

Response to Reviewer 3 Comments

1- In lines 28 and onwards, you argue a lack of literature looking at dynamic (GMM) analysis of the role of female on CSR and ESG issues, but fail to mention some examples. Please provide some, and position your work in that (brief) strand of literature. One example you should consider is Gaio, C., & Gonçalves, T. C. (2022). Gender diversity on the board and firms' corporate social responsibility. *International Journal of Financial Studies*, 10(1), 15.

Response:

The literature on the relationship between gender diversity and environmental performances of firms that addresses dynamic endogeneity is rather limited. We mention Gaio and Gonçalves (2022), Lu and Herremans (2019), Kassini et al (2016), Silla, et al (2016) that opt for a dynamic modelling using a System-GMM estimator. This estimator is particularly suitable to panels with large number of individual and few time periods, which the case for our paper. Moreover, it accommodates situations where the independent variable changes slowly (Antoniou et al., 2008). To keep a good flow in the text, we only mention these papers in the introduction section. We elaborate further on them in the literature review section. We describe their main purpose and explain how our analysis departs from them.

2- Please revise if it makes sense to present your research hypothesis in the introduction.

Response:

Thanks for the Suggestion. We highlighted the research hypothesis by moving it the introduction. We also added another hypothesis. The first relates to the very existence of a relationship between gender diversity on corporate boards and firms' performances. The second, deals with the intensity and shape of this relationship. We believe, this adds a deal of clarity to the text and purpose of the paper.

3- Please reconsider the use of adjectives such as "complicated" (line 79), interestingly (line 88) and so on.

Response:

We reviewed all the text and changed wording in different parts of the text.

4- What do you mean by "in the crowd" (line 141). Please revise carefully English for clarity.

Response:

We initially meant, among all these papers, there is one that... We rephrased this sentence and reviewed all the text. We edited sentences when needed.

5- Please revise your data: your max tangibility is over 2 (which means that Net PP&E, a subset of Assets, is 2 times those same Assets - this should be a typo. Similar problems might exist for a negative tobin's Q.

Response:

In our initial submission, we used winsorized data for all our econometric analysis. However, we, inadvertently, displayed summary statistics (Table 2) for raw data, i.e., before winsorizing. We should have reported only winsorized summary statistics. This is precisely what we do in this revised version of the paper.

The reason for winsorizing data (beyond its advantage of having regular statistical distribution) was that we initially have detected outliers. Further investigation revealed that one company (RIC: OBE.TO; CompName: Obsidian Energy Ltd) is responsible for these outliers. The company had presumably reported wrong values in FY-12, where PP&E was higher than Total Assets (see table below from Refinitiv Eikon).

RIC: OBE.TO			
Company Name: Obsidian Energy Ltd			
	Property/Plant/Equipment, Total - Net	Total Assets, Reported	Tangibility
FY0	1062292227	1131233180	0.9390568
FY-1	711076198	757344854.7	0.9389068
FY-2	1312952410	1466194363	0.8954832
FY-3	1887511916	1943242649	0.9713208
FY-4	2241393019	2391667329	0.9371676
FY-5	2220402085	2486224870	0.8930818
FY-6	3893344895	4280656117	0.9095206
FY-7	7239628163	8479944913	0.8537353
FY-8	9152542373	11609227872	0.7883851
FY-9	11592581393	14551960488	0.7966336

FY-10	12077896596	15288923771	0.7899769
FY-11	11383565767	14591150798	0.7801692
FY-12	27834189009	13192622172	2.1098299
FY-13	10235922729	12669132758	0.8079419
FY-14	7439783220	8463468487	0.8790466

We have reported this case to Refinitiv (Case number: 11297339) and our doubts were confirmed (See their response below). Refinitiv Eikon replaced old value of PP&E (27834189009) with a correct value (10788172656).

Hi Lasha,

We have investigated your query for RIC – OBE.TO for the year 2009(FY-12)

Property/Plant/Equipment, Total - Net is bigger than Total assets, as reported and confirm that we have amended Property, plant and equipment which was incorrectly captured and sent the correct data to product. Amended data is already available on the product. Please find the details in the attachment for Total Assets, Property, plant and equipment pulled in eikon excel and find the Eikon excel formula.

[=@TR\("OBE.TO","TR.TotalAssetsReported;TR.PropertyPlantEquipmentTotalNet","Period=FY0Frq=FY SDate=0 EDate=-12 Curn=USD CH=Fd RH=IN;periodenddate;currency;rfperiod",C3\)](#)

We have worked with content team to avoid this type of issue henceforth.

We deeply regret the inconvenience caused due to this.

Please let me know if you have any questions.

Regards,

Pavagal Latha

Fundamentals Content Support

In order to avoid similar mistakes, we opted for winsorizing data and avoid outliers.

Similarly, only one company had negative Tobins' Q in 2017 (RIC: ELR.TO ; company name: Eastern Platinum Ltd), which was a reporting typo as well.

However, our analysis is not affected by these outliers which are removed after winsorizing all the variables. In this revised version of the paper, we replace the table of summary statistics with the one based on winsorized variables.

6 - In line 192 you mention "all the sectors". But you are working one sector only, aren't you?

Response:

The sentence "The global average of corporate boards' gender diversity for all the sectors during 2008-2018 was about 13.5%" is correct as it is calculated based on all industries (5120 firms in total). However, since we are focusing on "Mining, Quarrying, and Oil and Gas Extraction Industry", it makes more sense indeed to report the value for that particular sector. Therefore, we update the text as follows: "The average of corporate boards' gender diversity for Mining, Quarrying, and Oil and Gas Extraction Industry during 2008-2018 was about 9.6%".

7- Explain your sentences in lines 242-244. What did you do specifically?

Response:

This is an explanation of the following sentence in our article: "To avoid bias and inconsistency that might be caused by instruments proliferation, we collapse the instruments matrix."

We are using longer lags of the dependent variable as additional instruments. Intuitively, there is a trade-off, on one hand, using longer lags gives more information and improves efficiency, but on the other hand sample gets smaller (as it is the case in standard 2SLS models). GMM is a way around this trade-off between lag length and sample length. However, implementation of System-GMM is not exempt from weaknesses. With the instruments count being quadratic in the time dimension, the variance matrix of the moments can be very large. Estimating its elements may be problematic in particular in a finite sample lacking the adequate amount of information. This finite sample bias can weaken Hansen J-test and overstate its p-value and therefore generate suspicious high pass rate of instruments validity. The problem is known as instruments proliferation (Roodman 2009).

To avoid bias and inconsistency due to instruments proliferation, we limit the number of instruments used and collapse the instrument matrix which prevents the model from being over-fitted.

8- Lines 330 and onwards are presenting conclusions that are not warranted by the results and the english is a bit strange (what do you mean by "households' anxiety"?). Similar problems stem from the following paragraphs discussing the results.

Response:

We revised the concerned section and rewrote the text in order to improve on clarity. The revised text reads as follows:

Greater gender diversity for a firm located in a country with high political and economic uncertainty would lower the firm's environmental performance (0.616-0.853=-0.237). More precisely, a 1 percentage point increase in GenDiv in a country with high political and economic uncertainty

leads to an average decline of 0.24% in the firm's environmental performance in the following year.

This suggests that the previous finding on the positive relationship between more gender-diverse boards and a firms' environmental performances tends to be conditional on reduced policy and economic uncertainty. More gender-diverse corporate boards would not lead to better environmental performances of firms in countries with higher uncertainty (higher WUI score). The rationale for this result stems from the idea that uncertainty adversely affects the enabling environment of an economy. This may induce financial outcomes for firms that are so negative and diffuse that they could hardly be balanced by the benefits brought with more gender-diverse boards (Bloom 2014, Atsu and Adams 2021). Indeed, uncertainty hampers household confidence and makes it difficult for businesses to plan for the future. The lack of visibility for future economic and political prospects undermines agents' confidence and further raises their aversion to risk.

In terms of policy, our finding suggests that promoting gender diversity on corporate boards should be accompanied by measures that reduce political and economic uncertainty. This is particularly relevant for countries vulnerable to shocks whether internal or external (Covid-19, war, conflicts, trade tensions, etc.). These can further exacerbate agents' risk-aversion and deteriorate the market ability to create a sound economic and political environment in which agents interact effectively.

In order to assess which level of the country's uncertainty induces the negative effect of gender diversity, we introduce interaction terms with WUI quartile dummies (again, with two specifications, allowing slope and then the both slope and intercept to change). The findings are summarized in Table 4 (columns 3 and 4). They suggest that the interaction term with only the last quartile is statistically significant (at the 10% level), indicating that the impact of GenDiv on environmental performance is mostly driven by highly uncertain countries (those in the last quartile of the distribution). Countries below the 75th percentile of the WUI do not exhibit statistically significant differences among each other.

We investigate this finding further by examining, for different gender diversity levels, (a) the intensity of the relationship across high and low uncertainty levels and (b) the marginal impact of a country's uncertainty status on the firm's environmental performance (Figure 3). We find that in countries with a high (above median) uncertainty level, the environmental performances of firms are significantly lower than in countries with low uncertainty, and this impact is magnified as gender diversity in corporate boards increases. The finding is robust for both specifications, with fixed and without fixed intercepts. Higher gender diversity in countries with lower uncertainty increases a firm's environmental performance, whereas, in countries with high uncertainty, an increase in female board members has a negligible positive impact (Figure 3a) or even a negative impact (Figure 3c). The gap in environmental performance between countries with high versus low uncertainty increases as gender diversity in corporate boards increases.

A potential explanation of this finding refers to the exacerbating effects of political and economic uncertainties on entrepreneurs' risk-aversion. This, in turn, discourages investments in costly abatement technologies and environmental-friendly processes. More generally, increased risk aversion reduces investments and activities whose returns accrue more in a long-run. These include research and development efforts, and particularly

environmental-led activities, which are seen as secondary in firms' scale of priorities. Ultimately, this would put pressure on firms' behavior and worsen their environmental performances (Bloom, 2014⁹; Atsu and Adams, 2021³⁷).

The arguments above provides a rationale for the worsened environmental performances of firms in response to higher uncertainties, and explains the gap in effects for firms across countries of different uncertainty levels. However, this does not address the potential reasons behind the widening of this gap for higher gender diversity levels. One potential explanation of this result relates to the particular attitude of women toward risk. Females on boards tend to exhibit more risk aversion compared to their male peers. They tend to show more patience and are typically more willing to look for professional guidance when facing uncertainty (Liu, 2018³⁸). Females on boards tend to be more inclined to wait until uncertainty is resolved before making major business decisions. Therefore, the more females on corporate boards, the greater the weight of their decisions (i.e., the higher would be the effect of uncertainty in firms' decisions).

This finding begs the question of whether the differential between countries with high versus low uncertainty levels is statistically significant for increasing gender diversity levels. Figure 3 (b and d) trace the magnitude of the gap between the low and high uncertainty scores. It states that this gap is increasing, in absolute value, and is statistically significant at the 95% level for all values of gender diversity (for gender diversity levels larger than 10%, for both specification Figures 3b and 3d). This threshold value points to a standard and very important result in the literature. This refers to the critical mass theory, by which the impact of gender diversity on the environmental performance of firms materializes only when a critical mass weight of females is realized in corporate boards (Konrad et al., 2008³⁹; Torchia et al., 2011⁴⁰; Schwartz-Ziv, 2017⁴¹; among others). This suggests that an effective way to improve environmental quality and mitigate the adverse effects of economic activities is to encourage gender diversity in corporate boards in countries with low uncertainty where we find a higher impact on the firms' environmental performances.

In terms of policy, our findings suggest that promoting gender diversity cannot reach full potential, and may even lead to adverse results unless accompanied by measures that mitigate political and economic uncertainty. These measures would create an enabling environment both for households and entrepreneurs. These reduce their aversion to risk, which increases their confidence and willingness to invest. To unlock this potential, a country should implement accompanying measures that promote and strengthen stable institutions – as a defense against uncertainty. They contribute to anchoring economic agents' expectations, and stabilize the economy.