Impact of Market Timing on Corporate Capital Structure: Evidence from the UK IPO Market

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Abstract: This study examines the impact of market timing on corporate capital structure throughout the analysis of the IPO market in the UK. It should be noted that due to its cyclical activity, the IPO market is considered as a natural place to detect market timing effects.

In line with previous literature, this study considers the hot and cold classification as the equity timing measure. Market timers are identified as firms that go public in hot markets. Hot markets are characterised by periods of unusually high IPO volume and underpricing, usually on the back of the more favourable market conditions. On the contrary, cold markets are portrayed by opposite market conditions.

The main findings of this study show that, in the offering year, hot-market firms issue more equity and experience a larger decrease in their leverage ratios in comparison with cold-market firms. However, right after going public, hot-market firms start to increase their leverage ratios at a higher pace than their cold-market counterparts. Five years following the IPO, the difference in the leverage ratio when compared to the pre-issue level becomes slightly higher for cold-market firms, suggesting that the changes on leverage stop being driven by the market timing factor. These findings are consistent with the view that the impact of market timing on capital structure is not persistent over time.

Different econometric models were computed to test the research hypotheses. Also, the Huber-White estimator was applied to correct the error structure, ensuring that our findings were not biased by heteroscedasticity and error correlation. In addition, industry-fixed effects were included to control for cross-sectional heterogeneity.

1. INTRODUCTION

This study examines the impact of market timing on corporate capital structure by looking at the Initial Public Offering (IPO) events in the United Kingdom (UK). According to Alti (2006), the IPO market is considered as a natural place to capture the market timing effects, thus contributing to a more robust analysis.

The investigation on capital structure choices has started out with the seminal work of Modigliani and Miller (1958). However, their theory was heavily questioned for being based on a set of unrealistic economic assumptions. Since then, other theories have been presented, in a search for different determinants of the equity and debt combination. Market Timing Theory is one of the most recent theories among them, which has brought a new approach based on market conditions. According to this theory, the choice of the mix between equity and debt depends on which funding source is more valued by the financial market at that point of

time (Ayuba et al., 2019). In specific, firm's capital structure is influenced by market values and their fluctuations (Zavertiaeva and Nechaeva, 2017). Although several authors have found some evidence of market timing effects on capital structure in the 80s and 90s of the 20th century (e.g., Jalilvand and Harris, 1984; Rajan and Zingales, 1995; Pagano et al., 1998), more formal definitions were only developed by Baker and Wurgler (2002) and Alti (2006). These works led to several publications on this topic, which still receives lots of attention nowadays (e.g., Dong et al., 2020; Zhao et al., 2020; Cerpentier, et al., 2021; Gomes et al., 2019).

In line with the Market Timing Theory, firms are able to exactly time their offerings in order to take advantage of "windows of opportunity". In other words, firms go public when stock prices are high and market conditions are favourable (Wadhwa and Syamala, 2018). As a consequence, the cost of equity is relatively lower than other sources of funding, which reduces the overall cost of capital and, thus, increases the value of the firm (Guney and Hussain, 2012).

Taking into account that the IPO market is characterised by cycles with high swings (Ibbotson and Jaffe, 1975), the hot and cold market classification is considered as the equity timing measure. Hot markets are identified as periods with

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more advantages for IPOs due to the more favourable market conditions, contrarily to cold markets. As referred by Alti and Sulaeman (2012), the issuers' perception of favourable market conditions is usually linked to larger stock returns and market-to-book ratios. Still, the determination of the factors underlying the more favourable market conditions is not the purpose of this study.

Following the existing literature (e.g., Helwege and Liang, 2004), hot and cold markets are most often defined in terms of volume (i.e., number of firms going public), but also on the basis of underpricing (i.e., return in the first day of trading). At the same time, Lowry and Schwert (2002) show that underpricing and volume are positively correlated. Hence, in this study, both variables are used to define IPO markets. As in Banerjee et al. (2013), who have also applied underpricing and volume to split the UK IPO market, hot and cold markets are identified on a quarterly basis. Hot quarters are characterised by unusually high levels of IPO volume and underpricing, while in cold quarters the number of IPOs and first-day returns are lower than usual. Hot-market firms correspond to firms that go public in hot markets, being also designated as market timers or successful timers. In contrast, cold-market firms refer to firms that go public in cold markets.

This study addresses 3 research questions. Firstly, we analyse if there is evidence of market timing practices by firms in the IPO market (Hypothesis 1). This evidence is captured through linking the proceeds from the IPO to whether the market is hot or cold at the offering time. Then, we examine the short-term impact of IPO market timing on capital structure (Hypothesis 2). Finally, we determine how persistent is the impact of IPO market timing on capital structure (Hypothesis 3). The impact of market timing on capital structure is measured by the change in the book leverage ratio (Debt/Assets) from the pre-IPO year to year t. In the analysis of the short-term impact, t denotes the IPO year. Regarding the determination of the persistence of the impact, t assumes years IPO+1, IPO+2, IPO+3, IPO+4 and IPO+5.

The main research question that lies at the heart of this study concerns the persistence of the impact of IPO market timing on capital structure (Hypothesis 3). Baker and Wurgler (2002) were the first to analyse this question, creating an incentive to a growing number of subsequent investigations. Their study suggests that market timing has a persistent impact on capital structure, as firms can permanently lower their leverage by timing the equity markets. However, more recent studies (e.g., Alti, 2006; Hovakimian, 2006; Kayhan and Titman, 2007) sustain only partially the findings of Baker and Wurgler (2002). These authors show that market timing affects financing decisions, but argue that the effect is not persistent over time. According to their studies, the effect tends to disappear within a period of few years. In sum, although it is widely accepted that market conditions have a significant influence on corporate financing policy, there is no consensus on the persistence of its effect.

The analysis is based on a sample of 612 IPOs occurred in the UK market between 2002 and 2015. The IPO sample was obtained from Eikon database, and the financial data on IPO firms was collected from Datastream database.

Results show that equity issuance decisions are shaped by market conditions. Actually, there is a positive hot-market effect on the amount of proceeds raised during the IPO, confirming that hot-market firms benefit from "windows of opportunity" to issue more equity than cold-market firms. Also, results indicate there is a negative impact of market timing on the leverage ratio in the IPO year. The decline is larger for hot-market firms, although hot and cold market firms have similar pre-issue leverage levels. This evidence sustains the existence of a negative hot-market effect on leverage in the offering year. Nevertheless, immediately after going public, hot-market firms follow an active strategy of reversing the negative hot-market effect on leverage observed in the IPO year. More specifically, they start increasing their leverage ratios at a higher pace than their cold-market counterparts. Five years after the issue, the difference in the book leverage ratio regarding the pre-IPO year becomes slightly larger for cold-market firms, meaning that hot-market firms exhibit higher leverage levels. These results imply that the negative hot-market effect on leverage vanishes, suggesting that market timing only has a temporary impact on capital structure. These conclusions are in line with the study of Guney and Hussain (2012), who have also analysed the UK market.

This work contributes to enhance the existing literature on market timing and its impact on capital structure in several ways. Firstly, in contrast to most of studies that focus on the US market, this investigation shows evidence about the UK IPO market. According to Ernst & Young Global IPO Trends 2018, the UK IPO market is considered as one of the largest and most relevant in the world. Another innovation of this work is that its primary measure of hot and cold markets relies on underpricing, with the definition in terms of volume being used for robustness check purposes. Thirdly, this work extends the regression models used in previous literature in order to include additional interaction terms.

The remainder of this study is organised as follows. Section 2 reviews the relevant literature and presents the hypotheses development. Section 3 describes the sample selection and reports some summary statistics. Section 4 shows the research methodology, including the variables definition and the regression models. Section 5 exhibits and discusses the main results. Section 6 provides robustness tests. Section 7 concludes.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Evidence of Market Timing in the IPO Market

According to prior literature (e.g., Kaya, 2013; Dudley and James, 2013; Gomes et al., 2019), the evidence of market timing in the IPO market can be captured by linking the proceeds from the IPO to whether the market is hot or cold at the offering time. The proceeds from the IPO correspond to the amount of equity issued and are usually normalised by the total assets of the issuing firm.

Guney and Hussain (2012) suggest that firms that go public when the market is hot (i.e., hot-market firms) are characterised by inferior levels of performance, profitability and in-

vestment. Consequently, these firms seek "windows of opportunity" to issue more equity than they would otherwise be able to[1], going public only in the presence of more favourable market conditions. Contrarily, firms that go public when the market is cold (i.e., cold-market firms) reduce their equity issues to the necessary minimum, in response to worse market conditions. Therefore, hot-market firms are likely to issue more equity and less debt when compared to cold-market firms (Allini et al., 2018), implying that there is a positive hot-market effect on the amount of equity issued at the IPO time.

Thus, we formulate the following hypothesis:

H1: Hot-market IPO firms issue more equity than cold-market IPO firms do.

2.2. Impact of Market Timing on Capital Structure

2.2.1. Short-term Impact

To examine the short-term impact of market timing on capital structure, several authors focused on the change in book leverage ratio from the pre-IPO year to the IPO year (e.g., Bougatef and Chichti, 2010; Çelik and Akarim, 2013; Huang, 2014; Dudley and James, 2013).

According to Alti (2006), market timing has a negative impact on leverage in the IPO year, as firm's leverage ratio decreases due to the issued equity. Hot and cold market firms tend to have similar pre-issue leverage levels. However, the reduction in book leverage ratio in the issuing year has a greater extent in hot-market firms (Dong et al., 2020), suggesting that there is a negative hot-market effect on leverage in the IPO year. In line with H1, hot-market firms issue more equity and less debt. Hence, at the end of the issue year, they have lower leverage ratios when compared to cold-market firms.

Thus, the second hypothesis is as follows:

H2: The negative impact of market timing on leverage in the IPO year is larger for hot-market firms.

2.2.2. Persistence of the Impact

In accordance with the empirical evidence (e.g., Guney and Hussain, 2012; Kaya, 2013), immediately after going public, firms follow an active strategy of reversing the negative impact of market timing on leverage. Therefore, they start increasing their leverage ratios. Although in the IPO year hot-market firms have lower leverage ratios than cold-market firms (according to H2), the increase in leverage ratio in the following years is larger for hot-market firms. Kaya (2013) argues that hot-market firms are rewarded with more favour-

able financing conditions, in particular better interest rates, than cold-market firms.

The main question of this study is to determine how persistent is the impact of IPO market timing on capital structure. The persistence of the impact has been analysed through the cumulative change in book leverage ratio from the pre-issue year to years subsequent to IPO (e.g., Guney and Hussain, 2012).

According to Alti (2006), the impact of market timing is persistent as long as the cumulative change in book leverage regarding the pre-IPO level reflects the negative hot-market effect on leverage. The negative hot-market effect on leverage disappears when the difference in the book leverage regarding the pre-IPO year becomes larger for cold-market firms. This implies that hot-market firms exhibit higher leverage levels and, consequently, are closer to their initial leverage levels than cold-market firms. Thus, when the negative hot-market effect completely vanishes, the impact of market timing on capital structure loses its persistence.

In line with Baker and Wurgler (2002), market timing has a large effect on capital structure that is persistent over at least for 10 years. In other words, firms can permanently lower their leverage by timing the equity markets (i.e., by issuing equity when their market values are high relative to book or past market values). Also, Zhao et al. (2020), prove that the effect of equity market timing on firm's capital structure exists for more than 7 years.

Nevertheless, other studies have turned up with a different point of view about the persistence of the impact of market timing on capital structure. Alti (2006) shows that the impact of market timing on leverage completely disappears 2 years after the IPO, suggesting that market timing only has a short-term impact on capital structure. Also, Hovakimian (2006) and Kayhan and Titman (2007) confirm that changes in leverage ratio are driven by market timing in the short term, but do not find evidence of the long-run persistence of market timing effects on leverage. Moreover, Guney and Hussain (2012), who focus on the reality of the UK IPO market, demonstrate that market timing does not have a persistent impact on capital structure over time. According to them, in the long run, firms' capital structure decisions are apparently motivated by the existence of leverage targets.

This way, the following hypothesis is tested:

H3: Market timing only has a temporary impact on capital structure.

3. SAMPLE

3.1. Sample Selection

This study analyses how market timing affects the capital structure of UK firms that went public between 2002 and 2015. For this purpose, it was used the Eikon database to identify IPO firms and collect related IPO information. In addition, the Datastream database was also used to obtain IPO firms' financial data. Thereby, the construction of the sample required merging the information from these two

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[1] Some authors present different explanations for firms issue more equity, besides the market timing perspective. Batnini and Hammami (2015) point out that firms go public just to seek more funds to finance their growth. Also, Çelik and Akarim (2013) refer that the amount of issued equity could be influenced by the total of dividends paid by firms during the IPO year. Additionally, Lowry (2003) shows that the investor sentiment impacts the going public decision. Finally, Guney and Hussain (2012) mention that firms may only be attempting to reduce their leverage ratios at the IPO time if they were too high before.

databases, which was done through the International Securities Identification Number (ISIN)[2] code.

First of all, it was selected, from Eikon database, information on all IPOs available that occurred in the UK equity market from 1st January 2002 to 31st December 2015. From the initial sample of 1 160 IPOs, firms with no ISIN code and firms belonging to the Financial Industry (mainly banks and insurance firms) were excluded. Thus, the IPO sample from Eikon completed a total of 788 firms. Then, it was collected, from Datastream database, financial data from all listed firms in the UK market, including active and dead firms. The initial sample of 8 289 listed firms was restricted to exclude firms with no ISIN code available, resulting in a total of 5 038 firms remaining. At last, UK IPO firms from Eikon (788) and UK listed firms from Datastream (5 038) were matched through the ISIN code, ending up with a sample of 612 firms.

This study aims to capture the impact of market timing on capital structure from the pre-IPO year to year IPO+5. Consequently, financial data from IPO firms was collected, through Datastream database, for the period 2001-2017. As the sample of IPOs goes from 2002 to 2015, 2001 is the pre-IPO year for firms that went public in 2002, while 2017 is the most recent year for which financial data was available. Observations with missing information in Datastream were excluded. Moreover, in order to mitigate the impact of outliers, firm-year observations with leverage (D/A) greater than 1, profitability (EBITDA/A) greater than 1 and market-to-book ratio (M/B) greater than 10 were dropped.

3.2. Sample Statistics

Table **I** summarises the main characteristics of the UK IPO sample under analysis.

Panel A of Table **I** presents the IPO volume (measured as the number of IPOs) per year, from 2002 to 2015. As it can be seen, the IPO volume of the UK market fluctuated significantly during the period of analysis. For instance, while there are 116 IPOs per year in 2004 and 2005, only 1 IPO takes place in 2009. In a total sample of 612 IPOs, there are, on average, 44 firms going public per year.

Panel B of Table **I** clusters the number of IPOs by industry, according to the issuer industry classification defined in Eikon database. High Technology firms rank first, with 19% of the total IPO volume.

Panel C of Table **I** displays the sample period required to examine the impact of market timing on capital structure. The analysis comprises the year before the IPO (PRE-IPO), the IPO year (IPO) and the five years after the IPO (IPO+1, IPO+2, IPO+3, IPO+4, IPO+5). As evidenced in the panel, for IPOs occurred from 2013 onwards, it is not possible to

examine the 5 years subsequent to the offering, as financial data is only available until 2017.

Panel D of Table **I** shows the number of observations available in each year. Taking into account that data is only available until 2017 and that some firms became inactive during the period under analysis, the final sample results in a total of 3 545 firm-year observations.

Finally, Panel E of Table **I** reports the main characteristics of the IPO sample. The mean offer price was of 1.073 GBP. However, at the end of the first day of listing, shares were trading in the market at a mean price of 1.180 GBP, above of the mean offer price. This phenomenon is designated by underpricing. According to Ritter and Welch (2002), some theories explain the lower offer price based on the existence of asymmetric information. Still regarding the sample characteristics, firms offered a mean total of 37 872 899 shares, of which 25 702 106 correspond to primary shares. From the primary offering, firms raised a mean amount of new equity of approximately 35 million GBP. The remainder shares sold at the IPO are secondary shares[3] held by shareholders that decided to cash in by selling part of their holdings.

4. RESEARCH METHODOLOGY

4.1. Hot and Cold Markets

As pointed out by Ibbotson and Jaffe (1975), there are cycles in the equity market with certain periods being more advantageous for IPOs than others. Taking into account the existence of fluctuations in the market conditions, it is used the hot and cold market classification as the equity timing measure. As highlighted by Helwege and Liang (2004), hot and cold IPO markets are most often defined in terms of volume (i.e., number of firms going public), but also on the basis of underpricing (i.e., first-day return). According to Lowry and Schwert (2002), underpricing and IPO volume are positively correlated.

In this work, both variables are used to define IPO markets. Following Banerjee et al. (2013), who also employ underpricing and volume to characterise the UK IPO market, hot and cold markets are identified on a quarterly basis. For the hot and cold market classification in terms of IPO volume, it was used the initial sample of 1 160 IPOs from Eikon database. Concerning the definition based on underpricing, the initial sample was shortened to 1 000 IPOs, due to the existence of missing data to calculate the return in the first day of trading.

The definition of IPO markets based on IPO volume involved 4 stages. Firstly, it was obtained the number of IPOs in each quarter between 2002 and 2015. Then, the number of issues in each quarter was smoothed by using a 3-quarter centered moving average, in order to remove seasonal variations. Third, each 3-quarter centered moving average of the IPO volume was further detrended at the historical UK quar-

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tertly growth rate (0.42%)[4]. Finally, it was calculated the median in the distribution of the quarterly IPO volume over the last 20 years[5]. Hot (cold) quarters are defined as those for which the detrended quarterly moving average is above (below) the median of the quarterly IPO volume.

Regarding the definition of hot and cold markets based on underpricing, a similar procedure was followed. Nevertheless, it was required an additional step, as underpricing is specific to the individual firm. Initially, it was calculated the underpricing value of each firm (i)[6] for the sample of IPOs occurred between 2002 and 2015. Then, it was obtained the average underpricing in each quarter (which is designated by quarterly underpricing henceforth). Thirdly, the quarterly underpricing was smoothed by using a 3-quarter centered moving average, in order to remove seasonal variations. Additionally, each 3-quarter centered moving average was further detrended at the historical UK quarterly growth rate (0.42%). At last, it was determined the median in the distribution of quarterly underpricing. Hot (cold) quarters are defined as those for which the detrended quarterly moving average is above (below) the

Fig. (**1**) illustrates the detrended quarterly moving average of volume and underpricing for the UK IPO sample between 2002 and 2015. The horizontal lines correspond to the median values at 26.5 for volume and 12% for underpricing.

As shown in Fig. (**1**), there is a positive relationship between underpricing and IPO volume, although there is a slight time lag in certain periods. Indeed, the two variables exhibit a positive and strong correlation of 0.81. These results are consistent with the findings of Lowry and Schwert (2002). Hot markets are characterised by levels of underpricing and volume above the median. Conversely, in cold markets, the average initial return and the IPO volume are lower than usual.

4.2. Variables Definition

4.2.1. Dummy Variable HOT

As in previous studies (e.g., Alti, 2006; Kaya, 2013), the dummy variable *HOT* is considered the main variable of interest, as is used to capture the market timing effects on capital structure. In the main analysis, the dummy *HOT* is defined on the basis of underpricing.

The identification of hot (cold) markets depends on the level of underpricing because, as documented in previous literature, IPO firms have an unusually high average underpricing in hot markets (Helwege and Liang, 2004).

HOT assumes the value of 1 if the IPO takes place in a hot quarter, and 0 otherwise (i.e., if the firm goes public in a cold quarter).Hot (cold) quarters are defined as those for which the detrended quarterly moving average is above (below) the median of the quarterly underpricing (12%).

In the sample of 612 IPO firms, 446 (73% of the sample) are classified as hot-market firms and 166 (27% of the sample) as cold-market firms.

4.2.2. Dependent Variables

4.2.2.1. Evidence of Market Timing in the IPO Market

To capture the evidence of market timing in the IPO market, several studies (e.g., Çelik and Akarim, 2013; Dudley and James, 2013) link the amount of equity an IPO firm issues to whether the market is hot or cold at the time of the offering. The amount of equity issued at the IPO time is measured as Proceeds/Assets (1), defined as the proceeds from the sale of equities scaled by the total assets of issuing firms. Following the previous literature, two different dependent variables are used to test H1, Proceeds^P/A$_t$ and Proceeds^P/A$_{t-1}$ where t denotes the IPO year.

Total equity proceeds contemplate the proceeds from the sale of primary shares, but also from the secondary shares held by shareholders. Thus, the first variable used to capture IPO market timing, measured as Proceeds^P/A$_t$ (1.1), only reflects the amount of new equity raised at the IPO. This variable corresponds to the ratio between IPO proceeds from the sale of primary shares (Proceeds^P) and total assets (A) at IPO year-end (t), and is calculated as:

(1.1) Proceeds^P/A$_t$ = [Primary shares x Offer price] / Total Assets$_t$

The additional capital raised during IPO is mainly reflected in assets, so normalising IPO proceeds by IPO year-end assets could lead to biased results. In order to overcome this limitation, total IPO proceeds are also divided by total assets at the beginning of the IPO year (t-1). This variable is designated as Proceeds^P/A$_{t-1}$ (1.2) and is calculated as:

(1.2) Proceeds^P/A$_{t-1}$ = [Primary shares x Offer price] / Total Assets$_{t-1}$

4.1.2.2. Short-term Impact of Market Timing on Capital Structure

According to the extant literature (e.g., Guney and Hussain, 2012), the analysis of the short-term impact of market timing on capital structure consists of examining the impact of IPO market timing in the issue year, measured by the change in the book leverage ratio from the pre-IPO year to the IPO year (ΔLeverage$_t$) (2), where t denotes the IPO year.

$$(2)\ \Delta\text{Leverage}_t = (D/A)_t - (D/A)_{t-1}$$

4.1.2.3. Persistence of the Impact of Market Timing on Capital Structure

As stressed by Alti (2006), the impact of market timing on capital structure is persistent as long as the negative hot-market effect on leverage does not disappear completely. In other words, the impact of market timing is persistent while the difference in book leverage ratio regarding the pre-IPO level is larger for hot-market firms than for cold-market firms. Thus, to analyse the persistence of the impact of IPO market timing is used, as dependent variable, the cumulative change in book leverage ratio (ΔCumulative Leverage$_t$) (3)

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[4] The UK economy grew, on average, 1.7% per year between 2002 and 2015, which corresponds to a rate of 0.42% per quarter.
[5] Historical information on IPO volume was obtained from the London Stock Exchange website.
[6] Underpricing$_{(i)}$ = (Close price on first day of trading$_i$ – Offer price$_i$)/Offer Price$_i$

from the pre-IPO year to year *t,* where *t* denotes IPO+1, IPO+2, IPO+3, IPO+4 and IPO+5.

$$(3)\ \Delta \text{Cumulative Leverage}_\tau = (D/A)_\tau - (D/A)_{\text{PRE-IPO}}$$

4.2.3. Control Variables

According to the existing literature (e.g., Kaya, 2013), there are other characteristics that may influence the amount of capital raised at the IPO and the changes in the book leverage ratio. Thus, market-to-book ratio, profitability, size, tangibility and leverage were included in this study as control variables. Titman and Wessels (1988) and Rajan and Zingales (1995) consider these variables as the key determinants of financing policy. *Market-to-book ratio* (*M/B*) is the sum of debt and market capitalisation divided by total assets; *Profitability* (*PROF*) is measured by the earnings before interest, taxes, depreciation and amortization over total assets; *Size* (*SIZE*) is the natural logarithm of net sales or revenues; *Tangibility* (*TANG*) is defined as net plant, property and equipment over total assets; *Leverage* (*LEV*) corresponds to the ratio between debt and total assets.

Table **II** sums up the main specific characteristics of hot and cold UK IPO market firms for the pre-IPO year, the IPO year and the 5 years after the IPO. In general terms, the characteristics of the UK IPO sample under analysis are consistent with the patterns found in previous studies. Market-to-book ratio decreases, on average, for both hot and cold market firms around the IPO time, as documented by Alti (2006). Hot-market firms tend to have higher levels of market-to-book ratio than cold-market firms, suggesting that these firms take advantage of "windows of opportunity" coming from the more favourable market conditions to raise their equity capital. Profitability also experiences a decrease at the IPO time and subsequent years, which is referred by Jain and Kini (1994) and Mikkelson et al. (1997). Hot-market firms are, on average, less profitable than cold-market firms, supporting the view of Çelik and Akarim (2013) that less profitable firms are likely to issue more equity when the market is hot, as they found it more difficult when the market is less active. Size and tangibility slightly increase in the years following the IPO for both hot and cold market firms, which is in line with the results of Guney and Hussain (2012). Leverage experiences a greater decline in the IPO year, but starts to increase immediately in the first year after the offering. Although hot and cold market firms have similar levels of book leverage in the pre-IPO year, the reduction is larger for hot-market firms, which is consistent with Alti's (2006) results.

4.3. Regression Models

All regressions presented below are estimated using the Ordinary Least Squares (OLS) method. Following previous studies (e.g., Alti, 2006; Guney and Hussain, 2012), all regressions include industry-fixed effects, in order to control for heterogeneity in industry characteristics. For that purpose, industry dummy variables[7] are added, taking into ac-

count the issuer industry classification defined in Eikon database. The variables *M/B*, *PROF*, *SIZE*, *TANG* and *LEV* are winsorised at the 5th and 95th percentiles of their distributions. The Huber-White estimator is also used to correct the error structure for heteroscedasticity and for error correlation. It is a preventive technique which is specially adopted in cross sectional samples. This estimator turns the statistical inference made on the basis of OLS results robust when other methods of estimation are not used.

Furthermore, regressions are estimated using three different models. Model 1 is considered the baseline model, as is only regressed with the five control variables. Model 2 adds to the baseline model the interaction term *HOT*M/B*. As highlighted by Alti (2006), there is an eventual interaction between these two variables as both may capture market timing attempts. In fact, before the introduction of the dummy variable *HOT* by Alti (2006), Baker and Wurgler (2002) only looked to the M/B ratio to address the market timing hypothesis of the capital structure. Model 3 adds to the baseline model 4 interaction terms. Besides *HOT*M/B, HOT*SIZE*, *HOT*PROF* and *HOT*TANG* are also included. These terms aim to assess if hot-market firms with different growth opportunities, size, profitability and asset tangibility behave differently. Çelik and Akarim (2013) and Guney and Hussain (2012) have previously included the interaction terms *HOT*M/B* and *HOT*SIZE* to the baseline equation, and now the interaction terms *HOT*PROF* and *HOT*TANG* are added. According to Alti (2006), hot-market firms traditionally have low profitability, which is confirmed by our data (Table **II**). Hence, it is important to assess the impact of the interaction term *HOT*PROF* on the proceeds raised by companies (H1), as well as in their post-IPO changes in leverage (H2 and H3). Regarding asset tangibility, it is well documented in the literature that there is a positive relationship between asset tangibility and debt (e.g., Rajan and Zingales; 1995, Baker and Wurgler; 2002). This happens because tangible assets can be used as collateral in loans and, thus, can be related with higher leverage. This way, and given that hot-market firms traditionally approach their pre-IPO levels of leverage faster than cold-market firms do, it is relevant to observe the behaviour of the interaction term *HOT*TANG* alongside with the evolution of the *TANG* variable.

4.3.1. Evidence of Market Timing in the IPO Market

To examine whether there is evidence of market timing in the IPO market, the following regressions are estimated:

(1) $Y_t = c_0 + c_1 HOT + c_2(M/B)_t + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{t-1} + \varepsilon_t$

(2) $Y_t = c_0 + c_1 HOT + c_2(M/B)_t + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{t-1} + c_7 HOT*(M/B)_t + \varepsilon_t$

(3) $Y_t = c_0 + c_1 HOT + c_2(M/B)_t + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{t-1} + c_7 HOT*(M/B)_t +$

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[7] IPO firms under analysis are distributed between 11 industry categories. Thus, 10 dummy variables were created, where Dummy$_i$ = 1 if the observation belongs to the industry i and 0 otherwise. {i = Consumer Products and

Services, Consumer Staples, Energy and Power, Healthcare, High Technology, Industrials, Materials, Media and Entertainment, Real Estate, Retail}. When the 10 dummy variables are equal to 0, this means that the firm belongs to the Telecommunications industry.

$c_8HOT*(PROF)_{t-1}$ + $c_9HOT*(SIZE)_{t-1}$ + $c_{10}HOT*(TANG)_{t-1} + \varepsilon_t$

where t denotes the IPO year. The dependent variable Y_t is $Proceeds^P/A_t$ or $Proceeds^P/A_{t-1}$. The dummy variable *HOT* is the equity timing measure used to capture the market timing effect. All control variables are lagged one year, with the exception of *M/B* ratio, for which information is only available for the IPO year.

4.3.2. Short-term Impact of Market Timing on Capital Structure

To analyse the impact of IPO market timing on leverage in the offering year, the following regressions are estimated:

(1) $Y_t = c_0 + c_1HOT + c_2(M/B)_t + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{t-1} + \varepsilon_t$

(2) $Y_t = c_0 + c_1HOT + c_2(M/B)_t + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{t-1} + c_7HOT*(M/B)_t + \varepsilon_t$

(3) $Y_t = c_0 + c_1HOT + c_2(M/B)_t + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{t-1} + c_7HOT*(M/B)_t + c_8HOT*(PROF)_{t-1} + c_9HOT*(SIZE)_{t-1} + c_{10}HOT*(TANG)_{t-1} + \varepsilon_t$

where t is the IPO year. The dependent variable Y_t is the change in book leverage from the pre-IPO year to the IPO year $[(D/A)_t - (D/A)_{t-1}]$. All control variables are lagged one year, with the exception of *M/B* ratio, for which information is only available for the IPO year.

4.3.3 Persistence of the Impact of Market Timing on Capital Structure

To evaluate the persistence of IPO market timing effect in the five years subsequent to the IPO, the following regressions are estimated:

(1) $Y_t = c_0 + c_1HOT + c_2(M/B)_{t-1} + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{PRE-IPO} + \varepsilon_t$

(2) $Y_t = c_0 + c_1HOT + c_2(M/B)_{t-1} + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{PRE-IPO} + c_7HOT*(M/B)_{t-1} + \varepsilon_t$

(3) $Y_t = c_0 + c_1HOT + c_2(M/B)_{t-1} + c_3(PROF)_{t-1} + c_4(SIZE)_{t-1} + c_5(TANG)_{t-1} + c_6(LEV)_{PRE-IPO} + c_7HOT*(M/B)_{t-1} + c_8HOT*(PROF)_{t-1} + c_9HOT*(SIZE)_{t-1} + c_{10}HOT*(TANG)_{t-1} + \varepsilon_t$

where t corresponds to each one of the 5 years subsequent to the IPO (IPO+1, IPO+2, IPO+3, IPO+4, IPO+5). The dependent variable Y_t is the cumulative change in book leverage from the pre-issue year to year t $[(D/A)_t - (D/A)_{PRE-IPO}]$. The variable *LEV* is lagged to the pre-IPO year and the remainder control variables are lagged one year.

5. RESULTS

5.1. Changes in Book Leverage Ratio Around the IPO Year

Fig. (**2**) illustrates the mean values of book leverage ratio (D/A) for hot and cold market firms, from the pre-IPO year to year IPO+5. The aim of this figure is to assess if the trend

identified in previous researches is also present in the sample of UK IPO firms that is being analysed.

As demonstrated in Fig. (**2**), hot and cold market firms have, on average, similar levels of book leverage in the pre-issue year, which is consistent with the results of Guney and Hussain (2012), who have also studied the UK IPO market. In the IPO year, there is a negative impact on leverage that has a greater extent in hot-market firms. Consequently, at the end of the offering year, hot-market firms have, on average, lower leverage ratios than cold-market firms (as evidenced in column IPO). Immediately after going public, both hot and cold market firms start increasing their leverage ratios, although hot-market firms do it at a higher pace than their cold-market counterparts. After year IPO+1, hot-market firms increase their leverage ratio by, at least, 1 percentage point per year, on average. On the contrary, cold-market firms do not deviate too much from the level attained in the IPO year. Furthermore, hot and cold market firms apparently converge to a similar level of leverage in subsequent years to the offering, which is line with the findings of Guney and Hussain (2012). However, 5 years after the IPO, hot-market firms exhibit higher leverage ratios in comparison with cold-market firms. These results suggest that, although both hot and cold market firms remain far from their pre-issue leverage ratios, hot-market firms become slightly closer to their initial levels.

5.2. Univariate Results and Regression Estimations

5.2.1. Evidence of Market Timing in the IPO Market

Table **III** analyses the impact of market timing on the amount of equity issued during the IPO for hot and cold market firms, in order to validate whether hot-market firms issue more equity than cold-market firms (H1).

Panel A of Table **III** presents the mean values of $Proceeds^P/A_t$ and $Proceeds^P/A_{t-1}$ for hot and cold market firms, where t denotes the IPO year. In line with H1, in the IPO year, hot-market firms issue more equity than cold-market firms. Proceeds from the sale of primary shares are, on average, 76% of IPO year-end total assets for hot-market firms and 72% for cold-market firms. When proceeds are normalised by the pre-IPO total assets, the market timing effect is even larger, which is consistent with Alti's (2006) results. However, the differences in the amount of equity issued at the IPO time between hot and cold market firms are not statistically significant.

Panel B of Table **III** reports the results of the regressions. According to the existing literature, there is a positive hot-market effect on the amount of proceeds raised during the IPO. Therefore, it is expected that the coefficient of the dummy variable *HOT* exhibits a positive sign.

In model 1, the coefficient of the dummy *HOT* is zero, but not statistically significant. Regarding the other independent variables, the signs of their coefficients are consistent with the literature. *SIZE* and *TANG* have a negative impact on the proceeds raised by IPO firms, meaning that the higher the size and the asset tangibility, the lower the proceeds obtained, which is in line with the results of Alti (2006) and Kaya (2013).

After including the interaction term *HOT*M/B* (model 2), the sign of the coefficient of the dummy variable *HOT* turns up positive and statistically significant for the dependent variable Proceeds^P/A$_t$. In this model, the *M/B* coefficient is positive and significant, indicating that firms raise capital at the IPO to finance growth opportunities, as pointed out by Banerjee et al. (2013). However, the variable *M/B* loses its explanatory power for hot-market firms, as underlined by the negative sign of the coefficient of the interaction term *HOT*M/B*. For the dependent variable Proceeds^P/A$_t$, the coefficient associated with the variable *M/B* is 0.123 for cold-market firms, while for hot-market firms is 0.027 (0.123-0.096). This suggests that growth opportunities do not explain the amount of proceeds obtained at the IPO by hot-market firms. Or, in another words, that the proceeds raised by hot-market firms could not be used to finance new investments, which is also referred by Alti (2006).

When the model is expanded by including the four interaction terms (model 3), the coefficient of the variable *HOT* is even more positive than in model 2 and is statistically significant. The results of model 3 confirm the empirical evidence that there is a positive hot-market effect on the amount of proceeds raised during the IPO. According to Alti (2006), hot-market firms can sell more shares and at higher prices, when compared to cold-market firms. Also, looking at the interaction between the variables *HOT* and *M/B*, it seems again that growth opportunities do not positively affect the proceeds generated at the IPO by hot-market firms for the dependent variable Proceeds^P/A$_{t-1}$. In fact, the combined sign of the coefficients of *M/B* and *HOT*M/B* turns out to be negative (0.223 – 0.302). Being a hot-market firm also amplifies the negative impact of *SIZE* on the proceeds raised at the IPO, as indicated by the negative coefficient of *HOT*SIZE*. *PROF* exhibits a negative and significant sign, suggesting that less profitable firms tend to raise more proceeds during the IPO. As hot-market firms are characterised by inferior levels of profitability (according to Table **II**), the negative relationship between profitability and proceeds supports the view that the amount of equity raised by these firms is higher when compared to cold-market firms. This fact also shows that hot-market firms exploit "windows of opportunity" to go public.

5.2.2. Short-term Impact of Market Timing on Capital Structure

Table **IV** presents the results of the impact of market timing on leverage (D/A) in the IPO year. This table attempts to confirm whether there is a negative impact on leverage ratio in the offering year, which is larger for hot-market firms (H2).

Panel A of Table **IV** reports the mean values of the change in book leverage ratio from the pre-IPO year to IPO year [(D/A)$_t$ – (D/A)$_{t-1}$] for hot and cold market firms, where *t* denotes the IPO year. According to H2, both hot and cold market firms reduce the book leverage ratio in the IPO year. The reduction is, on average, 4.65 percentage points greater for hot-market firms.

Panel B of Table **IV** shows the results of the regressions. The hypothesis H2 states there is a negative impact of market timing on leverage in the IPO year, which is more negative for hot-market firms. Therefore, it is expected that the coefficient of the dummy variable *HOT* exhibits a negative sign.

Results confirm that there is a negative hot-market effect on the change in book leverage in the IPO year, implying that hot-market firms reduce their leverage ratios more than cold-market firms. The coefficient associated with the dummy variable *HOT* is negative and statistically significant for the 3 estimated models.

As in Alti (2006), *M/B* ratio also has a negative impact on the change in leverage. However, when interacting the *M/B* ratio with the dummy variable *HOT* (model 2), this negative effect is offset, suggesting that a raise in growth opportunities diminishes the decrease in leverage in IPO year for hot-market firms. This result is reinforced by model 3, with the coefficient associated to *HOT*M/B* (0.049) being statistically significant and more than offsetting the coefficient of *M/B* (-0.046). Profitability has a positive impact on the change in leverage in the 3 models, which is contrary to Alti (2006), but coherent with Guney and Hussain (2012), who have studied the UK IPO market as this work does.

The overall results from Table **IV** are also consistent with H1. In the IPO year, hot-market firms issue more equity than cold-market firms do, although they have similar pre-issue levels (see Fig. **2**). Consequently, the reduction in the book leverage ratio is larger for hot-market firms. This way, the negative impact of market timing on leverage in the IPO year has a greater extent for hot-market firms, in line with Dong et al., 2020.

5.2.3. Persistence of the Impact of Market Timing on Capital Structure

Table **V** exhibits the results of the impact of market timing on leverage in the 5 years following the IPO, in order to validate if market timing only has a temporary impact on capital structure (H3).

Panel A of Table **V** reports the mean values of the cumulative change in book leverage ratio from the pre-IPO year to year *t*, where *t* denotes years IPO+1, IPO+2, IPO+3, IPO+4 and IPO+5 [(D/A)$_t$ – (D/A)$_{PRE-IPO}$]. The first column (IPO+1) shows that the cumulative change in book leverage in the first year after the IPO is, on average, less negative than the change in book leverage in the IPO year (Panel A, Table **IV**) for both hot and cold market firms. This result implies that the negative impact of market timing on leverage starts to reverse in the first year following the IPO. The next columns illustrate that the cumulative change in book leverage regarding the pre-IPO year gradually increases in the 5 subsequent years, confirming that firms raise their leverage levels after the offering. In the first 3 years after the IPO (columns IPO+1, IPO+2 and IPO+3), the difference in book leverage regarding the pre-IPO level is, on average, larger for hot-market firms. However, in the fourth and fifth years following the IPO (columns IPO+4 and IPO+5), the difference in book leverage regarding the pre-IPO level turns up larger for cold-market firms. These results suggest that the negative hot-market effect on leverage (which starts in the IPO year, as evidenced in H2) disappears 4 or 5 years after the IPO.

Panel B of Table **V** presents the results of the regressions. According to H3, firms start to revert the negative impact of market timing on leverage in the first year following the IPO, by issuing more debt and less equity. The increase in book leverage ratio is larger for hot-market firms, due to the more favourable financing conditions. As a consequence, it is expected that, in year IPO+1, the coefficient of the dummy variable *HOT* exhibits a negative sign but less negative than in the IPO year. Market timing has a persistent impact on capital structure as long as the negative difference in the book leverage ratio regarding the pre-IPO year is larger for hot-market firms. When hot-market firms become closer to their pre-issue leverage levels than cold-market firms, the negative hot-market effect on leverage disappears and, consequently, the changes on leverage stop being driven by market timing. In that moment, it is expected that the coefficient of the dummy variable *HOT* turns up positive.

Column 1 of model 1 shows that, in the first year after the IPO, the coefficient of the dummy variable *HOT* (significant at 5%) is less negative than in the IPO year (changes from -0.054 to -0.043), confirming that hot-market firms start to increase their leverage ratios more than cold-market firms. The next columns demonstrate that the hot-market effect remains negative in years IPO+2, IPO+3 and IPO+4, indicating that hot-market firms continue to have larger negative differences in their book leverage ratios regarding the pre-IPO level than cold-market firms. However, the coefficient is becoming less negative and loses its statistical significance from year IPO+3 onwards. In year IPO+5, the coefficient of the dummy variable *HOT* turns up slightly positive (0.018), which means that the difference in book leverage regarding the pre-IPO level becomes larger for cold-market firms and, consequently, that the negative hot-market effect on leverage disappears completely. Thus, the impact of market timing on capital structure is not persistent for more than 5 years after the offering. These results suggest that there is only a temporary impact, in line with H3.

Results from model 2 are similar to model 1. However, according to this model, the coefficient of the dummy variable *HOT* turns positive in the year IPO+4, which is consistent with the results of Guney and Hussain (2012). In model 3, the coefficient of the dummy variable *HOT* is also negative in year IPO+1. Although not statistically significant, this is in accordance with the results from models 1 and 2.

It is also noteworthy that, in models 2 and 3, the effect of *M/B* on the independent variable is softened by the effect of the interaction term *HOT*M/B*, in particular for year IPO+1. This possibly indicates that, as pointed out by Alti (2006), both variables reflect the market timing effect around the IPO year.

6. ROBUSTNESS CHECKS

In the main analysis, IPO markets are signalled on the basis of underpricing. However, according to the existing literature, hot and cold markets are usually defined in terms of volume (e.g., Alti, 2006; Guney and Hussain, 2012; Çelik and Akarim, 2013). Thus, this section captures the market timing effects on capital structure by defining the dummy variable *HOT* on the basis of IPO volume. The aim is to check whether the main results do not change in the presence

of different hot and cold markets definitions and, so, are robust.

6.1. Methodology

The dummy variable *HOT* assumes the value of 1 if the IPO takes place in a hot quarter and 0 otherwise. Following the definition of hot and cold markets based on volume (which is described in section 4.1), we consider hot (cold) quarters as those for which the detrended quarterly moving average is above (below) the median of the quarterly IPO volume (26.5). According to the definition based on volume adopted in this section, in the sample of 612 IPO firms, 409 (67% of the sample) are classified as hot-market firms and 203 (33% of the sample) as cold-market firms.

In this section, it is additionally used the dependent variable Proceeds^{T}/A$_t$ (1.3) to capture the market timing effects in the IPO market. This variable comprises the total amount of equity firms get by going public and is defined as total IPO proceeds divided by total assets at IPO year-end:

(1.3) Proceeds^{T}/A$_t$ = [Total shares x Offer price] / Total Assets$_t$

6.2. Regression Estimations

Table **VI** reports the results of the robustness tests about the evidence of market timing in the IPO market and the impact of market timing on capital structure.

Panel A of Table **VI** confirms that there is a positive and significant hot-market effect on the amount of equity issued in the IPO year, supporting the view that hot-market firms issue more equity than cold-market firms (H1). The dependent variable Proceeds^{T}/A$_t$ also captures the positive hot-market effect, which is in line with Alti's (2006) results. The *M/B* coefficient is positive and statistically significant, suggesting that firms with more growth opportunities tend to raise more equity capital. However, this effect is softened when *M/B* is interacted with the dummy variable *HOT*.

The results of Panel B show that the coefficient associated with the dummy variable *HOT* is negative and statistically significant (-0.275), corroborating the hypothesis that there is a negative hot-market effect on leverage in the IPO year (H2). As seen before, this means that, in the IPO year, hot-market firms reduce their leverage ratios more than cold-market firms.

According to Panel C, the coefficient of the dummy variable *HOT* in the first year after the IPO (-0.253) is less negative than in the IPO year (-0.275), validating that hot-market firms start to increase their leverage ratios more than cold-market firms. In the subsequent years, the coefficient is increasingly less negative, indicating that hot-market firms continue to have larger differences in their book leverage ratios regarding the IPO year than cold-market firms. Nevertheless, the difference is getting smaller and not statistically significant from the year IPO+3 onwards. In year IPO+5, the coefficient of the dummy variable *HOT* turns positive (0.194), implying that the negative hot-market effect on leverage completely vanishes. Consequently, the impact of market timing on capital structure is not persistent over time (H3).

In summary, the results of the robustness tests are similar to the results of the main analysis, suggesting that the main conclusions do not change regardless of the definition of hot and cold IPO markets used.

All regressions are estimated using OLS, industry-fixed effects and the Huber-White estimator to correct the error structure for heteroscedasticity and for error correlation. *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

CONCLUSION

Since Modigliani and Miller (1958), several theories have emerged to explain firms' capital structure choices. Market Timing Theory is one of the most recent among them, which sheds a new light on the determinants of capital structure by assuming that this choice is influenced by market conditions. This study takes a closer look at the Market Timing Theory, analysing its impact on capital structure in the context of Initial Public Offerings. According to this theory, firms are able to time their equity issues, choosing to go public in periods of market overvaluation.

The majority of studies that examine the effects of market timing show evidence of the US market. Thus, this study fills a gap in the literature by focusing on the UK market, which has a relatively identical environment to the US in terms of national institutional factors, such as legal and main financing systems. A sample of 612 firms that went public in the UK market between 2002 and 2015 is used to develop the empirical tests.

The IPO market is split into hot and cold markets due to its cyclical activity. These markets are defined in terms of underpricing in the main analysis, and volume in the robustness checks. In line with Lowry and Schwert (2002), the two measures are positively correlated. Hot markets are characterised as periods of unusually high IPO volume and underpricing due to of the more favourable market conditions. In contrast, cold markets correspond to periods with both number of IPOs and first-day returns lower than usual, in response to worse market conditions.

Results show that hot-market firms issue more equity than cold-market firms, confirming that there is a positive hot-market effect on the amount of proceeds raised during the IPO. According to Guney and Hussain (2012), hot-market firms have inferior levels of performance, profitability and investment. Consequently, these firms seek "windows of opportunity" to issue more equity than they would otherwise be able to.

Also, results validate that the impact of market timing on leverage in the IPO year is negative, with the decline being especially larger for hot-market firms. Therefore, there is a negative hot-market effect on leverage in the offering year, although hot and cold market firms have similar pre-issue leverage ratios.

Nevertheless, immediately after the IPO, firms start increasing their leverage levels. While hot-market firms experience a greater increase in the years following the IPO, cold-market firms do not differ too much from the level reached in the offering year. Five years after the issue, hot-market firms exhibit higher leverage ratios than cold-market firms. As hot and cold market firms have identical leverage levels in the pre-issue year, the difference in the book leverage ratio regarding the pre-IPO year becomes slightly larger for cold-market firms. As a result, the negative hot-market effect on leverage vanishes, suggesting that the impact of market timing on capital structure is not persistent over time.

All in all, the main findings confirm that market timing plays an important role in corporate financing activity, in particular on capital structure decisions. Firms that correctly time their equity issues to take advantage of favourable market conditions are able to raise more proceeds, showing a more significant decrease in their leverage ratios. However, the changes on leverage driven by market timing are not persistent over time. In line with Alti (2006), there is only a temporary impact, as firms' capital structure decisions in the long run seem to be more consistent with the existence of targets for the book leverage ratio.

In further analyses, it would be interesting to assess if firms actually chase leverage targets in the long run that are not influenced by the market timing factor. Also, as a complement to this study, market timing could be evaluated not only regarding equity markets, but also in terms of debt markets.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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