Distinguishing True Female Board Participation from "Femwashing" in IPOs: The Role of Auditing as a Signal Clarifier[1]

Rodrigo de O. Leite
COPPEAD Graduate School of Business
Federal University of Rio de Janeiro
rodrigo.oliveira@coppead.ufrj.br
[Corresponding Author]

Fabio Caldieraro
Brazilian School of Business and Public Administration
Getulio Vargas Foundation

Micael Jardim
Brazilian School of Business and Public Administration
Getulio Vargas Foundation

Paulo Victor G. Novaes
UTS Business School
University of Technology Sydney
&
FUCAPE Business School

Abstract

How can investors extract information from signals provided through female board participation in IPO firms if such signals may be vulnerable to "femwash" strategies? We propose a simple theoretical model to make the case that employing a "Big Four" auditor can clarify the governance signal of female board participation in IPOs, and we empirically test the theoretical propositions derived from the model. Additionally, we develop a new metric of IPO performance considering both the duration of the IPO and the total amount raised in the process, which we call IPO Efficiency. Our results provide evidence that the percentage of females on the board is correlated with IPO investment levels for firms with "Big Four" auditing, but this correlation is not found for firms without "Big Four" auditing. This effect is driven by seasoned equity offerings. Our results are robust to several additional specifications. The results provide insights for pre-IPO firms deciding on the adoption of contracting with costlier auditing firms; and investors who may need to decide on whether or not to take into account female board participation in their decisions to invest in new IPOs.

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1. Introduction

Theranos, once Silicon Valley's darling, boasted a board filled with distinguished names and a commitment to diversity, with women prominently featured. But as the company's fraudulent practices unraveled, it became clear that these governance signals were little more than a façade strategically crafted to build credibility while hiding deep governance problems. This raises a critical question: how can investors distinguish between genuine and superficial signaling? Our study explores this dilemma, revealing how top-tier auditors such as the "Big Four" play a crucial role in clarifying these governance signals, especially during high-stakes IPOs.

There is ample evidence in the literature that financial and non-financial intermediaries are essential in helping a firm signal its true value to the market. For instance, high-ranked auditors (Datta et al, 2014), underwriters (Dong et al., 2011) and associations with prestigious universities (Colombo et al., 2019) are shown to indicate post-IPO stock returns of firms. Additionally, Guo et al. (2024), using Chinese data, show that "audit reports can reduce the speculative behavior of investors in the initial phase of IPOs", which can plausibly improve the ability of the firm to increase the amount raised in an IPO.

Given the known positive returns associated with engaging highly reputable auditors, such as those in the "Big Four," it's expected that all companies would do so. Nevertheless, curiously, many do not. This discrepancy suggests that the value of these auditors may lie in a different role than traditionally assumed. One key contribution of this paper is to demonstrate that these auditors act as signal "clarifiers", in addition to their role as signal "providers" (Wei et al., 2015). Through a straightforward theoretical model, we illustrate that firms may hire auditors to reinforce governance signals that are relatively inexpensive to implement, such as increasing the percentage of females on the board.

The percentage of females on board is closely linked to the idea of "board diversity," which may improve corporate governance based on behavioral agency theory (Dimungu-Hewage & Poletti-Hughes, 2023), in line with empirical evidence showing better governance for firms with higher board diversity (Adams & Ferreira, 2009). Moreover, empirical evidence also suggests that the percentage of female directors on the board at an IPO is considered by the market as a good governance indicator and is correlated with better IPO initial returns (Badru et al., 2019).

Nevertheless, since the cost of changing one director for another is negligible, it is conceivable these firms may not be sending an informative signal of better governance through a more gender-diverse board, but just pretending by "fempower-washing" (Sterbenk et al., 2022). "Fempower-washing" refers to the practice of superficially promoting gender equality or female empowerment in organizations, often for reputational benefits, without implementing meaningful or substantive changes to advance gender equality within the firm. Two recent cases in the USA, Theranos and Joonko, demonstrate that even companies engaged in fraudulent activities can attempt to send performance signals by mechanisms such as publicizing equitable and diverse boards; thus, highlighting how weak and easily manipulable these signals can be. Moreover, recent evidence (Marx et al., 2024) shows that venture capital firms, in the aftermath of George Floyd's murder, adopted a "token response" by funding a single Back-founded startup as a "minimum viable signal". This underscores the difficulty for genuinely committed firms to effectively signal their serious commitment to good governance without the support of more robust and costly "signal clarifiers."

Additionally, theoretical advancements (Benner & Zenger, 2016) suggest that firms with better future prospects will tend to adopt simpler and less costly governance strategies (such as improving the gender diversity of the board) in order to enhance valuations due to market pressures. However, because these strategies are easily

implementable, they can be easily copied by "lemon firms", which makes the costly clarification strategy of "Big Four" auditing even more useful in more polluted IPO markets.

Another important contribution of our paper is the introduction of metrics to analyze IPO proceeds raised by a firm that considers the IPO duration. Previous research, such as Benveniste & Wilhelm (1990), and Dambra et al. (2021), uses the total amount raised during the IPO not considering how long it takes to raise such proceeds. We argue that using the IPO proceeds directly, without time consideration, implies that a firm could derive positive utility from an IPO of infinite duration, as long as the IPO proceeds increase monotonically over time. To address this issue, we propose a new metric which we call "IPO Efficiency". This new metric takes into consideration duration concerns and has important theoretical advantages since it captures the Internal Rate of Return of the firm.

Ceteris paribus, we find that a 10% increase in the share of females on the board of a company undergoing IPO increase IPO proceeds by about one million dollars per day, but only for firms that employ a "Big Four" auditing firm. No significant effect was found for firms that do not employ a "Big Four" auditing firm. Additionally, we find that this effect is driven by the seasoned equity offerings (i.e., the "hot periods") of 2014-15 and 2020-21. Moreover, we also find evidence consistent with the theory that the market uses accruals that generate a larger positive discrepancy between EBITDA and Net Profits as a substitute "signal clarifier" for the informativeness of the percentage of females on the board for firms without "Big Four" auditing.

Our results are robust to several specifications and robustness tests, such as employing a two-stage Heckman selection model to address selection bias into "Big Four" auditors, using seasonal equity offerings as an exogenous shock, and employing

an alternative metric of IPO Efficiency which considers the variable opportunity cost of the IPO duration over time.

This paper contributes to the literature on the role of third-party validation in IPOs, as well as the impact of gender diversity on financial performance. On one hand, previous studies, such as those by Brealey et al. (1977) and Datta et al. (2014), highlight the importance of underwriters and auditors in signaling firm quality and influencing IPO outcomes. On the other hand, recent research, including Adams & Ferreira (2009) and Rau et al. (2024), provide evidence that board diversity, particularly female participation, serves as a positive governance signal, correlated with improved IPO performance. This paper extends these discussions by exploring how auditors, particularly those in the "Big Four," clarify the governance signal of female board participation in IPOs, shedding light on the intersection between strategy, governance, gender diversity, and financial market outcomes.

Our findings offer valuable insights for pre-IPO firms contemplating their strategic choices regarding contracting with higher-cost auditing firms. In an increasingly competitive financial landscape, these firms must weigh the benefits of enhanced signaling clarification that often accompany such costly audits against the potential higher costs (Babich & Sobel, 2004). Moreover, this research serves as a critical resource for investors who are assessing the informativeness of female board participation as a signal of good corporate governance when determining their investment decisions in IPOs. Therefore, both pre-IPO firms and investors can leverage these insights to make decisions that better align with their financial objectives.

In the next section, we position the paper with respect to the current literature. In the third section, we present a theoretical model of governance signaling that focuses on the role of auditing as signaling clarifiers. This section establishes two novel propositions to be empirically tested. In the fourth section, we provide empirical evidence that

supports our theory by: introduce a new IPO Efficiency metric and discuss its advantages; providing information about data and empirical strategy; and showing the results from our main specification and additional robustness specifications and extensions. Finally, we conclude the paper by summarizing the results; discussing implications for theory and practice; and showing the limitations and promising avenues for future research.

2. Literature Review

Signaling theory, introduced by Spence (1973), explains how entities use costly signals to convey quality in markets with information asymmetry. Brealey et al. (1977) highlighted the use of insider ownership as a signal of firm value, while Ross (1977) explored how financial structures serve a similar role. Additionally, Bell et al. (2012b) highlights how corporate governance can be a powerful signal during the IPO process. Moreover, Riley (2001) further elaborated on the broader applications of signaling in economic contexts, reinforcing its importance in reducing information asymmetry during an IPO.

Regarding the effect of "Big Four" auditing on earnings quality, Chen et al. (2022) analyze Chinese data and find that "Big Four" auditing firms enhance audit quality by selecting clients with higher earnings quality and exercising greater caution toward those at risk of earnings restatement, thereby reinforcing financial transparency and reducing the likelihood of misreporting. Thus, we argue in the next section that this mechanism increases the cost of board hirings, which clarifies the signal of good governance via the board composition of firms undergoing IPO.

Financial and non-financial intermediaries play a crucial role in helping firms signal their value to the market during IPOs, hence, these firms rely on third-party endorsements such as auditors, underwriters and prestigious universities to signal their

credibility. For example, Datta et al. (2014) show that firms engaging highly reputable auditors tend to experience better post-IPO stock returns. Similarly, Dong et al. (2011) found that firms that enlist high-quality underwriters also achieve superior post-IPO performance. Additionally, Colombo et al. (2019) shows that affiliations with a prestigious university signals a firm's quality in the scientific domain. These findings underscore the importance of third-party validation in conveying firm quality to potential investors.

A notable gap addressed by this paper lies in understanding the conditions under which a partner, such as a "Big Four" auditor, effectively serves as a clarifier of a signal of credibility and good governance quality. Furthermore, an additional gap this paper tackles is to provide a new rationale for why some firms would engage "Big Four" auditors while others do not, given the documented benefits of hiring a "Big Four" auditing firm.

In recent times, board diversity, especially the presence of female directors, has emerged as a key signal of effective governance. Drawing from behavioral agency theory, Abinzano et al. (2023) argued that board diversity can improve corporate governance, aligning management decisions with broader stakeholder interests. Moreover, Adams & Ferreira (2009) provide empirical evidence showing that "female directors have better attendance records than male directors, male directors have fewer attendance problems the more gender-diverse the board is, and women are more likely to join monitoring committees", which is in line with behavioral agency theory. Additionally, Rau et al. (2024) show that the percentage of female directors at the time of an IPO is positively correlated with initial IPO returns, suggesting that the market views gender diversity as a positive governance indicator, which is confirmed *ex post*.

However, the signaling power of board diversity may be undermined in some cases, particularly when firms superficially attempt to send such signals without meaningful governance reforms. Sterbenk et al. (2022) introduced the concept of "fempower-washing," where firms promote gender diversity for reputational benefits rather than genuine governance improvement. This practice inhibits the informativeness of board diversity as a signal of good governance, complicating the ability of investors to discern genuine signals from cosmetic ones.

Another important effect that undermines the signaling power of board diversity comes from theoretical evidence pointing out that firms with strong future prospects are more likely to adopt straightforward and cost-effective governance strategies, such as increasing board gender diversity, to improve their valuations in response to market pressures (Benner & Zenger, 2016). However, since these measures are relatively easy to implement, they can also be imitated by lower-quality firms issuing “minimum viable signals” (Marx et al., 2024). As a result, the use of a costly signaling clarifier—such as obtaining an audit from a "Big Four" firm—becomes an important instrument that helps the separation of high-quality firms from their less promising counterparts.

An additional dimension in the literature concerns the measurement of IPO performance. Traditionally, IPO underpricing has been a primary focus of analysis, with many studies highlighting it as a key indicator of performance (Bell, et al. 2008; Francis et al., 2010; Moore et al. 2010). Underpricing reflects the difference between the offer price and the first-day closing price, often seen as an indicator of market demand and investor sentiment. Beyond underpricing, several other metrics have been used to assess IPO success. These include total proceeds raised (Blass & Yafeh, 2001; Francis et al., 2010; Amin et al., 2019), first-day initial returns (Bruner et al., 2006), and IPO timing (Somaya and You, 2024) all of which provide insights into short-term outcomes.

However, IPO performance is not solely determined by immediate results. Long-term performance metrics, such as sustained growth, stock liquidity, and firm survival, are equally important. Studies have examined long-term benefits in terms of company survival (Bell et al., 2012a), stock valuation (Wu, 2012), and liquidity (Banti et al., 2017), offering a broader view of how IPOs perform over time. These metrics collectively reflect the overall health and sustainability of firms post-IPO, extending the analysis beyond the initial market reaction to include the firms' capacity to grow and maintain investor confidence in the long run (Cai & Zhu, 2015; Tupper et al. 2018).

Despite the richness of these performance measures, they often neglect the temporal dimension of capital raising. While total proceeds are commonly used to measure success, very few studies consider the duration of the IPO process. This oversight can result in misleading conclusions about performance because it fails to account for the opportunity cost of time. We provide a detailed discussion of these concerns in Section four.

Building on the theory discussed in this literature review, the next section presents a parsimonious theoretical model that aims to more precisely articulate predictions about how auditing influences the informativeness of the presence of female directors on the boards of pre-IPO firms as a signal of good corporate governance.

3. Theoretical Analysis

3.1 Model Overview

The previous section established that board diversity, particularly the inclusion of female directors, has become an important indicator of effective governance. Additionally, a higher percentage of female directors at the time of an IPO can be positively associated with initial IPO returns, indicating that the market may perceive gender diversity as a favorable governance signal.

On the other hand, it is possible that a "lemon firm" with poor corporate governance practices might appoint capable female board members but persist in its bad governance practices. This could happen if these board members cannot significantly influence governance decisions due to structural barriers or insufficient support. Alternatively, they might be unaware of these poor practices because of a lack of transparency, restricted access to essential information, or intentional concealment by the firm's *de facto* leadership. In other words, this "lemon firm" is adopting a "fempower-washing" approach in an attempt to copy the strategy of a better firm and thus issuing a "minimum viable signal" (Marx et al., 2024). In such cases, female board participation would not have a significant influence in IPO performance and thus female participation cannot be an informative signal.

To resolve this informational dilemma, we theorize that a "Big Four" auditing firm can serve as a "signal clarifier" for higher female board participation as an indicator of good governance. As discussed in the previous section, "Big Four" auditing firms tend to enhance audit quality by recruiting and retaining clients with higher earnings quality and acting more conservatively toward clients with a higher risk for earnings restatement. Consequently, these auditing firms tend to audit clients with lower risk profiles and stronger corporate governance. If such client companies engage in a "fem-power washing" strategy, they face higher costs due to increased scrutiny from the auditing firm the risk, of being dropped as a client, or receiving a negative audit report. The former implies directly in increased auditing fees, whereas the latter two entail significant reputational consequences.

3.2 Formal Model Specification and Analysis

We now provide a simple theoretical model that explains how a "Big Four" auditing firm can serve as a "signal clarifier". The model is based on Spence's (1973) signaling model.

The timing of the model is as follows. Before the game starts, a private firm decides to be publicly listed and start the IPO process. Then, the firm chooses its board composition prior to the IPO listing and decides whether to contract a "Big Four" auditing firm, or not. Subsequently, the auditing firm audits the financial reports and the governance structure of the company, releases its report, and the firm undergoes the IPO listing. Finally, the representative investor decides how much to invest in the company.

Below we analyze the signaling possibility through female board participation for the two possible auditing cases: without and with "Big Four" auditing.

Case 1: *Board Female Presence without "Big Four" Auditing*

As mentioned previously, suppose that there is only one representative investor, and there are just two groups of IPO firms, those with low future profits (normalized at 1), and those with high future profit levels $(1 + k)$. The first group is a proportion q of the population, while the second group has proportion $1 - q$. There is, in addition, a governance signal (measured by an index g), which is comprised by a higher proportion of females in the board. This signal is available at a very small cost $\varepsilon g/1$ for the low future profits group, and $\varepsilon g/(1 + k)$ for the high future profits group, where ε is an infinitesimal amount.

Suppose the investor believes that there is some level of female participation in the board (which we call g^*), such that if $g < g^*$, then future profits are 1 with probability 1, and that if $g \geq g^*$, the future profits are $1 + k$ with probability 1. Then, the investor offers an investment $I(g) = 1$ if $g < g^*$, and $I(g) = 1 + k$ if $g \geq g^*$.

From Spence (1973), we have that an informational equilibrium would require the low-profits group to set $g = 0$ if $1 > (1 + k) - \varepsilon g^*$ and the high-profits group to set $g = g^*$ if $(1 + k) - [\varepsilon g^*/(1 + k)] > 1$. Notice that, in this case, because ε is very small, then a

separating equilibrium cannot be sustained as both groups end up in a pooling equilibrium and set $g = g^*$. Consequently, the signal is irrelevant (non-informational). This result is in line with the reasoning by Benner & Zenger (2016), which argued that corporate governance strategies that are easily mimicable by "lemon firms" are irrelevant as market signals of firm quality.

Case 2: *Board Female Presence with "Big Four" Auditing*

Under a higher cost auditing (i.e., a "Big Four" auditing firm), then the signal of female board presence is more costly, due to higher compliance levels that a firm under a higher cost auditing faces. This higher cost happens because if the firm is appointing directors just to "fem-power wash" the board, or for other reasons that might impair governance, it will negatively affect the auditing report of the auditor. Because the "Big Four" auditing cost is higher, any event that may negatively impact its report has a higher marginal cost. Thus, any board modification (either hiring and/or firing males or females) is more costly.

In this case, the model is similar to that in the previous case, but now the cost is $g/1$ for the low future profits group, and $g/(1+k)$ for the high future profits group (in other words, the cost of compliance for both firms remains a significant factor).

The equilibrium is now changed, and we find that the low profits groups will set $g = 0$ if $1 > (1+k) - g^*$ and the high profits group will set $g = g^*$ if $(1+k) - [g^*/(1+k)] > 1$. Hence, there is a value of g^* in the range $k < g^* < k^2 + k$, such that the low future profits group will self-select into $g = 0$, and the high future profits group will self-select into $g = g^*$. Therefore, in this case we have a separating equilibrium and the signal is informational. A rational investor will invest 1 if $g < g^*$ and will invest $1 + k$ if $g \geq g^*$. Thus, higher quality firms are able to credibly signal their type by appointing a higher percentage of females for the board, in a result that relates to those in Deutsch &

Ross (2003). Furthermore, this more complex governance strategy, which combines board diversity with "Big Four" auditing to support a separating equilibrium, aligns with the arguments of Benner & Zenger (2016).

From the forthright model above, we establish two testable propositions:

Proposition 1 (Case 1): *Without "Big Four" auditing, the ratio of females in the board is non-informational, and thus it is not correlated with IPO investment levels.*

Proposition 2 (Case 2): *With "Big Four" auditing, the ratio of females in the board is informational, and thus it is correlated with IPO investment levels.*

These results call for a broadening of our current understanding of the signaling role of auditing by highlighting its additional role of signaling clarifier. They predict that the participation of females in a pre-IPO firm can signal good governance only when the firm submits itself to a costly thorough auditing process. In such cases, female participation can be an indicator of future firm performance. Conversely, when a firm adopts a cheaper auditing strategy, the governance signaling is jammed and investors will have more difficulty in identifying firms' performance. In the next section, we present the results of an empirical analysis designed to test the implications of the proposed model.

4. Empirical Analysis

4.1 Measuring IPO Efficiency

The utility one firm derives from the IPO should not be solely determined by the amount of capital raised. Suppose that two firms raise the exact same amount of money during IPO, but one raises it in 90 days, whereas the other raises it in 180 days. Then, it is

straightforward to notice that the first firm benefited more from the IPO than the second firm, since the former had access to the same amount of IPO proceeds, but in a shorter time frame. Therefore, a problem with using only the IPO proceeds to evaluate IPO success is that it can lead to spurious correlations, since it does not consider the cost of opportunity of time.

As Babich and Sobel (2004) argue, "many owners of growing privately held firms make operational and financial decisions in an effort to maximize the expected present value of the proceeds from an initial public offering." Thus, if we only use the total IPO proceeds as the dependent variable, it is logical that a firm will "squeeze" every last penny of an IPO without taking into consideration timing decisions (i.e., maximizing the nominal proceeds instead of its expected present value), and a firm would derive a positive utility from an IPO with an "infinite" duration, as long as the proceeds increase monotonically over time.

Hence, in this paper, we introduce what we call "IPO Efficiency," as an approximation to the utility function of the firm that considers both the amount raised and the time duration of the IPO. We model the efficiency of a firm i making an IPO that raises an amount of proceeds P over a time duration d as $E_{i,P,d} = \frac{P_i}{d_i}$. Notice that we make two assumptions in this model, first we assume that the present value (at $t = 0$) of P at time $t = d$ is equal to P (i.e., the risk-free interest rate is zero), and that the denominator increases linearly over d in the same way in all periods, independently of the risk-free rate. These assumptions make the interpretation of $E_{i,P,d}$ much more straightforward: it is the amount of dollars raised per day during the IPO. As a robustness analysis, we will later relax these assumptions by considering positive interest rates and a hyperbolic discount function that also take into account these interest rates (i.e., the denominator increases more in periods with higher interest rates). In any event, as it will be seen, the qualitative results will remain similar.

An additional benefit of this approach is that, under equilibrium, the firm should continue the IPO until the extra amount of money raised by continuing the IPO is below the internal rate of return ($E_{i,P,d}\ (d^*) \sim IRR(d^*)$), as Figure 1 showcases. Thus, firms with larger $E_{i,P,d}$ should be firms with higher internal rate of returns, which, in turn, are firms with better future prospects. This is exactly the reasoning behind the theoretical model developed in the previous section. Hence, this IPO efficiency variable captures the implied rates of returns that the market is anticipating from the firms.

<INSERT FIGURE 1 AROUND HERE>

4.2 Data and Identification Strategy

4.2.1 Sample

To construct our variables of interest, we gathered data from Bloomberg, Eikon, and prospectuses filed with the U.S. Securities and Exchange Commission (SEC) from IPOs listed on the Nasdaq and New York stock exchanges between 2011 and 2022, including both local and foreign offerings. All prospectuses were accessed through the SEC Edgar database whereas financial data was obtained directly from the IPO filings.

Following the methodology of Ferris et al. (2013), Hanley and Hoberg (2010), and Arnold et al. (2010), we excluded American Depositary Receipts/American Depositary Shares (ADR/ADS), Real Estate Investment Trusts (REITs), closed-end funds, limited partnerships, IPOs that did not raise proceeds, and significantly undervalued IPOs. Additionally, companies that were already listed (i.e., not pure primary IPOs) were removed from the dataset. After cleaning the data, our final sample covered 765 IPOs from 18 home countries. The home countries of IPO firms in our data are highlighted in Table 1, as well as the distribution of firms in these countries.

<INSERT TABLE 1 AROUND HERE>

4.2.2 Variables and Descriptive Statistics

Table 2 provides the summary statistics of all variables. The average total proceeds that an IPO raised in the sample was 288 million dollars. IPO duration was measured in days, from the IPO filing to the market debut, with data extracted from the IPO prospectus. The average IPO in our sample lasts 75 days. The IPO Efficiency variable is calculated as the ratio between IPO proceeds and IPO duration. A firm, on average, raises 7 million dollars per day during the IPO duration period. We will use IPO Efficiency as our main dependent variable.

<INSERT TABLE 2 AROUND HERE>

Our main independent variable is the ratio of females on the board of the firm that is seeking IPO. The average ratio is about 13%, but there is huge variability, with the minimum being 0% and the maximum being 82%.

We use as control the age of the firm (in years), size (proxied by the ln(Total Assets [in USD millions] +1) in order to avoid negative numbers), a dummy variable that assumes the value of 1 if the firm is in the tech sector, and the EBITDA of the firm in the period immediately previous to the IPO.

As the next subsection highlights, we use the "Big 4" dummy variable in order to split the sample between those firms that employ one of the "Big Four" auditing companies as auditors (PwC, KPMG, EY and Deloitte). We see that a large ratio of companies does not employ a "Big Four" auditor (37.4% of the sample), which enables our identification strategy, since we have enough observations in both cohorts to estimate two sets of regressions.

4.2.3 Identification Strategy

The two propositions of our paper will be tested in a series of similar regressions. We split our sample between IPOs which are audited by "Big Four" firms (PwC, KPMG, EY and Deloitte), and those that are not audited by these firms. We employ this estimation strategy for two reasons. First, this split sample estimation technique is commonly used in studies that have "Big Four" versus "non-Big Four" firms (Chen et al., 2022). Secondly, because we have different propositions for the two cohorts of firms, then this estimation technique allows us to independently assess the significance of both coefficients.

Thus, we proposed that the ratio of females in the board is not correlated with IPO investment levels, for firms without "Big Four" auditing. We assess this correlation in the following OLS regression:

$$IPO\ Efficiency_{i,c,t,Big\ 4=0} = \beta \cdot Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=0} + X'\gamma + \theta_c + \tau_t + \varepsilon_{i,c,t}.$$

Hence, the IPO Efficiency of a firm i from the country of origin c in year t that does not employ a "Big Four" auditing firm is a function of the percentage of females on board, the vector of control variables X, and country and year fixed-effects. We cluster the standard errors at the $Country \times Year$ level.

Conversely, the estimation for the second proposition is as follows:

$$IPO\ Efficiency_{i,c,t,Big\ 4=1} = \beta \cdot Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=1} + X'\gamma + \theta_c + \tau_t + \varepsilon_{i,c,t}.$$

The above model is exactly the same OLS regression from the previous cohort, but now in the subsample that employs a "Big Four" auditor. In the next subsection we will discuss the results of these two sets of models.

4.2 Results

Table 3 provides results from the main regressions of two model variations. For both cohorts of firms, the first model introduces the controls and fixed effects and the second model uses a more robust set of fixed effects (Year times Country, instead of Year and Country). These models provide evidence that supports both propositions 1 and 2.

<INSERT TABLE 3 AROUND HERE>

The first and second models from the aforementioned table show that that a 10% increase in the share of females on the board of a company undergoing IPO is correlated with about one million dollars per day increase in the IPO proceeds for companies with a "Big Four" auditor, which is economically meaningful.

For companies without a "Big Four" auditor, we find that the effect of an increase in the share of females on the board on IPO efficiency is not significantly differently from zero in both specifications. Therefore, we find evidence consistent with the predictions from our theoretical model: the ratio of females in the board is correlated with IPO investment levels, but only with for firms audited by "Big Four" auditors.

We acknowledge that these results are correlational in nature; thus, in the next subsections we will estimate a battery of additional tests in order to provide robustness tests and extensions that increase our confidence in these results.

4.3 Robustness Checks

4.3.1 Addressing Self-selection Bias

One important source of endogeneity in our main estimations is that firms self-select into being audited by a "Big Four" auditing firm, which may bias our estimations. In order to control for such selection bias, we estimate a two-stage Heckman selection

model using CEO and firm-level variables. First, we estimate for the full sample the following Probit model:

$$Big\ 4_{i,c,t} = \alpha + \delta_1 \cdot Female\ CEO_{i,c,t} + \delta_2 \cdot Founder\ CEO_{i,c,t} + \delta_3 \cdot Number\ of\ Board\ Members_{i,c,t} + X'\gamma + \varepsilon_{i,c,t}.$$

The variable $Female\ CEO_{i,c,t}$ assumes the value of 1 if the CEO during the IPO is a female, and, likewise, the variable $Founder\ CEO_{i,c,t}$ assumes the value of 1 if the CEO during the IPO the founder of the company. The variable $Number\ of\ Board\ Members_{i,c,t}$ counts the total number of board members. The vector X is comprised of the firm-level variables used as control in the baseline estimations (age, size, tech dummy variable, and EBITDA).

The rationale for the choice of these variables is as follows. The $Number\ of\ Board\ Members_{i,c,t}$ captures the effect of larger boards on the quality of each firm's corporate governance, which may affect the likelihood of a firm choosing to be audited by a "Big Four" auditor. Firms which have the founder as CEO, plausibly may excessively concentrate power on the Founding CEO figure (Naumovska & Harmon, 2024), which may affect the firm's propensity to hire a "Big Four" auditor; thus, the incorporation of the $Founder\ CEO_{i,c,t}$ variable. Lastly, we also include the $Female\ CEO_{i,c,t}$ variable in the first step of the selection model, since a female CEO would add to the female board participation signal and could also affect the firm´s motivation to hire a "Big Four" auditor.

We then estimate the Inverse Mills Ratio (IMR), which captures the individual sampling probability of each observation, as the ratio of the probability density function to the cumulative
distribution function from the Probit model.

Finally, we estimate the main model (for the sample audited by a "Big Four" firm), including the IMR variable, as follows:

$$IPO\ Efficiency_{i,c,t,Big\ 4=1} = \beta \cdot Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=1} + \delta \cdot IMR + X'\gamma + \theta_c + \tau_t + \varepsilon_{i,c,t}.$$

Table 4 provides the results, which are qualitatively similar to the estimated in the main section of the paper. These results provide evidence that selection bias is likely not driving the results of the correlation between the percentage of females on the board and IPO efficiency for firms with a "Big Four" auditor.

<INSERT TABLE 4 AROUND HERE>

4.3.2 Alternative Metric for IPO Efficiency

Previously, we modeled the efficiency of a firm i making an IPO that raises an amount P over a duration d as $E_{i,P,d} = \frac{P_i}{d_i}$. We now make two adjustments to this metric. First, we let the Proceeds at time $t = d$ to be valued at $P \cdot e^{-r_{f,t} \cdot \frac{d}{365}}$, with $r_{f,t}$ being the risk-free interest rate in year t. Secondly, we used a hyperbolic discount rate of d to be time dependent as $(1 + r_{f,t}) \cdot d$. This means that, in years with higher interest rates, firms will value the same present value of dollars after $t = d$ days as lower than in periods with lower interest rates.

Now, the IPO efficiency of a firm is $E_{i,P,d} = \frac{P \cdot e^{-r_{f,t} \frac{d}{365}}}{(1+r_{f,t}) \cdot d}$. The regression coefficient is much harder to interpret than the most parsimonious metric used in the previous estimations, but now one can argue that this IPO efficiency metric better captures the actual utility function of a firm when doing an IPO.

We now proceed to estimate a series of new OLS regressions with the alternative metric for IPO efficiency as follows:

$$Alternative\ IPO\ Efficiency_{i,c,t,Big\ 4=0\ or\ 1} = \beta \cdot Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=0\ or\ 1} + X'\gamma + \theta_c + \tau_t + \varepsilon_{i,c,t}.$$

Results from the alternative IPO efficiency metric are presented in Table 5. We again find that there is an association between the percentage of females on board for companies that employ a "Big Four" auditor (thus providing further evidence supporting Proposition 2), but we find no effect for companies without a "Big Four" auditor (also providing evidence supporting Proposition 2).

<INSERT TABLE 5 AROUND HERE>

4.4 Extensions

4.4.1 Seasonal Equity Offerings

Figure 2 shows the distribution of the number of IPOs per year in our dataset. It is easy to see that there are two periods with a high volume of IPOs in the data: 2014-2015 and 2020-2021, which for expositional purposes we call "IPO seasons". These periods of high volume are exogenous to the firm, since firms cannot decide when this period will occur. Therefore, we exploit the exogeneity in these cohorts to estimate a plausibly causal effect of the share of females on the board of a firm undergoing IPO on IPO efficiency.

<INSERT FIGURE 2 AROUND HERE>

There is ample research documenting the "IPO seasons" that lead to seasonal equity offerings (SEOs) (Loughran & Ritter, 1995). These "hot periods" attract seasonal equity offerings from firms that are in need of cash (DeAngelo et al., 2010), and the typical

firm undergoing an SEO underperforms the market in the long run (Loughran & Ritter, 1997).

Thus, if our theory is correct, then in these "hot periods", due to the fact that investors are "crowded" with information from IPO prospectuses of firms with lower levels of cash, as well as from firms with lower future returns, the IPO market will be more polluted with asymmetric information. In these conditions, the better-governance signal of a larger share of females on board becomes potentially useful to differentiate between firms with better future expected cash flows from those with lower expected future cashflows.

Moreover, because these "lemon firms" that go public through SEOs can easily implement a more-diverse-board strategy, this leads to the "lemons problem" highlighted by Benner & Zenger (2016). As a result, the use of a "Big Four" auditor as a costly signal clarifier becomes even more important to the market as a means to distinguish high-quality firms from their less promising counterparts. Thus, because the good governance signal provided by board diversity is more relevant in these periods, the "Big Four" clarification effect is also more useful to differentiate between good firms implementing *bona fide* corporate governance strategies and "lemon firms" implementing "fem-power washing" tactics.

Therefore, to capture this effect, we estimate the two sets of regressions of our cohorts ("Big Four" auditor x "Non-Big Four" auditing) as follows:

$$IPO\ Efficiency_{i,c,t,Big\ 4=1\ or\ 0} = \beta \cdot Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=1\ or\ 0} + \varphi \cdot High\ Year_t \times Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=1\ or\ 0} + X'\gamma + \theta_c + \tau_t + \varepsilon_{i,c,t}.$$

The coefficient of interest is φ, which measures the difference of the β coefficient of the IPO "high years" (2014-2015 and 2020-2021) versus the "low years" (all other years). Results are provided in Table 6.

<INSERT TABLE 6 AROUND HERE>

For the cohort that employs "Big Four" auditing, results show that the effect of a higher percentage of females on board on IPO efficiency is significant for the 2014-2015 and 2020-2021 years, as we theorized. Additionally, the baseline effect for the "low years", (i.e., the β coefficient) is not statistically different from zero. Thus, the female representation signaling effect only occurred in the 2014-2015 and 2020-2021 years for firms with "Big Four" auditing.

For the subsample that does not employ "Big Four" auditors, we have no consistent correlations for both β and φ, thus underscoring the robustness of our findings, and the soundness of our theoretical model. These results not only support our main theory: that the signal of higher governance is more useful during periods of heightened competition of firms in IPO, but also are more robust than the coefficients in our main regressions, since these "IPO seasons" are exogenous to the firms.

4.4.2 Accruals as a Substitute for Costly Signal

It is well known that firms undergoing IPO tend to use accruals opportunistically (Teoh et al., 1998). Typically, IPO firms adopt more income-increasing depreciation policies and they provide significantly less for uncollectible accounts receivable than their matched non-issuers. Additionally, because audit quality increase with "Big N" auditors (Jiang et al., 2019), we theorize that markets may use the information from the IPO firm's accrual as a substitute for "Big Four" auditing as a signal clarifier of the percentage of females on the board as a good governance signal.

Because IPO firms tend to inflate their "core" earnings through classification shifting (Liu & Wu, 2020), a proxy to measure such accruals can be the difference between the EBITDA (which will be subject to these classification shifts), and Net Profits (which will not be affected by these shifts). Therefore, we posit that companies with less

discrepancies between EBITDA and Net Profits, when signaling better corporate governance via female board participation, will raise more money per day of the IPO duration when compared to their counterparts with more discrepancies between EBITDA and Net Profits.

Thus, we calculate a proxy to gauge the level of accruals of an IPO Firm (in USD millions) as $EBITDA_i - Net\ Profits_i$, and then estimate the following set of OLS models:

$$IPO\ Efficiency_{i,c,t,Big\ 4=1\ or\ 0} = \beta \cdot Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=1\ or\ 0} + \varphi \cdot Accruals_{i,c,t,Big\ 4=1\ or\ 0} \times Percentage\ of\ Females\ on\ Board_{i,c,t,Big\ 4=1\ or\ 0} + X'\gamma + \theta_c + \tau_t + \varepsilon_{i,c,t}.$$

Table 7 provides the results for the model. We observe that there is no significant moderating effect of accruals for IPO firms audited by a "Big Four" auditor, with the baseline effect of the percentage of females on board remaining significant. Nevertheless, for firms not audited by a "Big Four" auditor, we observe that a higher positive discrepancy between EBITDA and Net Profits has a negative interaction with the percentage of females on board. Thus, we find evidence that the market may use the discrepancy between EBITDA and Net Profits as a substitute for the costly signal of audit quality when judging the informativeness of female presence in the board as a good governance indicator.

<INSERT TABLE 7 AROUND HERE>

5. Discussion and Conclusion

The concept of *fempower-washing* (Sterbenk et al., 2022) highlights the risk of superficial governance practices for both firms and investors. Our study shows that, during IPOs, the governance signal of female board participation is effective only when paired with a "Big Four" auditor, which lends credibility to this signal and reduces doubts about the authenticity of governance initiatives. A failure to account for this effect

may undermine the IPO performance or lead investors to invest in less promising companies.

Our study provides important insights for pre-IPO companies evaluating their strategic decisions related to engaging higher cost, but better ranked, auditing firms. In the highly competitive financial environment of the IPO process, these firms need to balance the advantages of stronger signaling clarity often associated with more expensive audits against the additional financial cost (Babich & Sobel, 2004). Additionally, the findings offer valuable guidance for investors who consider female board representation as a potential indicator of strong corporate governance when making IPO-related investment decisions. Thus, both pre-IPO firms and investors can use the insights from this paper to make more informed choices aligned with their financial goals.

This paper also provides three important contributions to literature. The first is to provide theoretical and empirical evidence for the role of "higher ranked" auditors as signal "clarifiers", in addition to their role as signal "providers" in the context of IPOs. While we do not contest that auditors can be by themselves a source of signal to the market (Wei et al., 2015), we highlight their important additional role as "signal clarifiers" of good corporate governance indicators. Thus, the use of these auditors can help solve the "lemons problem in the market for strategy" (Benner & Zenger, 2016).

The second contribution of this paper is the introduction of a new way to measure IPO success which we called "IPO Efficiency". This metric takes into consideration duration concerns and also has other important theoretical advantages, such as capturing the Internal Rate of Return of the firm, being better linked with the theoretical utility function of a firm undergoing IPO, and also being able to incorporate a variable opportunity cost of the duration.

The final contribution of this paper lies in the empirical results for the effect of female board participation on IPO investment levels found in the sample of 765 IPOs on NASDAQ and NYSE. We show that the percentage of females on board have a positive correlation with IPO Efficiency, such that, *ceteris paribus*, a 10% increase in the share of females on the board of a company undergoing IPO is correlated with about one million dollars per day increase of IPO proceeds, but only for firms that employ a "Big Four" auditing firm. Additionally, we find that this result is driven by the seasoned equity offerings of 2014-2015 and 2020-2021. Furthermore, we also find evidence supporting the theory that the market may rely on accruals that generate a larger positive discrepancy between EBITDA and Net Profits as a substitute "signal clarifier" for the informativeness of the percentage of females on the board for firms without "Big Four" auditing.

As any study, ours also have limitations. First, the focus on IPOs restricts the generalizability of our findings to other financial contexts, such as venture capital investment decisions, which are private. Additionally, we did not explore how institutional characteristics, such as legal frameworks and cultural norms, may interact with the auditor's ranking, which could influence the role of auditors as signal clarifiers across different jurisdictions.

Future research could examine the role of auditors as signal clarifiers in other financial settings, such as mergers, acquisitions, or debt issuances, to assess the broader applicability of our findings. Moreover, investigating the interaction between the institutional environment of a firm's country of origin and auditor ranking could provide valuable insights into how these factors influence governance signals and their impact on firm outcomes.

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Tables

Table 1. We provide the home country distribution of 765 firms that underwent IPOs in NYSE and Nasdaq from 2011 to 2022. The first column shows the number of firms and the second column provides the percentage of the distribution.

Home Country	Number of IPOs	% in the Dataset
Austria	1	0.13
Belgium	1	0.13
Brazil	1	0.13
Canada	12	1.57
China	14	1.83
Denmark	3	0.39
France	1	0.13
Germany	3	0.39
Ireland	3	0.39
Israel	14	1.83
Italy	1	0.13
Japan	1	0.13
Luxembourg	3	0.39
Netherlands	12	1.57
Singapore	3	0.39
Switzerland	5	0.65
United Kingdom	15	1.96
United States	672	87.84
Total	765	100

Table 2. We provide summary statistics of the 765 IPOs from 2011 to 2022 which comprise our sample. The first column shows the average, and the second column provides the standard deviation. Third and fourth columns show the minimum and maximum of the distribution, respectively.

Variable	Obs	Mean	SD	Min	Max
Total Proceeds (in USD million) [1]	765	288.448	882.178	3.080	16006.880
IPO Duration (in days) [2]	765	74.987	106.139	15.000	1055.000
IPO Efficiency ([1] / [2])	765	7.038	13.930	0.009	185.461
Percentage of Females on Board	765	0.126	0.149	0.000	0.818
Age (in years)	765	10.242	11.359	1.000	144.000
ln(Total Assets+1, in USD million)	765	4.607	2.054	0.093	10.496
Tech (1 = tech firm)	765	0.216	0.412	0.000	1.000
EBITDA (in USD million)	765	18.711	219.244	-2789.000	2724.000
Big 4 (1 = Yes)	765	0.626	0.484	0.000	1.000

Table 3. We provide results from OLS regressions using IPO Efficiency metric as dependent variable. Each observation is one IPO-level observation. The variable Percentage of Females on Board is the ratio of females on the board of the IPO company over the total number of board members. The variable Big 4 assumes the value of 1 if the auditor of the IPO firm is one of the "Big Four" auditing companies (PwC, KPMG, EY and Deloitte). We use the country of origin of the IPO firm and IPO year fixed effects when noted and we cluster the standard errors at the Country-Year level. Significance levels: ***p<0.01, **p<0.05, *p<0.10. Standard errors in parentheses.

	Big 4 = 1		Big 4 = 0	
Percentage of Females on Board	8.844**	10.983**	1.957	2.000
	(4.233)	(4.360)	(3.850)	(4.018)
Observations	479	479	286	286
R^2	0.33	0.35	0.44	0.44
Controls	Y	Y	Y	Y
Country of Origin FE	Y	N	Y	N
Year FE	Y	N	Y	N
Country x Year FE	N	Y	N	Y
Country x Year Clustered SE	Y	Y	Y	Y

Table 4. We provide results from OLS regressions using the Heckman two-stage selection model to control for self-selection into being audited by a "Big Four" company. In the first stage we model the probability of being audited by a "Big Four" company as a function of the control variables, as well as CEO and Board-level variables (Female CEO, Founder CEO and the Number of Board Members). Each observation is one IPO-level observation. The variable Percentage of Females on Board is the ratio of females on the board of the IPO company over the total number of board members. The variable Big 4 assumes the value of 1 if the auditor of the IPO firm is one of the "Big Four" auditing companies (PwC, KPMG, EY and Deloitte). We use the country of origin of the IPO firm and IPO year fixed effects when noted and we cluster the standard errors at the Country-Year level. Significance levels: ***p<0.01, **p<0.05, *p<0.10. Standard errors in parentheses.

	Big 4 = 1	
Percentage of Females on Board	8.713*	10.620**
	(4.422)	(4.518)
Inverse Mills Ratio	35.989**	36.371*
	(17.777)	(20.069)
Observations	479	479
R^2	0.35	0.37
Controls	Y	Y
Country of Origin FE	Y	N
Year FE	Y	N
Country x Year FE	N	Y
Country x Year Clustered SE	Y	Y

Table 5. We provide results from OLS regressions using the Alternative IPO Efficiency metric as dependent variable. Each observation is one IPO-level observation. The variable Percentage of Females on Board is the ratio of females on the board of the IPO company over the total number of board members. The variable Big 4 assumes the value of 1 if the auditor of the IPO firm is one of the "Big Four" auditing companies (PwC, KPMG, EY and Deloitte). We use the country of origin of the IPO firm and IPO year fixed effects when noted and we cluster the standard errors at the Country-Year level. Significance levels: ***p<0.01, **p<0.05, *p<0.10. Standard errors in parentheses.

	Big 4 = 1		Big 4 = 0	
Percentage of Females on Board	8.804**	10.928**	1.917	1.956
	(4.200)	(4.319)	(3.849)	(4.017)
Observations	479	479	286	286
R^2	0.33	0.35	0.43	0.44
Controls	Y	Y	Y	Y
Country of Origin FE	Y	N	Y	N
Year FE	Y	N	Y	N
Country x Year FE	N	Y	N	Y
Country x Year Clustered SE	Y	Y	Y	Y

Table 6. We provide results from OLS regressions using IPO Efficiency metric as dependent variable. Each observation is one IPO-level observation. The variable Percentage of Females on Board is the ratio of females on the board of the IPO company over the total number of board members. The variable Big 4 assumes the value of 1 if the auditor of the IPO firm is one of the "Big Four" auditing companies (PwC, KPMG, EY and Deloitte). The variable "High IPO Year" assumes the value of 1 if the year has a number of IPOs above the average (2014, 2015, 2020, 2021). We use the country of origin of the IPO firm and IPO year fixed effects when noted and we cluster the standard errors at the Country-Year level. Significance levels: ***p<0.01, **p<0.05, *p<0.10. Standard errors in parentheses.

	Big 4 = 1		Big 4 = 0	
Percentage of Females on Board	-4.626	-5.268	-3.932	-3.860
	(5.788)	(6.712)	(8.823)	(9.173)
Percentage of Females on Board x High IPO Year	20.564***	24.148***	9.523	9.421
	(7.228)	(6.914)	(8.372)	(8.646)
Observations	479	479	286	286
R^2	0.33	0.35	0.44	0.44
Controls	Y	Y	Y	Y
Country of Origin FE	Y	N	Y	N
Year FE	Y	N	Y	N
Country x Year FE	N	Y	N	Y
Country x Year Clustered SE	Y	Y	Y	Y

Table 7. We provide results from OLS regressions using the IPO Efficiency metric as dependent variable. Each observation is one IPO-level observation. The variable Percentage of Females on Board is the ratio of females on the board of the IPO company over the total number of board members. The variable Big 4 assumes the value of 1 if the auditor of the IPO firm is one of the "Big Four" auditing companies (PwC, KPMG, EY and Deloitte). The variable "Accruals" is the difference between EBITDA and Net Profit. We use the country of origin of the IPO firm and IPO year fixed effects when noted and we cluster the standard errors at the Country-Year level. Significance levels: ***p<0.01, **p<0.05, *p<0.10. Standard errors in parentheses.

	Big 4 = 1		Big 4 = 0	
Percentage of Females on Board	10.257*	12.926**	2.087	2.130
	(5.795)	(5.930)	(3.863)	(4.030)
Percentage of Females on Board x Accruals	-0.019	-0.024	-0.012***	-0.012***
	(0.040)	(0.041)	(0.003)	(0.003)
Observations	479	479	286	286
R^2	0.33	0.36	0.44	0.44
Controls	Y	Y	Y	Y
Country of Origin FE	Y	N	Y	N
Year FE	Y	N	Y	N
Country x Year FE	N	Y	N	Y
Country x Year Clustered SE	Y	Y	Y	Y

Figures

Figure 1: Graph of the optimal IPO duration (d*)

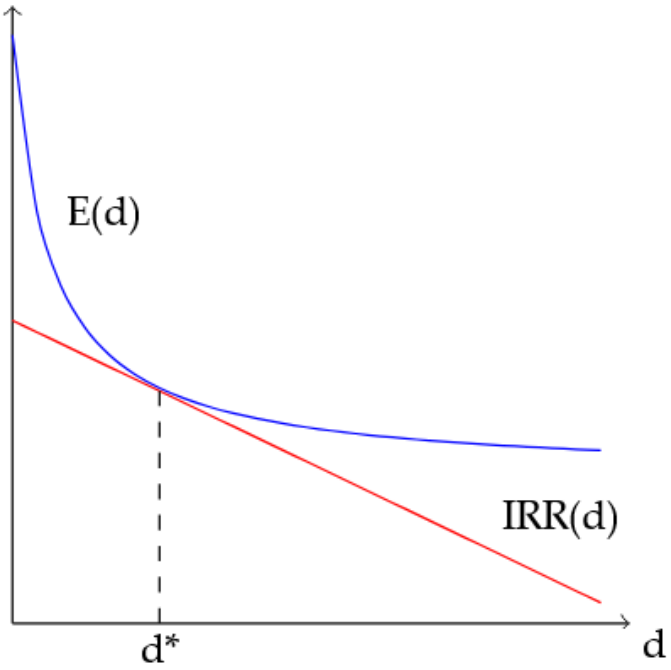

Figure 2: Graph of the number of IPOs per year