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INVESTMENT SOLUTIONS

IMPACT CUBED EMPIRICAL OBSERVATIONS

# Gender Equality: Materiality Check

Gender equality is not only a matter of human rights and effective governance but has the potential for financial materiality, impacting investment returns. Impact Cubed's empirical testing indicates gender equality could be as significant as other well-known style factors and efficiently integrated into portfolios and multi-factor models.

# Introduction

As the sustainable investing landscape evolves, we find ourselves presented with ever more elaborate metrics. These datapoints are often very business activity-specific and highly dependent on assumptions, and usually have little to no historic data or practical investment applications.

However, we would like to present one factor that is consistently and intuitively defined across thousands of equity- and bond-issuing corporates globally, that is reported annually in public domains, and that is impactful (pun intended) on investment returns.

## Gender equality is the factor in question.

Gender equality is intuitively defined as percentages of women in different functional groups within an organisation, such as board-level or senior management. It is relatively easy to handle in portfolio construction due to its well-behaved distribution, bounded naturally between 0% and 100%. It has a long history (for an ESG datapoint). And finally, it is a factor that we observe in our everyday lives, unlike many of the more abstract sustainability issues.

There is a spectrum of motivation when it comes to intentionally integrating gender equality into a portfolio. At one end we have pure values alignment – an investor simply prioritises gender parity in the companies they invest in, with no concerns around the resulting impact on risk and return. At the other end of the spectrum, an investor may target improved gender equality in their portfolio purely in pursuit of better risk-adjusted returns, irrespective of whether there is any values alignment.

If gender equality were simply noise in terms of investment returns (i.e. financially immaterial), then its role in portfolios is confined only to values alignment. However, if we can demonstrate that it is, in fact, a material investment factor, we are able to deploy our well-established factor investing toolbox to integrate gender equality enhancements into portfolios with the goal of both improving values alignment and enhancing returns.

The Impact Cubed Investment Solutions team specialises in integrating sustainability into portfolio construction and analytics using an advanced factor investing framework. We conduct extensive analysis on

each sustainability factor in order to understand, to the fullest extent possible, how best to integrate these factors into portfolios with the objective of achieving the optimal balance between all three dimensions: sustainability, risk and return.

Most of existing gender investment research does not adopt a factor investing approach. Some studies attempt to address investment materiality indirectly by examining the impact of gender balance on corporate profitability or employee satisfaction. Here, we examine the financial materiality of gender equality through the "return space", in the same way in which we may examine any other non-ESG investment factors – by performing quantitative analysis directly linking gender equality to investment returns using carefully constructed factor mimicking portfolios.

We start the main body of this paper by providing a comprehensive overview of the gender equality factor and highlighting notable examples. We go on to present observations that would suggest that gender equality is in fact material in terms of investment returns, providing a comparative context against common style factors. This is followed by further notable observations in regional and sectoral context as well as exploring statistical relationships with commonly used style factors.

## Background

### DEFINITION OF GENDER EQUALITY FOR THIS STUDY

We use the gender equality datapoint from Impact Cubed's flagship Corporate dataset for this study. It is a combination of the percentages of women in board positions and senior management as reported in publicly disclosed company records. An equal weighted average is taken when both measures are available for a particular issuer in a particular annual period.

### INVESTMENT UNIVERSE

Impact Cubed datapoints span over 30,000 corporates globally. For the purpose of this study, we have adopted a universe of developed and emerging market large and mid-cap equity securities. This equity universe covers more than 50 country domiciles and in recent years, typically consists of around 2,500 constituents.

%

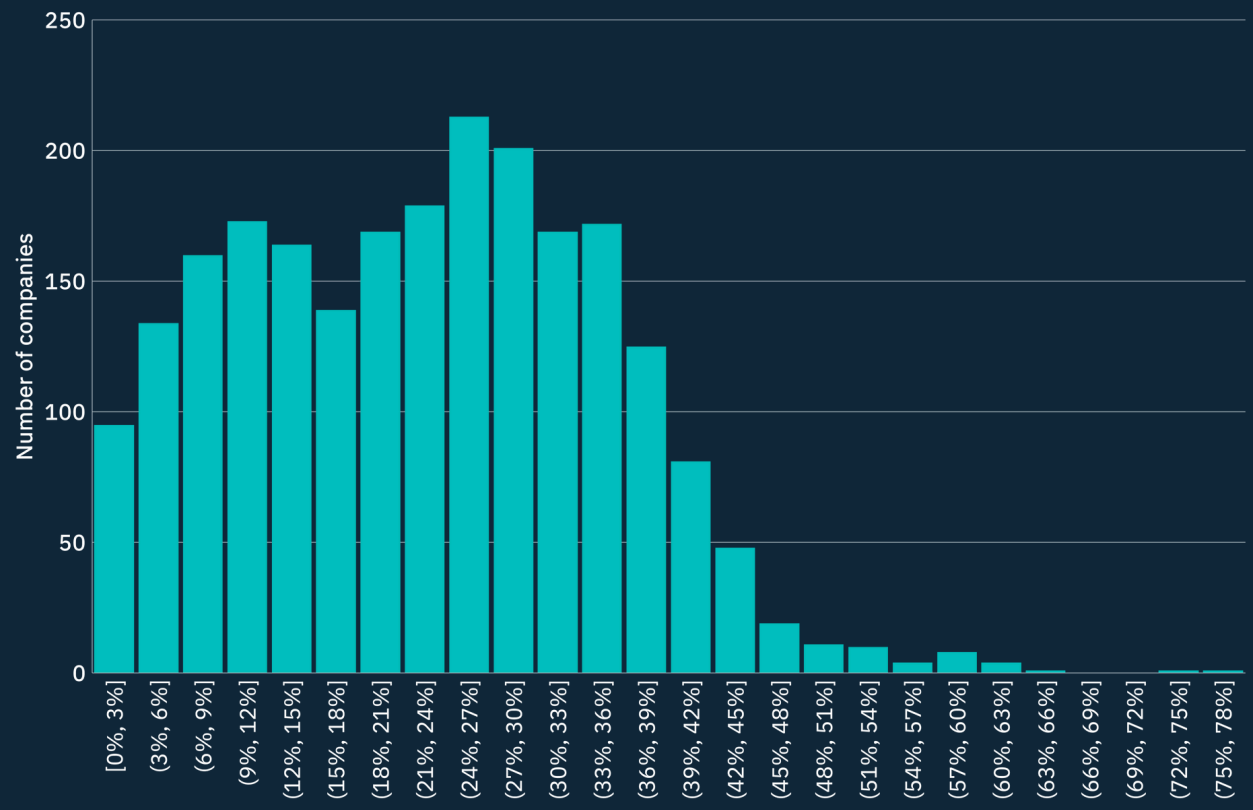
WOMEN IN BOARD POSITIONS & SENIOR MANAGEMENT

*Unless otherwise noted, all figures are sourced from Impact Cubed's corporate dataset.*

COVERAGE

Gender equality is one of the most widely reported operational datapoints in our expansive dataset. Since the start of our dataset (2014) we consistently record over 99% coverage both in terms of number of equities covered and cap weighting (see Appendix Fig.1 for more detail).

HISTOGRAM : % WOMEN IN BOARD AND TOP MANAGEMENT, GLOBAL DM & EM UNIVERSE, 2024




# Factor Overview

## COUNTRY

Norway and Australia are the countries with the highest reported gender equality in this study's global universe. In the case of Norway, gender diversity in company boards is a legal requirement, as mandated by the Norwegian parliament. The rest of the top ten is made up of countries from continental Europe (France, Netherlands, Spain), the Nordics (Finland, Denmark, Sweden) and the British Commonwealth (UK, Canada).

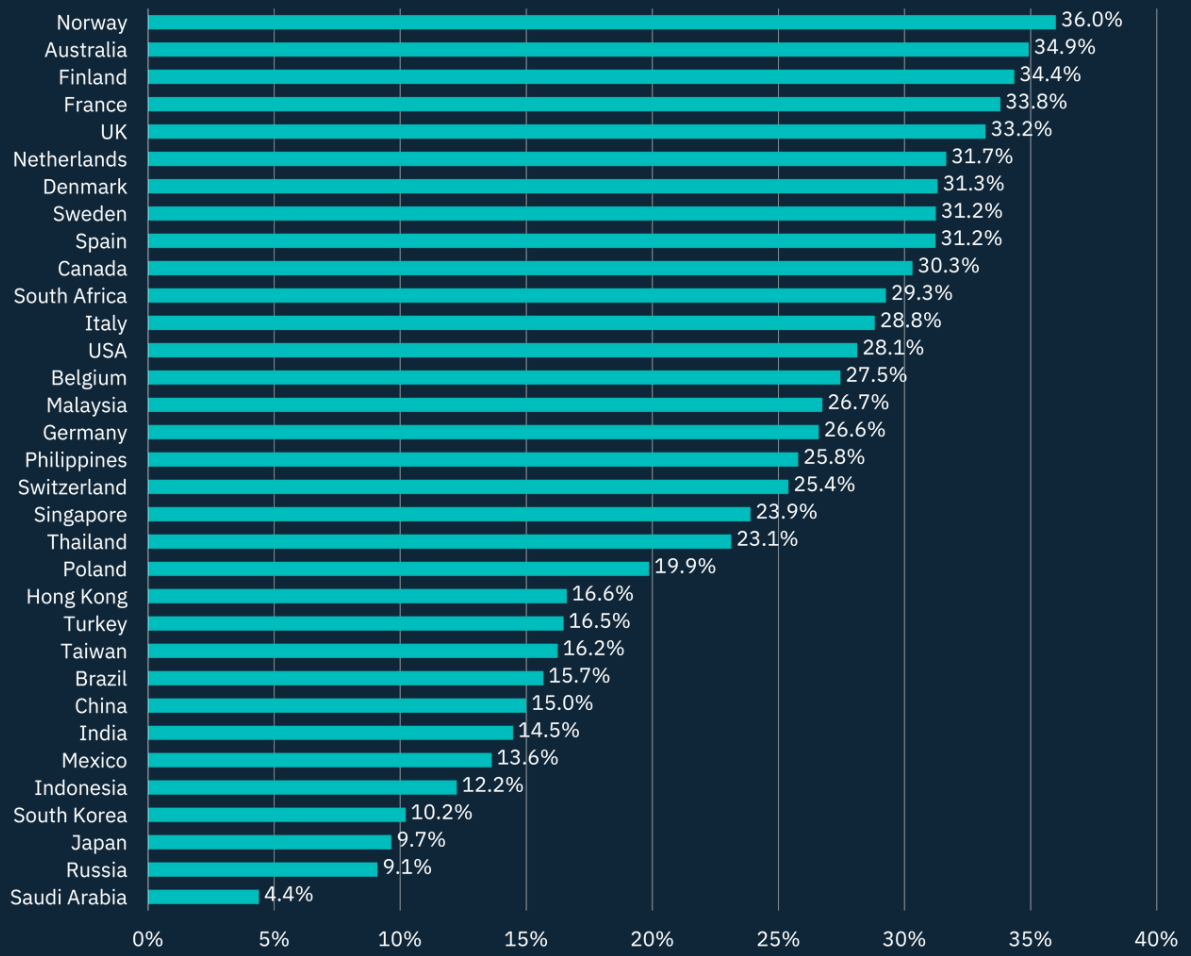
1ST 

2ND 

The US accounts for the largest number of constituents in the study's universe and sits in 13th place out of 33 countries total in terms of average gender equality. Germany, Switzerland and Poland are the lowest ranked European countries.

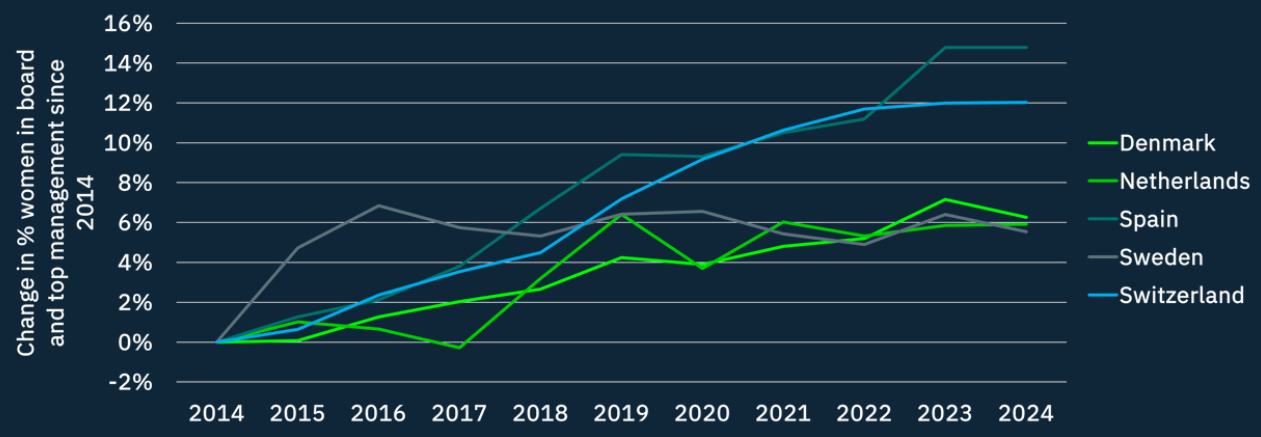
Countries within emerging markets, notably BRICs and other Asian nations such as Japan and South Korea, dominate the bottom half of the ranking.

AVERAGE GENDER EQUALITY: % WOMEN IN BOARD AND TOP MANAGEMENT, 2024




In Europe, the countries which have demonstrated the lowest rates of improvement in gender equality throughout this 11-year period are the ones that started with the highest proportion of female board members and senior professionals (Denmark, Sweden, Netherlands). Conversely, the countries exhibiting the greatest improvements are the ones that started with the lowest levels of representation (Spain, Switzerland).

AVERAGE GENDER EQUALITY: % WOMEN IN BOARD AND TOP MANAGEMENT, 2024

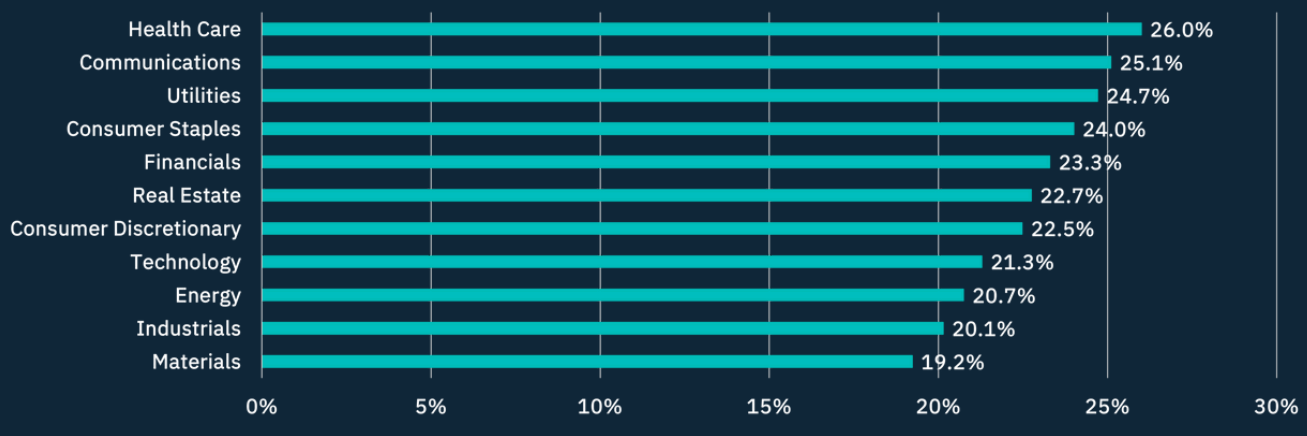



Globally, Canada, Australia and Spain reported the most significant improvements over the sample period, while Russia and Taiwan made the least progress. Both countries' progress peaked in 2018, and levels of gender equality have deteriorated since.

## SECTOR

Sectoral breakdown shows Energy, Industrials and Materials at the bottom of the pack. This may not seem particularly surprising given these industries might be characterised as more "traditional". However, an exception to this rule is found in Utilities which demonstrates the third highest level of gender equality across the sectors examined.

AVERAGE GENDER EQUALITY: % WOMEN IN BOARD AND TOP MANAGEMENT, 2024



On the other hand, while Technology might be regarded by some as a progressive industry, it may disappoint some readers to learn that it sits firmly in the bottom half of the ranking when calculated using equal weighted averaging. It is worth noting that the technology sector rises to fourth place when gender equality is calculated using cap-weighted averaging, indicating that mega cap tech firms are the gender leaders in their sector.

In terms of time series, we see a much tighter range of results. Healthcare (up 8.3%, since 2014) and Communications (up 8.2%) were the leading improvers, while Financials (up 5.6%) and Real Estate (up 5.3%) lagged at the bottom of the rankings.

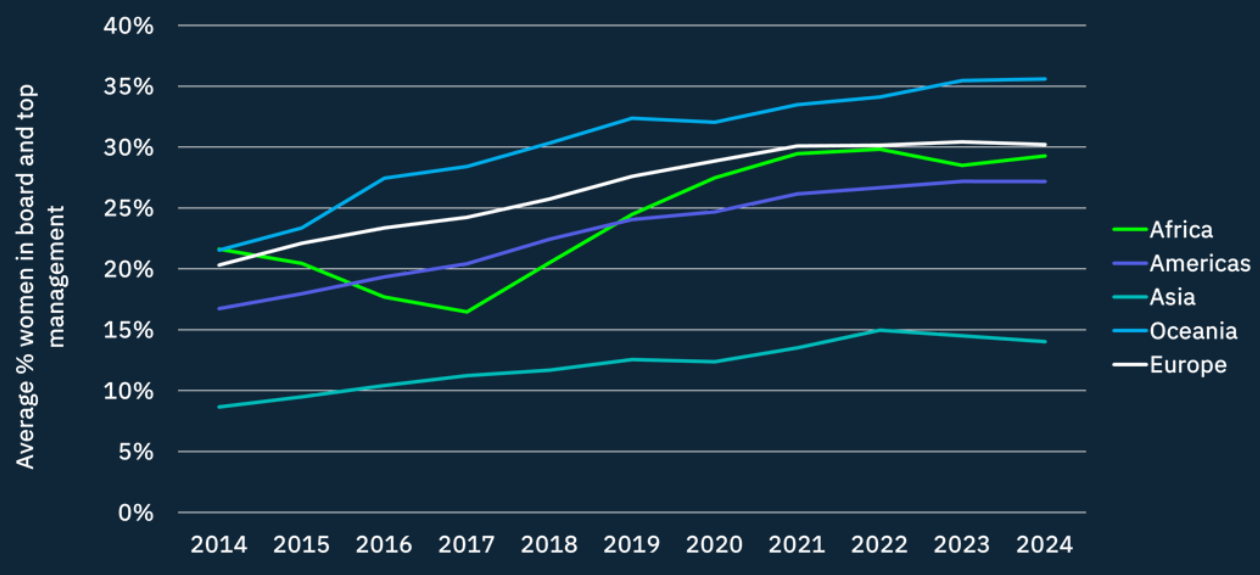
**8.3%**

**RISE IN AVERAGE GENDER EQUALITY IN HEALTHCARE**

## REGION

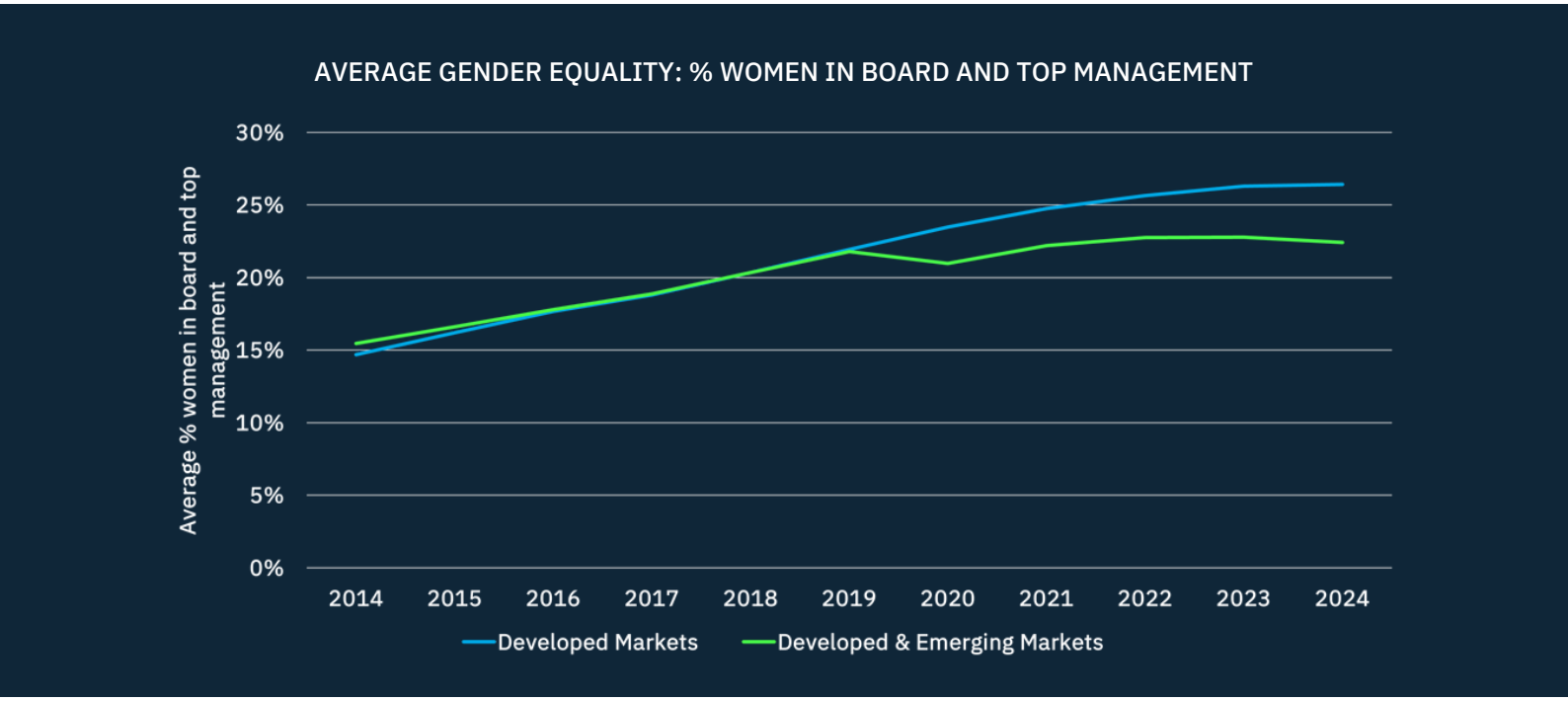
Perhaps surprisingly to many, Oceania was the region with the highest levels of gender equality in 2024; this is likely due to the overrepresentation of Australian and New Zealand companies. Africa sits at the middle of the pack. However, similar to the disproportional representation from those two countries in Oceania, the reported data derives almost exclusively from South African firms and is therefore not necessarily an accurate reflection of the whole continent. Finally, Asia lags behind the rest of the world in terms of both ranking and rate of improvement.

AVERAGE GENDER EQUALITY: % WOMEN IN BOARD AND TOP MANAGEMENT



## GLOBAL

Globally, gender equality has improved consistently over the 11-year sample period. However, it is worth noting that the rates of improvement seen in the developed markets sub-universe and the overall Developed Markets (DM) and Emerging Markets (EM) did begin to diverge in 2019, pointing to a different pace of progress depending on the market in consideration.




# Materiality

So, is gender equality a material investment factor?

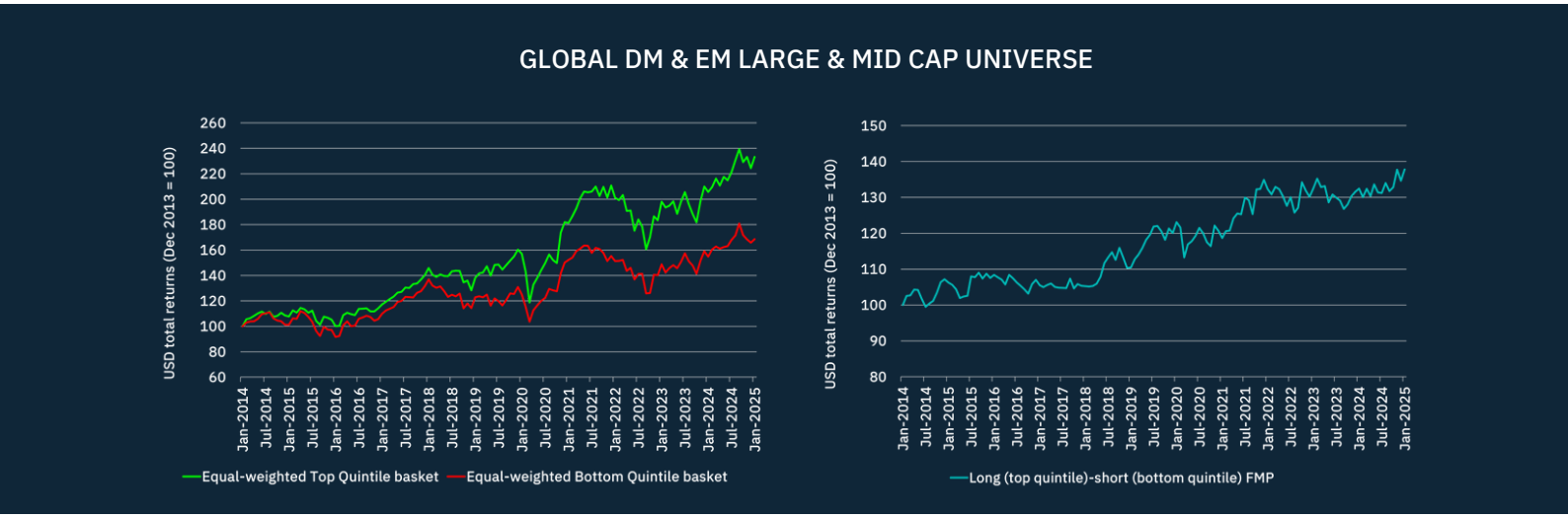
Let's start by acknowledging that there is no broadly agreed definition of materiality. Different researchers could have different thresholds. Some may set the threshold quite high and require significant statistical proof in comprehensive sector- and country-controlled settings. Some may set the threshold lower and aim to prove a factor is not random noise.
Our approach sits somewhere between the two.

Demonstrating a factor is not noise is an important first step but is in itself not sufficient justification to make something an implementable investment factor. On the other hand, it is not realistic to expect a factor to work broadly in all sector- and country-neutral constructions.

As mentioned above, we see the interrogation of factor efficacy in the return space as an important exercise. There is an extensive library of well-established factor investing analytical tools. These tools form the foundation of how we link sustainability factors (or indeed any investment factors) to the risk and return dimensions. The construction of factor-mimicking portfolios and the resultant portfolio characteristics revealed are also critical in informing the optimal portfolio construction approach for each factor.

## Building Factor-Mimicking Portfolios

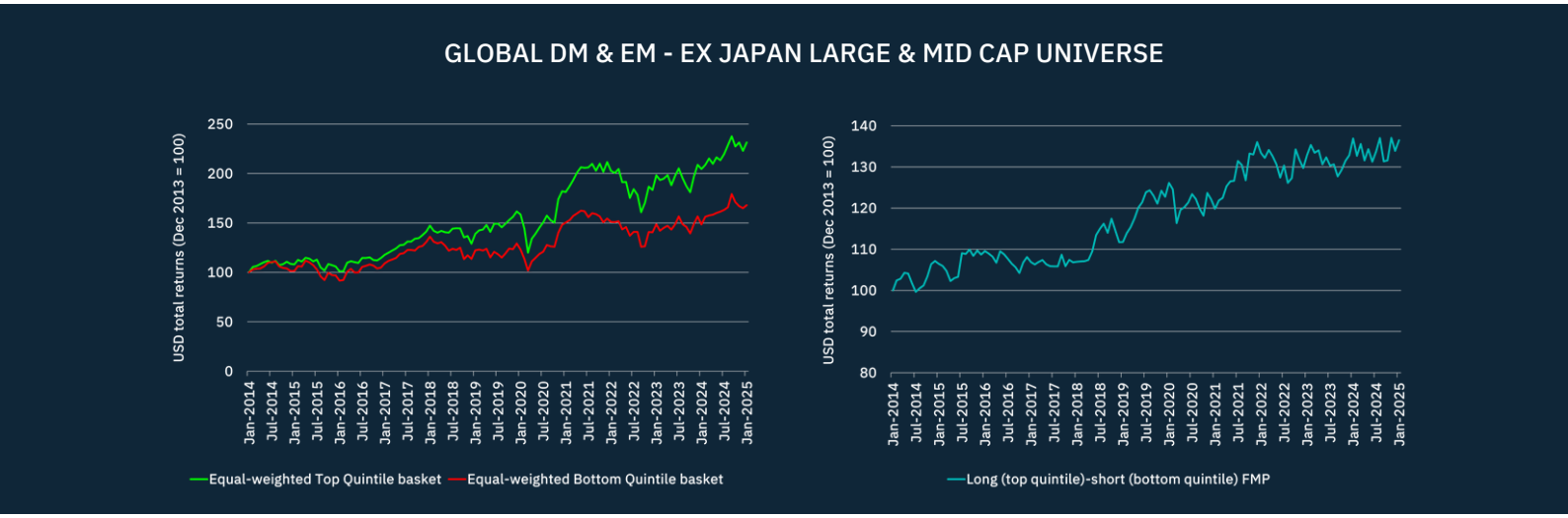
We approach the construction of factor-mimicking portfolios (FMP) for sustainability factors in two ways. First, we use the classic Fama-French rank and sort method in which we build a long-short portfolio made up of a long basket of top quintile gender equality companies and a short basket of bottom quintile gender equality companies. We use equal weighting for these baskets to remove mega cap effects and rebalance them with the corresponding universe and gender data changes on an annual basis. Below are the performance simulations of these baskets and the long-short factor over the 11-year sample period.




We will perform statistical tests on these FMP return series in later sections but we can get a sense of whether the factor is random noise by simply observing the return series.

Japan has the largest number of companies in the sample universe after the US. Given the low average gender equality result we observed earlier,

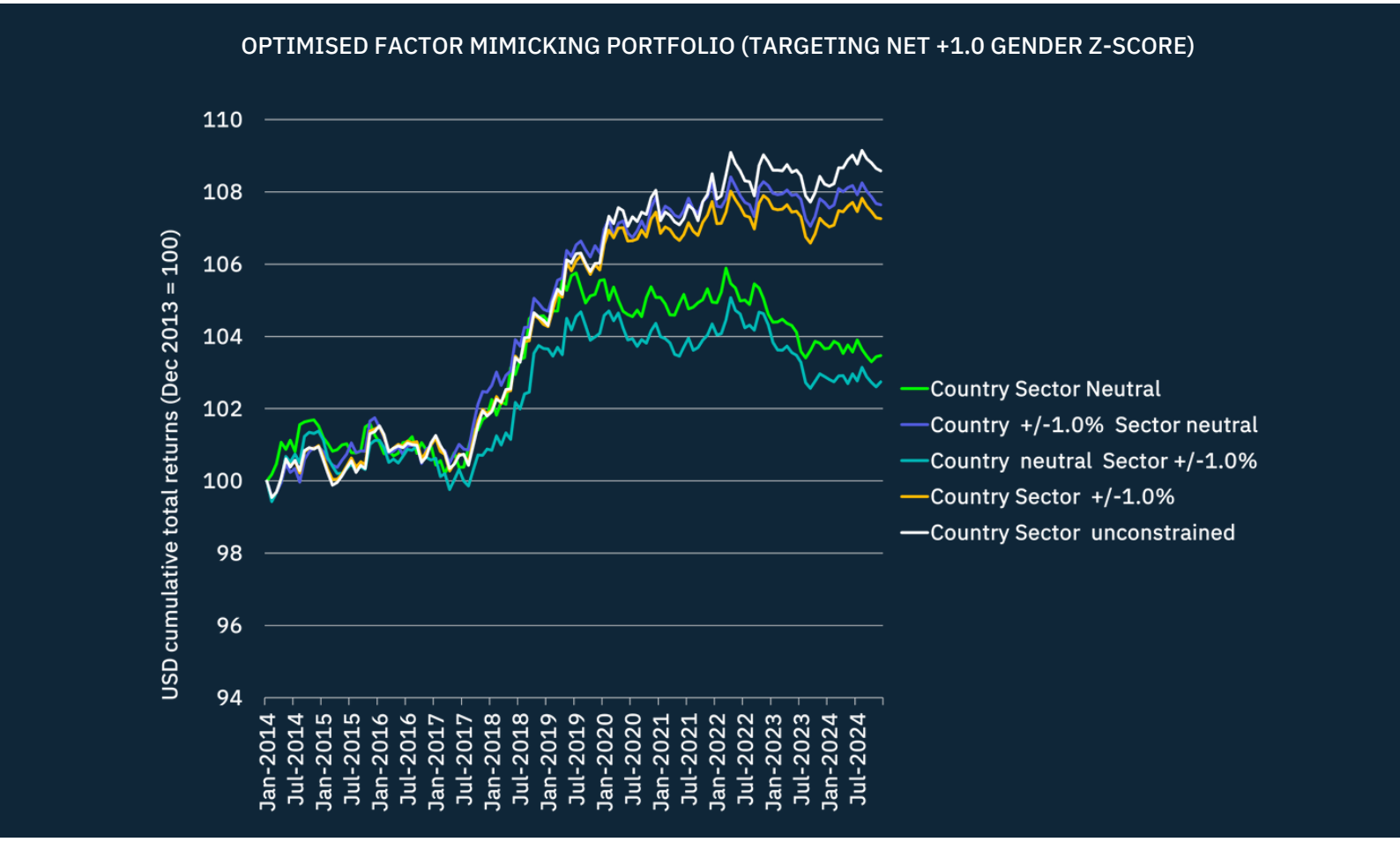
it is no surprise that Japan is over-represented in the bottom quintile baskets. In order to understand whether Japan was having an outsized impact on the results, we constructed another set of FMPs using an ex-Japan universe.




Lack of gender equality is clearly a regionally orientated issue, so we expect country exposure to play some part in the FMP analyses. However, it is comforting to see that the results remain essentially the same in an ex-Japan universe, that the results are not simply a Japan-underweight phenomenon.

The second method by which we construct FMPs is optimisation. Here, we create a minimum volatility long-short portfolio that has a net positive unit exposure to the gender equality factor. This is rebalanced annually with the corresponding universe and gender data changes.

This method of constructing FMPs offers us the ability to control net exposure in terms of sector and country. Below is the performance of different optimised FMPs:




It is interesting to note that the FMPs with some flexibility in country exposure, meaningfully outperformed the FMPs that are constructed to be country-neutral. In some ways, this is not surprising; gender equality is heavily influenced by cultural norms and so it would make sense that FMP active returns would be more pronounced when net country exposure is allowed. This notable geographical effect is reminiscent of the sector effect we observe in the carbon factor. On the other hand, it merits highlighting that a net country exposure of +/-1% is pronouncedly small, especially once you take into account the gross exposure of the FMPs is around 100%.

## Is it Noise?

We performed two well-established tests to assess whether the return series of these gender equality FMPs are random walks: the Augmented Dickey-Fuller (ADF) test and the Variance Ratio (VR) test. These tests are designed to test stationarity - whether a time series maintains a consistent mean and variance over time, exhibiting predictable dynamics rather than erratic, unbounded fluctuations.

Results from both tests consistently rejected the null hypothesis of non-stationarity, confirming that the long-short gender FMP returns are stationary, lacks a unit root, and does not follow a random walk. To further contextualise these findings, we ran the same test on traditional style factors —Beta, Size, Value, Momentum, and Quality — to provide a relative context.

### AUGMENTED DICKIE-FULLER TEST

| FMP RETURN SERIES | Test statistics | P-value significance | Conclusion |
|---|---|---|---|
| Gender equality (quintile) | -13.30 | 0.001 | Reject Null |
| Gender equality (optimised) | -11.83 | 0.001 | Reject Null |
| Beta | -13.01 | 0.001 | Reject Null |
| Size | -11.06 | 0.001 | Reject Null |
| Value | -11.65 | 0.001 | Reject Null |
| Momentum | -11.47 | 0.001 | Reject Null |
| Quality | -11.73 | 0.001 | Reject Null |

### VARIANCE RATIO TEST

| FMP RETURN SERIES | Test statistics | P-value significance | Conclusion |
|---|---|---|---|
| Gender equality (quintile) | -4.70 | 0.0000 | Reject Null |
| Gender equality (optimised) | -4.98 | 0.0000 | Reject Null |
| Beta | -4.26 | 0.0000 | Reject Null |
| Size | -3.94 | 0.0001 | Reject Null |
| Value | -4.92 | 0.0000 | Reject Null |
| Momentum | -4.65 | 0.0000 | Reject Null |
| Quality | -4.56 | 0.0000 | Reject Null |

The ADF and VR tests yielded uniform conclusions across all factors, reinforcing that gender, like these other well-established style factors, exhibits stationarity and systematic behaviour rather than stochastic

randomness. These findings would support the position that gender equality is potentially a factor with meaningful investment implications.

## Explaining Market Returns

With some convincing test results suggesting gender equality does not follow a random walk, next we assessed whether gender equality displays any explanatory power with regards to market returns.

We first performed a regression to explain market returns of the same DM & EM equity universe over the 11-year sample period using a common 5-factor model (Beta, Size, Value, Momentum and Quality). We then performed a second regression, adding gender equality as a sixth independent variable. The results are shown in the table below.

**2014-2024**

| | Slope | Std error | tStat | pValue |
|---|---|---|---|---|
| Intercept | 0.00 | 0.00 | 1.52 | 0.1303 |
| Beta | 0.82 | 0.07 | 11.32 | 0.0000 |
| Low Size | 0.62 | 0.13 | 4.62 | 0.0000 |
| Value | 0.09 | 0.18 | **0.53** | 0.5940 |
| Mometum | 0.01 | 0.11 | **0.10** | 0.9220 |
| Quality | 0.62 | 0.16 | 3.78 | 0.0002 |

Adjusted R-Squared: **0.57**

| | Slope | Std error | tStat | pValue |
|---|---|---|---|---|
| Intercept | 0.00 | 0.00 | 1.58 | 0.1164 |
| Beta | 0.72 | 0.07 | 10.31 | 0.0000 |
| Low Size | 0.76 | 0.13 | 6.03 | 0.0000 |
| Value | -0.08 | 0.16 | **-0.48** | 0.6346 |
| Mometum | -0.03 | 0.10 | **-0.31** | 0.7571 |
| Quality | 0.58 | 0.15 | 3.82 | 0.0002 |
| **Gender** | **0.64** | **0.13** | **4.94** | **0.0000** |

Adjusted R-Squared: **0.64**

The 5-factor model explains market returns well with adjusted R-squared (how well the independent variables explain the variation in the dependent variable) at 0.57. Adding gender equality to the model improved the adjusted R-squared marginally to 0.64.

Furthermore, the t-stat of the gender equality variable is high at 4.9, indicating high confidence in the coefficient as a predictor of market returns. It is also notable that the t-stat for the gender equality factor is in the same range as the size and quality factor (6.0 and 3.8 respectively) Note, it is important to assess the robustness of regression models. To do so, we ran the same regressions over different time periods and observed consistent results (see Appendix Fig. 2 for the regression results for the most recent 5-year period).

Furthermore, we tested for multicollinearity using a Variance Inflation Factor test and found that the independent variables are not confounded with each other (see Appendix Fig. 3).

While it is no simple task to offer a conclusive yes or no answer to the question "is gender equality a material investment factor?", the significant stationarity tests results do indicate that the gender equality factor does not follow a random walk. The market returns regressions give interesting initial results to form the basis of further analytical work into this topic.

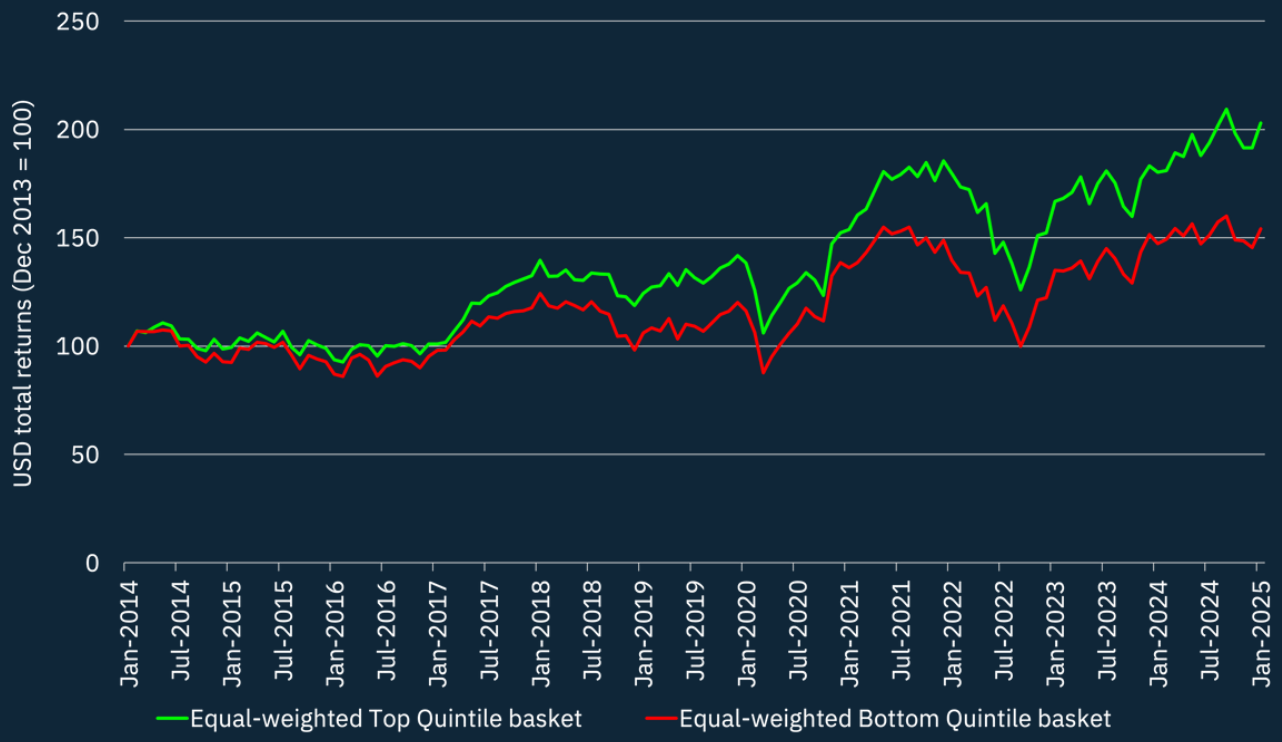
## Further Notable Observations

We further examined the factor by constructing quintile FMPs for individual region, country and sector sub-universes. This interrogation revealed interesting findings.

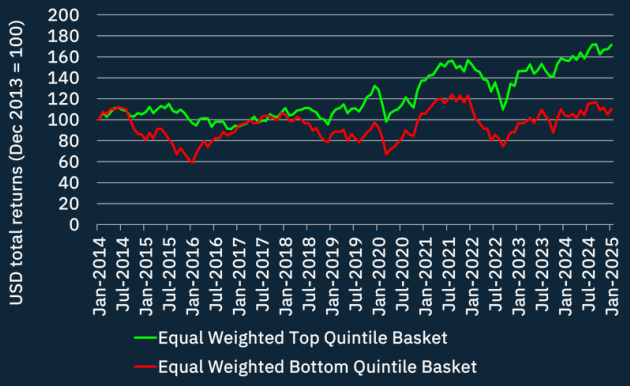
On the positive side, we see gender equality acting as a demonstrably positive return factor in Europe, UK and Taiwan. However, this sits in unfortunate contrast to the minimal return impact seen in both Sweden and Japan, two countries at opposite ends of the gender equality ranking.

Overall, individual country analysis shows gender return impact between positive and neutral. We did not observe a meaningful number of countries in which the gender equality factor is a significantly negative return driver.

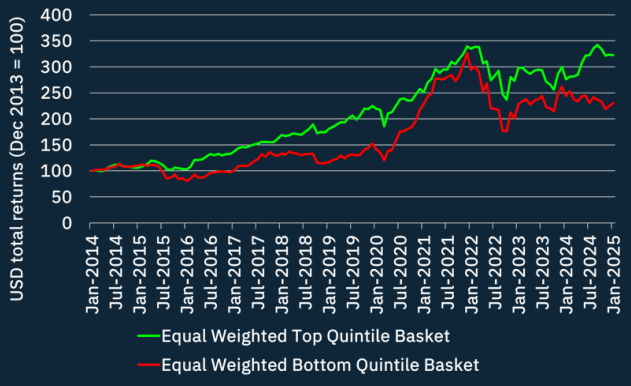
## EUROPE LARGE & MID CAP UNIVERSE

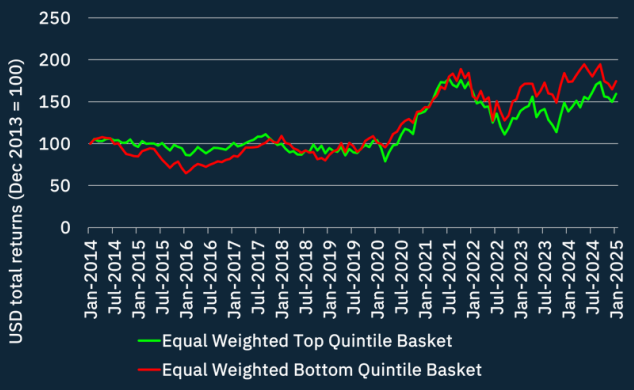


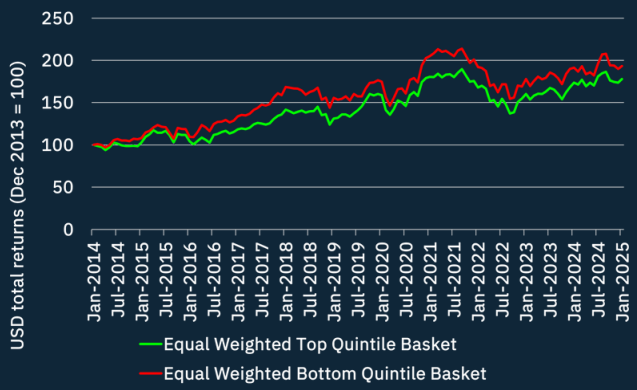

## UNITED KINGDOM

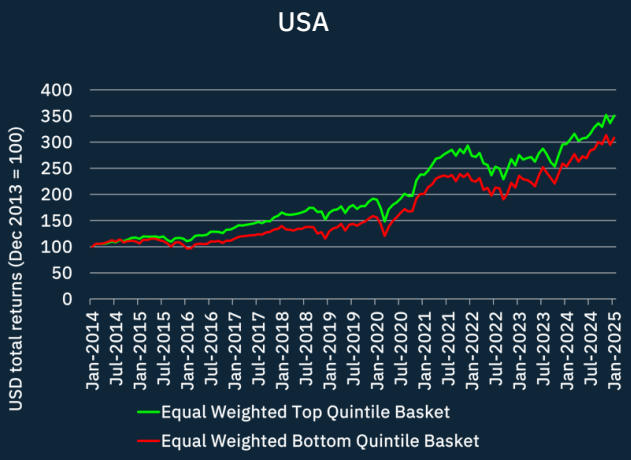



## TAIWAN



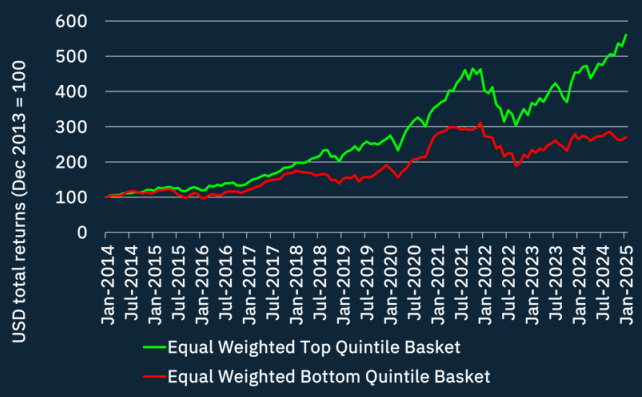


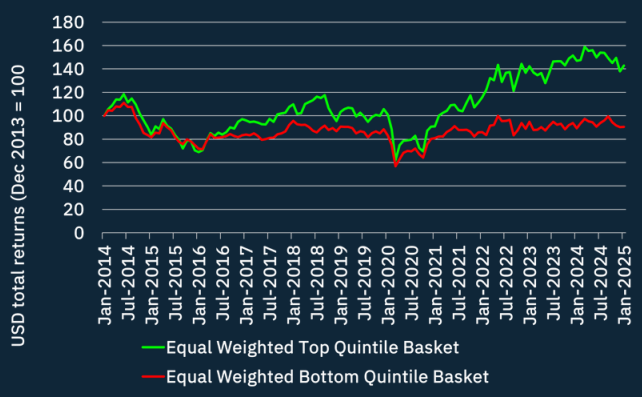



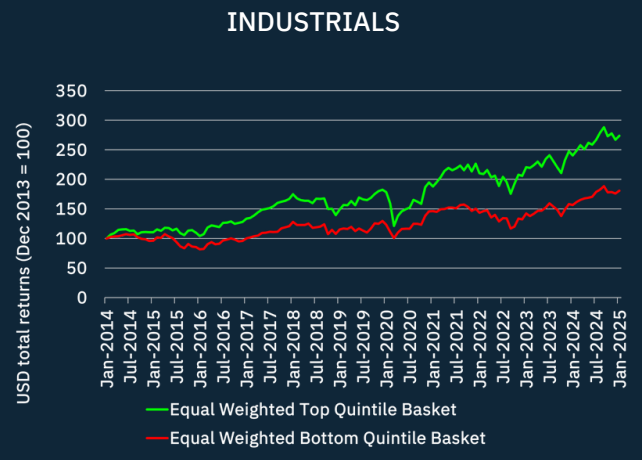



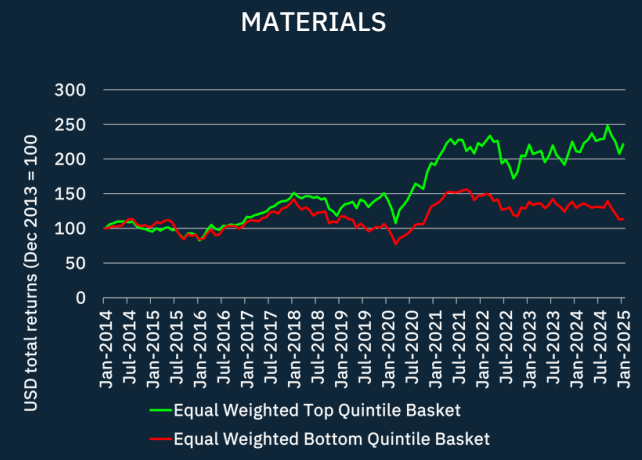

When viewed in individual sectors, we see 6 out of 11 Level 1 sectors exhibiting significant positive gender returns, with no individual sectors showing negative performance impact.

What is perhaps the most interesting is that the positive gender returns are concentrated in the sectors with the lowest average gender equality: technology, materials, industrials and energy.




# Style Factor Relationship

It is also instructive to test to what extent gender equality factor returns can be explained by other investment factors. We ran a regression with the same 5-factor model as earlier in the article to explain gender equality returns.

| VARIABLES | Slope | tStat |
|---|---|---|
| Beta | 0.03 | 0.83 |
| Momentum | -0.11 | -1.90 |
| **Size** | **-0.29** | **-4.30** |
| Value | 0.04 | 0.99 |
| **Quality** | **0.11** | **1.46** |

Adjusted R-Squared: **0.15**

| CORRELATION | 10Y | 5Y | 2Y |
|---|---|---|---|
| Beta | -0.1 | 0.0 | 0.0 |
| Momentum | 0.2 | 0.1 | 0.1 |
| Size | **-0.3** | **-0.2** | **-0.4** |
| Value | 0.0 | 0.0 | -0.1 |
| Quality | **0.3** | **0.2** | **0.2** |

The adjusted R-squared of this regression is small, 0.15. This indicates that only 15% of the variations in gender factor returns can be explained by the 5-factor model. One could reasonably interpret this as supportive of the view that gender equality is not well explained by other style factors and contains its own material information.

## Final Remarks

Gender equality is a topic that touches on a wide range of issues and opportunities. These include human rights, effective governance and access to talent pools among many others. These are reasons why investors may want to intentionally integrate better gender equality in their portfolios.

Could financial materiality be another reason to incorporate gender equality in portfolios? In this article we shared observations that would indicate gender equality is not a random walk and likely contain information that has impact on investment returns. In this respect, the statistical tests tell us gender equality is no less material than other well-known style factors. We also presented observations that gender equality can be part of a multi-factor model that explains market returns and that it cannot be explained away by other style factors.

If the outcome of digesting these observations leads you to conclude that gender equality is a material investment factors, the next step would be to design how gender equality could be effectively integrated into portfolios. The various geographic and sectoral insights and return characteristics of different FMP constructions start to inform us on how best a portfolio manager can tilt into this factor.

There is a long list of research areas to explore. We are beginning to test various more nuanced ways to define gender equality. We are performing more sophisticated tests to see how gender equality can explain financial performance and how it itself can be explained by other factors. The knowledge we gain from these research efforts, and resultant discussions with leading investors, will build a valuable foundation on which advanced and intentional gender factor investing could be deployed.

# Appendix

FIGURE 1: IMPACT CUBED DATA COVERAGE

| Year | Coverage rate (cap-weighted) | Coverage rate (equal-weighted) |
|---|---|---|
| 2014 | 99.76% | 99.21% |
| 2015 | 99.89% | 99.75% |
| 2016 | 99.91% | 99.76% |
| 2017 | 99.90% | 99.76% |
| 2018 | 99.88% | 99.77% |
| 2019 | 99.88% | 99.77% |
| 2020 | 99.87% | 99.64% |
| 2021 | 99.73% | 99.04% |
| 2022 | 99.92% | 99.38% |
| 2023 | 99.87% | 99.69% |
| 2024 | 99.76% | 99.30% |

FIGURE 2.1: 5-YEAR REGRESSION RESULTS, 2020-2024

| | Slope | Std error | tStat | pValue |
|---|---|---|---|---|
| Intercept | 0.00 | 0.01 | 0.53 | 0.5996 |
| Beta | 0.84 | 0.11 | 7.92 | 0.0000 |
| Low Size | 0.72 | 0.23 | 3.12 | 0.0030 |
| Value | 0.08 | 0.27 | 0.29 | 0.7713 |
| Mometum | 0.00 | 0.20 | -0.02 | 0.9869 |
| Quality | 0.72 | 0.26 | 2.71 | 0.0089 |

Adjusted R-Squared: **0.55**

# Appendix Cont.

FIGURE 2.2: 5-YEAR REGRESSION RESULTS, 2020-2024

| | Slope | Std error | tStat | pValue |
|---|---|---|---|---|
| Intercept | 0.01 | 0.00 | 1.08 | 0.2849 |
| Beta | 0.55 | 0.11 | 5.04 | 0.0000 |
| Low Size | 0.83 | 0.20 | 4.21 | 0.0001 |
| Value | -0.26 | 0.24 | -1.10 | 0.2753 |
| Mometum | -0.10 | 0.17 | -0.61 | 0.5419 |
| Quality | 0.63 | 0.23 | 2.79 | 0.0072 |
| **Gender** | **0.99** | **0.21** | **4.69** | **0.0000** |

Adjusted R-Squared: **0.68**

FIGURE 3: 5-YEAR REGRESSION RESULTS, 2020-2024

| | Regression 1 VIF value | Regression 2 (with Gender) VIF value |
|---|---|---|
| Beta | 1.46 | 1.60 |
| Size | 2.50 | 2.64 |
| Value | 1.32 | 1.38 |
| Momentum | 2.40 | 2.42 |
| Quality | 2.46 | 2.47 |
| Gender | - | 1.37 |

# Disclaimers

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# About Impact Cubed

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**This sustainable investing research was carried out by the pioneering Investment Solutions Team at Impact Cubed. Aston Chan, CIO Head of Investment Solutions, extends his gratitude and recognition to Will Huang and Yukti Mehta for their diligence and tireless contribution.**