GLOBAL FINANCIAL STRATEGIES
www.credit-suisse.com

Form Follows Function

Organizational Structure and Investment Results

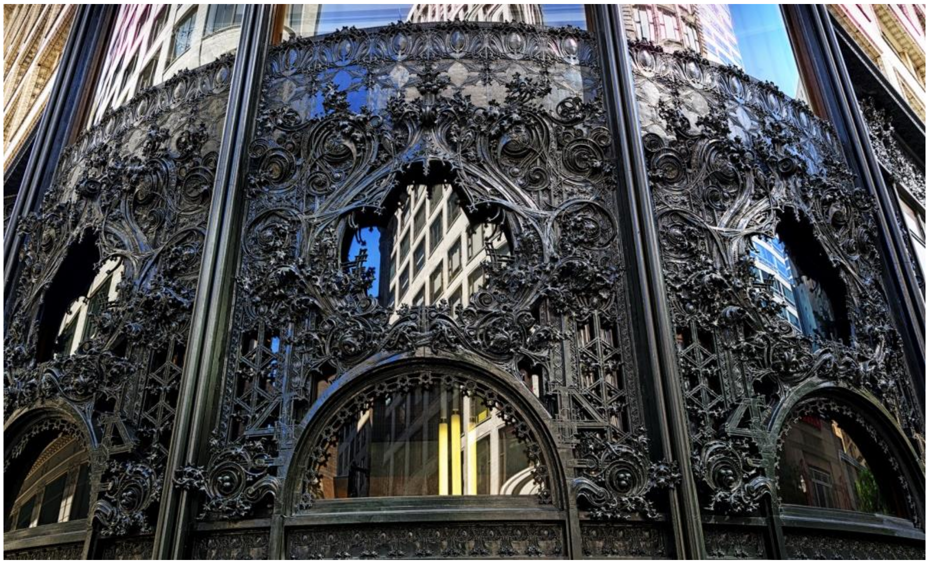
July 8, 2016

Authors

Michael J. Mauboussin
michael.mauboussin@credit-suisse.com

Dan Callahan, CFA
daniel.callahan@credit-suisse.com

Darius Majd
darius.majd@credit-suisse.com



Source: iStockphoto.
Note: Ironwork designed by Louis Sullivan.

"It is the pervading law of all things organic, and inorganic, of all things physical and metaphysical, of all things human and all things superhuman, of all true manifestations of the head, of the heart, of the soul, that the life is recognizable in its expression, that form ever follows function. This is the law."

Louis H. Sullivan[1]

- A thoughtful leader carefully considers how his or her firm seeks to add economic value and builds the organization to do so.
- Research suggests that the organization is more important than the individuals within it.
- Teams of three portfolio managers deliver higher gains, adjusted for risk, than funds managed by a single individual or by teams of other sizes.
- Informational diversity has a positive influence on performance and social category diversity has a modestly negative influence.
- Researchers find that funds run by analysts deliver higher returns than similar funds run by portfolio managers in the same firm.

FOR DISCLOSURES AND OTHER IMPORTANT INFORMATION, PLEASE REFER TO THE BACK OF THIS REPORT.

Introduction

Louis Sullivan, a modernist American architect who lived in the late 19th and early 20th century, popularized the phrase "form follows function." His point was that an architect should design a building to serve its intended function. The concept applies to organizations as well. A thoughtful leader carefully considers how his or her firm seeks to add economic value and builds the organization to do so. Our focus is on investment management companies.

In simple terms, an investment firm starts with data, which it seeks to refine into information. Analysts and portfolio managers then evaluate that information and identify securities that appear to be mispriced. Mispricings are absolute when price differs from value and relative when two securities are mispriced compared to one another. Portfolio managers then assemble securities in a portfolio. The goal is to generate attractive returns after considering risk. Organizations can do these tasks quantitatively, qualitatively, or through some blend of the two. See exhibit 1.

Exhibit 1: Possible Sources of Edge in an Investment Process

Data	**Information**	**Security Selection**	**Portfolio Construction**

Source: Credit Suisse.

There are multiple sources of possible edge throughout the process. Firms can gain access to better data than the competition or have means to refine that data into information that is superior to others. Other firms may rely on analysis or portfolio management to squeeze out an advantage. Quantitative approaches provide rigor and consistency. Fundamental approaches can benefit from specialization and identify instances where the rules-based approaches go wrong.

There are related aspects such as time horizon. Some investment firms seek many little anomalies and trade frequently to capitalize on them. Think Jim Simons and Renaissance Technologies. Others take a long view with a belief that large mispricings will evaporate over time. Think Warren Buffett and Berkshire Hathaway. Both firms have been successful but have radically different organizational structures.

The nature of the client base is also vital. Investors have a tendency to buy high and sell low, which means that the dollar-weighted rates of return for most funds are well below the time-weighted rates of return.[2] The types of clients an investment firm has and how they add or withdraw funds also has an influence on the organization and results of the firm.

Here is the main point: You should align every aspect of your organization to support the source of edge you perceive. Form follows function.

This is important because research shows that the organization is more important than the individuals within it.[3] Klaas Baks, a professor of finance at the Goizueta Business School at Emory University, used a standard economic model that considered managers and organizations as the factors of production and abnormal returns as the output. He studied more than 2,000 equity mutual funds and concluded that the organization explains about 70 percent of the difference between fund results and that the manager was only 30 percent.[4] While the relative contribution of the manager and the organization depends on your assumptions, the manager's contribution is less than half in nearly all situations.

Further supporting this argument is evidence that the performance of investment professionals drops off sharply when they switch firms.[5] One of the main reasons for this performance degradation is that professionals leave behind "firm specific human capital"—essentially a set of resources, methods, culture, informal networks, and talented co-workers—that supports and augments their own capabilities. Notwithstanding the evidence of the importance of the organization, 85 percent of analysts that researchers interviewed believed that their performance on the job was independent of their employers and hence considered their skills to be portable.

Academics have looked carefully at organizational structure and have concluded that it is important in determining both strategy and performance.[6] One dimension researchers studied was hierarchy, defined as "the distinct number of layers of the structure of the fund." For example, a fund with a chief executive officer, a chief investment officer, a head of fixed income, a portfolio manager, and analysts would have five layers. The research shows that each additional layer an investment firm has reduces average performance.

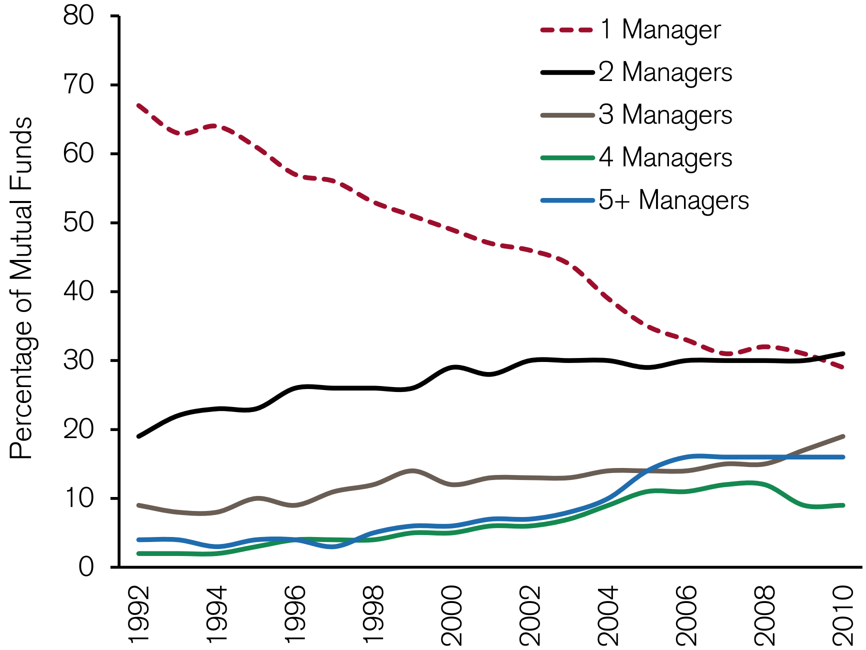
The rest of this report draws on research to highlight various aspects of organizational structure. We discuss the role of team size in success in managing portfolios, how team composition affects performance, the difference in performance between funds run by analysts and portfolio managers within the same firm, and which sources of input are most useful to portfolio managers. The goal is to prompt an assessment of your own organization. Where do you create value? Are there changes you can make to align your structure with your objectives more effectively?

Portfolio Management Team Size

The shift from single- to team-managed equity mutual funds is one of the biggest changes in the money management business in the U.S. in the last quarter century. Exhibit 2 shows that about 70 percent of equity mutual funds had a single manager in the early 1990s and that teams manage close to three-quarters of funds today. Further, the members are anonymous in about 20 percent of funds run by teams.[7]

From the point of view of a fund company, having a single manager run a fund has pros and cons. The pros are that it is easier to market a fund with a superstar manager, and indeed the inflows for named managers exceed those of funds run anonymously. Single managers may also have a greater incentive to perform than a member of a team because he or she is personally accountable for the fund's results. Further, funds run by one individual have higher fees.[8] The cons are that single managers seek to capture more of the fund's economics and take on more risk than team-managed funds do.

Exhibit 2: Mutual Funds Shift from One to Multiple Managers



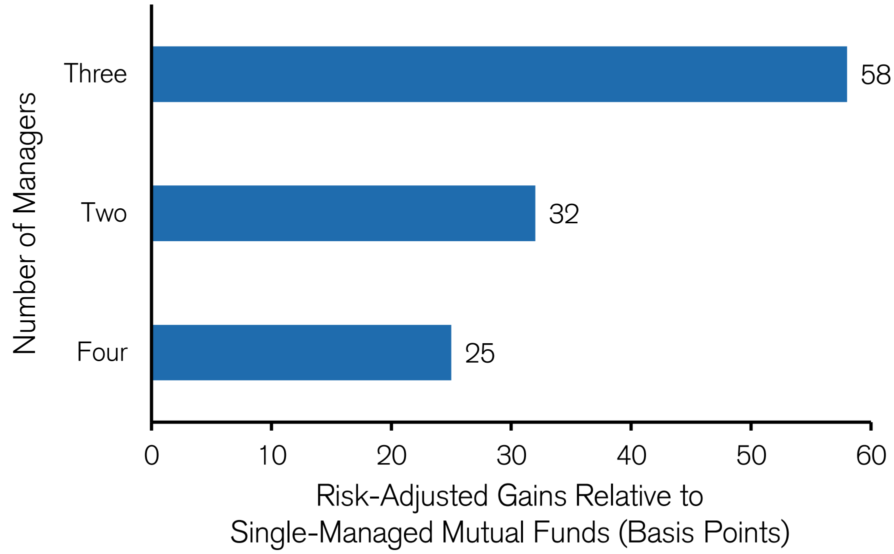
Source: Saurin Patel and Sergei Sarkissian, "To Group or Not to Group? Evidence from Mutual Fund Databases," Journal of Financial and Quantitative Analysis, *Forthcoming, 2016.*

Prior studies showed that funds run by teams had returns that were comparable or slightly lower than funds run by individuals.[9] Team-run funds are also generally less risky.[10] The difficulty in completing this analysis properly is the accuracy with which the performance monitoring groups, including Morningstar and The Center for Research in Security Prices (CRSP), report the data.

New research by Saurin Patel and Sergei Sarkissian, professors of finance, corrected this data issue and then re-examined the performance of various sizes of teams relative to single-managed funds.[11] Exhibit 3 summarizes their findings. They show that the highest gains, adjusted for risk, come from teams of three members. From there, there is a substantial drop to two-person teams and finally, teams of four. (The numbers for teams of five or more are similar to those of three, but the researchers found they could draw no sound conclusions because the sample size was too small.)

It is interesting to note that a team with an odd number of members is at the top of the list. Having three team members allows sufficient diversity to entertain and vet multiple points of views and has a built-in mechanism to break ties.

Exhibit 3: Team-Managed Funds Relative to Single-Managed Funds (Annual Returns)



Source: Saurin Patel and Sergei Sarkissian, "To Group or Not to Group? Evidence from Mutual Fund Databases," Journal of Financial and Quantitative Analysis*, Forthcoming, 2016.*

As they examined the data more closely, Patel and Sarkissian realized that only the teams in large metropolitan areas outperformed the single managers.[12] The idea is that larger cities have higher employee skills and productivity than smaller ones, which create favorable conditions for team results.[13] So it is not simply a team that makes a difference. It is a team that has the requisite characteristics.

The work by Patel and Sarkissian prompts an assessment of the structure of portfolio management teams for investment firms that rely on a fundamental approach to security selection. Prior research of portfolio manager results shows that those who attended more selective colleges or universities generated better returns.[14] While the era of the single-managed fund has been fading for decades, only recent work shows that teams deliver better results than individuals do under certain conditions, as well as which team size is most effective. We now turn to the topic of how to construct a team to get the highest probability of success.

Team Composition

Groups are effective at making decisions when the views of team members are diverse and there is a mechanism to aggregate those views.[15] Diverse teams have the potential to add value when the members have different information, the information and models of the members are relevant to the problem at hand, and there is sufficient communication.[16] Promoting diversity within an organization and managing it effectively are separate tasks. As leading researchers have noted, "To implement policies and practices that increase the diversity of the workforce without understanding how diverse individuals can come together to form effective teams is irresponsible."[17]

Organizational theorists who study diversity distinguish between social category diversity, which is often what organizations consider when they assess the issue, and informational diversity.[18] Social category diversity includes differences in gender, age, ethnicity, religion, and sexual orientation. Informational diversity focuses on variability in education, experience, training, and abilities. Exhibit 4 provides a brief summary of the variables for each type of diversity.

Exhibit 4: Variables and Proxies for Social Category and Informational Diversity

	Social category		Informational
Variables:	Gender	Variables:	Education
	Age		Experience
	Race		Functional knowledge
	Ethnicity		Expertise
	Religion		Training
	Sexual orientation		Abilities
Proxies:	Gender	Proxies:	Education (degree level)
	Age		Industry tenure

Source: Karen A. Jehn, Gregory B. Northcraft, and Margaret A. Neale, "Why Differences Make a Difference: A Field Study of Diversity, Conflict, and Performance in Workgroups," Administrative Science Quarterly, *Vol. 44, No 4, December 1999, 741-763. Also, Michaela Bär, Alexandra Niessen, and Stefan Ruenzi, "The Impact of Work Group Diversity on Performance: Large Sample Evidence from the Mutual Fund Industry,"* Center for Financial Research Working Paper No. 07-16*, September 2007.*

Informational diversity generally contributes to the team's ability to add value because the team reveals and examines different points of view. The role of social category diversity is less clear. Social category diversity adds value when it is a proxy for informational diversity and when group communication is effective. However, if social category diversity leads to diminished group communication and members fail to reveal their unshared information, team performance suffers.

Researchers used this framework to test the impact of each type of diversity on the results for teams that manage U.S. equity mutual funds.[19] Because they could measure neither type of diversity readily, they developed proxies for each. The researchers used gender and age as proxies for social category diversity and education level and industry tenure as proxies for informational diversity (see Exhibit 4).

They applied these measures to 2,260 teams from 1996 to 2003. Investment teams are a good test ground for diversity because the task is clear, there are a large number of decisions that go into managing a portfolio, and the environment is consistent. They found that informational diversity has a positive influence on performance and that social category diversity has a modestly negative influence. The drag of social category diversity is the result of gender diversity, as age diversity had no significant impact. The researchers found, for example, that a single-gender team would outperform a team consisting of three males and one female by 122 basis points per year.

Gender diversity's negative impact on portfolio results requires some additional discussion. To begin, it is important to recognize that globally only 15 percent of portfolio managers are women, with a high of 32 percent in Asia to a low of 11 percent in Latin America.[20] The diversity research shows that being a token within a group, for example one woman among men or one man among women, tends to be counterproductive.[21]

Studies of a large number of mutual and hedge funds show no difference in average performance but that men generally have a higher standard deviation of results than women do and are more overconfident.[22]

Gender diversity likely fails to add value for a couple of reasons. The first is that women remain underrepresented in portfolio management and hence face the challenge of critical mass. Second, research shows that there remains bias against women.[23] For instance, women-run funds have lower inflows than their male counterparts, fail at a higher rate because of an inability to raise funds, and receive less media attention.

This discussion underscores the point that promoting diversity in the workplace without instructing employees how to manage it properly ultimately does a disservice to all. There is nothing magical about a team. You must assemble it properly, in terms of both size and composition, and manage it effectively to derive the benefits.

Analyst-Run Funds within Fund Families

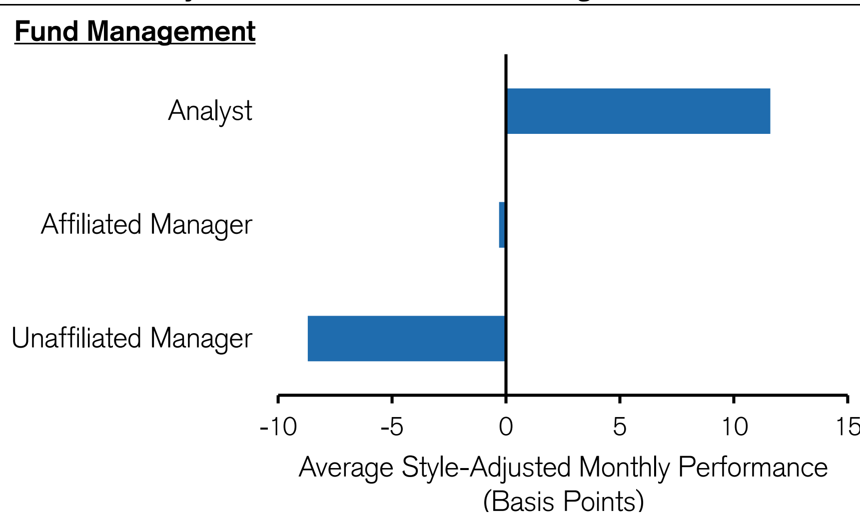
In most investment management firms that rely on fundamental analysis, analysts evaluate securities and recommend that portfolio managers buy or sell them. Portfolio managers, in turn, generally share in the analysis and create portfolios in an effort to deliver excess returns. Analysts are mostly responsible for security selection, or finding edge. Portfolio managers are mostly responsible for portfolio construction, or figuring out how best to capitalize on that edge.

The first question is whether buy-side analysts have demonstrated skill. Some studies show that analysts contribute to excess returns for portfolios and others suggest they do not.[24] Much of this research is based on the data from a single global asset manager.

Gjergji Cici and Claire Rosenfeld, professors of finance, took a novel approach to assess the skill of buy-side analysts.[25] They looked at results for 68 nontraditional funds run exclusively by analysts (roughly half, we estimate, are Fidelity Select funds) at 14 mutual fund families over a decade. This approach allowed them to examine actual investment decisions of buy-side analysts rather than just their recommendations.

Cici and Rosenfeld found that the funds run by the analysts delivered higher returns than funds with similar characteristics run by portfolio managers in the same firm. They labeled a portfolio manager in the same firm as an "affiliated manager." Exhibit 5 summarizes their finding. They also found that the analyst-run funds outperformed comparable unaffiliated managers.

Exhibit 5: Performance of Analyst-Run versus Portfolio Manager-Run Funds



Source: Gjergji Cici and Claire Rosenfeld, "A Study of Analyst-Run Mutual Funds: The Abilities and Roles of Buy-Side Analysts," Journal of Empirical Finance*, Vol. 36, March 2016, 8-29.*

What is going on? First, the researchers showed that some mutual fund families have more skilled analysts than others, leading to better results for the funds run by both analysts and portfolio managers. Second, they found that portfolio managers who rely on analyst ideas do better than those who do not. It turns out that how much portfolio managers use analyst recommendations is a function of tenure. The longer a portfolio manager has been around, the less likely he or she is to listen to the analysts. While it is plausible to assume that the more seasoned managers add value through their experience, the data suggest that they would be better off sticking to the recommendations of the analysts.

Analyst funds are also smaller on average than manager funds and have lower expense ratios. These factors also contribute to relative performance.

One element that Cici and Rosenfeld do not emphasize but is worthy of consideration is portfolio construction. Analyst-run funds are usually sector neutral. Hence, they rely almost exclusively on stock selection for excess returns. By contrast, manager-run funds commonly have sector tilts. Disaggregating security selection and portfolio construction in performance attribution is particularly important.

To Whom Should Portfolio Managers Listen?

Portfolio managers get information from their internal analysts as well as external analysts. Sell-side research, while shrinking, remains a big business. For example, the global budget for sell-side equity research was $8.2 billion in 2007 and is expected to be 40 percent of that amount in 2017.[26] How do portfolio managers balance recommendations from the inside and outside?

Researchers examined this question and found that portfolio managers place an average weight of over 70 percent on buy-side analysts, less than 25 percent on sell-side analysts, and less than 5 percent on independent research.[27] The study considered the decisions of portfolio managers of more than 1,000 funds over a 3-year span. There is evidence that mutual fund trades follow sell-side recommendations to some degree and that those recommendations are informative.[28]

Portfolio managers rely more on their own analysts as the average number of sell-side analysts following a stock declines, the average error in sell-side forecasts for a company expands, and as the standard deviation of sell-side analyst estimates rises.

When asked about how they use the sell-side analysts, buy-side professionals suggest that they value experience following a company, which includes deep industry knowledge and frequent communication with management.[29] However, buy-side analysts generally have a longer time horizon than those on the sell-side. More than 80 percent of buy-side analysts said their time horizon was longer than one year, and a quarter of them suggested it was beyond three years. Most sell-side recommendations use one-year target prices.

The reliance on internal versus external sources is relevant to the discussion about form and function. An investment firm that can secure external sources for data or information that add value and are cost effective requires fewer resources internally. That said, leaders of investment firms must constantly monitor the trade-offs between in-house and external input into the investment process.

Conclusion

It is a challenge for active money managers to generate excess returns. Central to developing the skill to do so is a process that identifies and exploits market mispricings. There are many possible ways of finding edge, from the short-term signal that Renaissance Technologies gathers to the long-term value that Berkshire Hathaway seeks. But in all cases, it is essential to align your resources—people, process, and capital—to serve your source of edge. In other words, consider how you intend to achieve your objective and consider how to organize your firm to do so most effectively.

An honest appraisal of most investment firms reveals at least some mismatch between form and function, if for no other reason than organizational inertia. This report shares academic research that may shed some light on what works. Teams of the proper size and construction can outperform single managers. Analyst-run funds can outperform portfolio manager-run funds, especially if the managers stop heeding the analysts. And the trade-off between internal and external sources of information relies on what your firm needs and values.

Endnotes

[1] Louis H. Sullivan, "The Tall Office Building Artistically Considered," *Lippincott's Magazine*, March 1896, 404-409.
[2] Ilia D. Dichev, "What Are Investors' Actual Historical Returns? Evidence from Dollar-Weighted Returns," *American Economic Review,* Vol. 97, No. 1, March 2007, 386-401; Andrea Frazzini and Owen A. Lamont, "Dumb Money: Mutual Fund Flows and the Cross-Section of Stock Returns," *Journal of Financial Economics*, Vol. 88, No. 2, May 2008, 299-322.
[3] Klaas P. Baks, "On the Performance of Mutual Fund Managers," *Working Paper*, June 2003.
[4] Mark Hulbert, "The Star Manager May Have a Minor Role," *New York Times,* July 6, 2003.
[5] Boris Groysberg, *Chasing Stars: The Myth of Talent and the Portability of Performance* (Princeton, NJ: Princeton University Press, 2010).
[6] Massimo Massa and Lei Zhang, "The Effects of Organizational Structure on Asset Management," *Working Paper*, February 1, 2008.
[7] Massimo Massa, Jonathan Reuter, and Eric Zitzewitz, "When Should Firms Share Credit with Employees? Evidence from Anonymously Managed Mutual Funds," *Journal of Financial Economics*, Vol. 95, No. 3, March 2010, 400-424.
[8] Richard T. Bliss, Mark E. Potter, and Christopher Schwarz, "Performance Characteristics of Individually-Managed versus Team-Managed Mutual Funds," *Journal of Portfolio Management*, Vol. 34, No. 5, Spring 2008, 110-119.
[9] Joseph Chen, Harrison Hong, Wenxi Jiang, and Jeffrey Kubik, "Outsourcing Mutual Fund Management: Firm Boundaries, Incentives, and Performance," *Journal of Finance*, Vol. 68, No. 2, April 2013, 523–558; Michaela Bär, Alexander Kempf, and Stefan Ruenzi, "Is a Team Different from the Sum of Its Parts? Evidence from Mutual Fund Managers," *Review of Finance*, Vol. 15, No. 2, April 2011, 359-396; and Larry J. Prather and Karen L. Middleton, "Are N+1 Heads Better Than One? The Case of Mutual Fund Managers," *Journal of Economic Behavior and Organization*, Vol. 47, No. 1, January 2002, 103-120.
[10] Iordanis Karagiannidis, "The Effect of Management Team Characteristics on Risk-Taking and Style Extremity of Mutual Fund Portfolios," *Review of Financial Economics*, Vol. 21, No. 3, September 2012, 153-158.
[11] Saurin Patel and Sergei Sarkissian, "To Group or Not to Group? Evidence from CRSP, Morningstar Principia, and Morningstar Direct Mutual Fund Databases," *Journal of Financial and Quantitative Analysis*, Forthcoming, 2016.
[12] Saurin Patel and Sergei Sarkissian, "Teams, Location, and Productivity," *Working Paper*, April 15, 2016.
[13] Luís M. A. Bettencourt, José Lobo, Dirk Helbing, Christian Kühnert, and Geoffrey B. West, "Growth, Innovation, Scaling, and the Pace of Life in Cities," *Proceedings of the National Academy of Sciences*, Vol. 104, No. 17, April 24, 2007, 7301-7306.
[14] Judith Chevalier and Glenn Ellison, "Are Some Mutual Fund Managers Better than Others? Cross-Sectional Patterns in Behavior and Performance," *Journal of Finance*, Vol. 54, No. 3, June 1999, 875-899.
[15] Scott E. Page, *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies* (Princeton, NJ: Princeton University Press, 2007); Michael J. Mauboussin and Dan Callahan, "Building An Effective Team: How to Manage a Team to Make Good Decisions," *Credit Suisse Global Financial Strategies*, January 8, 2014.
[16] Edward P. Lazear, "Globalisation and the Market for Team-Mates," *Economic Journal*, Vol.109, No. 454, March 1999, 15-40.
[17] Elizabeth Mannix and Margaret A. Neale, "What Differences Make a Difference? The Promise and Reality of Diverse Teams in Organizations," *Psychological Science in the Public Interest*, Vol. 6, No. 2, October 2005, 31-55.

[18] Karen A. Jehn, Gregory B. Northcraft, and Margaret A. Neale, "Why Differences Make a Difference: A Field Study of Diversity, Conflict, and Performance in Workgroups," *Administrative Science Quarterly*, Vol. 44, No 4, December 1999, 741-763.
[19] Michaela Bär, Alexandra Niessen, and Stefan Ruenzi, "The Impact of Work Group Diversity on Performance: Large Sample Evidence from the Mutual Fund Industry," *Center for Financial Research Working Paper No. 07-16*, September, 2007.
[20] "Women in the Financial Services Industry," *Oliver Wyman*, 2016, 75. A report for the U.S. only shows that less than 10 percent of fund managers are women. See Laura Pavlenko Lutton and Erin Davis, "Funds Managed by Women," *Morningstar Research Report*, June 2015.
[21] Iris Bohnet, *What Works: Gender Equality By Design* (Cambridge, MA: Belknap Press, 2016); Vicki W. Kramer, Alison M. Konrad, Sumru Erkut, and Michele J. Hooper, "Critical Mass on Corporate Boards: Why Three or More Women Enhance Governance," *Directors Monthly*, February 2007, 19–22.
[22] Alexandra Niessen and Stefan Ruenzi, "Sex Matters: Gender and Mutual Funds," *Center for Financial Research Working Paper No. 06-01*, March, 2006; Rajesh Aggarwal and Nicole M. Boyson, "The Performance of Female Hedge Fund Managers," *Review of Financial Economics*, Vol. 29, April 2016, 23-36; Richard T. Bliss and Mark E. Potter, "Mutual Fund Managers: Does Gender Matter?" *Journal of Business and Economic Studies*, Vol. 8, No. 1, 2002, 1–15; Stanley M. Atkinson, Samantha Boyce Baird, and Melissa B. Frye, "Do Female Mutual Fund Managers Manage Differently?" *Journal of Financial Research*, Vol. 26, No. 1, Spring 2003, 1–18; Brad M. Barber and Terrance Odean, "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment," *Quarterly Journal of Economics,* Vol. 116, No. 1, February, 2001, 261-292; and Christi R. Wann and Bento J. Lobo, "Gender-Based Trading: Evidence from a Classroom Experiment," *Journal of Economics and Finance Education*, Vol. 9, No. 2, Winter 2010, 54-61.
[23] Alexandra Niessen-Ruenzi and Stefan Ruenzi, "Sex Matters: Gender and Prejudice in the Mutual Fund Industry," *Working Paper*, May 2013.
[24] Boris Groysberg, Paul Healy, and George Serafeim, "The Stock Selection and Performance of Buy-Side Analysts," *Management Science*, Vol. 59, No. 5, May 2013, 1062-1075; Stefan Frey and Patrick Herbst, "The Influence of Buy-Side Analysts on Mutual Fund Trading," *Journal of Banking and Finance*, Vol. 49, December 2014, 442-458; and Michael Rebello and Kelsey D. Wei, "A Glimpse Behind a Closed Door: The Long-Term Investment Value of Buy-Side Research and Its Effect on Fund Trades and Performance," *Journal of Accounting Research*, Vol. 52, No. 3, June 2014, 775-815.
[25] Gjergji Cici and Claire Rosenfeld, "A Study of Analyst-Run Mutual Funds: The Abilities and Roles of Buy-Side Analysts," *Journal of Empirical Finance*, Vol. 36, March 2016, 8-29.
[26] C.R., "Analysts Beware: Regulating Equity Research," *Economist: Schumpeter Blog,* May 16, 2014.
[27] Yingmei Cheng, Mark H. Liu, and Jun Qian, "Buy-Side Analysts, Sell-Side Analysts, and Investment Decisions of Money Managers," *Journal of Financial and Quantitative Analysis*, Vol. 41, No. 1, March 2006, 51-83.
[28] Jeffrey A. Busse, T. Clifton Green, and Narasimhan Jegadeesh, "Buy-Side Trades and Sell-Side Recommendations: Interactions and Information Content," *Journal of Financial Markets*, Vol. 15, No. 2, May 2012, 207-232.
[29] Lawrence D. Brown, Andrew C. Call, Michael B. Clement, and Nathan Y. Sharp, "Skin in the Game: The Inputs and Incentives that Shape Buy-Side Analysts' Stock Recommendations," *Working Paper*, October 2014.

Important information

This document was produced by and the opinions expressed are those of Credit Suisse as of the date of writing and are subject to change. It has been prepared solely for information purposes and for the use of the recipient. It does not constitute an offer or an invitation by or on behalf of Credit Suisse to any person to buy or sell any security. Nothing in this material constitutes investment, legal, accounting or tax advice, or a representation that any investment or strategy is suitable or appropriate to your individual circumstances, or otherwise constitutes a personal recommendation to you. The price and value of investments mentioned and any income that might accrue may fluctuate and may fall or rise. Any reference to past performance is not a guide to the future.

The information and analysis contained in this publication have been compiled or arrived at from sources believed to be reliable but Credit Suisse does not make any representation as to their accuracy or completeness and does not accept liability for any loss arising from the use hereof. A Credit Suisse Group company may have acted upon the information and analysis contained in this publication before being made available to clients of Credit Suisse. Investments in emerging markets are speculative and considerably more volatile than investments in established markets. Some of the main risks are political risks, economic risks, credit risks, currency risks and market risks. Investments in foreign currencies are subject to exchange rate fluctuations. Before entering into any transaction, you should consider the suitability of the transaction to your particular circumstances and independently review (with your professional advisers as necessary) the specific financial risks as well as legal, regulatory, credit, tax and accounting consequences. This document is issued and distributed in the United States by Credit Suisse Securities (USA) LLC, a U.S. registered broker-dealer; in Canada by Credit Suisse Securities (Canada), Inc.; and in Brazil by Banco de Investimentos Credit Suisse (Brasil) S.A.

This document is distributed in Switzerland by Credit Suisse AG, a Swiss bank. Credit Suisse is authorized and regulated by the Swiss Financial Market Supervisory Authority (FINMA). This document is issued and distributed in Europe (except Switzerland) by Credit Suisse (UK) Limited and Credit Suisse Securities (Europe) Limited, London. Credit Suisse Securities (Europe) Limited, London and Credit Suisse (UK) Limited, authorised by the Prudential Regulation Authority (PRA) and regulated by the Financial Conduct Authority (FCA) and PRA, are associated but independent legal and regulated entities within Credit Suisse. The protections made available by the UK's Financial Services Authority for private customers do not apply to investments or services provided by a person outside the UK, nor will the Financial Services Compensation Scheme be available if the issuer of the investment fails to meet its obligations. This document is distributed in Guernsey by Credit Suisse (Guernsey) Limited, an independent legal entity registered in Guernsey under 15197, with its registered address at Helvetia Court, Les Echelons, South Esplanade, St Peter Port, Guernsey. Credit Suisse (Guernsey) Limited is wholly owned by Credit Suisse and is regulated by the Guernsey Financial Services Commission. Copies of the latest audited accounts are available on request. This document is distributed in Jersey by Credit Suisse (Guernsey) Limited, Jersey Branch, which is regulated by the Jersey Financial Services Commission. The business address of Credit Suisse (Guernsey) Limited, Jersey Branch, in Jersey is: TradeWind House, 22 Esplanade, St Helier, Jersey JE2 3QA. This document has been issued in Asia-Pacific by whichever of the following is the appropriately authorised entity of the relevant jurisdiction: in Hong Kong by Credit Suisse (Hong Kong) Limited, a corporation licensed with the Hong Kong Securities and Futures Commission or Credit Suisse Hong Kong branch, an Authorized Institution regulated by the Hong Kong Monetary Authority and a Registered Institution regulated by the Securities and Futures Ordinance (Chapter 571 of the Laws of Hong Kong); in Japan by Credit Suisse Securities (Japan) Limited; elsewhere in Asia/Pacific by whichever of the following is the appropriately authorized entity in the relevant jurisdiction: Credit Suisse Equities (Australia) Limited, Credit Suisse Securities (Thailand) Limited, Credit Suisse Securities (Malaysia) Sdn Bhd, Credit Suisse AG,Singapore Branch,and elsewhere in the world by the relevant authorized affiliate of the above.

This document may not be reproduced either in whole, or in part, without the written permission of the authors and CREDIT SUISSE.

© 2016 CREDIT SUISSE GROUP AG and/or its affiliates. All rights reserved