
Fund Managers by Gender

The Global Landscape

Morningstar Research

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Executive Summary

This paper expands Morningstar's research on fund managers by gender, a topic we first explored in 2015 with studies in the United States, Spain, and Hong Kong. Here, we explore fund managers by gender on a global scale and find discouraging trends: Across 56 countries, about one in five funds has a woman manager, and in the eight-year time frame we studied, women have not made sizable gains in managing the world's mutual funds. We also find the rate of women fund managers is lower than the rate of women in other professions with similar education requirements, such as doctors and lawyers. This finding prompted us to study women within the fund industry to understand if the opportunities for women are uniformly distributed or whether there are better opportunities in certain areas.

This research into relative opportunity rests on a statistical model we built to measure the relative likelihood of a fund being managed by a woman or a man. The model offers a multivariate view of the factors contributing to the higher likelihoods of women being named fund managers. By comparing the output, we can identify areas where women have earned more and less opportunity than their male peers relative to industry norms and, therefore, recognize areas where women are making gains, staying even, or losing ground.

To our knowledge, a larger data set has never been assembled to approach this question. Many studies focus on what is driving the lack of women in industries dominated by men. Here, however, we unpack cross-sectional variations among funds as they relate to the portfolio manager's gender. In some respects, we note encouraging levels of equality, and in others, we do not. These trends have evolved through time. This paper's primary contribution is to identify areas of progress and regression in the fund industry as a way to encourage gender diversity among fund managers.

Key Takeaways

- ▶ About one in five funds has at least one manager who is a woman, a figure that has not improved since the global financial crisis of 2008.
- ▶ Countries with large financial centers have lower proportions of women fund managers than many smaller markets.
- ▶ Women have better odds of running funds in areas of industry growth--passive, funds of funds, and team-managed funds. Likewise, it appears more difficult for women to win management roles in the more established parts of the fund industry: actively managed funds and solo-managed funds.
- ▶ In some asset classes, women fund managers are more-credentialed than men, yet they're still broadly underrepresented in fund portfolio manager ranks.

- ▶ Women have lower odds today of managing the types of funds that were once more likely to have women managers, including smaller funds and socially responsible funds.
- ▶ The industry's largest firms are more likely to name women as fund managers than smaller firms.

Introduction

Morningstar began formally studying fund managers by gender in 2015 after observing first-hand over decades that women are underrepresented in the fund industry. We studied the rates of women managers in three countries, the United States, Spain, and Hong Kong, and found that women are vastly outnumbered by men in fund-management ranks not only in absolute terms but also relative to other professional industries, including law and medicine.

In this latest look at fund managers by gender, we harnessed Morningstar's global database of mutual funds and their managers to consider fund managers across 56 countries, and the trends we saw in the U.S., Spain, and Hong Kong are repeated globally: Women are not often tapped to manage mutual funds, regardless of geography. Globally, about one in five fund managers is a woman, and that management rate is largely unchanged since 2008. These numbers suggest that the fund industry as a whole is not becoming more gender-inclusive.

Taking a deeper look at the data, we found there are geographic bright spots in the industry. Women have been named fund managers at a relatively higher rate in places such as Hong Kong, Singapore, France, Spain, and Israel. At least 20% of fund managers are women in these markets. But elsewhere, women are behind the global norm. In larger financial centers, such as Brazil, India, Germany, and the United States, the local rate of women-managed funds is below the global standard.

Intuitively, if there are geographic environments that are more conducive to women portfolio managers, it stands to reason that opportunities for women also may vary by fund attribute. Our study found this to be true. The aggregate data on women fund managers shows they are broadly underrepresented in the industry, but, within smaller portions of the industry, women's representation has been uneven. For example, in the U.S., where 10% of fund managers are women, one might expect that 10% of all passive-fund managers are women, 10% of active-fund managers are women, and so forth. In fact, our study found that women are better represented in some areas of the industry than others. For example, women have better odds of managing passive funds than active funds.

To study women fund managers, we considered 26,340 managers of funds registered in 56 countries, all of which are included in Morningstar's global database, making this study the most comprehensive of its kind. Morningstar indicated the gender of 15,996 of those managers primarily through information supplied to Morningstar by those managers' employers. For the remaining 10,344 managers, we identified each manager's gender by examining his or her first name. We ran those first names through an algorithm that assigns the probability of being a woman based on local census data. When the

algorithm assigned more than 50% probability that the first name is female, we assumed the manager is a woman.

To audit the results, we manually verified managers' gender in cases where Morningstar's gender data did not match the algorithm's gender probability. We did the same for managers with gender-neutral first names, and in regions where the algorithm may not be sufficiently sensitive to local naming conventions. For example, in France, *Patrice* is more often a man's name, while in the U.S., *Patrice* skews feminine. To manually verify gender, we looked to professional photos, biographical descriptions, and titles and pronouns such as *Mr.*, *Mrs.*, *Ms.*, *he*, *she*, *his*, or *her*. However, we were not able to include all countries. We did not include countries where first names are locally reflected by characters but then are translated into letters for storage in Morningstar's database or countries where first names typically are not associated with a specific gender. As such, we excluded China, Japan, and Taiwan from the study.

Once we determined each manager's gender, we began looking at the managers assigned to mutual funds and exchange-traded funds by listed domicile. Some funds, such as Templeton Global Bond, are domiciled in multiple countries, so these managers and their funds were included multiple times in the study. That said, each country's data reflects the funds--and managers--registered in that market. It is also worth noting that Morningstar's manager data is more complete in some countries than others. In the United States, public documents reflecting fund managers' names are widely available and changes are reflected quickly in Morningstar's database. Not all markets are as transparent, however. There may be cases where the management information on a given fund is outdated. Even so, the broad trends hold true: Women are underrepresented in fund-management ranks globally.

Here's the structure of this paper:

- ▶ We first review descriptive data on women in professional industries globally. The findings underscore an absolute and relative gender disparity in the fund industry.
- ▶ Next, we provide a brief explanation of how our 2016 results can be interpreted, and then we discuss the key takeaways of the modeling exercise.
- ▶ Following the takeaways, we conclude the paper with some general observations and areas requiring further research.
- ▶ The last section, the Appendix, details the data used for the analysis, describes the model, provides the data tables, lists our references, and concludes with acknowledgements.

Women in Professional Industries by Country

Our analysis of fund managers by gender found a significant disparity in the percentage of women managers by country. Women are best represented in percentage terms in smaller markets for the traditional mutual fund industry, including Singapore, Portugal, Spain, Hong Kong, and France. In larger markets, such as Australia/New Zealand, Canada, Luxembourg, the Netherlands, and the United Kingdom, the percentage of women fund managers ranges from 11% to 14%. The U.S. and Germany have the worst inclusion rates among larger markets, where women fund managers are 10% and 9%, respectively. Furthermore, their rates are down from highs in 2008 when, respectively, 11% and 12% of fund managers were women. This is a downward trend we saw generally across larger markets.

Women fund managers are underrepresented relative to other professions that require similar education, including lawyers and doctors. In all cases where data is available, women make up a lower percentage of fund managers than lawyers and doctors. In France, for example, women are 21% of managers named to registered funds, while women are more than half of that nation's lawyers and 43% of France's doctors. In the U.S., the rate of women funds managers is lower than that in France at 10%, and the rate of women lawyers and doctors also is lower at 36% and 33%, respectively. Comparing fund managers with doctors and lawyers is somewhat misleading as doctors and lawyers are credentialed upon completing their education and meeting certification standards, whereas a fund-management role is a leadership position typically achieved later in one's career.

The broader data on professional women suggests that some countries have done a better job of fostering women's professional careers, both inside and outside of the fund industry. The data also suggests that there are biases that prevent professional women from being more successful in countries such as Australia/New Zealand, the United States, Germany, Brazil, India, and Poland. In these countries, we saw there are higher rates of women CFA charterholders than women fund managers. Furthermore, the CFA Institute reported 49% of women primarily take the CFA exams for career advancement or to improve chances of obtaining a job, compared with only 45% of men. While only a 4% difference, it stands to reason there are differing viewpoints by gender on the qualifications needed to secure a desired position in the financial industry. Taken together, it appears to be more difficult--or less appealing--for women to manage funds in countries where the industry is more-established and men have long dominated leadership roles.

Exhibit 1 Percentage of Women Fund Managers, Lawyers, Doctors, and Chartered Financial Analysts by Country

Country	Fund Managers	Lawyers	Doctors	CFAs
Singapore	30	—	—	29
Portugal	28	—	—	16
Spain	26	40	52	21
Hong Kong	26	47	31	26
France	21	52	43	22
Israel	19	—	—	—
Italy	17	42	40	20
Chile	16	—	—	—
Mexico	15	—	—	9
Luxembourg	14	47	34	19
United Kingdom	13	—	47	20
Denmark	13	—	48	10
Belgium	13	45	39	9
Finland	13	—	47	17
Bermuda	13	—	—	—
Sweden	12	—	47	12
Norway	12	—	46	21
Netherlands	12	—	52	14
Canada	11	37	—	20
Ireland	11	—	43	19
Australia & New Zealand	11	—	43	16
South Africa	11	—	—	17
Switzerland	10	—	40	21
United States	10	36	33	16
Germany	9	32	45	12
Brazil	7	—	—	11
India	7	—	—	11
Poland	7	—	56	12

Sources: Morningstar, Inc. Data as of Dec. 31, 2015. & Various Professional Groups and Government Data

Interpretation

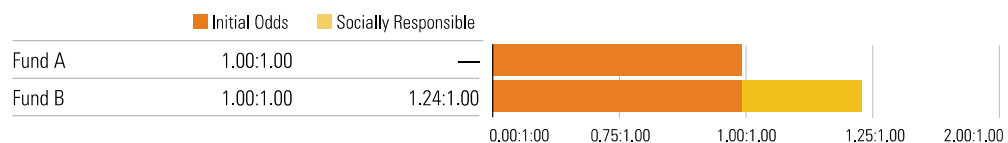
Our study looked initially at where women are managing funds by geography. From there, the goal of our modeling exercise was to determine if certain characteristics are more prevalent among women fund managers relative to men fund managers. To begin, we defined our dependent variable to be the manager's gender and then we deployed a logistic regression to our data. Our technique allowed us to measure gender among each independent variable, so our model told us the change in odds of the manager being a woman for a typical, one-unit increase in each variable. We controlled for factors such as region, fund age, and manager age so we could be certain that our results were not swayed because of regulatory regimes or because opportunities are skewed based on the fund's age or the tenure of a manager.

Let us take an example: Consider two equity funds, Fund A and Fund B. They have the exact same characteristics, and we do not know the manager's gender. We expect each fund to have the same relative odds of having a woman manager: 50% or 1:1. Being a man or being a woman is equally likely.

Now suppose we gather additional information and find out that Fund B has a socially responsible investing mandate while Fund A does not. For argument's sake, let us say that we had observed that every other fund with a SRI mandate had a woman fund manager. In this case, we might reasonably expect that there is a higher likelihood that this new Fund B is managed by a woman. As a result, we would change our expectation, surmising that Fund B has higher odds of being managed by a woman than Fund A.

Conceptually, this is what the logistic regression accomplishes. Using our data, we find that SRI funds are more often managed by women historically, holding constant the effect of other forces. We expect this effect to increase the odds of a woman fund manager by 24%.

Exhibit 2 Odds Interpretation



Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Above, the orange bars represent the initial odds of each fund being managed by a woman. The 50% odds--or 1:1 odds-- means women are equally likely as men to manage SRI funds. However, our model tells us that this is not true. If the fund has an SRI mandate, we find women are 24% more likely than their male peers to manage it. The odds are now 1.24:1 in favor of women. Going forward, we will report these effects by expected change in odds, so the odds are relative to the 1:1 norm. For the above example, Fund B is plotted at 1.24:1, reflecting its higher odds of having a woman manager.

Although the logistic regression output initially is presented as log odds, we described it here as a change in odds relative to that 50-50 norm, as shown above by the X-axis and marked 1:1. The graphics in the rest of this paper will follow the general rule. When odds are greater than 1 that a woman will be named manager on a fund type, those results will be plotted to the right of the 1.00:1.00 X-axis marker. When odds are less than 1 that a woman will be named manager on a fund type, those results will be plotted to the left of the 1.00:1.00 X-axis line.

The study looked at fund attributes concurrently, so the results can be combined to identify a larger trend. For example, if women have higher odds of being named both manager of a passive fund and a socially responsible fund, then there are even greater odds of running a passive SRI fund. (For those readers who wish to see the log odds output, we provide them in the Appendix as well as a derivation for how to obtain odds from log odds.)

A few additional methodology notes:

- ▶ To compare the relative economic impact of each factor, we cited the maximum change in odds for each fund characteristic. For example, to measure whether a woman has better odds of managing a large fund versus a small fund as measured by assets under management, we considered the odds of her managing the fund with the most assets in the category and compared that with her odds of managing the smallest fund in the category.
- ▶ For binary variables, our results showed the odds of the fund having the attribute versus not having the attribute. Put simply, we showed the likelihood of a woman managing a passive fund or not managing a passive fund.
- ▶ For integer variables, such as the number of funds to which a fund manager is named, we reported only the change in odds where the manager goes from managing one fund to managing two funds. (For more detail, see Exhibit 14.)

Key Takeaways

Our study's findings support the hypothesis that women have had limited leadership opportunities in the fund industry, and, in many well-established areas, we have not observed improvement since the 2008 financial crisis. Where women do manage funds, they're more likely to share that authority or implement an investment strategy that's more-widely adopted, such as an indexing methodology shared across funds at a firm.

Women have made gains in some areas, however. Women are more likely to manage a passive fund rather than an active fund, and they're more likely to be chosen to run a fund of funds than a fund that buys and sells individual securities. Women are more likely to share management responsibilities with others, and women managers individually oversee a lower number of funds.

Our paper will walk through each finding in detail. We also examine women's qualifications for fund-management roles, which appear sound overall. Finally, we highlight three areas of the industry where women have had more success running funds.

Gender Bias in the Investing Process

Across asset classes, women are less likely to manage active funds. One of the most statistically significant findings of our study is that a woman is more likely to manage a fund that closely tracks an index than manage a fund that is actively managed, meaning it deviates from the benchmark index. The odds of a woman managing a passive fund over an active fund in the same asset class is 1.36:1. For a fixed-income fund, her odds of being named a passive fund manager over active are 1.23:1. And a woman's odds of running a passive allocation fund versus an active fund are the highest: 1.41:1.

At first glance, we could assume that women are benefitting from a growth area for the industry. One might argue that women are earning jobs as passive fund managers because more passive funds are being launched, and it appears easier for a woman to earn a newly created position than unseat the existing manager of an established fund. Our study's construction, however, suggests that women's odds are improving beyond industry growth. In our model, we controlled for both the age of the fund and the manager's experience level. We also ran our study each month to capture as much of the industry shift to passive management as possible. Put another way, the controls allow us to determine whether a woman's odds of managing a passive fund have increased or decreased absent of industry trends, and we find that women still are far more likely to manage passive funds than active funds. Conversely, our study found that women have lower odds of managing an active fund, which is a longer-established portion of the mutual fund industry. We do not suggest, however, that women are moving from active to passive management. Women--and men, for that matter--need different skills to manage active versus passive funds. With active funds, the manager aims to deliver higher returns than the fund's benchmark index by assembling a group of securities--or portfolios of securities. Active managers

are responsible for every investment decision. With passive portfolios, the fund manager's objective is to deliver returns that match the benchmark and ensure that the owned securities meet the outlined investment criteria.

Our analysis cannot tease out whether women are being disproportionately offered passive-management roles or if they are actively choosing to do so. Regardless, the data tells us that the average woman fund manager is less likely to be involved in active management. This is the first instance where we see women moving away from active security selection.

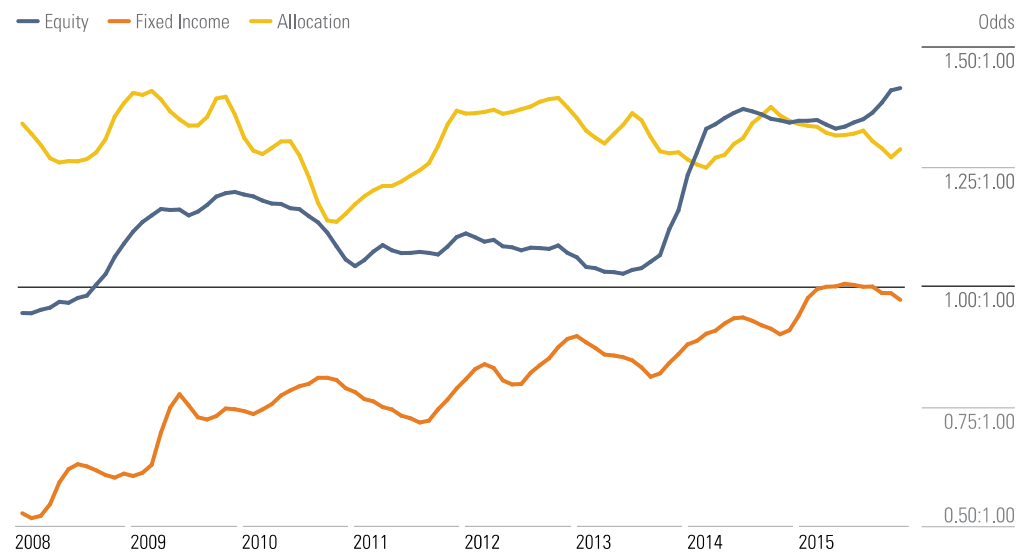
Exhibit 3 Active Management's Effect on Odds of a Woman Fund Manager



Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Women are managing funds of funds at an increasing rate. Since the start of our study, across asset classes, women fund managers have had increasing odds of being named a fund-of-funds manager. As the name suggests, funds of funds' holdings are not individual securities, but other funds. For equity funds of funds, the relative likelihoods for women increased to 1.49:1 from 0.96:1 over the course of our study. Women were far less likely to run a fixed-income fund of funds at the beginning of the measurement period, but a woman's odds of being named portfolio manager improved significantly to 0.96:1 from 0.52:1. The best odds of a woman being named portfolio manager of a fund of funds rests with allocation offerings. The odds fluctuated, starting at 1.35:1 and ending at 1.30:1.

These results--combined with our earlier findings about passive funds--suggest women are less likely to manage portfolios that center on individual security selection and more likely to allocate assets, select managers, or implement indexing strategies.

Exhibit 4 Fund of Funds' Effect on Odds of a Woman Fund Manager Through Time

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Women are more likely to be a member of a management team than to be a solo manager. Initially, this trend toward women being named to team-managed funds was one of the most discouraging correlations: Women are more likely than men to share management responsibility than to run a fund solo.

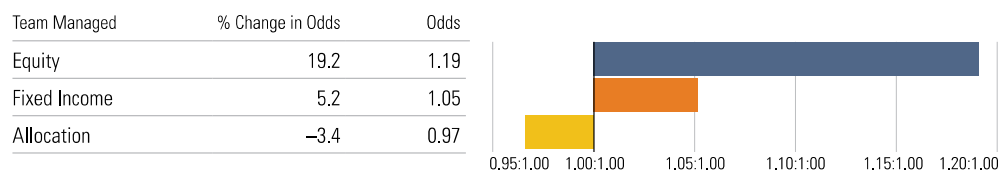
A team-management assignment may seem less appealing on the surface, but academic research suggests that women may prefer to work in teams. Healy & Pate (2011) found that generally "women prefer to compete in teams, whereas men prefer to compete as individuals." They suggested that the formation of teams may help reduce representative gender gaps. Their analysis specifically looked at the role of teams within competitive environments. Given the fund industry's unchanging emphasis on performance relative to peers, it is reasonable to expect that women may prefer to work on team-managed funds over the long term. For this study, we control for different levels of competition within categories and the impact on the team-managed funds in those peer groups using the Herfindahl-Hirschman Index, which is a measure of market competition.

Fortunately for women, team-managed funds are in vogue. When our study began in January 2008, the percentage of team-managed funds was 39.7%, but by December 2015, that percentage rose to 45.1%. Since we update the model each month, monthly growth is reflected in our output. When we look at the relative likelihoods of women being named to a team-managed fund through time, we see minimal shifts in how men and women are named to fund-management teams. If the same rate of opportunities were available to men and women, the odds would be 1:1. This was the case for the better part of the study for fixed-income and allocation funds. In late 2013, however, the two asset classes diverged. Women are still more likely to be hired in a team for fixed-income, but the opposite effect occurs for allocation funds.

Among equity funds, women had higher odds of being named to a team than as a solo manager. The odds of her being named to a team-managed fund are 1.19:1.

Ideally, the typical woman fund manager would have the same likelihood of running a fund solo as a typical male fund manager. However, Healy & Pate's research suggests the rise of team-managed funds may be a sign of propitious environments for women in the fund industry.

Exhibit 5 Team Managed's Effect on Odds of a Woman Fund Manager



Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Women are less likely to manage multiple funds at once. We found that in cases where a woman manages one fund, her odds of managing a second fund are lower. Her odds get lower still with each additional fund. Specifically, after the first management assignment, a woman's odds of a second assignment go down to 0.94:1, 0.60:1, and 0.99:1, for equity, fixed-income, and allocation funds, respectively. Regardless of asset class, we saw this trend hold up. Women are named on fewer funds than men. This finding may suggest that women are less likely to be investment-policy leaders or viewed by their firm as star managers who can attract assets to offerings based on their reputations.

We explored potential counterarguments for our finding. For example, reporting of fund-management teams varies by regulatory regime, so we controlled for 21 of the largest countries and regions. We found that the effect persisted despite the country and regional variations. Therefore, we found differing regulatory regimes did not have an impact on our overall findings.

We also explored whether differences in firm reporting had an impact on our results. Some firms may be slow to remove managers who have left the firm and its funds, for example, because this change would warrant unnecessary publicity. There is some risk, therefore, that our study is using some stale data. However, it stands to reason that such behavior by firms would have an impact on men and women managers equally and would not affect our study's overall conclusions.

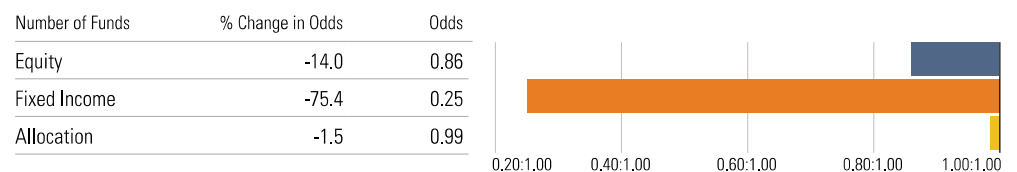
If the data misrepresents one gender over the other, that would lead to three scenarios: Women are less likely, equally likely, or more likely than men to manage the same number of funds. If the first case were true, our results would understate women's fund-management duties. If the latter two cases were true, firms are implicitly disclosing that women are named managers on fewer funds.

We also considered whether there are scenarios where there's a disadvantage to fundholders should a woman manager run multiple funds. For example, a woman manager may have a specialty that's applicable to only one fund. Unfortunately, there's no data available that describes why a fund manager is named, so we were not able to tease out this information and distinguish if women are playing specialized roles and therefore would be named to a fewer number of funds. Overall, though, this scenario seems very limited in scope and is unlikely to affect our overall results.

Another potential disadvantage could come if a woman manager already has been named to run a large fund. If she were named manager of a second or subsequent fund, her skills arguably would be spread too thin. Our study addresses this scenario by controlling for fund size and thus limits this scenario's impact on our overall results.

Among ETFs and index mutual funds, it is not uncommon for the same manager or management team to be named across multiple funds. But among actively managed funds, the managers who are named to multiple funds are often chief investment officers, team leaders, or star managers, whose reputations help attract and keep assets in a mutual fund. Star managers sometimes are hired as subadvisors for offerings from multiple firms. For example, Daniel Ivascyn, chief investment officer at U.S.-based PIMCO, is named manager on more than a dozen funds. The small but consistent trend that women are less likely to be named on multiple funds may suggest that the typical woman fund manager has less influence in the investing process than a man fund manager.

Exhibit 6 Active Management's Effect on Odds of a Woman Fund Manager



Source: Morningstar, Inc. Data as of Dec. 31, 2015.

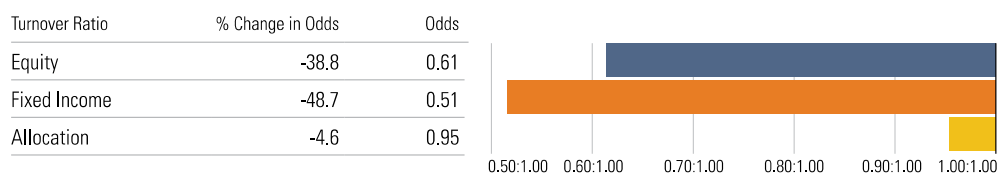
Women Managers Demonstrate Conviction and Qualifications

Women fund managers hold on to their investment holdings longer than men fund managers. Out of all the factors examined in our model, turnover ratio is one that has been written about extensively in the media, often through a lens of overconfidence. For example, there have been several popularized articles arguing women may be better fund managers than men because they do not suffer from overconfidence. Such articles cite the Barber & Odean (2001) brokerage data study that found men trade 45% more than women, indicating that women tend to hold on to their investment positions longer.

Our study supports Barber & Odean's finding. We found that women fund managers hold their investment positions longer than men fund managers, and this trend is significant and persistent for all three asset classes. The most meaningful effects are among equity and fixed-income funds. When comparing two funds in a category where one has the highest turnover ratio in the category and another has the lowest, the odds that the high-turnover fund is managed by a woman is 0.61:1 for equity funds and 0.51:1 for fixed-income funds. However, the effect for allocation funds is less meaningful. The woman's odds of managing the high-turnover fund is 0.95:1.

While Barber & Odean used turnover ratio as a proxy for overconfidence, we view turnover ratio as a measure of a manager's patience and willingness to have conviction in an investment decision. We find women are less likely to trade, and the trend is remarkably consistent through time. The trend does not change in periods of distress or growth. In periods of downturn, women are more likely to hold on to their investments, indicating higher conviction. In periods of success, on average, women also are less likely to be looking for quick wins. This invest-with-conviction approach that we observe among women may be especially beneficial for active managers, which increasingly face cost scrutiny and largely have underperformed passive funds with a conventional higher-turnover approach. Unfortunately, our research shows women have lower odds of managing active funds.

Exhibit 7 Turnover Ratio's Effect on Odds of a Woman Fund Manager



Source: Morningstar, Inc. Data as of Dec. 31, 2015.

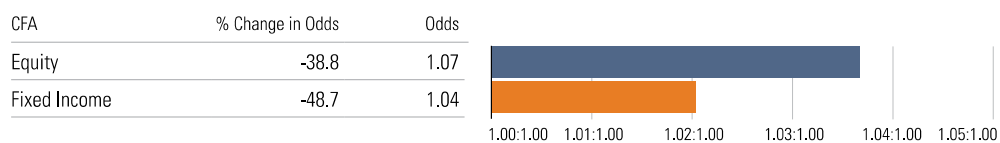
Women equity and fixed-income managers are more likely to be CFA charterholders, signaling they're well-qualified for the roles. Our study showed that women running equity and bond funds are more likely to have a Chartered Financial Analyst® designation than men peers. The CFA charter is awarded to individuals who pass a three-part exam, typically taken over three years, that tests the principles of

investment analysis and portfolio construction. Candidates also must have relevant industry experience. CFA charterholders aren't guaranteed to be top analysts or portfolio managers, but the professional designation suggests experience and expertise in the field. Morningstar's data showed that the odds that a woman fund manager holds a CFA charter relative to a man is 1.07:1 for equity funds and 1.04:1 for fixed-income funds.

If it is more likely for women fund managers to be CFA charterholders than men, women are demonstrating a basic qualification for the role more often than men. In fact, the data also may suggest that women need to be more credentialed than men to win a fund-management role, reflecting a potential hiring bias. The CFA designation may be an objective measure that helps women overcome employers' implicit stereotypes about gender and analytical ability. For example, Reuben, Sapienza, & Zingales (2014) studied discrimination by gender during the hiring process. They found that "men are more likely to boast about their performance, whereas women tend to underestimate it," which makes it tougher for women to win leadership roles, but the CFA designation may provide tangible proof of a woman's readiness for the job--regardless of how she markets those skills to her employer.

There are a few counterarguments. In recent years, the CFA charter has risen in importance as a credential for fund managers, so that might explain the higher rate of CFA charters among women. We did, however, control for manager age in our study, and the effect still holds. A second criticism is this effect does not hold for the average allocation fund manager: A woman allocation fund manager has lower odds of having her CFA charter relative a man by 0.76:1. This suggests there is a different hiring standard for allocation fund managers relative to equity or fixed-income fund-management roles. Because allocation funds focus more on asset allocation and manager selection rather than individual security selection, those portfolio-management roles may require different skills and implicit biases. As with the findings on women portfolio managers' lower turnover ratios, allocation fund managers display diverging traits relative to equity and fixed-income managers. The industry would benefit from additional research on the different skill sets and hiring biases for funds by asset class.

Exhibit 8 CFA's Effect on Odds of a Woman Fund Manager



Source: Morningstar, Inc. Data as of Dec. 31, 2015.

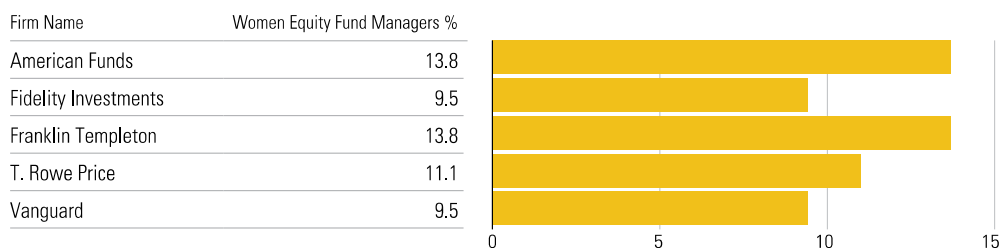
Shifting Opportunities for Women in the Fund Industry

The largest equity firms are more likely to hire women portfolio managers. Our study considered whether women had better odds of being an equity fund manager at a large firm rather than a small firm, and we found that larger is better. Among funds at one of the top 10 largest firms by global equity assets under management, a woman's odds of being named an equity fund manager are 1.83:1 relative to earning the same role at a smaller firm.

Intuitively, this makes sense: The larger the firm, the larger the number of funds, the larger the number of people managing funds, the more opportunities for a woman to be named to a management team. There may be more jobs available to women at large firms, but it is worth noting that incremental change at a small firm increases a woman's odds of management considerably. Let us say a firm offers 10 equity funds. If just one of those funds has women portfolio managers, the firm's rate of women managers already meets the global average, and if a second woman gets a fund-management role, the firm has doubled the global average.

Next, let us look at gender diversity at the largest fund firms by global equity assets under management and how it compares with the global average. Worldwide at an equity firm, 7.7% of equity fund managers are women. Over the course of the study, five firms--American Funds, Fidelity Investments, Franklin Templeton, T. Rowe Price, and Vanguard--remained among the 10 largest equity fund companies, and the percentage of women equity fund managers exceeded the industry average at each firm.¹ Yet these firms are far from gender equal. As of December 2015, their rates of women equity fund managers ranged between 13.8% and 9.5%.

Exhibit 9 % of Women Equity Fund Managers at Largest Firms by Global Equity Fund Assets Under Management



Source: Morningstar, Inc. Data as of Dec. 31, 2015.

The largest firms provide more opportunities to women in the industry, not only because of the portion of managers that are women but also due to the sheer volume of positions. Alone, these five firms account for 12.4% of all equity portfolio manager positions held by women.

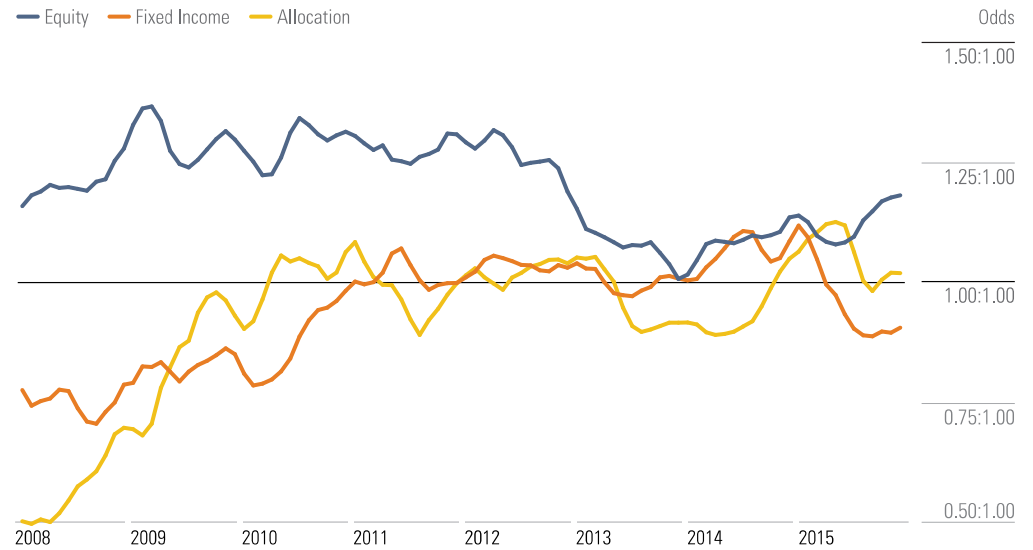
¹ Source: Morningstar, Inc. Data as of Dec. 31, 2015. To determine the global equity average, we considered all unique companies with funds classified under the equity asset class. As of December 2015, we looked at all managers listed at that firm, found the rate of women portfolio managers, and finally, averaged the rates across all companies considered.

One global asset manager that stands out for its gender equality in fund-management ranks is Aberdeen Asset Management PLC. As of December 2015, women accounted for 31.2% of equity portfolio managers at the United Kingdom-domiciled firm. In terms of total assets under management in equities, Aberdeen ranks as number 151 out of 3,167 fund companies, and its equity assets land it in the top 5% of all equity companies studied.

Fund size is no longer indicative of a manager's gender. At the beginning of our study in 2008, we observed a gender bias among fund managers based on a fund's assets under management relative to category peers. For fixed-income and allocation fund managers, women were more likely to be managing funds with fewer assets under management than their male peers. In January 2008, the odds that a woman would be managing the largest fund in a Morningstar Category were far worse than her odds of running the category's smallest fund, with her odds decreasing to 0.83:1 for fixed-income funds and 0.49:1 for allocation funds. Since 2011, the odds evened out when considering funds by size of assets, and by December 2015, the bias had disappeared. Now, the change in likelihood of a woman running a small versus a large fund is 0.95:1 for fixed-income funds and 0.90:1 for allocation funds.

This trend is good news overall, but it does not extend to equity funds. In January 2008, women were far more likely to be managing larger equity funds within each category than smaller funds, as evident by the 1.30:1 odds. By December 2015, the trend has not changed, as the relative odds inched higher to 1.32:1 odds. This data suggests women have less opportunity to manage a smaller equity fund.

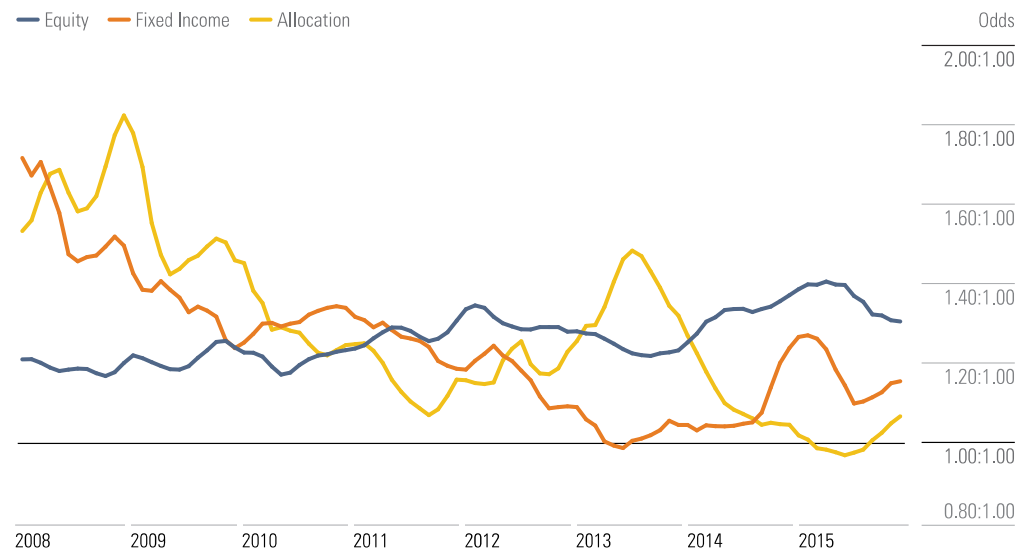
It is unclear why the odds of a woman being named to a small or large fund differs by asset class. Previous research has shown that, among new equity funds, investors send more cash to funds being run with women managers (Davidson, Sargis, & Strauts [2016]). If women managers attract more assets to new funds, we would assume that firms would actively recruit more women to run smaller funds in hopes of growing them at a faster rate.

Exhibit 10 Fund Size's Effect on Odds of a Woman Fund Manager Through Time

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Socially responsible investing is no longer heavily tilted toward women fund managers. When our study began in January 2008, fund manager roles for funds with socially responsible investing mandates were predominately associated with women. The relative likelihood of having a woman fund manager on a socially conscious fund were 1.22:1 for equity funds, 1.68:1 for fixed-income funds, and 1.58:1 for allocation funds. Since 2008, however, the overall odds of a woman being named manager of an SRI fund steadily decreased. By the end of 2015, women still held an edge over men in being named managers of these funds, but the gender gap narrowed.

Market conditions helped narrow the gap. Higher proportions of men entered the SRI niche at a time of growing job opportunities and growing popularity among investors. Globally, 1,042 new funds identified as socially conscious entered the market during our study, opening up over 2,090 new portfolio manager positions. During the same time, Davidson & Strauts (2015) found SRI funds attracted assets at a faster rate than non-SRI funds. The rate of fund launches was so swift that there aren't enough qualified women to maintain the same percentage of fund-management roles that they previously held. Our study suggests that men entered this market as it expanded, causing the overall likelihood of a woman managing a socially conscious fund to decrease.

Exhibit 11 Socially Responsible Investing's Effect on Odds of a Woman Fund Manager Through Time

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Why Women (Don't) Manage

This study did not attempt to answer the question of why so few women pursue careers in asset management or earn roles as fund managers. Many other papers explain why gender disparities still exist in professions dominated by men. The financial industry may be less tolerant of career interruptions, which are more typical for women, or it may be less conducive to balancing career and family (Bertrand, Goldin, & Katz, 2010). A Morningstar study found there is a weak talent pipeline for fund managers as measured by masters of business administration enrollment and CFA charterholders (Lutton & Davis, 2015).

Another deterrent for women portfolio managers may be counterintuitive as it pertains to income: Researchers have found there is an aversion to women out earning their partners. When women earn more than their partner, researchers have found ties to lower marriage rates, higher divorce rates, and uneven distribution of household tasks, with the woman taking on more despite her earnings potential outside the home (Bertrand, Kamenica, & Pan, 2015).

Another hypothesis for why so few women enter the financial industry includes research suggesting that women may have weaker quantitative skills (Ellison & Swanson, 2010) or are subject to stereotypes affecting women (Reuben, Sapienza, & Zingales, 2014).

For women who do pursue careers in the fund industry, one study suggests there are challenges midcareer, about the time that a woman would likely be named a fund manager. A report from consulting firm Oliver Wyman, which relied on survey data from women in the financial-services

industry, suggests that women find a lack of support at midcareer, which may prompt them to leave the industry before they have been named a portfolio manager.

Oliver Wyman's sister company, Mercer, found that women leave financial services at midcareer at higher rates than men and at higher rates than other industries. "Female managers, senior managers and executives in financial services are 20 percent to 30 percent more likely to leave their employer than their peers in other industries." The survey data showed that women face "a less attractive career trade-off than men" because their workplaces were insufficiently flexible when it came to working options and support for family responsibilities. What is more, the processes around promotion and pay were not sufficiently predictable, transparent, or equitable. Perhaps most notable is the women's perception of culture, which they note contains "persistent sources of low inclusion" that bears out through unconscious bias and traditional assumptions.

We saw these explanations play out in our study. In the United States, for example, the likelihood that a woman will earn a fund manager role has declined since 2008. Generally, this is the case around the world. In most geographic regions, after controlling for all other factors, women had higher likelihoods of managing equity or allocation funds in January 2008 than they do today. Women have made modest gains in fixed-income, but the odds were never in their favor. Women are still far less likely to manage a fixed-income fund than men, regardless of time period or country. A comparison of the change in likelihood of having a woman fund manager by country and asset class is available in the Appendix.

Conclusion

In this paper, we sought to explain variations in portfolio manager positions by gender. We wanted to understand if women had equal opportunities within the industry comparative to her male peers. In doing so, we identified areas of implicit bias and areas where such bias has been erased. We did so by constructing a model to reveal historical relationships between managers, funds, firms, geography, and how such factors adjust the likelihoods of having a fund managed by a woman.

In short, we find the women managers are more likely to have a CFA and to manage in teams, rather than on their own. Not surprisingly, the best chance of finding an equity fund run by a woman is at the largest equity firms. Yet, times are shifting for women in the industry. Socially responsible investing, a market niche previously heavily associated with women, is now attracting men at a rapid pace. Across asset classes, women are managing funds of all sizes. However, women are still named on fewer funds than men, and the rate of women in the industry is decreasing in the United States.

The main result of the paper is the following: Embedded in the fund industry's shift to meet different investor preferences is a shift in how managers are resourced across these funds. Men and women are not uniformly distributed on fund-management teams. These trends of who, what, where, and how

women manage are not limited to the United States; rather, we see these effects persist globally. We see gender disparity in every market we examined.

After reflecting on our results, we see opportunity for more research. A vital first step would be further research into why someone enters and leaves the fund industry. The heart of this question is a behavioral issue. In addition to compensation, economic scenarios, education levels, and other tangible data-measured factors, there is a behavioral side of this question that Morningstar's Behavioral Science team may help us explore.

Second, we found that in some cases management trends among allocation funds managed by women were inconsistent with the corresponding equity or fixed-income asset classes. This may reflect differences in portfolio objectives and construction. Further research into the work of fund managers by asset class would help identify the differences between the types of work fund managers do. In future studies, we would consider refitting the model, not by asset class, but by holding types: fund versus individual securities.

Third, we see there are clear patterns for the types of opportunities afforded to women in the industry. Are there clear compensation differences among men and women fund managers? Researching how compensation varies by gender at the portfolio manager level is of interest to us.

Fourth, we did not address relative performance by gender in this paper. This topic is of great interest to us at Morningstar. The findings of this paper will provide a mental framework for how we want to construct that study.

In the coming months, we expect to continue studying women in the financial industry. We hope to answer many of these questions. ■■■

Appendix

Data

Our study relied on Morningstar fund data sources and the University of Minnesota for gender data. The sample period began in January 2008 and ended in December 2015. Over the entirety of the sample, 26,340 unique managers were included, spanning over 54,377 unique funds. Monthly manager and monthly fund counts, respectively, ranged from 13,965 to 16,392 and 27,248 to 36,605 depending on the period, with recent periods having higher counts for both. Our sample included managers in multiple broad asset classes--balanced manager counts ranged from 3,732 to 5,133, equity 9,692 to 10,435, and fixed-income 3,503 to 4,777. In December 2015, our sample spanned a total of 16,392 managers. The corresponding fund counts were as follows -- allocation fund counts range from 5,338 to 9,505, equity 15,652 to 18,563, and fixed-income 5,450 to 8,948. In December 2015, our sample spanned a total of 36,605 funds.

We constructed our analysis to look at portfolio manager job opportunities. Therefore, our data set looked at each manager named to a fund for each month the fund was in existence. From our perspective, a team-managed fund provided more job opportunities than a solo-managed fund, so the data set should reflect the true number of portfolio management jobs and the associated characteristics of that fund. For example, a fund with three managers with an inception prior to January 2008 and surviving through December 2015 appeared in our data set 288 times, three managers, for 12 months, for eight years.

Because we are interested in fund characteristics, we rolled up share class data to the fund level. For funds providing complete asset information for all share classes, we calculated the asset-weighted variables. For those funds where complete asset information was not available, we computed equally weighted variables.

Our sample of funds did not suffer from survivorship bias. Morningstar's global fund databases return a full history of dead funds, and these funds are included in our sample where applicable. Moreover, our evaluation technique dynamically incorporated monthly changes in fund-universe composition, providing a more holistic and realistic picture of historical performance. Each monthly snapshot captured any funds that were subsequently merged or liquidated away.

Regression Coefficients

The control and dependent variables in our regressions are important to understand. Many continuous explanatory variables are standardized into percentile units across all funds (1 lowest percentile, 100 highest percentile) cross-sectionally by date and their Morningstar Category. Country level and integer variables are not standardized into percentiles. Imputation by category was performed on all missing data for continuous explanatory variables. We imputed each category's percentile median for each date.

Dependent Variable

Gender

Morningstar did not collect the gender of portfolio managers globally for all managers. Of the 26,340 fund managers in our study, we collected gender information on 15,996 managers. However, we did collect the first name of the fund managers. To identify gender on the remaining managers, their first names were run through an algorithm that assigned the probability of being female based on census data. Probabilities higher than 50% were assigned as female.

To audit the results, we manually verified any manager where Morningstar's gender data did not match up with the algorithm, any gender-neutral name, or managers from regions where we felt the naming conventions would not be suitable for the algorithm. For example, *Patrice* in France is more heavily associated with men, while *Patrice* in the United States is often associated with women. The gender data underwent extensive cleaning. Manual verification was completed by identifying gender using professional photos, bio descriptions, or titles and pronouns such as *Mr.*, *Mrs.*, *Ms.*, *he*, *she*, *his*, or *her*.

However, we were not able to include all countries. Because of Morningstar's data-collection process or regional-reporting regulations, we did not include China, Japan, or Taiwan. In our database, names originally in character form were translated into English based on their pronunciations. Identifying gender when tones of pronunciation were not recorded was not possible through an algorithm or web searches.

Finally, while a person's gender may not necessarily fall into the male-female binary, because of the nature of our data, we implemented the binary structure. We recognize that we were misclassifying and not considering fund managers who do not fit into this system.

Independent Variables

Actively Managed

This is a categorical, dummy variable that indicates whether a fund tracks an index. While an index typically has a much larger portfolio than a mutual fund, the fund's management may study the index's movements to develop a representative sampling and match sectors appropriately. If the fund is not classified as an index fund, then we assumed the fund is actively managed.

Assets Under Management

Assets under management is measured as the fund's total market value of investments in USD. The variable is placed into percentiles by date and category. Because the percentiles are left skewed, it is necessary to square-transform it. When we refer to AUM in relation to odds, we are referring to the square odds of AUM.

Asset-Weighted Manager Tenure

The firm-level tenure number is an asset-weighted average of the longest manager tenure of each fund assigned to the firm. The tenure number at the fund level is the number of months the current manager has been on the fund. For funds with more than one manager, the tenure of the manager who has been with the fund the longest was used in the calculation.

CFA

This is a categorical, dummy variable that indicates whether the fund manager has received the Chartered Financial Analyst designation.

Country Fixed Effects

These are categorical, dummy variables indicating whether a fund is domiciled in the country. We only include countries where we have had a large enough sample for each asset class. Additionally, we put the remaining countries into regional groupings. For example, *Australasia* represents Australia and New Zealand, which includes over 600 Australian managers and 60 New Zealand managers. For countries with very small representation, we grouped by continent. *Asia Pacific* includes Hong Kong, Malaysia, Philippines, and Singapore. *Other Latin America* includes funds domiciled in Bahamas, Bermuda, British Virgin Islands, Cayman Islands, Chile, Mexico, Puerto Rico, and the US Virgin Islands. *Other Europe* includes Andorra, Czech Republic, Estonia, Gibraltar, Greece, Guernsey, Iceland, Ireland, Jersey, Latvia, Liechtenstein, Lithuania, Malta, Monaco, Portugal, Russia, San Marino, and Slovenia. *United Kingdom* includes United Kingdom and Isle of Man.

Overall, we included as variables 16 countries and five other regions in our model. These are the countries where we had representative coverage of managers and their respective gender across the three asset classes. We included the rates of women fund managers in the Data Tables section of the Appendix. We expanded that coverage to include country rates of women fund managers that had at least 30 managers listed per time period.

Experience

This is an integer variable indicating the number of years a manager has been in the fund industry. To calculate years of experience, we first use the manager's age and subtract 25 years. Otherwise, we subtract today's date from the earliest date a firm reports a manager working at its firm.

Fund of Funds

This is a categorical, dummy variable that indicates whether a fund is structured as a fund of funds—a fund that specializes in buying shares in other mutual funds rather than in individual securities. Quite often this type of fund is not discernible from its name alone but rather through prospectus wording.

Manager Age

This is an integer variable indicating the age of a manager. To calculate age, we use the manager's listed birth year. If the information is unavailable, we calculate the number of years a manager is named on a fund and then add 40 years.

Market Concentration Index

This is a continuous variable (0,1] that indicates market concentration within a Morningstar Category. A 1 indicates a firm has a complete monopoly over the category, whereas a number close to 0 indicates a competitive category where no single firm can control the category's assets. Market Concentration Index is calculated for each category each month. The calculation is below:

$$\text{Market Concentration Index} = \sum_{i=1}^n \left(\frac{x_i}{C_k}\right)^2$$

n = number of funds in Morningstar Category k

x = Firm's Assets within Morningstar Category k

C = Total Assets in Morningstar Category k

Net Expense Ratio

Different regions have different reporting requirements for mutual fund expenses. For example, in the U.S., Net Expense Ratio is the most commonly used data point that encompasses all fees levied on the investor over the past year, including performance-based fees. In the United Kingdom and Europe, Ongoing Charge is the most commonly used data point to express fees levied on investors in the past year. Unlike Net Expense Ratio, Ongoing Charge does not include performance-based fees. Therefore, to harmonize net expense ratios of U.S., U.K., and Europe-domiciled funds, we add performance fees back into the Ongoing Charge.

For funds of funds, we also included acquired fund expenses.

For all domiciles in our purview, we do our best to harmonize fee-reporting differences across geographies using the following mapping procedure:

$$\text{Net Expense Ratio} = \begin{cases} \text{NetExpenseRatio} & \text{Domicile} = \text{USA} \\ \text{IndirectCostRatio(orMER)} & \text{Domicile} = \text{AUS} \\ \text{ManagementExpenseRatio} & \text{Domicile} = \text{CAN or NZL} \\ \text{OngoingCharge} + \text{PerformanceFee(orNER)} & \text{Region} = \text{UK, EU} \\ \text{JPAf - TaxTotalExpenseRatio} & \text{Domicile} = \text{JAP} \\ \text{FoF.NetExp}_i = \text{FoF.exp}_i + \text{AcquiredFundExpense} & \text{FoF} = \text{Yes, Acq Fund Exp} \neq \text{NA} \\ \text{FoF.NetExp}_i = \text{FoF.exp}_i + \sum_{i=1}^N w_i \text{exp}_i & \text{FoF} = \text{Yes and Region} = \text{US} \\ \text{NetExpenseRatio} & \text{Otherwise} \end{cases}$$

Number of Firm Movements

This is an integer variable indicating the number of unique firms a fund manager has worked at as a portfolio manager.

Number of Funds Managed

This is an integer variable indicating the number of unique funds a fund manager is currently managing. Number of Funds Managed was right-skewed, and therefore it was necessary to log-transform it. When we refer to Number of Funds Managed in relation to odds in this paper, we are referring to the log odd of Number of Funds Managed.

Socially Responsible Fund

This is a categorical, dummy variable that indicates whether a fund has identified itself as socially conscious. This data point indicates if the fund selectively invests based on certain noneconomic principles. Such funds may make investments based on such issues as environmental responsibility, human rights, or religious views. A socially conscious fund may take a proactive stance by selectively investing in, for example, environmentally friendly companies or firms with good employee relations. This group also includes funds that avoid investing in companies involved in promoting alcohol, tobacco, or gambling or in the defense industry.

Team-Managed

This is a categorical, dummy variable that indicates a fund is managed by at least two people.

Top Ten Firm (AUM)

This is a categorical, dummy variable that indicates whether a fund is from a firm with top 10 assets under management in the respective asset class.

Turnover Ratio

There are two main methods of calculating Turnover Ratio: US SEC and UCITS. Taiwan also has unique rules about Turnover calculations, but for simplicity, we only cover the US and UCITS rules here.

- ▶ US SEC measures the portfolio manager's trading activity by taking the lesser of purchases or sales (excluding all securities with maturities of less than one year) and dividing by average monthly net assets. A turnover ratio of 100% or more does not necessarily suggest that all securities in the portfolio have been traded. In practical terms, the resulting percentage loosely represents the percentage of the portfolio's holdings that have changed over the past year.
- ▶ UCITS calculates turnover ratio by $(\text{absolute value of purchases} + \text{absolute value of sales}) - (\text{absolute value of inflows} + \text{absolute value of outflows})$, all divided by average net assets.

- ▶ In the absence of flows, the UCITS methodology double-counts turnover. For example, if a manager sells all the securities in the portfolio and replaces them, turnover is 200% (not 100%). The calculation is based on the assumption that all flow activity triggers trades and that these trades should not be counted as turnover (hence, the subtraction of the gross absolute value of flows). This has important implications for how we choose to standardize turnover ratios because the raw values will be distributed differently depending on the region considered. U.S. funds' Turnover Ratios are systematically lower than UCITS funds simply because of this difference in reporting requirements. Therefore, we chose to standardize Turnover Ratio cross-sectionally by date, asset class, and regional categories.

Style Tilts

Equity funds: We run rolling three-year regressions of a fund's return onto the region-appropriate Fama-French-Carhart factors—RMRF, HML, SMB, and UMD. All returns, which we source from the French data library, are in U.S. dollars, include dividends and capital gains, and are not continuously compounded. We select region-appropriate factors based on each fund's Morningstar Category classification, which is based in turn on the fund's portfolio-holdings data. For example, funds that invest in the stocks of U.S. large-capitalization firms are classified into the U.S. large-blend category. The Fama-French-Carhart factors are calculated for each of the following regions: global, global ex-U.S., Europe, Japan, Asia Pacific ex-Japan, and North America. Each regional set of factors will contain the following:

RMRF (also known as "excess return on the market") is the excess return of the region-specific market portfolio, which is calculated as that market's market-cap-weighted portfolio return minus the regional risk-free rate (that is, the one-month T-bill in the U.S.).

SMB ("small minus big") and HML ("high minus low") portfolio returns represent factor portfolios designed to proxy a common risk in equity returns arising from cross-sectional differences in market capitalization and valuation. To construct the SMB and HML factors, stocks in a region are sorted into two market-cap and three book/market equity groups at the end of each June. "Big" stocks are those in the top 90% of June market cap for the region, and "small" stocks are those in the bottom 10%. The B/M breakpoints for a region are the 30th and 70th percentiles of B/M for that region's "big" stocks.

SMB is the equal-weight average of the returns on the three "small" stock portfolios for the region minus the average of the returns on the three "big" stock portfolios. HML is the equal-weight average of the returns for the two high B/M portfolios for a region minus the average of the returns for the two low B/M portfolios.

UMD ("up minus down") is a factor portfolio designed to proxy an observed return pattern of momentum in equities where recent winners keep winning and recent losers keep losing. The 2x3 sorts on size and lagged momentum to construct UMD are similar, but the size-momentum portfolios are formed monthly. For portfolios formed at the end of month $t-1$, the lagged momentum return is a stock's cumulative return for month $t-12$ to month $t-2$. The momentum breakpoints for a region are the 30th and 70th

percentiles of the lagged momentum returns of the “big” stocks of the region. UMD is the equal-weight average of the returns for the two winner portfolios for a region minus the average of the returns for the two loser portfolios.

The regression rolls monthly—providing a set of factor betas, alpha, and R-squared each month estimated from the prior 36 months’ experience. The equity asset-class regression takes the form:

$$r_{i,t} = \alpha_i + \beta_i^{rmrf} RMRF_t + \beta_i^{hml} HML_t + \beta_i^{smb} SMB_t + \beta_i^{umd} UMD_t + e_{i,t}$$

Subsequently, we use the estimated time-series of factor alphas and betas above (α_i , β_i^{rmrf} , β_i^{hml} , β_i^{smb} , β_i^{umd}) as our explanatory variables in our cross-sectional regressions. For simplicity, we refer to these in our write-ups and charts as Alpha (α_i), Market Beta (β_i^{rmrf}), Value Beta (β_i^{hml}), Size Beta (β_i^{smb}), and Momentum Beta (β_i^{umd}).

Fixed income and balanced funds: We run rolling three-year regressions of a fund’s return onto the region-appropriate Fama-French factors—RMRF, HML, and SMB—as well as TERM and DEF factor series, which we compute in a manner consistent with that set forth in Chen, Roll, and Ross (1986) and Fama-French (1993).

TERM (“term premium”) is a factor portfolio designed to proxy a common risk in bond returns arising from unexpected changes in interest rates. The portfolio return is calculated by going long the Barclays Capital U.S. Treasury 10-20 Year TR USD Index and short the Barclays Capital U.S. Treasury Bill 1-3 Month TR USD Index.

DEF (“default”) is a factor portfolio designed to proxy a common risk in bond returns arising from shifts in economic conditions that could change the likelihood of default. The portfolio return is calculated by going long the Barclays Capital U.S. Corporate High Yield TR USD Index and short the Barclays Capital U.S. Government TR USD Index.

The regression rolls monthly—providing a set of factor betas, alpha, and R-squared each month estimated from the prior 36 months’ experience. The fixed-income and balanced asset-class returns-based style-analysis regression takes the form:

$$r_{i,t} = \alpha + \beta_i^{rmrf} RMRF_t + \beta_i^{hml} HML_t + \beta_i^{smb} SMB_t + \beta_i^{term} TERM_t + \beta_i^{def} DEF_t + e_{i,t}$$

Subsequently, we use the estimated time-series of factor betas above (α_i , β_i^{rmrf} , β_i^{hml} , β_i^{smb} , β_i^{term} , β_i^{def}) as our explanatory variables in our cross-sectional regressions. For simplicity, we refer to these in our write-ups and charts as Alpha (α_i), Market Beta (β_i^{rmrf}), Value Beta (β_i^{hml}), Size Beta (β_i^{smb}), Duration Beta (β_i^{term}), and Credit Beta (β_i^{def}).

To estimate a fund's beta to the factors above, we require 36 months of return history. For those funds that do not have 36 months of return history, they will not have their own set of factor betas, alphas, or R-squared. In this case, we impute the Morningstar Category average value by date. Once the fund passes the 36-month mark, we stop the imputation.

Methodology

To evaluate what specific factors are related to fund manager's gender, we employ a series of monthly cross-sectional logistic regressions. Each month, we regress the manager's gender on a set of contemporaneous explanatory variables. The set of explanatory variables we use for each asset class is slightly different from each other. We purposefully re-estimate the models by asset class so we are capturing within-asset-class variations in job type rather than between-asset-classes. As constructed, we believe the model offers a glimpse at the inherent biases toward a portfolio manager's gender.

We apply the following framework to the data globally across asset classes:

Cross-Sectional Regression:

$$gender_i = \alpha + \lambda_t X_{i,t} + \sigma_t B_{i,t} + \phi_t Z_{i,t} + \varepsilon_{i,t+1}$$

Where $gender_i$ is a binary variable with 1 indicating female and 0 indicating male. $X_{i,t}$ is a vector of explanatory characteristics at time t and $B_{i,t}$ is a set of indicator characteristics.

The vector of returns-based style analysis variables, Z_i , is estimated uniquely by fund from a regression on the prior 36 months of returns. The regression rolls monthly—providing a set of factor betas, alpha, and R-squared each month estimated from the prior 36 months' experience. The factors included in the regression change depending on the broad asset class considered.

The equity asset class returns-based style-analysis regression takes the form:

$$r_{i,t} = \alpha + \beta_i^{rmrf} RMRF_t + \beta_i^{hml} HML_t + \beta_i^{smb} SMB_t + \beta_i^{umd} UMD_t + e_{i,t}$$

The fixed-income and balanced asset class returns-based style-analysis regression takes the form:

$$r_{i,t} = \alpha + \beta_i^{rmrf} RMRF_t + \beta_i^{hml} HML_t + \beta_i^{smb} SMB_t + \beta_i^{term} TERM_t + \beta_i^{def} DEF_t + e_{i,t}$$

The contents of the vectors X_i , β_i , Z_i are as follow:

Exhibit 12 Variables Included in Model

X_i	β_i (yes/no)	Z_i
Asset Weighted Manager Tenure	Top Ten Firm	Market Beta
Fund Size	Actively Managed	Size Beta
Turnover Ratio	Socially Responsible Fund	Value Beta
Expense Ratio	Fund of Funds	Momentum Beta *
Market Concentration Index (HHI)	Team Managed	Credit Beta **
Number of Current Funds	CFA	Term Beta **
Firm Movements		
Manager Age	Asia Pacific	
	Australasia	
	Belgium	
	Brazil	
	Canada	
	Finland	
	France	
	Germany	
	India	
	Israel	
	Italy	
	Luxembourg	
	Netherlands	
	Other Europe	
	Other Latin America	
	Poland	
	South Africa	
	Spain	
	Sweden	
	United Kingdom	
	United States	

Source: Morningstar, Inc. * Equity only. ** Fixed-income and allocation only.

How to Obtain Final Estimates

Cross-sectional regressions, as specified above, are run each month. As a result, we are left with several vectors of coefficients on each date estimated from each model. For example, we have a matrix \vec{B} that collects the time-series of estimated coefficients from $t=1$ to $t=T$ for each vector:

$$\vec{B} = \begin{bmatrix} \Omega_1 & \phi_1 & \lambda_1 \\ \vdots & \vdots & \vdots \\ \Omega_T & \phi_T & \lambda_T \end{bmatrix}$$

Then, the final estimates of the coefficient vectors Ω , ϕ , λ are averages across time:

$$\begin{aligned} \hat{\Omega} &= \frac{1}{T} \sum_{t=1}^T \widehat{\Omega}_t \\ \hat{\phi} &= \frac{1}{T} \sum_{t=1}^T \widehat{\phi}_t \\ \hat{\lambda} &= \frac{1}{T} \sum_{t=1}^T \widehat{\lambda}_t \end{aligned}$$

Standard errors are assumed to be uncorrelated over time:

$$\begin{aligned} \sigma(\hat{\Omega}) &= \frac{1}{T} \text{var}(\Omega_t) = \frac{1}{T^2} \sum_{t=1}^T (\widehat{\Omega}_t - \Omega)^2 \\ \sigma(\hat{\phi}) &= \frac{1}{T} \text{var}(\phi_t) = \frac{1}{T^2} \sum_{t=1}^T (\widehat{\phi}_t - \phi)^2 \\ \sigma(\hat{\lambda}) &= \frac{1}{T} \text{var}(\lambda_t) = \frac{1}{T^2} \sum_{t=1}^T (\widehat{\lambda}_t - \lambda)^2 \end{aligned}$$

How to Convert from Log Odds to Odds

The output of a logistic regression is the change in log odds of a manager's gender given a certain characteristic. For simplicity, we convert from log odds to the change in odds. Given the below regression,

$$\text{logit}(\text{gender}) = \alpha_0 + \beta_i X_i$$

We calculate the percent change in odds for a given variable as follows:

$$\% \text{ change in odds given } X_j = e^{c\beta_j} - 1$$

Where c represents the multiplicative factor used to determine the maximum effect observable. A detailed table of such factors is found in the Appendix.

Data Tables

In the tables below, we show the panel regression results. Coefficients are expressed in percentage terms, are bolded when statistically significant at the 5% level, and are expressed as follows. The t-statistics are presented in the row below the coefficients. Coefficients can be interpreted as the change in log odds of a manager's gender by moving from one percentile to another or, in the case of dummy variables, when the factor moves from False to True. A full breakdown of the coefficients is found in Exhibit 14.

Exhibit 13 Raw Regression Results by Asset Class and Model

	Factors	Equity %	Fixed-Income %	Allocation %
	(Intercept)	-2.095 -45.013	-0.487 -10.555	-1.957 -29.999
Firm	Asset Weighted Manager Tenure	-0.004 -17.263	0.002 18.973	-0.002 -9.55
	Top Ten Firm (AUM)	0.633 27.064	-0.107 -4.893	0.015 0.405
Fund Structure	Actively Managed	-0.44 -33.153	-0.254 -13.539	-0.512 -11.11
	Socially Responsible Fund	0.238 45.703	0.206 15.377	0.237 13.841
	Fund of Funds	0.141 12.393	-0.231 -14.046	0.271 50.927
	Fund Size	2 E-5 21.756	-1 E-5 -5.189	-1 E-5 -4.405
	Portfolio Turnover	-0.005 -27.030	-0.007 -26.196	-5 E-4 -1.474
	Team Managed	0.176 41.788	0.051 7.435	-0.034 -3.669
	Expense Ratio	-0.002 -16.556	-0.003 -16.936	0.001 4.617
	Market Concentration Index (HHI)	0.023 9.707	-0.084 -15.362	0.062 9.294
	Fund Age	0.002 15.41	0.001 11.541	0.001 5.911
Manager Characteristics	CFA	0.071 8.223	0.04 5.81	-0.27 -30.989
	Number of Current Funds Managed	-0.027 -4.753	-0.255 -43.576	-0.003 -0.464
	Number of Firm Movements	2 E-4 0.051	-0.034 -7.241	-0.056 -20.253
	Manager Age	0.01 26.634	0.006 7.622	0.003 2.886

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Exhibit 13 Raw Regression Results by Asset Class and Model (Continued)

Style	Market Beta	1 E-4	0.003	0.001
		0.565	12.439	5.285
	Momentum Beta	0.001	—	—
		6.868	—	—
	Size Beta	-0.001	5 E-4	-0.002
		-8.526	3.022	-7.779
	Value Beta	4 E-4	-0.001	2 E-4
		3.067	-2.011	0.9
	Credit Beta	—	0.001	-0.002
		—	5.137	-6.941
	Duration Beta	—	0.001	0.004
		—	2.423	12.434
Country	Australia & New Zealand	0.257	-1.08	1.018
		6.833	-20.295	26.043
	Asia Pacific	1.137	-0.941	-2.203
		37.8	-8.682	-4.307
	Belgium	0.399	-0.155	0.976
		11.117	-1.949	20.594
	Brazil	0.084	-0.571	-2.502
		1.261	-37.686	-5.088
	Canada	0.166	-1.304	0.862
		4.246	-19.904	25.125
	Finland	0.774	-1.48	0.921
		15.236	-34.943	14.33
	France	1.155	-0.453	1.027
		25.868	-9.412	24.784
	Germany	0.015	-0.846	0.011
		0.342	-26.432	0.145
	India	-0.288	-1.331	-0.151
		-10.222	-40.628	-3.501
	Israel	0.567	-0.398	0.931
		10.682	-9.024	12.126
	Italy	0.831	-0.607	0.842
		14.158	-19.549	22.878
	Luxembourg	0.723	-0.92	0.762
		17.86	-21.838	14.714
	Netherlands	0.179	-3.985	0.352
		5.046	-8.911	7.307
	Other Europe	0.567	-1.218	0.354
		14.139	-27.537	6.915
	Other Latin America	0.745	-0.528	0.227
		25.192	-10.179	4.697
	Poland	0.566	-1.471	-0.409
		15.195	-44.418	-11.707
	South Africa	-0.002	-0.956	0.141
		-0.077	-25.924	2.196

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Exhibit 13 Raw Regression Results by Asset Class and Model (Continued)

Market Beta	1 E-4	0.003	0.001
Spain	1.649	0.458	0.89
	34.252	8.759	21.713
Sweden	0.294	-1.752	0.401
	7.255	-18.578	7.717
United Kingdom	0.791	-1.028	0.4
	26.743	-21.982	7.682
United States	0.035	-1.776	0.155
	0.741	-41.476	2.976

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Exhibit 14 Coefficient Multiplication Factors for Chart Displays

Firm	Factor	Country or Region	Factor
Asset Weighted Manager Tenure	100	Asia Pacific	1
Top Ten Firm	1	Australasia	1
		Belgium	1
Fund Structure		Brazil	1
		Canada	1
Actively Managed	1	Finland	1
Socially Responsible Fund	1	France	1
Fund of Funds	1	Germany	1
Fund Size	1E+04	India	1
Turnover Ratio	100	Israel	1
Team Managed	1	Italy	1
Expense Ratio	100	Luxembourg	1
Market Concentration Index (HHI)	1	Netherlands	1
		Other Europe	1
Manager Characteristics		Other Latin America	1
CFA	1	Poland	1
Number of Current Funds	2	South Africa	1
Firm Movements	1	Spain	1
Manager Age	1	Sweden	1
		United Kingdom	1
Style Characteristics		United States	1
Market Beta	100		
Momentum Beta	100		
Size Beta	100		
Value Beta	100		
Credit Beta	100		
Term Beta	100		

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Exhibit 15 Change in Likelihood of Woman Fund Manager by Country/Region

Country	Equity %		Fixed Income %		Allocation %	
	Jan-2008	Dec-2015	Jan-2008	Dec-2015	Jan-2008	Dec-2015
Asia Pacific	183	134	-91	40	-100	11
Australasia	25	-30	-81	-8	358	91
Belgium	54	-9	-62	-25	64	78
Brazil	36	-60	-43	-36	-100	-100
Canada	28	-27	-89	-39	166	47
Finland	83	17	-82	-86	143	-42
France	238	57	-64	19	152	51
Germany	32	-53	-70	-43	56	-65
India	-27	-27	-77	-78	15	-44
Israel	40	19	-61	1	376	-20
Italy	171	-18	-69	-38	158	56
Luxembourg	103	11	-70	-30	170	-4
Netherlands	78	-37	-84	-85	294	12
Other Europe	84	-2	-84	-44	72	-31
Other Latin America	59	79	-66	25	205	-48
Poland	55	0	-74	-74	-14	-65
South Africa	-14	-21	-73	-47	37	-46
Spain	376	173	-29	141	60	58
Sweden	27	-26	-87	-46	213	-15
United Kingdom	86	54	-77	-37	61	-12
United States	15	-41	-90	-70	83	-41

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

Exhibit 16 Percentage of Women Fund Managers by Country

Country	Jan-2008	Dec-2008	Dec-2009	Dec-2010	Dec-2011	Dec-2012	Dec-2013	Dec-2014	Dec-2015
Australia & New Zealand	9.9	9.7	10.4	9.8	9.5	10.0	10.2	10.4	11.0
Belgium	14.8	14.1	12.6	11.2	13.0	14.0	13.4	12.8	13.1
Bermuda	14.3	13.9	21.1	19.5	17.9	16.7	16.3	12.2	12.5
Brazil	12.7	9.2	10.5	9.8	9.0	8.7	7.4	7.7	7.1
Canada	13.2	13.1	11.5	11.1	11.0	11.9	12.0	12.3	11.5
Chile	12.3	10.3	9.6	11.7	15.8	12.4	17.0	18.0	16.1
Denmark	10.4	12.6	13.2	13.1	12.9	13.4	12.4	13.0	13.2
Finland	16.0	16.7	16.5	17.2	16.1	15.8	15.2	13.7	12.9
France	21.1	21.0	20.9	21.2	21.3	21.1	22.0	20.7	20.9
Germany	12.0	11.7	11.3	10.8	10.5	10.0	9.9	10.0	9.0
Hong Kong	6.7	13.3	16.7	17.0	16.4	19.0	24.3	23.5	25.6
India	7.1	6.0	6.6	9.5	7.4	8.3	8.2	7.4	6.7
Ireland	13.3	13.4	14.4	14.2	13.3	13.0	12.0	11.8	11.5
Israel	22.2	20.6	22.8	22.9	23.3	22.4	21.4	17.5	19.3
Italy	20.9	21.0	21.5	22.4	20.7	21.2	18.4	19.4	17.0
Luxembourg	15.5	15.3	14.7	14.5	14.3	14.4	14.1	13.9	13.6
Mexico	13.3	14.6	11.1	13.3	13.3	13.3	13.1	15.0	14.5
Netherlands	13.1	9.4	7.5	8.5	9.2	13.3	12.5	12.3	11.7
Norway	10.6	11.6	12.0	11.1	11.0	12.1	11.3	13.9	11.9
Poland	8.2	6.2	7.3	7.8	6.7	6.7	6.7	6.7	6.7
Portugal	20.0	22.2	20.5	20.9	18.4	21.4	26.8	25.9	27.7
Singapore	27.3	25.0	25.4	27.3	26.7	27.9	28.4	28.0	29.7
South Africa	9.0	8.8	9.0	9.6	10.3	10.7	10.6	9.9	10.8
Spain	18.1	19.3	22.1	22.1	21.9	23.1	24.8	26.0	25.6
Sweden	11.9	10.8	10.8	10.9	12.4	14.5	13.4	12.9	12.2
Switzerland	12.1	12.1	11.8	11.1	11.5	11.9	10.5	9.9	9.5
United Kingdom	13.1	12.3	12.7	13.3	13.1	12.9	13.4	13.4	13.4
United States	11.4	11.0	10.9	10.9	10.4	10.1	9.8	9.7	9.7

Source: Morningstar, Inc. Data as of Dec. 31, 2015.

References

Our methodology uses the regression approach pioneered in Fama and MacBeth (1973) to easily calculate standard errors that correct for correlation across assets. Furthermore, using the approach found in Fama and MacBeth (1973), we are able to easily build models in which the independent variables change over time.

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