

# **On the claim that gender diverse executive Boards in the US, UK and India outperform male-only Boards by \$655 billion per year**

## **A simple Bayesian Network model simulates the results with exactly the opposite conclusion**

Norman Fenton, 29 September 2015

A very widely reported story in today's news (see, for example, the report in the Guardian<sup>1</sup> and this Press release<sup>2</sup>) claims that companies in which there is at least one female executive on the Board ('gender diverse' companies) outperform companies with male-only executives. Moreover, the report claims the opportunity costs of having male-only company Boards in 2014 (in terms of lower returns on assets) were a staggering US\$655 billion in the US, UK and India. The report author Francesca Lagerberg concludes that:

"The research clearly shows what we have been talking about for a while: that diversity leads to better decision-making"

I heard Francesca interviewed on Radio 4 this morning and I immediately sensed there were major problems with her claims. In fact, based on the 'full report'<sup>3</sup> – and in the absence of other data - the claims cannot be supported and, indeed, the study exemplifies some of the classic misuses of statistics that we wrote about in the first chapter of our book<sup>4</sup>. While I am sure that most people agree that greater gender diversity in the Boardroom is a worthy objective, that objective is surely not going to be achieved by conducting and publicising flawed statistical studies.

What the study actually did was consider the most successful public companies (which in the UK were the FTSE 350) and look at the return on asset ratio (ROA) comparing it for those companies that had at least one female executive on the Board (called 'gender diverse') and those that did not. So in the UK the ROA was 6.71% for 'gender diverse' companies compared to 6.18% for 'male-only' companies. This percentage difference (0.53%) is then applied to the Gross Domestic Product (GDP) of the UK to arrive at a figure of \$74billion. In the US it is \$567billion and in India \$14billion – hence the total \$655 billion.

Now, even if we ignore obvious problems with the study such as the lack of representativeness of the companies selected and the highly dubious (and bizarre) extrapolation of opportunity loss calculation, there are still fundamental flaws from a statistical/probabilistic viewpoint. In particular:

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<sup>1</sup> <http://www.theguardian.com/business/2015/sep/29/companies-with-women-on-the-board-perform-better-report-finds>

<sup>2</sup> [http://www.grantthornton.global/en/press/press-releases-2015/diverse-boards-in-india-uk-and-us-outperform-male-only-peers-by-us\\$655bn/](http://www.grantthornton.global/en/press/press-releases-2015/diverse-boards-in-india-uk-and-us-outperform-male-only-peers-by-us$655bn/)

<sup>3</sup> [http://www.grantthornton.global/globalassets/1.-member-firms/global/insights/article-pdfs/2015/wib\\_value\\_diversity\\_final\\_web.pdf](http://www.grantthornton.global/globalassets/1.-member-firms/global/insights/article-pdfs/2015/wib_value_diversity_final_web.pdf)

<sup>4</sup> Fenton, N.E. and M. Neil, Risk Assessment and Decision Analysis with Bayesian Networks. 2012, CRC Press

1. Although only the 'top' companies in each country were considered there is inevitably a very large range in **size** of these companies. The largest companies not only generate the highest ROA's but are also more likely to have female executives. Without information about company size (which was **not** in the detailed report) there is no way of knowing whether the difference in ROA is not explained away by company size rather than gender diversity (in fact below we simulate such an impact). Indeed, there could be any number of other factors other than gender diversity that explain away differences in ROA.
2. Very few of the companies have at least one female executive (in the US only 35 out of the 500 companies do and in the UK only 47 of the 350 companies do) so the comparative analysis is being performed on very different size sets – the 'gender diverse' sets are really quite small (maybe too small). This is important for a number of reasons but the following is especially pertinent: among the top companies big losses are relatively **rare** events; if the set includes a company triggering such a rare event then the overall average ROA will take a hit. Because there are so many more male-only companies in the study there is a much greater chance that the male-only set will include at least one company making a rare big loss.
3. While ROA is a 'success factor' that was positively correlated with 'gender diversity' Francesca implied during the interview that there were many other possible success factors that could have been chosen that may not have been positively correlated. This suggests the study was 'cherry picking' ROA because it gave the 'right results'. In fact, if you take enough complete random factors you will find at least one that has a significant correlation (see Section 1.5 of our book).

To expose the problems with the study we demonstrate a very simple model (a Bayesian network) that replicates broadly the results of the study but which provides **exactly the opposite conclusions**. Specifically in this model:

1. The overall ROA is higher for gender diverse boards than male-only (as per the study)
2. However, despite 1, for each category of company size the ROA is lower for gender diverse boards than male-only. In other words in each individual category the gender diversity has a negative (not positive) impact on ROA
3. The overall positive correlation is fully explained by company size (the small number of companies with women execs tend to be the largest companies who have largest ROAs)

The Bayesian Network (BN) model structure is shown in Figure 1.

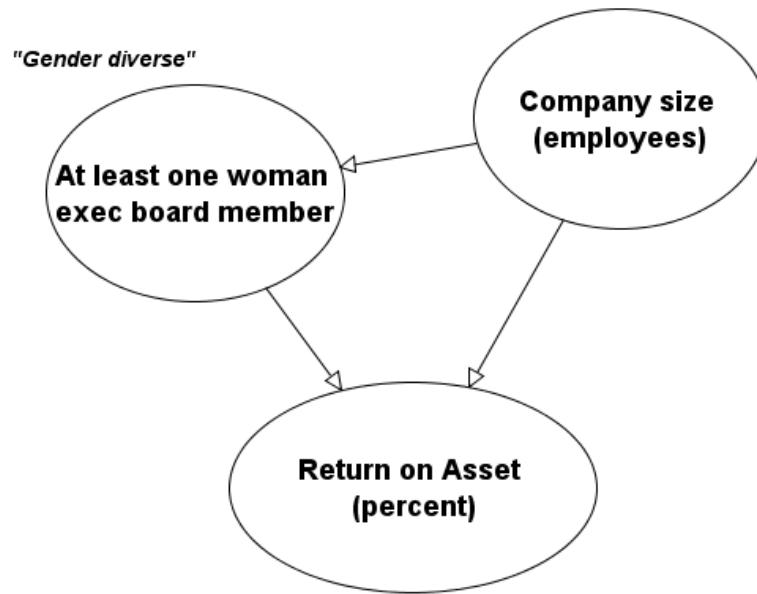


Figure 1 BN model structure

The statistical/probabilistic assumptions made in the model lead to the so-called marginal probability distributions shown in Figure 2:

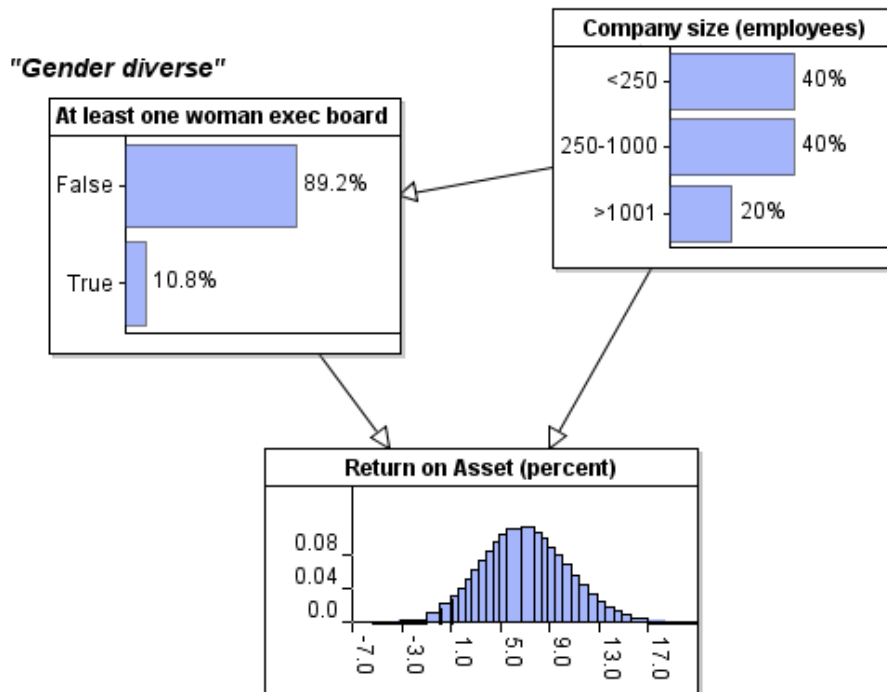


Figure 2 Marginal distributions

These are a good match to the data. So, for example, about 10% of the companies have at least one female exec on the Board and the overall mean ROA is about 6.5%.

However, in the model we have defined the conditional distribution of ROA as shown in Figure 3.

Company size (employees)	<250		250-1000		>1001	
At least one woman exec board member	False	True	False	True	False	True
Expressions	Normal(5,10)	Normal(4.8,10)	Normal(7,12)	Normal(6.8,12)	Normal(9,15)	Normal(8.8,15)

Figure 3 Conditional probability distribution for ROA

For example, for companies with less than 250 employees, the ROA is a Normal distribution with mean 5 and variance 10 for male-only companies. However, note that we have deliberately defined the distributions such that in each category of company size the mean of ROA is **lower** for gender diverse companies than male-only. In other words in each category **gender diversity has a negative impact on ROA by definition**. Yet, despite this, the 'overall' impact of gender diversity appears to be positive as shown in Figure 4 – a result which replicates the Lagerberg study.

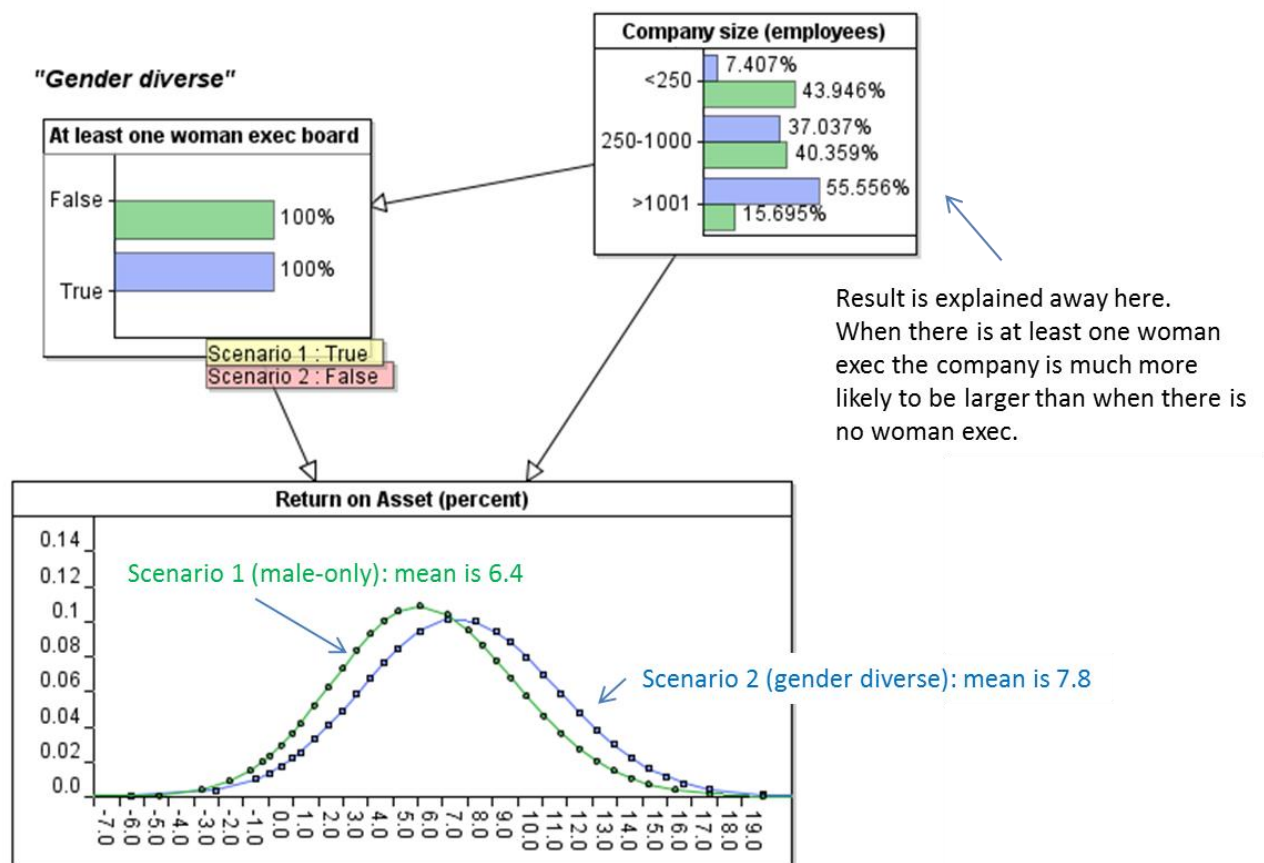


Figure 4 Comparing gender diverse and male-only companies

But note that (by backward Bayesian inference that is automatically performed by the BN tool) the increase in ROA is actually explained away by an increase in company size. If we know that a company has at least one female executive then there is a much higher chance that it is a larger company with a higher ROA. In summary the genuinely negative impact of gender diversity on ROA is dwarfed by the positive impact of company size. The observation that gender diversity leads to increased ROA is nothing more than a statistical illusion.

The simulated BN model only proves that *it is possible* to get the results Lagerberg got with exactly the opposite state of the world to the one she claimed from the results. Without further data there is no way of knowing whether the BN model is really an accurate representation of reality. However, since Lagerberg's detailed results provide no data to determine whether the BN model is wrong, there is absolutely no reason to accept her conclusions. The intense unquestioning media attention that the study attracted is completely unfounded and does great damage to the reputation of science (and statistics in particular). Having more female executive Board members may very well lead to improved performance but Lagerberg's study clearly fails to show this. What the study does highlight is yet again the need for proper causal/explanatory models to be used in statistical studies such as these. Making such an approach both universally feasible and acceptable is the major objective of the EU-funded programme BAYES-KNOWLEDGE<sup>5</sup>.

The BN model in this report is available for download<sup>6</sup> and can be run in the free version of AgenaRisk<sup>7</sup>.

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<sup>5</sup> [https://www.eecs.qmul.ac.uk/~norman/projects/B\\_Knowledge.html](https://www.eecs.qmul.ac.uk/~norman/projects/B_Knowledge.html)

<sup>6</sup> [http://www.eecs.qmul.ac.uk/~norman/Models/debunk\\_gender\\_diversity.cmp](http://www.eecs.qmul.ac.uk/~norman/Models/debunk_gender_diversity.cmp)

<sup>7</sup> <http://www.agenarisk.com/>