The effects of warrants in the long-term performance of Initial Public Offerings: evidence for the British market

by

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Dissertation of Master in Finance

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2015

Biographical Note

Tiago Barbosa was born on December 13, 1986, in Penafiel, Portugal. He earned his Bachelor`s degree in Economics from the Department of Economics, Management and Industrial Engineering, at the University of Aveiro (DEGEI-UA), in 2008. During the period of his Bachelor's degree he studied at the University of Milan – Bicocca in Italy as an exchange student. In September 2008, he enrolled as a graduate student in the Master's in Finance at the School of Economics and Management, at the University of Porto (FEP-UP). Having finished the curricular part of his Master's, he started to work as a financial controller and commercial manager in multinational and national corporations, respectively. In the summer of 2014 he decided to return to the University of Porto to finish his Master's programme, starting again in September of that year.

Acknowledgements

First, I would like to thank my advisor, Professor Cláudia Ribeiro for her objective contributions and motivation. I am also grateful to Professor Paulo Pereira, Director of the Master's in Finance, for accepting my re-entry in the Master's, encouraging me to complete it.

Second, I would like to thank and dedicate this work to my parents, who always encouraged me to study, providing me with conditions to do it.

Then and with no particular order, I would leave my sincere thanks to the people who also helped me to complete this goal. To Éder Marcos de Oliveira, a friend without whom I could not deliver this research work; to Paula Carvalho for all the help in the collection of data and the kind words in difficult times; to Diana Oliveira, my English teacher, who prepared me for this challenge also reviewing all my work; to Professor Vitorino Martins for the clarification of doubts about econometrics; to all the staff of the FEP library; and to Ana Matos for never giving up on me and for all the advice that helped me grow as a person.

Directly or indirectly many other friends were important throughout this project, especially Evaldo Baptista, Pedro Gomes, Francisco Reis and Lassana Dafé.

All these people know that for me this project was more than an academic work. This project became a life lesson.

To all of you, thank you!

Abstract

The agency costs hypothesis argues that firms include warrants in their IPOs to bind managers to optimal investment decisions, while the signalling hypothesis considers that those firms are riskier and expects higher returns than from other firms that do not include warrants in order to compensate the investors' extra risks. Thus, this study tests the extent to which the agency costs and signaling models explain the reason for the issuance of IPOs with warrants in the United Kingdom between 2000 and 2011. Analyzing a sample with fifty-six companies of which twenty-three issued IPOs with warrants while the other thirty-three issued IPOs without warrants, we conclude that most firms that used warrants in their IPOs are from the mining and manufacturing industries, followed by finance, insurance and real estate. The firms that issued IPOs without warrants during this period have the same SIC code as firms that used warrants. Contributing for filling in a gap in literature through the use of the long-term price performance approach, we analyze the performance of these firms comparing with firms that issued IPOs without warrants. All results were compared with the returns of a market index and a set of control non-IPOs firms, listed in the United Kingdom Stock Exchanges and matched on both size-and-book-to-market ratio and industry-size-and-book-to-market-ratio. Despite the event-study analysis present results that do not corroborate totally the agency costs and signaling models, in matched calendar-time regressions the performance of IPOs with warrants is better than that of IPOs without warrants when based in direct comparison of value-weighted portfolios. So, these results meet the prediction of the agency costs and signaling theories. Thus, this study launches again the discussion around this topic and reveals that, although this theme has been little studied, it cannot be completely disregarded.

Keywords: Warrants; Initial Public Offerings; Long-term Abnormal Returns; Agency Costs; Signaling

JEL-Codes: D82; G14; G30

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Acronyms

BHAR – Buy and Hold Abnormal Return

CAR – Cumulative Abnormal Return

HML – High minus low

IPO – Initial Public Offering

MSCI – Morgan Stanley Capital International

SEO – Seasoned Equity Offering

SIC – Standard Industrial Classification

SMB – Small minus big

WLS – Weighted Least Square

1. Introduction

In order to raise funds for business expansion and investment, many companies choose to go to the market in the form of public offerings. With the development of financial markets, some initial public offerings (IPOs) have been including warrants and not only the traditionally common or preferred stocks. "This method consists of a bundle of common stocks and warrants, sold together as a package, but traded separately in the aftermarket" (Gajewski et al., 2007, p. 25). However, this method is debatable. "Practitioners often regard IPOs with warrants as "sweeteners" used to boost weak demand for low quality offerings. Academics argue that the practitioners' view is unsatisfactory" (Mazouz et al., 2008a, p. 210). For academics this method originates a sequential financing that can ensure investors a lower probability of excess free cash flow being squander in negative net present value projects (Schultz, 1993). In the same way, it can be used to signal the issuers' confidence in their future performance because the second stage financing is conditional on stock price appreciation (Chemmanur and Fulghieri, 1997). So, according to the agency costs hypothesis, firms include warrants in their IPOs to bind managers to optimal investment decisions, while the signalling hypothesis expects that firms that use warrants in their IPOs are riskier than firms that not use warrants. This originates expected higher returns to compensate the investors' extra risks.

However, it is yet complicated to argue that returns are higher as suggested by theory, because this topic has received little attention from the finance literature. The existing studies have been focusing on reasons for firms to use warrants in IPOs, testing the agency costs and signaling hypothesis. The study of Mazouz et al. (2008a) was the only to test the extent to which the agency costs and signaling models explain the reason for IPOs with warrants issuance using the long-term price performance approach. Filling in a gap in the empirical literature and analyzing IPOs with warrants in the Hong-Kong Stock Exchange from 1990 to 2002, they conclude that their long-term price performance rejects the predictions of both models. Not contesting their results we think that their conclusion cannot be assumed as entirely feasible, once the prices of listed firms and their respective performance can be influenced by external factors not directly connected with the firms but with the markets' momentum and consequent investment

of shareholders in products sometimes unknown. So, it is relevant to analyze new markets, hoping to get results, which can corroborate or refute the existing findings. Following the same methodology of Mazouz et al. (2008a) we will test the extent to which the agency costs and signaling models explain the reasons for the issuance of IPOs with warrants in the United Kingdom from 2000 to 2011. So, we will study a sample with fifty-six companies of which twenty-three issued IPOs with warrants while the other thirty-three issued IPOs without warrants. Most firms that used warrants in their IPOs are from the mining and manufacturing industries, followed by finance, insurance and real estate. The firms that issued IPOs without warrants during this period have the same SIC Code as firms that used warrants.

Analyzing a market for so long removed from this topic, we will also try to obtain answers about the type of firms that are more likely to use warrants in IPOs. To obtain these results, we used a descriptive analysis of our sample, distributing firms by deciles and comparing with other previous studies. After that, we used the event-study analysis of abnormal returns and the calendar-time regressions of Fama (1998). For robustness purposes and following previous studies, we will systematically compare the obtained returns to a set of control firms matched on both size and book-to-market ratio and industry-size-and-book-to-market ratio.

The results obtained reveal that the type of firms using warrants in their IPOs have been changing. Nowadays, there are larger companies using warrants to signal their value and increase the raise of capital in initial public offerings. Some of these companies are directly connected with areas of activity in which future cash flows are uncertain, like mining. On the other hand, the performance of these companies according to the event-study analysis underperform the firms that issued IPOs without warrants, revealing results consistent with the agency costs and signaling models. The results of calendar-time regression follow the same trend. However, in matched calendar-time regressions the performance of IPOs with warrants is better than that of IPOs without warrants when based in direct comparison of value-weighted portfolios. More conclusively we can argue that the results obtained show some evidence that supports the agency costs and signaling hypotheses.

This way, we are the first study supporting partially the agency costs and signaling

models, analyzing a new market with more recent data. Using the long-term price performance approach, we also do a more specific analysis based only on companies from the same industry, hoping not to get skewed results. More importantly, this study launches again the discussion around this topic.

The remaining sections of the paper are structured as follows: section 2 presents the literature review, including the main theory that explains the use of warrants in IPOs and the main empirical studies about the long-term performance of firms that issue IPOs with warrants; section 3 contains the data description and the control samples that we used in our analysis; in section 4, the methodology and the empirical results are presented; finally, section 5 includes the main conclusions and is followed by the bibliography and the appendix parts.

2. Literature review

In this section we analyze the agency costs and signaling hypotheses and present the results of the main empirical studies that test the predictions of these hypotheses. We also present the scarce empirical studies that analyzed the long-term performance of equity offerings with warrants.

2.1. Agency costs hypothesis

When a firm issues IPOs with warrants, equity is expected to be used to finance investments with positive net present value. However, if investors, normally out of the firm management, cannot determine the real value of potential investments, they may be reluctant to subscribe any equity offering. They are before the potential risk of free cash-flow, which states that remaining funds from IPOs can be squandered by managers on projects with negative net present value for their own personal benefit, particularly when ownership is dispersed and the firm's monitoring is reduced (Jensen, 1986). Motivated by this hypothesis, Schultz (1993) illustrates that warrants in IPOs can be used to limit the agency costs, arguing that IPOs with warrants serve the same purpose as staged equity financing in venture capital. Providing equity financing in stages, the use of warrants in IPOs encourages managers to make optimal investment decisions for the firm, once the success of financing in stages is dependent on their decisions. Thus, the second step of financing only happens if the managers choose high value projects where the stock price will exceed the warrant exercise price, and warrant holders will certainly obtain a profit exercising these warrants. In addition, this prevents firms from selling shares in a second round of equity financing without first determining the value of their projects, providing, thus, a constant analysis and dissemination of project results.

The agency costs hypothesis leads to several testable predictions. "First, because the initial public offering with warrants proceeds are used to determine the viability of potential investments, many firms will prove to have no positive net present value investment" (Schultz, 1993, p. 205). Thus, a small group of firms that use warrants in their IPOs survive. Second, "the firms that can survive will be more likely to receive additional equity" (Schultz, 1993, p. 205). Third, the firms that issue IPOs with warrants

"are more likely to issue initial public offerings with warrants if their prospects are difficult to evaluate on the basis of the current available information" (Schultz, 1993, p. 205), suggesting that these firms have a "short operation background, sophisticated products and little sales, earnings or assets" (Schultz, 1993, p. 205). Fourth, the IPOs with warrants are used when managers own a small portion of the firm's equity and thus, if they make bad investments, the costs will be lower.

Consistent with these predictions, Schultz (1993) shows that most firms that issue warrants in initial public offerings are also smaller, younger and mainly from high-tech or services industries. In the same way these firms tend to have more agency costs and are more risky and more likely to fail than those issuing shares alone. However, Jain (1994), Lee et al. (2003) and How and Howe (2001) find that the probability of failure is independent of whether the IPOs are issued with warrants or not, when firms have similar characteristics.

2.2. Signalling hypothesis

Based on a pioneer study of Leland and Pyle (1977), Chemmanur and Fulghieri (1997) propose a signalling model, which requires the interaction of asymmetric information and managers' risk aversion. "Their model allows for the firms to differ in both the mean and the riskiness of their future cash flows. At time 0, the firms` insiders know the true mean and the variance of the future cash flows, but they do not know the exact value that will occur at time 1" (Gajewski et al., 2007, p. 29). Thus, the good firms can use three signals to distinguish themselves from the bad firms: the fraction of equity retained, the degree of underpricing and the number of warrants. All signals are costly for the firm, whereby firm insiders will choose the signal that maximize their utility, or equivalently, minimize signalling costs. Thus, Chemmanur and Fulghieri (1997) have demonstrated that, in equilibrium, high risk firms package their equity with warrants while lower risk firms issue equity alone.

Their model also provides several testable predictions. First, in a group of firms that are indistinguishable prior to the initial public offering, the subset of firms that employ warrants will have a greater variability of future cash flows compared to those that have made initial public offerings with equity alone. Second, the proportion of the firm's

value sold as warrant increases with the level of the IPO firm riskiness, holding constant the fraction of equity retained by insiders. Third, the percentage of underpricing increases with the firm's riskiness, regardless of the type of IPO. Fourth, in IPOs with warrants, the fraction of equity retained by firm insiders decreases according to the firm's riskiness, keeping constant the proportion of the firm sold as warrant.

Empirically, Schultz (1993) offers a strong conclusion that supports the greater variability of future cash-flows from firms that issue IPOs with warrants compared with firms that issue IPOs without warrants. Analysing data from firms that issued initial public offerings in the Australian Stock Exchange, How and Howe (2001) provide results that support the Chemmanur and Fulghieri (1997) predictions. They find that firms that issue IPOs with warrants are more risky than firms that do not include warrants in IPOs, while the level of underpricing increases with this risk. After controlling the equity retained by insiders, the proportion of firm value sold as warrant increases with firm riskiness. Similar results are found by Lee et al. (2003) for Australian IPOs and by Jain (1994) for US IPOs. However, comparing IPOs with warrants, Garner and Marshall (2005) conclude that this riskiness is not uniform across all IPOs. They conclude that companies with longer warrant exercise periods and a lower ratio of shares to warrants are riskier. Analyzing the Chinese IPOs listed in the Hong-Kong Stock Exchange, Mazouz et al. (2008b) also obtained results that support the signaling model. However and using other model of analysis based on the long-term price performance approach, Mazouz et al. (2008a) rejects the prediction of agency costs and signaling models.

The predictions of the signaling model were also tested in other types of equity offerings like seasoned equity offerings (SEOs). Byoun and Moore (2003) support the signaling predictions for US SEOs, while Chollet and Ginglinger (2001) show that in France, SEOs are likely to be offered by firms that face high information asymmetry.

2.3. Performance of equity offerings with warrants

In an efficient market setting, the use of warrants in equity offerings should not provide any advantage to the issuing firm. However, the theories about this topic are based on the assumption of asymmetric information between insider and outsider investors.

Therefore, and considering also this assumption, the average long-term performance of offerings with warrants must be greater than that of offerings only with shares, to make up for the higher risk undertaken. This prediction is consistent with the Schultz (1993) and Chemmanur and Fulghieri (1997) models, once the firms are riskier, and for these level of risk high quality firms use warrants in their equity offerings to signal their quality. So, we can consider that the post-issue long-term performance of equity offerings with warrants is related with the significance of agency costs and asymmetric information problems in public offerings.

The empirical results show that long-term stock price performance of equity offerings with warrants is not consistent with the implications of the theories above explained, in spite of the evidence of less severe price reaction to announcements compared with equity offerings with shares only. Consistent with this conclusion, Lee (1997) shows that SEOs with warrants underperform the SEOs without warrants. This underperformance is robust to other alternative specifications based on various firm and/or offerings characteristics. Byoun (2004) measure the long-term price performance by selecting matched firms according to various firm caractherisicts and comparing them with firms that used warrants in their SEOs. They also find that, in general, the long-term stock performance of SEOs with warrants underperform not only the prior returns of non-issuing, size-and-book-to-market ratio matched firms but also similar SEOs without warrants. The same resuls are found when the long-term performance is compared with a market index or measured by the three-factor or four-factor model. Their conclusions are consistent with previous studies of Ritter (1991), Levis (1993); Loughran and Ritter (1995) and Jegadeesh (2000) that show that, on average, the post-issue long-term holding period stock price returns of issuing firms are lower than their matched firms and benchmarks.

Mazouz et al. (2008a) test the extent to which the agency costs and signaling models explain the reasons to include warrants in IPOs using the long-term price performance approach. They conclude that initial public offerings with warrants have higher profitability and better asset utilization rates compared with initial public offerings without warrants. However, the event-time average cumulative abnormal returns and buy-and-hold abnormal returns suggest that IPOs with warrants underperform

significantly the IPOs without warrants in the long term. Given the potential problems associated with the use of the event-time approach, they employ the matched calendar-time regression methodology. Also, under the matched calendar-time regression approach, they do not find any evidence that IPOs with warrants performed better than IPOs without warrants. Basically, these findings are not consistent with theories that explain the use of warrants in equity offerings as mechanisms of reducing agency costs or of signaling firms future cash-flows.

3. Data description and control samples

In this section we present our sample and explain how data was obtained, followed by a descriptive analysis. We also present a control samples, used to test the robustness of our sample.

3.1. Sample selection and data description

We analyze a sample of twenty-three IPOs with warrants and thirty-three IPOs without warrants issued in the United Kingdom from January 2000 to December 2011. The data were collected from Zephyr database and the subset of twenty-three IPOs with warrants was selected from a total of sixty-four IPOs with warrants issued in the European Union in the period above mentioned. Consistent with the prior literature, we excluded from the sample the close-end funds, investment trusts, acquisition vehicles and blank check companies and companies with missing data. Finally we excluded an IPO with warrants issued in the Cyprus Stock Exchange, once the introduction of different currencies in our analysis could bring errors related with the impossibility to eliminate the effect of the exchange rate that would be used to convert the values of this firm to pounds. After that, we selected the IPOs with warrants following a new criterion based on the only selection of IPOs without warrants that have the same SIC Codes[1] of IPOs with warrants. So, we distance ourselves from the study of Mazouz et al. (2008a) that analyzed all IPOs without warrants issued in the Hong-Kong Stock Exchange regardless if they were connected with the SIC Codes of IPOs with warrants or not. The offering information was obtained from the description of IPOs in the Zephyr database, while equity prices and market value and book to market ratio of firms were obtained from Datastream. The frequency distribution of all IPOs, over the sample period, is presented in table 1.[2]

The total number of IPOs with warrants is rather small and below the number of IPOs without warrants. The difference between IPOs with warrants and IPOs without warrants is not a surprise, and follows the trend already mentioned in other studies, namely How and Howe (2001), Lee et al. (2003) and Mazouz et al. (2008a). However,

[1] Standard Industrial Classification (SIC) codes are four-digit numerical codes assigned by the U.S. government to business establishments to identify the primary business of the establishment.
[2] A graph with the distribution of sample is in appendix 1.

the size of our sample is much smaller than the samples already studied. This reveals the differences on the use of warrants in IPOs around world. This procedure is more usual in countries like the United States, Australia and Hong-Kong, whereby almost all studies refer to the stock exchanges from these countries. These stock exchanges have more liquidity and a significant number of transactions. However, the volume of IPOs with warrants has been decreasing in the last years, coinciding with the regulatory changes in some countries.

Table 1 - Distribution of the sample, 2000-2011.

Year	IPOs with warrants	IPOs without warrants	All IPOs
2000	0	8	8
2001	0	1	1
2002	2	1	3
2003	2	1	3
2004	5	4	9
2005	5	7	12
2006	7	3	10
2007	0	4	4
2008	1	0	1
2010	1	4	5
2011	0	0	0
2000-2011	23	33	56

The table lists the number of firms that went public on United Kingdom during 2000-2011 by the issue year and issue type.

For example, in the Hong Kong Stock Exchange listing requirements, which became effective from September 15, 1994, the objective of the new regulation is to screen out a subset of poor IPO performers (Mazouz et al., 2008a). It is therefore possible to argue that the high quality of information associated with the newly introduced regulations should enable investors to better discriminate between high-and low-quality issuers. In our study, the number of IPOs with warrants increased consistently from 2002 to 2006, year with more IPOs with warrants listed. Curiously, after that, the number of IPOs with warrants decreased again, and there were no IPOs with warrants in the years of 2007 and 2011. The numbers of IPOs without warrants were more inconstant but with special incidence between 2004 and 2006, like the IPOs with warrants. Once we are analyzing IPOs with the same SIC code, we can conclude that the preference of companies to issue IPOs without warrants is much greater.

Table 2 summarizes the size and book-to-market rankings of the firms that issued IPOs as of the listing month, as well as their industry distribution. In the size ranking, for each month, we rank firms by their market value, which is calculated as the share price multiplied by the number of ordinary shares, at the beginning of the month, placing them into deciles.

Table 2 - Size, book-to-market and industry distribution of the sample firms.

	IPOs with warrants		IPOs without warrants		All IPOs	
	Number	(%)	Number	(%)	Number	(%)
Panel A: Size						
Decile 1-2	6	(26,09%)	5	(15,15%)	11	(19,64%)
Decile 3-4	3	(13,04%)	8	(24,24%)	11	(19,64%)
Decile 5-6	4	(17,39%)	8	(24,24%)	12	(21,43%)
Decile 7-10	10	(43,48%)	12	(36,36%)	22	(39,29%)
Panel B: M/B						
Decile 1-2	4	(17,39%)	8	(24,24%)	12	(21,43%)
Decile 3-4	8	(34,78%)	3	(9,09%)	11	(19,64%)
Decile 5-6	3	(13,04%)	7	(21,21%)	10	(17,86%)
Decile 7-10	8	(34,78%)	15	(45,45%)	23	(41,07%)
Panel C: Industry						
Mining	11	(47,83%)	3	(9,09%)	14	(25,00%)
Manufacturing	5	(21,74%)	3	(9,09%)	8	(14,29%)
Finance, insurance and real estate	4	(17,39%)	2	(6,06%)	6	(10,71%)
Services	2	(8,70%)	25	(75,76%)	27	(48,21%)
Transportation and public utilities	1	(4,35%)	0	(0,00%)	1	(1,79%)

This table describes the size, book-to-market and industry distribution of the sample firms. In the size ranking, for each month, we rank firms by their market value, placing them into deciles. Following the same method, in book-to-market ranking, for each month, we rank firms by their book-to-market ratios, placing then into deciles. In industry ranking firms each firms is assigned to one industry using primary SIC codes. Market value is the share price multiplied by the number of ordinary shares in issue based on the first month available market capitalization on the Datastream, after the offering date. Book to market ratio is defined as the balance sheet value of the ordinary (common) equity divided by the market value of the ordinary (common) equity in the company.

Following the same method, in the book-to-market ranking, for each month, we rank firms by their book-to-market ratio, which is defined as the market value of the ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity in the company, placing them into deciles. In industry ranking firms, each firm is assigned to one industry using primary SIC codes. To ensure the consistency of data, we checked the correspondence between the date of IPOs on Zephyr and the first available monthly price observations in Datastream. Some IPOs were excluded for having revealed inconsistencies. Panels A and B of table 2 lists the firms by their size-and-book-to-market ratios, respectively, splitting the IPOs by IPOs with warrants and IPOs without warrants. As we can see in the third column of panel A, the firms that issued IPOs between 2000 and 2011 tend to have a similar market value. Table 2 shows that 39,28% of firms that issued IPOs are in the first deciles and the other 39,29% firms are in the highest decile. Understanding which type of IPOs have more impact in this fact, we conclude that the firms that issued IPOs with warrants had a higher contribution for the increase of firms with high market value. Almost 44% of IPOs with warrants firms are concentrated in the largest decile, against 36% of IPOs without warrants firms. This conclusion is different from conclusions obtained by Mazouz et al. (2008a) that analyzed the IPOs in the Hong-Kong Stock Exchange, between 1990 and 2002. They conclude that firms that issued IPOs with warrants have a lower market value. In their study only 15,33% of IPOs with warrants firms are concentrated in the largest decile. Thus, we can conclude that the type of firms issuing IPOs with warrants have been changing, emerging large companies using warrants in their IPOs.

Analysing panel B, it is notorious that a significant number of IPOs firms (41,07%) are concentrated in the largest decile revealing better book-to-market ratios comparing with the value (8,94%) obtained by Mazouz et al. (2008a). Analysing separately the firms that issued IPOs with warrants and IPOs without warrants, we can verify that firms that issued IPOs without warrants have better book-to-market ratios. Nevertheless, it is important to mention that 34,78% of firms that issued IPOs with warrants have a higher market value than the firms that issued IPOs with warrants in the Hong-Hong Stock Exchange in the last century (9,75%). This result leads us to believe that in the last years the type of firms using warrants in their IPOs have been changing, so these companies present a greater dimension. Thus, the distribution of IPOs with warrants is

less consistent with the predictions of the agency costs and signalling models that argue that warrants are used by smaller firms in their initial equity offerings.

Panel C shows the industry distribution of our sample. The mining industry leads the number of IPOs with warrants, providing a clear indication of industry clustering in the British markets. This fact is not a surprise for us, once the United Kingdom has the most important Stock Exchanges of metals in the world. In other way, these numbers reveal that companies that have projects in areas with higher uncertainty, as is the case of mining industries, use warrants in initial equity offerings to provide more confidence to investors. Moreover, in the analysed period, companies with specific SIC codes from manufacturing companies and finance, insurance and real estate companies issued more IPOs with warrants than IPOs without warrants. The same did not happen for service companies, once, in the analysed period, this industry issued twenty-five IPOs without warrants against only two IPOs with warrants. These results are different from the results of other authors like Schultz (1993) and Lee et al. (2003) that considered the services industry as the industry with greater number of IPOs with warrants. Curiously, the results of Lee et al. (2003) showed that industries including mining, fishing, farming, transportation, construction, and financial services are the industries with less IPOs with warrants, in other words, the opposite of our results. However, a recent study of Mazouz et al. (2008a) reveals results more similar to ours, with the manufacturing industry leading the type of industry that issued more IPOs with warrants and the services firms opting to issue IPOs without warrants instead of IPOs with warrants. The mining industry does not have significant results in their study, maybe because the Hong-Kong Stock Exchange is not a reference in the price of metals, contrary to the London Stock Exchange, for example. The transportation and public utilities industry registered only one IPO with warrants. These conclusions are consistent with the agency costs and signalling models that predict some degree of industry clustering for IPOs with warrants, once the warrants are used in IPOs when the future cash flows are relatively uncertain leading to a systematic variation of viability of investment opportunities across industries (Schultz, 1993).

3.2. Control samples

Bearing in mind that the study aims to analyze the robustness of the performance of IPOs with warrants, we decided to compare systematically their returns to those of a set of control firms. Following the previous studies of Ritter (1991), Loughran and Ritter (1995), Eckbo and Norli (2005) and Mazouz et al. (2008a), these firms were matched on both size, size-and-book-to-market ratio and industry-size-and-book-to-market ratio. Size-matched firms were selected from all companies listed on the United Kingdom Stock Exchanges and publicly listed before their correspondent IPO firms. According to the criteria used to define the list of IPOs without warrants, we only chose companies with SIC codes belonging to the group of SIC codes from companies that issued IPOs with warrants. From these set of preselected companies, the size-matched firms are the non-IPOs firms closest in market capitalization to the companies that are analyzed. The IPOs firms' market capitalization is based on the first month available market capitalization on Datastream, after the offering date. When matching is based on the size-and-book-to-market ratio, the criterion is the selection of companies that have equity market values within 30% of the equity market value of the issuer from the set of firms above-mentioned. After that, this subset is ranked according to book-to-market ratios that are closest to the IPOs firms. In the industry-size-and-market-to-book-ratio matching, the matched firms are selected following the same method of the size-and-book-to-market ratio, adding the criterion that these non-IPOs firms must reveal the same SIC Code of the IPOs firms.

Table 3 shows the size-and-book-to-market ratios of the IPOs firms and their matched pairs. Once the analyzed sample did not show normality and homogeneity we used a non-parametric test, although some literature argues that parametric tests are robust to the violation of the normality assumption, since the size of samples is not extremely small ($n<30$) (Refinetti, 1996). So, we used the test of Wilcoxon-Mann-Whitney suitable to compare the medians of two independent populations. Thus, we compare the medians of each matched firms portfolios with the portfolios of initial public offerings. The size and book-to-market ratios of all IPOs is not significantly different from the values of their size-matched firms. The differences increase when the comparison is made with the other matched firms. The IPOs with warrants and IPOs without warrants

show the same trend, with exception to the value of book-to-market ratios that differ for all matched firms, including the size-matched firms. Analyzing directly the differences between IPOs with warrants and IPOs without warrants, it is notorious that firms that issued IPOs without warrants are greater than IPOs with warrants, confirming the conclusions of Schultz (1993) and Byoun and Moore (2003) that these firms are smaller and younger. Relatively to the market-to-book-value ratios, the IPOs firms are significantly higher than their matched firms, especially the size-matched firms. Our results are a little different from the results of Mazouz et al. (2008a). They did not find significant differences in the correspondence of IPOs with all their matched firms with regard to their size. Nevertheless, the book-to-market ratios between their IPOs and matched firms have the same trend. Therefore, we must agree with their conclusion that the difference in book-to-market ratios between IPOs and their matched firms calls for the use of other methods to better account for firms' characteristics.

Table 3 - Size-and-book-to-market characteristics of the IPOs firms and their non-issuing control firms.

	IPOs	Matched Firms					
		Size matched	p-Value	Size and b/m matched	p-Value	Industry, size and b/m matched	p-Value
Panel A: All IPOs							
Average size	50,29	50,28	0,980	42,18	0,202	39,46	0,073*
Average book-to-market-value	5,85	5,32	0,077*	4,99	0,303	5,98	0,302
	IPOs	Matched Firms					
		Size matched	p-Value	Size and b/m matched	p-Value	Industry, size and b/m matched	p-Value
Panel B: IPOs with warrants							
Average size	16,09	16,39	0,955	39,55	0,161	37,16	0,075*
Average book-to-market-value	6,58	3,74	0,486	5,32	0,217	3,95	0,144
	IPOs	Matched Firms					
		Size matched	p-Value	Size and b/m matched	p-Value	Industry, size and b/m matched	p-Value
Panel C: IPOs without warrants							
Average size	74,13	74,37	0,919	43,93	0,760	41,02	0,437
Average book-to-market-value	6,74	5,32	0,103	4,73	0,716	7,39	0,852

This table describes the size and book-to-market characteristics of the 56 analyzed firms that went public in United Kingdom between 2000 and 2011 and their non-issuing control firms matched on size, size-and-book-to-market ratio, and industry-size-and-book-to-market ratio. The firms were selected from all companies, with the same SIC Code of IPOs with warrants firms, listed on United Kingdom Stock Exchanges and publicly listed before their correspondent IPO firms. The size-matched firms are the non-IPOs firm closest in market capitalization to the IPOs firms. The size-and-book-to market matched firms are selected from the firms that have equity market values within 30% of the equity market value of issuer. After that, this subset is ranked according to book-to-market ratios closest to the IPOs firms. The industry-size-and-market-to-book ratio matching following the same method, with the restriction that the non-IPOs firm belongs to the same industry as the IPOs firm. Market value is the share price multiplied by the number of ordinary shares in issue based on the first month available market capitalization on the Datastream, after the offering date. The amount in issue is updated whenever new tranches of stock are issued or after a capital change. Market value is displayed in millions of units of local currency. Book to market ratio is defined as the balance sheet value of the ordinary (common) equity divided by the market value of the ordinary (common) equity in the company.
The results were automatically obtained by SPSS.
* indicate significance at 1%.

4. Methodology and results

Following very closely the methodology of Mazouz et al. (2008a), in this section we present the three main models referred in literature to analyse the long-term performance of IPOs: the event-time approach and the calendar-time and matched calendar-time regressions. The event-time approach uses a variety of methods for measuring long-term abnormal returns, suggesting that initial public offerings underperform the market index. However, this model is very debated in literature and to mitigate the biases associated with the use of the event-time approach, we use a standard calendar-time regression that suggests significantly negative abnormal returns for both type of IPOs only when the equally weighted returns are used. To better control for firm size and book-to-market characteristics, we also used the matched calendar-time factor regression.

4.1. Event-time abnormal returns

Abnormal returns are the crucial measure to assess the impact of an event. The general idea of this measure is to isolate the effect of the event from other general market movements. In event-study analyses, two different measures of aggregated abnormal returns are often used to measure the long-term price performance: the cumulative abnormal return (CAR) and/or the buy-and-hold-returns (BHAR). For robustness purposes, we used both. The samples of all IPOs, with and without warrants, were monitored for a 3-year period after issuance. To measure the abnormal returns associated with our samples of IPOs firms, we followed Mazouz et al. (2008a) and Cheng (2005) and used the event-induced average cumulative abnormal return ($\overline{CAR}$) and the event-induced average buy-and-hold return ($\overline{BHAR}$). The three-year $\overline{CAR}$ and $\overline{BHAR}$ are computed as described in equations (1) and (2) and w_i is the weight on the firm I and N is the number of firms.

$$\overline{CAR} = \sum_{i=1}^{N} w_i CAR_i \qquad (1)$$

$$\overline{BHAR} = \sum_{i=1}^{N} w_i BHAR_i \qquad (2)$$

For any abnormal average returns, we also calculated different portfolios based on equally-weighted and value-weighted returns. The equally weighted (EW) returns were obtained dividing each value by the total number of observations, $\omega_i = 1/N$, providing an equal weight for each firm. The value-weighted (VW) returns, $\omega_1 = MV_i/MV$, provide a more measured weight where MV_i is the issuer's common stock market value at the end of the event month and $MV = \Sigma_i MV_i$.

$$CAR_i = \sum_{t=1}^{N}(R_{i,t} - R_{B,t}) \qquad (3)$$

$$BHAR_i = \prod_{t=1}^{N}(1 + R_{i,t}) - \prod_{t=1}^{N}(1 + R_{B,t}) \qquad (4)$$

Equations (3) and (4) show how to estimate the firm's i event-induced cumulative abnormal returns (CAR_i) and event-induced buy-and-hold returns ($BHAR_i$), where $R_{i,t}$ is the monthly return of an event firm i in month t and $R_{B,t}$ is the monthly return of a benchmark firm or portfolio[3]. Such as Mazouz et al. (2008a), we measured the long-term performance of the event firms with respect to various benchmarks, testing the robustness of our results. In these benchmarks, we included a value-weighted market index (MSCI United Kingdom) and non-event firms matched with the event firm on size, size-and-book-to-market ratio, and industry-size-and-book-to-market ratio. The MSCI United Kingdom is an index of Morgan Stanley Capital International designed to measure the performance of the large and mid cap segments of the UK market. With 111 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in the UK. This index was carefully selected, once the index reinvests the dividends instead of distributing them by their subscribers. This was an essential condition for choosing the index because we also considered the dividend distribution of firms in the calculation of their returns. To determine the statistical significance of $\overline{CAR}$ and $\overline{BHAR}$, we also used the adjusted t-statistic by Brown and Warner (1980) and Brown and Warner (1985) and the skewness-adjusted t-statistic by Lyon et al. (1999), respectively[4]. All tests were made considering the null hypothesis equal to zero. It is usual to use zero according to literature, but we also used this value considering that in

[3] The returned of equity was computed as $R_{i,t} = Ln((P_{i,t} + D_{i,t})/(P_{i,t-1}))$, where $R_{i,t}$ is the monthly return of an event firm i in month t, $P_{i,t}$ is the price of stock firm in moment t, $D_{i,t}$ is the dividend distributed by shareholders of firm I in month t and $P_{i,t-1}$ is the price of stock firm in moment t-1.
[4] Detailed explanations of these significance tests are in the appendix 2 and 3.

efficient markets the real value of firms must be considered in the stock exchange quotation, so abnormal returns should not exist.

Table 4 shows the average CARs generated from using the market index and matched firms as reference portfolios. Panel A suggests that the equally-weighted CARs depend largely on the type of IPO and choice of benchmarks. When the benchmark is the size-matched firms, the IPOs with warrants (-0,02%) have a better performance than IPOs without warrants (-1,70%). However, the opposite happens with the other benchmark, especially when the industry is the factor of matching, once the difference between the performance of IPOs with warrants and IPOs without warrants is greater (-3,49% and -0,92%, respectively). The IPOs have a trend to underperform any matched portfolio and the opposite does not happen with the index of market as benchmark. Moreover, comparing with the index performance, the differences are even more significant. The IPOs with warrants underperform the market in -4,45%, while IPOs without warrants are slightly better but still negative (-3,95%).

Panel B presents the three-year value-weighted CARs. In this panel, it is possible to conclude that when the cumulative abnormal return is computed in a value-weighted form, the results improve considerably. For example, this time the performance of IPOs is positive when matched with any non-IPOs firms. Curiously, and comparing with the market index, the IPOs with warrants have a positive performance (0,21%) with a considerable statistical significance, while the performance of IPOs without warrants improved significantly, although it is still negative (-0,13%). Analysing the set of all IPOs, their values are always an intermediate value between the values of IPOs with warrants and IPOs without warrants. This fact can be related with the size of samples and the fact that only ten observations separate the total number of IPOs with warrants (23 firms) and IPOs without warrants (33 firms). Having the care to understand the difference of performance between IPOs with warrants and IPOs without warrants, we decided to compare them, using again the non-parametric test of Wilcoxon-Mann-Whitney. Panel C shows these results, differentiating the equally-weighted portfolio from the value-weighted portfolio. In the equally-weighted portfolio, the IPOs with warrants have worse performance than IPOs without warrants. However, the same does not happen when we are analyzing the value-weighted portfolios, where performance of

Table 4 - Three-year average cumulative abnormal return ($\overline{CAR}$) for the sample firms.

	N	Market Index		Matched Firms					
		Market Index		Size		Size-and-book-to-market		Industry-size-and-book-to-market	
		Mean CAR	p-Value	Mean CAR	p-Value	Mean CAR	p-Value	Mean CAR	p-Value
Panel A: equally-weighted portfolios									
All IPOs	56	-2,12%	0,000***	-0,60%	0,204	-0,22%	0,595	-1,01%	0,012**
IPOs with warrants	23	-4,45%	0,001***	-0,02%	0,990	-1,13%	0,516	-3,49%	0,015**
IPOs without warrants	33	-3,95%	0,000***	-1,70%	0,098*	-0,26%	0,775	-0,92%	0,340
Panel B: value-weighted portfolios									
All IPOs	56	-0,05%	0,011**	0,73%	0,737	1,14%	0,856	1,01%	0,115
IPOs with warrants	23	0,21%	0,045**	6,80%	0,445	2,17%	0,870	1,33%	0,170
IPOs without warrants	33	-0,13%	0,074*	0,08%	0,874	1,98%	0,888	2,01%	0,634
	N	Market Index		Size		Size-and-book-to-market		Industry-size-and-book-to-market	
		Mean CAR	p-Value[a]	Mean CAR	p-Value[a]	Mean CAR	p-Value[a]	Mean CAR	p-Value[a]
Panel C: IPOs with warrants versus IPOs without warrants									
Equally weighted-portfolios									
IPOs with warrants	23	-4,45%	0,358	-0,02%	0,223	-1,13%	0,239	-3,49%	0,072*
IPOs without warrants	33	-3,95%		-1,70%		-0,26%		-0,92%	
Value weighted-portfolios									
IPOs with warrants	23	0,21%	0,164	6,80%	0,276	2,17%	0,358	1,33%	0,152
IPOs without warrants	33	-0,13%		0,08%		1,99%		2,01%	

This table reports the 3-year post-IPO average cumulative abnormal return ($\overline{CAR}$). The $\overline{CAR}$ is calculated as $\overline{CAR} = \sum_{i=1}^{N}(w_i CAR_i)$, where w_i is the weight on firm i and N is the number of securities. The cumulative abnormal average returns were calculated using equally and value-weighted returns. The equally weighted (EW) returns were obtained dividing each value by the total number of observations, $\omega_i = 1/N$, providing an equal weight for each firm. The value-weighted (VW) returns, $\omega_1 = MV_i/MV$, provide a more measured weight where MV_i is the issuer`s common stock market value at the end of the event month and $MV = \Sigma_i MV_i$. The stock i's event-induced cumulative abnormal return (CAR_i) is estimated as $CAR_i = \sum_{t=1}^{N}(R_{i,t} - R_{B,t})$ where $R_{i,t}$ is the monthly return of an firm i in month t and $R_{B,t}$is the monthly return of benchmark or portfolios. Benchmarks are based on market index and on non-IPOs firms matched on size, size-and-book-to-market ratio, and industry-size-and-book-to-market ratio.

[a] Realized with the non-parametric Mann-Whitney test.

The results were automatically obtained by SPSS.

***, **, and * indicate significance at 1%, 5% and 10% respectively.

IPOs with warrants are greater than performance of IPOs without warrants, regardless of the benchmark used. In a comprehensive manner it is possible to conclude that equally-weighted CARs provide evidence of the underperformance of IPOs with warrants. When matching is based on industry-size-and-book-to-market ratio, the value-weighted CARs do not provide evidence of statistical significance. The results of equally-weighted CARs do not support the predictions of both agency costs and signaling models. These conclusions meet the findings of Mazouz et al. (2008a) that do not support the predictions of the models above-mentioned. Their average CARs results reveal a level of underperformance much higher than our values.

Table 5 shows the average BHARs generated from using the market index and matched firms as reference portfolios. Similar to the results of table 4, Panel A also suggests that the equally-weighted BHARs depend on the type of IPO and choice of benchmarks. In this panel all type of IPOs underperform the matched firms and especially the market index (-1,16%, -2,77% and -1,98%, respectively) with a high statistical significance. In another way, the results are more positive when the value-weight portfolios are analysed, in spite of the underperformance of IPOs with warrants (-0,42%) when compared with the market index. In other matched portfolios, IPOs with warrants and IPOs without warrants have positive performance with good levels of statistical significance across them. For example, when IPOs with warrants are compared with the size-and-book-to-market ratio firms in value-weight portfolios, these IPOs have a greater performance than IPOs without warrants. Panel C shows the differences between IPOs with warrants and IPOs without warrants in both weighted portfolios. Neither in equally-weighted portfolios nor in value-weighted portfolios are firms of IPOs with warrants better than firms that issue IPOs without warrants. Comparing our results with the study of Mazouz et al. (2008a), our study shows the same trend, except when they compared both types of IPOs with industry-size-and-book-to-market matched firms in value-weighted portfolios. In a general way, it is important to refer that the fact of value-weighted returns being much greater than equally-weighted returns suggests that the equally-weighted mean BHAR is driven by small-firm stocks. We also conclude that the underperformance of IPOs with warrants compared to that of IPOs without warrants is not consistent with agency costs and signaling explanations.

Table 5 - Three-year average abnormal return ($\overline{BHAR}$) for the sample firms.

	N	Market Index		Matched Firms					
		Market Index		Size		Size-and-book-to-market		Industry-size-and-book-to-market	
		Mean	p-Value	Mean	p-Value	Mean	p-Value	Mean	p-Value
Panel A: equally-weighted portfolios									
All IPOs	56	-1,16%	0,000***	-0,21%	0,318	-0,23%	0,328	-0,38%	0,045**
IPOs with warrants	23	-2,77%	0,001***	-0,02%	0,021**	-0,89%	0,665	-1,29%	0,064*
IPOs without warrants	33	-1,98%	0,000***	-0,59%	0,054*	-0,28%	0,030**	-0,28%	0,012**
Panel B: value-weighted portfolios									
All IPOs	56	0,14%	0,000***	0,81%	0,425	0,91%	0,034**	0,73%	0,019**
IPOs with warrants	23	-0,42%	0,020**	4,08%	0,000***	0,77%	0,622	0,56%	0,075*
IPOs without warrants	33	0,35%	0,001***	1,07%	0,063**	1,72%	0,004***	1,51%	0,024**
	N	Market Index		Size		Size-and-book-to-market		Industry-size-and-book-to-market	
		Mean	p-Value[a]	Mean	p-Value[a]	Mean	p-Value[a]	Mean	p-Value[a]
Panel C: IPOs with warrants versus IPOs without warrants									
Equally-weighted portfolios									
IPOs with warrants	23	-2,77%	0,032**	0,02%	0,402	-0,89%	0,084*	-1,29%	0,023**
IPOs without warrants	33	-1,98%		-0,59%		-0,28%		-0,28%	
Value-weighted portfolios									
IPOs with warrants	23	-0,42%	0,173	4,08%	0,204	0,77%	0,160	0,56%	0,051*
IPOs without warrants	33	0,35%		1,07%		1,72%		1,51%	

This table reports the 3-year post-IPO average buy and hold return ($\overline{BHAR}$). The $\overline{BHAR}$ is calculated as $\overline{BHAR} = \sum_{i=1}^{N}(w_i BHAR_i)$, where w_i is the weight on firm i and N is the number of securities. The cumulative abnormal average returns were calculated using equally and value-weighted returns. The equally weighted (EW) returns were obtained dividing each value by the total number of observations, $\omega_i = 1/N$, providing an equal weight for each firm. The value-weighted (VW) returns, $\omega_1 = MV_i/MV$, provide a more measured weight where MV_i is the issuer`s common stock market value at the end of the event month and $MV = \Sigma_i MV_i$. The stock i's event-induced cumulative abnormal return ($BHAR_i$) is estimated as $BHAR_i = \prod_{t=1}^{N}(1 + R_{i,t}) - \prod_{t=1}^{N}(1 + R_{B,t})$, where $R_{i,t}$ is the monthly return of an event firm i in month t and $R_{B,t}$is the monthly return of benchmark or portfolios. Benchmarks are based on market index and on non-IPOs firms matched on size, size-and-book-to-market ratio, and industry-size-and-book-to-market ratio.

[a] Realized with the non-parametric Mann-Whitney test.

The results were automatically obtained by SPSS.

***, **, and * indicate significance at 1%, 5% and 10% respectively.

4.2. Standard calendar-time regressions

The event-time approach above mentioned is often used to analyse the long-term performance of IPOs. However, this model is very debated in literature and to mitigate the biases associated with the use of the event-time approach, we use a standard calendar-time regression. According to Fama (1998), this regression eliminates the problem originated by the event-time approach, which overstates the statistical inference and does not control the correlation among individual firms. Thus, and like Mazouz et al. (2008a) we test the performance of a given portfolio beyond the level of which common risk factors can capture and automatically account for the cross-correlation of event firms in the portfolio variance.

$$R_{p,t} - R_{f,t} = \alpha_0 + \alpha_1\left(R_{m,t} - R_{f,t}\right) + \alpha_2 SMB_t + \alpha_3 HML_t + \alpha_4 UMD_t + \varepsilon_t \quad (5)$$

The equation (5) above mentioned is the based formula of employed regression, where $R_{p,t}$ is the monthly return of the portfolio of event firms; $R_{f,t}$ is the monthly return of the one-month United Kingdom Interbank Borrowing Rate (LIBOR) and $R_{m,t}$ is the monthly return of the market index (MSCI United Kingdom). The SMB_t (small minus big) and HML_t (high minus low) are the difference between the monthly returns of value-weighted portfolios of small big stocks and high and low book-to-market portfolios, respectively. The values of SMB_t and HML_t used in our regression were obtained in the Fama and French[5] site that computed this value for different regions of the world. We considered the values of European portfolios, assuming similarity between markets and firms across all Europe. Such as Eckbo and Norli (2005) and Mazouz et al. (2008a) we decided to include the UMD_t, a momentum factor. The value of UMD_t was also collected in the site of Fama and French and is computed as the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios. These portfolios are constructed as the intersections of two portfolios formed on the market value of equity (size) and three portfolios formed on the prior 12-month returns. The intercept, α_0, measures the average monthly abnormal return of the portfolio event firms.

[5] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html

Before employing the regression, we also organized the data considering the beginning of each month to form an equally and a value-weight portfolio of firms that issue IPOs within the previous 3 years. In order to ensure the exit of firms that passed the 3-year period and the entry of new firms, we rebalanced our portfolios monthly. Lastly we decided not to use a linear regression and, following Mazouz et al. (2008a), we applied a Weighted Least Squares (WLS) regression. Thus, we wanted to avoid some problems of linear regressions as the standard deviation of the error term being constant over all values of the predictor or explanatory variables. With a WLS regression we have the advantage of this model being an efficient method that makes good use of small data sets with ability to handle regression situations in which the data points are of varying quality. The results from WLS estimation of standard calendar-time regressions are reported in table 6.

These results show that under the standard calendar-time regression, the equally weighted portfolios generate statistically significant mean abnormal returns of -3,5%, -3,6% and -3,5% for all IPOs, IPOs with and without warrants, respectively. The intercept of IPOs with warrants is slightly higher than the intercept of IPOs without warrants. This fact also occurred in the study of Mazouz et al. (2008a) and can be related with two possible explanations. First, the negative abnormal performance has more prominence in small firms, while value-weighted portfolio returns are more directed to big firms (Loughran and Ritter, 2000). Fama (1998) and Mitchell and Stafford (2000) give us the second explanation related with the fact that, in a sample mostly with different-size firms (small or high growth firms), there is a high probability to over reject the null hypothesis of zero intercept. Curiously, the same does not happen in value-weighted portfolios, where the intercept of IPOs with warrants is lower than the intercept of IPOs without warrants. However, in value-weighted portfolios, this intercept is not statistically significant. Compared with the equally-weighted portfolios, the mean abnormal returns of this portfolios are worse for all IPOs returns and IPOs without warrants returns (-3,9% and -5%) with significance at 1% and 5%, respectively. Analysing the coefficient of determination (R-square), we can conclude that IPOs with warrants in equally-weighted portfolios have the best coefficient revealing that 57,1%

Table 6 - The post-issue 3-year abnormal returns from the standard calendar-time factor regressions.

	α0	p-Value	α1	p-Value	α2	p-Value	α3	p-Value	α4	p-Value	R-square
Panel A: equally-weighted portfolios											
All IPOs	-0,035	0,043**	0,837	0,000***	0,008	0,296	-0,002	0,696	-0,005	0,048**	0,484
IPOs with warrants	-0,036	0,051**	0,755	0,000***	0,018	0,028**	-0,004	0,470	-0,007	0,009***	0,571
IPOs without warrants	-0,035	0,074*	0,898	0,000***	0,000	0,947	0,000	0,938	-0,002	0,476	0,425
Panel B: value-weighted portfolios											
All IPOs	-0,039	0,091*	1,0695	0,000***	-0,001	0,932	0,006	0,467	-0,002	0,631	0,437
IPOs with warrants	-0,022	0,297	0,762	0,000***	0,009	0,323	0,003	0,694	-0,008	0,030**	0,489
IPOs without warrants	-0,050	0,048**	1,123	0,000***	-0,005	0,594	0,006	0,542	-0,002	0,694	0,425

This table show the post-issue 3-year abnormal returns from the standard calendar-time factor regressions. The WLS estimation is: $R_{p,t} - R_{f,t} = \alpha_0 + \alpha_1(R_{m,t} - R_{f,t}) + \alpha_2 SMB_t + \alpha_3 HML_t + \alpha_4 UMD_t + \varepsilon_t$, where $R_{p,t}$ is the monthly return of the portfolio of event firms; $R_{f,t}$ is the monthly return of one month United Kingdom Interbank Borrowing Rate (LIBOR) and $R_{m,t}$ is the monthly return of market index (MSCI United Kingdom). SMB_t (small minus big) and HML_t (high minus low) are the difference between the monthly returns of value weighted portfolios of small big stocks and high and low book-to-market portfolios, respectively. UMD_t is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios. These portfolios are constructed as the intersections of two portfolios formed on market value of equity (size) and three portfolios formed on prior 12-month return. The intercept, α_0, measures the average monthly abnormal return of the portfolio event firms. The estimations are associated with all IPOs, IPOs with warrants and IPOs without warrants using equally and value-weighted returns. The data was organized considering the beginning of each month to form an equally and a value-weight portfolio of firms that issue IPOs within the previous 3 years. All portfolios were rebalanced monthly to ensure that firms that reach the end of their 3-year period were excluded and new issues were included. When $R_{p,t}$ is computed on a value-weighted basis, the firm i's weight in forming the portfolios is its market value of equity at the end of the previous month.

The statistical significance is generated after conducting the Park test to evaluate the level of heteroscedasticity.

The results were automatically obtained by SPSS.

.***, **, and * indicate significance at 1%, 5% and 10% respectively.

of the dependent variable $R_{p,t} - R_{f,t}$ is explained by the independent variables. The other values are slightly below that coefficient, but yet in an intermediate level[6]. Considering the remaining variables, only α_1 (difference between the monthly return of market index, $R_{m,t}$, and the monthly return of the one-month United Kingdom Interbank Borrowing Rate, $R_{f,t}$) has special contribution for the model with a high level of confidence (99%). In the equally weighted-portfolio, α_4 (a momentum factor) also has a special contribution, with 99% of confidence, in the explanation of the returns of IPOs with warrants. The same happens to all IPOs returns but with less statistical significance (95% of confidence). In value-weighted portfolios, α_4 (a momentum factor) has again a special feature to IPOs with warrants presenting a significance of 5%.

These results are not consistent with the predictions of the agency costs model, once the IPOs with warrants do not have a better performance than IPOs without warrants in equally-weighted portfolios, and value-weighted portfolios. Thus, these results are not consistent with the predictions of the agency costs model, which expects that IPOs with warrants have better quality of investments, and consequently higher long-term risk-adjusted returns than IPOs without warrants.

4.3. Matched calendar-time regressions

Mazouz et al. (2008a) argue that, since the IPOs firms are generally small and high-growth firms, the problem of over-rejecting the null hypothesis is particularly severe. Thus, to avoid the over rejection problem associated with the standard calendar-time factor regression, we decided to follow Boehme and Sorescu (2002); Cheng (2005) and Mazouz et al. (2008a) that recommended the use of a zero-investment calendar-time portfolio consisting of long positions on event firms and short positions on the matched non-event firms.

$$R_{p,t} - R_{c,t} = \beta_0 + \beta_1\left(R_{m,t} - R_{f,t}\right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \xi_t \qquad (6)$$

[6]The R-square must be between zero and one. When R-square is equal to zero, we can consider that the model does not fit the data, while if the R-square is equal to one, the adjustment could be considered perfect.

This time, $R_{p,t}$ is the monthly return of the portfolio of event firms and $R_{c,t}$ is the monthly return of the matched portfolio of benchmark firms constructed both on an equally-weighted and a value-weighted basis. The benchmark firms are matched based on size, size-and-book-to-market ratio, and industry-size-and-book-to-market ratio as shown in section 3.2. The intercept β_0 is the average monthly abnormal return of the portfolio. The remaining items follow the description already mentioned in section 4.2.. As Mazouz et al. (2008a), we decided to compare the performance of IPOs with warrants and IPOs without warrants through re-estimation of equation six, using the $R_{p,t}$ as the monthly returns of the portfolios of IPOs without warrants and $R_{c,t}$ as the monthly returns of the portfolios of IPOs with warrants.

Table 7 shows the results of 3-year abnormal returns after issuance that derived from the matched calendar-time factor regressions, specifically for size, size-and-book-to-market ratio and industry-size-and-book-to-market ratio. In this case, the average abnormal returns of IPOs in equally-weighted portfolios are positive only for IPOs with warrants (1%), when matched with firms by size, but without statistical significance. All IPOs and IPOs without warrants analysed separately have underperformance with lower statistical significance (10%). The results of value-weighted portfolios have the same trend but in this case without any statistical significance. These results are different from those of Mazouz et al. (2008a). In their study, in value-weighted portfolios, both types of IPOs had a positive performance but without statistical significance. Understanding the best independent variables that explain the dependent variable $(R_{p,t} - R_{c,t})$ by R-square analysis, it is possible to conclude that in both portfolios the IPOs with warrants have best models than the IPOs without warrants. When the analysis is based on matched firms by size-and-book-to-market and industry-size-and-book-to-market ratios, the results of IPOs with warrants are worse. The comparison with these matched firms give best performance for IPOs without warrants with statistical significance in equally-weighted portfolios. However, the R-square analysis reveals a good model for IPOS with warrants when the analysis is compared with size-and-book-to-market firms.

The direct comparison between the performances of IPOs with warrants and IPOs without warrants, in the last three columns of table 7, show that the intercept of

regression (eq.(6)) is negative, revealing in both portfolios a better performance of IPOs with warrants. However, only there is acceptable statistical significance (1%) for value-weighted portfolios.[7] In this section, the results are positive for IPOs with warrants compared with IPOs without warrants. These results meet the predictions of the agency costs hypothesis and signaling hypothesis. The expected higher long-term risk-adjusted returns of IPOs without warrants are obtained.

[7] The remaining regression coefficients are presented in appendix 4.

Table 7 - The post-issue 3-year abnormal returns from the matched calendar-time factor regressions.

	Size match			Size-and-book-to-market match			Industry-size-and-book-to-market match			IPOs with warrants vs IPOs without warrants		
	β0	p-Value	R-square	β0	p-Value	R-square	β0	p-Value	R-square	β0	p-Value	R-square
Panel B: equally-weighted portfolios												
All IPOs	-0,023	0,057*	0,062	-0,019	0,286	0,066	-0,20	0,302	0,055			
IPOs with warrants	0,010	0,464	0,046	-0,014	0,524	0,086	-0,030	0,143	0,146	-0,007	0,781	0,047
IPOs without warrants	-0,027	0,097*	0,030	-0,023	0,061*	0,098	-0,031	0,032**	0,094			
Panel B: value-weighted portfolios												
All IPOs	-0,003	0,909	0,011	-0,001	0,970	0,098	-0,16	0,338	0,055			
IPOs with warrants	0,010	0,815	0,053	0,008	0,758	0,180	0,038	0,082*	0,096	-0,062	0,082*	0,166
IPOs without warrants	-0,004	0,794	0,019	0,033	0,154	0,064	0,015	0,424	0,046			

This table show the post-issue 3-year abnormal returns from the matched calendar-time factor regressions. The WLS estimation is: $R_{p,t} - R_{c,t} = \beta_0 + \beta_1(R_{m,t} - R_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \xi_t$, where $R_{p,t}$ is the monthly return of the portfolio of event firms;$R_{c,t}$ is the monthly return of the matched portfolio of benchmark firms,$R_{f,t}$ is the monthly return of one month United Kingdom Interbank Borrowing Rate (LIBOR) and $R_{m,t}$ is the monthly return of market index (MSCI United Kingdom). SMB_t (small minus big) and HML_t (high minus low) are the difference between the monthly returns of value weighted portfolios of small big stocks and high and low book-to-market portfolios, respectively. $UMD_t$is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios. These portfolios are constructed as the intersections of two portfolios formed on market value of equity (size) and three portfolios formed on prior 12-month return. The intercept β0 is the average monthly abnormal return of the portfolio that specifically corrects for (i) size, (ii) size-and-book-to-market ratio, and (iii) industry, size-and-book-to-market ratio. The remaining items follow the description already mentioned in section 3.2. The estimations are associated with all IPOs, IPOs with warrants and IPOs without warrants using equally and value-weighted returns. The data was organized considering the beginning of each month to form an equally and a value-weight portfolio of firms that issue IPOs within the previous 3 years. All portfolios were rebalanced monthly to ensure that firms that reach the end of their 3-year period were excluded and new issues were included. When $R_{p,t}$ is computed on a value-weighted basis, the firm i's weight in forming the portfolios is its market value of equity at the end of the previous month.
The statistical significance is generated after conducting the Park test to evaluate the level of heteroscedasticity.
The results were automatically obtained by SPSS.
***, **, and * indicate significance at 1%, 5% and 10% respectively.

6. Conclusions

The main purpose of this study was to understand if the agency costs and signalling hypotheses explain the reason to include warrants in IPOs, using the long-term price performance approach. Studying the IPOs with warrants issued in the United Kingdom after the year of 2000, we also analysed the type of firms that opted for this kind of strategy. Literature argues that these firms present future projects, which are difficult to evaluate on the basis of the current available information. So, these firms use warrants as a signal to differentiate themselves from bad firms. For Schultz (1993), these firms are smaller, younger and mainly from high-tech or services industries. In the same way, they are more likely to fail than firms that issue only shares in IPOs.

We found results that contradict some predictions of the agency costs model and the conclusions of Schultz (1993) above mentioned. We conclude that firms that issued IPOs with warrants in the United Kingdom had a higher contribution for the increase of firms with high market value compared with firms of IPOs without warrants. This fact leads us to believe that the type of firms issuing IPOs with warrants have been changing and large companies from industries until then characterized by the non-use of warrants in their IPOs have emerged. As an example, we can highlight the mining industries and manufacturing industries as the main industries using IPOs with warrants against services firms that prefer IPOs without warrants. Possible explanations can be related with the fact that these firms are using the warrants as mechanism of confidence to attract new investors, ensuring flexibility and a constant re-evaluation of their projects. These conclusions are in line with the conclusion that Mazouz et al. (2008a) obtained after analyzing the firms that issue IPOs with warrants in the Hong-Kong Stock Exchange. Perhaps, companies start seeing warrants as an important instrument to obtain financing at lower costs.

Using an approach different from most previous studies and following very closely the methodology of Mazouz et al. (2008a), we decided to compare the long-term price performance of these firms with firms that did not use warrants in IPOs. Trying to make an analysis more focused on the direct comparison of the same industry companies, we only used non-IPOs firms that have a SIC code that is encompassed in the group of SIC

codes from firms that issued IPOs with warrants. That way, we present results based on a more precise case study, which differentiates us from the study of Mazouz et al. (2008a). All results were compared with the returns of a set of control non-IPO firms, listed in the United Kingdom Stock Exchanges and matched on both size, size-and-book-to-market ratio and industry-size-and-book-to-market ratio. Our event study of cumulative abnormal returns presents worse results for IPOs with warrants in equally-weighted portfolios than in value-weighted portfolios, with a higher statistical significance when matched with the market index. These results do not support those obtained by Mazouz et al. (2008a), once their firms underperform the market when analyzed in value-weighted portfolios. However, our results show that IPOs with warrants underperform the IPOs with warrants when matched with industry-size-and-book-to-market non-IPOs firms, with 10% of statistical significance. Thus, the results do not support the agency costs and signaling models. The results of buy-and-hold abnormal returns are also not consistent with the agency costs and signaling models, once the IPOs with warrants underperform the market. On the other hand, IPOs without warrants have a positive performance in value-weighted portfolios. It is important to say that the same does not happen when the benchmark firms are matched on size. In this situation, the IPOs with warrants have a positive performance when compared with the performance of IPOs without warrants. Comparing directly IPOs with and without warrants, we obtained a worse performance for firms that used warrants in equally and value-weighted portfolios whenever there is an acceptable level of statistical significance.

By standard calendar-time regression, we concluded that the monthly averages of abnormal returns of the portfolio event firms are slightly worse for IPOs with warrants than IPOs without warrants in equally-weighted portfolios. These results are also not consistent with the predictions of the agency costs model. The same does not happen when the analysis is based on value-weighted portfolios but without statistical significance to support our conclusion. In matched calendar-time regressions the results follow the same trend (positive performance but without statistical significance) in both portfolios. Nevertheless the direct comparison between the performances of IPOs with warrants and IPOs without warrants reveals that in value-weighted portfolios, IPOs with

warrants have a better performance with an acceptable statistical significance. So, these results meet the prediction of the agency costs and signaling theories.

In general, we can state that our results show some evidences that support the agency cost and signaling hypotheses. The differences in results and respective conclusions are related with the type of portfolio used. However, and comparing directly both type of IPOs in value-weighted matched calendar-time regression, we have sufficient statistical significance to argue the success of warrants in initial public offerings.

This success can be explained by many factors, perhaps related with the profile of British investors and their expectations or with the fact that firms are taking real advantage of warrants in initial public offerings. In our study it is even possible to see that in the United Kingdom large companies are using warrants in their IPOs not worrying about the fact that this type of operation is associated with small and riskier firms. Most importantly, this study launches again the discussion around this topic and reveals that although it has been insufficiently studied, it cannot be completely disregarded. It discloses increasingly important indications to study and analyze new forms of capital funding in a world progressively filled with start-up firms that sometimes do not survive because they do not take advantage of the (un)efficiency of capital markets.

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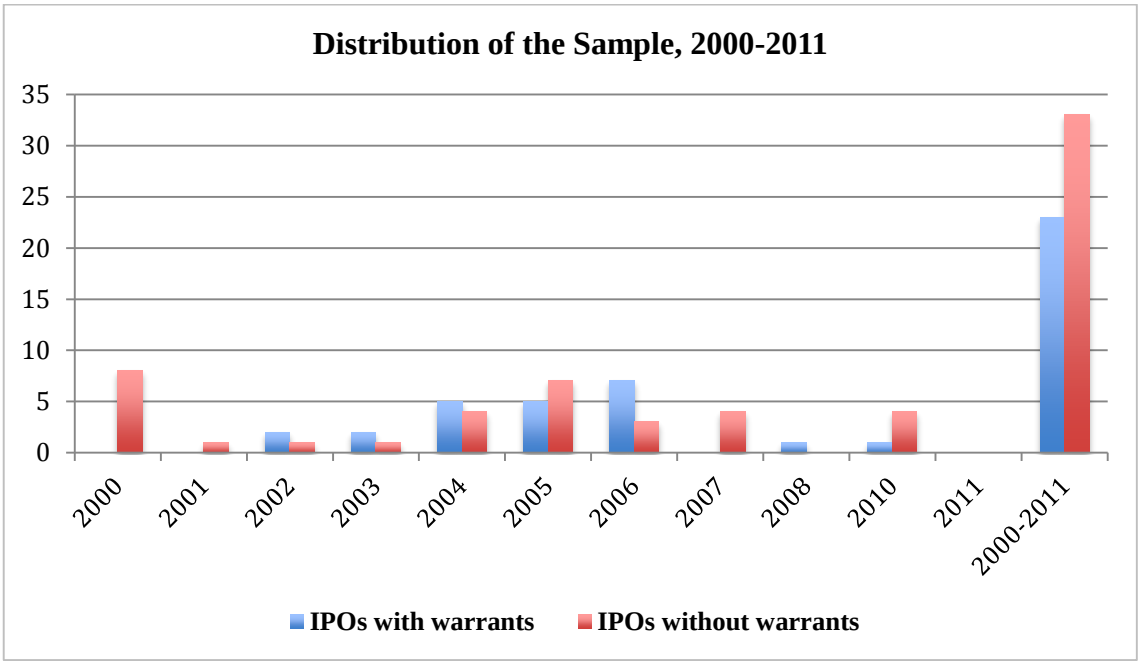
Appendix

Appendix 1 – Graph with distribution of the sample, 2000-2011.



Appendix 2 - Adjusted t-Statistic

Brown and Warner (1980) show that the ajusted t-Statistic is robust to an event-induced variance increase. The ajusted t-Statistic was obtained in site of event study metrics and is defined as:

$$T_{cross} = \frac{CAAR(T1,T2)}{\hat{\sigma}CAAR\ (T1,T2)} \qquad (A1)$$

Under the null hypothesis, the cumulative average abnormal return is equal to zero. The variance estimator of this statistic is based on the cross-section of abnormal returns.

$$\hat{\sigma}^2\ CAAR(T1,T2) = \frac{1}{(N-d)}\sum_{i=1}^{N}[CAR_i(T1.T2) - CAAR_i(T1,T2)]^2 \qquad (A1.1)$$

Appendix 3 - Skewness-adjusted t-Statistic

According to Lyon et al. (1999), long-term buy and hold abnormal returns are positively skewed and consistently lead to negatively biased t-statistics. To eliminate the skewness bias we use the skewness-adjusted t-test. Originally developed by Johnson (1978), is a transformed version of the usual t-test. The test statistic for the null hypothesis that the

mean buy-and-hold abnormal return is equal to zero is:

$$T_{Skewness-Ajusted} = \sqrt{N}\,[S + \frac{1}{3}\varphi S^2 + \frac{1}{6N}\varphi \qquad (A2)$$

where,

$$S = \frac{\overline{BHAR}(T1,T2)}{\hat{\sigma}BHAR} \qquad (A2.1)$$

and,

$$\varphi = \frac{\sum_{i=1}^{n}[BHAR_i(T1,T2) - \overline{BHAR(T1,T2)}]^3}{N\hat{\sigma}^3 BHAR} \qquad (A2.2)$$

Since $\sqrt{N}$Sis the usual t-statistic the estimated standard deviation is defined by:

$$\hat{\sigma}BHAR = \sqrt{\frac{1}{N-1}}\sum_{i=1}^{N}[BHAR_i(T1,T2) - \overline{BHAR}(T1,T2)]^2 \qquad (A2.3)$$

Appendix 4 – Remaining regression coefficients of re-estimation of equation six.

Analysing the remaining coefficients of the regression we can conclude that all of them have statistical significance, being β_1 the coefficient that more contributed for the model with high level of confidence.

Coefficients

	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta	Std. Error		
(Constant)	-,062	,035			-1,768	,082
RmtRft	,695	,216	,540	,168	3,221	,002
SMB	-,027	,012	-,388	,171	-2,271	,027
HML	,015	,008	,240	,126	1,895	,063
UMD	,012	,007	,294	,163	1,799	,077