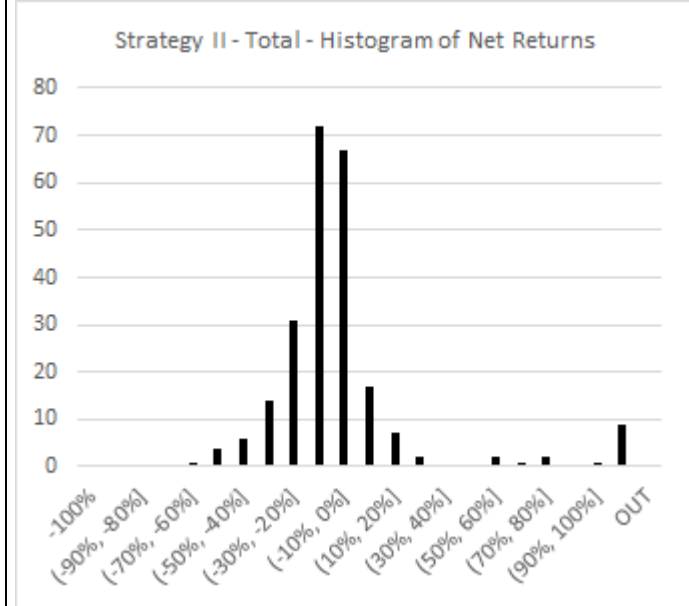


Figure 1-16 Histogram of Net Returns (IBEX - II).

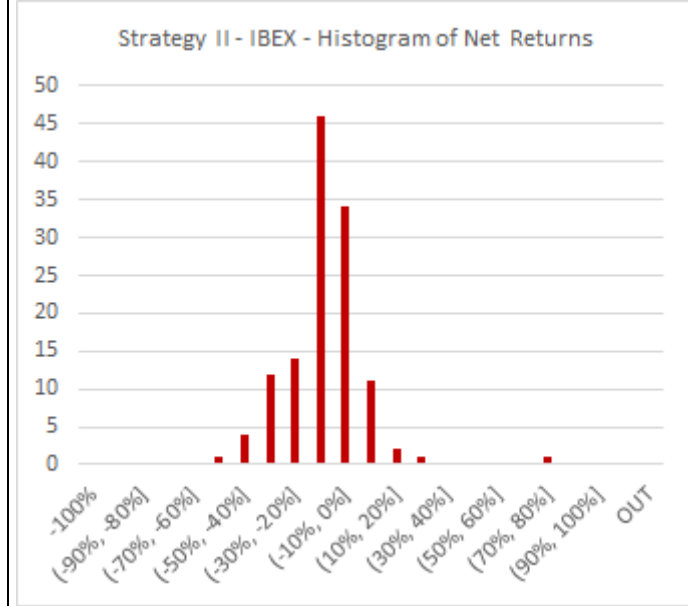


Figure 1-17 Histogram of Net Returns (MC - II).

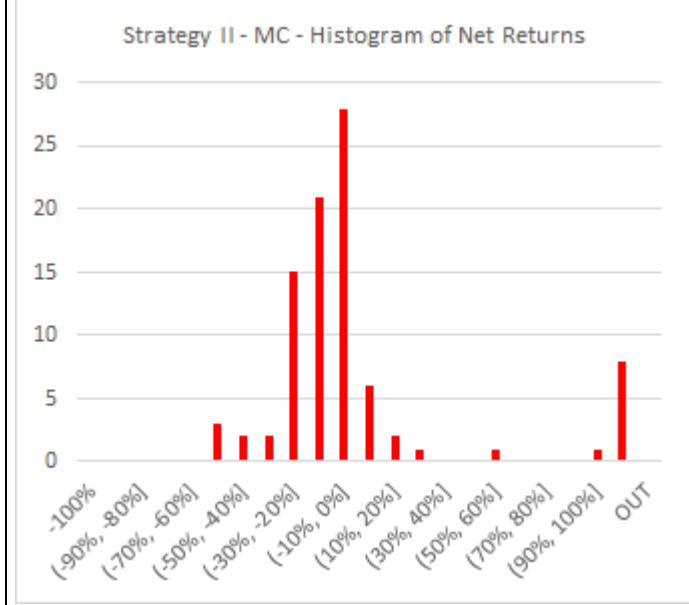
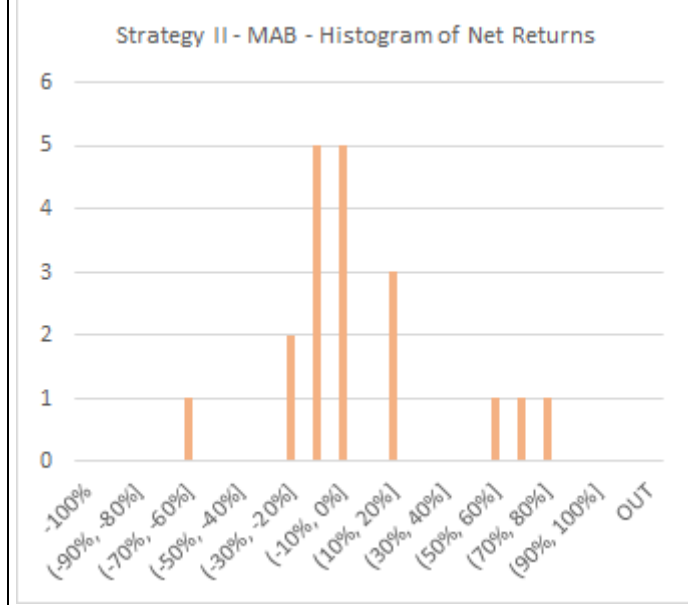


Figure 1-18 Histogram of Net Returns (MAB - II).



NOTE: Figures 1-15 to 1-24 show the Histogram of average net return for the set of rights issues, as well as for each of the subgroups constructed (calculated on the basis of Strategy II). The net returns considered as Outliers are also included as a separate value.

We can observe that the results for strategy II are not particularly different from those obtained for strategy I. Again, most of the net returns obtained are negative in all the groups analysed.

As in the previous case, it is again the case that more arbitrage opportunities are detected in the group of the dilutive processes.

In the Strategy II results, it was not possible to determine any return as an Outlier.

Figure 1-19 Histogram of Net Returns (DIL - II).

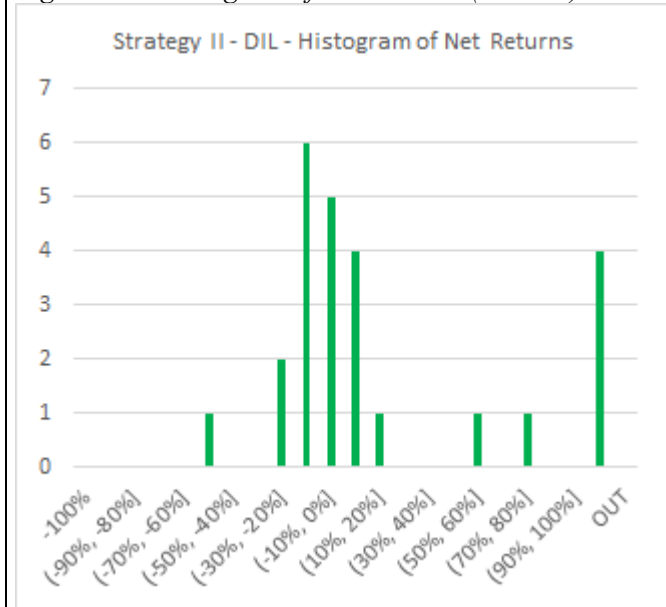


Figure 1-20 Histogram of Net Returns (nDIL - II).

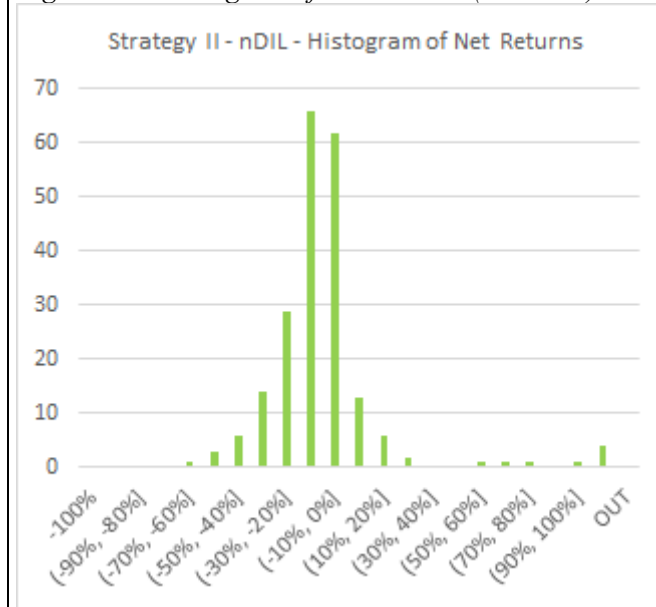


Figure 1-21 Histogram of Net Returns (MON - II).

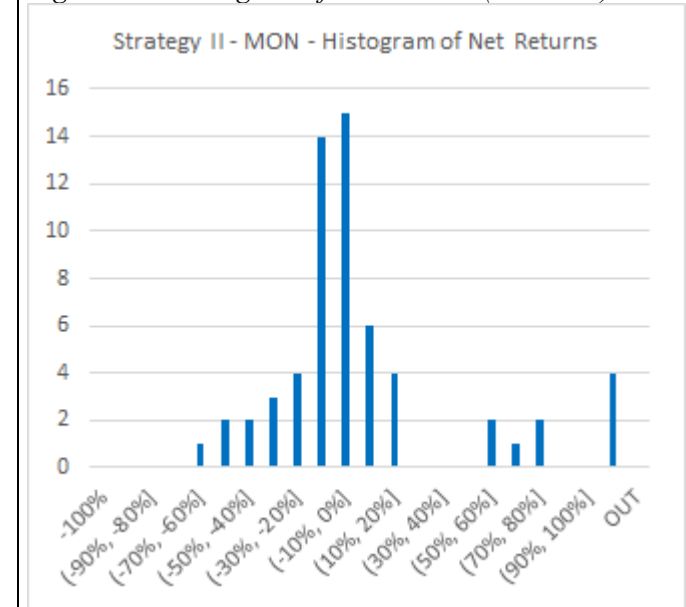


Figure 1-22 Histogram of Net Returns (REL - II).

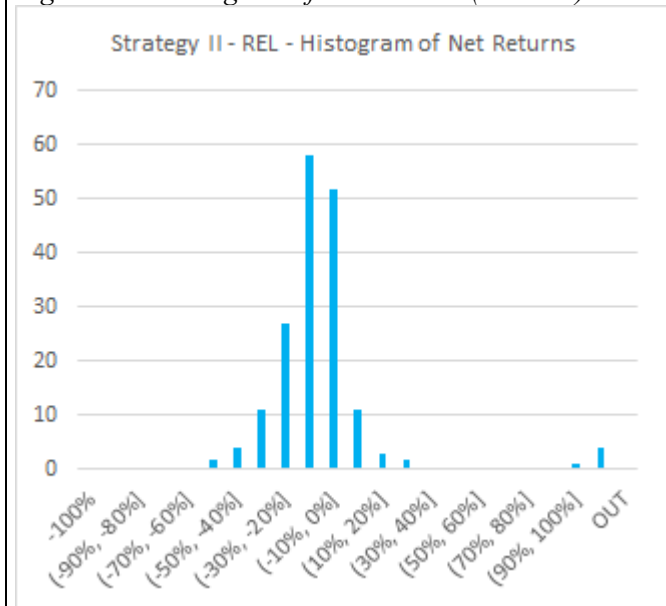


Figure 1-23 Histogram of Net Returns (INS - II).

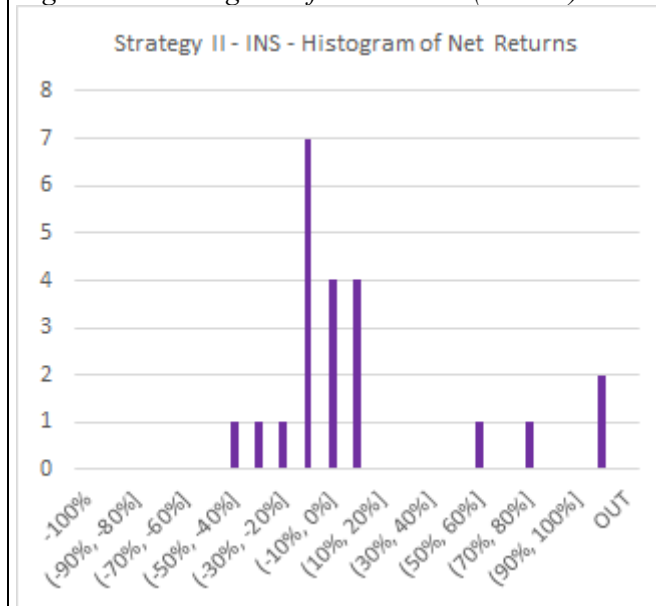


Figure 1-24 Histogram of Net Returns (nINS - II).

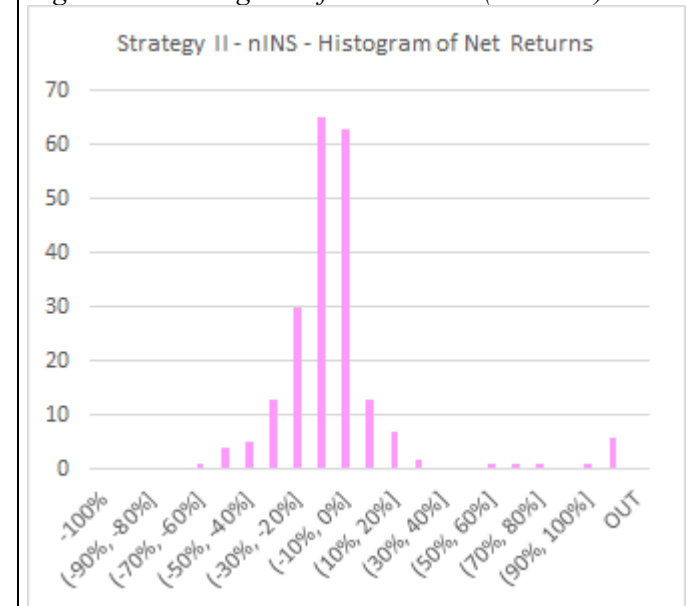


Table 1-3 Main statistics and results for t-Student and Wilcoxon test for IBEX, MC and MAB rights issues (daily and aggregate results).

Group	Results		Strategy I											Strategy II
			Avg.	t=1	t=2	t=3	t=4	t=5	t=6	t=7	t=8	t=9	t=10	Avg.
IBEX	Average (%)		-31,26%	-31,18%	-31,40%	-31,43%	-31,45%	-31,34%	-31,17%	-31,35%	-31,04%	-30,99%	-30,94%	-13,17%
	Median (%)		-29,35%	-29,46%	-29,39%	-29,35%	-28,77%	-29,54%	-30,03%	-29,79%	-29,47%	-29,34%	-28,86%	-12,16%
	Std. Dev. (%)		75,01%	34,69%	34,51%	34,46%	34,39%	34,61%	34,81%	34,57%	34,61%	35,06%	34,50%	15,14%
	t-Student test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
			***	***	***	***	***	***	***	***	***	***	***	***
	Wilcoxon test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
			***	***	***	***	***	***	***	***	***	***	***	***
MC	Average (%)		-19,75%	-24,91%	-28,94%	-29,15%	-27,09%	-27,05%	-26,70%	-27,82%	-27,72%	-27,53%	-29,25%	12,26%
	Median (%)		-25,22%	-26,91%	-28,27%	-26,98%	-25,40%	-27,18%	-24,58%	-24,66%	-24,76%	-26,56%	-24,79%	-11,13%
	Std. Dev. (%)		164,02%	63,87%	48,51%	49,91%	54,44%	54,83%	55,18%	52,03%	52,54%	55,52%	48,55%	86,86%
	t-Student test	P-Value	0,1451	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,1838
				***	***	***	***	***	***	***	***	***	***	
	Wilcoxon test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
			***	***	***	***	***	***	***	***	***	***	***	***
MAB	Average (%)		-16,66%	-22,18%	-29,15%	-24,08%	-17,68%	-15,80%	-7,06%	-8,84%	-8,82%	-6,74%	-9,79%	1,97%
	Median (%)		-3,75%	-11,44%	-21,49%	-12,43%	-7,94%	-0,85%	-3,62%	-7,26%	-7,26%	-3,59%	-7,26%	-8,44%
	Std. Dev. (%)		31,80%	33,40%	34,89%	35,12%	35,81%	42,44%	9,95%	9,75%	9,73%	9,71%	11,35%	34,46%
	t-Student test	P-Value	0,0039	0,0019	0,0004	0,0012	0,0164	0,0750	0,2507	0,0019	0,0004	0,0012	0,0164	0,8061
			***	***	***	***	**	*		***	***	***	**	
	Wilcoxon test	P-Value	0,0016	0,0003	0,0004	0,0009	0,0116	0,0532	0,2326	0,1425	0,1425	0,2326	0,1425	0,0001
			***	***	***	***	**	*						***

Table 1·4 Main statistics and results for t-Student and Wilcoxon test for dilutive and not dilutive rights issues (daily and aggregate results).

Group	Results		Strategy I											Strategy II
			Avg.	t =1	t =2	t =3	t =4	t =5	t =6	t =7	t =8	t =9	t =10	Avg.
Dilutives	Average (%)		17,05%	0,58%	1,95%	1,68%	1,77%	3,30%	3,94%	-4,24%	-2,94%	-4,16%	-0,78%	50,51%
	Median (%)		-1,98%	-1,05%	-0,94%	-1,04%	-5,97%	-1,02%	-5,36%	-4,09%	-4,17%	-0,94%	-4,83%	-1,50%
	Std. Dev. (%)		119,68%	52,41%	56,11%	58,79%	60,13%	64,01%	67,50%	51,95%	52,34%	52,49%	56,89%	137,89%
	t-Student test	P-Value	0,4573	0,9563	0,8609	0,8830	0,8795	0,7912	0,7682	0,9563	0,8609	0,8830	0,8795	0,0794
														*
	Wilcoxon test	P-Value	0,0608	0,1983	0,1346	0,0854	0,0714	0,0682	0,0793	0,0766	0,0944	0,0713	0,0764	0,3146
			*			*	*	*	*	*	*	*	*	*
Not Dilutives	Average (%)		-28,31%	-29,90%	-33,00%	-32,67%	-31,04%	-31,04%	-31,78%	-31,61%	-31,53%	-31,30%	-32,57%	-8,48%
	Median (%)		-26,86%	-28,68%	-29,75%	-29,26%	-26,78%	-28,34%	-30,19%	-29,05%	-29,18%	-29,46%	-29,02%	-11,80%
	Std. Dev. (%)		57,41%	49,66%	38,95%	39,40%	42,49%	42,80%	42,39%	42,83%	43,04%	45,15%	39,27%	32,58%
	t-Student test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0002
			***	***	***	***	***	***	***	***	***	***	***	***
	Wilcoxon test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,6009
			***	***	***	***	***	***	***	***	***	***	***	***

NOTES: Tables 1·3 and 1·4 show the main results on the arbitrage analysis performed on the sample of rights issues (i.e. the mean and median returns and their standard deviation, and the tests on the mean (t-Student) and on the median (Wilcoxon)), for IBEX, MC and MAB processes (Table 3) and the dilutive and non-dilutive ones (Table 4).

In summary, it can be observed that the statistically significant returns are always negative (with the exception of the dilutive group, where they are positive and high), while the medians are significant in many cases, and in most of them they are negative. On the other hand, no significant differences can be observed between the results of strategies I and II.

Table 1·5 Main statistics and results for t-Student and Wilcoxon test for monetary and released equity offerings (daily and aggregate results).

Group	Results		Strategy I											Strategy II
			Avg.	t =1	t =2	t =3	t =4	t =5	t =6	t =7	t =8	t =9	t =10	Avg.
Monetary	Average (%)		-15,83%	-17,03%	-19,44%	-18,38%	-17,24%	-15,93%	-15,55%	-15,10%	-14,37%	-14,09%	-12,80%	15,01%
	Median (%)		-8,01%	-10,94%	-15,85%	-10,94%	-12,12%	-9,67%	-11,25%	-15,11%	-8,41%	-8,29%	-8,03%	-5,96%
	Std. Dev. (%)		45,87%	47,60%	48,23%	47,68%	47,81%	50,04%	51,68%	52,82%	53,01%	53,21%	54,76%	90,67%
	t-Student test	P-Value	0,0019	0,0023	0,0008	0,0010	0,0021	0,0070	0,0298	0,0023	0,0008	0,0010	0,0021	0,2047
			***	***	***	***	***	***	**	***	***	***	***	***
	Wilcoxon test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0001	0,0003	0,0005	0,0007	0,0012	0,0008	0,0000
			***	***	***	***	***	***	***	***	***	***	***	***
Released	Average (%)		-27,47%	-30,95%	-33,46%	-33,53%	-31,86%	-31,99%	-31,63%	-32,62%	-32,57%	-32,39%	-33,93%	-8,11%
	Median (%)		-30,21%	-30,94%	-31,29%	-30,81%	-30,39%	-30,23%	-30,20%	-29,99%	-29,63%	-29,77%	-29,53%	-11,82%
	Std. Dev. (%)		72,10%	51,05%	38,88%	39,88%	43,70%	43,94%	44,40%	41,41%	41,66%	44,03%	37,20%	37,67%
	t-Student test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0049
			***	***	***	***	***	***	***	***	***	***	***	***
	Wilcoxon test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0620
			***	***	***	***	***	***	***	***	***	***	***	***

NOTES: Tables 1·5 and 1·6 show the main results of the arbitrage analysis performed on the sample of rights issues (i.e. the mean and median results and their standard deviation, and the tests on the mean (t-Student) and on the median (Wilcoxon), for monetary and released processes (Table 5) the insured and not insured ones, and the aggregation of them (Table 6).

In summary, the conclusions drawn from the analysis in Tables 3 and 4 are replicated here. In this case, there are no relevant differences between strategies I and II either.

Table 1-6 Main statistics and results for t-Student and Wilcoxon test for insured. not insured. and total rights issues (daily and aggregate results).

Group	Results		Strategy I											Strategy II
			Avg.	t=1	t=2	t=3	t=4	t=5	t=6	t=7	t=8	t=9	t=10	Avg.
Insured	Average (%)		-15,14%	-13,55%	-14,27%	-14,12%	-15,91%	-15,84%	-15,41%	-15,54%	-15,24%	-15,79%	-13,06%	20,02%
	Median (%)		-21,82%	-21,88%	-21,22%	-20,72%	-21,65%	-21,38%	-21,55%	-21,47%	-21,91%	-23,59%	-16,43%	-7,57%
	Std. Dev. (%)		52,54%	52,64%	51,91%	54,28%	54,01%	53,32%	52,98%	52,79%	52,29%	52,74%	52,73%	93,59%
	t-Student test	P-Value	0,1808	0,2301	0,2010	0,2254	0,1718	0,1683	0,1768	0,2301	0,2010	0,2254	0,1718	0,3272
	Wilcoxon test	P-Value	0,0069	0,0132	0,0088	0,0081	0,0058	0,0053	0,0069	0,0069	0,0069	0,0093	0,0177	0,0000
			***	**	***	***	***	***	***	***	***	***	**	***
Not Insured	Average (%)		-25,05%	-28,56%	-31,32%	-30,94%	-29,17%	-29,02%	-29,70%	-30,51%	-30,34%	-30,00%	-31,28%	-4,50%
	Median (%)		-25,91%	-26,13%	-28,91%	-26,88%	-26,06%	-26,68%	-28,36%	-27,37%	-27,82%	-28,68%	-27,55%	-11,29%
	Std. Dev. (%)		67,17%	50,24%	40,62%	41,21%	44,31%	45,27%	45,52%	43,30%	43,67%	45,75%	40,65%	51,39%
	t-Student test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,2027
			***	***	***	***	***	***	***	***	***	***	***	
	Wilcoxon test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,2132
			***	***	***	***	***	***	***	***	***	***	***	
Total	Average (%)		-24,34%	-27,43%	-30,03%	-29,68%	-28,17%	-28,02%	-28,54%	-29,29%	-29,10%	-28,89%	-29,85%	-2,28%
	Median (%)		-25,64%	-26,08%	-28,41%	-26,83%	-25,99%	-26,59%	-27,45%	-26,88%	-27,32%	-28,46%	-27,01%	-11,13%
	Std. Dev. (%)		85,00%	66,35%	55,07%	56,37%	60,64%	65,36%	59,31%	59,01%	61,99%	58,96%	63,01%	201,18%
	t-Student test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,8622
			***	***	***	***	***	***	***	***	***	***	***	
	Wilcoxon test	P-Value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
			***	***	***	***	***	***	***	***	***	***	***	***

Table 1·7 AAR and test results for each event for IBEX, MC MAB, dilutive and not dilutive rights issues.

Group	Relevant Date	AAR	Median	Std. Dev.	t-Student Test		Wilcoxon Test		Bootstrapping		
					P-Value		P-Value		Low	Up	
IBEX	Announcement	-0,1386%	4,3914%	0,0248%	0,5473		0,6450		-0,0061	0,0035	
	Meeting	-0,0430%	2,0442%	-0,0389%	0,7544		0,3545		-0,0035	0,0032	
	Start	1,7741%	20,3554%	-0,1239%	0,0844	*	0,2935		-0,0099	0,0152	
	End	0,3662%	3,7576%	0,0614%	0,0538	*	0,9559		-0,0037	0,0038	
	Result	-0,1290%	4,3901%	-0,0759%	0,6060		0,3259		-0,0060	0,0043	
	Quotation	-0,3612%	5,3577%	-0,0657%	0,2602		0,1576		-0,0079	0,0042	
MC	Announcement	0,0324%	1,2854%	0,0021%	0,7698		0,7282		-0,0030	0,0025	
	Meeting	0,2925%	1,4263%	0,1152%	0,0884	*	0,9428		-0,0034	0,0036	
	Start	0,9229%	16,3284%	-0,3162%	0,5063		0,0002	***	-0,0138	0,0838	
	End	0,0339%	2,3124%	0,0631%	0,8632		0,7811		-0,0049	0,0041	
	Result	-0,3073%	4,2292%	0,0079%	0,4035		0,5228		-0,0111	0,0042	
	Quotation	-0,1538%	1,2916%	-0,0936%	0,1838		0,1030		-0,0029	0,0022	
MAB	Announcement	-0,2889%	5,8326%	0,0242%	0,4933		0,5513		-0,0120	0,0060	
	Meeting	-0,0290%	2,2424%	-0,0657%	0,8947		0,3371		-0,0045	0,0055	
	Start	2,7092%	24,6650%	0,1872%	0,1156		0,9567		-0,0176	0,0225	
	End	0,6068%	4,6487%	0,1143%	0,0618	*	0,9296		-0,0050	0,0058	
	Result	0,3839%	3,5527%	-0,0716%	0,2166		0,5925		-0,0052	0,0078	
	Quotation	-0,4683%	7,9956%	0,0652%	0,5330		0,6194		-0,0220	0,0091	
Dilutives	Announcement	0,0171%	2,7492%	0,1112%	0,9700		0,5150		-0,0089	0,0105	
	Meeting	-0,5926%	2,2915%	-0,2019%	0,0861	*	0,0384	**	-0,0067	0,0069	
	Start	0,2066%	2,6165%	-0,1353%	0,5869		0,4510		-0,0072	0,0084	
	End	0,2912%	2,6563%	0,0210%	0,4512		0,7442		-0,0078	0,0080	
	Result	-1,1285%	6,5393%	-0,2871%	0,2585		0,0825	*	-0,0219	0,0146	
	Quotation	-0,7092%	3,8048%	-0,0169%	0,2454		0,1381		-0,0120	0,0147	
Not Dilutives	Announcement	-0,5413%	4,1318%	-0,4707%	0,4123		0,1184		-0,0123	0,0160	
	Meeting	0,4731%	2,7535%	0,0319%	0,2898		0,7395		-0,0080	0,0099	
	Start	16,7178%	58,3534%	0,4445%	0,0610	*	0,9762		-0,0815	0,0765	
	End	2,0049%	8,7021%	0,0371%	0,1292		0,8152		-0,0171	0,0274	
	Result	-1,2379%	8,5939%	-0,4548%	0,3618		0,1396		-0,0280	0,0210	
	Quotation	-1,7882%	13,6556%	0,1570%	0,4246		0,5605		-0,0609	0,0241	

NOTES: Table 1·7 shows the Aggregate Abnormal Returns (AAR) for each event analysed, and the tests performed on the abnormal returns for IBEX, MC, MAB, dilutive and non-dilutive rights issues. We can observe that, in general terms, abnormal returns are not significant, with the exception of those generated by the start and end of the trading period of pre-emptive subscription rights. It is also noteworthy that, when abnormal returns are significant, they are also positive.

Table 1·8 AAR and test results for each event for monetary, released, insured, not insured and total rights issues.

Group	Relevant Date	AAR	Median	Std. Dev.	t-Student Test		Wilcoxon Test		Bootstrapping		
					P-Value		P-Value		Low	Up	
Monetary	Announcement	-0,0889%	4,4259%	0,0406%	0,7178		0,8138		-0,0076	0,0035	
	Meeting	-0,1530%	1,8499%	-0,0474%	0,2647		0,2451		-0,0033	0,0029	
	Start	-0,1527%	2,1886%	-0,1566%	0,1932		0,0783	*	-0,0026	0,0025	
	End	0,1549%	2,4451%	0,0631%	0,2373		0,9413		-0,0032	0,0029	
	Result	0,0407%	3,3092%	-0,0377%	0,8406		0,4940		-0,0056	0,0037	
	Quotation	-0,1371%	2,0569%	-0,0729%	0,3007		0,1014		-0,0033	0,0030	
Released	Announcement	-0,9311%	7,5331%	-0,1311%	0,2038		0,0469	**	-0,0164	0,0102	
	Meeting	-0,1798%	2,4907%	-0,2204%	0,4905		0,1171		-0,0057	0,0061	
	Start	6,3014%	35,9585%	0,2570%	0,0542	*	0,9854		-0,0316	0,0234	
	End	0,7394%	5,8787%	-0,0172%	0,1656		0,5402		-0,0076	0,0117	
	Result	-0,3037%	6,9443%	-0,1923%	0,6385		0,3071		-0,0151	0,0107	
	Quotation	-1,2775%	8,9392%	-0,1188%	0,1691		0,0735	*	-0,0176	0,0127	
Insured	Announcement	0,1913%	1,8644%	0,0445%	0,1012		0,9566		-0,0030	0,0028	
	Meeting	0,0538%	1,6614%	0,1088%	0,7125		0,7476		-0,0034	0,0030	
	Start	-0,2807%	2,2969%	-0,2369%	0,0452	**	0,0113	**	-0,0032	0,0028	
	End	0,1969%	2,2009%	0,1097%	0,1421		0,9879		-0,0039	0,0034	
	Result	-0,0239%	1,4157%	0,0079%	0,8145		0,5269		-0,0027	0,0027	
	Quotation	0,1019%	1,5739%	-0,0630%	0,3785		0,4046		-0,0023	0,0031	
Not Insured	Announcement	-0,1204%	2,8105%	-0,4974%	0,8255		0,2070		-0,0102	0,0152	
	Meeting	0,5579%	2,4803%	-0,2319%	0,3392		0,7134		-0,0130	0,0117	
	Start	8,1243%	35,4366%	1,0732%	0,2269		0,9974		-0,1686	0,0237	
	End	0,0762%	5,0517%	-0,1476%	0,9358		0,4356		-0,0207	0,0189	
	Result	-1,5196%	8,8544%	-0,3237%	0,3630		0,2907		-0,0436	0,0201	
	Quotation	-0,4921%	2,5549%	-0,4174%	0,3761		0,2740		-0,0121	0,0103	
Total	Announcement	-0,1401%	4,4970%	0,0367%	0,5678		0,7504		-0,0072	0,0036	
	Meeting	-0,0992%	1,9967%	-0,0380%	0,4797		0,3014		-0,0033	0,0035	
	Start	1,2696%	18,6357%	-0,1752%	0,1939		0,0529	*	-0,0091	0,0288	
	End	0,3893%	3,6434%	0,0631%	0,0419	**	0,9694		-0,0032	0,0041	
	Result	0,0151%	3,6314%	-0,0508%	0,9447		0,3891		-0,0049	0,0044	
	Quotation	-0,3500%	5,5342%	-0,0630%	0,3106		0,1973		-0,0082	0,0047	

NOTES: Table 1·8 shows the Aggregate Abnormal Returns (AAR) for each event analysed, and the tests performed on the abnormal returns (t-Student and Bootstrapping on the mean and Wilcoxon on the median) for the monetary, released, insured, not insured and total rights issue. In summary, the conclusions obtained from the analysis in Table 1·7 seem to be replicated also for these groups, both in the significance and in the sign of the significant abnormal returns.

Table 1-9 Results for the long-term event study by model of reference for each group of rights issues.

	Total	IBEX	MC	MAB	Dilutes	Non-Dilutives	Monetary	Released	Insured	Not Insured
Panel A: CAPM										
Constant (%)	0,1200%	-0,3537%	-0,0200%	0,9100%	-0,9100%	0,2500%	0,0600%	0,1600%	-0,4800%	0,1600%
p-value	0,612	0,990	0,944	0,057	0,041	0,279	0,873	0,475	0,263	0,499
				*	**					
Adjusted R² (%)	52,7%	55,4%	35,0%	2,5%	8,1%	53,5%	26,9%	54,9%	25,9%	49,4%
Panel B: Fama and French										
Constant (%)	-0,0400%	0,0200%	-0,3000%	0,8800%	-1,0900%	0,1000%	-0,2100%	0,0400%	-0,6600%	0,0200%
p-value	0,855	0,949	0,322	0,080	0,020	0,626	0,562	0,852	0,128	0,927
				*	**					
Adjusted R² (%)	56,6%	57,7%	43,9%	2,7%	10,6%	56,9%	33,3%	57,3%	30,0%	52,6%
Panel C: Fama and French + Amihud										
Constant (%)	-0,0600%	0,0014%	-0,3300%	0,8900%	-1,0800%	0,0800%	-0,2300%	0,0200%	-0,6400%	-0,0056%
p-value	0,780	0,996	0,274	0,080	0,022	0,722	0,514	0,917	0,145	0,980
				*	**					
Adjusted R² (%)	56,7%	57,7%	44,2%	2,7%	10,6%	57,1%	33,4%	57,4%	30,1%	52,9%

NOTES: Table 1-9 shows the result of the long-term Event Study conducted according to the three benchmark models and for each group of rights issues. In summary, a relevant change in the results can be observed when adding the illiquidity factor, which highlights the importance of the model specification and its effects on the results.

Figure 1-25 Histogram of AR (Announcement).

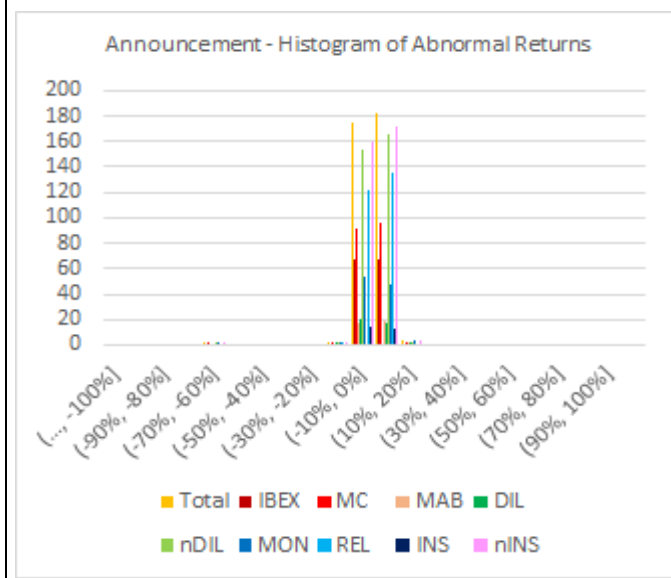


Figure 1-26 Histogram of AR (Meeting).

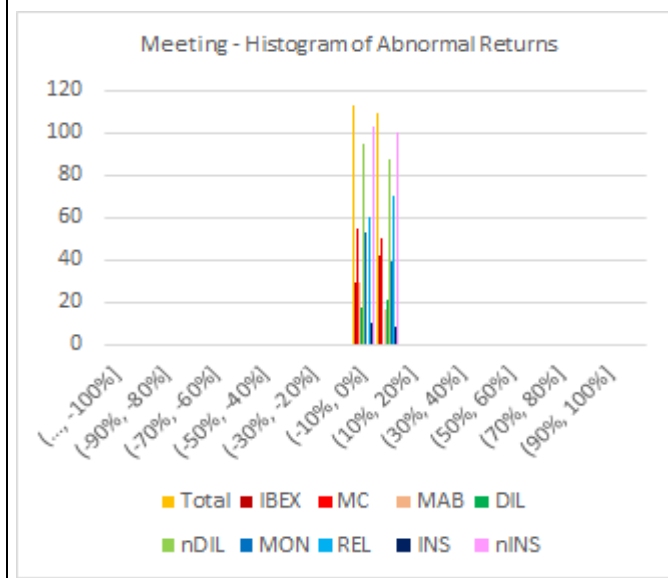


Figure 1-27 Histogram of AR (Start).

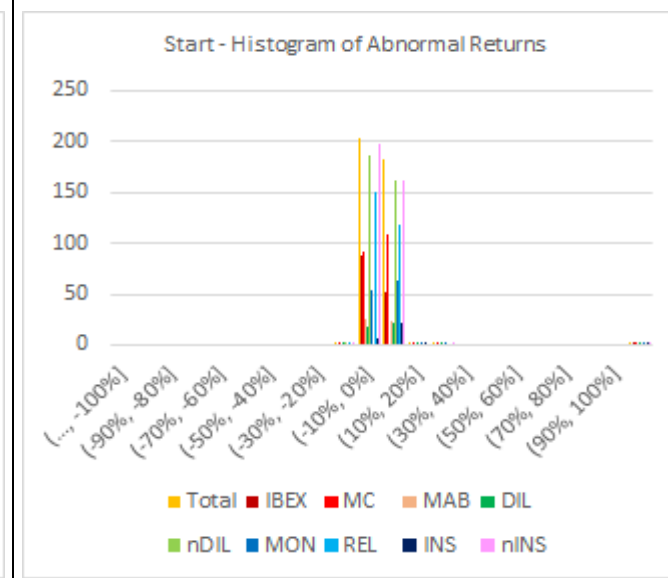


Figure 1-28 Histogram of AR (End).

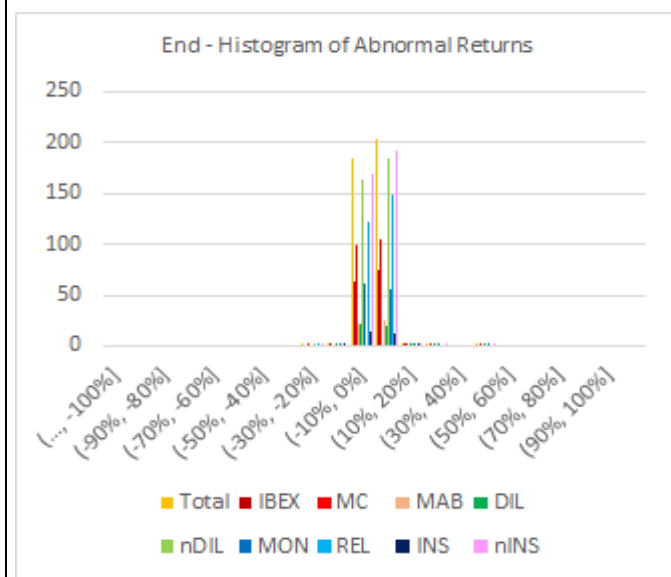


Figure 1-29 Histogram of AR (Result).

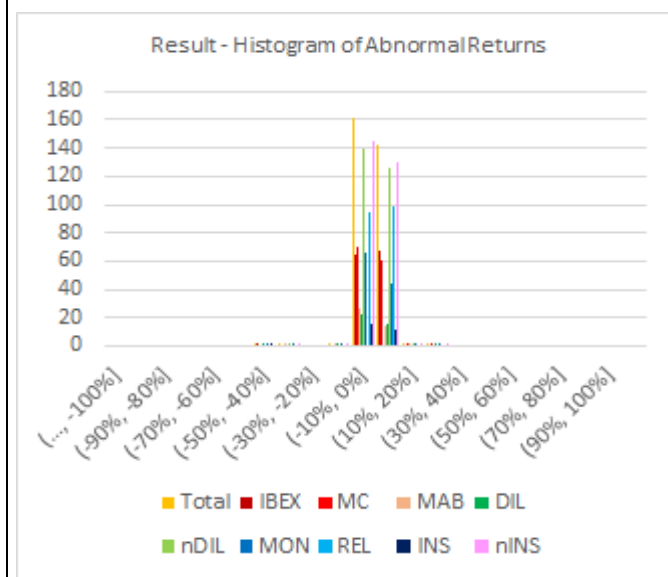
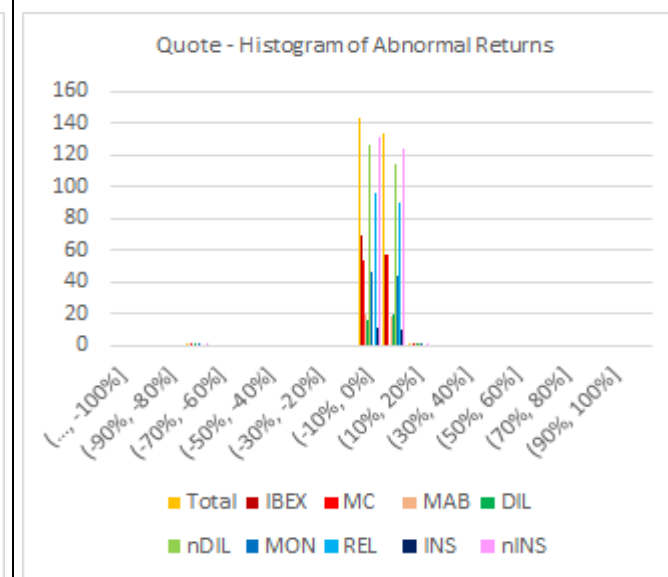


Figure 1-30 Histogram of AR (Quote).



NOTES: Figures 1-25 to 1-30 show the RA histogram for each of the events and groups analysed. In general terms, they cluster around 0%.

Chapter 2

Detecting, characterising and predicting arbitrage opportunities in international rights issues

2.1. INTRODUCTION

Equity offerings are one of the tools that companies have at their disposal to obtain funds to meet their financial needs. As opposed to the issuance of debt, which implies the subsequent need to repay the amount obtained and pay it back with a certain interest rate, these processes make it possible to obtain funds without having to repay them later, as they become part of the entity's equity and not of its liabilities⁴.

As with debt financing, the regulators of each country have established the rules that must be followed in equity offerings, both by the issuing company and by the investors and shareholders. Each country has its own regulations which, although in general terms are very similar, each territory may have particular regulatory features that give these processes different characteristics (and even results) to those that would be obtained under other regulations.

Equity offerings, when carried out by issuing new shares, may cause the owners of the old shares to see their percentage interest in the company reduced to a greater extent the more new shares are issued. One method of avoiding this dilution effect is the allocation of Preferential Subscription Rights, hereinafter also referred to as PSRs, to the old shares. The exercise of these rights is what makes it possible to acquire new shares and gives shareholders the possibility of keep their percentage stake intact. These investors may choose between exercising the rights and acquiring the new shares or selling them on the market. This mechanics generates a particular situation, which consists of two methods of obtaining the same shares, (1) buying the old shares directly on the market, and (2) acquiring them by purchasing and exercising the subscription rights. This coexistence of methods could imply the existence of arbitrage opportunities, when the price paid for the share in each of the methods differs significantly.

The aim of this paper is to study the rights issues that have taken place around the world, analysing the occurrence or not of arbitrage opportunities and identifying possible factors affecting the occurrence of such arbitrage opportunities. To this end, a sample of 3,629 processes carried out by companies from a total of 28 different countries will be studied, carrying out a set of tests to detect these arbitrage opportunities and analyse them, both individually and jointly.

To do so, a strategy designed to obtain the benefits of these arbitrages has been applied and, on the net results calculated, a series of statistical tests have been applied to characterize the main factors on which these returns may depend. Probabilistic models were then constructed to

⁴ See **Klein et al. (2002)**.

explain and predict the occurrence or non-occurrence of arbitrage in each of the countries. The results obtained point to the existence of arbitrage opportunities in rights issues in most of the countries studied. In addition, factors have been identified that have a relevant effect on the appearance or not of these anomalies, including the fact of being listed on a stock market index or the size of the equity offering, measured as the ratio between new and old shares, among others. The former seems to be related to a lower occurrence of these opportunities, while the latter seems to favour them. For its part, this casuistry seems to occur, to a greater or lesser extent, in all the territories analysed. Finally, a set of models capable of predicting the occurrence of arbitrage has been obtained, with greater or lesser accuracy depending on the country to which it is applied.

Finally, it should be noted that this work is the first work to study, jointly, the possible emergence of arbitrage opportunities in rights issues in different countries around the world. In addition, the time period and the volume of information covered allow us to draw a set of robust conclusions, both at a general level and in particular for each of the regions and each of the countries analysed. Furthermore, as will be explained below, the strategy used to obtain the possible returns from arbitrage has been put into practice in real trading, obtaining positive results in many cases and meeting theoretical expectations, which further reinforces the results obtained. In summary, the aim of this study is to establish a general framework for the analysis of equity offerings with rights at the international level.

Section 2 reviews the literature related to the objective of this study and discusses the preliminary conclusions that can be drawn from it. Section 3 defines the dataset used for this study and the different methods applied to obtain and filter all this information, while section 4 defines the methodology applied. Finally, sections 5 and 6 show, respectively, the most relevant results obtained and the conclusions of this study.

The results obtained in this paper point to the existence of arbitrage opportunities in equity offerings with subscription rights in all the countries analysed. Moreover, these anomalies seem to be sustained over time, contrary to what would be expected. Upon further analysis, several factors have been identified that have a high capacity to explain the occurrence and magnitude of these anomalous returns. This suggests that these factors, both related to the equity offering or the issuing company itself, have a significant effect on the occurrence or non-occurrence of arbitrage opportunities. In summary, this paper is the first to detect these behaviours in a large and diverse sample of equity offerings from around the world.

2.2. LITERATURE REVIEW

In the current literature there are many works whose object of study is equity offerings. The characteristics and complexity of these processes mean that they can be analysed from many points of view, from a legal perspective that analyses the regulation and practices with which they are carried out, to a financial approach, through analysis of their implications and impacts on the capital markets. Also including studies on the conditions of the decision-making process in which decisions of this type are made.

Regarding the focus of this paper, which is more centred on financial markets, a review of the literature reveals two main problems. Firstly, most of the studies detected that deal with the financial implications of rights issues were published years ago, and there are not many current articles dealing with this topic. Secondly, and to make the task even more difficult, there are hardly any studies that analyse in depth the possible emergence of arbitrage opportunities in these processes.

As an example of articles that do mention arbitrage opportunities in rights issues, we have the work of **Marzal and Montes (2000)**, which analyses a set of equity offerings in the Spanish market, in which they apply an arbitrage strategy with which they detect an average return of 6.55% (discounting transaction costs). Another relevant aspect of this work is that this profitability grows as the days go by, reaching a net profitability of up to 8.62%. This detail is very relevant, as it indicates that not only are there arbitrage opportunities in these processes, but also that they do not disappear over time, as would be expected. Although they do not go into this issue in great depth, there are articles detailing the strategy that should be followed to exploit possible arbitrage in the context of a right issue, which will be very similar to the one proposed in this paper. Specifically, the papers by **Gajewski and Ginglinger (2002)**, **Rantapuska and Knüpfer (2008)** and **Massa, Vermaelen and Xu (2013)** discuss this strategy and the effects it could have on their analyses.

In the same vein, the work by **Verdú, Carchano and Farinós (2022)** studies equity offerings in Spain from both an arbitrage and an event study perspective. The results of this study point in the direction already mentioned, confirming the presence of significant arbitrage opportunities that do not disappear over time.

Although there are not so many studies that deal directly with arbitrage in rights issues, there is literature that studies possible inefficiencies and market failures that occur in the context of these processes. This is the case of **Hietala (1994)**, in which an analysis of the Finnish market detects up to 58% of subscription rights undervalued with respect to their theoretical price. For

his part, **Poitras (2002)** finds that, in general, subscription rights listed on the Singapore markets are listed below their theoretical price. He also adds that the authorities often limit or even prohibit short selling, making it difficult for investors to carry out arbitrage transactions that would bring the price of the rights closer to their fair price⁵.

Market failures related to equity offerings are not limited only to subscription rights but can also occur on the share side of the issuing company, both in the price set for the new shares (in the case that they must be paid for) and in the effect of the process on the price of the shares that are already listed. An example would be the work of **Naveen, Hawaldar, and Mallikarjunappa (2018)**, in which the authors conduct a study on offerings in India, detecting that the new shares issued are, in general, undervalued with respect to their actual market value. Regarding the effects of these processes on the share price of the issuing companies, there seems to be a consensus in the literature that these effects are usually negative, even generating abnormally negative returns that do not always take a short time to disappear. Some examples of this behaviour can be found in works such as that of **Dutta (2017)** for the Australian market, or in the study by **Andrikopoulos (2009)** for companies located in the United Kingdom. A particular case is found by **Fung, Leung and Zhu (2008)** for the Chinese financial market. Specifically, they find that relevant events prior to the start of rights trading generate short-lived positive abnormal returns, while later events generate negative abnormal returns.

Finally, an additional factor that may affect the decision to use an equity offering as a means of financing is the regulations in force, both in terms of the ease or otherwise of carrying out this process, as well as the rules that will govern it. This fact may be the source of possible relevant differences in the results of these processes (and their implications and collateral effects on the market) between different countries. In this same sense, **Fauver et al. (2017)** demonstrate that regulation can significantly affect both the results of the equity offering and the subsequent performance of the company. Additionally, **Melia, Docherty and Easton (2020)** state that current regulation has a significant impact on the decision on how to obtain financing and warn that the regulator must be aware of the consequences of the new legislation, both with respect to efficiency in the financial markets and on the behaviour of agents.

⁵ We define the **fair price** as the price of the right at which the investor is indifferent between buying the shares in the market or acquiring them by subscribing to the rights.

With all this, the **main hypothesis** of this work is the following:

H₀: Equity offerings with subscription rights generate arbitrage opportunities.

H₁: Equity offerings with subscription rights do not generate arbitrage opportunities.

In recent years, many studies have been published that relate the positioning of companies in terms of sustainability, or the level of development of a country, with market efficiency. For example, **Bofinger, Heyden and Rock (2022)** highlight that ESG compliance by companies significantly affects their valuation. More specifically, the work of **Siew et. al. (2016)** highlights that a higher level of ESG disclosure is significantly and negatively related to market asymmetries. Finally, **Cao et al. (2019)** indicate that companies that incorporate ESG objectives into their business to a greater extent tend to react less to price signals in the market, making their returns more predictable.

Finally, it is necessary to establish the relationships between the emergence of arbitrage opportunities and market efficiency. In this sense, **Dothan (2008)** recalls that for markets to be efficient, prices must reflect all available information, and that there are no strategies that systematically produce positive results, indicating that the first condition contains the second. **Hogan et. al. (2004)** discuss the particular case of statistical arbitrage, showing possible strategies to exploit it and its incompatibility with the assumption of market efficiency. Finally, **Akbas et. al. (2016)** stresses the need for the absence of arbitrage for markets to function efficiently and proposes quantitative strategies to exploit these opportunities when they arise. The study concludes that the level of market efficiency varies over time, depending on the occurrence of these anomalies and the time in which they are absorbed by such strategies.

One of the main conclusions to be drawn from reading these and other studies is that there are indeed arbitrage opportunities in some equity offerings. Given that their mere presence is an anomaly, and that they imply that the market is not functioning efficiently, it is vital to characterise them and to study, to the extent possible, which factors explain their existence. If these drivers are known, all actors involved (issuers, investors and regulators) will have a better understanding of what they need to do to avoid these anomalies and make the market work better.

Given all this information already available, we contribute to the literature by analysing the appearance of arbitrage opportunities in rights issue processes, on a sample that includes different countries, and to establish common patterns and differences between them. This would be the first study to analyse, under the same method and with the same sample, rights issues carried out in countries on 5 continents, and it is the study that analyses the largest number of different countries. Furthermore, for the first time, econometric models will be built to capture

the effects of factors inherent to these processes on the possibility of arbitrage, and even to estimate in advance the probability of the occurrence or not of these irregularities (since the models will be built with factors known from the moment the equity offering is announced). The results obtained go beyond previous literature by identifying the factors that are related to arbitrage opportunities and the effect they may have.

2.3. DATA

Collecting the data necessary to prepare this study is a complex task, since it is necessary to gather information from many different countries with regulations and characteristics that differ from one another. Fortunately, all rights offering processes have at least an equivalent set of relevant characteristics across all countries, and this is the information that has been used.

The source of the information used in this work is the *Thomson Reuters Refinitiv* database, from which all the information on equity offerings has been extracted, as well as the price series used throughout the work. Given the large volume of information, a data environment has been built in which all the variables obtained will be organized and some simple calculations will be performed⁶. Although data from different years are available, this entire sample is treated as cross-sectional data.

The initial data sample consists of 5,991 rights issues, carried out by a total of 4,298 companies located in 65 different countries. With this sample, a study period of 20 years is obtained, spanning from January 1, 2000, to December 31, 2020. However, this is not the final sample, as many of these processes have had to be removed from the sample for different reasons, among which the following stand out.

1. Not having the series of share prices and subscription rights available.
2. Data recorded with errors (e.g., negative issue prices, among others).
3. Net returns of the arbitrage strategy considered as outliers, following the definition explained later.

⁶ The bulk of the calculations have been carried out using the *Python* programming language. The code used is available to the reader upon request and subject to correct citation.

The net sample, after eliminating observations with this type of error, consists of 3,628 rights issues from 27 countries on 5 continents⁷. Specifically, data are available for Egypt, Saudi Arabia and Tunisia (Africa), Brazil, Canada and the United States (America), Australia, Hong Kong, India, Malaysia, New Zealand, Pakistan, Singapore and Sri Lanka (Asia and Oceania) and Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Norway, Poland, Spain, Sweden and the United Kingdom (Europe). Since the analyses will be carried out mainly by country, the number of observations for each of the procedures carried out will be indicated when the results are shown.

All the variables collected for each of the rights issues are detailed below. Before that, it should be pointed out that the relevant factors are not only those obtained directly from the data source, but also others that are derived from the former. This will be clearly detailed in the following list of factors.

- **ID:** Identifier of the rights issue within the Refinitiv database.
- **Issuer:** Name of the issuer of the preferential subscription rights.
- **Continent:** Continent where the issuer of the rights is located, which can be Africa, America, Asia and Oceania and Europe.
- **Country:** ISO code of the country where the issuer of the rights is located.
- **Offer Price:** Issue price of the new shares.
 - **Monetary:** Indicates whether the issue is cash (i.e., whether the new shares are to be paid for) or non-cash. A rights issue is considered to be monetary when its issue price is different from zero.
- **Old:** Number of old shares required to obtain *new* new shares. This is discussed in more detail in the conversion ratio section below.
- **New:** Number of new shares that can be obtained for each *old* old share. It is discussed in depth in the conversion ratio section below.
 - **Dilution:** Indicates whether the rights issue is dilutive (i.e., the ratio of new shares to old shares is very high) or not. A right offering is considered dilutive when its *new/old* ratio is greater than or equal to 0.5. The choice of this parameter is detailed in the conversion ratio section.

⁷ Although Asia and Oceania are two different continents, in this paper they will be considered as one.

- **Method:** Interpretation of the *old* and *new* variables. It is discussed in depth in the conversion ratio section.
- **Year:** Year in which the process is carried out.
- **Equity/Capital:** Percentage that equity represents of the company's total capitalization after the issue.
 - This variable allows capturing the company's financial structure after the issue, considering the new distribution between equity and debt.
- **Issuer / exRight:** Issue price over theoretical *ex-Right* price.
 - This parameter captures the effect of the listing of the rights on the share price of the issuing company's shares.
 - It should be indicated that the ex-right price is a theoretical price calculated by Eikon.
- **Eco. Sector:** Economic sector to which the issuer of the rights belongs.
- **Bus. Sector:** Business sector (subcategory of the economic sector) to which the issuer belongs.
- **Index:** Indicates whether the issuer of the rights is listed in any stock market index.
- **EGS:** Degree of sustainability of the issuing company. It is detailed in the Sustainability section.
- **DEV:** Level of development of the country in which the issuing company is located. It is detailed in the Development section.
- **Use:** Indicates the purpose of the funds received from the issue. Sixteen possible uses have been identified, and it should be noted that the same process may have more than one purpose.
 - To better reflect the effects of the objectives, they have been grouped into 5 categories: *General*, *Acquisition*, *Investment*, *Refinancing* and *Other*. Each of these categories constitutes an additional factor, the value of which will depend on whether the issue has some of the objectives included in it.

The selection of these factors has been made based on experience in the actual application of the arbitrage strategy described below, as well as the literature reviewed. Moreover, the work by **Verdú, Carchano and Farinós (2022)** already demonstrates the effect that some of these factors can have on the occurrence of potential arbitrage. With respect to other factors, such as the country or the method for interpreting the relationship between new and old actions, they allow us to approximate the effect of the regulation of each territory. For their part, factors related

to sustainability and development have been added to test whether the results of the works mentioned in the literature review are also reproduced in these cases.

In addition to information on rights issues, data was also obtained on the main stock market indexes of each of the countries analysed (where available), as well as on the shares and subscription rights themselves. For each of these three assets (indices, shares and rights), its *ticker* (identifier in the *Refinitiv* database), the currency in which it is listed, and its ISIN have been obtained.

In order to carry out the analyses, it is necessary to obtain the price series of the shares and subscription rights when both assets are listed simultaneously. In this work, the closing prices⁸ corresponding to the first ten days and the last day of trading of the rights have been obtained (although sometimes less data are available).

Given the complexity of the analysis, and the fact of working with different countries, legislations, and procedures, some of the additional processes required to obtain more robust data are explained in more detail below.

2.3.1. Currency Adjustment

When downloading the data, the necessary checks have been made to ensure that the currency in which the share price series is expressed matches the currency in which the preferential subscription rights price series is expressed. In addition, it has been ensured that the currency in which the issue price of the new shares is expressed also matches the currency of both price series. The analyses and calculations performed allow us to obtain results in the form of yields, thus making it possible to remove from the analysis any possible effect of exchange rates on the returns calculated for the arbitrage strategy.

2.3.2. Conversion Ratio

A relevant factor in rights issues is the number of old shares that allow the necessary subscription rights to be obtained in order to be able to subscribe a given number of new shares. In this paper, this factor is determined by the variables *old* and *new*. However, two possible interpretations of this ratio have been detected depending on the country's legislation, and the

⁸ Calculations were also performed on opening, high and low prices for each session, but the results do not vary significantly.

application of one or the other may imply a significant change in the results of the arbitrage strategy from the perspective of an investor outside the company. Rewriting the variable *old* as *O*, and the variable *new* as *N*, these interpretations would be as follows:

1. One (1) old share entitles one (1) subscription right. A total number of (*O*) subscription rights entitle to receive a (*N*) number of new shares. An example would be the case of Spanish rights issues, in which an *old/new* ratio equals 19/5 (as in the case of the process of *Cellnex Telecom SA* in 2020) implies that 19 subscription rights are necessary to obtain 5 new shares, with one right being delivered beforehand for each old share.
2. One (1) subscription right is received for (*N*) number of old shares. One (1) subscription right enables a (*N*) number of new shares to be obtained. This happens, for example, in Canada, where an *old/new* ratio equal to 20/7 (as in the process of *Ivanhoe Mines Ltd.* in 2012) implies that one right allows to subscribe 7 new shares, although the shareholders received 1 right for each 20 old shares owned.

This obviously affects the results of the arbitrage strategy. It has also been observed that the method used is common to each country, so it has been identified which method is used in each of the territories analysed, and subsequent calculations have been made taking into account this casuistry.

2.3.3. Sustainability

The level of sustainability of an issuing company is measured through the *ESG* index, which is related to environmental, social and corporate governance factors, and is compiled by the *Thomson Reuters Eikon* database based on a set of factors. The value obtained by the company depends on its performance in a series of indicators, as well as its relative position with respect to other companies. Finally, a score between 0 and 1 is obtained, with 0 being the worst possible performance and 1 the best. This result is transformed into the quantitative variable *ESG*, which values can be D (less than 0.25), C (between 0.25 and 0.50), B (between 0.50 and 0.75) and A (greater than 0.75).

2.3.4. Development

The level of development of the country in which the issuing company is located is obtained through the classification made by the *World Bank* through the country's Gross National Income, establishing four categories (low, medium/low, medium/high and high), with

classification criteria that vary according to the year. For each right issue, the level of development corresponding to the year in which it was carried out was obtained, and three categories were obtained, grouping the two corresponding to medium income into one. Therefore, the DEV variable will have three possible values, "LOW" for a low level of development, "MDM" for a medium level of development (grouping the medium/low and medium/high levels) and "HGH" for a high level of development.

2.4. METHODOLOGY

This section details the set of calculations and procedures that have been carried out to analyse the rights issues identified in different countries, and to determine whether this type of process generates arbitrage opportunities. And, in addition, what are the characteristics of these anomalies in the market and what factors could have a significant implication in their formation.

The first and main step is to determine whether an arbitrage opportunity has occurred in a specific right issue. This arbitrage will take the form of a significant difference between the market price of the issuing company's shares and the price at which a new share can be obtained through subscription rights. To do this, a strategy has been constructed to exploit it, and once applied, its net return is obtained (i.e., the strategy's own return reduced by the estimated costs and commissions that may be incurred). Two studies are then carried out. The first aims to analyse the anomalous returns obtained and whether they are really significant, while the second seeks to identify which factors can cause the appearance of these anomalies, and whether it is possible to predict the probability of this occurrence.

2.4.1. Application of the arbitrage strategy and achievement of net return

2.4.1.1. Calculation of the average net return on the rights issues:

The arbitrage strategy consists of subscribing for new shares through preferential subscription rights and simultaneously taking a short position in the old shares. This strategy is built on the assumption that the price paid to obtain the new shares through subscription must coincide with the price at which the company's shares are trading. Due to the characteristics of the subscription rights, the reverse strategy (long position in the company's shares and short position in the subscription rights) is not feasible. Therefore, we can define the theoretical price of the company's shares using the rights as follows:

$$P_{i,t} = \frac{PSR_i * Right_{i,t} + N_i * I_i}{N_i} \quad [2.1]$$

where $P_{i,t}$ is the theoretical price of company i on day t , $Right_{i,t}$ is the price of the subscription right, PSR_i is the number of rights necessary to obtain N_i new shares, and I_i is the issue price of the new shares.

Regarding the formula, it should be noted that, if the rights issue is non-cash, the factor I_i will be equal to zero and will make that part of the formula disappear. On the other hand, when **method 1** is given, the factor PSR_i will be equal to Old_i , while when **method 2** of subscription ratio calculation is given, the factor PSR_i will always be equal to 1.

The gross return⁹ of the arbitrage strategy is then defined as the percentage difference between the market price (short position) and the theoretical price (long position) of the shares, as follows:

$$RB_{i,t} = \frac{S_{i,t} - P_{i,t}}{P_{i,t}} \quad [2.2]$$

where $RB_{i,t}$ is the gross return of the strategy, and $S_{i,t}$ is the market price of the issuing company's stock. Finally, the gross return is reduced by the estimated effect of the costs and commissions involved in the transactions necessary to carry out the strategy, as follows:

$$RN_{i,t} = RB_{i,t} - c \quad [2.3]$$

where $RN_{i,t}$ is the net return of the strategy, and c is the estimate of costs and fees. This is a constant factor that applies equally to all rights issues, and its derivation is explained in more detail in the section “Actual implementation of the strategy and estimation of fees”.

As explained in the data section, the series available would be the closing prices of the subscription rights and of the issuing company's shares, for the first ten days and the last day of trading of the rights. This period is reduced if the process lasts less than 10 days or if it is not possible to obtain the data for all of them. On the other hand, calculation tests have been carried out using the opening, maximum and minimum prices of each session, although no significant differences have been found in the results, so it has been decided to use only the closing price series.

⁹ Throughout the work, the returns calculated and shown will be on the cash value of the transaction. In no case are they annualised.

Once this calculation has been applied for each of the days for which all the data is available, the variable of interest in this study is defined as the average of the net returns for each of the days. For each right issue, an average net return is obtained, and it is identified whether it is positive, negative, or if it was not possible to calculate it. From this point on, when we speak of "net return", we refer to the average daily net yield of the process. Finally, for the purposes of this paper, an "arbitrage opportunity" will be considered to happen when the average net return of the strategy is positive, while "no arbitrage" will be defined as all the other cases.

2.4.1.2. Withdrawal of atypical abnormal returns:

On some occasions, the calculation described in the previous section results in an excessively high atypical return. This is mainly due to significant differences between the theoretical prices (price of shares with subscription rights) and the quoted prices of the issuing company's shares. These outliers artificially alter the results of some of the tests performed subsequently, so they have been removed from the sample for these tests. Specifically, it has been decided to consider as *outliers* those net returns equal to or greater than 1,000%.

Regarding the decision to establish as outlier those returns above 1,000%, we considered applying the "Median Absolute Deviation" (MAD) methodology proposed by **Leys et. al. (2013)**, both for the sample as a whole and for each country individually. However, the presence of excessively positive returns meant that this methodology was not able to remove from the sample all those returns considered too high. Because of this, it was decided to set the threshold discussed in the first paragraph.

After performing all the calculations and adjustments, it was possible to obtain results for 3,628 processes, with 2,145 positive results (of which 713 were considered *outliers*, leaving 1,432 without this consideration) and 2,196 negative results.

Depending on the characteristics of the subsequent tests to be performed, a sample including or not the atypical positive results will be used. In some of them, moreover, it has been possible to obtain results both for the complete sample and for the sample including only the outliers.

Finally, it should be noted that it is not possible to obtain negative outlier returns. This is due to the assumption that, when implementing the arbitrage strategy, no leverage is carried out on the short position, which implies that the lowest possible outlier return is equal to -100% (the maximum possible loss is the total investment). An average net return equal to -100% only occurs in a total of 18 issues.

The number and volume of outliers obtained is of great interest. It has been found that this is not a problem with the calculations, and that the data are the real ones. Possible causes for this behaviour could be low liquidity of the company's shares or rights. On the other hand, it has been found that in their last trading days, the price of subscription rights tends to plummet and approach zero, which could explode the returns of the proposed strategy. However, this analysis should be left for further study.

2.4.1.3. Real implementation of the strategy and estimation of commissions:

While the arbitrage strategy is relatively straightforward (it only requires buying the subscription rights and taking a short position in the shares), putting it into reality can be a relatively more complex task. Specifically, it should be borne in mind that it is not always possible to take short positions in a company's shares. It is possible that, in the period of interest (simultaneous listing of rights and shares), the option to take short positions in the shares of the particular company is not available or not allowed.

To circumvent this restriction, the short position in the shares will be replicated using Contracts for Difference (or CFDs). These derivatives make it possible to replicate a long or short position in the underlying stock, and their *payoff* will be equal to the difference between the opening and closing prices multiplied by the volume of contracts traded. Specifically, the payoff of a short position in a CFD is equal to the opening price minus the closing price, which replicates the payoff of a short position in the stock.

In the arbitrage strategy, only the long position in the rights, their subsequent subscription and immediate sale of the new shares would already allow the profit from the price differential to be obtained. However, this process is not so fast in reality. From the moment the decision is made to subscribe the rights until the new shares are available for sale, a certain amount of time passes, during which the share price can change and thus reduce or even eliminate the arbitrage profits. By taking the short position in the shares (or its equivalent with CFDs), any subsequent price movements are offset, thus ensuring that the final outcome is known from the opening of the positions.

Contracts for Difference allow to leverage a position, i.e., to invest a lower amount than would be necessary in an equivalent position in shares, which can significantly increase the return obtained. However, this action leads to market risk, in the sense that a sharp increase in the price of the underlying could lead to a *margin call* (i.e., the broker forcing the broker to add more funds) or even to the early closing of the position. To avoid this risk, it has been assumed that the investor dedicates 100% of the value of the position to this derivative, i.e., trading without leverage.

With all this information, an estimate can be made of the fees that will have to be paid during the development of the arbitrage strategy. For this purpose, we simulated an investment in a set of equity offerings carried out in Spain, for which the theoretical analysis pointed to the existence of arbitrage opportunities. It is also assumed that trading in rights and shares is carried out with the investment bank Renta 4 Banco, and that CFDs are contracted with the broker IG. Since we work in international markets, many of the operations have also been carried out with the broker Interactive Brokers or IB. In the simulated strategy, a maximum of €10,000¹⁰ is used, divided equally between trading with rights and shares and contracting contracts for differences, and all the information provided by the two entities mentioned is used to calculate the costs and commissions paid at each stage of the operation.

Finally, it should be noted that the complexity of the operations to be carried out leads to a very conservative estimate of the effect of commissions. After computing the calculations applying all these conditions, a maximum effect of costs and commissions equal to 2%¹¹ has been estimated. Although it is true that investments in countries other than Spain may imply a different expense, the actual transactions carried out in other countries have shown similar or lower costs. It should be noted that, given the volume of equity offerings analysed and the variety of territories covered, a more in-depth estimation of the effect of fees would be complicated, and would probably not significantly change the results from the conservative estimate made.

The theoretical strategy described in this paper has been applied to real equity offerings by companies located in Spain, France, and Germany, among other countries. These exercises act as an additional test to check whether the theoretical results obtained are real. With this practice, we also improve the robustness of the study by obtaining a set of results out-of-sample. The results of the most relevant investment of all those carried out are shown below.

2.4.2. Significance Test of Net Returns

The first test performed consists of contrasting the significance in mean and median of the net returns calculated for all the rights issues. This test is performed for both the full sample and the restricted sample in terms of all the variables discussed in the data section, with the exception of the **ID**, **Issuer** and **Year** factors. This is done in order to determine whether they

¹⁰ This amount is high enough to allow profitable investments in the equity offerings and at the same time operate Contracts for Difference without the need for leverage, but it is also not too large to distort the estimate of commissions.

¹¹ On a cash transaction basis, not annualised.

present significant results, which point to the fact that this factor has an important weight in the occurrence of arbitrage opportunities.

Regarding the sample, the tests are repeated once for the full sample, for the restricted sample for each of the territories (continent and country) studied, and for each possible value of the relevant factors identified. In addition, a joint restriction of the sample is also applied, both by country and by factor, which allows estimating the effect of these variables in the context of each country and/or region. For each data set we obtained its mean, median, standard deviation and number of data used. In addition, a total of three different tests have been applied, two on the mean and one on the median. Prior to performing these tests, the non-normality of the different samples was checked by means of the Jarque-Bera test. Then, the first test applied is the t-Student test, a parametric test on the mean of the results, was applied. After that, two non-parametric tests were applied, the **Wilcoxon (1992)** signed-rank test for the median, and finally a *backtesting* procedure on the mean, as defined in **Wilcox (2010)**.

2.4.3. Modelling the Returns from the Strategy

Once the results of the arbitrage strategy have been obtained and analysed, the aim is to explain them through factors directly or indirectly related to the rights issues. To do so, we intend to model them using the Ordinary Least Squares (OLS) methodology. Specifically, the model to be estimated would be as follows:

$$RET_i = \beta_0 + \beta_1 DIL_i + \beta_2 IDX_i + \beta_3 ISC_i + \beta_4 CAP_i + \varepsilon_i \quad [2.4]$$

where RET is the net return of the strategy, DIL is the New/Old ratio and IDX is a binary variable which represents if the issuer is listed in a stock index. Additionally, ISC and CAP are, respectively, the Issuer/ex-Right and Equity/Capital ratios. Every factor is also defined in the “Data” section. All models have been estimated with standard errors robust to heteroscedasticity, and the selection of factors has been made considering previous experience, other studies and the results of the tests explained above.

With regard to the estimation of the models, it should be noted that many countries do not have enough data on their own to obtain sufficiently robust models. To overcome this difficulty, it has been decided to estimate the models only for the total sample, and for the four groups resulting from classifying according to the continent in which the issuing company is located.

With respect to the estimated coefficients, their statistical significance was obtained by means of Student's t-test. For those factors that do not pass this test, their robustness is checked,

determining whether they should remain in the model despite not being significant or not. To carry out this test, the following steps are followed:

1. The original model is estimated with and without the factor in question, and the residuals of both general and restricted model are saved.
2. A Kruskal-Wallis test is applied to test the null hypothesis that both sets of residuals are from the same sample. Rejecting the hypothesis implies that the model varies significantly when the factor is removed, so the model is robust and should hold. Rejecting the null hypothesis implies that the factor is not robust.

2.4.3. Predicting Arbitrage Opportunities

After analysing and explaining the returns obtained by the arbitrage strategy, this paper aims to be even more ambitious, and to try to predict the occurrence or not of arbitrage opportunities, using the different factors related to equity offering that are available. In order to carry out this task, we intend to estimate probability models, following *logit* and *probit* methodologies.

In these models, the dependent variable will be a binary variable taking value 1 if there has been arbitrage (positive net return) and 0 otherwise. In this way, the model will estimate the estimated probability, with the available information, that an arbitrage opportunity will occur. In this sense, we will consider that the model has been successful in predicting an arbitrage when the binary variable takes a value equal to 1, and the estimated probability is greater than or equal to $2/3$. On the other hand, we will consider that the model has been successful in predicting an absence of arbitrage when the binary variable takes a value equal to 0, and the estimated probability is less than or equal to $1/3$.

As in the previous case, for this practice the variability of data within each country is also a factor to be considered. Firstly, each country may have different characteristics, so it would not make sense to aggregate different regions to estimate these models, so they will only be estimated for the samples of each of the countries. Secondly, the different distribution of data in each territory makes it impossible to apply the same model for all cases. To solve this problem, a general model has been developed and, for each country, the version that maximises the number of correctly predicted arbitrages will be estimated.

Therefore, the general model is as follows:

$$\begin{aligned}
ARB_i = & \beta_0 + \beta_1 MON_i + \beta_2 DIL_i + \beta_3 IDX_i + \beta_4 ISC_i + \beta_5 CAP_i + \beta_6 GEN_i \\
& + \beta_7 ACQ_i + \beta_8 INV_i + \beta_9 REF_i + \delta_1 DIL_i * ACA_i + \delta_2 DIL_i * BAS_i \\
& + \delta_3 DIL_i * CYC_i + \delta_4 DIL_i * NCY_i + \delta_5 DIL_i * ENE_i + \delta_6 DIL_i \\
& * FIN_i + \delta_7 DIL_i * GOV_i + \delta_8 DIL_i * HEA_i + \delta_9 DIL_i * IND_i \\
& + \delta_{10} DIL_i * EST_i + \delta_{11} DIL_i * TEC_i + \delta_{12} DIL_i * UTI_i + \varepsilon_i
\end{aligned} \tag{2.5}$$

where ARB_i is a binary variable that will take the value 1 if arbitrage has taken place and 0 otherwise, MON_i will take the value 1 if the right issue is monetary, and 0 otherwise, and DIL_i , IDX_i , ISC_i and CAP_i are defined as for the OLS model (Equation [8]). GEN_i , ACQ_i , INV_i and REF_i are binary variables that will take value 1 if the objectives of the process include at least one of a general, acquisition, investment, or refinancing nature, respectively, and 0 otherwise. Finally, interactions between the DIL_i variable and binary variables indicating the sector to which the issuing firm belongs are also included. Those sectors are: Academic and Educational Services (ACA_i), Basic Materials (BAS_i), Consumer Cyclicals (CYC_i), Consumer Non-Cyclicals (NCY_i), Energy (ENE_i), Financials (FIN_i), Government Activity (GOV_i), Healthcare (HEA_i), Industrials (IND_i), Real Estate (EST_i), Technology (TEC_i) and Utilities (UTI_i).

2.4.4. Temporal Robustness of Results

By working with a large sample period, it is possible to analyse whether the results vary significantly depending on the time period. To make this possible, all calculations have been repeated using only the sample belonging to three specific sample sub-periods, defined according to common characteristics, and functioning of the global economy.

The first period would include the years prior to the 2008 financial crisis, so it includes data pertaining to the period between 2000 and 2007, inclusive. The second period would include the years of the financial crisis and goes from 2008 to 2014 (inclusive). Finally, the third period includes the remaining years, corresponding to the period between 2015 and 2020, both included.

2.5. RESULTS

Given the wide range of available data and the variety of methodologies to be applied in this study, it is understood that the set of results obtained will also be significantly extensive. However, in this section we will comment only on the most representative results, eliminating those that do not provide new information¹².

2.5.1 General results of the Arbitrage Strategy

The results of the arbitration strategy should be discussed first. Table 2·1 shows the number of rights issues analysed for each country, as well as the total number of processes in which arbitrage was detected (positive net returns) and those in which it was not. The number of outcomes considered as outliers and removed from the sample for further analysis are also indicated. Table 2·2 shows the main statistics (mean, median, standard deviation, maximum, minimum, skewness and kurtosis) of the net returns series for each country.

¹² The Tables and Figures that best represent the results obtained are shown in the body of this article. The rest are available to the reader in the Annex that accompanies this article.

Table 2-1 Distribution of Equity Offerings by Region and Country

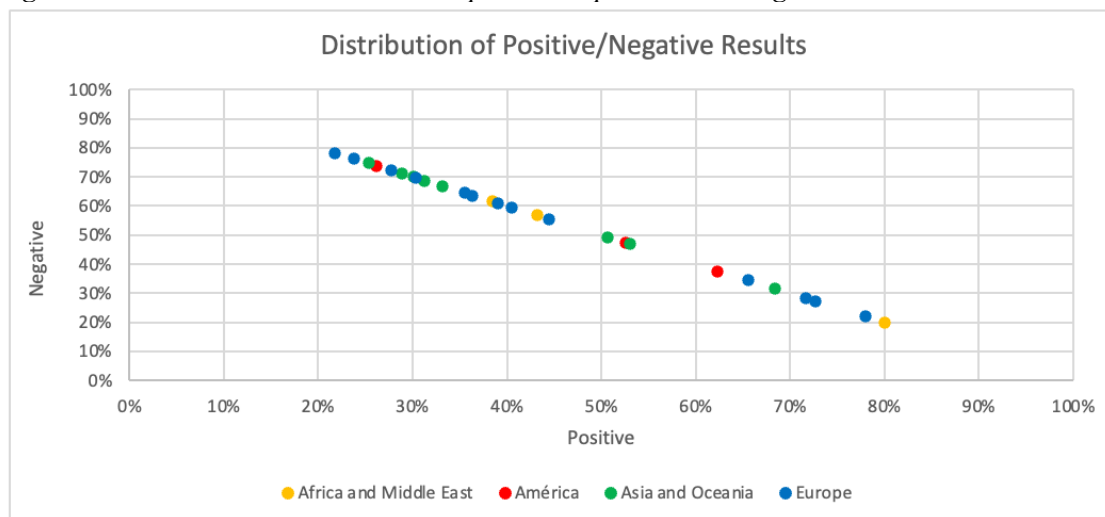
Region	Code	Net Sample	Result of the Strategy		
			Positive	Negative	Outliers
Africa and Middle East	AFR	95	49	46	1
Egypt	EGY	44	19	25	0
Saudi Arabia	SAU	25	20	5	0
Tunisia	TUN	26	10	16	1
America	AME	245	102	143	70
Brazil	BRA	130	34	96	28
Canada	CAN	77	48	29	38
United States of America	USA	38	20	18	4
Asia and Oceania	ASC	1,531	628	903	326
Australia	AUS	259	86	173	87
Hong Kong	HKG	357	181	176	151
India	IND	57	39	18	1
Malaysia	MYS	346	104	242	12
New Zealand	NZL	32	10	22	7
Pakistan	PAK	79	20	59	10
Singapore	SGP	296	157	139	55
Sri Lanka	LKA	104	30	74	3
Europe	EUR	1,758	654	1,104	316
Austria	AUT	11	8	3	0
Belgium	BEL	54	15	39	1
Denmark	DNK	37	15	22	2
Finland	FIN	50	39	11	16
France	FRA	293	89	204	31
Germany	DEU	46	10	36	1
Greece	GRC	45	20	25	17
Italy	ITA	132	48	84	26
Norway	NOR	59	23	36	10
Poland	POL	29	19	10	5
Spain	ESP	80	19	61	22
Sweden	SWE	862	306	556	165
United Kingdom	GBR	60	43	17	20
Total	-	3,629	1,433	2,196	713

Table 2-2 Main Statistics by Region and Country

Code	Main Statistics							
	Average	Median	St. Dev.	N	Max.	Min.	Skew	Kurt
AFR	8.84%	1.52%	0.67	95	307.84%	-100.00%	2.12	7.07
EGY	3.70%	-3.47%	0.80	44	307.84%	-100.00%	1.82	4.60
SAU	37.75%	18.48%	0.65	25	297.11%	-31.55%	2.61	7.64
TUN	-11.46%	-5.76%	0.31	26	85.49%	-64.55%	0.58	2.06
AME	65.30%	-4.78%	2.30	245	973.97%	-100.00%	2.49	5.16
BRA	60.09%	-27.81%	2.41	130	900.42%	-100.00%	2.14	3.37
CAN	87.66%	3.74%	2.32	77	973.97%	-77.73%	2.71	6.29
USA	37.85%	1.23%	1.80	38	858.56%	-85.83%	3.98	14.18
ASC	62.40%	-4.42%	2.13	1,530	981.00%	-100.00%	2.59	6.08
AUS	85.25%	-17.21%	2.51	259	948.94%	-100.00%	1.97	2.80
HKG	115.75%	0.14%	2.60	357	974.03%	-100.00%	1.95	2.60
IND	-6.01%	3.68%	0.41	57	82.66%	-100.00%	-0.76	0.20
MYS	10.86%	-20.68%	1.44	346	785.08%	-100.00%	3.48	12.71
NZL	55.03%	-10.25%	1.99	32	940.90%	-61.29%	3.13	10.02
PAK	-4.50%	-29.97%	1.03	79	558.34%	-91.68%	3.36	12.77
SGP	85.68%	0.66%	2.14	296	957.58%	-98.77%	2.47	5.32
LKA	17.58%	-18.36%	1.65	104	981.00%	-95.48%	3.92	16.85
EUR	41.72%	-2.26%	1.80	1,758	979.54%	-100.00%	3.47	11.93
AUT	2.14%	1.27%	0.06	11	18.69%	-9.07%	1.04	1.75
BEL	33.85%	-1.62%	1.54	54	966.84%	-85.60%	4.67	23.27
DNK	15.91%	-5.15%	1.42	37	752.39%	-94.70%	4.02	17.28
FIN	25.82%	-5.36%	1.66	50	965.43%	-81.92%	4.47	20.28
FRA	49.98%	-2.07%	1.71	293	917.51%	-93.96%	3.32	10.79
DEU	7.85%	-1.61%	0.81	46	340.57%	-97.24%	2.53	7.14
GRC	72.99%	-2.30%	2.25	45	916.17%	-93.35%	2.78	6.68
ITA	99.52%	-1.63%	2.54	132	953.60%	-94.79%	2.27	3.98
NOR	52.37%	1.34%	1.84	59	908.23%	-96.10%	3.18	9.79
POL	47.58%	-21.59%	1.81	29	668.09%	-93.52%	2.00	3.26
ESP	69.88%	4.18%	2.02	80	963.31%	-78.44%	3.13	9.39
SWE	28.15%	-4.27%	1.71	862	979.54%	-100.00%	3.85	14.78
GBR	66.30%	-1.79%	1.79	60	840.91%	-100.00%	2.28	5.24
TOT	51.25%	-2.76%	1.97	3,628	981.00%	-100.00%	2.99	8.52

Figure 2·1 shows a scatter plot relating the percentage of equity offerings with a positive result and those with a negative result, while Figure 2·2 shows a scatter plot relating the mean and median results of the strategies for each country, differentiating according to the continent in which they are located.

Figure 2·31 Distribution and relationship between positive and negative results



One constant observed in both the tables and graphs is the differences between the results for the means and medians. These differences come, on the one hand, from the fact that some excessively high yields are maintained, which force the means upwards, while they do not affect the medians. On the other hand, and as previously mentioned, the estimation of the commissions has been conservative, and significantly reduces the results. This does not have such an effect on the positive outliers, but it does have an effect on the bulk of the results. This is why the medians are so small with respect to the means. A more concrete analysis including statistical tests is needed to check the robustness of the results obtained. This will be discussed in the following sections together with the results of the estimated models.

2.5.2. Analysis by Continent - Returns and their Modelling.

Table 2·3 shows all the results obtained for the full sample while Figure 03 shows the histogram of net results¹³. The table show, firstly, the distribution between issues where arbitrage opportunities were detected and, secondly, the mean, median and standard deviation, as well as the result of the Student's t-test and Bootstrapping on the mean and the Wilcoxon test on the median. These two sets of results are shown both for the full sample and for the sub-sample corresponding to each of the sub-periods. The same results are shown below for subsets of the sample consisting of dilutive or monetary issues, and the ones where the issuing company is listed in a stock market index, as well as according to the ESG rating of the company or the level of development of the country. Finally, the estimation of the models is shown.

The results collected in the tables show that, firstly, in most cases both the means and medians are significant. This result is also true in the proposed subgroups. Furthermore, it can also be observed that in most cases the means are significant and positive, while the medians are significant and negative. With respect to the estimation of the models, we see that the dilution ratio of the rights issue always has a positive and significant effect on the outcome of the arbitrage strategy, while the fact that the issuing company is listed in a stock market index has a negative and significant effect on this outcome. On the other hand, the effect of the ISC variable appears to be less strong, while the CAP variable is neither significant nor robust in either case¹⁴. These

¹³ Tables 05 to 08 and Figures 09 to 12 show those results for each of the continents analyzed and can be found in the Annex.

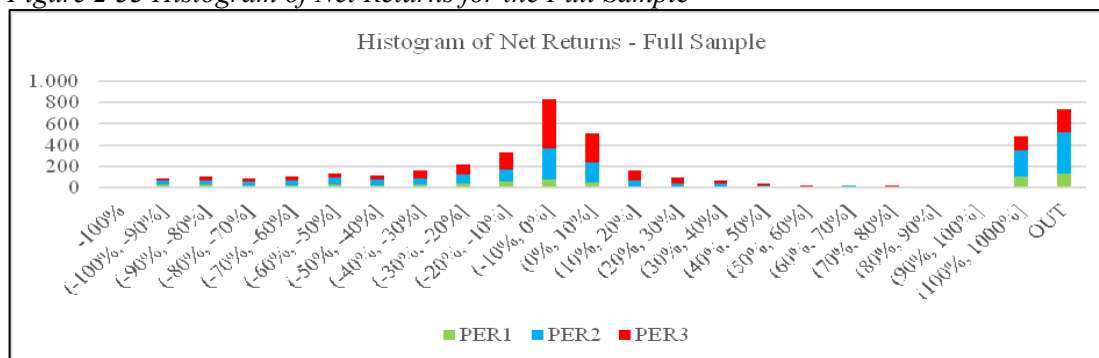
¹⁴ It has been considered that the IDX and CAP variables may be correlated, so the models have been estimated by eliminating the former and analysing the change in the latter. However, the restricted models do not vary significantly from the original ones.

results reinforce the conclusions reached with the tests presented previously and show that the factors analysed are relevant in the appearance or not of arbitrage opportunities, which justifies their use in the prediction models whose results are presented below.

Table 2-3 Summary of Results for the Full Sample

Region	Full Sample							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	192	35.82%	613	42.04%	628	38.41%	1,433	39.49%
nARB	344	64.18%	845	57.96%	1,007	61.59%	2,196	60.51%
TOT	536	-	1,458	-	1,635	-	3,629	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	51.25%	1.9663	-2.76%	0.0000	***	0.0000	***	+
PER1	64.77%	2.1946	-7.26%	0.0000	***	0.0276	**	+
PER2	57.11%	2.0335	-3.17%	0.0000	***	0.0001	***	+
PER3	41.39%	1.8122	-2.12%	0.0000	***	0.0000	***	+
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	1,946	68.42%	0.0000	***	-1.64%	0.5313		
MON	3,561	48.89%	0.0000	***	-2.89%	0.0000	***	
IDX	263	21.18%	0.0227	**	-7.31%	0.0003	***	
ESG_D	61	131.78%	0.0008	***	-2.21%	0.5755		
ESG_C	143	3.33%	0.7159		-7.53%	0.0000	***	
ESG_B	138	41.03%	0.0124	**	-2.35%	0.0202	**	
ESG_A	51	39.24%	0.0668	*	-1.04%	0.5707		
DEV_L	18	-3.77%	0.7421		-10.70%	0.0610	*	
DEV_M	725	26.58%	0.0000	***	-12.26%	0.0000	***	
DEV_H	2,827	57.61%	0.0000	***	-2.08%	0.0001	***	
OLS MODEL								
Factor	Value	St. Dev.	Significance		Robustness		P-Value	Result
			P-Value	Result	P-Value	Result		
Intercept	36.41%	0.1008	0.0003	***	-	-	-	-
DIL	2.30%	0.0098	0.0194	**	-	-	-	-
IDX	-33.99%	0.0975	0.0005	***	-	-	-	-
ISC	6.73%	0.0328	0.0401	*	-	-	-	-
CAP	18.07%	0.1379	0.1901		0.9034		-	-

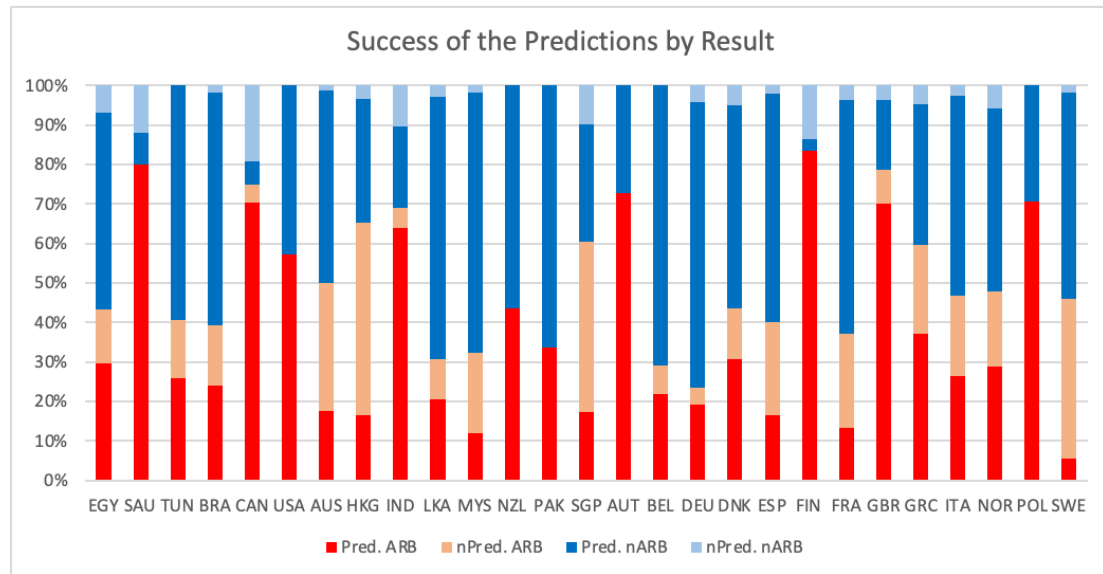
Figure 2-33 Histogram of Net Returns for the Full Sample



2.5.3. Analysis by Country – Returns and prediction of Arbitrage

Figure 2·4 shows the arbitrage and non-arbitrage occurrences in the sample that have been predicted by the models designed. For each country, we show the arbitrages predicted by the corresponding model (dark red) and those not predicted (light red), as well as the non-arbitrages predicted by the model (dark blue) and those not predicted (light blue)¹⁵.

Figure 2·34 Success on prediction of results



In this case we find a greater variety of results, from which, however, a common set of results can be extracted. Firstly, and considering the results by country in the annex, in general, the means seem to remain positive and the medians negative (in many cases both being significant), and the DIL and IDX variables do seem to influence the performance obtained, positive in the first case and negative in the second. Secondly, regarding prediction, and although

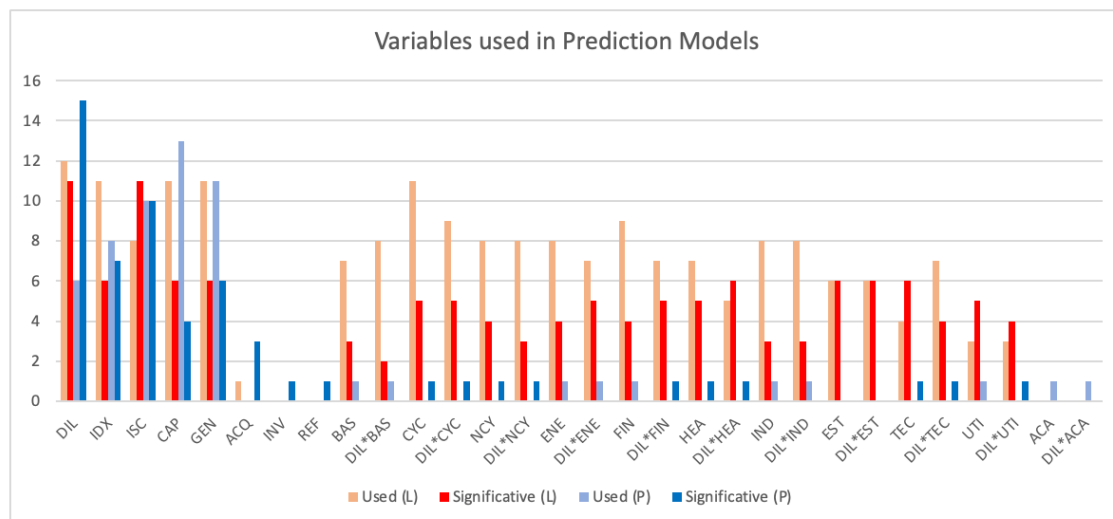
¹⁵ Tables 09 to 35 and Figures 13 to 39 show the results obtained for each of the countries. These figures follow the same structure as the previous ones, although instead of showing the results of the estimation of the OLS models, they show the percentage of success of the models estimated by the logit and probit methodologies. Specifically, it measures what percentage of arbitrages have been correctly predicted, and what percentage of non-arbitrages have been successfully predicted. It also measures in aggregate what percentage of outcomes are successfully predicted. These results are shown both for the complete sample and for each of the sub-periods (it should be noted that in some countries and for some of these sub-periods it has not been possible to obtain any valid model). Finally, Tables 36 to 43 show, for each country and period, which variables have been included in the model. These Figures are in the Annex.

the results vary from country to country, in general high success rates are observed, especially regarding the prediction of arbitrage opportunities.

Particularly noteworthy are the results obtained for the DIL and IDX factors both in the statistical tests for countries and territories and in the OLS estimation aggregated by continents. These factors seem to have a significant effect on the profitability of arbitrage strategies, common to practically all the subsamples analysed. In particular, the DIL variable seems to positively affect the average returns of these strategies, while the IDX variable is generally associated with lower returns. In addition, it should be noted that the inclusion of interactions of the DIL variable with the binary variables referring to economic sectors in the binary response models has significantly improved their predictive power for arbitrage.

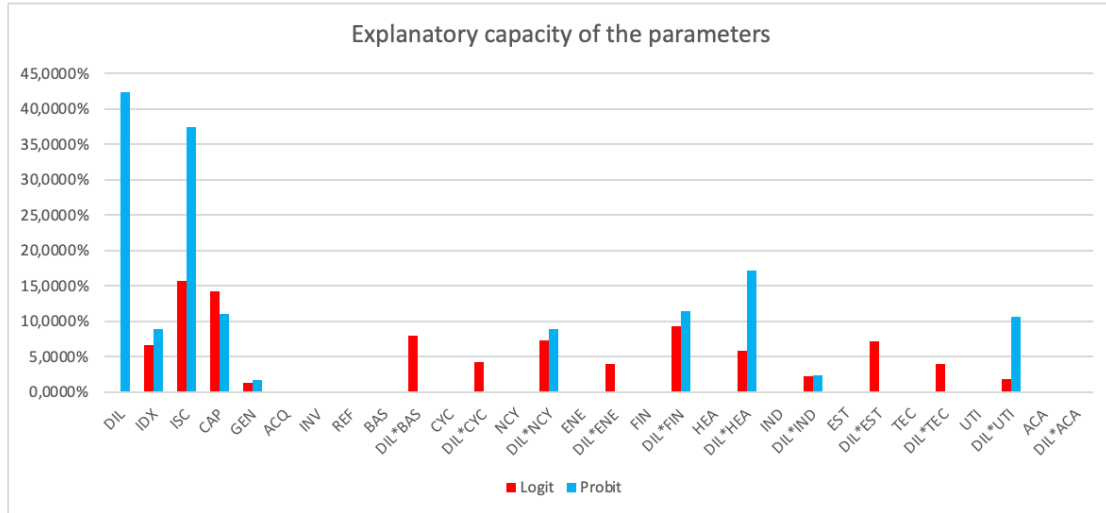
Regarding which variables have been included in each of the models, and their relative importance, this information can be summarised in Figures 2·5 and 2·6.

Figure 2·35 Variables used in Prediction Models



The first figure shows how many times each variable has been used in the Logit (red) and Probit (blue) models, as well as when they are significant (dark colour) and when they are not (light colour).

Figure 2-36 Explanatory capacity of the parameters



The second figure summarises the average explanatory power of each variable, which has been calculated for each country using the following formula:

$$Exp_x = \frac{\overline{R^2} - \overline{R_{\{-x\}}^2}}{\overline{R^2}} \quad [2.6]$$

where $\overline{R^2}$ is the adjusted R-Squared of the original model, while $\overline{R_{\{-x\}}^2}$ is the adjusted R-Squared of the model without the variable of interest x .

These figures, taken together, show that the main explanatory variables for these anomalies are DIL, IDX, or to a lesser extent ISC and CAP. Moreover, it can be seen how Logit models use interactions with economic sector variables to a greater extent than Probit models, and that in the former the explanatory capacity of DIL is distributed among these interactions.

2.5.4 Temporal analysis and effects of Sustainability and Progress

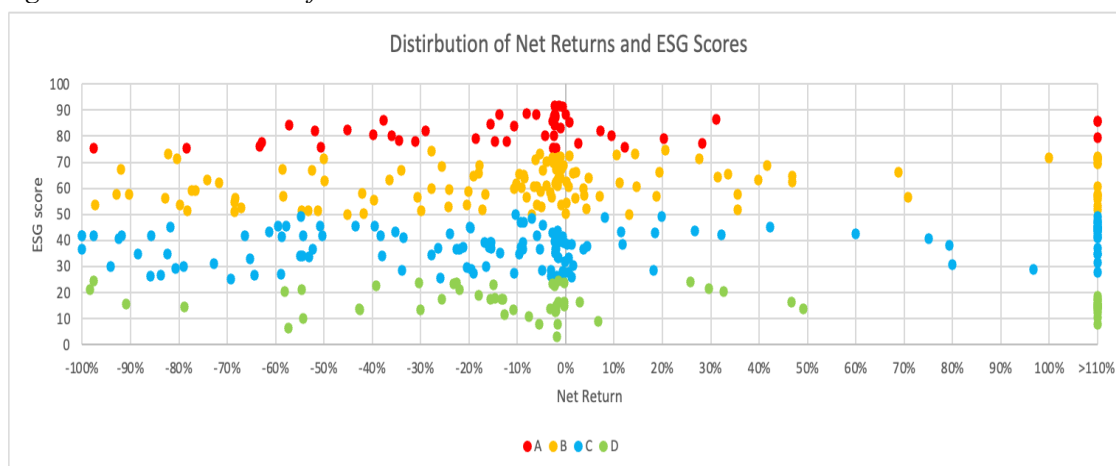
All calculations were repeated for each of the previously defined sample sub-periods to ensure the robustness of the results and to detect if there are significant variations depending on the time range. However, only the results that best allow us to observe this temporal variability are shown in the Figures.

On the other hand, the results also allow us to observe possible effects of the level of sustainability of the issuing company or the level of development of the country at the time when the equity offering is carried out. Specifically, as can be seen from the results of the statistical tests for the different countries and territories, higher levels of sustainability and development

seem to be related to lower results of the arbitrage strategies, the latter being negative on average for those cases in which these variables are at their highest values.

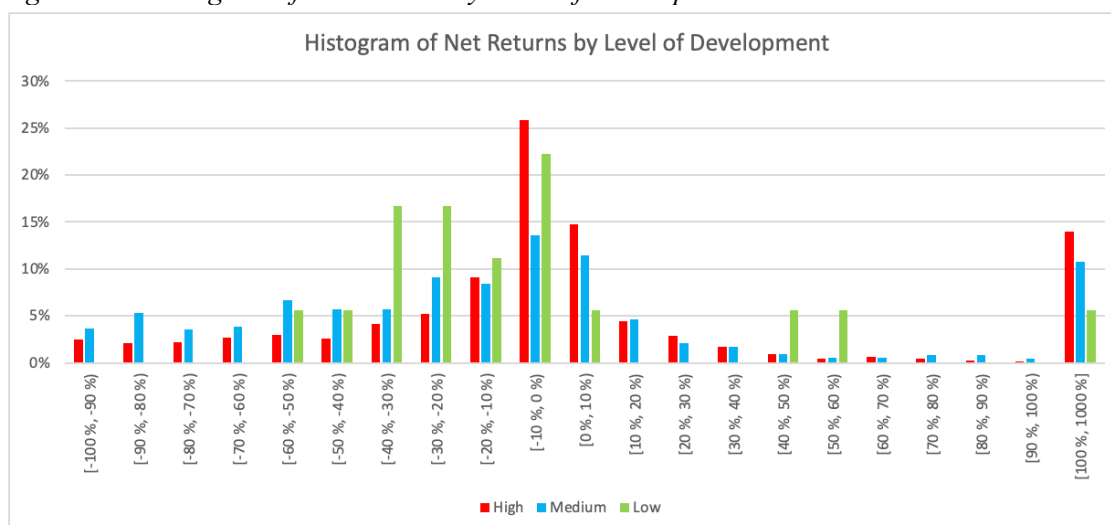
In more detail, Figure 2·7 shows a scatter plot in which the horizontal axis indicates the net performance, while the vertical axis indicates the ESG score. In addition, the dots are shown in different colours depending on the ESG rating.

Figure 2·37 Distribution of Net Returns and ESG scores



This graph clearly shows how those processes with higher levels of sustainability are grouped in the negative or near-zero returns. Regarding the level of development, Figure 2·8 shows three histograms of net returns, grouping them according to whether the country's level of development is low, medium or high.

Figure 2·38 Histogram of Net Returns by Level of Development



This figure shows how most returns are clustered around zero, although the density is higher in the negative part for medium and high levels.

2.5.5. Real application of the strategy – Case of Atari (France)

All methodologies and results presented so far consist of simulations of arbitrage strategies that have already occurred, using the historical price series of both shares and subscription rights. However, in the framework of this research, the arbitrage strategy described above has been applied to real cases, testing whether the theoretical results are fulfilled once the proposed strategies are implemented. These transactions were carried out when the theoretical calculations pointed to a positive result sufficiently high to cover the costs associated with the different parts of the strategy, and they have been carried out on different equity offerings, although the most exemplary case will be discussed below.

At the beginning of 2022 (out of sample), the French company Atari S.A. carried out a rights issue with the following conditions:

- New shares with a par value of 0.100€ and a share premium of 0.154€.
- Every 4 subscription rights entitle the holder to 1 new share.
- The rights will be traded on the market from 11/03/2022 until 24/03/2022.

As there was an issue premium, the shares were to be paid at the time of subscription, so the equity offering was monetary. The dilution ratio is 1/4, so it is not a dilutive issue. The company is not listed in a relevant stock market index. The investment strategy was developed using *Renta 4 Bank* for the purchase and sale of shares and rights, and the broker *IG* for CFD trading, and it was as follows:

1. On 03/23/2022, 40,000 PSRs are purchased at a price of 0.0039€, which means paying 156.00€ plus 15.00€ in commissions.
2. On the same day a short CFD position is opened on Atari shares at an opening price of 0.2072€, maintaining a margin of 1,000.00€ (50% of the investment) and paying 5.00€ in commissions.
3. On 04/01/2022 the corresponding 10,000 shares are obtained, after having paid the subscription price of 0.1640 €, implying a total cost of 1,640.00€. On the same day the shares are sold at 0.1865€ obtaining a income of 1,865.00€. An additional 15.00€ are paid as commissions.
4. On the same day, the short CFD position is closed at a closing price of 0.1878€, implying a gross profit of 194.43€, while the combined maintenance and closing commissions amount to 19.34€.

5. The total investment made for this strategy was 2,796.00 €, while the gross result was 3,059.43 €. If we take into account that the total commissions were 54.34€ (1,94% of total cost), we obtain a net amount of 3,005.09€ (a profit of 209.09€, which is equivalent to 7.48% on the investment).

It should be noted that, given the nature of the operation and the use of CFDs, the final result of the operation could be accurately calculated from the very moment the positions were opened. Table 04 summarizes all the information related to this strategy.

As indicated at the beginning of this section, this strategy has been implemented not only in this case, but in a series of equity offerings, especially in Spain, but also in different countries (such as France and Germany)¹⁶. In all cases, positive returns were obtained that were in line with the estimated theoretical results, which adds further robustness to the results and conclusions reached in this paper. Nevertheless, these results allow the addition of an out-of-sample analysis that strengthens the theoretical results obtained for the sample analysed.

¹⁶ Tables with the results of all other operations are available upon request.

Table 2-4 Application of the Arbitrage Strategy on Atari S.A. (April 2022)

Table 2 - Application of the Hedging Strategy on ATARI S.A. (April 2022)

ATARI S.A.					
Characteristics					
DSP	4	New Stocks	1		
Notional	0.0100€	Premium	0.1640€	Price	0.1640€
Start	11/03/2022	End	24/03/2022		
Implementation of the Strategy					
1. Strategy related to the stock and rights					
1.1. Preferential Subscription Rights					
Operation	Volume	Price	Value		
Buying the PSRs	40.000	0.0039€	156.00€		
Commissions	1	15.00€	15.00€		
1.2 Stocks of the Company					
Operation	Volume	Price	Value		
Subscribing the stocks	10.000	0,1640€	1,640.00€		
Selling the stocks	10.000	0.1865€	1,865.00€		
Commission	1	15.00€	15.00€		
2. Strategy related to the Contracts for Differences					
2.1. Opening of the position					
Operation	Volume	Price	Value		
Opening a position	10.000	0.2072	-		
Margin included	-	-	1,000.00€		
Commissions	1	5.00€	5.00€		
2.2. Close of the position					
Operation	Volume	Price	Value		
Opening a position	10.000	0.1878€	194.43€		
Commissions	1	19.34€	19.34€		
3. Result of the Strategy					
Concept	Value	% over Investment			
0. Total Investment	2,796.00€	-			
1. Stocks and rights	1.865.00€	-			
2. CFDs	1,194.43€	-			
Gross Result (I)	3,059.43€	9.4217%			
Gross Result (II)	263.43€	9.4217%			
Total Commissions	54.43€	1.9435%			
Net Result (I)	3,005.09€	7.4782%			
Net Result (II)	209.09€	7.4782%			

2.6. CONCLUSIONS

The objective of this work has been to conduct a joint analysis of rights issues carried out around the world, the search for possible arbitrage opportunities that may have occurred, as well as their explanation, and even their prediction, through factors related to the process and to the issuing company. To this end, a strategy aimed at exploiting these potential arbitrage opportunities was first designed and implemented. Once the returns of such strategy have been obtained, they have been explained and modelled through different statistical tests and OLS estimations, and finally we have tried to predict the occurrence of these arbitrage opportunities through the estimation of *logit* and *probit* probability models. All this has been done on a sample of several thousand rights offerings performed in 27 countries on all continents over a total of 20 years.

The results obtained provide sufficient evidence to not to reject the **main hypothesis** of the study, and to show that arbitrage opportunities have been uninterruptedly occurring in these processes over the years and are present nowadays. Positive returns have been obtained for all countries, and the average returns for each country have been positive and significant. However, the same evidence does not seem to indicate that this is the case for all issues, since in most cases the medians have been negative and significant. It could be accepted that this anomaly occurs in a significant percentage in each country, but not systematically.

On the other hand, this type of occurrence does not seem to be the result of chance since some factors have been found that seem to significantly affect the probability of this happening. For example, it has been identified that the more new shares are issued in relation to the number of existing shares, the higher the possible performance of the arbitrage strategy. On the other hand, the fact that the company is listed in a stock index seems to reduce this result¹⁷. In addition to these two factors, it has also been possible to establish a negative relationship between the returns of the arbitrage strategy and the level of sustainability of the issuing company or the degree of development of the country at the time of the process.

Finally, having obtained a series of factors that explain to a greater or lesser extent the occurrence of arbitrage, an attempt has been made to predict its occurrence by means of probability models. Although the results of this prediction within the sample are very varied, in general, high prediction success rates have been obtained, which reinforces the role of the factors studied in the appearance of these anomalies.

¹⁷ Note that for those companies listed in stock indices, the probability of short positions is higher.

It is true that the bulk of this study corresponds to a rather theoretical framework, since all the work has been carried out with a specific sample of equity offerings that have already taken place, and the modelling and prediction has always been done within the sample. However, it has been shown that this study has a real application, since the proposed arbitrage strategy has been applied in processes outside the sample period. In all the cases in which it has been applied, the strategy has allowed not only to obtain positive results, but also to know the final result at the very moment of opening the positions, even if their closing was delayed by weeks. These out-of-sample results enhance the consistency and quality of these conclusions.

The appearance of arbitrage opportunities is an anomaly that indicates that the market is not functioning properly. A market that behaves efficiently will not experience arbitrage, or it will last as little as possible, and this is not happening in many of the cases analysed in this paper. Market incompleteness, for example due to the impossibility of taking short positions in the issuing company, may be an additional factor explaining the emergence (and maintenance over time) of arbitrage opportunities, and consequently preventing the market from functioning efficiently. However, a relevant contribution that has emerged from these results is that the effort for sustainability by the companies and the level of economic development of the countries have positive effects on the efficiency of the market, which in this case is observed in that the results of these strategies are smaller, until they become negative, when the value of these two variables is higher.

Finally, the greatest contribution of this work has consisted of uniting in a single study the study of rights offerings in different countries on all continents, obtaining not only common results for each of them, but also identifying factors and behaviours common to all of them. It has been possible to obtain relevant results for all countries, considering the different methodologies that had to be applied depending on the territories. Thus, we can consider that the results obtained already take into account the effect of differences in regulation between countries, which increases the robustness of the conclusions obtained.

After this analysis, other similar studies are still pending, since arbitrage opportunities are not the only type of market anomalies that can occur in the context of equity offerings. An example could be the appearance of anomalous returns as a consequence of milestones or events that are part of these processes. It would also be of great interest to carry out a study dedicated exclusively to the positive outliers detected, and to identify the causes that may be behind these anomalous results. These studies and other similar ones remain as a pending task for future research.

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2.8. ANNEX

Table 2-5 Summary of Results for Africa and the Middle East

Region	Africa and Middle East							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	0.00%	12	44.44%	37	55.22%	49	51.58%
nARB	1	100.00%	15	55.56%	30	44.78%	46	48.42%
TOT	1	-	27	-	67	-	95	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	8.84%	0.6728	1.52%	0.2185		0.6861		
PER1	-64.55%	0.0000	-64.55%	0.0000	***	0.1587		
PER2	7.35%	0.8140	0.90%	0.6836		0.3838		
PER3	10.40%	0.6207	3.26%	0.1748		0.8288		
Catheg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	62	20.19%	0.0367	**	6.13%	0.9773		
MON	88	5.44%	0.3941		1.31%	0.6209		
IDX	4	56.43%	0.3240		6.26%	0.7674		
ESG D	-	-	-		-	-		
ESG C	1	79.97%	0.0000	***	79.97%	0.8413		
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	62	10.47%	0.2028		3.16%	0.7910		
DEV H	27	5.09%	0.7239		-2.39%	0.3415		
OLS MODEL								
Factor	Value	St. Dev.	Significance		Robustness		P-Value	Result
			P-Value	Result	P-Value	Result		
Intercept	-44.32%	0.1637	0.0068	***	-	-	-	-
DIL	24.36%	0.0808	0.0026	***	-	-	-	-
IDX	-1.54%	0.1904	0.9355		0.9175		-	-
ISC	62.25%	0.1520	0.0000	***	-	-	-	-
CAP	16.39%	0.2446	0.5027		0.9602		-	-

Figure 2-39 Histogram of Net Returns for Africa and Middle East

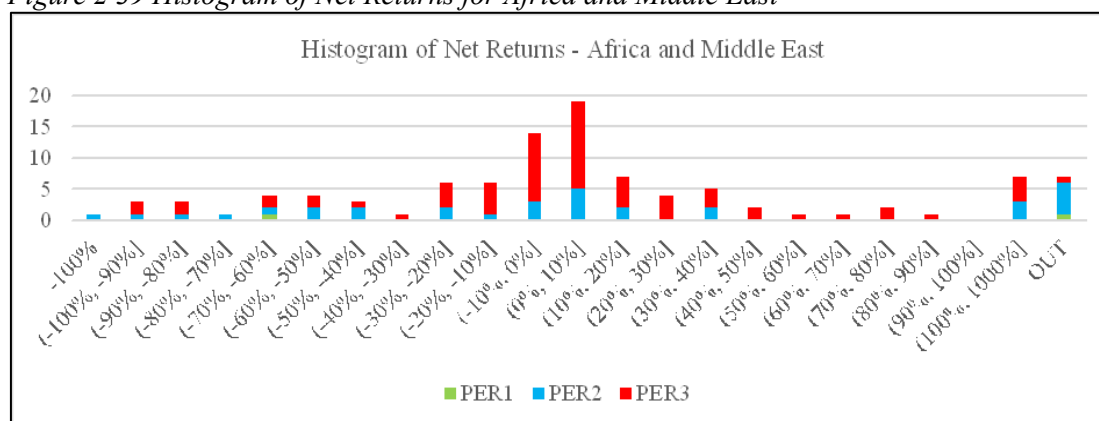


Table 2-6 Summary of Results for America

Region	America							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	62	46.97%	40	35.40%	102	41.63%
nARB	0	-	70	53.03%	73	64.60%	143	58.37%
TOT	0	-	132	-	113	-	245	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	65.30%	2.2993	-4.78%	0.0000	***	0.0371	**	+
PER1	-	-	-	-		-		
PER2	82.79%	2.5594	-0.58%	0.0003	***	0.3684		+
PER3	44.88%	1.9322	-15.37%	0.0150	**	0.0246	**	+
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	140	95.16%	0.0000	***	1.08%	0.9186		
MON	240	61.35%	0.0000	***	-5.11%	0.0206	**	
IDX	17	17.57%	0.7105		-34.63%	0.0197	**	
ESG D	9	423.73%	0.0106	**	390.38%	0.9747		
ESG C	28	-50.20%	0.0000	***	-52.60%	0.0000	***	
ESG B	8	30.21%	0.7515		-72.86%	0.0807	*	
ESG A	3	-65.14%	0.0485	**	-63.27%	0.0544	*	
DEV L	-	-	-		-	-		
DEV M	100	76.96%	0.0025	***	-25.71%	0.0850	*	
DEV H	145	57.27%	0.0018	***	0.42%	0.4886		
OLS MODEL								
Factor	Value	St. Dev.	Significance		Robustness		P-Value	Result
			P-Value	Result	P-Value	Result		
Intercept	113.19%	0.4636	0.0146	**	-	-		
DIL	-0.70%	0.0023	0.0026	***	-	-		
IDX	-133.96%	0.2663	0.0000	***	-	-		
ISC	-2.61%	0.0776	0.7364		0.9397			
CAP	-54.05%	0.6303	0.3912		0.9332			

Figure 2-40 Histogram of Net Returns for America

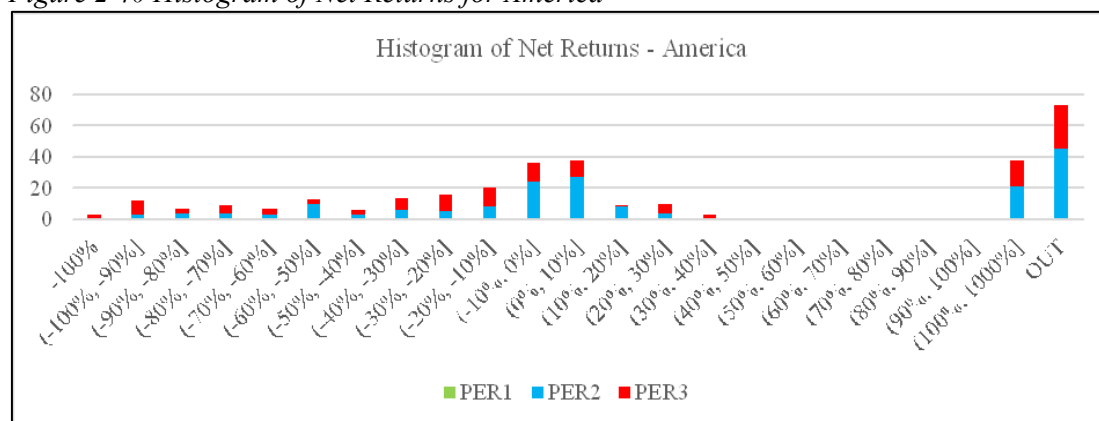


Table 2-7 Summary of Results for Asia and Oceania

Region	Asia and Oceania							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	145	37.08%	264	41.84%	219	43.03%	628	41.02%
nARB	246	62.92%	367	58.16%	290	56.97%	903	58.98%
TOT	391	-	631	-	509	-	1,531	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	62.40%	2.1295	-4.42%	0.0000	***	0.0014	***	+
PER1	64.34%	2.2730	-14.00%	0.0000	***	0.0252	**	+
PER2	73.17%	2.1853	-4.09%	0.0000	***	0.3784		+
PER3	47.52%	1.9270	-2.07%	0.0000	***	0.0063	***	+
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	882	88.82%	0.0000	***	-0.51%	0.9958		
MON	1,499	57.01%	0.0000	***	-5.07%	0.0000	***	
IDX	147	7.61%	0.4753		-11.60%	0.0001	***	
ESG_D	36	103.39%	0.0215	**	-2.70%	0.4252		
ESG_C	62	21.30%	0.2001		-3.90%	0.0191	**	
ESG_B	35	-16.32%	0.0251	**	-5.07%	0.0298	**	
ESG_A	3	-5.28%	0.7324		-0.06%	0.2965		
DEV_L	18	-3.77%	0.7421		-10.70%	0.0610	*	
DEV_M	528	18.51%	0.0066	***	-16.30%	0.0000	***	
DEV_H	943	88.84%	0.0000	***	-1.60%	0.8803		
OLS MODEL								
Factor	Value	St. Dev.	Significance		Robustness			
			P-Value	Result	P-Value	Result		
Intercept	24.27%	0.1645	0.1401		-	-		
DIL	12.76%	0.0414	0.0020	***	-	-		
IDX	-69.82%	0.1071	0.0000	***	-	-		
ISC	6.85%	0.0354	0.0529	*	-	-		
CAP	32.33%	0.2266	0.1535		0.8627			

Figure 2-41 Histogram of Net Returns for Asia and Oceania

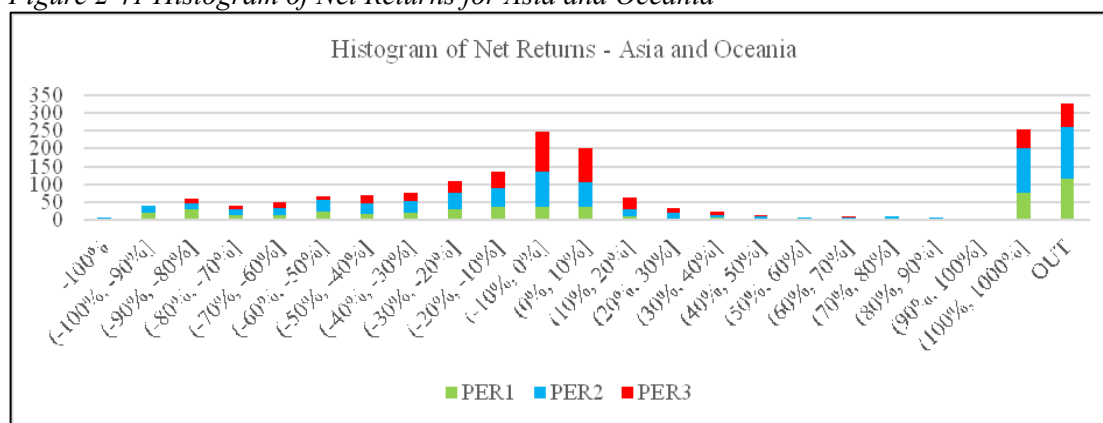


Table 2-8 Summary of Results for Europe

Region	Europe							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	47	32.64%	275	41.17%	332	35.10%	654	37.20%
nARB	97	67.36%	393	58.83%	614	64.90%	1,104	62.80%
TOT	144	-	668	-	946	-	1,758	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	41.72%	1.7963	-2.26%	0.0000	***	0.0000	***	+
PER1	66.74%	1.9838	-1.53%	0.0001	***	0.5650		+
PER2	38.68%	1.7597	-3.24%	0.0000	***	0.0000	***	+
PER3	39.85%	1.7873	-1.99%	0.0000	***	0.0002	***	+
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	862	46.67%	0.0000	***	-2.60%	0.0000	***	
MON	1,734	42.34%	0.0000	***	-2.22%	0.0000	***	
IDX	95	41.35%	0.0194	**	-1.04%	0.5325		
ESG_D	16	31.44%	0.4784		-5.44%	0.0813	*	
ESG_C	52	9.26%	0.5115		-2.26%	0.0619	*	
ESG_B	95	63.07%	0.0045	***	-1.92%	0.1956		
ESG_A	45	49.16%	0.0401	**	-0.94%	0.7966		
DEV_L	-	-	-		-	-		
DEV_M	35	32.99%	0.2483		-1.63%	0.0070	***	
DEV_H	1,712	41.27%	0.0000	***	-2.33%	0.0000	***	
OLS MODEL								
Factor	Value	St. Dev.	Significance		Robustness			
			P-Value	Result	P-Value	Result		
Intercept	12.88%	0.1265	0.3088		-	-		
DIL	2.65%	0.0125	0.0341	**	-	-		
IDX	13.81%	0.2032	0.4968		0.9181			
ISC	75.61%	0.1640	0.0000	***	-	-		
CAP	25.85%	0.1744	0.1382		0.8028			

Figure 2-42 Histogram of Net Returns for Europe

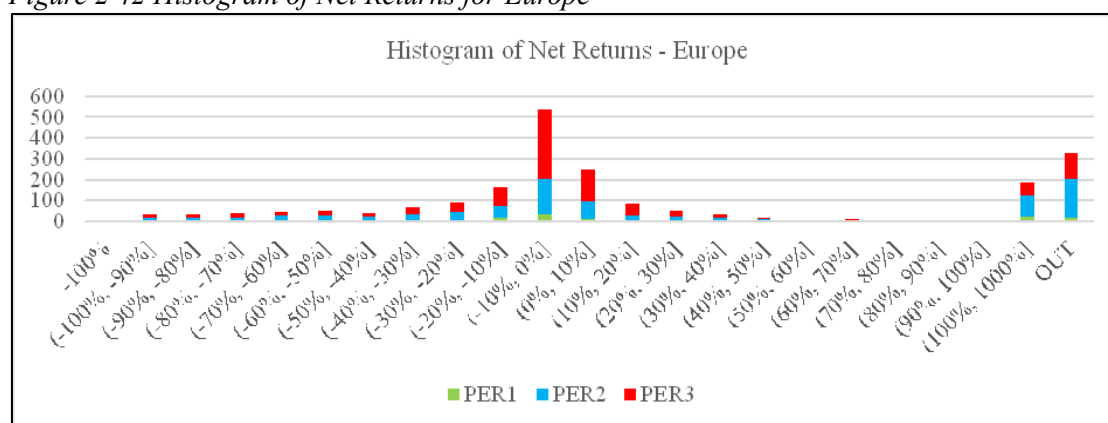


Table 2-9 Summary of Results for Egypt (EGY)

Country	Egypt (EGY)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	4	26.67%	15	51.72%	19	43.18%
nARB	0	-	11	73.33%	14	48.28%	25	56.82%
TOT	0	-	15	-	29	-	44	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	3.70%	0.7966	-3.47%	0.7761		0.3033		-
PER1	-	-	-	-		-		-
PER2	-8.38%	0.6817	-18.55%	0.7218		0.2970		-
PER3	7.45%	0.8254	1.52%	0.6306		0.4441		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	31	13.44%	0.3792		4.26%	0.6948		
MON	37	-4.52%	0.6645		-4.55%	0.2055		
IDX	1	222.14%	0.0000	***	222.14%	0.8413		
ESG D	-	-	-		-	-		
ESG C	1	79.97%	0.0000	***	79.97%	0.8413		
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	11	0.29%	0.9917		-17.31%	0.3611		
DEV H	27	5.09%	0.7239		-2.39%	0.3415		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	72.22%	90.48%	82.05%	66.67%	95.24%	82.05%		
PER1								
PER2	100.00%	100.00%	100.00%	50.00%	100.00%	84.62%		
PER3	78.57%	83.33%	80.77%	50.00%	75.00%	61.54%		

Figure 2-43 Histogram of Net Returns for Egypt (EGY)

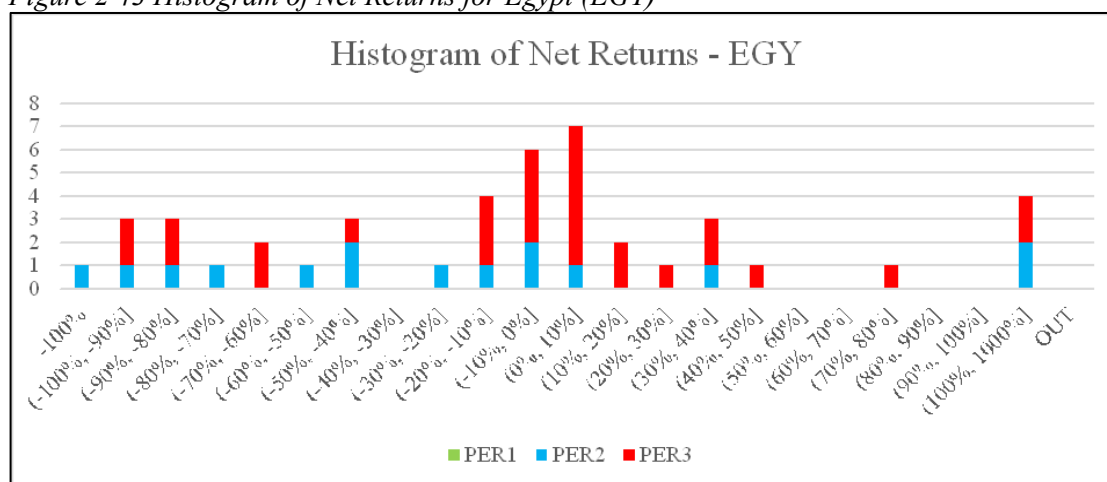


Table 2-10 Summary of Results for Saudi Arabia (SAU)

Country	Saudi Arabia (SAU)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	2	100.00%	18	78.26%	20	80.00%
nARB	0	-	0	0.00%	5	21.74%	5	20.00%
TOT	0	-	2	-	23	-	25	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	37.75%	0.6476	18.48%	0.0076	***	0.9995		-
PER1	-	-	-	-		-		-
PER2	168.08%	1.2903	168.08%	0.3166		0.9101		-
PER3	26.42%	0.3880	17.87%	0.0035	***	0.9984		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	24	39.39%	0.0073	***	21.07%	0.9995		
MON	25	37.75%	0.0076	***	18.48%	0.9995		
IDX	3	1.20%	0.7992		6.15%	0.5000		
ESG D	-	-	-		-	-		
ESG C	-	-	-		-	-		
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	25	37.75%	0.0076	***	18.48%	0.9995		
DEV H	-	-	-		-	-		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	100.00%	50.00%	91.67%	85.00%	50.00%	79.17%		
PER1								
PER2								
PER3	100.00%	25.00%	86.36%	100.00%	25.00%	86.36%		

Figure 2-44 Histogram of Net Returns for Saudi Arabia (SAU)

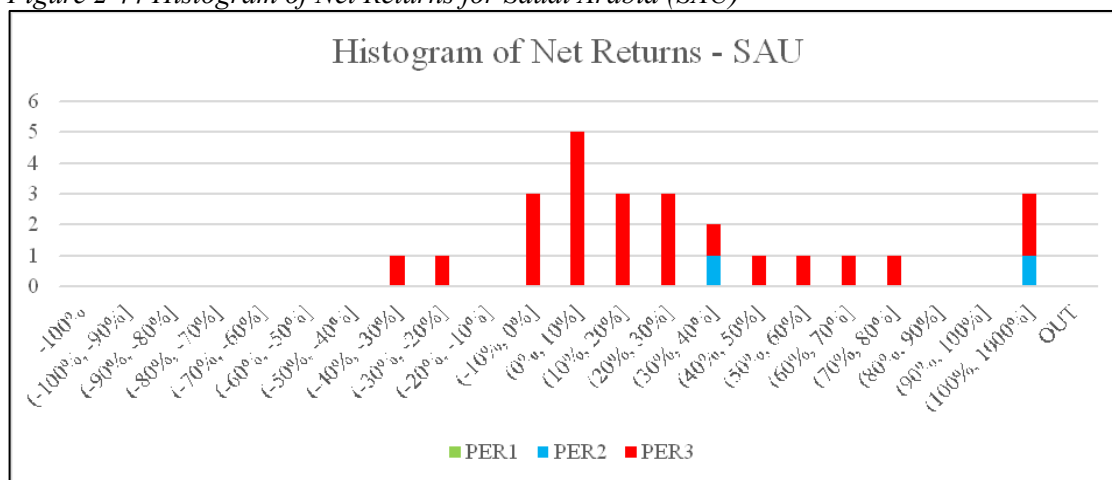


Table 2-11 Summary of Results for Tunisia (TUN)

Country	Tunisia (TUN)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	0.00%	6	60.00%	4	26.67%	10	38.46%
nARB	1	100.00%	4	40.00%	11	73.33%	16	61.54%
TOT	1	-	10	-	15	-	26	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	-11.46%	0.3057	-5.76%	0.0675	*	0.0310	**	-
PER1	-64.55%	0.0000	-64.55%	0.0000	***	0.1587		-
PER2	-10.64%	0.2626	1.98%	0.2320		0.3606		-
PER3	-8.46%	0.3103	-8.61%	0.3087		0.0304	**	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	7	-15.74%	0.0904	*	-10.12%	0.0315	**	
MON	26	-11.46%	0.0675	*	-5.76%	0.0310	**	
IDX	-	-	-		-	-		
ESG D	-	-	-		-	-		
ESG C	-	-	-		-	-		
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	26	-11.46%	0.0675	*	-5.76%	0.0310	**	
DEV H	-	-	-		-	-		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	71.43%	100.00%	81.82%	71.43%	100.00%	81.82%		
PER1								
PER2	100.00%	100.00%	100.00%	75.00%	100.00%	80.00%		
PER3	66.67%	100.00%	83.33%	66.67%	100.00%	83.33%		

Figure 2-45 Histogram of Net Returns for Tunisia (TUN)

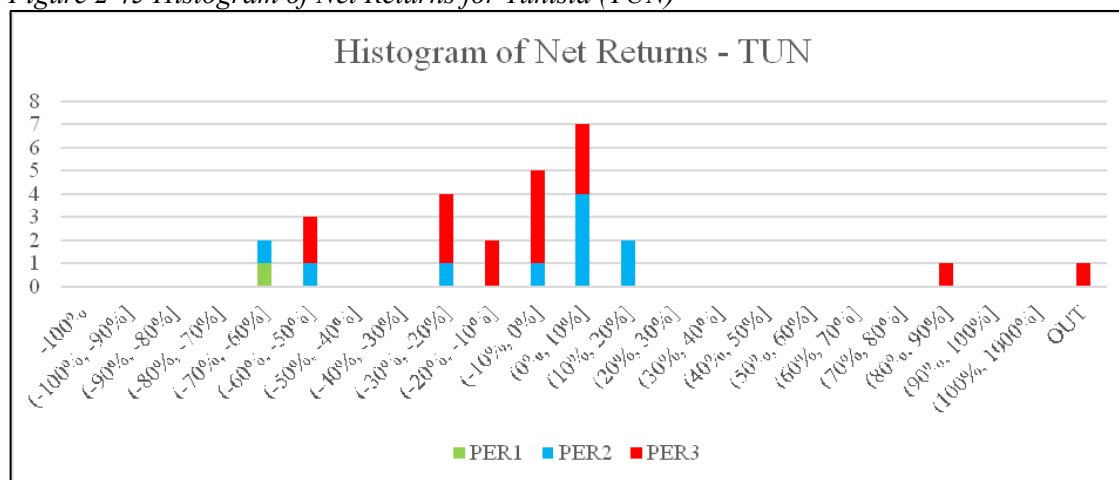


Table 2-12 Summary of Results for Brazil (BRA)

Country	Brazil (BRA)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	14	28.00%	20	25.00%	34	26.15%
nARB	0	-	36	72.00%	60	75.00%	96	73.85%
TOT	0	-	50	-	80	-	130	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	60.09%	2.4056	-27.81%	0.0051	***	0.0040	***	-
PER1	-	-	-	-		-		-
PER2	97.64%	2.9350	-36.87%	0.0227	**	0.1185		-
PER3	36.62%	1.9689	-25.15%	0.1002		0.0068	***	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	59	113.73%	0.0020	***	-10.58%	0.6692		
MON	126	54.96%	0.0100	**	-29.43%	0.0018	***	
IDX	17	17.57%	0.7105		-34.63%	0.0197	**	
ESG D	6	419.19%	0.0388	**	484.93%	0.9421		
ESG C	22	-57.47%	0.0000	***	-54.70%	0.0000	***	
ESG B	8	30.21%	0.7515		-72.86%	0.0807	*	
ESG A	3	-65.14%	0.0485	**	-63.27%	0.0544	*	
DEV L	-	-	-		-	-		
DEV M	98	78.58%	0.0024	***	-27.37%	0.1032		
DEV H	32	3.44%	0.9224		-37.25%	0.0005	***	
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	61.90%	97.06%	88.76%	57.14%	97.06%	87.64%		
PER1								
PER2	90.91%	100.00%	97.30%	27.27%	96.15%	75.68%		
PER3	90.00%	97.62%	96.15%	10.00%	97.62%	80.77%		

Figure 2-46 Histogram of Net Returns for Brazil (BRA)

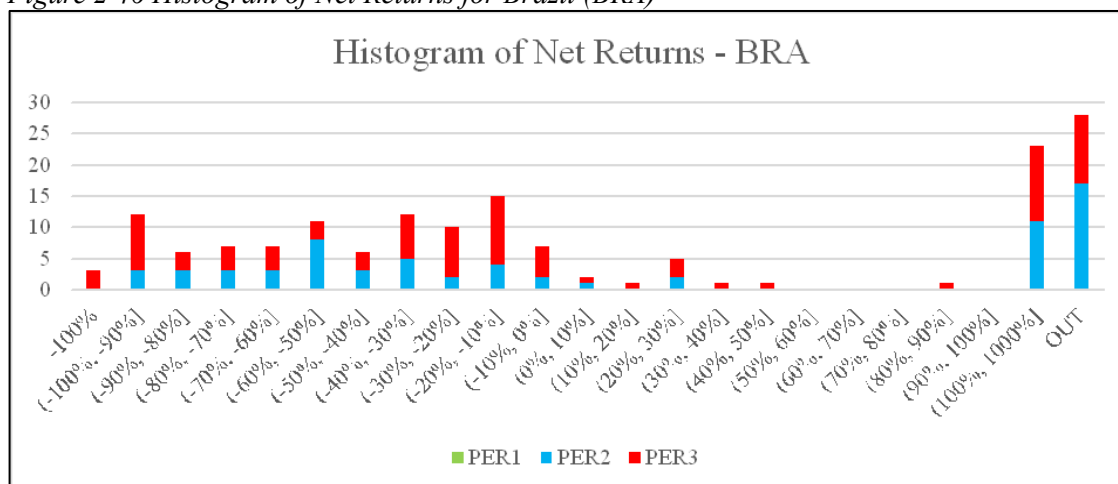


Table 2-13 Summary of Results for Canada (CAN)

Country	Canada (CAN)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	31	63.27%	17	60.71%	48	62.34%
nARB	0	-	18	36.73%	11	39.29%	29	37.66%
TOT	0	-	49	-	28	-	77	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	87.66%	2.3154	3.74%	0.0014	***	0.9978		-
PER1	-	-	-	-		-		-
PER2	94.00%	2.4945	3.74%	0.0112	**	0.9929		-
PER3	76.57%	1.9581	3.84%	0.0482	**	0.9336		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	58	101.32%	0.0020	***	3.64%	0.9985		
MON	76	83.69%	0.0022	***	3.64%	0.9966		
IDX	-	-	-		-	-		
ESG D	3	432.80%	0.2098		346.42%	0.8575		
ESG C	1	-27.68%	0.0000	***	-27.68%	0.1587		
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	2	-2.47%	0.3722		-2.47%	0.0899	*	
DEV H	75	90.07%	0.0014	***	4.16%	0.9983		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	94.74%	26.32%	71.93%	68.42%	73.68%	70.18%		
PER1								
PER2	92.00%	75.00%	86.49%	80.00%	83.33%	81.08%		
PER3	92.31%	42.86%	75.00%	46.15%	85.71%	60.00%		

Figure 2-47 Histogram of Net Returns for Canada (CAN)

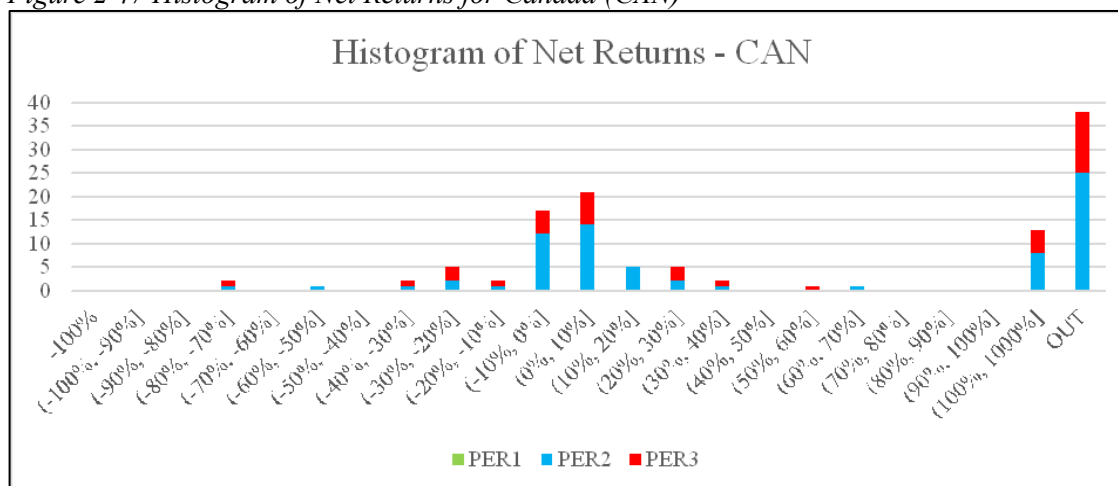


Table 2-14 Summary of Results for the United States (USA)

Country	United States (USA)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	17	51.52%	3	60.00%	20	52.63%
nARB	0	-	16	48.48%	2	40.00%	18	47.37%
TOT	0	-	33	-	5	-	38	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	37.85%	1.8001	1.23%	0.2029		0.6002		-
PER1	-	-	-	-		-		-
PER2	43.64%	1.9250	1.28%	0.2021		0.6091		-
PER3	-0.32%	0.0513	1.18%	0.8974		0.5536		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	23	32.00%	0.3961		1.18%	0.3690		
MON	38	37.85%	0.2029		1.23%	0.6002		
IDX	-	-	-		-	-		
ESG D	-	-	-		-	-		
ESG C	5	-22.71%	0.1940		-10.59%	0.0690	*	
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	38	37.85%	0.2029		1.23%	0.6002		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	100.00%	100.00%	100.00%	14.29%	90.91%	61.11%		
PER1								
PER2	100.00%	100.00%	100.00%	33.33%	88.89%	66.67%		
PER3								

Figure 2-48 Histogram of Net Returns for the United States (USA)

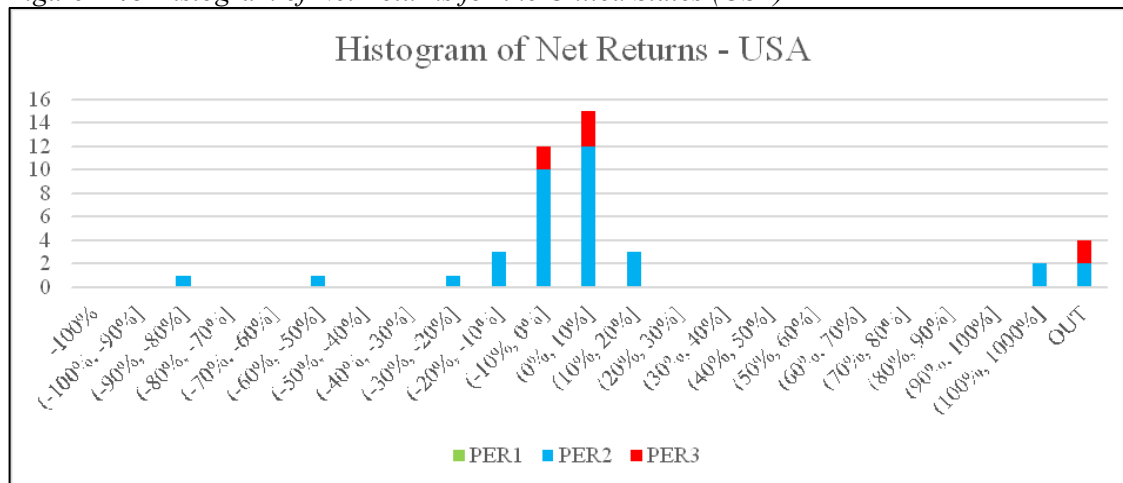


Table 2-15 Summary of Results for Australia (AUS)

Country	Australia (AUS)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	34	34.34%	31	44.29%	21	23.33%	86	33.20%
nARB	65	65.66%	39	55.71%	69	76.67%	173	66.80%
TOT	99	-	70	-	90	-	259	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	85.25%	2.5094	-17.21%	0.0000	***	0.1051		-
PER1	97.90%	2.5475	-22.57%	0.0002	***	0.7009		-
PER2	116.90%	2.7752	-8.47%	0.0008	***	0.7523		-
PER3	46.71%	2.1792	-20.03%	0.0450	**	0.0003	***	-
Catheg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	102	164.13%	0.0000	***	2.61%	0.9990		
MON	255	79.45%	0.0000	***	-17.81%	0.0428	**	
IDX	18	13.00%	0.7284		-35.01%	0.0389	**	
ESG D	21	187.16%	0.0120	**	-1.53%	0.8632		
ESG C	23	23.19%	0.5168		-33.53%	0.0569	*	
ESG B	8	-42.85%	0.0214	**	-44.87%	0.0250	**	
ESG A	1	-36.06%	0.0000	***	-36.06%	0.1587		
DEV L	-	-	-		-	-		
DEV M	8	60.20%	0.5056		-18.81%	0.1038		
DEV H	245	84.00%	0.0000	***	-17.64%	0.0735	*	
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	35.48%	97.71%	77.72%	9.68%	97.71%	69.43%		
PER1	51.85%	93.02%	77.14%	22.22%	97.67%	68.57%		
PER2	47.62%	96.55%	76.00%					
PER3	64.29%	98.31%	91.78%					

Figure 2-49 Histogram of Net Returns for Australia (AUS)

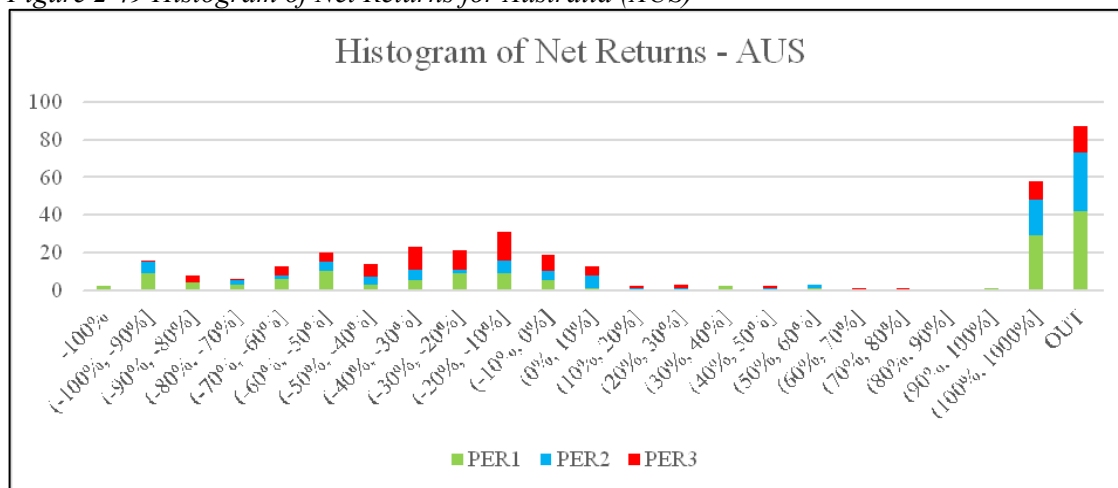


Table 2-16 Summary of Results for Hong Kong (HKG)

Country	Hong Kong (HKG)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	42	53.85%	64	45.07%	75	54.74%	181	50.70%
nARB	36	46.15%	78	54.93%	62	45.26%	176	49.30%
TOT	78	-	142	-	137	-	357	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	115.75%	2.6048	0.14%	0.0000	***	0.9993		-
PER1	176.23%	3.1384	2.75%	0.0000	***	0.9982		-
PER2	86.97%	2.1574	-1.06%	0.0000	***	0.7679		-
PER3	111.16%	2.6368	1.09%	0.0000	***	0.9954		-
Catheg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	246	137.79%	0.0000	***	0.69%	0.9997		
MON	354	112.36%	0.0000	***	0.01%	0.9985		
IDX	2	294.51%	0.0088	***	294.51%	0.9101		
ESG D	4	6.71%	0.4370		-1.82%	0.3575		
ESG C	18	55.60%	0.0969	*	-0.63%	0.5433		
ESG B	9	-15.48%	0.2124		-5.07%	0.1068		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	34	112.67%	0.0080	***	6.41%	0.9883		
DEV H	321	116.32%	0.0000	***	-0.12%	0.9946		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	25.35%	90.00%	58.56%	9.15%	96.67%	54.11%		
PER1	78.13%	92.31%	84.48%	25.00%	80.77%	50.00%		
PER2	35.71%	91.55%	66.93%	10.71%	98.59%	59.84%		
PER3	38.89%	83.02%	60.75%	18.52%	88.68%	53.27%		

Figure 2-50 Histogram of Net Returns for Hong Kong (HKG)

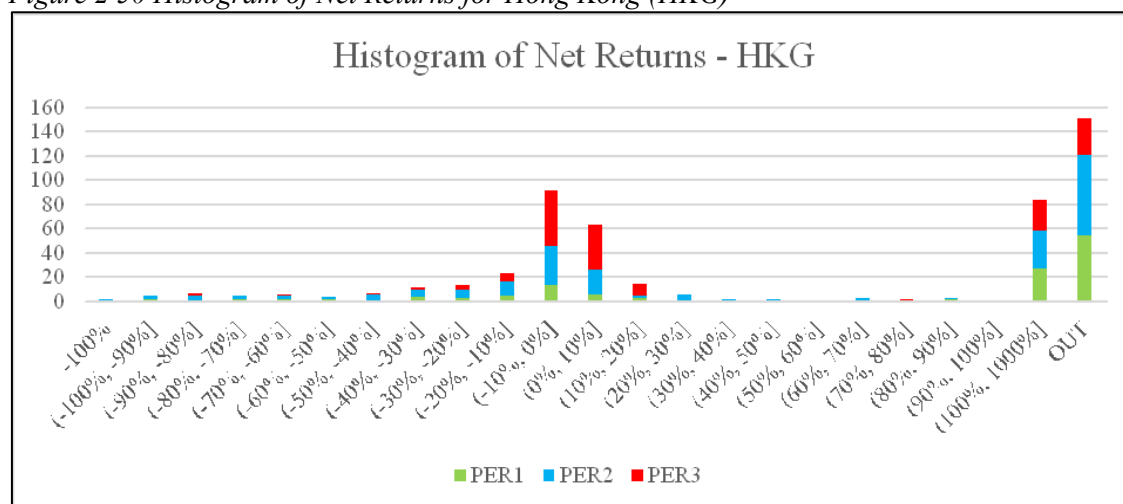


Table 2-17 Summary of Results for India (IND)

Country	India (IND)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	1	20.00%	15	60.00%	23	85.19%	39	68.42%
nARB	4	80.00%	10	40.00%	4	14.81%	18	31.58%
TOT	5	-	25	-	27	-	57	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	-6.01%	0.4146	3.68%	0.2829		0.7403		-
PER1	-56.75%	0.4566	-89.00%	0.0499	**	0.0398	**	-
PER2	-9.40%	0.4316	2.39%	0.2869		0.3991		-
PER3	7.01%	0.2890	4.41%	0.2274		0.9912		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	20	3.46%	0.7276		4.69%	0.8839		
MON	56	-6.01%	0.2829		3.68%	0.7403		
IDX	18	3.01%	0.7603		4.72%	0.9277		
ESG D	1	-90.96%	0.0000	***	-90.96%	0.1587		
ESG C	3	15.87%	0.1495		11.81%	0.9456		
ESG B	5	-2.25%	0.8922		3.72%	0.7499		
ESG A	1	20.27%	0.0000	***	20.27%	0.8413		
DEV L	1	-8.19%	0.0000	***	-8.19%	0.1587		
DEV M	43	-4.84%	0.4354		4.22%	0.7907		
DEV H	12	-10.02%	0.4734		3.60%	0.5000		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	94.12%	66.67%	86.96%	82.35%	33.33%	69.57%		
PER1								
PER2	100.00%	100.00%	100.00%	50.00%	100.00%	80.00%		
PER3	100.00%	100.00%	100.00%	100.00%	0.00%	88.24%		

Figure 2-51 Histogram of Net Returns for India (IND)

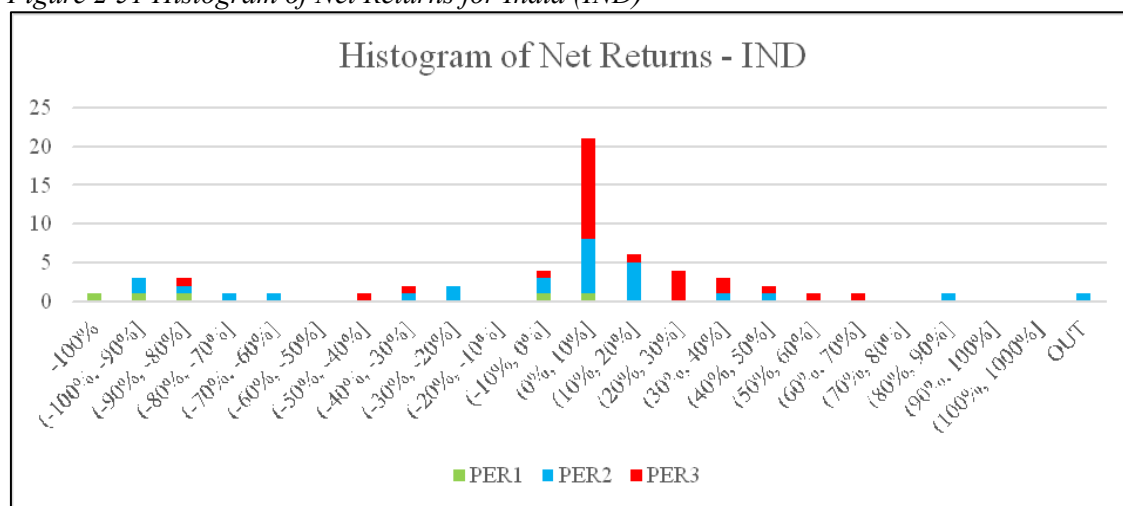


Table 2-18 Summary of Results for Malaysia (MYS)

Country	Malaysia (MYS)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	33	25.58%	49	28.82%	22	46.81%	104	30.06%
nARB	96	74.42%	121	71.18%	25	53.19%	242	69.94%
TOT	129	-	170	-	47	-	346	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	10.86%	1.4373	-20.68%	0.1607		0.0000	***	-
PER1	-19.73%	1.0861	-35.44%	0.0412	**	0.0000	***	-
PER2	28.29%	1.5923	-16.90%	0.0217	**	0.0007	***	-
PER3	31.78%	1.5454	-0.88%	0.1653		0.1704		-
Catheg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	248	24.02%	0.0178	**	-16.50%	0.0002	***	
MON	343	6.51%	0.3750		-20.82%	0.0000	***	
IDX	8	-7.68%	0.5711		-1.69%	0.3372		
ESG D	1	-39.24%	0.0000	***	-39.24%	0.1587		
ESG C	10	-17.81%	0.0823	*	-9.17%	0.0463	**	
ESG B	9	-11.76%	0.3670		-0.37%	0.2970		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	282	8.07%	0.3329		-21.99%	0.0000	***	
DEV H	35	30.03%	0.3118		-7.03%	0.0747	*	
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	37.33%	97.11%	79.03%	16.00%	97.11%	72.58%		
PER1								
PER2	25.58%	96.15%	75.51%	13.95%	97.12%	72.79%		
PER3	75.00%	95.83%	86.36%	60.00%	91.67%	77.27%		

Figure 2-52 Histogram of Net Returns for Malaysia (MYS)

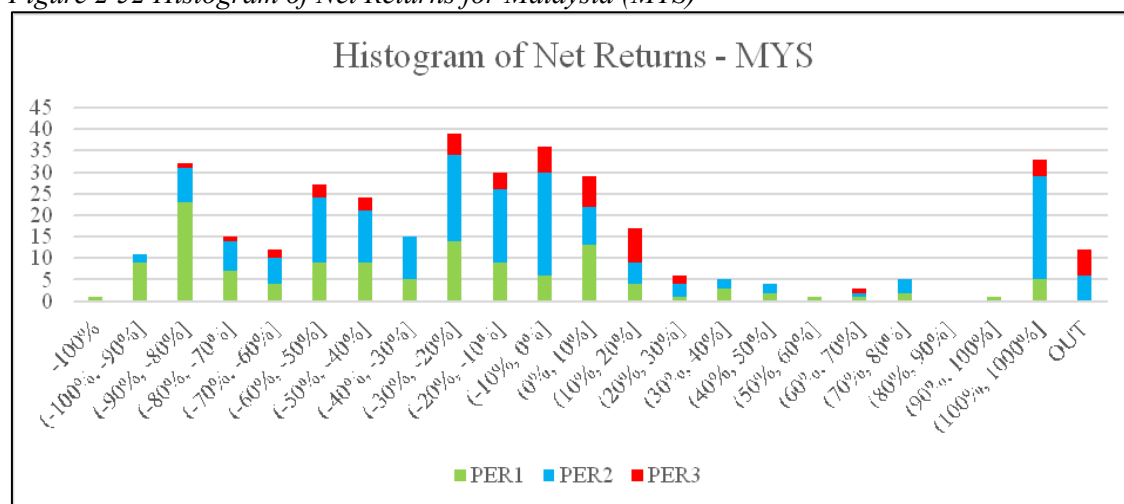


Table 2-19 Summary of Results for New Zealand (NZL)

Country	New Zealand (NZL)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	5	26.32%	5	41.67%	0	0.00%	10	31.25%
nARB	14	73.68%	7	58.33%	1	100.00%	22	68.75%
TOT	19	-	12	-	1	-	32	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	55.03%	1.9927	-10.25%	0.1284		0.2329		-
PER1	9.83%	0.7344	-10.67%	0.5668		0.1477		-
PER2	135.31%	2.9454	-6.50%	0.1398		0.5623		-
PER3	-49.56%	0.0000	-49.56%	0.0000	***	0.1587		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	14	76.93%	0.0929	*	-0.81%	0.7837		
MON	31	58.40%	0.1171		-9.82%	0.2849		
IDX	4	-40.46%	0.0370	**	-48.68%	0.0339	**	
ESG D	5	-13.90%	0.4203		-30.10%	0.2501		
ESG C	1	-61.29%	0.0000	***	-61.29%	0.1587		
ESG B	1	-54.67%	0.0000	***	-54.67%	0.1587		
ESG A	-	-	-		-	-		
DEV L	17	-3.51%	0.7723		-10.72%	0.0813	*	
DEV M	13	121.09%	0.1544		-9.82%	0.4583		
DEV H	2	123.25%	0.4023		123.25%	0.6726		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	100.00%	100.00%	100.00%	75.00%	93.33%	86.96%		
PER1	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%		
PER2	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%		
PER3								

Figure 2-53 Histogram of Net Returns for New Zealand (NZL)

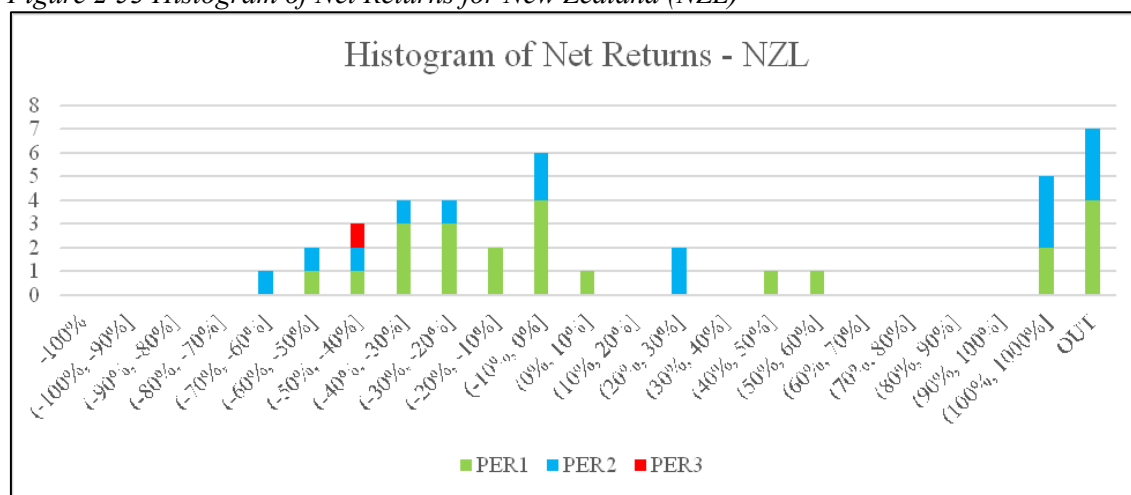


Table 2-20 Summary of Results for Pakistan (PAK)

Country	Pakistan (PAK)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	3	16.67%	17	27.87%	20	25.32%
nARB	0	-	15	83.33%	44	72.13%	59	74.68%
TOT	0	-	18	-	61	-	79	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	-4.50%	1.0299	-29.97%	0.6988		0.0001	***	-
PER1	-	-	-	-		-		-
PER2	-23.88%	0.3804	-30.82%	0.0164	**	0.0088	***	-
PER3	1.22%	1.1475	-29.97%	0.9341		0.0020	***	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	38	30.73%	0.1366		-1.40%	0.5087		
MON	68	-23.97%	0.0032	***	-32.52%	0.0000	***	
IDX	21	-35.27%	0.0013	***	-34.49%	0.0015	***	
ESG D	-	-	-		-	-		
ESG C	-	-	-		-	-		
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	43	-1.36%	0.9355		-32.10%	0.0102	**	
DEV H	36	-8.25%	0.6017		-29.95%	0.0013	***	
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	100.00%	100.00%	100.00%	66.67%	97.83%	92.73%		
PER1								
PER2								
PER3	100.00%	100.00%	100.00%	66.67%	97.30%	91.30%		

Figure 2-54 Histogram of Net Returns for Pakistan (PAK)

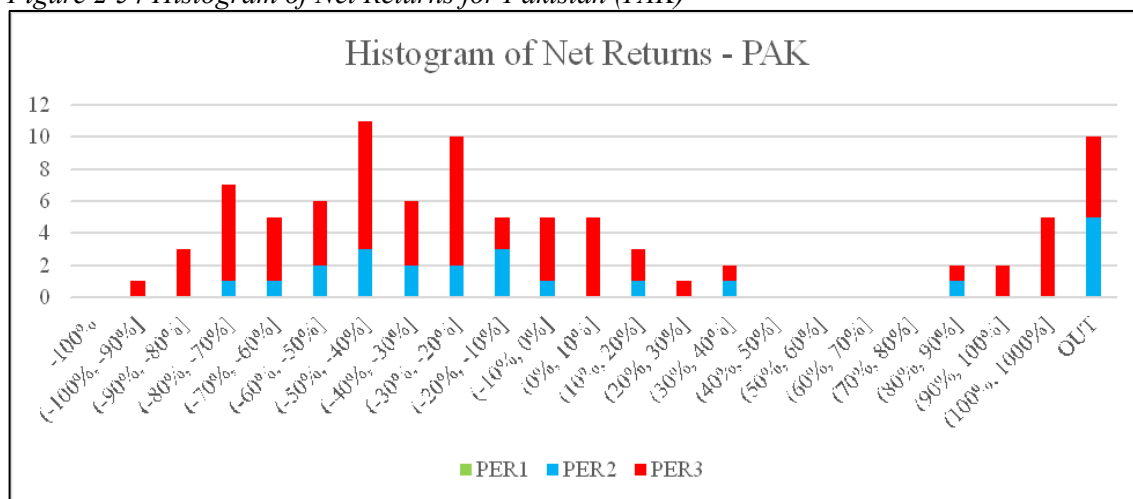


Table 2-21 Summary of Results for Singapore (SGP)

Country	Singapore (SGP)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	30	49.18%	83	57.64%	44	48.35%	157	53.04%
nARB	31	50.82%	61	42.36%	47	51.65%	139	46.96%
TOT	61	-	144	-	91	-	296	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	85.68%	2.1448	0.66%	0.0000	***	0.9998		-
PER1	71.46%	1.9530	-0.55%	0.0059	***	0.5923		-
PER2	131.44%	2.6142	2.73%	0.0000	***	1.0000		-
PER3	22.81%	0.9231	-0.19%	0.0206	**	0.9322		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	160	106.12%	0.0000	***	1.93%	0.9998		
MON	293	83.35%	0.0000	***	0.54%	0.9996		
IDX	6	1.53%	0.6476		-0.86%	0.4583		
ESG D	4	-8.89%	0.0498	**	-9.19%	0.0339	**	
ESG C	7	-3.08%	0.7343		-1.65%	0.5000		
ESG B	3	27.55%	0.2688		14.70%	0.8575		
ESG A	1	-0.06%	0.0000	***	-0.06%	0.1587		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	292	85.52%	0.0000	***	0.66%	0.9998		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	29.03%	75.22%	51.05%	4.03%	82.30%	41.35%		
PER1	66.67%	91.67%	80.00%					
PER2	64.29%	79.63%	70.97%	24.29%	79.63%	48.39%		
PER3	66.67%	91.43%	79.41%	18.18%	88.57%	54.41%		

Figure 2-55 Histogram of Net Returns for Singapore (SGP)

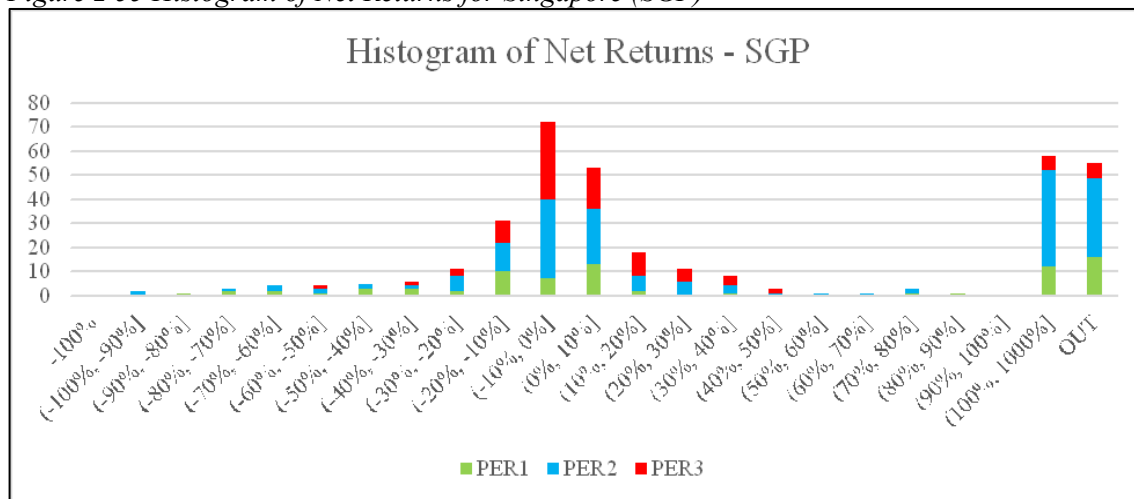


Table 2-22 Summary of Results for Sri Lanka (LKA)

Country	Sri Lanka (LKA)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	-	13	26.53%	17	30.91%	30	28.85%
nARB	0	-	36	73.47%	38	69.09%	74	71.15%
TOT	0	-	49	-	55	-	104	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	17.58%	1.6484	-18.36%	0.2793		0.0000	***	-
PER1	-	-	-	-		-		-
PER2	18.28%	1.6545	-30.00%	0.4431		0.0205	**	-
PER3	16.96%	1.6429	-9.53%	0.4473		0.0002	***	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	54	45.37%	0.0689	*	-3.49%	0.1621		
MON	98	-11.41%	0.1940		-22.02%	0.0000	***	
IDX	69	16.66%	0.3807		-11.60%	0.0010	***	
ESG D	-	-	-		-	-		
ESG C	-	-	-		-	-		
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	104	17.58%	0.2793		-18.36%	0.0000	***	
DEV H	-	-	-		-	-		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	68.18%	96.55%	88.75%	36.36%	96.55%	80.00%		
PER1								
PER2	88.89%	96.43%	94.59%	44.44%	100.00%	86.49%		
PER3	76.92%	93.33%	88.37%	46.15%	93.33%	79.07%		

Figure 2-56 Histogram of Net Returns for Sri Lanka (LKA)

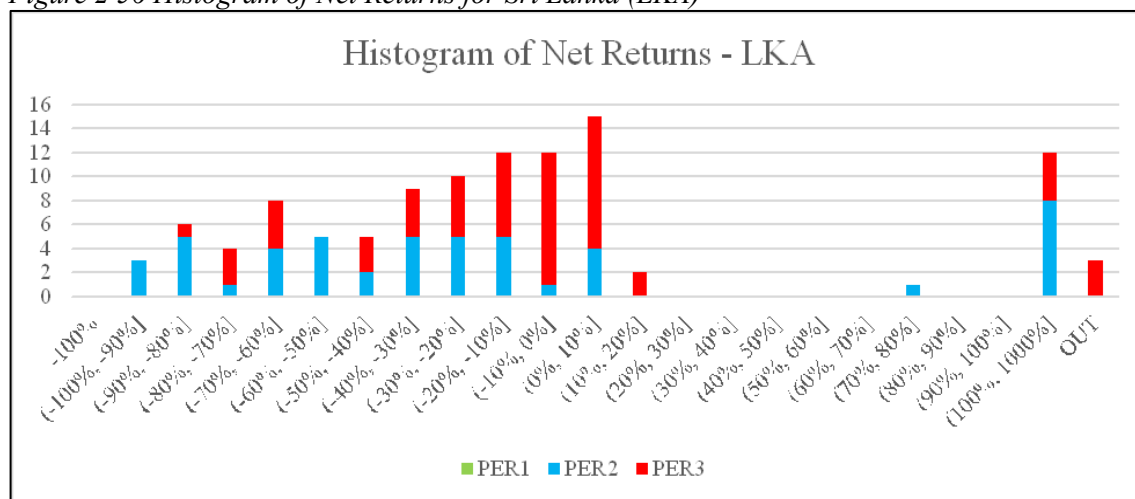


Table 2-23 Summary of Results for Austria (AUT)

Country	Austria (AUT)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	2	100.00%	4	80.00%	2	50.00%	8	72.73%
nARB	0	0.00%	1	20.00%	2	50.00%	3	27.27%
TOT	2	-	5	-	4	-	11	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	2.14%	0.0648	1.27%	0.2989		0.9088		-
PER1	4.74%	0.0224	4.74%	0.2054		0.9101		-
PER2	2.56%	0.0903	0.18%	0.5597		0.8274		-
PER3	0.31%	0.0202	0.16%	0.7792		0.6425		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	5	5.24%	0.1874		2.50%	0.9310		
MON	11	2.14%	0.2989		1.27%	0.9088		
IDX	2	0.15%	0.0992	*	0.15%	0.9101		
ESG D	-	-	-		-	-		
ESG C	1	-2.16%	0.0000	***	-2.16%	0.1587		
ESG B	2	0.15%	0.0992	*	0.15%	0.9101		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	11	2.14%	0.2989		1.27%	0.9088		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%		
PER1								
PER2	100.00%	100.00%	100.00%	75.00%	0.00%	60.00%		
PER3	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%		

Figure 2-57 Histogram of Net Returns for Austria (AUT)

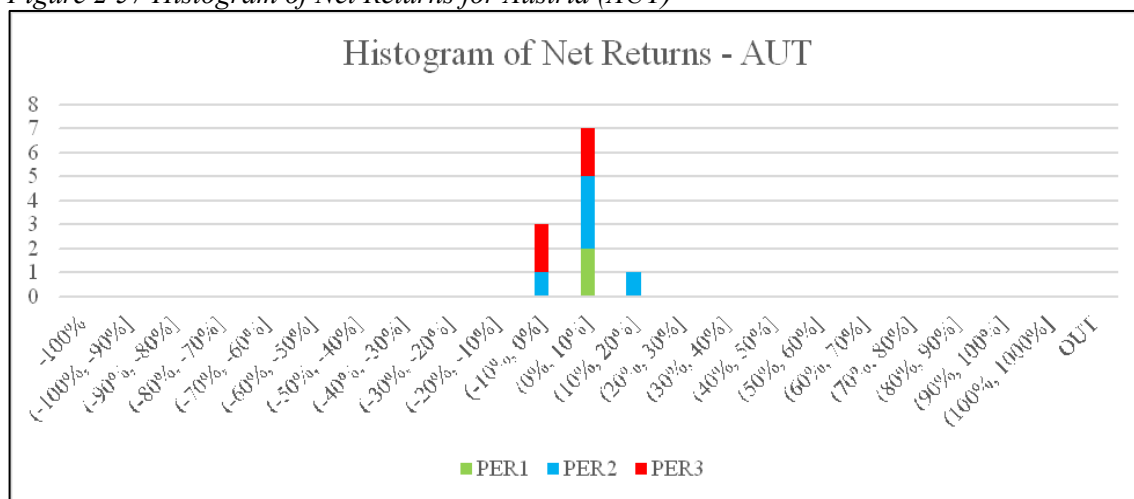


Table 2-24 Summary of Results for Belgium (BEL)

Country	Belgium (BEL)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	0.00%	8	42.11%	7	22.58%	15	27.78%
nARB	4	100.00%	11	57.89%	24	77.42%	39	72.22%
TOT	4	-	19	-	31	-	54	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	33.85%	1.5444	-1.62%	0.1132		0.0188	**	-
PER1	-6.65%	0.0603	-5.34%	0.1144		0.0339	**	-
PER2	21.03%	1.1300	-1.54%	0.4279		0.4840		-
PER3	46.93%	1.8230	-1.61%	0.1621		0.0156	**	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	16	100.14%	0.1464		0.27%	0.6792		
MON	53	28.70%	0.1730		-1.63%	0.0087	***	
IDX	-	-	-		-	-		
ESG D	2	-1.17%	0.2938		-1.17%	0.0899	*	
ESG C	2	-2.47%	0.1109		-2.47%	0.0899	*	
ESG B	7	206.73%	0.1716		-1.50%	0.7505		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	35	32.99%	0.2483		-1.63%	0.0070	***	
DEV H	19	35.44%	0.2506		-1.54%	0.3290		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	77.78%	100.00%	94.74%	44.44%	96.55%	84.21%		
PER1								
PER2	80.00%	85.71%	83.33%	60.00%	100.00%	83.33%		
PER3	50.00%	94.74%	86.96%	50.00%	100.00%	91.30%		

Figure 2-58 Histogram of Net Returns for Belgium (BEL)

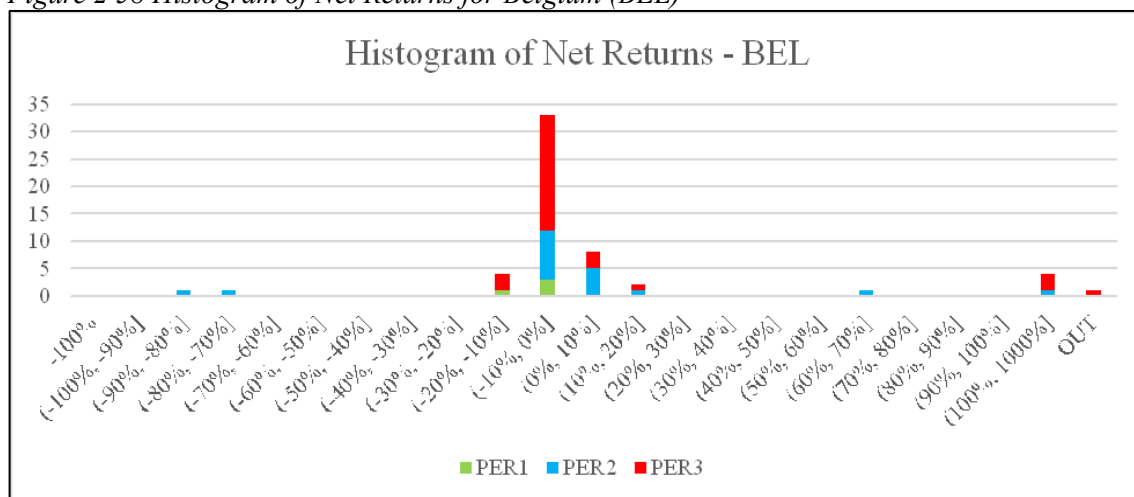


Table 2-25 Summary of Results for Denmark (DNK)

Country	Denmark (DNK)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	0.00%	6	40.00%	9	45.00%	15	40.54%
nARB	2	100.00%	9	60.00%	11	55.00%	22	59.46%
TOT	2	-	15	-	20	-	37	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	15.91%	1.4173	-5.15%	0.4992		0.0081	***	-
PER1	-2.99%	0.0389	-2.99%	0.4729		0.3274		-
PER2	52.78%	2.0412	-5.31%	0.3336		0.1057		-
PER3	-9.86%	0.6472	-3.98%	0.5038		0.0167	**	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	23	-6.05%	0.6870		-6.88%	0.0081	***	
MON	37	15.91%	0.4992		-5.15%	0.0081	***	
IDX	-	-	-		-	-		
ESG D	-	-	-		-	-		
ESG C	2	-2.20%	0.0381	**	-2.20%	0.0899	*	
ESG B	-	-	-		-	-		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	37	15.91%	0.4992		-5.15%	0.0081	***	
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	72.73%	93.33%	84.62%	18.18%	100.00%	65.38%		
PER1								
PER2								
PER3	100.00%	100.00%	100.00%	42.86%	100.00%	71.43%		

Figure 2-59 Histogram of Net Returns for Denmark (DNK)

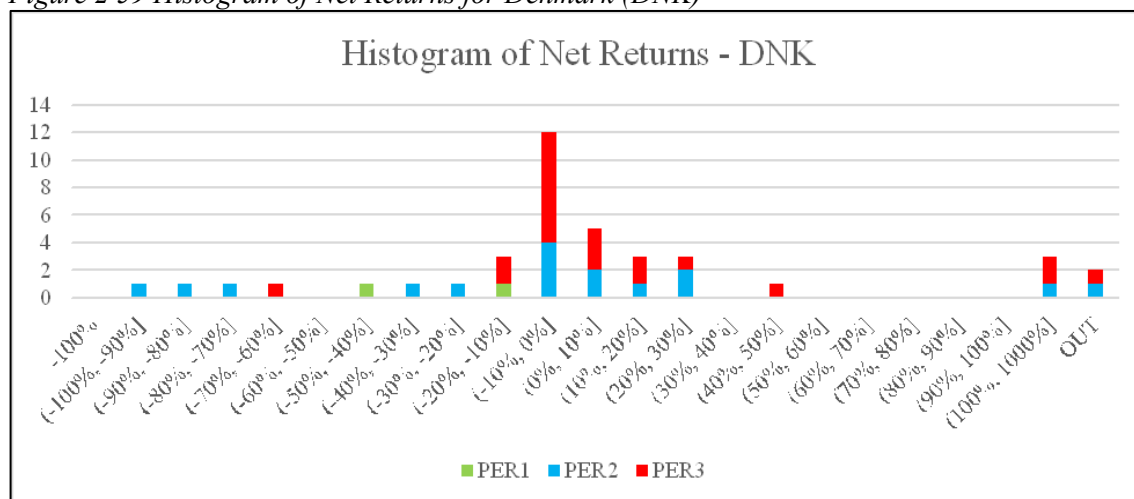


Table 2-26 Summary of Results for Finland (FIN)

Country	Finland (FIN)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	3	60.00%	18	72.00%	18	90.00%	39	78.00%
nARB	2	40.00%	7	28.00%	2	10.00%	11	22.00%
TOT	5	-	25	-	20	-	50	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	25.82%	1.6584	-5.36%	0.2763		0.0004	***	-
PER1	164.68%	2.5125	-4.19%	0.2166		0.6571		-
PER2	22.47%	1.9412	-8.20%	0.5682		0.0009	***	-
PER3	-4.70%	0.1028	-3.00%	0.0550	*	0.0239	**	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	27	34.94%	0.3617		-4.19%	0.0062	***	
MON	50	25.82%	0.2763		-5.36%	0.0004	***	
IDX	3	-31.34%	0.2719		-12.44%	0.1425		
ESG D	1	-6.53%	0.0000	***	-6.53%	0.1587		
ESG C	-	-	-		-	-		
ESG B	2	-47.18%	0.3056		-47.18%	0.0899	*	
ESG A	1	-17.90%	0.0000	***	-17.90%	0.1587		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	50	25.82%	0.2763		-5.36%	0.0004	***	
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	100.00%	20.00%	82.22%	100.00%	0.00%	77.78%		
PER1	100.00%	100.00%	100.00%	50.00%	100.00%	75.00%		
PER2	94.12%	50.00%	82.61%	94.12%	16.67%	73.91%		
PER3	93.75%	100.00%	94.44%	100.00%	100.00%	100.00%		

Figure 2-60 Histogram of Net Returns for Finland (FIN)

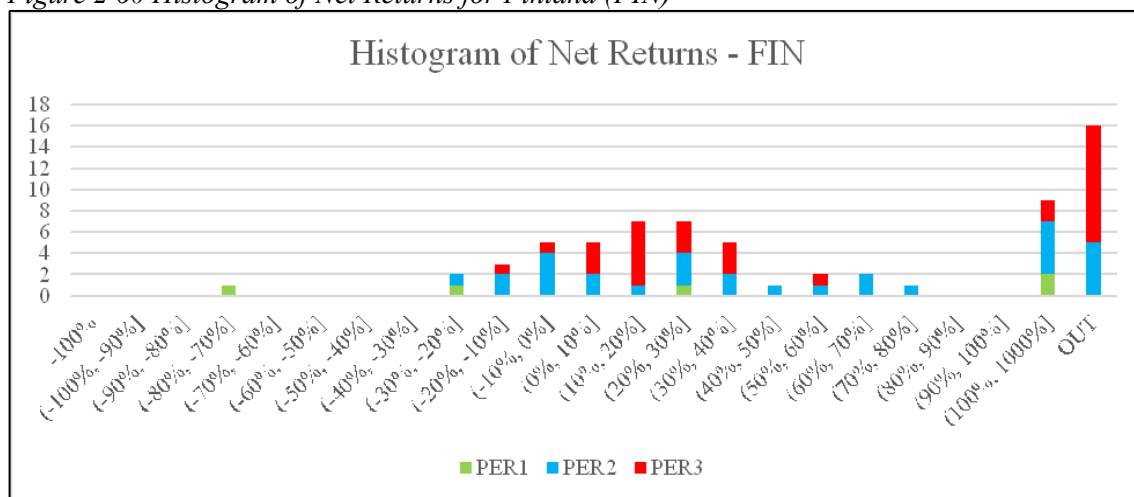


Table 2-27 Summary of Results for France (FRA)

Country	France (FRA)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	7	20.00%	41	28.87%	41	35.34%	89	30.38%
nARB	28	80.00%	101	71.13%	75	64.66%	204	69.62%
TOT	35	-	142	-	116	-	293	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	49.98%	1.7137	-2.07%	0.0000	***	0.1386		-
PER1	50.58%	1.7960	-2.21%	0.1049		0.0507	*	-
PER2	26.92%	1.3596	-2.57%	0.0197	**	0.0017	***	-
PER3	78.02%	2.0096	-0.05%	0.0001	***	0.9788		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	75	43.01%	0.0107	**	-1.87%	0.3024		
MON	293	49.98%	0.0000	***	-2.07%	0.1386		
IDX	16	93.04%	0.1046		-1.29%	0.5000		
ESG D	1	15.36%	0.0000	***	15.36%	0.8413		
ESG C	-	-	-		-	-		
ESG B	17	-4.23%	0.6419		-1.97%	0.1659		
ESG A	18	83.74%	0.1004		-1.29%	0.5433		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	292	50.15%	0.0000	***	-2.02%	0.1458		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	36.54%	94.17%	74.84%	7.69%	96.12%	66.45%		
PER1	100.00%	100.00%	100.00%	100.00%	85.71%	90.91%		
PER2	35.00%	96.49%	80.52%	5.00%	98.25%	74.03%		
PER3	67.86%	94.87%	83.58%	28.57%	92.31%	65.67%		

Figure 2-61 Histogram of Net Returns for France (FRA)

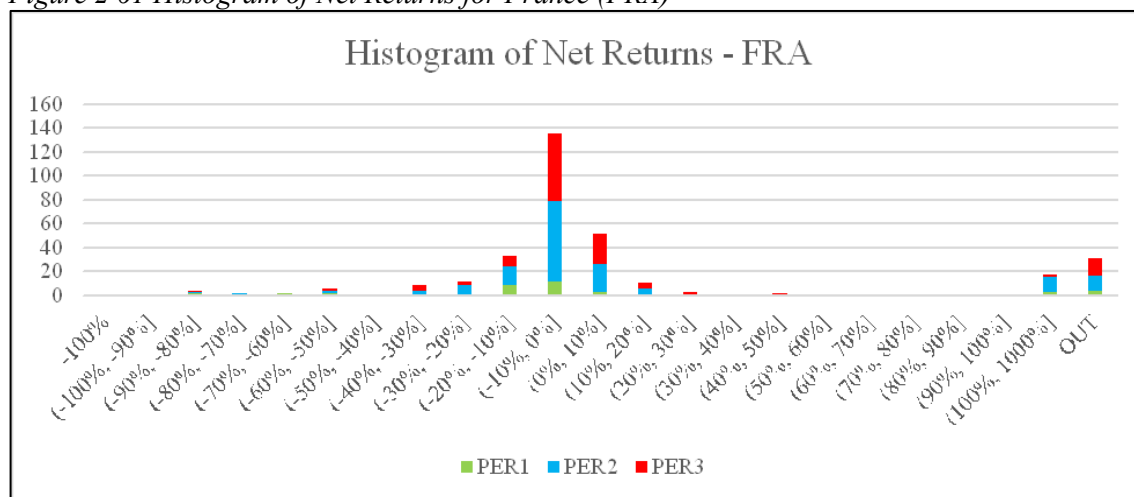


Table 2-28 Summary of Results for Germany (DEU)

Table 2-26 Summary of Results for Germany (DEU)

Country	Germany (DEU)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	0.00%	8	32.00%	2	25.00%	10	21.74%
nARB	13	100.00%	17	68.00%	6	75.00%	36	78.26%
TOT	13	-	25	-	8	-	46	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	7.85%	0.8114	-1.61%	0.5199		0.1878		-
PER1	-5.55%	0.2800	-1.20%	0.5066		0.4070		-
PER2	24.49%	1.0245	-1.31%	0.2436		0.4625		-
PER3	-24.08%	0.3004	-17.45%	0.0577	*	0.0617	*	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	19	8.70%	0.5477		4.95%	0.7656		
MON	45	7.85%	0.5199		-1.61%	0.1878		
IDX	9	-13.29%	0.2389		-1.61%	0.1871		
ESG_D	1	1.19%	0.0000	***	1.19%	0.8413		
ESG_C	6	-10.15%	0.3919		-1.17%	0.3001		
ESG_B	3	-24.28%	0.3637		-1.61%	0.2965		
ESG_A	4	-17.94%	0.3230		-9.79%	0.1367		
DEV_L	-	-	-		-	-		
DEV_M	-	-	-		-	-		
DEV_H	45	7.85%	0.5199		-1.61%	0.1878		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	90.00%	96.55%	94.87%	30.00%	100.00%	82.05%		
PER1								
PER2	87.50%	93.75%	91.67%	37.50%	100.00%	79.17%		
PER3	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%		

Figure 2-62 Histogram of Net Returns for Germany (DEU)

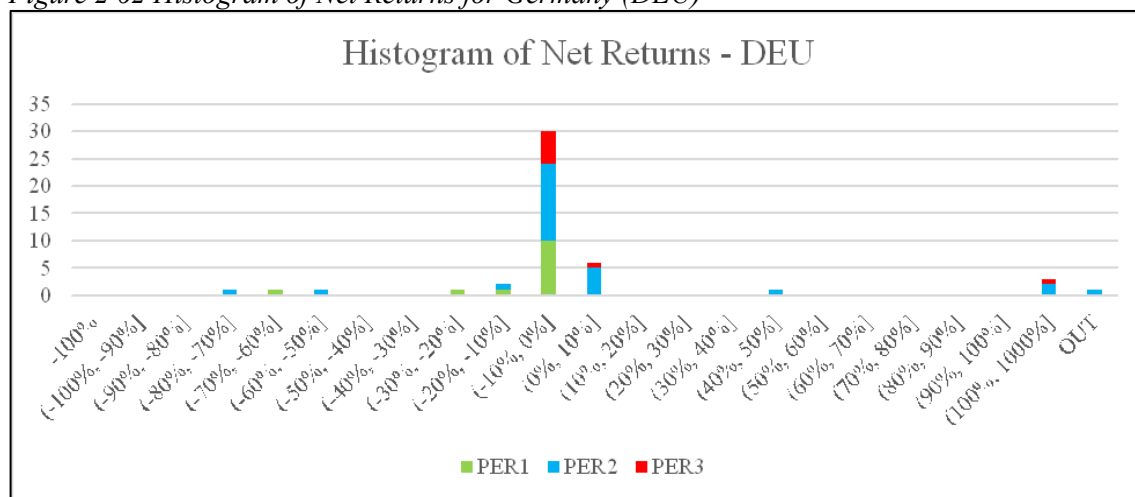


Table 2-29 Summary of Results for Greece (GRC)

Country	Greece (GRC)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	4	57.14%	10	38.46%	6	50.00%	20	44.44%
nARB	3	42.86%	16	61.54%	6	50.00%	25	55.56%
TOT	7	-	26	-	12	-	45	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	72.99%	2.2468	-2.30%	0.0347	**	0.4350		-
PER1	88.35%	2.4406	-7.20%	0.3752		0.3060		-
PER2	97.78%	2.5900	-6.17%	0.0657	*	0.5555		-
PER3	10.34%	0.6174	-1.49%	0.5736		0.3189		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	32	100.65%	0.0357	**	-1.12%	0.5521		
MON	44	75.64%	0.0321	**	-1.98%	0.4860		
IDX	1	47.88%	0.0000	***	47.88%	0.8413		
ESG D	-	-	-		-	-		
ESG C	-	-	-		-	-		
ESG B	3	45.55%	0.3993		-6.70%	0.5000		
ESG A	1	23.06%	0.0000	***	23.06%	0.8413		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	45	72.99%	0.0347	**	-2.30%	0.4350		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	64.29%	88.24%	77.42%	21.43%	94.12%	61.29%		
PER1	50.00%	100.00%	75.00%	50.00%	100.00%	75.00%		
PER2	85.71%	100.00%	94.44%	14.29%	100.00%	66.67%		
PER3	100.00%	100.00%	100.00%	80.00%	75.00%	77.78%		

Figure 2-63 Histogram of Net Returns for Greece (GRC)

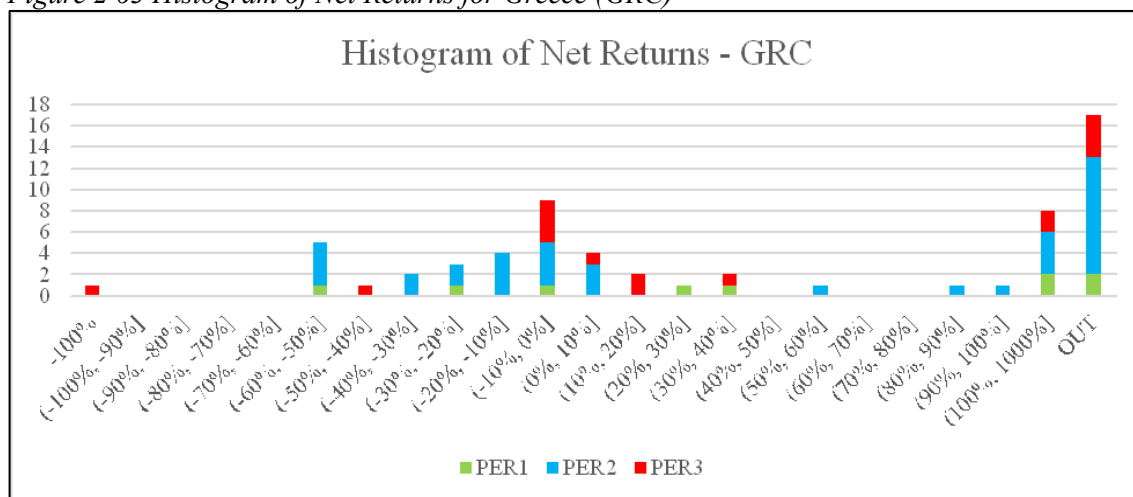


Table 2-30 Summary of Results for Italy (ITA)

Country	Italy (ITA)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	4	19.05%	28	47.46%	16	30.77%	48	36.36%
nARB	17	80.95%	31	52.54%	36	69.23%	84	63.64%
TOT	21	-	59	-	52	-	132	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	99.52%	2.5359	-1.63%	0.0000	***	0.6359		-
PER1	78.81%	2.3325	-1.23%	0.1372		0.6294		-
PER2	42.73%	1.5752	-1.98%	0.0416	**	0.0286	**	-
PER3	172.33%	3.2245	0.35%	0.0003	***	0.9671		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	75	72.77%	0.0067	***	-2.10%	0.1349		
MON	130	101.08%	0.0000	***	-1.76%	0.6693		
IDX	1	368.37%	0.0000	***	368.37%	0.8413		
ESG D	5	133.01%	0.3510		-7.89%	0.5536		
ESG C	4	-14.31%	0.2630		-5.92%	0.0721	*	
ESG B	11	17.78%	0.6815		-1.92%	0.1066		
ESG A	6	3.92%	0.6738		8.94%	0.6234		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	132	99.52%	0.0000	***	-1.63%	0.6359		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	56.76%	95.24%	81.00%	37.84%	93.65%	73.00%		
PER1								
PER2	80.00%	96.43%	89.58%	50.00%	96.43%	77.08%		
PER3	100.00%	100.00%	100.00%	60.00%	95.83%	82.05%		

Figure 2-64 Histogram of Net Returns for Italy (ITA)

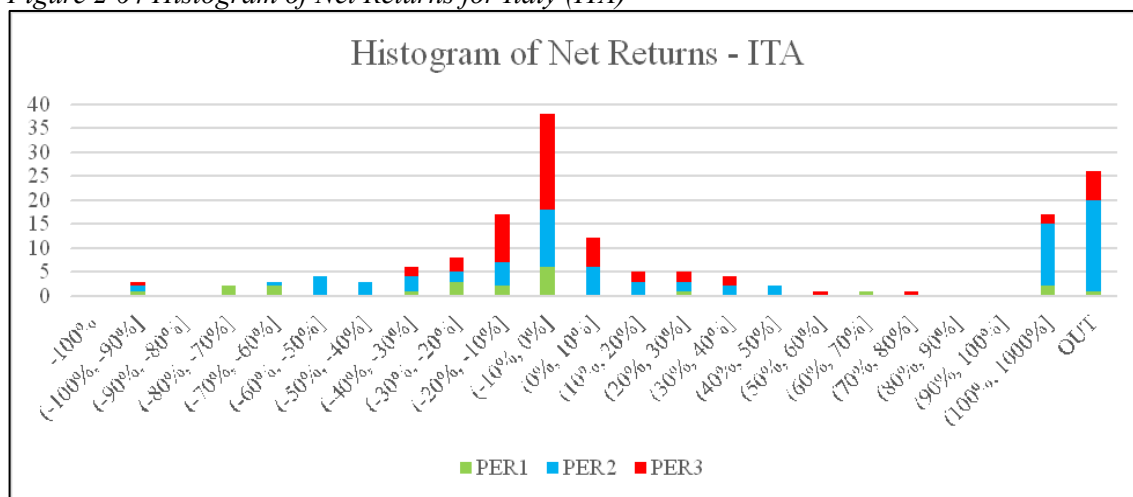


Table 2-31 Summary of Results for Norway (NOR)

Country	Norway (NOR)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	4	57.14%	11	42.31%	8	30.77%	23	38.98%
nARB	3	42.86%	15	57.69%	18	69.23%	36	61.02%
TOT	7	-	26	-	26	-	59	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	52.37%	1.8424	1.34%	0.0331	**	0.8459		-
PER1	-3.84%	0.3926	-10.77%	0.8044		0.2495		-
PER2	77.95%	2.0880	9.96%	0.0685	*	0.9966		-
PER3	41.92%	1.7720	-0.94%	0.2390		0.3563		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	44	37.56%	0.0812	*	-0.22%	0.7759		
MON	57	55.20%	0.0297	**	1.58%	0.9057		
IDX	2	45.97%	0.3120		45.97%	0.9101		
ESG D	-	-	-		-	-		
ESG C	2	9.45%	0.6283		9.45%	0.6726		
ESG B	3	16.32%	0.5156		17.33%	0.7035		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	59	52.37%	0.0331	**	1.34%	0.8459		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	62.50%	90.32%	80.85%					
PER1	50.00%	0.00%	33.33%	50.00%	0.00%	33.33%		
PER2	100.00%	100.00%	100.00%	66.67%	100.00%	89.47%		
PER3	25.00%	88.24%	68.00%	12.50%	100.00%	72.00%		

Figure 2-65 Histogram of Net Returns for Norway (NOR)

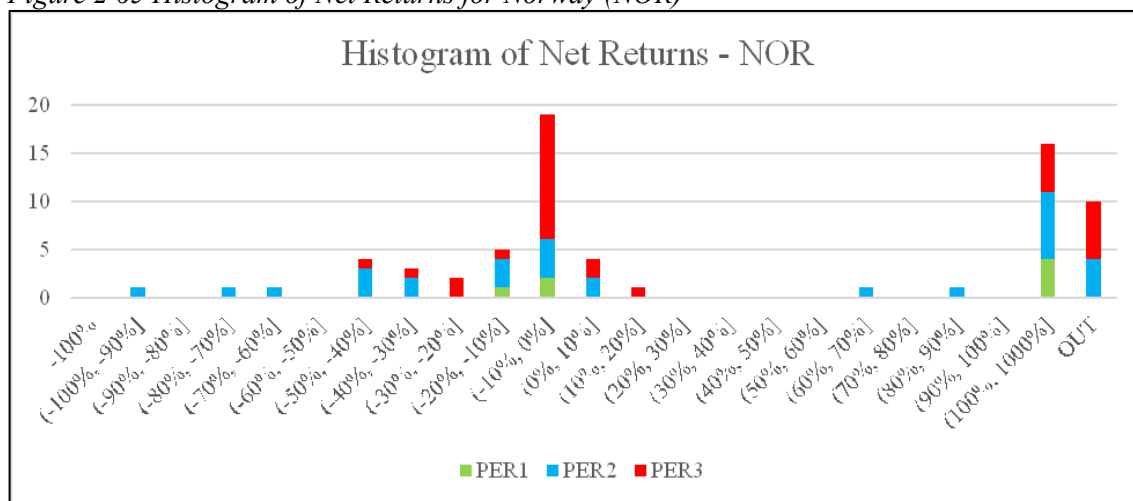


Table 2-32 Summary of Results for Poland (POL)

Country	Poland (POL)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	0	0.00%	12	80.00%	7	53.85%	19	65.52%
nARB	1	100.00%	3	20.00%	6	46.15%	10	34.48%
TOT	1	-	15	-	13	-	29	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	47.58%	1.8088	-21.59%	0.1677		0.3688		-
PER1	160.76%	0.0000	160.76%	0.0000	***	0.8413		-
PER2	26.89%	2.0191	-49.94%	0.6140		0.0498	**	-
PER3	62.74%	1.5569	8.28%	0.1719		0.7466		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	18	99.76%	0.0617	*	-1.33%	0.8570		
MON	28	52.34%	0.1403		-15.76%	0.4277		
IDX	12	-28.88%	0.1009		-48.44%	0.0497	**	
ESG D	2	-45.88%	0.1454		-45.88%	0.0899	*	
ESG C	2	329.72%	0.3996		329.72%	0.6726		
ESG B	1	-85.21%	0.0000	***	-85.21%	0.1587		
ESG A	-	-	-		-	-		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	29	47.58%	0.1677		-21.59%	0.3688		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	100.00%	100.00%	100.00%	81.82%	100.00%	87.50%		
PER1								
PER2	100.00%	100.00%	100.00%	100.00%	50.00%	90.00%		
PER3	66.67%	100.00%	83.33%	66.67%	100.00%	83.33%		

Figure 2-66 Histogram of Net Returns for Poland (POL)

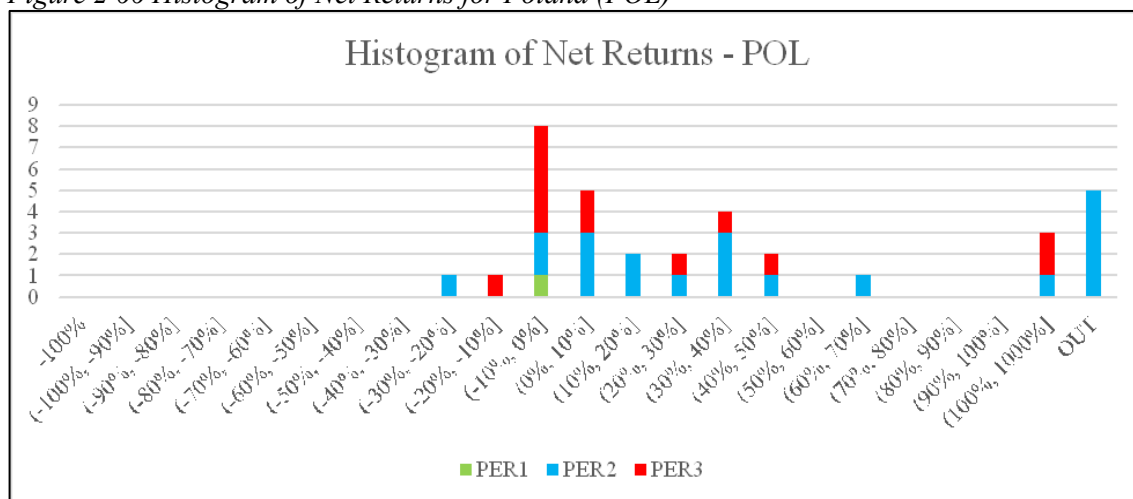


Table 2-33 Summary of Results for Spain (ESP)

Country	Spain (ESP)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	1	25.00%	12	30.00%	6	16.67%	19	23.75%
nARB	3	75.00%	28	70.00%	30	83.33%	61	76.25%
TOT	4	-	40	-	36	-	80	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	69.88%	2.0239	4.18%	0.0028	***	0.9970		-
PER1	0.43%	0.1362	-5.84%	0.9535		0.3575		-
PER2	28.97%	1.5562	-3.39%	0.2462		0.4201		-
PER3	123.05%	2.4264	20.43%	0.0044	***	0.9999		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	31	86.43%	0.0498	**	0.74%	0.9643		
MON	73	78.12%	0.0022	***	10.75%	0.9996		
IDX	12	44.76%	0.1981		10.20%	0.9503		
ESG D	1	-4.35%	0.0000	***	-4.35%	0.1587		
ESG C	5	23.21%	0.0019	***	23.06%	0.9784		
ESG B	11	150.84%	0.1140		-6.29%	0.7031		
ESG A	4	19.79%	0.2675		7.06%	0.7674		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	80	69.88%	0.0028	***	4.18%	0.9970		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	41.67%	97.30%	83.67%	8.33%	100.00%	77.55%		
PER1	100.00%	100.00%	100.00%					
PER2	80.00%	100.00%	94.74%					
PER3								

Figure 2-67 Histogram of Net Returns for Spain (ESP)

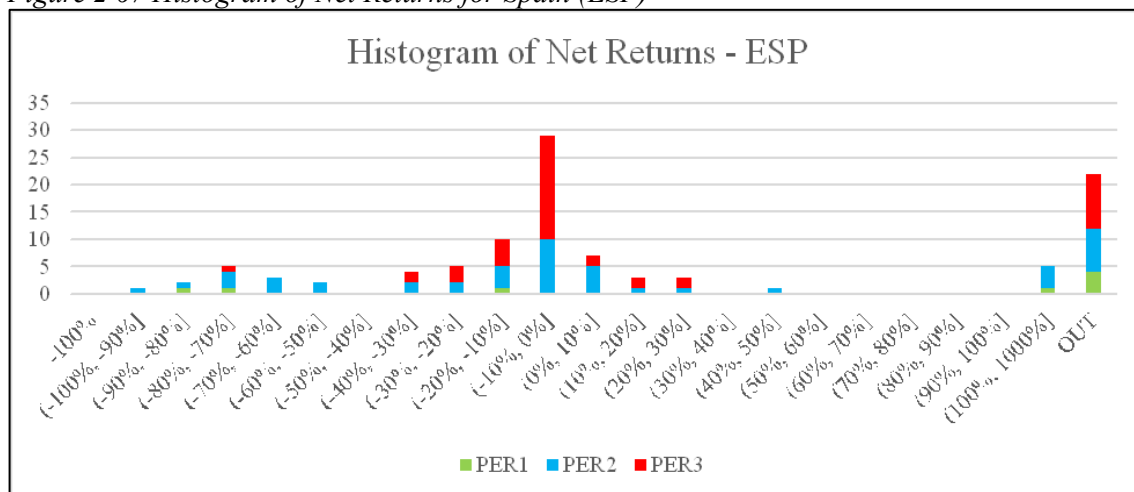


Table 2-34 Summary of Results for Sweden (SWE)

Country	Sweden (SWE)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	10	37.04%	97	39.11%	199	33.90%	306	35.50%
nARB	17	62.96%	151	60.89%	388	66.10%	556	64.50%
TOT	27	-	248	-	587	-	862	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	28.15%	1.7070	-4.27%	0.0000	***	0.0000	***	-
PER1	109.54%	2.6621	2.01%	0.0421	**	0.8065		-
PER2	43.64%	2.0073	-7.99%	0.0011	***	0.0001	***	-
PER3	17.69%	1.4798	-3.60%	0.0052	***	0.0000	***	-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	443	38.67%	0.0000	***	-3.83%	0.0000	***	
MON	803	28.52%	0.0000	***	-4.26%	0.0000	***	
IDX	9	118.90%	0.2442		4.25%	0.6608		
ESG D	1	0.04%	0.0000	***	0.04%	0.8413		
ESG C	5	-28.40%	0.1291		-9.98%	0.0690	*	
ESG B	12	130.49%	0.1635		-2.00%	0.3768		
ESG A	4	0.75%	0.9393		4.74%	0.6425		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	810	28.15%	0.0000	***	-4.27%	0.0000	***	
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	12.28%	96.44%	64.08%	3.95%	98.63%	62.23%		
PER1	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%		
PER2	32.88%	93.33%	70.47%	6.85%	97.50%	63.21%		
PER3	11.18%	95.80%	62.82%	2.63%	98.74%	61.28%		

Figure 2-68 Histogram of Net Returns for Sweden (SWE)

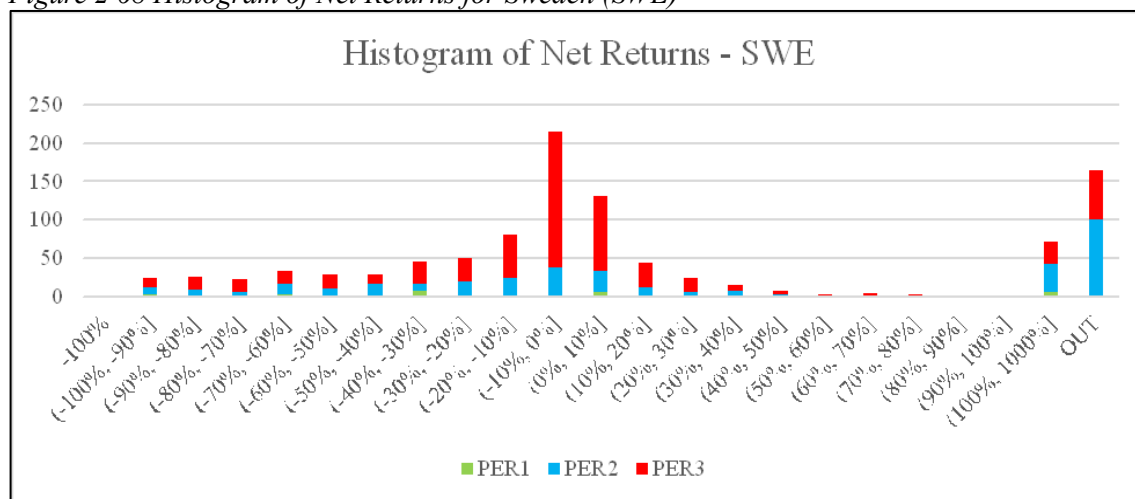


Table 2-35 Summary of Results for United Kingdom (GBR)

Country	United Kingdom (GBR)							
Rights Issues	PER1		PER2		PER3		FULL	
	Total	%	Total	%	Total	%	Total	%
ARB	12	75.00%	20	86.96%	11	52.38%	43	71.67%
nARB	4	25.00%	3	13.04%	10	47.62%	17	28.33%
TOT	16	-	23	-	21	-	60	-
Net Ret.	Average	St. Dev.	Median	t-Stat	Result	W-Stat	Result	Boot
FULL	66.30%	1.7947	-1.79%	0.0058	***	0.7802		-
PER1	148.62%	1.9379	71.22%	0.0078	***	0.9851		-
PER2	23.05%	1.3555	-10.12%	0.4235		0.0955	*	-
PER3	50.94%	1.8931	-1.58%	0.2318		0.6553		-
Catgeg.	N	Average	t-Stat	Result	Median	W-Stat	Result	
DIL	32	54.58%	0.1219		-9.88%	0.1309		
MON	59	68.34%	0.0051	***	-1.58%	0.8155		
IDX	22	44.50%	0.2627		-0.62%	0.6087		
ESG D	2	-36.83%	0.2384		-36.83%	0.0899	*	
ESG C	14	5.58%	0.7591		-5.82%	0.2352		
ESG B	15	95.35%	0.0699	*	2.35%	0.8329		
ESG A	5	134.87%	0.2216		7.42%	0.8274		
DEV L	-	-	-		-	-		
DEV M	-	-	-		-	-		
DEV H	52	48.48%	0.0429	**	-2.15%	0.5036		
PREDICTION BINARY MODEL								
Sample	Logit			Probit				
	ARB	nARB	TOT	ARB	nARB	TOT		
FULL	90.32%	85.71%	88.89%	74.19%	92.86%	80.00%		
PER1	100.00%	100.00%	100.00%	66.67%	100.00%	75.00%		
PER2	100.00%	100.00%	100.00%	100.00%	0.00%	85.71%		
PER3	100.00%	100.00%	100.00%	100.00%	90.00%	95.00%		

Figure 2-69 Histogram of Net Returns for United Kingdom (GBR)

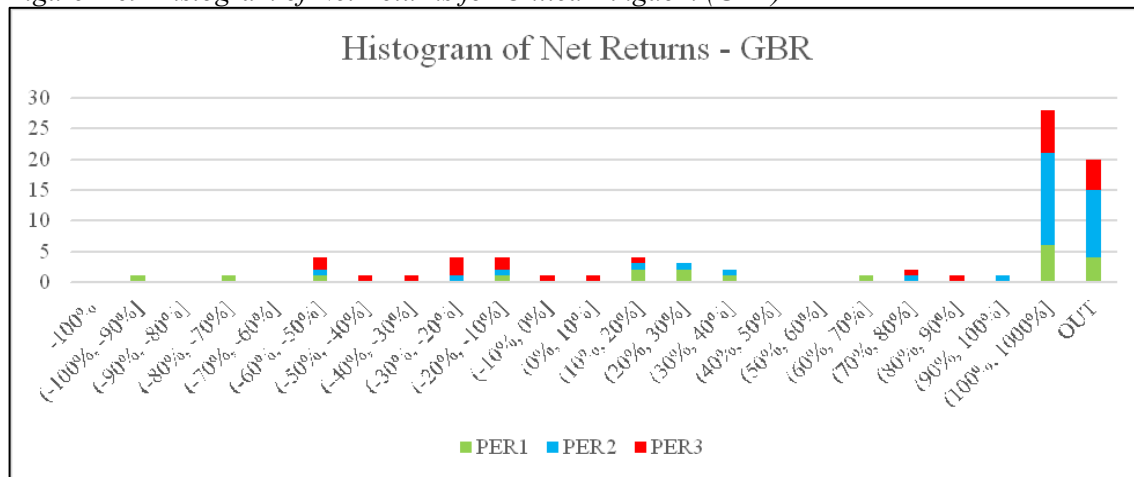


Table 2-36 Probability Models estimated for each country – Logit Model and Full Sample

LOGIT MODEL – Period 1																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY		X	X	X	X	X					X	X	X	X	X		X				
SAU		X	X		X	X							X								
TUN		X		X	X	X						X			X			X			
BRA		X	X	X	X	X						X	X		X		X		X	X	X
CAN		X										X							X		
USA		X		X	X	X						X		X	X						
AUS		X	X	X	X						X	X		X	X			X	X	X	X
HKG		X	X		X	X					X	X	X	X				X	X	X	X
IND		X		X							X	X			X						
MYS		X	X	X	X	X				X	X	X	X	X			X	X	X		X
NZL		X	X	X	X	X					X		X	X	X				X	X	
PAK		X	X	X	X	X					X	X	X	X	X		X	X			
SGP		X	X	X	X						X		X	X	X		X		X	X	
LKA		X	X	X	X	X					X	X			X			X			X
AUT		X	X	X	X																
BEL	X	X		X	X										X			X	X		
DNK		X		X	X						X	X		X	X		X			X	
FIN		X				X							X		X		X			X	
FRA		X	X	X		X	X					X	X	X	X		X	X	X	X	X
DEU		X	X	X	X	X					X	X		X			X	X		X	
GRC		X	X	X	X										X			X	X	X	
ITA		X		X	X	X						X			X		X	X	X	X	X
NOR		X	X	X	X	X					X		X	X			X	X		X	
POL		X	X	X		X									X			X	X		
ESP		X	X	X	X	X						X	X		X		X	X	X	X	
SWE		X		X		X						X	X	X			X		X		X
GBR		X	X								X		X	X			X	X	X	X	X

Table 2-37 Probability Models estimated for each country – Logit Model and Period 1

LOGIT MODEL – Period 1																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY																					
SAU																					
TUN																					
BRA																					
CAN																					
USA																					
AUS		X	X	X	X	X							X		X		X	X	X	X	
HKG		X		X	X	X	X				X	X			X			X		X	X
IND																					
MYS																					
NZL			X	X																	
PAK																					
SGP		X		X	X						X	X			X		X	X	X		
LKA																					
AUT																					
BEL																					
DNK																					
FIN		X			X	X															
FRA		X	X	X		X															X
DEU																					
GRC				X																	
ITA																					
NOR				X																	
POL																					
ESP					X																
SWE			X		X																
GBR	X	X		X	X																

Table 2-38 Probability Models estimated for each country – Logit Model and Period 2

LOGIT MODEL – Period 2																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY		X	X	X	X	X						X			X				X		
SAU																					
TUN		X			X																
BRA		X	X	X	X	X					X		X	X				X	X		X
CAN		X		X	X									X					X		
USA		X		X	X	X					X	X		X					X		
AUS		X	X	X	X						X	X	X	X	X				X	X	
HKG		X	X		X	X					X	X	X	X	X			X	X	X	X
IND			X	X	X	X															
MYS	X	X	X								X			X	X			X		X	
NZL		X		X										X							X
PAK																					
SGP		X	X	X	X						X	X	X		X			X	X	X	X
LKA		X	X	X	X	X						X			X			X	X		
AUT		X	X	X											X						
BEL		X									X						X	X	X		X
DNK																					
FIN		X			X						X		X		X		X			X	
FRA		X	X	X	X	X				X	X	X	X	X	X		X	X	X	X	
DEU		X	X	X	X	X					X						X		X	X	
GRC		X		X	X							X	X	X	X			X		X	
ITA		X	X	X	X						X	X			X		X			X	X
NOR		X		X	X	X					X		X	X			X	X	X	X	
POL		X	X																		
ESP		X	X	X	X	X							X		X			X		X	
SWE		X	X	X		X	X	X			X	X	X	X				X	X	X	
GBR		X	X		X							X		X	X		X		X		X

Table 2-39 Probability Models estimated for each country – Logit Model and Period 3

LOGIT MODEL – Period 3																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY		X	X	X	X	X				X	X		X		X		X		X		
SAU		X													X						
TUN		X			X						X				X						
BRA		X	X	X	X	X						X	X		X		X	X	X		X
CAN		X									X	X							X		
USA																					
AUS		X	X	X	X	X					X	X		X	X			X			X
HKG		X		X	X	X					X		X	X	X		X			X	X
IND		X		X							X		X	X							
MYS		X	X	X		X						X	X		X		X	X		X	
NZL																					
PAK		X	X	X	X	X						X	X		X			X			X
SGP		X	X	X	X						X	X	X	X	X			X	X	X	
LKA		X	X	X		X						X			X			X			
AUT				X																	
BEL		X		X	X	X					X		X						X		
DNK		X		X								X			X		X		X	X	
FIN		X		X	X	X					X	X	X				X	X			
FRA		X		X							X	X			X			X	X	X	
DEU		X	X	X																	
GRC		X	X	X	X													X			
ITA		X		X	X	X						X			X		X	X	X	X	
NOR		X		X	X	X					X				X			X	X	X	
POL		X	X		X										X						
ESP																					
SWE		X	X	X	X	X					X	X	X		X		X	X	X	X	X
GBR		X	X	X							X	X									

Table 2-40 Probability Models estimated for each country – Probit Model and Full Sample

PROBIT MODEL – Full Sample																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY		X		X	X	X	X	X		X		X	X	X	X		X	X	X	X	
SAU		X		X	X	X	X				X	X			X			X			
TUN		X		X	X	X						X			X			X			
BRA		X	X	X	X	X				X	X	X	X	X	X		X	X		X	X
CAN		X		X		X	X														
USA		X		X		X															
AUS		X	X	X	X	X	X	X	X												
HKG		X	X	X	X	X															
IND		X		X																	
MYS		X	X	X	X	X															
NZL		X	X	X	X	X															
PAK		X	X	X	X	X															
SGP		X	X	X	X	X															
LKA		X	X	X	X	X															
AUT		X		X	X																
BEL		X		X	X																
DNK		X		X	X	X															
FIN						X															
FRA		X	X	X	X	X															
DEU		X	X	X	X																
GRC		X	X	X	X																
ITA		X	X	X	X	X															
NOR																					
POL	X	X		X	X	X															
ESP		X	X	X	X	X															
SWE		X	X			X	X														
GBR		X	X	X	X	X															

Table 2-41 Probability Models estimated for each country – Probit Model and Period 1

PROBIT MODEL – Period 1																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY																					
SAU																					
TUN																					
BRA																					
CAN																					
USA																					
AUS		X	X	X	X	X															
HKG		X		X	X	X															
IND																					
MYS																					
NZL				X	X																
PAK																					
SGP																					
LKA																					
AUT																					
BEL																					
DNK																					
FIN	X			X		X															
FRA		X	X	X		X															
DEU																					
GRC				X																	
ITA																					
NOR				X																	
POL																					
ESP																					
SWE			X	X	X	X															
GBR			X			X															

Table 2-42 Probability Models estimated for each country – Probit Model and Period 1

PROBIT MODEL – Period 2																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY		X	X	X	X	X															
SAU																					
TUN				X																	
BRA		X	X	X	X	X															
CAN				X		X															
USA		X		X	X																
AUS																					
HKG		X	X	X	X	X															
IND				X	X																
MYS		X	X	X	X																
NZL		X	X																		
PAK																					
SGP		X	X	X	X	X															
LKA		X	X	X	X	X															
AUT		X	X																		
BEL		X		X																	
DNK																					
FIN			X		X																
FRA		X	X	X	X	X															
DEU		X			X	X															
GRC	X	X		X																	
ITA		X	X	X	X																
NOR		X		X	X	X															
POL			X		X	X	X														
ESP																					
SWE		X	X	X	X	X															
GBR			X			X															

Table 2-43 Probability Models estimated for each country – Probit Model and Period 3

PROBIT MODEL – Period 3																					
	MON	DIL	IDX	ISC	CAP	GEN	ACQ	INV	REF	ACA	BAS	CYC	NCY	ENE	FIN	GOV	HEA	IND	EST	TEC	UTI
EGY		X		X	X	X															
SAU		X				X															
TUN		X			X																
BRA		X	X	X	X	X															
CAN				X	X	X															
USA																					
AUS																					
HKG		X		X																	
IND			X	X																	
MYS		X	X	X	X																
NZL																					
PAK		X	X	X	X	X															
SGP		X	X	X	X	X															
LKA		X	X	X	X	X															
AUT				X		X															
BEL		X		X	X																
DNK		X		X	X																
FIN		X		X	X																
FRA		X		X	X																
DEU		X			X																
GRC			X	X	X																
ITA		X		X	X	X															
NOR		X		X	X	X															
POL		X	X		X																
ESP																					
SWE		X	X	X		X															
GBR		X		X	X	X															

Chapter 3

On abnormal returns in events link to international seasoned equity offerings

3.1. INTRODUCTION

Equity offerings serve as an alternative financing method for companies instead of taking on more debt. Through this approach, companies raise funds by issuing new shares, which investors can purchase to become partial owners of the company. Sometimes, companies opt to issue subscription rights, enabling existing shareholders to buy enough shares to maintain or slightly adjust their ownership stake. The announcement and execution of these processes are noteworthy market events, shedding light on the company's financial state and potential future plans that necessitate extra funding. Valuable details emerge from the process's conditions, like the quantity of new shares relative to existing ones and the potential issuance of subscription rights. Later in the process, the level of demand for the new shares provides insights into its success or failure, indicating if the company attracted sufficient interest or struggled due to low demand. Overall, this process yields a substantial amount of information for the market¹⁸.

All these conditions provide the perfect breeding ground for anomalies in the market, which could be exploited by some investors to make a profit¹⁹. For example, equity offerings with subscription rights generate two ways to access shares of the same company, and an arbitrage opportunity. On the other hand, these processes involve different phases or events, each of which can have effects on the markets²⁰. If some investors were to discover events that systematically generate a specific effect on the issuing company's share price, they could devise strategies aimed at exploiting these patterns of behaviour and thus obtain returns different from the expected.

It is on the latter type of anomalies that this paper focuses. As can be seen in the following section, the occurrence of anomalous returns in the context of equity offerings is a subject for which numerous studies have already been carried out. The aim of this study is to characterise the behaviour of the markets during this type of process, and whether it can be said that anomalous returns are generated in a significant and systematic way. To this end, a sufficiently large sample of events occurring in equity offerings, both with and without the issue of subscription rights, started by companies from many different countries is analysed. Specifically, 52 different types of events related to equity offerings carried out by 1,125 companies from 38 countries from all continents and belonging to 11 different economic sectors will be analysed. To ensure that the methodology does not affect the results, different procedures will be applied to calculate the anomalous returns, and a few statistical tests over its significance will be applied.

¹⁸ See Loderer et al. (1991), Eckbo and Masulis (1995) and Walker and Yost (2008).

¹⁹ See Asquith and Mullins (1986) and Masulis and Korwar (1996).

²⁰ See Smith (1986) and Huang et al. (2016).

The results obtained after the application of all the proposed methodologies point to the existence of events that, in the context of equity offerings, generate effects in a systematic and significant way, and that could be used by investors to obtain returns different from those expected by the market. In addition, the behaviour of these returns is identified according to certain characteristics of the issuing company or the equity offering itself, as well as according to the event, country and economic sector. Certain factors have been identified, such as whether or not subscription rights are issued or whether the issuing company is listed in a stock market index, which appear to be favouring the appearance of anomalous returns. In addition, certain countries (such as Japan or Spain), events (such as the day on which the rights cease to be traded) or specific economic sectors (such as energy) have been shown to be more prone to generate this type of anomaly. Last but not least, the results suggest that these inefficiencies are lower when the company has a socially and environmentally sustainable behaviour, which may act as a new incentive to adopt more socially and environmentally responsible behaviour.

3.2. LITERATURE REVIEW

Equity offerings are very complex phenomena and can have many implications, not only for the issuing company but also for the rest of the market conditions. It is also a subject that has been widely analysed in the literature, both from a corporate perspective, dealing with its motivations, organisation, and consequences for the company itself, and from a market perspective, analysing the behaviour of the issuer's shares and other agents in the market.

The focus of this article is on the possible existence of market anomalies in this type of process, which has been the subject of study for many years. For example, **Brav et al. (2000)** already found evidence of negative abnormal returns in small companies after issuing shares, while **Li and Zhao (2003)** already identified some factors that could be related to these anomalies. A similar conclusion is reached by **Pastor-Llorca and Martín-Ugedo (2004)**, while in **Pastor-Llorca and Poveda-Fuentes (2004)** it is suggested that in some cases some companies artificially raise their profits before announcing an equity offering, and that the subsequent regulation of this data generates these anomalous returns. Subsequently, **Sala and Pastor-Llorca (2006)** suggests that investors form excessively optimistic expectations before the start of these processes, and that the anomalies are due to the progressive correction of these expectations. Further on, **Henry and Koski (2010)** points out that, in this type of process, short positions taken by investors may reduce market efficiency rather than increase it.

Subsequently, we continue to find works dedicated to analysing these anomalies and identifying their origins. This group includes articles like **Huang and Tompkins (2010)**, which focuses on the composition of the board of directors of the issuing company, and **Hao (2014)**,

which indicates that a higher presence of institutional investors increases the negative anomalies detected. More recently, **Labidi and Gajweski (2019)** argue that market conditions are more favourable when the issuer publishes more information about its intangible assets. Finally, **Krishnan and Wu (2022)** argue that the methodology used to detect anomalous returns plays a very important role in explaining them. All these results, moreover, appear to hold when analysed for individual countries. The presence of negative abnormal returns in capital raising processes is the common ground between **Shahid et al. (2010)** for China, **Dutta (2017)** for Australia, **Naveen Kumar et al. (2018)** for India, **Luu (2021)** for Vietnam, and more recently, **Verdú et al. (2022)** for Spain.

Although most of the studies discussed so far are relatively old, there are other equally relevant studies published more recently, which complement and extend the results achieved by the previous ones. This is the case of **Veld et al. (2020)**, in which they detect significant negative cumulative abnormal returns around equity offerings. For their part, **Prasad et al. (2021)** highlights the importance of possible disruptions that shake the economy, pointing out that these can significantly increase the volatility of the abnormal returns generated by these processes. **Krishnan and He (2022)** focus on the banking sector specifically, and find factors directly related to the lower performance recorded by these entities after equity offerings, while more recently, **Mansley et al. (2023)** analyse as a relevant factor the objective that the issuing company intends to achieve and for which it issues the shares.

The shown so far is but a sample of the existing literature on equity offerings and the possible occurrence of anomalies during these processes. However, after analysis, several relevant shortcomings have been detected, which can be summarised in two main problems, being (1) the focus on one country and, therefore, specific conditions; and (2) the analysis of only few events, or limited to only one, such as the announcement of the process. With all this, the **main hypothesis** of this paper could be summarized in the following statements:

- H_0 :** *Events related to equity offerings systematically generate anomalous returns.*
 H_1 : *Events related to equity offerings do not systematically generate anomalous returns.*

This article will carry out a study that solves all these detected limitations, carrying out a joint analysis for equity offerings from all over the world, and whose scope covers, if not all, most of the relevant events that occur in this type of process. This will be done using a particularly large database of events from many equity offerings in different countries. Moreover, considering that the presence of anomalous returns has been proven, this work will not be limited to identifying and calculating them, but will carry out different tests to determine which are significant, and which are the factors that may play a decisive role in their formation.

3.3. DATA

3.3.1. Data selection and filtering

This article aims to analyse a significantly large number of equity offerings around the world. For data collection, we will work with the *Thomson Reuters Refinitiv Database*, and the events to be analysed will be those for which this database has information on at least what type of event it is, and what day it occurred. From now on, the "observations" will be each of the events. In addition to the events themselves, for each equity offering we have obtained data such as the country of the issuer and whether the issuer is listed on the main stock market index of that territory, as well as its economic and business sector. Furthermore, information is also available on whether subscription rights were issued in the process. It should be noted that information on these factors is available for each observation.

The initial sample consists of 65,299 equity offerings from 30,388 companies from 62 countries, totalling 146,344 different events, grouped in 90 categories. However, the absence of the necessary data has prevented a result for many of these observations, following the procedure described in the Methodology section, so they have been removed from the sample. The final sample consists of 2,861 equity offerings, made by 1,125 companies, grouped in 52 analysed events (Table 01), and located in 38 different countries (Table 02), totalling 5,500 cases studied. The countries for which we still have enough information in the final sample are Egypt, Israel and South Africa (Africa and the Middle East); Bermuda, Brazil, Canada, Chile, Peru and the United States (America); Australia, China, Hong Kong, India, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore and South Korea (Asia and Oceania); and Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey and the United Kingdom (Europe). Additionally, companies available belong to 11 different economic sectors, these being: academic and educational service, basic materials, consumer cyclicals, consumer non-cyclicals, energy, financials, healthcare, industrials, real estate, technology, and utilities.

Table 01, Table 02, Table 03 and Table 04 briefly define those events, countries and sectors, respectively, that have been included in the analysis and shows the identification code assigned to each one²¹. In both cases we have the number of observations corresponding to each group, although for each country and sector we also have the number of firms involved.

Table 3-1 Description of the analyzed events.

Code	Description	Events	Code	Description	Events
E01	Allotment Date	129	E53	Latest Time for Splitting Nil Paid	8
E03	Announce Date	21	E54	Lat. Time for Split. Part. or Full. Paid	5
E05	Annual General Meeting	61	E55	Launch Date	2
E09	Books Closing Date	40	E56	Listing Date	51
E10	Closing Date	59	E58	Mandated	1
E13	Completed	45	E59	Meeting Of Shareholders	25
E19	Date When Application Begins	887	E61	Overallotment Exercise Date	18
E20	Date When Application Ends	976	E62	Payment Date	81
E21	Date When Bookbuilding Begins	33	E64	Postponed Date	14
E22	Date When Bookbuilding Ends	36	E65	Pricing Date (UKNI)	23
E24	Dealings In New Shares or Stocks Full. Paid	30	E66	Prospectus Completed	902
E25	Dealings In New Shares or Stocks Nil Paid	4	E68	Ready Trading Start Date	4
E27	Dispatch Of Share Certificates	717	E69	Record Date for Entit. to Rights	240
E28	Dispatch Of Provisional Allotment Letters	6	E73	Rights Trading Cease Date	35
E31	Effective Date (UKNI)	2	E74	Rights Trading Start Date	29
E36	Entitlement Initial Exercise Date	1	E75	Roadshow	9
E40	Expected Closing	6	E76	Rumored (UKNI)	1
E41	Expected Issue Date	83	E77	Settl. Date for All Trades (UKNI)	1
E42	Expected Listing Date	90	E81	Start Of Offer Period	2
E43	Expected Maturity	1	E82	Subscription Begins	197
E44	Extraordinary General Meeting	91	E83	Subscription Delivery Date	268
E47	First Settlement Date	2	E84	Subscription Ends	166
E49	Issue Date	9	E85	Suspension Of Trading in Shares	4
E50	Last Day for Ren. Letters of Acceptance	1	E88	When Issued Trading End Date	2
E51	Latest Time for Acceptance Payment in Full	3	E89	When Issued Trading Start Date	2
E52	Latest Time for Receipt of Forms Of Proxy	7	E90	Withdrawn	70

²¹ The numbering is not continuous because there were originally a larger number of different events in the sample, but for some of them it has not been possible to obtain results.

Table3-2: Description of the analyzed countries.

Code	Country	Firms	Events	Code	Country	Firms	Events	Code	Country	Firms	Events
R101	Egypt	1	3	R305	Indonesia	6	30	R413	Ireland	2	3
R102	Israel	7	16	R306	Japan	385	1.662	R415	Italy	7	21
R111	South Africa	4	15	R307	Malaysia	10	21	R416	Luxembourg	2	5
R203	Bermuda	4	17	R309	New Zealand	10	70	R417	Netherlands	3	5
R204	Brazil	9	35	R311	Philippines	2	10	R418	Norway	2	6
R206	Canada	8	21	R312	Singapore	9	50	R419	Poland	1	1
R207	Chile	1	11	R313	South Korea	45	411	R420	Portugal	4	12
R208	Peru	1	1	R401	Austria	6	45	R421	Spain	2	10
R209	United States	282	797	R405	Denmark	3	11	R422	Sweden	4	15
R301	Australia	173	1.705	R407	Finland	5	15	R423	Switzerland	6	44
R302	China (Mainland)	8	14	R408	France	16	45	R424	Turkey	4	10
R303	Hong Kong	18	75	R409	Germany	12	40	R425	United Kingdom	44	178
R304	India	16	55	R410	Greece	3	15				

Table3-3: Description of the analyzed economic sectors.

Code	Sector	Firms	Events	Code	Sector	Firms	Events
S010	Academic	6	26	S080	Healthcare	79	354
S020	Materials	140	998	S090	Industrials	201	815
S030	Cyclical	192	794	S110	Real Estate	83	645
S040	Non-Cyclical	61	243	S120	Technology	139	510
S050	Energy	49	445	S130	Utilities	48	165
S060	Financials	127	505				

Table 4: Description of the analyzed relevant factors.

Code	Factor	Events	Code	Factor	Events
IDX	Indexed	826	nIDX	Not Indexed	4,674
RGT	Sub. Rights	1,369	nRGT	No Sub. Rights	4,131
ESGA	ESG Score: A	66	ESGB	ESG Score: B	197
ESGC	ESG Score: C	348	ESGD	ESG Score: D	221
HGH	High Dev.	5,080	MDM	Medium Dev.	369
LOW	Low Dev.	47			

Although the database used provides a great deal of information, it has certain limitations. The most notable limitation is that for many equity offerings there is no data on many events. In most observations there is only information on one event, and in no case is there data on more than 8 events. However, the methodologies that will be applied to the data to obtain the anomalous returns, coupled with the large volume of information available, allow robust and valid results to be obtained.

Finally, the daily data series used in the different models are all from *Thomson Reuters*, and the closing prices of each session are used. For some calculations, the price series of stock market indexes are also necessary, as well as for assets considered as “risk-free”. For the former, the main stock market index of each country is used, and when it does not exist or is not available, the S&P 500 index is selected in replacement. For the latter, the yield on 10-year bonds of the corresponding state is used and, when this information is not available, the yield on 10-year U.S. bonds is selected^{22,23}.

3.3.2. Sustainability and level of development

Two additional factors to be introduced in the analysis are the level of development of the country and the level of sustainability of the issuing company at the time of the equity offering. The ESG index, also provided by Thomson Reuters, is used to measure the former. This factor is calculated based on several factors related to the issuing company, such as its governance and policies, and results in a number from 0 (worst) to 100 (best). However, the qualitative scale of this index is used, which takes four different values, these being D (0-24), C (25-49), B (50-74) and A (75-100). However, the main problem with this factor is that information is not always available, and it is only available for 832 observations.

Finally, the level of development is the only variable that comes from a different database since the information comes from the World Bank. Specifically, the level of development is obtained by taking as a reference the Gross National Income of each country each year. With this information, it is determined whether the level of development is "high", "medium-high", "medium-low" and "low" according to a set of limits that vary each year. For the purposes of this paper, the "medium-high" and "medium-low" levels have been merged into a single "medium" level, and in this case, information is available for all observations. Of all the equity offerings, 5,080 was realised in a country with a high level of development, 369 with a medium level of development, and 47 with a low level of development (for 4 observations we were not able to obtain this information).

²² This problem is one of the motivations for applying different methodologies and tests to ensure that we control for effects. On the other hand, the percentage of the sample affected by this problem is small.

²³ All price series used are closing prices, as no differences were found when trading with other series. On the other hand, since the abnormal returns sought are not generated because of the application of any specific trading strategy, the commissions that this would imply are not considered.

3.4. METHODOLOGY

To determine whether the events related to equity offerings generate significant effects on the market, the first step is to calculate the abnormal returns associated with each of the events, comparing the actual return on that day with the return estimated by different models, or by trying to directly estimate the effect of this event on the firm's returns. Once obtained, these returns will be subjected to a set of statistical tests to determine whether these effects are significant. These tests will be performed both for the full sample and for a set of subsamples formed according to different criteria²⁴.

3.4.1. Calculation of Abnormal Returns

Anomalous returns will be calculated as the difference between the actual return experienced by the issuing company's stock, and that estimated by both the CAPM model of **Sharpe (1964)** and **Lintner (1965)** and the **Fama and French (1993)** 3-factor model, both trained with the price series of that company during the previous year. Equations [1] and [2] show this operation:

$$AR_{i,t} = R_{i,t} - [\widehat{\alpha}_0 + \widehat{\alpha}_1 * R_{M,t}] \quad [1]$$

$$AR_{i,t} = R_{i,t} - [\widehat{\beta}_0 + \widehat{\beta}_1 * R_{M,t} + \widehat{\beta}_2 * SMB_t + \widehat{\beta}_3 * HML_t] \quad [2]$$

where AR_i is the abnormal return calculated, $R_{i,t}$ and $R_{M,t}$ are, respectively, the performance of company i and that of the corresponding market portfolio on the day of the event, SMB_t and HML_t are, respectively, the values of the Fama and French factors, and $\widehat{\alpha}_0$, $\widehat{\alpha}_1$, $\widehat{\beta}_0$, $\widehat{\beta}_1$, $\widehat{\beta}_2$ and $\widehat{\beta}_3$ are the coefficients estimated by the models defined in equations [3] and [4]:

$$\overline{R}_t = \alpha_0 + \alpha_1 * R_{M,t} + \varepsilon_t \quad [3]$$

$$\overline{R}_t = \beta_0 + \beta_1 * R_{M,t} + \beta_2 * SMB_t + \beta_3 * HML_t + \varepsilon_t \quad [4]$$

The data series for the SMB and HML factors are obtained from *Kenneth French's* database. Since there are no series for every country, each territory has been assigned the series

²⁴ All calculations and procedures were performed using the Python programming language. The code is available to the reader upon request.

that best fits its characteristics. In the case of countries for which there is no series, the series "Developed countries except United States" is used.

In all of the above equations both the yield of the issuing company and the market portfolio have been corrected for the return on the risk-free asset. The Market Portfolio will be the main stock market index of the corresponding country. Regarding the period, it was decided to use the year prior to the first event identified for each equity offering. However, to avoid unidentified events in this process contaminating the price series, the 60 days prior to the first event are not considered. Therefore, the price series has 300 data points, the first one corresponding to 360 days before the first event, and the last one to 60 days before that event. Once the parameters have been obtained, abnormal returns are calculated for the day of the event (t) and for the five days before and after the event.

As mentioned in the Data section, it has not been possible to perform this procedure for all observations, either due to lack of data on the price series or due to errors in the results. All observations for which it was not possible to obtain an anomalous return have been removed from the sample. Finally, in view of the distribution of these returns, no positive or negative outliers were considered to exist.

3.4.2. Robustness check

To add a methodology that allows us to increase the robustness of the results, we decided to obtain an estimate of the event effect inspired by the Differences-in-Differences methodology, defined as the difference between the subtraction of the pre- or post-event means of the issuing company's return series, and the subtraction of the pre- and post-event means of the market portfolio series. This is defined in the equation [6]:

$$D_i = (T1_i - T0_i) - (C1_i - C0_i) \quad [6]$$

where T0 and T1 are, respectively, the average return of the firm in the year before and after the event, and C0 and C1 are, respectively, the average return of the market portfolio in the year before and after the event. However, to ensure that this methodology better captures the effect of the event and to comply with the assumption of parallel trends, it will only be applied if the coefficient β_1 estimated in the Fama and French model is between 0.8 and 1.2.

Although the Differences-in-Differences methodology could provide interesting results, we have to stick with this approximate result as we are unable to apply this procedure due to two main problems, being: (1) the event only affects one company, so the treatment group would only

have one "treated" subject, and (2) the events occur on different days depending on the company. These problems also make it difficult, if not impossible, to organise the data in the form of panel data.

3.4.3. *Withdrawal of Outliers*

To deal with possible outliers, the “Median Absolute Deviation” (MAD) methodology of **Leys et al. (2013)** is applied. For each series, following the procedure described in the aforementioned article, the MAD factor is calculated, and those anomalous returns exceeding the limits defined by the median plus/minus 2.5 times this factor are removed from the sample. This procedure involves the removal of between 12 and 131 observations, which is equivalent to removing between 0.22 % and 2.38 % of the relevant sample. This methodology has been applied first to the 22 series of anomalous returns as well as to the 9 series obtained from them.

3.4.4. *Applications of statistical tests*

Once an anomalous return has been obtained for each observation, a series of statistical tests will be applied to determine whether significant effects can be considered to have been generated. These tests will be applied both on the whole sample and on subsamples constructed based on different criteria.

Firstly, a standard Student's t-test on the mean is applied. On the other hand, the relatively higher volume of negative anomalous returns suggests that the mean may be forced to this side, which leads us to consider the usefulness of performing analyses also on the median, to see if there are significant differences. For this purpose, a non-parametric test on the median will be used, which consists of the **Wilcoxon (1992)** signed-rank test.

These analyses will be carried out on 9 different samples of results. First, we have the total accumulative anomalous return (AAR_i), obtained as the sum of the 11 calculated anomalous returns (this being a common estimation period in the papers reviewed, such as **Mansley et al. (2023)**). Then we have the partial cumulative anomalous returns (pre_AAR_i and pos_AAR_i), which contain, respectively, the anomalous returns before and after the day of the event. Finally, the anomalous returns corresponding to the day of the event (AR_t). From each these categories we have two series (one for the CAPM model and one for the Fama and French model), and additionally we have the series of the Differences-in-Differences results. Mathematically, the different cumulative abnormal returns are obtained by following the expressions [7], [8] and [9]:

$$AAR_i = \sum_{s=\tau-5}^{\tau+5} AR_{i,s} \quad [7] \quad pre_AAR_i = \sum_{s=\tau-5}^{\tau-1} AR_{i,s} \quad [8] \quad pos_AAR_i = \sum_{s=\tau+1}^{\tau+5} AR_{i,s} \quad [9]$$

A series of codes have been established to name each of these nine AR series. Table 3·5 shows the equivalences between the codes and the series.

Table 3·5: Codes assigned for each AR data series.

#	Code	Series
1	tot_AAR_C	AAR corresponding to the entire estimation period, obtained by the CAPM model.
2	tot_AAR_F	AAR corresponding to the entire estimation period, obtained by the FF model.
3	pre_AAR_C	AAR corresponding to the period prior to the event, obtained by the CAPM model.
4	pre_AAR_F	AAR corresponding to the period prior to the event, obtained by the FF model.
5	pos_AAR_C	AAR corresponding to the period after to the event, obtained by the CAPM model.
6	pos_AAR_F	AAR corresponding to the period after to the event, obtained by the FF model.
7	eve_EAR_C	AR corresponding to the event , obtained by the CAPM model.
8	eve_EAR_F	AR corresponding to the event , obtained by the FF model.
9	tot_RBT_T	AR corresponding to the event , obtained by the Differences-in-Differences approach.

To avoid confusion, it should be clarified that, for each series, each of its observations will correspond to a cumulative anomalous return (sum of the 5 anomalous returns before or after the event, or of the 11 returns) or to an individual anomalous return in the case of the series referring to the day of the event or to the robustness check. The main statistics and results shown hereafter will correspond to each set of observations.

Finally, for each series, the tests will be applied both for the full sample and for a series of classifications according to different characteristics of the processes, the country in which they are carried out or the specific event to which the anomalous performance corresponds. First, the characteristics analysed are whether the issuer is listed on a stock index, whether the equity offering is made by issuing subscription rights, the ESG rating of the issuer (D, C, B or A) or the level of development of the country (low, medium, and high) at the date of the event. Subgroups are then also formed according to the country in which the issuer is located, the event to which the abnormal return corresponds, and the concatenation of both factors.²⁵

²⁵ If any of the subgroups does not contain at least 5 observations, the tests will not be carried out.

3.5. RESULTS

First, before analysing the results of the proposed tests, Figures 01 and 02 present the box plots corresponding to the series of daily abnormal returns estimated by the CAPM and Fama and French models, respectively.

Figure 3-1: Boxplot for the CAPM abnormal returns

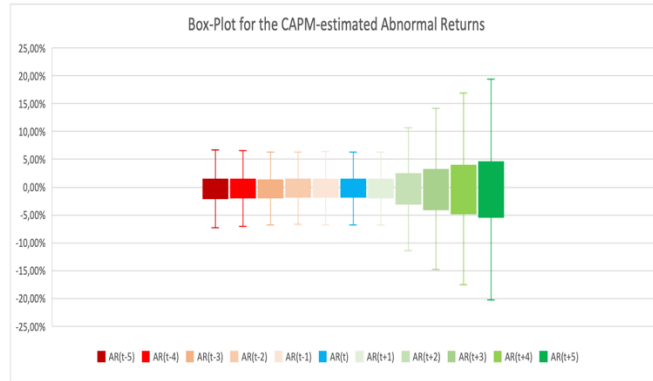
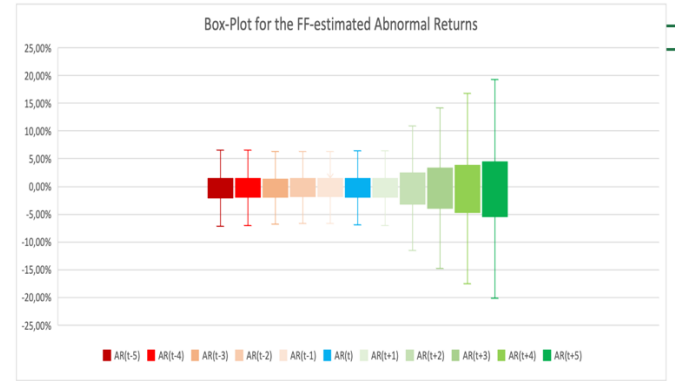


Figure 3-2: Boxplot for the FF abnormal returns

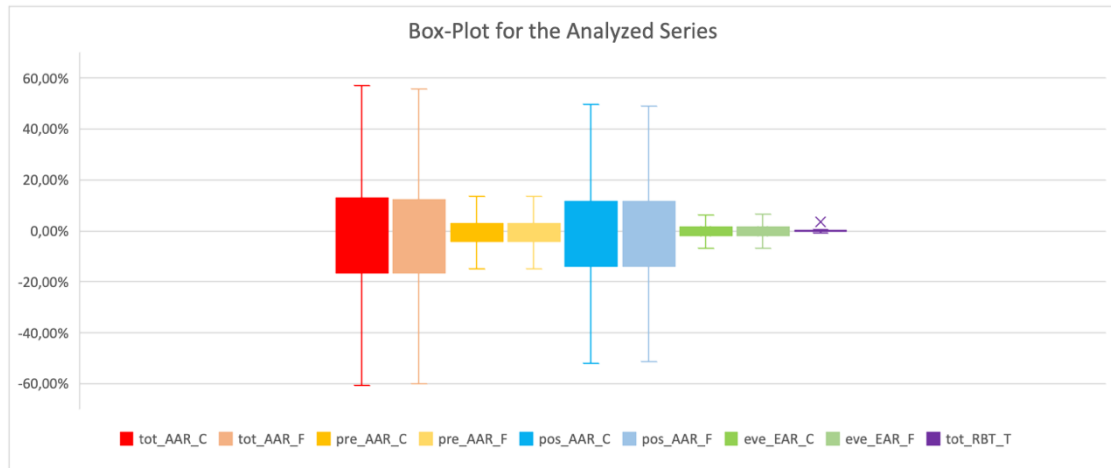


Next, the behaviour of the nine series to be analysed must be studied. For this purpose, Table 3-6 contains their main statistics, while Figure 3-3 presents the Box plots for the diary abnormal returns and for the nine AR series.

Table 3-6: Main statistics for the nine AR series

	tot_AAR_C	tot_AAR_F	pre_AAR_C	pre_AAR_F	pos_AAR_C	pos_AAR_F	eve_EAR_C	eve_EAR_F	tot_RBT_T
Sample	5.253	5.253	5.180	5.180	5.201	5.203	4.359	4.359	2.248
Removed	247	247	320	320	299	297	1.141	1.141	3.252
Average	-0,47%	-1,03%	-0,33%	-0,51%	0,01%	-0,28%	-0,03%	-0,07%	3,60%
St. Dev.	36,31%	36,13%	12,31%	13,54%	31,38%	31,06%	6,28%	5,43%	104,21%
Median	-1,58%	-1,56%	-0,47%	-0,47%	-1,01%	-1,10%	-0,13%	-0,16%	-0,09%
Minimum	-270,75%	-268,69%	-204,84%	-272,91%	-211,93%	-252,63%	-100,29%	-103,46%	-842,31%
Maximum	272,88%	267,55%	263,60%	280,89%	274,35%	245,38%	265,09%	163,58%	999,61%
Skewness	1,15	0,61	6,29	1,46	1,34	0,83	16,60	5,08	2,87
Kurtosis	9,62	9,65	155,84	186,87	11,06	10,79	748,23	223,88	51,08
P-Value (JB)	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000

Figure 3-3: Boxplot for the AR analyzed series



This set of tables and graphs allows us to glimpse a series of very relevant preliminary results. It can be clearly seen how the distribution of the anomalous yields is similar on the days of the event and the days prior to it. However, once the event has taken place, and as the days progress, the variability of the anomalous yields increases continuously. This is also observed in the aggregated series, as those that aggregate the 11 days and the 5 days after the event show a higher variability.

Regarding the data series, the reduction in the sample size is striking, which is mainly due to the following two different reasons:

- 1) Due to missing data or estimation errors, it has not been possible to obtain a result for any of the days that make up the series. In the case of the robustness check, many observations do not meet the criterion of an estimated beta coefficient close to one.
- 2) Observations have been considered as outliers in some of the calculation steps and have been removed from the final sample.

Finally, it should be noted that for all series, both when analyzing the full sample and with any of the sub-samples, the Jarque-Bera test leads to reject the null hypothesis of normality in the series of anomalous returns.

Once the series have been obtained, the target results will be the means and medians corresponding to each of the groupings of interest. Once obtained, the previously mentioned tests will be applied to determine their sign and significance. Before doing so, Figures 3-4 to 3-9 show scatter plots showing the behavior of the average/median pairs for each of the groupings. The even-numbered Figures show the results for the CAPM model, while the odd-numbered Figures show the results for the FF model.

Figure 3·4: Dispersion of Results by Country – CAPM

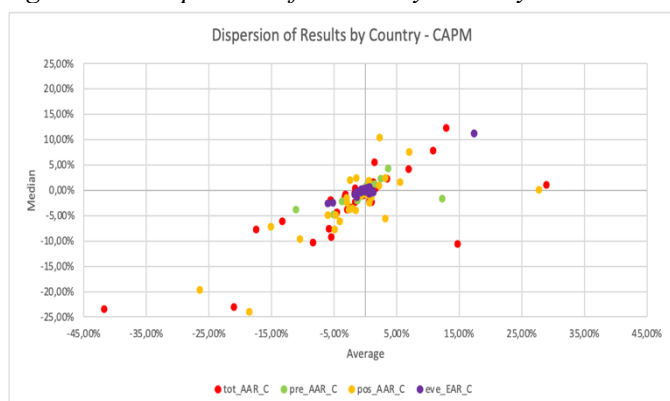


Figure 3·5: Dispersion of Results by Country – FF

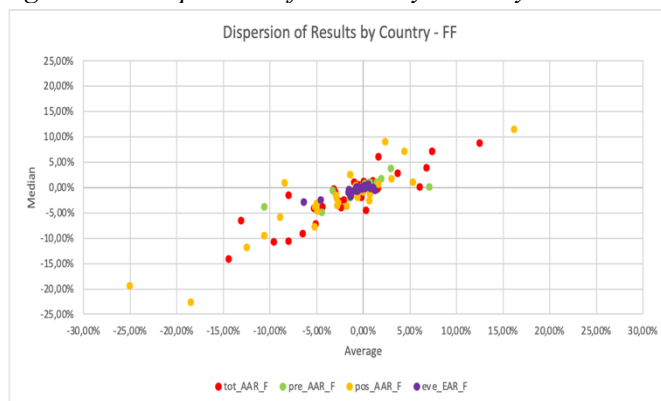


Figure 3·6: Dispersion of Results by Event – CAPM

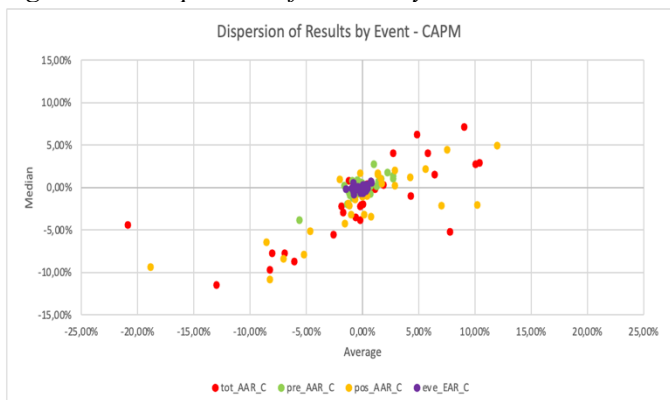


Figure 3·7: Dispersion of Results by Event – FF

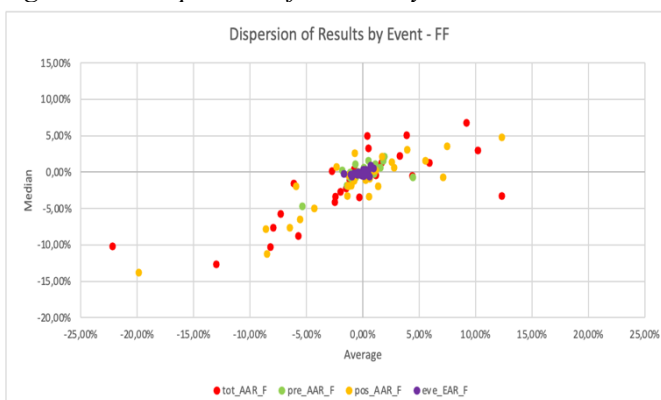


Figure 3·8: Dispersion of Results by Economic Sector – CAPM

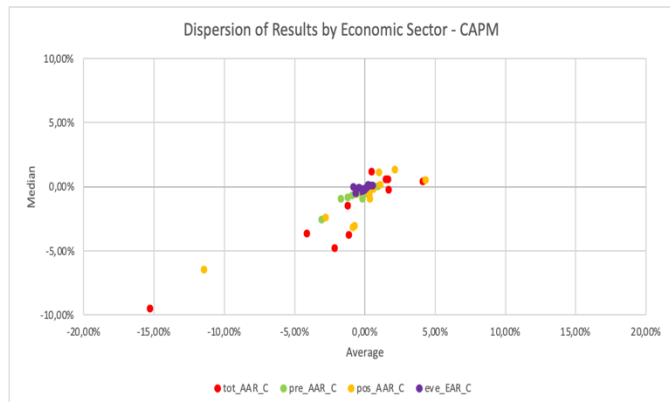


Figure 3·9: Dispersion of Results by Economic Sector – FF



The analysis of these graphs shows that the behavior of the mean and median anomalous yields obtained is very similar in the different groups. Although in most cases they are close to 0, it is noteworthy that the pairs belonging to the aggregation of the 11 days and the 5 days after the event show greater volatility. This is also the case, although to a lesser extent, in the 5-day pre-event grouping. These observations are consistent with those made previously.

The results of the tests performed are shown below. First, Table 3·7 shows the results for the complete sample of all series.

Table 3·7: Main results for the nine AR series, full sample.

Full Sample	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	5.253	-0,47 %	36,31%	-1,58 % ***	0,3446	0,0000
tot_AAR_F	5.253	-1,03 % **	36,12%	-1,56 % ***	0,0386	0,0000
pre_AAR_C	5.180	-0,33 % *	12,31%	-0,47 % ***	0,0543	0,0000
pre_AAR_F	5.180	-0,51 % ***	13,54%	-0,47 % ***	0,0072	0,0000
pos_AAR_C	5.201	0,01 %	31,38%	-1,01 % ***	0,9781	0,0001
pos_AAR_F	5.203	-0,28 %	31,06%	-1,1 % ***	0,5131	0,0000
eve_EAR_C	4.359	-0,03 %	6,27%	-0,13 % ***	0,7379	0,0001
eve_EAR_F	4.359	-0,07 %	5,43%	-0,16 % ***	0,3765	0,0000
tot_RBT_T	2.248	3,6 %	104,18%	-0,09 % ***	0,1020	0,0000

Note: The averages and medians show the results of Student's t-tests and Wilcoxon tests, respectively, following the P-values shown in the last two columns. Specifically, it is indicated whether the factor is significant at 1% (***), 5% (**) or 10% (*).

The results obtained for the complete sample allow us to detect significance on average only for the aggregation of the days prior to the event and, to a lesser extent, for the aggregation of the 11 days. Due to the method of calculating the anomalous returns, it was expected to find more significance in the medians than in the means. This is precisely the result shown in this table, in which all medians are negative and significant.

The next step is to show the results obtained for the different subsamples constructed from the different factors, countries, events, and sectors. However, the large number of results makes it difficult to show them in a simple and efficient way. To summarize the results, Figures 3·10 to 3·17 have been constructed, in which each grouping is represented by a bar with 9 sections, each corresponding to the different series. The color of the bar indicates the possible result: significant and positive coefficient (green), significant and negative (red), not significant (orange), and no result (blue). The even figures represent the averages, and the odd figures represent the medians.

Figure 3-10: Significance of the Average AAR by Factor

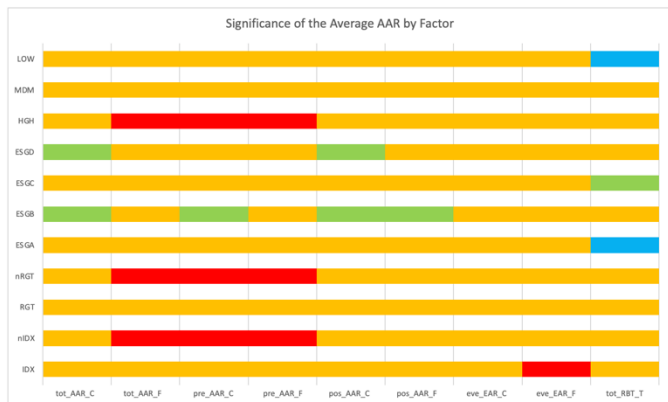


Figure 3-11: Significance of the Median AAR by Factor

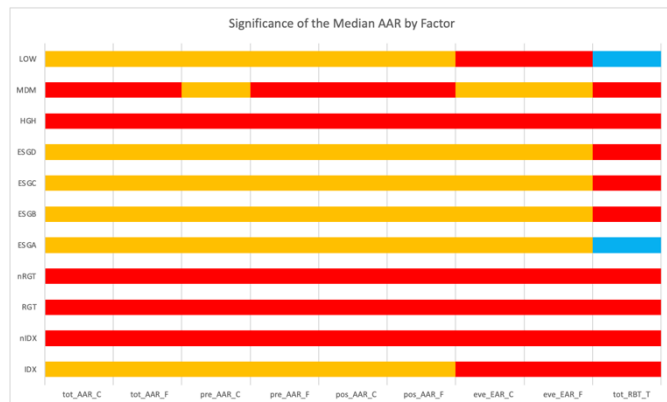


Figure 3-12: Significance of the Average AAR by Country

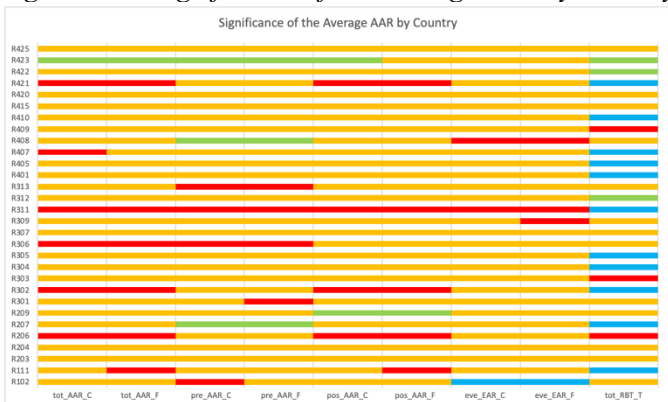


Figure 3-13: Significance of the Median AAR by Country



Figure 3-14: Significance of the Average AAR by Event

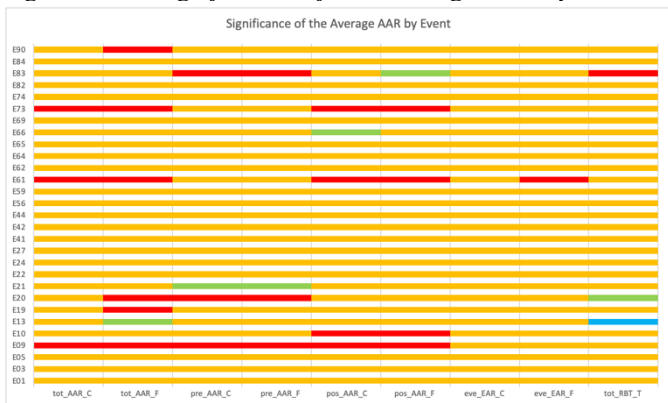


Figure 3-15: Significance of the Median AAR by Event

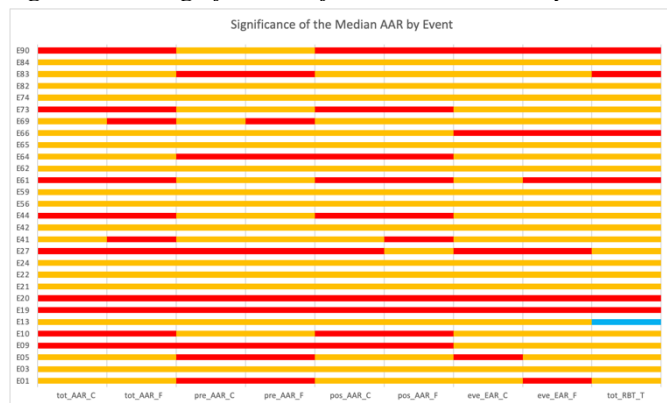


Figure 3-16: Significance of the Average AAR by Sector

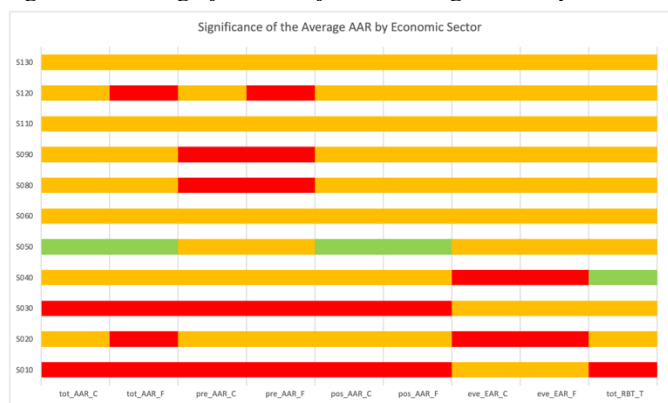
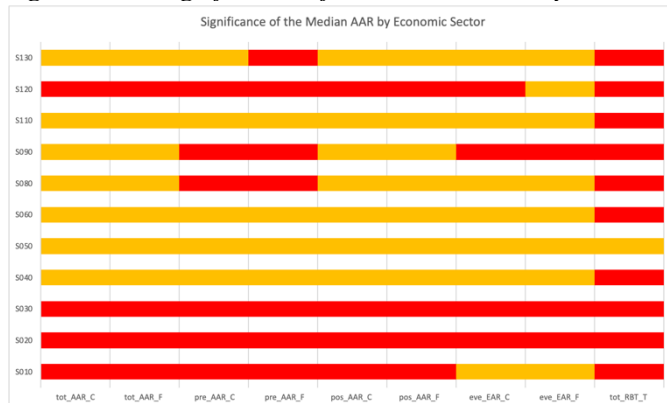


Figure 3-17: Significance of the Median AAR by Sector



These tables show a very relevant set of results that should be analyzed in detail^{26;27}. First, it should be considered that some results may be conditioned by the sample size, which may vary significantly from one grouping to another (this size can be seen in the tables in the appendix). However, it is considered that the variety of results and the set of groups with sufficient observations makes this work sufficiently robust to this issue.

At a first general glance, there are many significant results in the different groups created. The significant medians are always negative. Although there are many non-significant results, the volume of those that are significant generates sufficient sample evidence to affirm that, under certain conditions, significant anomalous returns are systematically generated.

Focusing attention on the classification by factors, most of the anomalies are in companies not listed in stock market indexes or in equity offerings that do not issue subscription rights. On the other hand, it seems to be observed that higher ESG levels would be related to a lower volume of anomalies, with no significant results detected at level A. It is very noticeable that, in these groupings, all significant anomalous returns are positive. Finally, the development level does not offer conclusive results, since although there are anomalies only at the highest level, it concentrates most of the observations.

The analysis by country is very similar to that by event. There are many cases in which only a few series are significant, although there are several cases in which most of the results point to significant anomalies. The most significant cases would be, by country, Canada (R206), China (R302), Japan (R306), Philippines (R311), France (R408), Spain (R421) and Switzerland (R423); and by event, "Books Closing Date" (E09), "Overallotment Exercise Date" (E61), "Rights Trading Cease Date" (E73) and "Subscription Delivery Date" (E83). In all these cases the results are negative, with the sole exception of Switzerland (R421), for which, they are positive. Finally, if we analyze by economic sector, we also see very varied results, and anomalies in most groups. It is noteworthy that the "Academic & Educational Services" (S010) and "Consumer Cyclical" (S030) sectors show so many significant negative returns. The "Energy" sector (S050) also shows significant anomalous returns, although in this case, they are positive.

²⁶ Tables 3·08 to 3·88, in the appendix, show the corresponding numerical values. The results by factors are found in Tables 08 to 18; the results by country are shown in Tables 3·19 to 3·48; the results by event can be seen in Tables 3·49 to 3·77, while the results by economic sector are in Tables 3·78 to 3·88.

²⁷ There are countries or events that do not appear in these Figures and Tables. This is because not enough observations are available to create a group, but they are included in other groupings.

3.6. CONCLUSIONS

The effects of equity offerings on the issuing company's share price and on the financial market have been written about in recent years. Many studies have been able to identify and quantify this type of anomaly in specific territories and under specific conditions. However, until now, there has been no analysis with a sufficiently large sample size to provide a global perspective on this contingency, and from which conclusions valid for many territories and events can be drawn. The aim of this study was to provide robust results that would allow this gap to be filled, and it is considered that sufficient evidence has been obtained to meet this objective.

The analysis was not limited to the day of the event in question, but also considered the five days before and after the event in case the effect of the event could be sustained over time. Furthermore, when carrying out statistical tests on the significance of these performances, different series have been studied, both the performance of the day of the event itself and the accumulation of the entire study period, as well as the accumulation of the days before or after the event. This multitude of analyses has made it possible to obtain a robust set of results in which the risk of the chosen methodology leading to a different result from the real one has been reduced as much as possible. Furthermore, these analyses have been carried out on the complete sample of events, but also on different subsamples created using different criteria considered relevant. They have been grouped according to factors specific to the company or equity offering, including measures of the company's commitment to its environment, but also according to the type of event, the economic sector to which the company belongs or the country in which it is located.

The results obtained suggest that there are events corresponding to equity offerings systematically and significantly affect the issuing company's share price. In aggregate terms, anomalous behaviour has been detected, especially in the days following the event analysed. This implies that some investors who were aware of these behavioural patterns could design strategies aimed at exploiting these anomalies and obtaining significant profits. This would imply that, within the framework of these processes and in certain cases, the markets would not be behaving in the more efficient way. More specifically, some factors have been identified that may be related to the appearance or not of these anomalies, both specific to the issuing companies (listing in stock market indexes) or to the conditions of the equity offerings (whether they issue subscription rights). In addition, it has also been possible to identify certain patterns of behaviour depending on the country in which the issuing company is located or the specific event taking place. More significantly, it has been observed how a better environmental and social performance, measured through the ESG grade, has a negative effect on the appearance of the anomalies detected in this study. A higher ESG level is more difficult to find related to significant anomalous performances.

In summary, this work joins and completes the existing literature on anomalies in equity offerings, providing a global and complete vision of this phenomenon, and trying to provide a more robust explanation of what type of anomalies occur in these processes, how they work and what factors are involved in their appearance. It also provides sample evidence that companies with a greater commitment to society and the environment tend to take advantage of the benefits of more efficient behaviour in financial markets. Finally, this work can serve to provide more information on equity offering processes, both to issuing companies and investors, but also to regulators, on where inefficiencies may occur, their possible effects and ways to correct them.

Finally, as possible extensions of this work and/or future research, it would be of great interest to analyse intra-daily data to know the effects of certain events on the same day of their publication, and during the minutes and hours before and after that moment. Additionally, in the process some outliers have been detected that could contaminate the results, and for this reason they have been removed. It would be very interesting to carry out a further study focused on these results, to explain them in depth and determine what factors could be causing them.

Acknowledgement

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3.8. ANNEX

Table 3-8: Main results for the nine series, companies listed in the main stock index of their countries.

Indexed	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	811	1,53 %	30,59%	0,5 %	0,1533	0,5712
tot_AAR_F	810	-0,02 %	31,36%	-0,25 %	0,9855	0,3395
pre_AAR_C	809	0,29 %	9,41%	-0,09 %	0,3853	0,4844
pre_AAR_F	809	0,01 %	13,68%	-0,03 %	0,9758	0,3152
pos_AAR_C	808	1,37 %	26,24%	0,77 %	0,1395	0,6924
pos_AAR_F	808	0,63 %	26,95%	0,36 %	0,5066	0,5445
eve_EAR_C	724	-0,13 %	3,27%	-0,06 % *	0,3027	0,0864
eve_EAR_F	724	-0,31 % *	5,02%	-0,16 % **	0,0963	0,0215
tot_RBT_T	301	8,97 %	134,80%	-0,06 % ***	0,2490	0,0000

Table 3-9: Main results for the nine series, companies not listed in the main stock index of their countries.

Not Indexed	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	4.442	-0,84 %	37,25%	-1,99 % ***	0,1328	0,0000
tot_AAR_F	4.443	-1,22 % **	36,92%	-2,08 % ***	0,0283	0,0000
pre_AAR_C	4.371	-0,44 % **	12,77%	-0,54 % ***	0,0218	0,0000
pre_AAR_F	4.371	-0,6 % ***	13,51%	-0,59 % ***	0,0032	0,0000
pos_AAR_C	4.393	-0,24 %	32,23%	-1,38 % ***	0,6260	0,0000
pos_AAR_F	4.395	-0,45 %	31,76%	-1,32 % ***	0,3484	0,0000
eve_EAR_C	3.635	-0,01 %	6,71%	-0,16 % ***	0,9059	0,0002
eve_EAR_F	3.635	-0,03 %	5,51%	-0,16 % ***	0,7812	0,0001
tot_RBT_T	1.947	2,76 %	98,58%	-0,1 % ***	0,2162	0,0000

Table 3-10: Main results for the nine series, equity offerings with subscription rights.

Sub. Rights	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	1.267	-0,16 %	41,11%	-1,06 % **	0,8890	0,0254
tot_AAR_F	1.267	-1,05 %	41,68%	-1,12 % **	0,3678	0,0111
pre_AAR_C	1.239	0,03 %	12,45%	-0,23 % *	0,9355	0,0550
pre_AAR_F	1.239	-0,56 %	13,61%	-0,23 % **	0,1449	0,0110
pos_AAR_C	1.243	-0,02 %	35,73%	-1,24 % **	0,9863	0,0367
pos_AAR_F	1.244	-0,35 %	36,23%	-1,3 % **	0,7334	0,0268
eve_EAR_C	1.018	-0,2 %	5,71%	-0,15 % **	0,2706	0,0154
eve_EAR_F	1.020	-0,18 %	5,71%	-0,16 % **	0,3068	0,0136
tot_RBT_T	362	2,9 %	52,80%	-0,07 % ***	0,2964	0,0013

Table 3-11: Main results for the nine series, equity offerings without subscription rights.

No Sub. Rights	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	3.986	-0,57 %	34,64%	-1,74 % ***	0,2967	0,0000
tot_AAR_F	3.986	-1,02 % *	34,17%	-1,9 % ***	0,0586	0,0000
pre_AAR_C	3.941	-0,44 % **	12,26%	-0,55 % ***	0,0238	0,0000
pre_AAR_F	3.941	-0,49 % **	13,52%	-0,56 % ***	0,0237	0,0000
pos_AAR_C	3.958	0,02 %	29,89%	-0,97 % ***	0,9645	0,0005
pos_AAR_F	3.959	-0,26 %	29,25%	-1,02 % ***	0,5756	0,0003
eve_EAR_C	3.341	0,02 %	6,44%	-0,13 % ***	0,8672	0,0008
eve_EAR_F	3.339	-0,04 %	5,34%	-0,16 % ***	0,6721	0,0002
tot_RBT_T	1.886	3,73 %	111,36%	-0,1 % ***	0,1462	0,0000

Table 3-12: Main results for the nine series, companies with a ESG grade of A.

ESG A	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	66	1,62 %	30,11%	-1,57 %	0,6632	0,5996
tot_AAR_F	66	2,06 %	26,87%	-1,26 %	0,5361	0,6897
pre_AAR_C	66	1,12 %	6,93%	-0,26 %	0,1927	0,4378
pre_AAR_F	66	0,57 %	5,89%	-0,15 %	0,4382	0,4911
pos_AAR_C	66	0,59 %	26,76%	-0,42 %	0,8587	0,5089
pos_AAR_F	66	1,83 %	23,93%	-0,21 %	0,5377	0,7755
eve_EAR_C	63	-0,1 %	3,17%	0,48 %	0,8123	0,6594
eve_EAR_F	63	-0,35 %	3,06%	-0,16 %	0,3688	0,1397
tot_RBT_T	-	-	-	-	-	-

Table 3-13: Main results for the nine series, companies with a ESG grade of B.

ESG B	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	195	4,56 % **	30,97%	2,16 %	0,0413	0,9441
tot_AAR_F	195	2,36 %	25,72%	1,31 %	0,2011	0,8970
pre_AAR_C	195	0,74 % *	6,13%	1,1 %	0,0938	0,9871
pre_AAR_F	195	0,13 %	9,68%	0,83 %	0,8555	0,9878
pos_AAR_C	195	4,06 % **	27,85%	1,74 %	0,0430	0,9350
pos_AAR_F	195	2,47 % *	20,86%	2,38 %	0,0999	0,9047
eve_EAR_C	169	-0,28 %	2,89%	-0,1 %	0,2055	0,1916
eve_EAR_F	170	-0,27 %	2,93%	-0,14 %	0,2350	0,1513
tot_RBT_T	59	-5,85 %	49,20%	-0,07 % **	0,3650	0,0102

Table 3-14: Main results for the nine series, companies with a ESG grade of C.

ESG C	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	344	0,94 %	27,48%	1,52 %	0,5261	0,5896
tot_AAR_F	344	-1,18 %	32,05%	0,47 %	0,4938	0,3355
pre_AAR_C	343	0,34 %	5,69%	0,01 %	0,2674	0,7853
pre_AAR_F	343	0,07 %	15,84%	-0,16 %	0,9349	0,4483
pos_AAR_C	344	0,66 %	25,42%	0,35 %	0,6299	0,6032
pos_AAR_F	344	-0,88 %	25,45%	0,15 %	0,5212	0,3878
eve_EAR_C	308	-0,07 %	2,93%	0,08 %	0,6816	0,6656
eve_EAR_F	308	-0,42 %	6,53%	0,07 %	0,2645	0,5830
tot_RBT_T	151	15,96 % *	105,87%	-0,06 % ***	0,0659	0,0000

Table 3-15: Main results for the nine series, companies with a ESG grade of D.

ESG D	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	221	5,48 % **	37,67%	1,99 %	0,0318	0,9833
tot_AAR_F	221	3,11 %	37,02%	1 %	0,2130	0,9639
pre_AAR_C	220	1,14 %	16,38%	0 %	0,3011	0,5425
pre_AAR_F	220	0,14 %	6,43%	-0,25 %	0,7494	0,5564
pos_AAR_C	221	4,08 % *	32,05%	0,41 %	0,0599	0,9402
pos_AAR_F	221	2,72 %	34,09%	0,19 %	0,2363	0,9292
eve_EAR_C	182	0,31 %	3,23%	0,29 %	0,1910	0,9098
eve_EAR_F	181	0,3 %	3,19%	0,14 %	0,2019	0,9228
tot_RBT_T	104	11,54 %	134,24%	-0,05 % **	0,3828	0,0190

Table 3-16: Main results for the nine series, companies located in a high-developed country.

High	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	4.876	-0,31 %	36,88%	-1,6 % ***	0,5522	0,0000
tot_AAR_F	4.876	-0,93 % *	36,35%	-1,68 % ***	0,0735	0,0000
pre_AAR_C	4.805	-0,33 % *	12,61%	-0,5 % ***	0,0699	0,0000
pre_AAR_F	4.805	-0,53 % ***	13,24%	-0,52 % ***	0,0052	0,0000
pos_AAR_C	4.826	0,18 %	31,91%	-0,98 % ***	0,7019	0,0004
pos_AAR_F	4.828	-0,14 %	31,55%	-1,1 % ***	0,7515	0,0002
eve_EAR_C	4.039	-0,02 %	6,40%	-0,14 % ***	0,8250	0,0001
eve_EAR_F	4.039	-0,07 %	5,51%	-0,16 % ***	0,4478	0,0000
tot_RBT_T	2.097	3,48 %	103,23%	-0,09 % ***	0,1230	0,0000

Table 3-17: Main results for the nine series, companies located in a medium-developed country.

Medium	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	339	-2,16 %	28,11%	-1,42 % **	0,1585	0,0469
tot_AAR_F	339	-1,92 %	33,85%	-0,22 % *	0,2978	0,0654
pre_AAR_C	338	-0,32 %	7,44%	-0,18 %	0,4233	0,1637
pre_AAR_F	338	-0,11 %	17,59%	-0,31 % *	0,9105	0,0999
pos_AAR_C	337	-1,81 %	23,57%	-1,79 % **	0,1592	0,0413
pos_AAR_F	337	-1,77 %	23,99%	-1,13 % *	0,1754	0,0527
eve_EAR_C	294	-0,04 %	4,42%	-0,1 %	0,8818	0,2334
eve_EAR_F	294	-0,05 %	4,24%	-0,1 %	0,8317	0,1527
tot_RBT_T	151	5,22 %	116,66%	-0,05 % *	0,5835	0,0638

Table 3-18: Main results for the nine series, companies located in a low-developed country.

Low	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	38	-5,92 %	24,75%	-1,66 %	0,1489	0,1305
tot_AAR_F	38	-5,88 %	24,95%	-1,6 %	0,1545	0,1336
pre_AAR_C	37	-0,31 %	7,86%	1,53 %	0,8116	0,5866
pre_AAR_F	37	-0,4 %	8,49%	1,83 %	0,7779	0,5866
pos_AAR_C	38	-4,63 %	21,73%	-1,42 %	0,1968	0,1075
pos_AAR_F	38	-4,56 %	21,84%	-0,88 %	0,2062	0,1305
eve_EAR_C	26	-1,44 %	4,53%	-0,39 % *	0,1178	0,0954
eve_EAR_F	26	-1,37 %	4,34%	-0,37 % *	0,1196	0,0871
tot_RBT_T	-	-	-	-	-	-

Table 3-19: Main results for the nine series, Israel.

Israel	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	8	-3,18 %	4,95%	-0,85 % *	0,1123	0,0617
tot_AAR_F	8	-3 %	4,80%	-0,97 %	0,1198	0,1038
pre_AAR_C	8	-1,34 % *	1,72%	-2,01 % *	0,0646	0,0617
pre_AAR_F	8	-0,72 %	1,98%	-0,38 %	0,3371	0,2004
pos_AAR_C	5	-2,12 %	5,54%	-3,59 %	0,4408	0,2501
pos_AAR_F	5	-2,8 %	4,04%	-3,5 %	0,1955	0,1125
eve_EAR_C	-	-	-	-	-	-
eve_EAR_F	-	-	-	-	-	-
tot_RBT_T	5	-0,21 %	0,34%	-0,12 %	0,2414	0,1726

Table 3-20: Main results for the nine series, South Africa.

South Africa	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	15	14,75 %	73,27%	-10,58 %	0,4486	0,1971
tot_AAR_F	15	-9,58 % *	19,80%	-10,69 % *	0,0820	0,0626
pre_AAR_C	15	12,27 %	47,84%	-1,69 %	0,3372	0,4548
pre_AAR_F	15	0,02 %	6,87%	0,23 %	0,9902	0,3882
pos_AAR_C	15	3,16 %	53,03%	-5,63 %	0,8208	0,1057
pos_AAR_F	15	-8,95 % *	16,37%	-5,81 % *	0,0527	0,0559
eve_EAR_C	13	-0,79 %	2,15%	0,05 %	0,2092	0,1727
eve_EAR_F	13	-0,75 %	2,26%	0,13 %	0,2534	0,1912
tot_RBT_T	-	-	-	-	-	-

Table 3-21: Main results for the nine series, Bermuda.

Bermuda	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	17	0,98 %	19,11%	-2,31 %	0,8351	0,2770
tot_AAR_F	17	0,29 %	19,30%	-4,52 %	0,9522	0,2316
pre_AAR_C	17	-0,77 %	3,58%	-1,22 %	0,3896	0,1048
pre_AAR_F	17	-1,45 %	3,72%	-2,08 % **	0,1275	0,0420
pos_AAR_C	17	0,65 %	14,38%	-2,47 %	0,8556	0,3265
pos_AAR_F	17	0,67 %	14,72%	-2,56 %	0,8539	0,2614
eve_EAR_C	17	1,1 %	4,59%	0,01 %	0,3370	0,6208
eve_EAR_F	17	1,07 %	4,70%	-0,07 %	0,3630	0,6563
tot_RBT_T	8	1,55 %	4,55%	-0,1 % *	0,3683	0,0807

Table 3-22: Main results for the nine series, Brazil.

Brazil	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	27	1,4 %	20,69%	5,47 %	0,7284	0,7179
tot_AAR_F	27	1,62 %	21,74%	6,07 %	0,7013	0,7339
pre_AAR_C	27	-0,81 %	6,04%	-0,76 %	0,4907	0,2583
pre_AAR_F	27	-0,73 %	5,60%	-0,6 %	0,5052	0,2506
pos_AAR_C	27	2,24 %	19,32%	10,34 %	0,5521	0,7645
pos_AAR_F	27	2,38 %	20,54%	9,06 %	0,5526	0,7718
eve_EAR_C	20	-0,04 %	3,06%	0,19 %	0,9523	0,6031
eve_EAR_F	20	-0,04 %	3,17%	0,01 %	0,9572	0,5740
tot_RBT_T	14	52,33 %	188,91%	0,03 %	0,3188	0,3189

Table 3-23: Main results for the nine series, Canada.

Canada	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	16	-21,01 % ***	25,45%	-23,02 % ***	0,0048	0,0075
tot_AAR_F	16	-20,85 % ***	25,76%	-25,27 % ***	0,0055	0,0075
pre_AAR_C	16	-1,05 %	11,55%	-0,64 %	0,7200	0,2675
pre_AAR_F	16	-0,95 %	11,33%	-0,57 %	0,7426	0,2847
pos_AAR_C	16	-18,55 % ***	23,58%	-23,98 % ***	0,0066	0,0087
pos_AAR_F	16	-18,53 % ***	24,22%	-22,63 % ***	0,0079	0,0075
eve_EAR_C	16	-1,41 %	4,97%	-1,35 % *	0,2750	0,0981
eve_EAR_F	16	-1,37 %	4,81%	-1,83 % *	0,2707	0,0894
tot_RBT_T	9	-0,19 % **	0,24%	-0,16 % **	0,0466	0,0142

Table 3-24: Main results for the nine series, Chile.

Chile	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	8	28,93 %	75,71%	1,02 %	0,3156	0,7581
tot_AAR_F	8	0,99 %	4,54%	1,29 %	0,5576	0,7581
pre_AAR_C	8	1,39 % *	1,94%	1,15 %	0,0821	0,9536
pre_AAR_F	8	1,43 % *	1,95%	1,11 %	0,0777	0,9536
pos_AAR_C	8	27,74 %	75,56%	0,08 %	0,3336	0,5557
pos_AAR_F	8	-0,26 %	4,11%	0,1 %	0,8643	0,4443
eve_EAR_C	7	-0,23 %	0,56%	-0,06 %	0,3224	0,1990
eve_EAR_F	7	-0,21 %	0,55%	-0,01 %	0,3613	0,1990
tot_RBT_T	-	-	-	-	-	-

Table 25: Main results for the nine series, United States.

United States	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	795	1,56 %	30,97%	0,69 %	0,1553	0,8962
tot_AAR_F	795	1,54 %	29,41%	-0,13 %	0,1413	0,8132
pre_AAR_C	796	-0,42 %	11,76%	-0,14 %	0,3171	0,2665
pre_AAR_F	796	0,19 %	15,29%	-0,22 %	0,7288	0,2156
pos_AAR_C	794	2,14 % **	26,31%	0,93 %	0,0221	0,9476
pos_AAR_F	795	1,59 % *	24,11%	0,63 %	0,0626	0,9018
eve_EAR_C	787	-0,16 %	4,88%	-0,13 % **	0,3447	0,0335
eve_EAR_F	783	0,15 %	6,70%	-0,18 % **	0,5359	0,0113
tot_RBT_T	503	5,12 %	130,95%	-0,1 % ***	0,3807	0,0000

Table 3-26: Main results for the nine series, Australia.

Australia	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	1.593	0,6 %	39,36%	-2 % ***	0,5415	0,0071
tot_AAR_F	1.593	-0,21 %	40,09%	-1,93 % ***	0,8353	0,0048
pre_AAR_C	1.554	-0,12 %	12,31%	-0,44 % ***	0,6934	0,0010
pre_AAR_F	1.554	-0,73 % **	14,66%	-0,44 % ***	0,0492	0,0000
pos_AAR_C	1.563	0,87 %	34,45%	-1,47 % **	0,3192	0,0343
pos_AAR_F	1.564	0,71 %	34,60%	-1,35 % *	0,4162	0,0535
eve_EAR_C	1.261	-0,15 %	5,54%	-0,16 % ***	0,3529	0,0054
eve_EAR_F	1.264	-0,23 %	6,27%	-0,25 % ***	0,1975	0,0017
tot_RBT_T	439	0,82 %	89,51%	0,03 %	0,8481	0,9746

Table 3-27: Main results for the nine series, China (Mainland).

China (Mainland)	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	12	-13,27 % **	20,81%	-6,11 % **	0,0492	0,0299
tot_AAR_F	12	-13,11 % *	20,72%	-6,54 % **	0,0507	0,0356
pre_AAR_C	11	-1,17 %	5,48%	-0,73 %	0,4963	0,3948
pre_AAR_F	11	-1,32 %	5,69%	-0,88 %	0,4583	0,3611
pos_AAR_C	10	-10,45 % **	13,98%	-9,68 % **	0,0424	0,0372
pos_AAR_F	10	-10,62 % **	14,42%	-9,51 % **	0,0448	0,0372
eve_EAR_C	8	-5,25 %	10,31%	-2,41 % *	0,1933	0,0617
eve_EAR_F	8	-4,58 %	8,78%	-2,43 % *	0,1838	0,0617
tot_RBT_T	-	-	-	-	-	-

Table 3-28: Main results for the nine series, Hong Kong.

Hong Kong	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	75	-5,55 %	34,53%	-1,9 % **	0,1679	0,0308
tot_AAR_F	75	-5,31 %	35,67%	-4,15 % **	0,2012	0,0251
pre_AAR_C	68	-1,26 %	9,26%	-0,65 %	0,2677	0,3017
pre_AAR_F	68	-0,85 %	8,94%	-0,82 %	0,4362	0,3479
pos_AAR_C	75	-4,75 %	33,28%	-4,92 % **	0,2201	0,0308
pos_AAR_F	75	-4,9 %	33,96%	-4,63 % **	0,2153	0,0280
eve_EAR_C	58	0,44 %	3,80%	-0,06 %	0,3857	0,5262
eve_EAR_F	58	0,47 %	3,77%	0,15 %	0,3510	0,5324
tot_RBT_T	53	-0,39 % ***	0,62%	-0,28 % ***	0,0000	0,0001

Table 3-29: Main results for the nine series, India.

India	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	46	-3,28 %	22,55%	-1,28 %	0,3287	0,2508
tot_AAR_F	46	-3,16 %	22,63%	-0,35 %	0,3484	0,2794
pre_AAR_C	45	0,16 %	6,60%	0,94 %	0,8748	0,7869
pre_AAR_F	45	0,18 %	6,80%	0,83 %	0,8584	0,7491
pos_AAR_C	46	-3,01 %	20,11%	-1,57 %	0,3152	0,1409
pos_AAR_F	46	-2,95 %	20,18%	-1,58 %	0,3268	0,1509
eve_EAR_C	33	-0,59 %	3,08%	0,18 %	0,2775	0,2238
eve_EAR_F	33	-0,54 %	3,02%	0,08 %	0,3087	0,2238
tot_RBT_T	-	-	-	-	-	-

Table 3-30: Main results for the nine series, Indonesia.

Indonesia	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	24	-1,73 %	28,73%	-0,53 %	0,7707	0,2119
tot_AAR_F	24	6,07 %	49,85%	0,11 %	0,5564	0,2743
pre_AAR_C	24	-0,64 %	4,01%	0,08 %	0,4397	0,2743
pre_AAR_F	24	7,1 %	37,87%	0,04 %	0,3679	0,3875
pos_AAR_C	24	-1,47 %	26,93%	2,38 %	0,7911	0,2288
pos_AAR_F	24	-1,39 %	27,01%	2,5 %	0,8035	0,2119
eve_EAR_C	16	0,58 %	3,27%	0,66 %	0,4891	0,8495
eve_EAR_F	16	0,54 %	3,31%	0,69 %	0,5226	0,8495
tot_RBT_T	-	-	-	-	-	-

Table 3-31: Main results for the nine series, Japan.

Japan	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	1.602	-1,7 % **	34,06%	-2,39 % ***	0,0462	0,0000
tot_AAR_F	1.602	-2,06 % **	32,87%	-2,42 % ***	0,0123	0,0000
pre_AAR_C	1.591	-0,6 % *	13,90%	-0,84 % ***	0,0876	0,0000
pre_AAR_F	1.591	-0,79 % **	12,53%	-0,85 % ***	0,0118	0,0000
pos_AAR_C	1.592	-0,82 %	29,24%	-1,13 % ***	0,2607	0,0019
pos_AAR_F	1.592	-0,79 %	29,18%	-1,2 % ***	0,2783	0,0027
eve_EAR_C	1.254	0,18 %	8,36%	-0,19 % **	0,4464	0,0100
eve_EAR_F	1.254	-0,07 %	3,75%	-0,18 % **	0,4886	0,0131
tot_RBT_T	951	4 %	101,93%	-0,15 % ***	0,2269	0,0000

Table 3-32: Main results for the nine series, Malaysia.

Malaysia	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	16	-4,61 %	15,09%	-4,31 % *	0,2406	0,0813
tot_AAR_F	16	-4,4 %	14,76%	-3,87 % *	0,2517	0,0981
pre_AAR_C	16	-0,62 %	6,00%	-1,02 %	0,6849	0,2346
pre_AAR_F	16	-0,49 %	5,71%	-0,99 %	0,7339	0,2507
pos_AAR_C	16	-2,96 %	13,07%	-2,46 % *	0,3787	0,0669
pos_AAR_F	16	-2,86 %	13,15%	-2,06 % *	0,3972	0,0669
eve_EAR_C	11	-1,49 %	3,36%	-0,46 %	0,1725	0,1640
eve_EAR_F	11	-1,51 %	3,21%	-0,49 %	0,1496	0,1640
tot_RBT_T	13	49,25 %	170,79%	0,02 %	0,3189	0,6496

Table 3-33: Main results for the nine series, New Zealand.

New Zealand	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	70	0,01 %	27,55%	0,53 %	0,9968	0,4499
tot_AAR_F	70	-0,49 %	27,80%	0,56 %	0,8825	0,3595
pre_AAR_C	62	0,83 %	7,67%	-0,28 %	0,3976	0,7161
pre_AAR_F	62	0,56 %	7,35%	-0,35 %	0,5518	0,5433
pos_AAR_C	67	0,2 %	25,38%	-0,8 %	0,9485	0,3064
pos_AAR_F	67	0 %	25,55%	-0,79 %	0,9993	0,2891
eve_EAR_C	45	-1,42 %	5,84%	-0,36 %	0,1096	0,1147
eve_EAR_F	45	-1,53 % *	5,99%	-0,43 % *	0,0932	0,0735
tot_RBT_T	9	0,02 %	0,04%	0,03 %	0,1019	0,9307

Table 3-34: Main results for the nine series, Philippines.

Philippines	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	10	-41,79 % **	42,28%	-23,42 % ***	0,0122	0,0025
tot_AAR_F	10	-40,12 % ***	38,84%	-25,18 % ***	0,0097	0,0035
pre_AAR_C	10	-11,1 % *	16,56%	-3,84 % **	0,0630	0,0183
pre_AAR_F	10	-10,63 % *	15,29%	-3,8 % **	0,0555	0,0183
pos_AAR_C	10	-26,49 % **	28,90%	-19,69 % ***	0,0176	0,0063
pos_AAR_F	10	-25,03 % **	27,71%	-19,45 % ***	0,0189	0,0083
eve_EAR_C	7	-6,01 % **	6,09%	-2,62 % ***	0,0401	0,0090
eve_EAR_F	7	-6,38 % **	6,62%	-2,83 % ***	0,0435	0,0090
tot_RBT_T	-	-	-	-	-	-

Table 3-35: Main results for the nine series, Singapore.

Singapore	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	50	-2,9 %	27,02%	-3,79 % *	0,4518	0,0787
tot_AAR_F	50	-2,58 %	27,63%	-2,68 %	0,5122	0,1021
pre_AAR_C	50	-1,32 %	5,63%	-0,94 % **	0,1035	0,0451
pre_AAR_F	50	-1,02 %	5,56%	-0,74 % *	0,2021	0,0845
pos_AAR_C	50	-2,7 %	22,06%	-3,77 %	0,3912	0,1074
pos_AAR_F	50	-2,69 %	22,62%	-2,97 % *	0,4053	0,0987
eve_EAR_C	44	1,27 %	8,00%	-0,43 %	0,2969	0,2311
eve_EAR_F	44	1,28 %	7,80%	-0,53 %	0,2838	0,2347
tot_RBT_T	31	0,12 % **	0,33%	-0,04 %	0,0484	0,9501

Table 3-36: Main results for the nine series, South Korea.

South Korea	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	404	-2,25 %	50,88%	-3,43 % **	0,3738	0,0397
tot_AAR_F	404	-2,39 %	50,98%	-3,93 % **	0,3457	0,0351
pre_AAR_C	398	-1,05 % *	11,14%	-0,73 % **	0,0616	0,0186
pre_AAR_F	398	-1,01 % *	11,16%	-0,8 % **	0,0706	0,0208
pos_AAR_C	402	-1,58 %	43,34%	-3,9 % **	0,4638	0,0254
pos_AAR_F	402	-1,75 %	43,50%	-3,68 % **	0,4216	0,0192
eve_EAR_C	330	0,43 %	6,50%	0,34 %	0,2259	0,8448
eve_EAR_F	331	0,42 %	6,54%	0,36 %	0,2479	0,8545
tot_RBT_T	30	0,03 %	0,42%	-0,08 %	0,6984	0,5041

Table 3-37: Main results for the nine series, Austria.

Austria	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	44	1,61 %	16,08%	0,44 %	0,5103	0,6412
tot_AAR_F	44	1,51 %	15,64%	-0,3 %	0,5262	0,5326
pre_AAR_C	44	0,68 %	3,97%	0,12 %	0,2647	0,7357
pre_AAR_F	44	0,67 %	3,92%	0,16 %	0,2657	0,7689
pos_AAR_C	44	0,87 %	14,12%	0,2 %	0,6842	0,5649
pos_AAR_F	44	0,7 %	13,84%	-0,21 %	0,7376	0,4489
eve_EAR_C	38	0,07 %	2,10%	0,38 %	0,8347	0,5491
eve_EAR_F	38	0,16 %	2,08%	0,32 %	0,6420	0,6656
tot_RBT_T	-	-	-	-	-	-

Table 3-38: Main results for the nine series, Denmark.

Denmark	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	11	-5,83 %	28,53%	-7,64 %	0,5136	0,1870
tot_AAR_F	11	-5,12 %	27,82%	-7,14 %	0,5552	0,2668
pre_AAR_C	11	0,79 %	5,60%	0,24 %	0,6487	0,6389
pre_AAR_F	11	0,57 %	5,67%	0,98 %	0,7476	0,6389
pos_AAR_C	11	-6,04 %	30,60%	-4,87 %	0,5274	0,2118
pos_AAR_F	11	-5,14 %	29,98%	-3,88 %	0,5820	0,2385
eve_EAR_C	9	-0,71 %	3,11%	-0,46 %	0,5137	0,1302
eve_EAR_F	9	-0,67 %	3,30%	-0,74 %	0,5620	0,1871
tot_RBT_T	-	-	-	-	-	-

Table 3-39: Main results for the nine series, Finland.

Finland	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	15	-8,36 % *	17,91%	-10,33 % *	0,0922	0,0778
tot_AAR_F	15	-7,99 %	18,60%	-10,57 % *	0,1184	0,0864
pre_AAR_C	15	-3,74 %	9,06%	-2,15 % *	0,1322	0,0559
pre_AAR_F	15	-3,28 %	9,17%	-0,52 % *	0,1880	0,0778
pos_AAR_C	14	-4,9 %	12,70%	-7,78 % *	0,1725	0,0991
pos_AAR_F	14	-5,2 %	12,99%	-7,79 % *	0,1579	0,0789
eve_EAR_C	13	-0,05 %	1,47%	-0,34 %	0,9066	0,3248
eve_EAR_F	12	0,18 %	1,32%	0,09 %	0,6464	0,7349
tot_RBT_T	-	-	-	-	-	-

Table 3-40: Main results for the nine series, France.

France	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	45	-1,67 %	21,55%	0,44 %	0,6065	0,3319
tot_AAR_F	45	-8 %	37,52%	-1,56 % *	0,1595	0,0943
pre_AAR_C	45	2,47 % ***	5,04%	2,32 %	0,0020	0,9997
pre_AAR_F	45	1,93 % **	4,99%	1,73 %	0,0126	0,9964
pos_AAR_C	45	-2,5 %	19,64%	1,99 %	0,3975	0,3360
pos_AAR_F	45	-8,43 %	36,99%	0,94 %	0,1334	0,1214
eve_EAR_C	41	-1,79 % **	4,79%	-0,8 % **	0,0213	0,0288
eve_EAR_F	42	-1,61 % **	4,32%	-0,91 % **	0,0201	0,0176
tot_RBT_T	19	-0,03 %	0,13%	-0,03 % *	0,2658	0,0989

Table 3-41: Main results for the nine series, Germany.

Germany	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	40	1,24 %	25,09%	1,55 %	0,7562	0,5851
tot_AAR_F	40	0,02 %	25,59%	1,13 %	0,9952	0,4465
pre_AAR_C	39	0,87 %	6,83%	0,65 %	0,4291	0,7529
pre_AAR_F	39	0,65 %	6,73%	-0,18 %	0,5494	0,6468
pos_AAR_C	40	0,48 %	20,79%	1,88 %	0,8856	0,4946
pos_AAR_F	40	-0,6 %	21,50%	-1,94 %	0,8619	0,2726
eve_EAR_C	37	-0,1 %	2,82%	-0,05 %	0,8384	0,5150
eve_EAR_F	37	-0,02 %	2,90%	0,04 %	0,9723	0,5450
tot_RBT_T	10	-0,23 % ***	0,10%	-0,21 % ***	0,0001	0,0035

Table 3-42: Main results for the nine series, Greece.

Greece	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	14	6,86 %	18,78%	4,14 %	0,1950	0,8016
tot_AAR_F	14	6,75 %	18,70%	3,89 %	0,1995	0,8187
pre_AAR_C	14	0,68 %	4,13%	1,18 %	0,5484	0,7837
pre_AAR_F	14	0,71 %	3,99%	1,12 %	0,5175	0,8347
pos_AAR_C	14	5,5 %	17,64%	1,59 %	0,2643	0,7837
pos_AAR_F	14	5,34 %	17,69%	1 %	0,2792	0,8016
eve_EAR_C	14	0,68 %	1,96%	0,12 %	0,2197	0,7648
eve_EAR_F	14	0,7 %	1,91%	0,11 %	0,1918	0,8187
tot_RBT_T	-	-	-	-	-	-

Table 3-43: Main results for the nine series, Italy.

Italy	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	21	-5,48 %	20,21%	-9,2 % *	0,2285	0,0653
tot_AAR_F	21	-6,48 %	20,16%	-9,07 % **	0,1561	0,0396
pre_AAR_C	21	-0,94 %	3,12%	-1,06 % *	0,1819	0,0849
pre_AAR_F	21	-0,95 %	2,85%	-1,31 % *	0,1402	0,0653
pos_AAR_C	21	-4,09 %	18,47%	-6,12 % *	0,3228	0,0849
pos_AAR_F	21	-4,97 %	18,99%	-3,07 % *	0,2442	0,0530
eve_EAR_C	19	-0,5 %	1,66%	-0,12 % *	0,2095	0,0989
eve_EAR_F	19	-0,62 %	1,57%	-0,73 % *	0,1036	0,0583
tot_RBT_T	5	112,76 %	225,50%	0,04 %	0,3261	0,8274

Table 3-44: Main results for the nine series, Portugal.

Portugal	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	12	3,4 %	13,47%	2,29 %	0,4010	0,8267
tot_AAR_F	12	3,66 %	13,63%	2,8 %	0,3721	0,8640
pre_AAR_C	12	0,49 %	3,63%	-0,98 %	0,6488	0,5313
pre_AAR_F	12	0,79 %	3,79%	-0,38 %	0,4864	0,6232
pos_AAR_C	12	3,11 %	12,10%	2,44 %	0,3918	0,8059
pos_AAR_F	12	3,02 %	12,09%	1,74 %	0,4056	0,8059
eve_EAR_C	11	-0,23 %	1,79%	-0,08 %	0,6847	0,3611
eve_EAR_F	11	-0,16 %	1,79%	0,04 %	0,7732	0,5354
tot_RBT_T	5	-0,03 %	0,08%	-0,05 %	0,4771	0,2501

Table 3-45: Main results for the nine series, Spain.

Spain	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	10	-17,48 % *	24,83%	-7,73 % **	0,0531	0,0463
tot_AAR_F	10	-14,42 % *	22,75%	-14,05 % **	0,0760	0,0372
pre_AAR_C	10	-1,07 %	4,13%	-0,7 %	0,4334	0,2223
pre_AAR_F	10	-0,9 %	4,06%	-1,03 %	0,5029	0,1931
pos_AAR_C	10	-15,16 % **	20,54%	-7,25 % *	0,0445	0,0571
pos_AAR_F	10	-12,53 % *	18,80%	-11,79 % **	0,0644	0,0463
eve_EAR_C	9	-1,39 %	2,25%	-0,5 % **	0,1002	0,0332
eve_EAR_F	9	-1,11 %	2,07%	-0,66 % *	0,1450	0,0549
tot_RBT_T	0	0 % ***	0,00%	0 % ***	0,0000	0,0000

Table 3-46: Main results for the nine series, Sweden.

Sweden	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	15	12,86 %	48,87%	12,29 %	0,3256	0,7698
tot_AAR_F	15	12,48 %	49,52%	8,71 %	0,3455	0,8029
pre_AAR_C	15	-5,16 %	11,87%	-4,82 % *	0,1143	0,0626
pre_AAR_F	15	-4,45 %	10,81%	-4,89 % *	0,1334	0,0778
pos_AAR_C	15	17,42 %	45,49%	11,09 %	0,1603	0,8720
pos_AAR_F	15	16,19 %	45,06%	11,47 %	0,1858	0,8029
eve_EAR_C	15	0,6 %	5,17%	-0,77 %	0,6601	0,4324
eve_EAR_F	15	0,75 %	5,21%	-0,22 %	0,5885	0,3882
tot_RBT_T	5	0,63 % ***	0,17%	0,72 %	0,0012	0,9784

Table 3-47: Main results for the nine series, Switzerland.

Switzerland	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	44	10,78 % ***	23,68%	7,78 %	0,0042	0,9976
tot_AAR_F	44	7,36 % **	21,65%	7,16 %	0,0294	0,9743
pre_AAR_C	44	3,66 % ***	7,00%	4,25 %	0,0012	0,9992
pre_AAR_F	44	2,97 % ***	5,93%	3,81 %	0,0018	0,9980
pos_AAR_C	44	6,96 % **	20,43%	7,6 %	0,0289	0,9859
pos_AAR_F	44	4,41 %	20,78%	7,19 %	0,1663	0,9339
eve_EAR_C	40	0,18 %	3,04%	0,34 %	0,7084	0,6762
eve_EAR_F	40	-0,03 %	2,50%	0,31 %	0,9471	0,5956
tot_RBT_T	38	0,08 % *	0,26%	0,05 %	0,0521	0,9124

Table 3-48: Main results for the nine series, United Kingdom.

United Kingdom	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	176	-0,29 %	28,96%	-0,92 %	0,8952	0,3450
tot_AAR_F	176	-1 %	36,09%	1,07 %	0,7132	0,3681
pre_AAR_C	176	0,53 %	7,58%	0,06 %	0,3556	0,7896
pre_AAR_F	176	-0,2 %	18,74%	0,07 %	0,8876	0,5865
pos_AAR_C	176	-0,87 %	25,08%	-0,16 %	0,6442	0,2788
pos_AAR_F	176	-0,83 %	25,71%	0,44 %	0,6695	0,3283
eve_EAR_C	166	0,06 %	2,38%	-0,1 %	0,7436	0,5814
eve_EAR_F	166	0,03 %	2,20%	-0,14 %	0,8698	0,4186
tot_RBT_T	82	-7,2 %	116,14%	-0,08 % ***	0,5762	0,0004

Table 3-49: Main results for the nine series, event E01.

E01	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	125	-0,24 %	36,87%	-3,82 %	0,9433	0,2113
tot_AAR_F	125	-0,32 %	37,08%	-3,43 %	0,9237	0,2371
pre_AAR_C	120	-1,13 %	8,42%	-0,91 % *	0,1432	0,0599
pre_AAR_F	120	-0,92 %	7,85%	-0,75 % *	0,2016	0,0631
pos_AAR_C	123	0,77 %	33,52%	-3,43 %	0,8006	0,3647
pos_AAR_F	123	0,54 %	34,03%	-3,41 %	0,8608	0,3194
eve_EAR_C	103	0,12 %	8,36%	-0,18 %	0,8839	0,1846
eve_EAR_F	103	0,04 %	8,13%	-0,5 % *	0,9582	0,0935
tot_RBT_T	33	0,22 %	1,16%	-0,03 %	0,2871	0,6692

Table 3-50: Main results for the nine series, E03.

E03	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	20	0,72 %	26,91%	-0,16 %	0,9061	0,5298
tot_AAR_F	20	-0,13 %	24,57%	-0,44 %	0,9810	0,5149
pre_AAR_C	20	-0,48 %	10,30%	0,84 %	0,8373	0,5740
pre_AAR_F	20	-1,12 %	9,64%	-0,08 %	0,6098	0,4554
pos_AAR_C	20	1,36 %	20,62%	1,55 %	0,7719	0,5740
pos_AAR_F	20	0,93 %	19,13%	0,12 %	0,8303	0,5740
eve_EAR_C	17	-0,18 %	3,20%	0,01 %	0,8158	0,4529
eve_EAR_F	16	0,07 %	3,14%	0,03 %	0,9286	0,5819
tot_RBT_T	5	-0,06 %	0,32%	-0,13 %	0,6842	0,2501

Table 3-51: Main results for the nine series, E05.

E05	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	56	4,26 %	37,56%	-0,95 %	0,3997	0,5455
tot_AAR_F	56	4,36 %	37,44%	-0,57 %	0,3874	0,5519
pre_AAR_C	51	-0,85 %	6,59%	-1,2 % *	0,3620	0,0758
pre_AAR_F	51	-0,96 %	7,06%	-1 % *	0,3366	0,0813
pos_AAR_C	56	5,61 %	33,25%	2,17 %	0,2122	0,7534
pos_AAR_F	56	5,54 %	33,04%	1,6 %	0,2147	0,7403
eve_EAR_C	42	-0,77 %	4,73%	-0,79 % **	0,2983	0,0395
eve_EAR_F	42	-0,41 %	4,85%	-0,23 %	0,5832	0,1289
tot_RBT_T	23	11,73 %	55,41%	-0,02 %	0,3211	0,3805

Table 3-52: Main results for the nine series, event E09.

E09	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	36	-13 % **	31,80%	-11,45 % ***	0,0193	0,0052
tot_AAR_F	36	-12,99 % **	31,54%	-12,63 % ***	0,0185	0,0065
pre_AAR_C	34	-5,63 % ***	10,87%	-3,81 % ***	0,0048	0,0029
pre_AAR_F	34	-5,35 % ***	11,09%	-4,73 % ***	0,0082	0,0035
pos_AAR_C	36	-8,27 % *	28,06%	-10,81 % **	0,0858	0,0105
pos_AAR_F	36	-8,51 % *	27,87%	-11,28 % **	0,0756	0,0109
eve_EAR_C	29	0,73 %	4,82%	0,75 %	0,4208	0,7019
eve_EAR_F	30	0,68 %	4,62%	0,58 %	0,4235	0,7071
tot_RBT_T	5	-0,11 %	0,38%	-0,2 %	0,5484	0,1726

Table 3-53: Main results for the nine series, E10.

E10	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	55	-8,05 %	36,28%	-7,71 % *	0,1056	0,0796
tot_AAR_F	55	-7,96 %	36,32%	-7,67 % *	0,1098	0,0847
pre_AAR_C	55	-0,08 %	9,49%	0,57 %	0,9483	0,4467
pre_AAR_F	55	0,09 %	9,65%	0,6 %	0,9429	0,5167
pos_AAR_C	55	-8,54 % **	30,29%	-6,43 % **	0,0414	0,0333
pos_AAR_F	55	-8,6 % **	30,43%	-7,87 % **	0,0409	0,0365
eve_EAR_C	42	0,74 %	5,49%	0,76 %	0,3862	0,6012
eve_EAR_F	42	0,71 %	5,48%	0,86 %	0,4069	0,6392
tot_RBT_T	7	-0,06 %	0,20%	-0,05 %	0,4670	0,1184

Table 3-54: Main results for the nine series, E13.

E13	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	45	7,79 %	39,00%	-5,2 %	0,1871	0,6598
tot_AAR_F	45	12,31 % *	48,22%	-3,27 %	0,0938	0,7157
pre_AAR_C	44	0,01 %	8,89%	-1,01 %	0,9969	0,3458
pre_AAR_F	44	4,43 %	29,23%	-0,75 %	0,3208	0,4860
pos_AAR_C	45	7,03 %	31,42%	-2,11 %	0,1404	0,7869
pos_AAR_F	45	7,11 %	31,57%	-0,68 %	0,1379	0,7736
eve_EAR_C	42	0,81 %	8,01%	0,58 %	0,5173	0,7110
eve_EAR_F	42	0,94 %	7,52%	0,5 %	0,4243	0,6804
tot_RBT_T	-	-	-	-	-	-

Table 3-55: Main results for the nine series, event E19.

E19	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	849	-1,75 %	36,08%	-2,95 % ***	0,1570	0,0000
tot_AAR_F	849	-2,42 % **	33,70%	-3,33 % ***	0,0369	0,0000
pre_AAR_C	840	-0,45 %	12,20%	-0,78 % ***	0,2843	0,0000
pre_AAR_F	840	-0,61 %	12,61%	-0,75 % ***	0,1589	0,0000
pos_AAR_C	841	-1,16 %	31,28%	-2,12 % ***	0,2832	0,0003
pos_AAR_F	842	-1,29 %	29,63%	-1,91 % ***	0,2060	0,0004
eve_EAR_C	664	0,31 %	11,00%	-0,16 % **	0,4669	0,0323
eve_EAR_F	665	-0,16 %	4,03%	-0,16 % **	0,3016	0,0136
tot_RBT_T	453	-0,91 %	96,37%	-0,13 % ***	0,8408	0,0000

Table 3-56: Main results for the nine series, E20.

E20	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	925	-1,87 %	35,16%	-2,18 % ***	0,1068	0,0001
tot_AAR_F	925	-2 % *	35,28%	-2,71 % ***	0,0849	0,0001
pre_AAR_C	914	-0,75 % *	12,17%	-0,7 % ***	0,0628	0,0000
pre_AAR_F	914	-0,8 % **	12,21%	-0,77 % ***	0,0468	0,0000
pos_AAR_C	917	-0,69 %	31,76%	-1,43 % ***	0,5093	0,0039
pos_AAR_F	917	-0,75 %	31,83%	-1,2 % ***	0,4729	0,0039
eve_EAR_C	727	-0,09 %	4,28%	-0,18 % **	0,5807	0,0133
eve_EAR_F	728	-0,11 %	4,31%	-0,18 % **	0,4765	0,0227
tot_RBT_T	469	10,52 % **	113,70%	-0,12 % ***	0,0457	0,0000

Table 3-57: Main results for the nine series, E21.

E21	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	33	6,41 %	23,05%	1,5 %	0,1199	0,8213
tot_AAR_F	33	5,88 %	21,09%	1,31 %	0,1189	0,8641
pre_AAR_C	32	2,2 % *	6,11%	1,8 %	0,0501	0,9666
pre_AAR_F	32	1,92 % **	5,21%	2,09 %	0,0456	0,9783
pos_AAR_C	33	4,23 %	20,41%	1,19 %	0,2424	0,7654
pos_AAR_F	33	3,94 %	19,43%	3,03 %	0,2531	0,8020
eve_EAR_C	29	0,05 %	3,02%	-0,67 %	0,9312	0,4018
eve_EAR_F	29	0,1 %	2,83%	-0,48 %	0,8567	0,4356
tot_RBT_T	10	-0,06 %	0,20%	-0,14 %	0,3376	0,1423

Table 3-58: Main results for the nine series, event E22.

E22	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	36	-0,46 %	26,55%	-0,6 %	0,9178	0,5188
tot_AAR_F	36	-0,75 %	25,96%	0,4 %	0,8628	0,5063
pre_AAR_C	35	0,71 %	6,14%	0,51 %	0,4982	0,8451
pre_AAR_F	35	0,49 %	5,82%	1,53 %	0,6193	0,8331
pos_AAR_C	36	-1,27 %	23,69%	-1,89 %	0,7501	0,3472
pos_AAR_F	36	-1,26 %	23,28%	-0,43 %	0,7476	0,3076
eve_EAR_C	31	0,14 %	2,32%	0,1 %	0,7472	0,5312
eve_EAR_F	31	0,03 %	2,15%	-0,16 %	0,9385	0,5312
tot_RBT_T	13	56,32 %	195,47%	-0,08 %	0,3194	0,3248

Table 3-59: Main results for the nine series, E24.

E24	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	29	4,85 %	19,97%	6,27 %	0,2012	0,9248
tot_AAR_F	29	3,87 %	20,99%	5,09 %	0,3295	0,8849
pre_AAR_C	29	1,63 %	6,39%	1,02 %	0,1801	0,8763
pre_AAR_F	29	1,78 %	6,04%	1,55 %	0,1234	0,9307
pos_AAR_C	29	2,85 %	18,97%	2,05 %	0,4246	0,8719
pos_AAR_F	29	1,72 %	20,66%	2,17 %	0,6571	0,8152
eve_EAR_C	27	0,4 %	2,37%	0,31 %	0,3933	0,6846
eve_EAR_F	27	0,39 %	2,30%	-0,03 %	0,3855	0,6317
tot_RBT_T	9	0,04 %	0,14%	-0,03 %	0,3993	0,7427

Table 3-60: Main results for the nine series, E27.

E27	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	677	-0,21 %	40,78%	-2,17 % **	0,8929	0,0293
tot_AAR_F	677	-1,17 %	43,46%	-1,07 % **	0,4826	0,0258
pre_AAR_C	658	-0,36 %	10,21%	-0,67 % ***	0,3639	0,0042
pre_AAR_F	658	-1,11 %	19,27%	-0,75 % ***	0,1387	0,0027
pos_AAR_C	665	0,38 %	36,59%	-1,03 % *	0,7891	0,0793
pos_AAR_F	665	0,26 %	36,06%	-1,1 %	0,8521	0,1190
eve_EAR_C	520	-0,28 %	5,32%	-0,3 % **	0,2275	0,0283
eve_EAR_F	521	-0,43 %	7,04%	-0,37 % **	0,1634	0,0238
tot_RBT_T	185	-0,27 %	120,58%	0,04 %	0,9757	0,7817

Table 3-61: Main results for the nine series, event E41.

E41	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	78	-0,13 %	34,40%	-2,01 %	0,9744	0,1371
tot_AAR_F	78	-6,12 %	35,50%	-1,6 % **	0,1320	0,0287
pre_AAR_C	78	0,01 %	6,38%	-0,49 %	0,9837	0,4436
pre_AAR_F	78	-0,14 %	6,23%	-0,26 %	0,8408	0,3297
pos_AAR_C	75	0,16 %	31,92%	-3,15 %	0,9660	0,1541
pos_AAR_F	75	-5,94 %	33,72%	-1,91 % **	0,1311	0,0398
eve_EAR_C	65	-0,35 %	3,99%	0,1 %	0,4817	0,2994
eve_EAR_F	65	-0,31 %	3,76%	-0,15 %	0,5053	0,2641
tot_RBT_T	28	0,01 %	0,27%	0,01 %	0,7743	0,4188

Table 3-62: Main results for the nine series, E42.

E42	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	87	-0,64 %	38,33%	-3,5 %	0,8769	0,1393
tot_AAR_F	87	0,59 %	38,41%	-0,05 %	0,8865	0,2600
pre_AAR_C	87	0,69 %	11,99%	-0,75 %	0,5906	0,2465
pre_AAR_F	87	0,44 %	11,48%	-0,65 %	0,7229	0,1347
pos_AAR_C	86	-1,03 %	28,34%	-3,21 %	0,7379	0,1712
pos_AAR_F	86	0,58 %	29,25%	-0,89 %	0,8546	0,3420
eve_EAR_C	71	-0,39 %	4,17%	-0,22 %	0,4336	0,2129
eve_EAR_F	73	-0,5 %	4,15%	-0,36 %	0,3040	0,1096
tot_RBT_T	22	0,02 %	0,21%	0 %	0,6566	0,5581

Table 3-63: Main results for the nine series, E44.

E44	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	84	-2,61 %	34,32%	-5,55 % ***	0,4874	0,0075
tot_AAR_F	84	-2,5 %	34,33%	-4,09 % **	0,5065	0,0136
pre_AAR_C	82	-0,74 %	7,07%	-0,73 %	0,3479	0,2333
pre_AAR_F	82	-0,82 %	6,36%	-0,5 %	0,2462	0,1507
pos_AAR_C	84	-1,6 %	30,31%	-4,24 % **	0,6293	0,0153
pos_AAR_F	84	-1,39 %	30,72%	-3,29 % **	0,6790	0,0265
eve_EAR_C	73	-0,33 %	3,67%	-0,04 %	0,4403	0,3991
eve_EAR_F	73	-0,35 %	3,55%	-0,08 %	0,3991	0,3075
tot_RBT_T	30	18,59 %	100,03%	-0,04 %	0,3171	0,4713

Table 3-64: Main results for the nine series, event E56.

E56	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	51	9,02 %	38,90%	7,14 %	0,1041	0,9242
tot_AAR_F	51	9,18 %	39,62%	6,81 %	0,1041	0,9229
pre_AAR_C	51	1,42 %	8,39%	0,71 %	0,2312	0,7590
pre_AAR_F	51	1,56 %	8,33%	0,59 %	0,1862	0,8487
pos_AAR_C	50	7,53 %	33,77%	4,49 %	0,1214	0,9155
pos_AAR_F	50	7,48 %	34,27%	3,59 %	0,1290	0,8890
eve_EAR_C	45	0,24 %	7,44%	0,14 %	0,8284	0,6762
eve_EAR_F	45	0,32 %	7,19%	0,17 %	0,7653	0,7418
tot_RBT_T	14	45,78 %	165,05%	0 %	0,3183	0,6811

Table 3-65: Main results for the nine series, E59.

E59	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	22	10,37 %	54,40%	2,87 %	0,3812	0,5836
tot_AAR_F	22	0,39 %	24,68%	4,97 %	0,9413	0,4548
pre_AAR_C	23	0,99 %	7,80%	2,77 %	0,5493	0,8192
pre_AAR_F	23	1,08 %	7,55%	1,12 %	0,4992	0,8028
pos_AAR_C	20	10,21 %	54,66%	-2,03 %	0,4138	0,3969
pos_AAR_F	20	-1,03 %	21,18%	-1,89 %	0,8301	0,3271
eve_EAR_C	16	0,45 %	3,05%	-0,1 %	0,5614	0,6413
eve_EAR_F	16	0,58 %	3,24%	-0,63 %	0,4874	0,7153
tot_RBT_T	10	-84,2 %	252,63%	-0,05 %	0,3194	0,2223

Table 3-66: Main results for the nine series, E61.

E61	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	18	-8,22 % *	16,94%	-9,72 % **	0,0550	0,0427
tot_AAR_F	18	-8,22 % *	18,17%	-10,28 % **	0,0719	0,0427
pre_AAR_C	18	-0,2 %	3,86%	0,6 %	0,8256	0,5433
pre_AAR_F	18	-0,65 %	4,66%	1,09 %	0,5603	0,5947
pos_AAR_C	18	-7,06 % **	13,56%	-8,38 % **	0,0412	0,0389
pos_AAR_F	18	-6,49 % *	13,62%	-7,6 % **	0,0591	0,0427
eve_EAR_C	18	-0,96 %	2,51%	-0,1 %	0,1219	0,1334
eve_EAR_F	18	-1,07 % *	2,53%	-0,35 % *	0,0907	0,0785
tot_RBT_T	13	-11,06 %	37,82%	-0,1 % ***	0,3124	0,0012

Table 3-67: Main results for the nine series, event E62.

E62	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	81	5,79 %	44,85%	4,03 %	0,2488	0,8049
tot_AAR_F	81	3,29 %	39,69%	2,21 %	0,4576	0,7367
pre_AAR_C	80	2,7 %	22,24%	1,4 %	0,2810	0,8239
pre_AAR_F	80	0,16 %	7,39%	0,14 %	0,8492	0,6040
pos_AAR_C	81	2,86 %	34,06%	0,22 %	0,4525	0,7099
pos_AAR_F	81	2,75 %	34,20%	0,59 %	0,4708	0,6836
eve_EAR_C	69	0,31 %	4,41%	-0,41 %	0,5574	0,4043
eve_EAR_F	70	0,44 %	4,38%	-0,11 %	0,4012	0,5639
tot_RBT_T	20	32,59 %	142,41%	-0,07 %	0,3190	0,1395

Table 3-68: Main results for the nine series, E64.

E64	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	12	-6,1 %	16,20%	-8,68 %	0,2188	0,1047
tot_AAR_F	12	-5,73 %	16,67%	-8,74 %	0,2592	0,1733
pre_AAR_C	11	-1,4 %	3,26%	-1,93 % *	0,1847	0,0548
pre_AAR_F	11	-1,43 %	3,66%	-1,84 % *	0,2247	0,0774
pos_AAR_C	12	-4,67 %	12,30%	-5,1 % *	0,2151	0,0790
pos_AAR_F	12	-4,31 %	12,81%	-5,01 % *	0,2688	0,0912
eve_EAR_C	10	-0,17 %	3,32%	-0,66 %	0,8719	0,2875
eve_EAR_F	10	-0,13 %	3,24%	-0,43 %	0,9001	0,2538
tot_RBT_T	5	-0,12 %	0,21%	-0,18 %	0,2740	0,1125

Table 3-69: Main results for the nine series, E65.

E65	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	23	1,88 %	36,55%	0,3 %	0,8075	0,6974
tot_AAR_F	23	1,67 %	36,98%	1,23 %	0,8304	0,6974
pre_AAR_C	23	1,24 %	13,95%	0,18 %	0,6729	0,4516
pre_AAR_F	23	0,99 %	13,77%	-0,24 %	0,7330	0,3241
pos_AAR_C	23	1,37 %	29,83%	1,73 %	0,8276	0,6759
pos_AAR_F	23	1,37 %	30,29%	-1,99 %	0,8302	0,6310
eve_EAR_C	21	-0,81 %	6,75%	0,54 %	0,5897	0,4242
eve_EAR_F	21	-0,76 %	6,80%	-0,17 %	0,6152	0,3972
tot_RBT_T	5	0,02 %	0,34%	-0,06 %	0,8886	0,3429

Table 3-70: Main results for the nine series, event E66.

E66	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	882	1,1 %	32,55%	-0,14 %	0,3171	0,6823
tot_AAR_F	882	1,13 %	30,88%	-0,44 %	0,2757	0,5232
pre_AAR_C	880	-0,46 %	12,87%	-0,2 %	0,2868	0,1683
pre_AAR_F	880	0,2 %	15,22%	-0,28 %	0,7010	0,1113
pos_AAR_C	879	1,71 % *	27,31%	0,51 %	0,0642	0,7845
pos_AAR_F	880	1,17 %	25,52%	0,23 %	0,1740	0,6589
eve_EAR_C	850	-0,15 %	4,88%	-0,14 % **	0,3637	0,0191
eve_EAR_F	847	0,13 %	6,58%	-0,19 % ***	0,5698	0,0058
tot_RBT_T	510	5,34 %	129,89%	-0,09 % ***	0,3539	0,0000

Table 3-71: Main results for the nine series, E69.

E69	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	213	0,01 %	39,29%	-1,97 %	0,9965	0,1162
tot_AAR_F	213	-1,48 %	42,51%	-2,23 % *	0,6124	0,0849
pre_AAR_C	206	-0,26 %	10,88%	-0,34 %	0,7311	0,1711
pre_AAR_F	206	-0,55 %	11,10%	-0,31 % *	0,4785	0,0751
pos_AAR_C	208	-0,04 %	34,94%	-1,07 %	0,9880	0,2021
pos_AAR_F	208	-1,32 %	38,97%	-1,85 %	0,6248	0,1441
eve_EAR_C	170	0,41 %	6,12%	-0,12 %	0,3777	0,4588
eve_EAR_F	170	0,46 %	5,96%	-0,06 %	0,3121	0,4373
tot_RBT_T	70	0,06 %	0,92%	-0,04 %	0,5984	0,4086

Table 3-72: Main results for the nine series, E73.

E73	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	31	-20,86 % ***	41,97%	-4,43 % **	0,0096	0,0134
tot_AAR_F	31	-22,2 % ***	42,28%	-10,18 % ***	0,0065	0,0051
pre_AAR_C	30	-0,91 %	9,84%	0,8 %	0,6155	0,5369
pre_AAR_F	30	-1,07 %	9,81%	-0,26 %	0,5539	0,4387
pos_AAR_C	31	-18,84 % ***	33,29%	-9,39 % ***	0,0037	0,0029
pos_AAR_F	31	-19,85 % ***	33,32%	-13,78 % ***	0,0024	0,0020
eve_EAR_C	24	-1,46 %	5,00%	-0,16 %	0,1651	0,2464
eve_EAR_F	24	-1,7 %	5,50%	-0,26 %	0,1446	0,2202
tot_RBT_T	9	0,17 %	0,60%	0,02 %	0,4246	0,7427

Table 3-73: Main results for the nine series, event E74.

E74	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	27	10,02 %	57,76%	2,72 %	0,3756	0,7179
tot_AAR_F	27	10,2 %	57,97%	3,03 %	0,3692	0,7097
pre_AAR_C	26	-1,63 %	8,32%	0,25 %	0,3279	0,3851
pre_AAR_F	26	-1,82 %	7,90%	0,21 %	0,2515	0,4047
pos_AAR_C	27	11,95 %	53,75%	4,91 %	0,2583	0,7260
pos_AAR_F	27	12,29 %	54,16%	4,82 %	0,2489	0,7260
eve_EAR_C	21	-0,47 %	7,44%	0,06 %	0,7749	0,5208
eve_EAR_F	21	-0,45 %	7,21%	-0,01 %	0,7800	0,4792
tot_RBT_T	6	0,36 %	0,68%	0,07 %	0,2547	0,7685

Table 3-74: Main results for the nine series, E82.

E82	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	191	-1,24 %	46,93%	0,78 %	0,7161	0,3798
tot_AAR_F	191	-2,72 %	43,42%	0,18 %	0,3870	0,2879
pre_AAR_C	190	0,71 %	20,18%	0,18 %	0,6275	0,2930
pre_AAR_F	190	-0,44 %	10,14%	0,08 %	0,5487	0,3240
pos_AAR_C	188	-2,02 %	37,13%	0,95 %	0,4558	0,2806
pos_AAR_F	188	-2,35 %	37,15%	0,66 %	0,3870	0,2255
eve_EAR_C	160	0,06 %	5,02%	0,29 %	0,8870	0,6518
eve_EAR_F	159	0,03 %	5,07%	0,31 %	0,9338	0,6544
tot_RBT_T	33	-0,01 %	0,37%	-0,08 %	0,8345	0,2868

Table 3-75: Main results for the nine series, E83.

E83	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	261	0,41 %	24,14%	0,39 %	0,7819	0,6233
tot_AAR_F	261	1,36 %	27,77%	0,72 %	0,4303	0,6912
pre_AAR_C	260	-1,18 % ***	5,94%	-0,64 % ***	0,0015	0,0025
pre_AAR_F	260	-1,2 % ***	6,12%	-0,76 % ***	0,0018	0,0020
pos_AAR_C	260	1,58 %	20,48%	1,07 %	0,2142	0,8948
pos_AAR_F	260	2,57 % *	24,48%	1,35 %	0,0918	0,9242
eve_EAR_C	210	0,02 %	3,14%	-0,07 %	0,9315	0,4096
eve_EAR_F	209	-0,01 %	3,17%	-0,16 %	0,9674	0,3550
tot_RBT_T	154	-6,47 % *	44,32%	-0,15 % ***	0,0722	0,0000

Table 3-76: Main results for the nine series, event E84.

E84	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	161	2,7 %	38,03%	4,01 %	0,3683	0,7574
tot_AAR_F	161	0,51 %	33,11%	3,23 %	0,8457	0,6132
pre_AAR_C	158	2,73 %	22,04%	1,01 %	0,1219	0,9656
pre_AAR_F	158	1,03 %	11,44%	0,68 %	0,2592	0,9331
pos_AAR_C	160	-0,19 %	28,33%	1,66 %	0,9311	0,4939
pos_AAR_F	160	-0,7 %	28,50%	2,56 %	0,7566	0,4124
eve_EAR_C	135	0,26 %	5,62%	0,3 %	0,5883	0,7637
eve_EAR_F	134	0,23 %	5,65%	0,28 %	0,6366	0,7719
tot_RBT_T	31	0,04 %	0,38%	-0,06 %	0,6028	0,5930

Table 3-77: Main results for the nine series, E90.

E90	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	68	-6,94 %	34,37%	-7,74 % **	0,1003	0,0162
tot_AAR_F	68	-7,28 % *	34,51%	-5,78 % ***	0,0864	0,0093
pre_AAR_C	68	-1,21 %	12,95%	-0,46 %	0,4438	0,3753
pre_AAR_F	68	-1,05 %	12,80%	-0,23 %	0,5020	0,3777
pos_AAR_C	66	-5,22 %	27,92%	-7,93 % **	0,1339	0,0191
pos_AAR_F	66	-5,58 %	27,83%	-6,45 % **	0,1084	0,0148
eve_EAR_C	57	-0,8 %	5,07%	-0,41 % *	0,2364	0,0565
eve_EAR_F	57	-0,98 %	5,07%	-0,59 % **	0,1490	0,0155
tot_RBT_T	40	0,25 %	2,15%	-0,04 % *	0,4631	0,0752

Table 3-78: Main results for the nine series, Academic sector.

Academic	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	26	-15,3 % ***	21,78%	-9,51 % ***	0,0014	0,0007
tot_AAR_F	26	-15,74 % ***	22,87%	-9,74 % ***	0,0017	0,0009
pre_AAR_C	26	-3,09 % ***	4,52%	-2,54 % ***	0,0018	0,0017
pre_AAR_F	26	-3,47 % ***	4,81%	-2,57 % ***	0,0011	0,0013
pos_AAR_C	26	-11,46 % ***	19,54%	-6,43 % ***	0,0062	0,0066
pos_AAR_F	26	-11,35 % ***	20,38%	-5,7 % ***	0,0088	0,0062
eve_EAR_C	24	-0,82 %	2,63%	-0,03 %	0,1414	0,2202
eve_EAR_F	24	-0,99 %	2,88%	-0,1 %	0,1073	0,1879
tot_RBT_T	12	-0,46 % ***	0,31%	-0,33 % ***	0,0004	0,0011

Table 3-79: Main results for the nine series, Materials sector.

Materials	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	943	-1,16 %	40,52%	-3,76 % ***	0,3803	0,0000
tot_AAR_F	943	-2,85 % **	41,27%	-3,43 % ***	0,0344	0,0000
pre_AAR_C	913	0,2 %	13,29%	-0,53 % ***	0,6477	0,0049
pre_AAR_F	913	-0,84 %	17,75%	-0,7 % ***	0,1523	0,0005
pos_AAR_C	928	-0,87 %	34,94%	-3,15 % ***	0,4482	0,0002
pos_AAR_F	928	-1,6 %	34,53%	-3,33 % ***	0,1584	0,0001
eve_EAR_C	724	-0,64 % ***	5,85%	-0,51 % ***	0,0034	0,0000
eve_EAR_F	724	-0,59 % ***	5,77%	-0,53 % ***	0,0061	0,0000
tot_RBT_T	309	-1,89 %	79,21%	-0,06 % *	0,6756	0,0803

Table 3-80: Main results for the nine series, Cyclical sector.

Cyclical	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	754	-4,12 % ***	35,92%	-3,64 % ***	0,0017	0,0000
tot_AAR_F	754	-4,53 % ***	36,73%	-3,42 % ***	0,0007	0,0000
pre_AAR_C	738	-1,22 % ***	9,66%	-0,83 % ***	0,0006	0,0000
pre_AAR_F	738	-1,53 % ***	11,36%	-0,77 % ***	0,0003	0,0001
pos_AAR_C	748	-2,8 % **	30,91%	-2,41 % ***	0,0133	0,0001
pos_AAR_F	748	-2,91 % **	31,11%	-2,46 % ***	0,0108	0,0001
eve_EAR_C	577	-0,18 %	4,43%	-0,32 % ***	0,3335	0,0077
eve_EAR_F	577	-0,2 %	4,52%	-0,34 % ***	0,3001	0,0082
tot_RBT_T	335	6,4 %	99,16%	-0,18 % ***	0,2380	0,0000

Table 3-81: Main results for the nine series, non-Cyclicals sector.

Non-Cyclicals	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	232	0,46 %	36,82%	1,19 %	0,8478	0,2523
tot_AAR_F	232	0,25 %	38,42%	0,81 %	0,9208	0,2294
pre_AAR_C	226	-0,19 %	8,88%	-0,19 %	0,7504	0,2132
pre_AAR_F	226	2,42 %	27,62%	-0,31 %	0,1899	0,2615
pos_AAR_C	228	1,01 %	34,57%	1,1 %	0,6595	0,4796
pos_AAR_F	228	-1,77 %	24,09%	0,85 %	0,2680	0,3237
eve_EAR_C	191	-0,42 % *	3,19%	-0,08 %	0,0713	0,1777
eve_EAR_F	192	-0,44 % *	3,35%	-0,16 %	0,0726	0,1464
tot_RBT_T	107	15,7 % *	94,70%	-0,14 % ***	0,0893	0,0000

Table 3-82: Main results for the nine series, Energy sector.

Energy	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	427	4,1 % *	46,01%	0,42 %	0,0663	0,7070
tot_AAR_F	427	4,29 % **	43,33%	0,1 %	0,0416	0,7119
pre_AAR_C	428	-0,25 %	16,76%	-0,28 %	0,7533	0,1484
pre_AAR_F	428	-0,29 %	9,77%	-0,25 %	0,5397	0,1254
pos_AAR_C	420	4,31 % **	39,22%	0,55 %	0,0248	0,8183
pos_AAR_F	420	4,29 % **	39,33%	-0,16 %	0,0259	0,7793
eve_EAR_C	375	0,18 %	7,80%	-0,02 %	0,6609	0,4365
eve_EAR_F	376	0,45 %	5,82%	-0,1 %	0,1372	0,3745
tot_RBT_T	153	12,63 %	149,14%	-0,04 %	0,2965	0,1767

Table 3-83: Main results for the nine series, Financials sector.

Financials	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	467	1,48 %	23,55%	0,59 %	0,1748	0,7834
tot_AAR_F	467	1,45 %	24,37%	0,27 %	0,1984	0,5279
pre_AAR_C	464	0,23 %	5,90%	0,02 %	0,3994	0,5207
pre_AAR_F	464	0,4 %	10,40%	-0,17 %	0,4129	0,2265
pos_AAR_C	464	1,06 %	20,78%	0,15 %	0,2703	0,7393
pos_AAR_F	465	1,15 %	19,40%	0,3 %	0,2007	0,6133
eve_EAR_C	415	0,22 %	3,19%	0,14 %	0,1658	0,8973
eve_EAR_F	416	-0,1 %	5,93%	0,04 %	0,7324	0,7842
tot_RBT_T	215	4,5 %	82,71%	-0,04 % ***	0,4264	0,0014

Table 3-84: Main results for the nine series, Healthcare sector.

Healthcare	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	328	-1,22 %	38,24%	-1,49 %	0,5626	0,3273
tot_AAR_F	328	-0,65 %	35,77%	-2,06 %	0,7408	0,2952
pre_AAR_C	321	-1,71 % **	14,02%	-0,95 % ***	0,0295	0,0014
pre_AAR_F	321	-0,97 % **	8,15%	-0,8 % ***	0,0336	0,0031
pos_AAR_C	323	0,34 %	31,91%	-0,9 %	0,8475	0,5299
pos_AAR_F	323	0,24 %	32,08%	-0,22 %	0,8927	0,4933
eve_EAR_C	277	0,43 %	4,76%	0,07 %	0,1349	0,7733
eve_EAR_F	277	0,37 %	4,72%	-0,01 %	0,1981	0,7230
tot_RBT_T	140	7,6 %	64,16%	-0,1 % ***	0,1632	0,0000

Table 3-85: Main results for the nine series, Industrials sector.

Industrials	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	797	-0,37 %	31,47%	-0,37 %	0,7397	0,1283
tot_AAR_F	797	-0,21 %	34,05%	-0,08 %	0,8637	0,1572
pre_AAR_C	786	-0,9 % ***	7,33%	-0,64 % ***	0,0006	0,0004
pre_AAR_F	786	-0,78 % ***	7,69%	-0,66 % ***	0,0045	0,0003
pos_AAR_C	790	0,59 %	27,22%	-0,18 %	0,5448	0,4685
pos_AAR_F	790	0,64 %	29,80%	-0,21 %	0,5476	0,4888
eve_EAR_C	668	-0,07 %	4,05%	-0,17 % **	0,6376	0,0196
eve_EAR_F	665	-0,08 %	4,10%	-0,21 % **	0,6055	0,0145
tot_RBT_T	356	3,3 %	96,93%	-0,11 % ***	0,5209	0,0000

Table 3-86: Main results for the nine series, Real Estate sector.

Real Estate	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	631	1,67 %	33,07%	-0,23 %	0,2040	0,4767
tot_AAR_F	632	1,57 %	30,03%	-0,12 %	0,1900	0,5865
pre_AAR_C	629	0,9 %	14,46%	0,04 %	0,1192	0,7780
pre_AAR_F	629	0,42 %	10,42%	0,03 %	0,3182	0,5568
pos_AAR_C	631	0,3 %	26,39%	-0,59 %	0,7734	0,3567
pos_AAR_F	632	0,9 %	25,00%	-0,26 %	0,3641	0,6441
eve_EAR_C	555	0,53 %	11,69%	0,12 %	0,2814	0,7282
eve_EAR_F	555	0,29 %	7,65%	-0,02 %	0,3795	0,3580
tot_RBT_T	305	-1,79 %	129,68%	-0,07 % ***	0,8099	0,0000

Table 3-87: Main results for the nine series, Technology sector.

Technology	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	493	-2,14 %	40,90%	-4,77 % ***	0,2450	0,0011
tot_AAR_F	493	-3,75 % **	39,14%	-4,51 % ***	0,0339	0,0003
pre_AAR_C	494	-0,17 %	17,71%	-0,95 % ***	0,8342	0,0008
pre_AAR_F	494	-1,16 % ***	8,97%	-0,7 % ***	0,0042	0,0013
pos_AAR_C	489	-0,74 %	37,51%	-3,05 % ***	0,6647	0,0049
pos_AAR_F	489	-1,35 %	38,90%	-2,78 % ***	0,4439	0,0025
eve_EAR_C	412	-0,03 %	5,35%	-0,21 % *	0,9143	0,0939
eve_EAR_F	413	-0,04 %	5,31%	-0,23 %	0,8885	0,1054
tot_RBT_T	235	6,44 %	84,17%	-0,15 % ***	0,2423	0,0000

Table 3-88: Main results for the nine series, Utilities sector.

Utilities	Sample	Average	St. Dev.	Median	P-Value (t)	P-Value (W)
tot_AAR_C	155	1,63 %	25,23%	0,57 %	0,4222	0,6607
tot_AAR_F	154	-1,51 %	23,63%	-0,33 %	0,4276	0,3930
pre_AAR_C	155	-0,57 %	5,58%	-0,56 %	0,2087	0,1085
pre_AAR_F	155	0,03 %	28,13%	-0,75 % *	0,9896	0,0890
pos_AAR_C	154	2,11 %	23,32%	1,33 %	0,2624	0,7990
pos_AAR_F	154	0,4 %	14,04%	0,41 %	0,7262	0,5993
eve_EAR_C	141	0,11 %	2,67%	-0,06 %	0,6392	0,3839
eve_EAR_F	140	0,09 %	2,58%	-0,13 %	0,6669	0,2622
tot_RBT_T	81	-15,55 %	176,91%	-0,07 % ***	0,4311	0,0000

Chapter 4

On the relationship between ESG scores and market efficiency in equity issues

4.1. INTRODUCTION AND LITERATURE REVIEW

In times of uncertainty in the financial markets, a vital task for companies is not only to diversify their sources of financing, but also to try to perform as well as possible in the market. On the other hand, the climate emergency is becoming more and more patent, and its effects are beginning to have consequences on company performance as well, so sustainable behaviour is increasingly essential in companies, but is this type of procedures better valued in the financial markets? Do companies with more sustainable behaviour perform better in the financial markets?

The current literature argues that this relationship would exist. For example, **Lourenço et al. (2012)** suggests that sustainability can explain the price of companies in the markets, arguing that investors tend to penalize companies that could improve their commitment to sustainability but choose not to do so. The study conducted by **Maletic et al. (2015)** aims to explain this relationship in more depth, and they state that an improvement in the company's sustainability implies an improvement in innovation, which generates a better performance in the markets. More recently, in **Hardiningsih (2020)** the author argues that the publication, and especially good disclosure, of information related to sustainability significantly improves the performance of companies.

One way to measure a company's sustainability is through the ESG score, which grades from 0 (worst) to 100 (best) (or, in its qualitative equivalent, from D (worst) to A (best)) the firm's sustainability component based on several internal factors and policies. There is, in fact, literature that suggests that this score could have real effects on financial markets. For example, the work of **Cui and Docherty (2020)** highlights possible overreactions in financial markets because of changes in the ESG score. For its part, the study by **Cao et al. (2022)** points to the existence of positive biases in the markets' assessment of companies with high ESG scores. All this is also illustrated in **Bofinger et al. (2022)**, where the authors state that a good ESG is related to an overvaluation of the company by the markets. Finally, the article by **Wu et al. (2022)** stands out, where it is suggested that higher ESG improves market efficiency, and that this may be due to an increase in liquidity and the reduction of information asymmetries.

One of the processes in which companies test the confidence that markets have in them are equity offerings. In this sense, it would make sense to ask whether companies with a stronger sustainable component benefit from being treated more efficiently and more fairly when they are trying to raise finance directly in the market. Regarding to this, the work of **Henri and Koski (2010)** stands out, because they show that in some phases of these processes the number of short positions increases, and document situations in which this implies a reduction in market efficiency. In their work, **Liu et al. (2016)** stated that the market tends to react when such

processes are announced. Moreover, they argue that the magnitude of this reaction depends not only on the characteristics of the issuing company, but also on the issue itself. On the other hand, **Oh and Kim (2018)** show that equity offerings tend to be correlated with reductions in market efficiency. More recently, **Verdú et al. (2022)** demonstrated that in equity offerings that issue subscription rights, arbitrage opportunities can occur, and that there are factors that can increase or decrease the probability of these anomalies occurring.

With all this, the sustainability efforts of the companies can be considered as a relevant factor in the possibility of arbitrage opportunities in equity offerings. Specifically, a higher ESG rating is expected to reduce (or even become negative) the returns obtained from strategies created to exploit these anomalies, and to increase the fairness in the valuation of new shares. This is the hypothesis of this paper, which is going to be tested for a sample of processes from around the world, on which a set of statistical and econometric tests are going to be performed. As will be shown below, this paper is providing some evidence that firms with better ESG performances are benefiting from higher market efficiency.

4.2. DATA

4.2.1 Main variables

The data comes from the *Thomson Reuters Refinitiv* database, and consists of 440 observations corresponding to equity offerings made in 23 countries around the world (from Africa: Egypt; from America: Brazil, Canada and the United States; from Asia and Oceania: Australia, Hong Kong, India, Malaysia, New Zealand and Singapore; and from Europe: Austria, Belgium, Deutschland, Denmark, Finland, France, Italy, Norway, Poland, Spain, Sweden and the United Kingdom), for which the following information is available:

1. Characteristics of the equity offering, as the proportion between issued shares and the ones already in circulation (i.e., how many old shares are necessary to obtain a given number of new shares) and the subscription price of the new ones.
2. Other relevant data, as the ex-right share price or the ratio between the equity and the capitalization value of the company after the process.
3. ESG score of the issuer and level of development of the country at the time of the process. This will be explained in depth below.

The variable of interest in this paper will be the net performance of the arbitrage strategy described below. Since these are returns, it is possible to compare between different countries. On the other hand, for testing purposes, those observations considered as outliers will be removed from the sample, as explained in the next section.

4.2.2 ESG Scores and level of development

The variable of interest around which this study revolves is the ESG rating of the issuers. There are many sources of information on this factor although, for consistency reasons, it has been decided to use the data provided by *Thomson Reuters Refinitiv*. To calculate this rating, a series of company factors related to its governance and the environmental and social impact of its operations are considered, and a score between 0 (worst) and 100 (best) is obtained from this analysis. Finally, each score is assigned a grade, with D being a score between 0 and 25, C between 25 and 50, B between 50 and 75 and A between 75 and 100.

Finally, the level of development of a country is obtained from the World Bank and depends on the country's Gross National Product. For each year, a series of thresholds are established that determine whether the level of development is low, medium, or high. In the sample of this study there are no observations with a low level of development.

4.3. METHODOLOGY

4.3.1. Arbitrage strategy and data filtering

The target variable consists of the result of arbitrage strategies carried out in the equity offerings analysed. To do this, the negotiation strategy described in **Verdú, Carchano and Farinós (2022)** will be applied, also following the procedure explained in that study. This strategy consists of acquiring new shares through the purchase and subscription of rights and taking an equivalent short position in the company's shares, and adjusting for the effect of costs and commissions and using a conservative approach for those. More concretely, this strategy consists of carrying out the following two actions simultaneously:

1. Acquire subscription rights and exercise them to obtain a given number of new shares, paying the subscription price if applicable.
2. Take a short position in the same number of shares of the issuing company.

The two legs of this strategy represent the two ways of accessing the company's shares that coexist while the rights are listed. Therefore, it is expected that the price per share paid in

both will not be significantly different. The performance of the strategy will be obtained as the difference between the theoretical price of the new shares (the price paid to acquire the new shares) and the quoted price of the new shares, corrected for the effect of any fees and commissions charged for carrying out these transactions.

The **Theory Price** () of the new shares and the **net return** (NR_i) on the operation for the equity offering i is therefore obtained as follows:

$$P_{i,t} = \frac{PSR_{i,t} * Right_i + N_i * I_i}{N_i} \quad [4.1] \quad NR_i = \frac{S_{i,t} - P_{i,t}}{P_{i,t}} - c \quad [4.2]$$

where $PSR_{i,t}$ is the price of the subscription rights; $Right_i$ and N_i are interpreted as the $Right_i$ number of rights needed to obtain N_i new shares, while I_i is the price of the new shares; $S_{i,t}$ is the quoted price of the issuing company's shares; and c is the estimated effect of commissions.

This return is calculated for the first ten trading days of the rights and the last one, and averaged over all of them, resulting in an average net return for each equity offering. For the effect of fees, the procedure described in **Verdú, Carchano and Farinós (2022)** has been followed and a set of investments in equity offerings with arbitrage opportunities detected have been simulated, estimating the effect of fees using the information provided by different brokers. Following this process, and using a conservative estimate, the effect of the costs has been estimated at 2 percentage points.

The presence of particularly high returns forces us to filter out atypical results from the sample. The high dispersion of the data causes procedures such as the "Median Absolute Deviation" of **Leys et. al (2013)** to not work properly, so it is decided to remove from the sample those observations with a result higher than 1,000 %. The net sample is therefore made up of 377 observations. Even after eliminating the main outliers, there may still be excessively high returns that could alter the results. This is why in this study we will analyze both the mean and the median, since the latter is not affected by the outliers.

4.3.2. Significance Tests.

The non-normality of the samples will be checked by means of a Jarque-Bera test. Then, the student's t-test on the mean and the **Wilcoxon (1992)** signed-rank test on the median were applied to this sample of results.

4.3.3. Model Estimation.

To control for factors that may have implications on the outcome of the strategy, it was decided to introduce variables into the model in line with the results of **Verdú, Carchano and Farinós (2022)**. The proposed model is defined as follows:

$$RET_i = \beta_0 + \beta_1 * NTO_i + \beta_2 * ETC_i + \beta_3 * ITE_i + \beta_4 * ESGA_i + \beta_5 * ESGB_i + \beta_6 * ESGC_i + \beta_7 * DEVH_i + \varepsilon_i \quad [4.3]$$

where RET_i is the result of arbitrage strategy i , NTO_i is the ratio of new shares over old shares, ETC_i is the ratio between equity and capitalization, ITE_i is the ratio between the subscription price and the ex-right price, $ESGX_i$ takes the value 1 if the company's ESG score is X (D being the reference value) and $DEVH_i$ takes the value 1 if the country's level of development is high (taking the medium level as a reference).

The variables NTO_i and ETC_i approximate the size of the equity offering with respect to the original situation of the company, and therefore the impact of this process. They are expected to have a positive effect on the outcome of the strategy. For the same reason, the ITE_i ratio should have the opposite effect. The ESG or development-related factors have their lowest possible value as a reference, so they are expected to have a negative coefficient. Given the nature of the variables, no problems of endogeneity or reverse causality are expected.

This model is estimated by OLS, using standard errors robust to heteroscedasticity. For those factors that are not significant, a robustness test will be applied, which involves estimating the model with and without this factor and obtaining the series of residuals for each one. Robustness will be determined if the Kruskal-Wallis test rejects that both series come from the same sample.

4.4. RESULTS

4.4.1 Significance Tests

Table 4-1 shows, for the full and restricted sample for each ESG value, the distribution of the sample, the main statistics and results of the tests performed.

Table 4-1 Descriptive statistics and results for the total sample and sub-samples.

	T	A	B	C	D
Average	58.2675%	25.8629%	54.1200%	42.2782%	130.7663%
St. Dev.	2.1301	1.7083	2.1407	1.7955	2.8905
Median	-2.7607%	-2.5558%	-2.6067%	-5.9079%	-2.0744%
N (Total)	440	59	147	156	78
N (Positive)	123	12	47	43	21
N (Negative)	254	38	83	94	39
N (Outliers)	63	9	17	19	18
Maximum	997.5403%	989.8729%	995.0700%	997.5403%	973.9676%
Minimum	-100.0000%	-97.6149%	-97.3438%	-100.0000%	-98.4135%
Skewness	2.8157	4.5643	3.0725	2.8691	1.7307
Kurtosis	7.6018	22.7772	9.0882	9.0378	1.7731
JB-Stat	830.7949	988.4829	405.3060	396.0499	33.7174
P-Value (JB)	1.0000	1.0000	1.0000	1.0000	1.0000
Result (JB)					
t-Stat	5.3112	1.0705	2.8825	2.7561	3.5043
P-Value (t)	0.0000	0.2896	0.0046	0.0067	0.0009
Result (T)	***		***	***	***
W-Stat	-2.8957	-2.5436	-1.5766	-2.0132	0.3018
P-Value (W)	0.0019	0.0055	0.0574	0.0220	0.6186
Result (W)	***	***	*	**	

Note: This table shows the main statistics for the sample and for each subsample. N refers to the sample size, which in turn is divided into "positive" and "negative" (respectively, if the outcome of the strategy is positive or negative). Finally, for each test performed, we have its corresponding critical value and P-Value, and an indicator as to whether the Null Hypothesis is rejected at 10% (*), 5% (**) or 1% (***).

From this table, it is noteworthy that there is sufficient data on arbitrage opportunities (defined as positive returns of the strategy). Both in the overall sample and in each of the

subsamples, arbitrage opportunities have been detected in between 20% and 40% of the observations.

We can also find positive and significant means (except for rating A) and negative medians in (and significant as of rating C). The results indicate that the higher the ESG level, the worse the performance of the strategy, which suggests that it improves market efficiency. Problems are still observed with outlier returns, but they are corrected by also considering the medians.

4.4.2. Model Estimation

The results of the estimation of the proposed model are shown in Table 4·2. The results reinforce the previous observations. We observe that the higher the ESG value, the lower the outcome of the arbitrage strategy. Of the ratios, only the one relating new and old shares is significant, while the level of development does not seem to have a significant effect either. Although the results of the robustness tests are not shown, in all the variables for which they were necessary (those that were not significant), the P-values are greater than 0.1, so that none of them passes this test.

Table 4-2 OLS estimation result for the complete samples.

	Coefficient	Std. Error	P-Value	Result
Intercept	0.7726	0.4872	0.1128	
NTO	0.3152	0.1434	0.0280	**
ETC	-0.0004	0.3950	0.9992	
ITE	0.3392	0.4429	0.4437	
ESGA	-1.0149	0.4510	0.0244	**
ESGB	-0.6928	0.4033	0.0858	*
ESGC	-0.7812	0.4007	0.0512	*
DEVH	0.2082	0.2819	0.4601	

Note: For each factor, the estimated coefficient, its standard deviation, and the P-value associated with the significance test are shown, in this order. The last column summarizes whether the factor is significant at 10% (*), 5% (**) or 1% (***).

4.5. CONCLUSIONS

This study aims to analyze the relationship between the presence or absence of arbitrage opportunities in equity offerings and the level of sustainability of the issuing company, measured through the ESG score. For this purpose, arbitrage strategies have been simulated on more than 300 processes around the world, and a series of statistical and econometric tests have been applied on the results to obtain a relationship between them and the ESG level of the issuing companies.

The results obtained suggest that higher ESG scores would be related to behaviour closer to efficiency in these offerings. Firstly, it is observed that in companies with a higher level of sustainability, the mean and median results of arbitrage strategies are lower. The estimated OLS model also shows that higher ESG levels, on average, significantly reduce the performance of these strategies, after controlling for other relevant factors.

In summary, these results provide evidence of a possible positive relationship between the level of sustainability achieved by companies and market efficiency. A higher ESG score seems to be related to better company behaviour and performance in the markets. This fact may imply that these companies may be able to access financing through the financial market under better conditions than companies with a worse performance in terms of sustainability. Therefore, these results may constitute an incentive for companies to make a firm commitment to sustainable and responsible behaviour.

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CONCLUSIONS

Study of market anomalies in equity offerings

DOCTORAL THESIS CONCLUSIONS

In this Doctoral Thesis we have studied possible market anomalies in the context of international equity offerings. This study has been carried out in four phases: (i) joint analysis of arbitrage opportunities and short and long term event effects for Spanish equity offerings with subscription rights; (ii) analysis of arbitrage opportunities for equity offerings worldwide and their explanation and prediction; (iii) analysis of event effects in the financial markets for all international equity offerings; and (iv) analysis of the relationship between the occurrence of arbitrage opportunities and the level of sustainability of the issuing company or the country's level of development.

This Thesis begins with a more specific analysis focused on one country, and then generalizes the studies to cover as many processes as possible. Once the market anomalies have been detected and characterized, the case of a specific factor that could affect their appearance and strength is considered. After applying all the calculations, methodologies and statistical and econometric tests proposed in the four chapters, a robust set of conclusions has been reached. As a preview of what follows, it should be noted that not only is there a common thread linking the four chapters, but there is also a clear coherence between the results obtained.

In the first chapter, market anomalies are detected, both in the form of significant arbitrage opportunities and systematic short- and long-term effects on financial markets. By extending the sample to international equity offerings, we not only continue to detect significant arbitrage opportunities, but also find factors with a high capacity to explain them, and even manage to predict many of them within the sample. On the other hand, when extending the sample to equity offerings that do not issue subscription rights, systematic effects caused by the events that are part of this process continue to be detected, even when applying different methodologies. Finally, sufficient evidence is obtained to not reject the hypothesis that a greater commitment to environmental and social aspects of the company, or a higher level of development of the country, allows companies to benefit from greater efficiency in the financial markets.

The four chapters coincide in demonstrating the existence of market anomalies in the framework of equity offerings at the international level. Although these anomalies are not something that occurs systematically in all the processes analyzed, the volume of cases and their combined significance are sufficient reasons to conclude that this type of behavior exists. Furthermore, in the specific case of arbitrage opportunities, it has been found that, contrary to what would be expected, they do not disappear over time. It should be noted that, although all the results obtained here correspond to processes that had already ended at the time the analyses were carried out, the same arbitration strategy was implemented in a real case outside the sample. This

investment in an equity offering with subscription rights in 2022 was successful and generated the theoretically expected return, which further reinforces the conclusions reached by demonstrating that the theoretical results can occur in practice.

Not only has this sample evidence in favor of the presence of market anomalies been detected, but factors that positively or negatively affect both their probability of occurrence and the strength with which they emerge have also been identified. To give some examples, regarding arbitrage, the company's listing in relevant stock market indexes, or greater commitment to social or environmental aspects, seem to be negatively related to the appearance of these anomalies, while the size of the equity offering (i.e., the number of new shares with respect to old ones) seems to favor possible arbitrage. Regarding the short- and long-term effects of events, the effect of stock index listing is maintained, while the use of subscription rights seems to generate a greater number of significant anomalies. Finally, we have also detected some countries or specific contingencies in which these anomalies are more present.

The results obtained provide a comprehensive overview of market anomalies in the context of equity offerings at the international level. Until now, there have been many studies analyzing these issues, but from more specific points of view and limited to certain aspects or events. Moreover, there was hardly any recent literature on the specific case of possible arbitrage opportunities. This gap is filled by the results and conclusions of this research project.

Finally, these conclusions may also have repercussions beyond the scientific side. It has been shown that there are certain strategies that can lead investors to detect potential arbitrage opportunities and exploit them, which would make it easier to correct them and put an end to the anomaly that implies that they do not disappear over time. In addition, valuable information is also provided to companies considering or about to undertake an equity offering, especially about the factors they should take into account in order to benefit from a more efficient behavior in the financial markets, and therefore a fairer valuation of their new shares. In addition, given the current global situation, we consider it very relevant to have proven that a greater environmental commitment generates better conditions for companies, which may serve as an incentive for more companies to commit to improving their activity in this regard. Finally, these conclusions can also be of use to the different regulatory bodies, since they show them which factors can improve efficiency in the markets, as well as which factors can constitute sources of significant anomalies.

FUTURE RESEARCH

One of the objectives of this paper is to establish a framework and common conclusions for the analysis of market anomalies in international equity offerings. Considering the volume and scope of the results obtained in these four chapters, and the publication of some of these chapters in scientific journals, it is considered that this objective has been achieved. By establishing these common conclusions, but at the same time showing results for many different countries, it is possible that some avenues of research have already been resolved. However, during the development of this project and in analyzing its results, new questions arise that may give rise to new avenues of research that could be addressed in the future.

First, it would be of interest to replicate many of these analyses with intraday data, to understand how these anomalies behave with a greater level of depth, and especially to determine the duration of many of these, or if there are even results that are generated in the minutes or hours after the different events and that would be diluted when using daily data.

Secondly, there are many cases that could not be included in this analysis and that could significantly affect the anomalies detected, or even generate new ones. This could be the case of equity offerings carried out by companies listed simultaneously in different markets. It could also be of interest to analyze the effects of these processes on the price of the different financial derivatives that depend on the shares of the issuing company. In this same group of analyses, it would also be appropriate to review those results considered as positive outliers and which have been removed from the sample. Their high volume and magnitude would require an in-depth study to understand what factors could explain them.

Finally, it would be of great interest to apply a more in-depth analysis to the effects of events on financial markets, and to try to model them. One possibility that could be considered would involve applying the Kalman Filter methodology to estimate econometric models to explain the stock returns of issuing companies. If the constant parameter (α) of the model is allowed to vary over time, it should experience a "jump" on the day of the event or in subsequent days, which the model should detect. One could even try to model that "jump" and determine whether its sign or size varies significantly depending on the event in question, or other factors that we already know are related to this anomaly.

RESUM

Estudi d'anomalies de mercat en les ampliacions de capital

INTRODUCCIÓ I OBJECTIUS

La present Tesi Doctoral ha sigut redactada en un idioma que no és cap dels dos idiomes oficials de la Universitat de València. Per tant, en aquesta secció de la Tesi es troba un resum detallat de la mateixa i dels seus quatre capítols. D'aquesta manera, es compleix amb la normativa referent a tesis doctorals presentades en una llengua diferent de les oficials de la Universitat de València²⁸.

Les empreses necessiten capital suficient per a desenvolupar eficaçment les seues activitats, el qual sol provindre dels recursos generats al oferir els seus béns o serveis en el mercat. Aquest capital permet a les empreses finançar operacions, compensar als factors de producció i mantindre l'activitat en curs, al mateix temps que permet un major creixement i expansió. No obstant això, en determinades situacions, les empreses poden necessitar recursos addicionals més ràpidament del que generen les seues activitats. Per a fer front a aquesta situació, poden buscar noves fonts de finançament, sent l'emissió de deute una opció habitual. Una altra alternativa és organitzar una ampliació de capital, en la qual l'empresa emet accions que els inversors poden comprar, convertint-se en propietaris de l'empresa sense l'obligació de reembossar el finançament.

Les ofertes d'accions impliquen l'emissió d'un major nombre d'accions, la qual cosa pot diluir als accionistes existents al tindre una menor participació sobre l'empresa. Per a mantindre el seu percentatge de propietat, les empreses poden utilitzar drets de subscripció preferent, que permeten als accionistes obtindre noves accions, o vendre'ls a altres inversors. Les ofertes d'accions poden ser processos complexos, que es prolonguen en el temps i impliquen diversos esdeveniments, com l'anunci, l'aprovació i la cotització de les noves accions. Es presenten en diferents formes i estan subjectes a diverses normatives en els diferents països. En general, les ofertes d'accions ofereixen a les empreses diverses maneres de recaptar fons i als inversors l'oportunitat de participar en el creixement i els beneficis futurs de l'empresa.

Les ampliacions de capital poden tindre efectes significatius en l'empresa i el mercat. Aquests efectes poden donar lloc a anomalies del mercat que no poden corregir-se automàticament. Una font d'anomalies sorgeix en les ampliacions de capital amb drets de subscripció, en les quals els inversors poden obtindre les mateixes accions de dues maneres: (1)

²⁸ Concretament, aquest resum compleix amb el requisit establert en el segon paràgraf de l'article 7 del "Reglament sobre depòsit, Avaluació i Defensa de la Tesi Doctoral" de la Universitat de València, aprovat en Consell de Govern de 29 de novembre de 2011 (ACGUV 266/211) i modificat en Consell de Govern de 28 de febrer de 2012 (ACGUV 51/2012).

comprant directament les accions existents, o (2) comprant drets de subscripció i exercitant-los per noves accions. En teoria, el preu de cada acció hauria de ser el mateix per a tots dos mètodes. No obstant això, si existeix un diferencial de preus, els inversors podrien explotar aquesta oportunitat d'arbitratge, donant lloc a una anomalia del mercat coneguda com a oportunitat d'arbitratge. A més, totes les ofertes d'accions alliberen una quantitat considerable d'informació als mercats durant el seu desenvolupament, la qual cosa pot influir en el comportament d'aquest. Determinats esdeveniments relacionats amb les fases del procés poden generar efectes sistemàtics que, de ser coneguts pels inversors, podrien ser explotats mitjançant estratègies específiques per a obtenir beneficis superiors als que ofereix el mercat. Aquesta font d'anomalies basada en la informació és comuna a totes les ofertes d'accions.

És essencial analitzar situacions reals per a comprendre l'aparició i freqüència d'aquestes anomalies del mercat en el marc de les ampliacions de capital amb l'emissió de noves accions. Els investigadors poden estudiar si determinats territoris o circumstàncies són més propensos a aquestes anomalies i investigar factors relacionats amb la pròpia oferta o l'empresa emissora que puguin afectar la probabilitat que es produïsquen aquestes distorsions. Comprendre aquestes anomalies pot ajudar inversors i reguladors a prendre decisions amb coneixement de causa i fomentar un mercat més eficient.

La present Tesi Doctoral té com objectiu analitzar la possible presència de les anomalies prèviament esmenades dins dels processos d'ampliació de capital de empreses a tot el món. A més, també es pretén determinar quins factors tenen un pes important en la formació de les anomalies detectades, i quines circumstàncies beneficien o perjudiquen la seua aparició. Aquest estudi s'ha repartit en quatre capítols diferents, tenint cadascun un àmbit d'aplicació concret i aplicant unes metodologies diferents. Explicat en poques paraules, el Capítol I analitza la presència dels dos tipus d'anomalies prèviament esmenades a ampliacions de capitals realitzades per empreses espanyoles mitjançant l'emissió de drets de subscripció preferent. El Capítol II es centra únicament en les possibles oportunitats d'arbitratge, si bé l'àmbit d'estudi passa a ser internacional, analitzant processos realitzats per empreses de diferents països. Per la seua part, el Capítol III manté l'àmbit internacional, però afegint totes les ampliacions de capital possibles (no només les que emeten drets de subscripció), i enfocant l'anàlisi als possibles rendiments anòmals generats per els diferents esdeveniments que es poden donar a aquests processos. Finalment, el Capítol IV torna a enfocar-se en les oportunitats d'arbitratge, i tracta de determinar la relació entre, per una banda el comportament i el compromís de l'empresa emissora en termes socials i mediambientals, i per l'altra un millor i més eficient comportament als mercats financers, caracteritzat per una menor aparició de les anomalies objectiu d'aquest estudi.

Capítol I: Oportunitats d'arbitratge i impacte d'esdeveniments a ampliacions de capitals espanyoles.

El Capítol I consisteix en un primer estudi sobre les possibles anomalies que es poden donar en les ampliacions de capital, i es fa enfocat en el cas d'Espanya. Durant la recerca d'informació i després d'analitzar els estudis previs que es van poder detectar, va quedar clar que el tema concret del que tracta aquesta Tesi Doctoral no ha sigut suficientment tractat en la literatura. S'observa que n'hi ha treballs que analitzen els efectes de mercats que tenen alguns dels principals esdeveniments que es donen en aquests processos, i, fins i tot, n'hi ha algun treball (només s'identifica un) que parla de possibles oportunitats d'arbitratge. Tanmateix, s'observa que la majoria d'aquests treballs es van publicar fa prou temps, i que no hi ha cap que analitzi els dos enfocaments a l'hora. Amb tot, l'objectiu d'aquest primer treball es analitzar les possibles oportunitats d'arbitratge, així com els possibles rendiments anòmals generats en el marc de ampliacions de capital dutes a terme mitjançant drets de subscripció per empreses espanyoles.

Per a dur a terme aquest treball, s'obté informació per a un total de 395 ampliacions de capital realitzades per 111 empreses diferents entre els anys 2000 i 2020 (ambdós inclosos). D'aquestes ampliacions de capital, s'obté informació rellevant sobre l'empresa, com si està llistada a l'índex IBEX-35 o si pertany al Mercat Continu (MC) o al Mercat Alternatiu Borsari (MAB, actualment en un nom diferent); i sobre el propi procés, com el preu de les noves accions, assenyalant si és diferent de zero (monetàries) o no (alliberades), la relació entre les noves i les velles accions, assenyalant si les noves representen més del 50% de les velles (dilutives) o no (no dilutives); i en el cas de les ampliacions de capital monetàries, si estan o no assegurades. Addicionalment, s'obtenen les sèries amb els preus de tancament de sessió de les accions de totes les empreses, així com dels drets, de l'índex IBEX-35 i d'altres factors. Per finalitzar, s'obté el dia en el que es produeixen sis esdeveniments diferents, sent aquests (1) l'anunci de l'ampliació de capital, (2) la seua aprovació per la Junta General d'Accionistes, (3) l'inici i (4) el final de la negociació dels drets de subscripció, (5) la publicació dels resultats, i (6) l'entrada a negociació de les noves accions. Per a analitzar les oportunitats d'arbitratge es dissenya i es prova teòricament una estratègia de negociació, mentre que per als rendiments anormals, s'utilitza la metodologia *Event Study* a curt i a llarg termini.

L'estratègia d'arbitratge proposada consisteix en comprar els drets de subscripció i exercir-los per obtenir les noves accions, i al mateix temps obrir una posició curta en les accions de l'empresa emissora. Degut a les característiques dels drets de subscripció, no és possible emprar l'estratègia contrària. Si el preu a pagar per obtenir una nova acció és el mateix per a comprar l'acció al mercat que per obtenir-la mitjançant l'ampliació de capital, aquesta estratègia

no tindrà un rendiment positiu. Si aquest sí que es dona, és que a la corresponent ampliació de capital va existir una oportunitat d'arbitratge. Tanmateix, cal tindre en compte l'efecte de les comissions i costos a pagar per dur a terme l'estratègia. Aquest efecte s'estima de manera conservadora emprant informació facilitada per diferents entitats financeres.

Amb aquesta informació, el preu teòric de les noves accions i el rendiment net de l'estratègia s'obtenen de les següents equacions:

$$P_{i,t} = \frac{Right_{i,t} * Old_i + I_i * New_i}{New_i}$$

$$NR_{i,t} = \frac{S_{i,t} - P_{i,t}}{P_{i,t}} - c$$

on $P_{i,t}$ és el preu teòric de les noves accions, $Right_{i,t}$ és el preu dels drets, I_i és el preu de subscripció d'aquestes, mentre que New_i indica el número d'accions noves que es poden obtenir amb Old_i drets (donat que en tots els casos analitzats a cada acció vella li correspon un dret de subscripció). Per altra banda, $NR_{i,t}$ indica el rendiment net de l'estratègia, mentre que $S_{i,t}$ representa el preu de mercat de les accions de l'empresa, i c l'efecte estimat de les comissions. Aquest rendiment s'obté per a cadascú dels 11 dies en els que els drets cotitzen, i es calcula una mitja. Per tant, cada ampliació de capital tindrà un rendiment net mig associat.

Aquesta estratègia assumeix que es poden obrir posicions curtes a les empreses analitzades en tot moment (o, al menys, durant l'ampliació de capital). Com aquest supòsit no sempre es compleix, s'ha dissenyat una versió alternativa de l'estratègia, que no requereix prendre posicions curtes. Aquesta calcula la diferència el preu pagat per les accions noves cada dia de cotització dels drets de subscripció, i el preu amb el que les noves accions inicien la seua cotització. El rendiment net de l'ampliació de capital s'obté com la mitja de les diferències calculades, i s'analitzarà de la mateixa manera que la sèrie de rendiments de l'estratègia original.

Per a dur a terme l'*Event Study* a curt termini, en primer lloc s'estimen els paràmetres d'un model CAPM emprant les dades corresponent a l'any anterior al anunci de l'ampliació de capital. Amb aquests paràmetres estimats, es calcula el rendiment anòmal com la diferència entre el rendiment experimentat per l'empresa cadascú dels dies d'esdeveniments, i els que espera el model. Per tant, per a cada ampliació de capital, es tindrà un rendiment anòmal per a cadascú dels sis esdeveniments. A continuació, es poden veure les equacions per estimar el model i per obtenir els rendiments anormals estimats:

$$R_{i,t} - R_{f,t} = \alpha + \beta(R_{m,t} - R_{f,t}) + \varepsilon_t$$

$$\widehat{AR}_{i,t} = R_{i,t} - [R_{f,t} + \hat{\alpha} + \hat{\beta}(R_{m,t} - R_{f,t})]$$

on $AR_{i,t}$ és el rendiment anòmal estimat, $R_{i,t}$ és el rendiment de l'empresa emissora, $R_{m,t}$ és el rendiment de la cartera de mercat (l'índex IBEX-35, i l'índex IBEX *SmallCap* per a empreses MAB), $R_{f,t}$ és el rendiment de l'actiu lliure de risc (bo del tresor a un any), α i β són els paràmetres del model, i ε_t és el terme d'error.

Una vegada obtingudes les sèries d'anomalies (tant els resultants de l'estratègia d'arbitratge com els rendiments anòmals generats pels esdeveniments), primerament s'utilitzaran algunes metodologies per eliminar els possibles *outliers*, i després seran sotmeses a proves estadístiques per determinar la seua significativitat. Concretament, s'aplicaran el test t de *Student* i una prova basada en *Bootstrapping* per analitzar la mitja, així com el test de *Wilcoxon* sobre la mitjana. Aquestes proves es realitzaran sobre la mostra completa, però també sobre diferents submostres creades emprant com a criteri per filtrar diferents factors.

Finalment, l'*Event Study* a llarg termini es du a terme construint una cartera equiponderada que continga les accions de totes les empreses que han tingut una ampliació de capital durant el darrer any. Una vegada construïda, s'obté la seua sèrie de rendiments mensuals i aquesta s'analitza mitjançant tres models diferents, sent aquests (1) el model CAPM, (2) el model de Fama i French, i (3) el darrer model agregant un factor d'il·liquiditat. El rendiment anòmal vindrà representat per la constant del model, i s'utilitzarà un test t de *Student* per determinar si aquesta és significativa o no. Aquest procés es realitza tant per a la mostra completa, però també amb les mateixes submostres obtingudes seguint el procediment explicat anteriorment. A continuació es presenten les equacions corresponents als tres models esmenats.

$$R_{p,t} - R_{f,t} = \alpha_1 + \beta_1(R_{m,t} - R_{f,t}) + u_t$$

$$R_{p,t} - R_{f,t} = \alpha_2 + \delta_1(R_{m,t} - R_{f,t}) + \delta_2SMB_t + \delta_3HML_t + v_t$$

$$R_{p,t} - R_{f,t} = \alpha_3 + \theta_1(R_{m,t} - R_{f,t}) + \theta_2SMB_t + \theta_3HML_t + \theta_4ILLIQ_t + w_t$$

on $R_{p,t}$, $R_{m,t}$ i $R_{f,t}$ són, respectivament, el rendiment mensual de la cartera objectiu, de la cartera de mercat (l'índex IBEX-35, i l'índex IBEX *SmallCap* per a empreses MAB) i de l'actiu lliure de risc (bo del tresor a un any); SMB_t i HML_t són els factors relacionats amb la grandària i el valor; $ILLIQ_t$ és el factor relacionat amb l'il·liquiditat (construït emprant els rendiments i volums de contractació mensuals de les empreses), α_j és el paràmetre constant de cada equació, els termes β_n , δ_n i θ_n es refereixen als paràmetres dels models, i u_t , v_t i w_t són els termes d'error.

Els resultats obtinguts es mostren mitjançant un conjunt de Figures i de Taules, en funció de les característiques dels mateixos i del que es considera més important per ressaltar. Els rendiments obtinguts per a les estratègies d'arbitratge són positius en molts casos, i les probes aplicades certifiquen la seua significativitat. A més, destaca el fet de que aquestes anomalies no desapareixen ràpidament, tal i com s'esperaria, sinó que es mantenen en el temps, inclús havent casos on es mantenen durant pràcticament tots els dies de negociació del dret de subscripció. Pel que respecta als resultats de l'*Event Study* a curt i llarg termini, malgrat que es troben alguns resultats significatius en els dos casos, aquests no són tan forts i tan rellevants com els trobats en el cas de les oportunitats d'arbitratge.

En conclusió, aquest treball ha complert el seu objectiu, demostrant la presència de anomalies de mercat en el marc de les ampliacions de capital amb drets de subscripció dutes a terme per empreses espanyoles, sent les oportunitats d'arbitratge les principals ineficiències detectades. A més, s'han pogut identificar un conjunt de factors, relacionats tant amb l'ampliació de capital (la proporció entre les noves i les velles accions) com amb la pròpia empresa (que estiga inclosa en un índex borsari), que estarien condicionant significativament els resultats. Addicionalment, aquest treball és el primer que obté resultats rellevants d'un terme un anàlisi conjunt d'arbitratge i de rendiments anormals. Els següents passos a seguir consistirien principalment en ampliar l'àmbit d'estudi a tots els països possibles, i a determinar amb una exactitud major quins és el pes i el mode en el que els diferents factors estudiats afecten a la formació d'aquestes anomalies. Açò és, precisament, l'objectiu principal dels Capítols II i III.

Capítol II: Detectant, caracteritzant i predient oportunitats d'arbitratge a ampliacions de capitals internacionals.

Una vegada s'ha provat que, en un país i baix unes condicions concretes, les ampliacions de capital generen anomalies de mercat, és el moment de verificar si aquesta conclusió es manté quan s'analitzen països amb característiques i normatives diferents. Ampliar la mostra utilitzada permetrà no només comprovar fins a quin punt es pot afirmar que aquests comportaments ineficients es donen sistemàticament a aquest tipus de processos, sinó que a més ens permeten comprovar amb major profunditat quins són els principals factors que afecten a la formació d'aquestes anomalies, i quin és el paper que hi juguen.

Revisant la literatura existent respecte a aquest tema, s'han trobat els mateixos problemes que en el cas del Capítol I; els treballs són antics (encara que a aquest cas n'hi ha de més relativament recents), i no s'ha trobat cap que enfoque directament les possibles oportunitats de arbitratge, malgrat que sí que n'hi ha dels que parlen en algun moment de l'estratègia que caldria

seguir per obtindre benefici d'aquestes, si bé no les tracten en profunditat. Amb tota la informació disponible, aquest capítol proposa les següents hipòtesis nul·la i alternativa:

H_0 : *Les ampliacions de capital amb drets de subscripció generen oportunitats d'arbitratge.*
 H_0 : *Les ampliacions de capital amb drets de subscripció no generen oportunitats d'arbitratge.*

En poques paraules, el Capítol II consisteix en una ampliació del anàlisi d'oportunitats d'arbitratge dut a terme al Capítol I. Aquesta ampliació consisteix tant en una major mostra com en l'aplicació de noves metodologies buscant anar més enllà i obtenir nous i més complets resultats. Per a estudiar i comprovar aquesta hipòtesi, s'ha recollit una mostra neta de 3.628 ampliacions de capital realitzades entre els anys 2000 i 2020 (ambdós inclosos) per empreses localitzades a 27 països diferents, repartits per tots els continents. S'han arreglat, a més, la mateixa informació de la que es parla en el Capítol I (característiques de l'ampliació de capital i de l'empresa emissora, així com les diferents sèries de preus de accions i factors). Així tot, s'ha recollit també nova informació, com determinades ràtios relacionades amb l'ampliació de capital i els seus resultats, el sector d'activitat de l'empresa emissora, i l'objectiu del procés. A més, s'ha recopilat també el nivell de desenvolupament del país al que pertany l'empresa emissora, i el factor ESG, que mesura el compromís de la companyia en termes socials i mediambientals (aquests dos últims factors es corresponen a la data en la que es va realitzar l'ampliació de capital).

Un aspecte que cal considerar al ampliar la mostra a diferents països és la diferència en el funcionament dels processos en funció del territori. Un dels factors més afectat és la relació entre les accions velles i les noves, i, especialment com afecta aquesta al número de drets necessari per obtindre una acció nova. Aquesta relació no sempre és la mateixa, i s'ha tingut que determinar quins països segueixen unes regles i quins segueixen altres per assegurar que, en tot moment, el resultat de l'estratègia d'arbitratge es correspon amb el que s'haguera obtingut amb una implementació real de la mateixa. Per altra banda, també ha sigut necessari realitzar alguns ajustos per assegurar la coherència entre les monedes en les que s'expressen els preus.

Amb tota aquesta informació, el primer pas consisteix en tornar a estimar els rendiments de les estratègies d'arbitratge, cosa que es realitza seguint els mateixos passos que els descrits al Capítol I (no analitzant, en aquest cas, l'estratègia alternativa proposada). Aquest procediment es repeteix tant en l'estimació dels rendiments de l'estratègia com en la realització de proves estadístiques sobre la mostra completa i les diferents submostres construïdes (en aquest cas es prescindeix de la prova del *Bootstrapping*). Ara en canvi, els factors utilitzats per crear submostres són més nombrosos, generant una major quantitat de resultats i obrint la possibilitat de identificar nous patrons de comportament. No obstant, la grandària de la mostra permet donar un pas més i

tractar d'explicar millor la formació de les anomalies o, al menys, identificar clarament quins factors juguen un paper rellevant. Açò es prova de dos formes diferents.

En primer lloc, es proposa un model per tractar d'explicar els rendiments obtinguts per a l'estratègia d'arbitratge, mitjançant un conjunt de factors que, tant als resultats del Capítol I com als obtinguts fins a aquest moment per al Capítol II, han demostrat tindre un paper important. Degut a la diversitat de dades entre països, aquest model només s'ha estimat per a la mostra completa i per a les submostres corresponents als quatre grups continentals en els que s'han agrupat els països, sent aquests: (1) Àfrica i l'Orient mitjà, (2) Amèrica, (3) Àsia i Oceania, i (4) Europa. En concret, el model proposat és el següent:

$$RET_i = \beta_0 + \beta_1 DIL_i + \beta_2 IDX_i + \beta_3 ISC_i + \beta_4 CAP_i + \varepsilon_i$$

on RET_i és el rendiment de l'estratègia d'arbitratge, IDX_i és una variable binària que indica si la empresa està llistada al principal índex borsari del seu país, i DIL_i , ISC_i i CAP_i son ràtios que expressen, respectivament, la relació entre les accions noves i les velles, entre el preu de subscripció de les noves accions i el preu *ex-right* de les accions velles (el que es dona el dia abans en que es descompta del preu el poder obtindre el dret), i entre el recursos propis i la capitalització de l'empresa després de l'ampliació de capital. Els termes β_j es refereixen als paràmetres del model, i ε_i és el terme d'error de l'equació.

En segon lloc, per determinar en major mesura si els factors poden explicar aquestes anomalies, es proposa un model per intentar predir la seua aparició dins de la mostra. Per a açò, es crea una variable binària que indica si s'ha donat una oportunitat d'arbitratge (un rendiment net positiu) o no, i es proposa un model per a ser estimat en les metodologies *lògit* i *probit*. De nou, ens trobem en el problema de que cada país presenta una estructura de dades diferents, pel que es decideix seleccionar les variables més adequades per a cada país. D'aquesta manera, encara que el model siga únic, el model estimat serà diferent per a cada país. El resultat de l'estimació d'aquests models s'interpreten com la probabilitat que hi haja o no una oportunitat d'arbitratge en una ampliació de capital. En aquest sentit, es considerarà que el model ha encertat un arbitratge si aquest s'ha donat, i la probabilitat estimada és superior a dos terços, i es considerarà que ha encertat un no arbitratge, si aquest no s'ha donat i la probabilitat estimada és inferior a un terç. El model general és el següent:

$$\begin{aligned}
ARB_i = & \vartheta_0 + \vartheta_1 MON_i + \vartheta_2 DIL_i + \vartheta_3 IDX_i + \vartheta_4 ISC_i + \vartheta_5 CAP_i + \vartheta_6 GEN_i + \vartheta_7 ACQ_i \\
& + \vartheta_8 INV_i + \vartheta_9 REF_i + \delta_1 DIL_i * ACA_i + \delta_2 DIL_i * BAS_i + \delta_3 DIL_i * CYC_i \\
& + \delta_4 DIL_i * NCY_i + \delta_5 DIL_i * ENE_i + \delta_6 DIL_i * FIN_i + \delta_7 DIL_i * GOV_i \\
& + \delta_8 DIL_i * HEA_i + \delta_9 DIL_i * IND_i + \delta_{10} DIL_i * EST_i + \delta_{11} DIL_i * TEC_i \\
& + \delta_{12} DIL_i * UTI_i + u_i
\end{aligned}$$

on ARB_i és la variable binària que indica si s'ha detectat un arbitratge, MON_i és una variable binària que indica si la ampliació de capital és monetària o alliberada, i GEN_i , ACQ_i , INV_i i REF_i són variables binàries que indiquen si al menys un dels objectius de l'ampliació de capital s'enquadra dins de la seua categoria (sent, respectivament, objectius generals, d'adquisició, d'inversió o de refinançament). Finalment, s'han inclòs les interaccions entre la variable DIL_i i variables binàries que indiquen el sector econòmic al que pertany l'empresa, sent ACA_i (acadèmic), BAS_i (materials bàsics), CYC_i (consum cíclic), NCY_i (consum no cíclic), ENE_i (energia), FIN_i (financer), GOV_i (governamental), HEA_i (sanitari), IND_i (industrial), EST_i (immobiliari), TEC_i (tecnològic) i UTI_i (servicis). Els termes ϑ_j i δ_n es refereixen, respectivament, als paràmetres del model i de les interaccions, i u_i és el terme d'error de l'equació.

Per últim, altra novetat d'aquest capítol és que no es limita als resultats teòrics, sinó que a més mostra una implementació real de l'estratègia proposada. Durant l'elaboració d'aquest treball es va provar a aplicar l'estratègia a la negociació real, en diverses ampliacions de capital d'empreses espanyoles i internacionals, i es va comprovar que els resultats obtinguts eren pràcticament iguals als que s'esperaven teòricament. El cas més rellevant va ser la inversió a l'ampliació de capital de l'empresa francesa *Atari S.A.*, els resultats de la qual es mostren al capítol. Aquestes aplicacions real també van permetre conèixer millor el funcionament de l'estratègia i, especialment, estimar de manera més robusta d'efecte de les comissions.

La mostra tant elevada que s'empra a aquest estudi ha permès dur a terme una major varietat de proves i, per tant, obtindrà una major varietat de resultats. En termes generals, totes les proves apunten a la presència d'oportunitats d'arbitratge en el marc de les ampliacions de capital realitzades pràcticament tots els països analitzats. A més, el bon resultat dels models estimats, així com l'elevada taxa d'encert dels models de predicció, ens permet concloure que els factors analitzats tenen un paper rellevant en la formació d'aquestes anomalies. Concretament, es pot observar com a major nombre d'accions noves respecte a les velles, més probable és que trobe un arbitratge. Per l'altra banda, que l'empresa pertanyi a un índex borsari tendeix a reduir aquestes anomalies. Finalment, un resultat molt destacable és que es pot comprovar que empreses amb major compromís social i ambiental tendeixen a sofrir menys anomalies i a aprofitar-se d'unes millors i més eficients condicions, cosa que pot servir d'incentiu a noves empreses a

adoptar aquests tipus de comportaments. Aquests resultats motiven un estudi més exhaustiu, que es realitza en el Capítol IV. Finalment, queda pendent analitzar amb més profunditat les possibles anomalies durant les diferents fases i esdeveniments d'aquests processos, cosa que es durà a terme en el Capítol III.

Capítol III: Sobre rendiments anòmals amb els esdeveniments vinculats a les ampliacions de capital internacionals.

Fins a aquest moment, una de les dos anomalies de mercat que podrien succeir en el marc de les ampliacions de capital ha pogut ser confirmada en un anàlisi a nivell internacional. S'ha trobat evidència suficient per determinar que, en determinades circumstàncies, aquests processos generen oportunitats d'arbitratge. El següent pas es estudiar la segona de les anomalies de mercat, i analitzar si també es donen rendiments anormals. En aquest sentit, s'ha de destacar que la realització de cadascuna de les fases de les ampliacions de capital implica l'abocament de molta informació al mercat. En teoria, aquesta informació deuria ser ràpidament processada i incorporada, i no deuria generar moviments més enllà dels previstos pel mercat. Tanmateix, s'han trobat molts estudis apuntant a que açò no s'estaria acomplint, i que, en alguns casos, s'estarien generant rendiments diferents als esperats, dels quals alguns inversors podrien traure profit. Malgrat el volum de literatura trobada en aquest cas, s'han detectat una sèrie de problemes rellevants, com que molts dels estudis no són massa recents, o que es centren en un esdeveniment, un país o unes circumstàncies concretes. Aquestes debilitats són la principal motivació d'aquest estudi, que té com a principal objectiu analitzar, des d'un punt de vista internacional, si en el processos de les ampliacions de capital es generen de manera sistemàtica rendiments anormals.

Respecte a la recerca d'informació i de dades, aquest treball té l'avantatge de poder utilitzar la base de dades creada per al Capítol II. Si bé, en aquest cas, la mostra pot ampliar-se encara més, i incloure les ampliacions de capitals que no han emès drets de subscripció preferent. L'única informació addicional que ha sigut necessari afegir és tota la relacionada amb els diferents esdeveniments donats a cadascuna de les ampliacions de capital. Aquests esdeveniments seran les observacions principals d'aquest anàlisi. En total, i després de netejar i filtrar la informació disponible, la mostra neta consisteix en un total de 5.500 esdeveniments relacionats amb 2.861 ampliacions de capital realitzades entre els anys 2000 i 2020 per 1.125 empreses localitzades a 38 països de tots els continents, i que pertanyen a 11 sectors econòmics diferents. Aquests esdeveniments es classifiquen en un total de 52 categories.

Durant la recerca d'estudis que tractaren aquest camp, un dels descobriments que va destacar per damunt dels altres era que la metodologia emprada podia afectar als resultats, de manera que aquests podrien ser diferents en funció de quins mètodes i procediments s'escolliren.

Per aquest motiu, s'ha decidit utilitzar diferents mètodes per calcular els rendiments anòmals, i aquests també seran analitzats de varies formes diferents. D'aquesta manera, s'obtenen resultats més robustos i es redueix el risc de que els resultats estiguen molt condicionats per la metodologia.

En termes generals, el procediment escollit per obtindre els rendiments anòmals corresponents a cada esdeveniment és el mateix *Event Study* que es va realitzar al Capítol I, però amb dos diferències fonamentals. La primera és que van a utilitzar-se dos models de referència per obtindre els rendiments anormals (l'un més complex que l'altre), i la segona és que, a més d'estimar el rendiment anòmal corresponent al dia de l'esdeveniment, també s'obtidran equivalents per als 5 dies anterior i posteriors al mateix. Un altra diferència addicional respecte al Capítol I és que, mentre que a aquest els esdeveniments a analitzar eren sis concrets, en aquest treball són tots per als que es dispose d'informació. La resta del procediment és equivalent al que ja s'ha explicat.

El primer model utilitzat és el model CAPM (mateix que al Capítol I). Per tant, l'equació del model i la fórmula per calcular el rendiment anòmal corresponent a cada esdeveniment són les següents:

$$R_{i,t} - R_{f,t} = \beta_0 + \beta_1(R_{m,t} - R_{f,t}) + \varepsilon_t$$

$$\widehat{AR}_{i,t} = R_{i,t} - [R_{f,t} + \widehat{\beta}_0 + \widehat{\beta}_1(R_{m,t} - R_{f,t})]$$

on $AR_{i,t}$ és el rendiment anòmal estimat, $R_{i,t}$ és el rendiment de l'empresa emissora, $R_{m,t}$ és el rendiment de la cartera de mercat principal índex borsari de cada país), $R_{f,t}$ és el rendiment de l'actiu lliure de risc (bo del tresor a 10 anys per a cada país), els termes β_j són els paràmetres del model, i ε_t és el terme d'error.

El segon model utilitzat és el model de Fama i French, que consisteix en una ampliació del model CAPM amb dos factors corresponents als efectes grandària i valor. Per tant, l'equació del model i la fórmula per obtindre el rendiment anòmal corresponent a cada esdeveniment són les següents:

$$R_{i,t} - R_{f,t} = \delta_0 + \delta_1(R_{m,t} - R_{f,t}) + \delta_2SMB_t + \delta_3HML_t + u_t$$

$$\widehat{AR}_{i,t} = R_{i,t} - [R_{f,t} + \widehat{\beta}_0 + \widehat{\beta}_1(R_{m,t} - R_{f,t}) + \widehat{\delta}_2SMB_t + \widehat{\delta}_3HML_t]$$

on SMB_t i HML_t són els factors relacionats amb la grandària (els que millor s'adapten a cada país), els termes δ_n es refereixen als paràmetres del models, i u_t , és el terme d'error.

Una vegada estimats els models i calculats els rendiments anormals estimats, a cada esdeveniment li correspondran onze rendiments que, per a dur a terme el seu anàlisi, s'agregaran de tres maneres diferents. En concret, s'agregaran els corresponents als cinc dies anteriors a l'esdeveniment per una banda, i als cinc dies posteriors per altra banda, i també s'agregaran tots. El rendiment corresponent al dia de l'esdeveniment també s'analitzarà per separat. Per tant, per cada model es generaran quatre sèries, amb una observació per cada esdeveniment analitzat. Durant aquest procés, a més, també es detectaran alguns *outliers*, que seran retirats de la mostra per evitar que contaminen els resultats.

Finalment, és necessari un anàlisi addicional que faci la funció de prova de robustesa. La intenció inicial era aplicar la metodologia de “Diferències en Diferències” per estimar l'efecte dels esdeveniments, però l'estructura de les dades ho impedia. Per tant, es va decidir estimar aquest efecte amb una metodologia inspirada en aquesta, però més senzilla. Concretament, l'efecte de cada esdeveniment s'estimaria seguint la següent fórmula:

$$D_i = (T1_i - T0_i) - (C1_i - C0_i)$$

on d és l'efecte estimat, $T1$ i $T0$ són, respectivament, la mitja dels rendiments de l'empresa que realitza l'ampliació de capital (grup de tractament) l'any posterior i anterior a l'esdeveniment, mentre que $C1$ i $C0$ són, respectivament, la mitja dels rendiments de l'índex borsari del país corresponent (grup de control) l'any posterior i anterior a l'esdeveniment. Per a ser consistent amb els supòsits de la metodologia escollida, aquest efecte només s'estimarà pel model de Fama i French quan el factor de la cartera de mercat és suficientment proper a la unitat. Cal tindre en compte, no obstant, que aquesta estimació seria incondicional, i que no estaria controlant per altres possibles factors.

Una vegada aplicada tota aquesta metodologia, el resultat són nou sèries de rendiments anormals agregats, sent aquestes els corresponents al dia de l'esdeveniment, als cinc dies anteriors, als cinc dies posteriors i als onze dies, tots aquests obtinguts amb el model CAPM i el model de Fama i French, a més de la sèrie corresponent a la prova de robustesa. Totes aquestes seran analitzades amb les dos proves que ja s'han utilitzat en els capítols anteriors, amb l'objectiu de determinar si, de manera agregada, els rendiments anormals identificats són o no significatius. Concretament, de nou s'utilitzarà la prova *t* de *Student* sobre la mitja, i la prova de *Wilcoxon* sobre la mitjana. En aquest cas, també, les proves es realitzaran sobre la mostra total, i també sobre un conjunt de submostres construïdes seguint diferents criteris. Concretament, les observacions s'agruparan en funció de determinats factors, sobre els qual els capítols anteriors ja han determinat que poden tindre un efecte real en la formació d'anomalies. A més, les observacions també es classificaran en funció de a quin esdeveniment concret pertanyen, en quin país està localitzada

l'empresa que realitza l'ampliació de capital, o a quin sector econòmic pertanyia aquesta. L'elevada quantitat de factors considerats rellevants a aquest treball ha generat un volum igualment gran de resultats, amb els beneficis que això implica.

Una vegada obtinguts i analitzats els resultats de tots aquests procediments, es poden observar un conjunt de tendències i de patrons de comportament comuns molt rellevants. Primerament, es pot comprovar que els rendiments anormals estimats es tornen més volàtils els dies posteriors a l'esdeveniment, i eixa volatilitat va augmentant conforme passen els dies. Açò també es pot observar a les sèries agregades, ja que encara que totes tinguen unes mitges i mitjanes properes a zero, les que agreguen els dies posteriors a l'esdeveniment presenten una major volatilitat i uns resultats més dispersos. Finalment, pel que respecta als resultats de les proves de significativitat, malgrat l'elevat volum de resultats es poden observar patrons comuns. Destaca el fet de trobar mitges significatives tant positives com negatives, però les mitjanes significatives són sempre negatives. A més, n'hi ha un major volum de mitjanes significatives que de mitges, encara que açò pot estar generat pel mètode d'obtenció dels rendiments anormals. Finalment, es poden trobar països, esdeveniments i sectors econòmics on es donen més resultats significatius, tant en mitges com en mitjanes. De tots els resultats obtinguts, destaca que factors com estar llistat a un índex borsari o que l'ampliació de capital es realitze mitjançant drets de subscripció pareixen reduir les anomalies. Respecte a altres possibles condicions on s'han donat més anomalies, entre altres destaquen països com el Japó, Espanya o Suïssa, esdeveniments com el final del període de negociació dels drets de subscripció, o sectors econòmics com els relacionats amb els bens de consum o l'energia.

Amb tot açò, es pot concloure que existeix evidència suficient per confirmar que les ampliacions de capital generen, de manera sistemàtica, rendiments anòmals significatius, especialment baix determinades condicions que han pogut ser identificades. Un altre resultat a destacar és que, en aquest anàlisi, el compromís de l'empresa en termes socials i ambientals, de nou, pareix reduir les ineficiències que pateix la mateixa, malgrat en aquest cas l'efecte no és tant evident ni fort com l'identificat en el Capítol II. Aquest resultat, en conjunt amb els ja obtinguts als capítols anteriors, poden servir per a que les empreses coneguen millor a quins factors donar més atenció si volen beneficiar-se de millors condicions en una possible ampliació de capital. Per altra banda, els inversors estarien interessants en conèixer quins factors poden apuntar a una possible ineficiència que podrien explotar, mentre que els reguladors tindrien més informació sobre com millorar l'eficiència del mercat, especialment a aquest tipus de processos.

Finalment, aquest treball obri la porta a noves investigacions. Per exemple, resultaria de gran interès aplicar aquest tipus d'anàlisi amb dades intradiàries. És a dir, investigar si es donen rendiments anormals significatius durant les hores, minuts, o inclús segons anteriors i posteriors

a la publicació de la informació corresponent a l'esdeveniment. Per altra banda, els resultats obtinguts tornen a incidir en la possible importància de un comportament més responsable de l'empresa, pel que resultaria de gran interès dur a terme un estudi enfocat únicament en aquesta possible situació, cosa que es realitzarà en el Capítol IV.

Capítol IV: Sobre la relació entre les puntuacions ESG i l'eficiència de mercat en ampliacions de capital.

Fins a aquest moment, el Capítol I ha donat evidència de què, a Espanya, les ampliacions de capital generen dos tipus d'anomalies de mercat; l'aparició d'oportunitats d'arbitratge i la generació sistemàtica de rendiments anormals. El Capítol II i el Capítol III han demostrat, respectivament, que aquestes dos anomalies de mercat es donen també a nivell internacional, sent una anomalia inherent al propi procés de les ampliacions de capital. Els tres capítols, a més, han permès identificar un conjunt de factors que afecten a la formació d'aquestes anomalies, sent aquests factors relacionats tant en les ampliacions de capital com en les pròpies empreses emissores. Un dels factors identificats com a molt rellevant és el compromís i el comportament de l'empresa emissora en termes socials i mediambientals, mesurats amb la puntuació ESG. De nou, els estudis trobats no s'enfoquen massa en aquest tema concret, pel que es pot identificar una manca important a la literatura. Per altra banda, sí s'han trobat treballs que suggereixen que les empreses més compromeses en aquests termes es beneficien d'un millor i més eficient comportament als mercats financers. Aquesta possibilitat, apuntada pels capítols II i III, motiva l'estudi més exhaustiu que es du a terme en aquest treball, enfocat als factors ESG i al nivell de desenvolupament del país on es localitza l'empresa emissora. Concretament, es va a analitzar la relació entre aquests factors i l'aparició o no d'oportunitats d'arbitratge.

Per a dur a terme aquest treball, no ha resultat necessari obtindre nova informació, ja que amb la obtinguda i calculada al Capítol II és suficient. De la base de dades construïda en el seu moment, s'han seleccionat totes les ampliacions de capital per a les quals es disposa d'informació respecte a la puntuació ESG de l'empresa emissora en el moment de dur a terme aquest procés. La variable d'interès torna a ser el rendiment net de l'estratègia d'arbitratge, sobre la qual s'aplicaran els tests t de *Student* sobre la mitja, i *Wilcoxon* sobre la mitjana, que ja s'han aplicat en els capítols anteriors. En aquest cas, les submostres es van a construir tenint en compte únicament la qualificació ESG (A, B, C o D), i el nivell de desenvolupament del país en el moment de l'ampliació de capital (podent ser "alt", o "mitjà", no havent suficient observacions corresponents a un nivell "baix"). Per altra banda, també es proposa la següent equació per tractar d'explicar els rendiments de l'estratègia d'arbitratge:

$$RET_i = \beta_0 + \beta_1 * NTO_i + \beta_2 * ETC_i + \beta_3 * ITE_i + \beta_4 * ESGA_i + \beta_5 * ESGB_i + \beta_6 * ESGC_i \\ + \beta_7 * DEVH_i + \varepsilon_i$$

on RET_i és el rendiment net, i NTO_i , ETC_i i ITE_i son ràtios que expressen, respectivament, la relació entre les accions noves i les velles, entre el recursos propis i la capitalització de l'empresa després de l'ampliació de capital, i entre el preu de subscripció de les noves accions i el preu *ex-right* de les accions velles. $ESGA_i$, $ESGB_i$ i $ESGC_i$ son variables binàries que indiquen si la qualificació ESG és, respectivament, A, B o C (siguent D el nivell de referència), i $DEVH_i$ és una variable binària que indica si el país te un nivell de desenvolupament alt (sent el nivell mitjà el de referència).

Els resultats obtinguts demostren clarament com nivells més elevats de qualificació ESG estan relacionats amb rendiments menys elevats i, per tant, amb menors oportunitats d'arbitratge. Açò es pot vore tant en els resultats de les proves estadístiques com en els coeficients estimats per al model proposat. El mateix resultat es replica per al nivell de desenvolupament del país (major nivell de desenvolupament, menors són els rendiments obtinguts, i per tant menys arbitratges són detectats), encara que aquest efecte no és tant clar ni tant fort com en el cas de la qualificació ESG. Amb tota aquesta informació i resultats, aquest treball aporta evidència de què un compromís més fort en termes socials i mediambientals pot està relacionat amb una menor aparició d'anomalies de mercat. Aquest resultat es considera molt rellevant, ja que pot servir com a incentiu per a què moltes més empreses adopten comportaments molt més responsables, amb les externalitats positives que açò implicaria per a la pròpia empresa i per a la societat en el seu conjunt.

CONCLUSIÓ

Aquesta Tesi Doctoral ha estudiat les possibles anomalies de mercat que poden esdevenir en el marc dels processos d'ampliació de capital duts a terme per empreses de tot el món. Aquestes anomalies consistirien, principalment, en l'aparició d'oportunitats d'arbitratge entre les velles i les noves accions, o bé en la generació de manera sistemàtica de rendiments anòmals com a conseqüència de diferents esdeveniments relacionats amb aquests processos i la informació que aquests aboquen al mercat. Concretament, s'han realitzat estudis dedicats no només a detectar si aquestes anomalies realment es donen de manera sistemàtica, sinó també a identificar quins patrons de comportament segueixen, quines condicions les afavoreixen, i quins factors afecten, tant positivament com negativament la seua aparició.

L'estudi s'ha realitzat en quatre etapes, sent estes: (i) estudi dels dos tipus d'anomalies en ampliacions de capital amb drets de subscripció realitzades per empreses espanyoles, (ii) anàlisi

enfocat en possibles oportunitats d'arbitratge a ampliacions de capital amb drets de subscripció realitzades per empreses de tot el mon, (iii) investigació sobre possibles rendiments anormals generats de manera sistemàtica per determinats esdeveniments a tot tipus d'ampliacions de capital realitzades per companyies a tot el mon, i (iv) estudi enfocat en l'efecte del compromís i comportament en termes ambientals i socials per part de les empreses sobre les ineficiències de mercat que aquestes poden patir. Per a dur a terme aquests estudis, s'han emprat un conjunt molt variat de metodologies, des dels mètodes de neteja i filtratge d'informació, fins a les proves estadístiques i econòmiques.

Els resultats obtinguts en tots els capítols apunten en la mateixa direcció, i és que existeix evidència suficient per afirmar que aquests tipus d'anomalies poden donar-se en ampliacions de capital a tot el mon i en condicions molt diverses. A més, també s'han pogut identificar quins són els territoris, condicions i factors que afecten l'aparició aquestes anomalies, ja siga afavorint com perjudicant la seua aparició.

En el cas de les oportunitats d'arbitratge, encara que la intensitat varia entre els territoris, aquestes s'han detectat en la totalitat dels països analitzats (en alguns d'ells, les oportunitats d'arbitratge representen més del 50% del total de observacions). En aquests casos, destaca el fet de què no han desaparegut amb el temps, tal i com s'esperaria, sinó que s'han mantingut durant dies i, en alguns casos, durant tot el temps en el que els drets de subscripció estaven en negociació. Per altra banda, els models proposats per explicar, e inclús per predir l'aparició d'aquestes anomalies i la seua magnitud han donat molt bons resultats (tenint països com Àustria o Finlàndia amb una taxa d'èxit superior al 60%), el que demostra que els factors escollits (com la pertinència a un índex borsari, algunes ràtios relacionades amb l'ampliació de capital (relació entre les noves accions i les velles, relació entre els recursos i la capitalització de l'empresa després de l'ampliació de capital, o la relació entre el preu d'emissió de les noves accions i el preu *ex-right* de les velles) o els objectius del procés (si són de caràcter general o concrets, com els relacionats amb adquisicions, inversions o refinanciacions)) si tenen un efecte significatiu en la seua formació. Per últim, però no per ell menys important, cal destacar que aquests resultats teòrics han estat acompanyats d'implementacions reals de l'estratègia d'arbitratge proposada, obtenint resultats en concordança amb els que es calculaven teòricament. Pel que respecta als rendiments anormals, aquests també han pogut ser identificats en moltes ampliacions de capital a tots els països analitzats. Per evitar que la metodologia escollida afectara als resultats, s'han aplicat alhora diferents procediments, apuntant tots ells en la mateixa direcció. I, encara més, s'han pogut identificar factors com la pertinència a un índex borsari o l'ús de drets de subscripció, o condicions com determinats territoris (Japó, Espanya o Suïssa), esdeveniments (final de la cotització dels drets de subscripció) o sectors econòmics (bens de consum i energia), que presenten un major

volum de resultats significatius. Per últim, aquest treball ha demostrat la importància i els beneficis per a les empreses d'un comportament social i mediambiental més fort, al demostrar que nivells més alts d'aquest tipus de compromís redueixen les ineficiències que pot patir l'empresa.

Considerem que aquests resultats són prou rellevants, i que poden ser realment útils per a molts agents econòmics. Per als organismes reguladors, aquests resultats donen més informació respecte a quins aspectes deuen tindre més controlats per assegurar un comportament millor i més eficient dels mercats financers. Pel que respecta als inversors, aquest treball ofereix molta informació respecte a quins factors podrien apuntar a la presència d'anomalies de mercat que, amb una correcta planificació i amb estratègies de negociació adequades, li'ls permetrien obtindre uns beneficis significatius mentre, alhora, ajuden a corregir-les. Finalment, les empreses, i especialment les que estiguen plantejant dur a terme una ampliació de capital, poden beneficiar-se de les aportacions d'aquesta Tesi. Concretament, d'aquests resultats poden conèixer quins són els factors i les variables a tindre en compte per assegurar que s'aprofiten d'unes millors condicions de mercat, i que les seues accions tinguen el preu més just possible. A més, aquest estudi també pot servir com a incentiu per a què les empreses es comprometen de manera més forta a adoptar pràctiques i compromisos destinats a millorar el seu ambient, amb tots els beneficis que això pot aportar tant a la pròpia empresa com a la societat en general.

FUTURES INVESTIGACIONS

Una vegada finalitzat aquest treball, es considera que la Tesi Doctoral ha acomplert amb tots els objectius amb els que es va proposar. No obstant, queden encara moltes preguntes que els resultats no poden respondre, i aquests inclús han donat pas a noves preguntes que no s'havien plantejat en un primer moment. Totes aquestes propostes, que es resumeixen a continuació, motivarien la realització de nous estudis en un futur proper.

En primer lloc, replicar molts de les anàlisis amb dades intradiàries permetria comprendre millor com es comporten les anomalies del mercat i revelar si existeixen efectes a curt termini que podrien diluir-se en utilitzar dades diàries. Això podria llançar llum sobre la vertadera dinàmica d'aquestes anomalies i la seua duració. En segon lloc, encara queden casos per explorar que podrien influir significativament en les anomalies detectades o fins i tot donar lloc a altres noves. Per exemple, l'examen de les ofertes d'accions realitzades per empreses que cotitzen simultàniament en diferents mercats i l'estudi dels efectes sobre els derivats financers dependents de les accions de l'empresa emissora podrien aportar valuoses dades. En aquest mateix sentit, en el procés de càlcul dels rendiments de l'estratègia d'arbitratge es van detectar resultats excessivament elevats, que es van retirar per evitar que contaminaren els resultats, però que

resultaran d'especial rellevància per als inversors. Resultaria de gran interès analitzar en profunditat aquests casos, i identificar possibles explicacions a aquests comportaments. Finalment, resulta de gran profit aplicar una anàlisi més sofisticada per a comprendre els efectes dels esdeveniments en els mercats financers i modelitzar-los utilitzant la metodologia del Filtre de *Kalman*. Permetre que el paràmetre constant (alfa) del model varie al llarg del temps podria ajudar a identificar "salts" en dies d'esdeveniments o dies posteriors, permetent detectar i examinar les seues característiques i variacions en funció del tipus d'esdeveniment o altres factors rellevants associats a aquestes anomalies.

Seguint aquestes futures línies d'investigació, podria aconseguir-se una comprensió més completa i detallada de les anomalies del mercat i de la seua dinàmica subjacent, la qual cosa podria aportar valuosos coneixements als inversors, els responsables polítics i els investigadors de l'àmbit financer.