

TOULOUSE ECONOMISTS ON **Asset Management**

ANNUAL REPORT 2016-17

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Amundi
ASSET MANAGEMENT

Toulouse
School
of Economics

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EXPERTS IN PARTNERSHIP

As the largest asset manager in Europe, Amundi is naturally concerned with responsible investment. As part of its cultural identity, but also because of its size, Amundi is bound to consider the broad impact of capital investments on society or, as economists would say, to internalize possible investment externalities.

TSE is a first-class academic player in the world of sustainable finance, behavioral finance, and environmental economics. Many TSE researchers are world experts in long-term asset valuation, climate change, investor behavior, and the economics of natural resources.

A partnership between Amundi and TSE on asset management and responsible investments strengthens our mutual expertise. We currently focus on three main topics. First, on responsible investment, how can finance become a tool for improving our society, and how should we take into account the well-being of future generations? The second theme is linked to behavioral finance: how understanding the behavior of individual investors can help asset managers to better serve their clients and to identify investment opportunities. Third, how long-term investment is deeply intertwined with risks associated with natural resources, and in particular with access to water.

TSE and Amundi have begun a rich discussion of these topics, and the following pages will give you examples of recent exchanges. Christian Gollier discusses his research on long-term risk in financial markets, showing how the fundamental uncertainty surrounding the distant future requires a radical rethinking of our standard asset valuation models. Sebastien Pouget presents his research on how we should think about the risk and returns of socially responsible investments, and how responsible investment can outperform traditional investment strategies. Milo Bianchi talks about his research on financial literacy and portfolio choices, documenting that some investors have a poor understanding of basic financial principles, and these investors rebalance their portfolios in ways that could be highly detrimental for their long-term wealth accumulation.

We look forward to seeing this fertile partnership yield even more fruit, which I am sure will be exciting both for the academic and for the investment community!



Milo Bianchi (TSE researcher)
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MEET THE RESEARCHERS

World-class economics

In the fast-changing landscape of today's financial markets, Amundi representatives can draw directly on the knowledge networks, nuanced opinion and latest discoveries of TSE's research hub.

Here, we present some of the leading economists involved in the partnership.



MARIANNE ANDRIES

An assistant professor in finance, Marianne joined TSE in 2012. Her areas of interest are asset pricing and behavioral finance theory.

After working as an investment banker, she did her PhD in finance at Chicago University. She was a visiting researcher at Banque de France in 2016-2017.



MILO BIANCHI

Formerly an associate professor at Paris-Dauphine University, Milo has been a TSE researcher since 2013. A junior member of the Institut Universitaire de France, he also won the 2014 AFSE Malinvaud Prize for best published paper among economists under age 40. With a PhD from Stockholm School of Economics, his interests include financial and behavioral economics and corporate finance.



RENÉ GARCIA

After several years at EDHEC Business School as a Chair professor in Finance, René has recently rejoined Montreal University where he taught econometrics and finance from 1991 until 2007.

A graduate of ESSEC with a PhD from Princeton, he is the co-founder and former editor-in-chief of the Journal of Financial Econometrics. His research interests include the valuation of financial assets, portfolio and risk management, nonlinear and regime-switching models.



CHRISTIAN GOLLIER

Alongside Jean Tirole, Christian created TSE and subsequently served as director. His interests include decision theory under uncertainty, environmental economics, finance, investment, consumption theory, insurance and cost-benefit analysis. Christian has published over 100 articles in top-tier journals and seven books including The Economics of Risk and Time, winner of the 2001 Paul A Samuelson Award. He is also a knight of the Legion of Honor.



ALEXANDER GUEMBEL

Alexander is a professor of finance at the Toulouse School of Management, where he is affiliated with CRM and TSE. Alexander's research in finance focuses on incentive problems and information aggregation. He was visiting Professor at London Business School. His work has been published in the Journal of Finance, Review of Economic Studies, European Economic Review and the Journal of the European Economic Association.



NOUR MEDDAHI

After 10 years' teaching at Montreal University, Nour became a TSE professor in 2013, returning to the city where he earned his PhD. He is also an associate editor of the Journal of Business and Economics Statistics. His research interests include financial econometrics, econometrics, time-series, asset pricing and risk management.



SÉBASTIEN POUGET

Professor of finance at University of Toulouse Capitole and Director of Research Partnerships at TSE, Sébastien has also taught asset management and behavioral finance at Princeton. He studies financial markets using a multidisciplinary approach that combines insights from economics, psychology and history. His research has been published in international academic journals such as the Journal of Finance, Econometrica, Management Science and the Review of Economic Studies. He is co-director of the research center on Sustainable Finance and Responsible Investment (FDIR chair).



ARNAUD REYNAUD

Deputy director of the TSE-R research program, Arnaud is also research director at INRA (French Institute for Research in Agriculture). He is a natural resource economist with a strong specialization in water economics. He has worked on dynamic models for water allocation across heterogeneous agents and has conducted research for the Joint Research Centre of the European Commission. He won the Quality of Research Discovery Award by the American Association of Agricultural Economics in 2006.



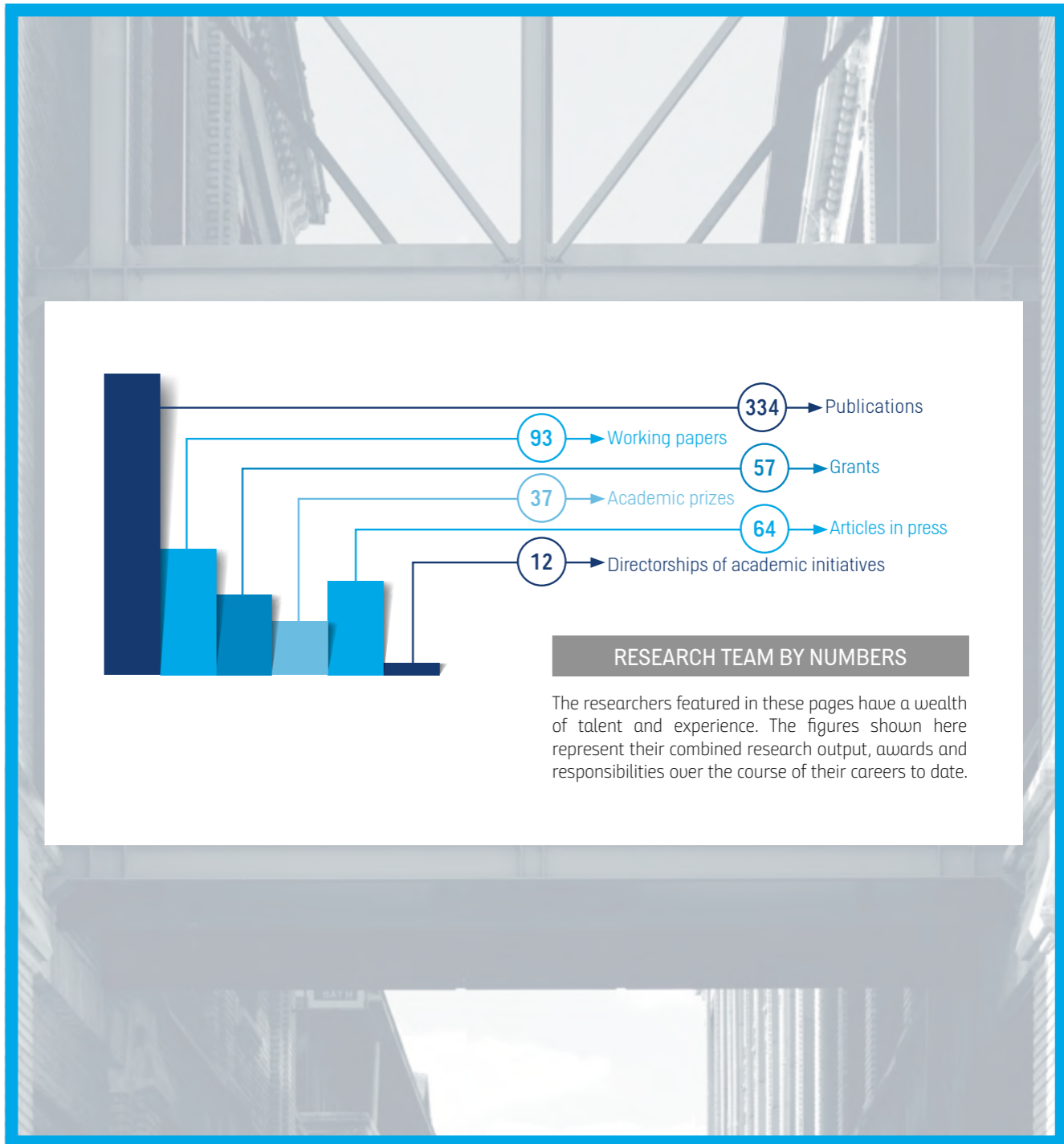
NICOLAS TREICH

A research director at INRA (French Institute for Research in Agriculture), Nicolas combines his work at TSE with his position as co-editor-in-chief of the Geneva Risk and Insurance Review. His research concerns risk and decision theory, environmental economics and benefit-cost analysis. He has published several scientific papers including some on the precautionary principle, the value of statistical life and climate policy. He has organized several international conferences, and has written various broad audience papers and reports on risk policy issues.



STÉPHANE VILLENEUVE

Professor of applied mathematics and dean of the mathematics department at University of Toulouse Capitole, Stéphane is also affiliated with the Centre for Research in Management (CNRS) and TSE. He coordinates the Market Risk and Value Creation Chair, sponsored by SCOR under the aegis of the Fondation du Risque. His research focuses on stochastic methods in finance and more recently on their applications in dynamic contracting.



PARTNERS IN ACTION

Make research relevant for Society

Amundi representatives can access cutting-edge economic research and interact with TSE members at regular events organized by the partnership. Structured around key research themes, here we feature some of the partnership's recent activities and relevant publications.

TO FIND OUT MORE ABOUT THE PARTNERSHIP:
www.idei.fr/contract/amundi



SOME RECENT RESEARCH

- **Milo Bianchi** "Financial Literacy and Portfolio Dynamics", *Journal of Finance*, forthcoming
- **Milo Bianchi** (with Jean-Marc Tallon) "Ambiguity Preferences and Portfolio Choices: Evidence from the Field", *Management Science*, forthcoming
- **René Garcia** (with Jean-Sébastien Fontaine and Sermin Gungor) (2016), "Funding Liquidity, Market Liquidity and the Cross-section of Stock Returns"
- **René Garcia** (with Caio Almeida, Kym Ardison, and Jose Vicente) (2017), "Non-Parametric Tail Risk, Stock Returns and the Macroeconomy", *Journal of Financial Econometrics*, 15-3, 333-376
- **Christian Gollier** (2017), "Ethical asset valuation and the good society", *Columbia University Press*
- **Christian Gollier** (with Dietz, S. and L. Kessler) (2017), "The climate beta", *Journal of Environmental Economics and Management*, forthcoming
- **Sébastien Pouget and Stéphane Villeneuve**, "A Mind is a Terrible Thing to Change: Confirmatory Bias in Financial Markets" (with Julien Sauvagnat), *The Review of Financial Studies*, 30-6, 2066-2109
- **Arnaud Reynaud** (with Fabio Farinosi et al) "An innovative approach to the assessment of hydro-political risk: a spatially explicit, data driven indicator of hydro-political issues"
- **Arnaud Reynaud** (with Mathieu Couttenier and Raphael Soubeyran) "Cooperation and Conflict in International River Basins: Findings from an Empirical Analysis"
- **Nicolas Treich** (with Matthew Adler et al.) (2017), "Priority for the worse off and the social cost of carbon", *Nature Climate Change*, forthcoming



DEDICATED WORKSHOPS AND TALKS



- "Socially Responsible Investment" / *Amundi*, December 8, 2016
 - Christian Gollier (TSE) : Long-term risk and return in financial markets
 - Sébastien Pouget (TSE) : Performance drivers behind responsible investments
- "Institutional Investors as Active Owners" / *TSE*, July 6, 2017
 - Marie Brière (Amundi) and Sébastien Pouget (TSE) : BlackRock vs Norway Fund at Shareholder Meetings: An Empirical Analysis of Disagreement in the Governance of Corporations
- "Sustainable and Responsible Asset Management in a Challenging Environment" / *Amundi*, November 14, 2017
 - Jean Tirole (TSE)
- "Asset Allocation and Factor Investing" / *Amundi*, June 7, 2017
 - Sylvain Chassang (New York University) : Mostly Prior-Free Asset Allocation
 - Philipp Krueger (Swiss Finance Institute) : Sticky Expectations and the Profitability Anomaly
- "Household Finance: non-standard determinants of investment decisions" / *Amundi*, December 20, 2017
 - Nadja Guenster (University of Muenster and University of California at Berkeley) : Altruism versus Egoism in Investment Decisions
 - Milo Bianchi (TSE) : Financial Literacy and Portfolio Choices: Lessons from French Investors

LONG-TERM RISK IN FINANCIAL MARKETS

Uncertainty and discount rates

Christian Gollier

RESEARCH HIGHLIGHTS

Do we do enough for the distant future? This question is central to many policy debates, from the fight against climate change to the reduction of public deficits, or investments in research and education. TSE Researcher Christian Gollier has investigated whether markets value assets with extra long-term cash-flows at the right level, providing efficient price signals for long-term investors.

Since Weitzman (1998), environmental and climate economists have debated whether different discount rates should be used to evaluate investments for different time horizons. A similar trend emerged in financial economics, demonstrating that long-run consumption risks differ markedly from short-run ones. This empirical observation justifies adapting the discount rates to value zero-coupon assets as a function of their maturity.

DEEP UNCERTAINTY

A critical dimension surrounding the distant future is the deep uncertainty that affects the dynamics of economic growth. For example, a relatively small change in the trend of growth has an immense impact on future consumption when projected over many decades or centuries. Similarly, uncertainty about the true volatility of growth magnifies the long-run risk, as does the uncertain frequency of macroeconomic catastrophes.

Conventional wisdom suggests that parameter uncertainty has negligible asset pricing implications, at least for short-lived assets. However, parameter uncertainty and updating beliefs generate long-run risks since shocks to beliefs are persistent. More precisely, because posterior moments are martingales under rational expectations, shocks to rational beliefs are permanent. This magnifies the long-run consumption risk. That has two important consequences in the consumption capital asset pricing model (CAPM). First, it raises the precautionary motive of prudent agents to invest in long-dated assets that are safe. In other words, it reduces the efficient long-term risk-free discount rate. Second, it raises the risk of any asset with a payoff that is positively correlated with aggregate consumption. This raises the long-term equity premium.

ISOLATING UNCERTAINTY

In his paper 'Evaluation of long-dated assets: The role of parameter uncertainty', Christian aims to isolate the role of parameter uncertainty

for the determination of the term structure of risk-adjusted discount rates, in particular the risk-free rates and the aggregate risk premia. He focuses on the case in which these term structures are known to be flat in the absence of parameter uncertainty. Under the discounted expected utility model with constant relative risk aversion, this requires the growth of log consumption to be governed by a random walk - increments are stationary and serially independent. Under this assumption, the growth process is characterized by the distribution of increments in log consumption. Christian assumes that this distribution is subject to some parametric uncertainty. His generic results hold without making any restriction on this distribution or on the nature of the parameter uncertainty.

Christian shows that parameter uncertainty has no effect on short-term risk-adjusted discount rates. To be more precise, he demonstrates that the efficient instantaneous risk-adjusted discount rates are obtained by applying the standard CAPM pricing formulas using the expected cumulants as if they were the true values. This implies that mean-preserving spreads in the distribution of cumulants have no impact on the price of very short-term zero-coupon bonds and equity in his framework.

Parameter uncertainty also makes the term structure of risk-free discount rates decreasing, because of the precautionary effect induced by long-run risk. Christian considers an interpretation of Weitzman (1998, 2001) in which the future growth rate of consumption is subject to some parametric uncertainty. Because the present value of a sure future payoff is a convex function of the interest rate, its expected value is increased by this uncertainty. This reduces the "certainty equivalent" discount rate. Because the present value is increasingly convex with maturity, this implies a decreasing term structure of the certainty equivalent discount rate. This is another way to express the fact that parameter uncertainty magnifies long-run risk, so that long-term risk-free discount rates should be reduced.

CARBON COSTS

This argument has been frequently used in favor of a relatively large social cost of carbon, defined as the present value of the marginal climate damage generated by carbon dioxide emissions today. However, this argument holds only if long-term climate damages are uncorrelated with long-term aggregate consumption, which is unrealistic. Adjusting the discount rates to risk requires estimating the maturity-specific risk premia. Because the persistence of learning shocks magnifies the long-run aggregate risk compared to this benchmark case, it raises the aggregate long-term risk premium. This provides an intuition to Christian's result that the term structure of the aggregate risk premia is increasing in the generic context of a random walk. This property holds if the set of uncertain cumulants are independently distributed. However, this property does not hold in general because the risk premium is also affected by the higher cumulants of log consumption outside the Gaussian world.

The persistence of shocks to beliefs has an ambiguous effect on the long-term risk-adjusted discount rate because it reduces the risk-free rate and potentially raises the risk premium. If the asset's beta is large enough, the net effect may be positive, yielding an increasing term structure of the risk-adjusted discount rates. If the parameter uncertainty affects cumulants in a statistically independent way, Christian shows that the risk-adjusted discount rate is reduced by the uncertainty if and only if the consumption CAPM beta of the asset is smaller than half the degree of relative risk aversion. This suggests that parameter uncertainty should induce us to invest more for the distant future if the investment opportunity set contains enough projects with a small beta.

WHEN DISASTER STRIKES

Christian explores some special cases to quantify these effects. He assumes that the economy may face macroeconomic catastrophes at low frequency. In normal time, the growth of log consumption is Gaussian, but a large drop in aggregate consumption strikes the economy at infrequent dates. The true probability of catastrophes is very hard to estimate, and a small modification in the choice of parameters values has a huge effect on asset prices, so Christian explicitly introduces ambiguity about this probability into his model. This dramatically affects the term structures of risk-adjusted discount rates. Using a Bayesian approach to calibrate our degree of ignorance on the probability of catastrophes, he shows that the risk-free rate and the risk premium for long maturities are strongly impacted by the uncertain frequency of catastrophes, leading to an impressive overshooting of the analysis to explain the standard asset-pricing puzzles.

Christian also assumes that log consumption follows an arithmetic Brownian motion whose trend or volatility is uncertainty. Weitzman (2007) showed that the standard asset-pricing puzzles can easily be reversed once it is recognized that the volatility of the growth of aggregate consumption is uncertain. Christian reexamines Weitzman's model without making any structural assumption about the collective beliefs on this volatility. He also reexamines Veronesi (2000) who considered the case of an uncertain trend of growth.

Christian aims to characterize the term structures for bonds and equity without restricting the model to specific beliefs about the trend of growth. This analysis is generalized to the case of mean-reversion, relaxing the random-walk restriction.

POLICY IMPLICATIONS

Investors and policy evaluators, especially those involved in the fight against climate change, should give careful attention to parameter uncertainty when they value dividends and benefits that materialize in the distant future. The standard recommendation in the US and many European countries to use a single discount rate to evaluate public policies independent of their risk profile is particularly problematic for policies having long-lasting socioeconomic impacts.

Parametric uncertainty justifies using a downward-sloping risk-free discount rate and an upward-sloping risk premium to value investment projects. However, markets do not follow these recommendations. The yield curve is indeed usually increasing for maturities below 20 years. And it has recently been discovered that the term structure of the equity premium is downward sloping. Moreover, Giglio, Maggiori and Stroebel (2015) showed that the rates at which real-estate cashflows are discounted have a decreasing term structure for maturities ranging from 50 to 999 years. They estimated discount rates by comparing real-estate prices of freeholds to those of leaseholds, in the UK and Singapore. This suggests that the risk-adjusted discount rate for real-estate assets is low for very long maturities, implying for example discount rates below 2.6% for 100-year benefits.

Christian's recognition of the intrinsic ambiguity in the frequency of catastrophes provides another justification for the risk-free discount rate and the aggregate risk premium to be respectively decreasing and increasing with maturity.

SUMMING UP

Christian examines the term structures of efficient risk-adjusted discount rates when the random walk of economic growth is affected by parametric uncertainty. His results do not rely on any structural assumption underlying this uncertainty. He shows that parametric uncertainty does not affect the discount rates used to value very short-term zero-coupon bonds and equity. It also makes the term structure of the risk-free rates decreasing. The term structure of aggregate risk premia is increasing when the uncertain cumulants of log consumption are independent. Under some conditions, the term structure of risk-adjusted discount rates is increasing if and only if the asset's beta is larger than two times the relative risk aversion. Christian applies these generic results to an uncertain probability of macroeconomic catastrophes, and to an uncertain trend or volatility of growth. These sources of uncertainty have a strong effect on efficient long-term discount rates.

RESPONSIBLE INVESTMENTS

What's the best strategy?

Sébastien Pouget

What returns can socially responsible (SR) investors expect? TSE's Sébastien Pouget is Director of the 'Sustainable Finance and Responsible Investment' (FDIR) research chair. Here he discusses various conceptual frameworks to analyze the risk-adjusted performance of SR investment, offering valuable insights on the ways it can outperform traditional strategies.

SR investors complement financial analysis with extra-financial research which aims to understand corporations' performance in terms of environmental, social, and governance (ESG) issues. Extra-financial elements can be viewed as a constraint on feasible portfolio allocations. But they can also constitute an opportunity for asset managers to be more discerning and creative.

SR investors implement three main types of strategies. In the negative screening strategy, investors refrain from investing in certain sectors or in firms that engage in activities viewed as inconsistent with sustainable development or moral values (for instance, the production of unconventional weapons). The best-in-class strategy selects, in each sector, the companies that are the most socially responsible. Finally, engagement strategies aim to improve the SR behavior of companies by actively discussing with executives, voting at shareholder meetings, and participating on boards of directors.

EFFICIENT MARKETS

The classic theory of finance teaches that, if markets are informationally efficient, the best strategy is to perfectly diversify across all available assets. In this scenario, investors' common beliefs, as well as any new information, are instantaneously incorporated in asset prices. SR investment strategies thus have no reason to outperform conventional ones. This is not because SR companies are not good investments but because, if they are, they trade at high prices. In addition, negative screening strategies suffer because they exclude certain sectors or firms, so that the resulting portfolios are less than optimally balanced.

Best-in-class and negative screening strategies may also induce a higher valuation for SR firms. Investors who follow SR strategies tend to concentrate on the same assets and thus bid up their valuation. Consequently, the expected return on SR companies may be lower than on standard companies. But as discussed by Benabou and Tirole (2010), some investors, driven by altruism or self-image concerns,

may derive utility from knowing that SR companies enjoy a lower cost of capital or from not endorsing inappropriate activities.

Various empirical studies suggest that more responsible companies deliver a lower risk-adjusted return than others. This result has been shown to hold both in stock and bond markets, and for issues such as employee relations and environmental performance. Moreover, Andries (2008) suggests that this result is particularly strong after the year 2000, corresponding to a turning point at which sustainable development issues became more prevalent in financial markets.

INEFFICIENT MARKETS

Critics of the efficient market hypothesis point out that it often takes time for information to be reflected in market prices. SR strategies may then outperform if they enable investors to take positions before markets completely incorporate their information. The success of SR strategies thus relies heavily on anticipations and the ability to rapidly take positions.

Investors may have various trading motives, including liquidity or informational reasons. This multiplicity of motives introduces noise in the price formation process and reduces market efficiency. Upon observing an investor selling an asset, it is difficult to know whether the sale is due to liquidity needs or to bad news. So market participants react less to the trade than if its motivation was clear. The market thus does not fully incorporate private information and it becomes interesting to collect such information.

In this context, SR investment strategies based on ESG research insights may outperform less informed standard strategies. ESG research analysts may be more receptive to signals that ESG factors might be responsible for future liabilities (such as polluting technologies) and/or future profitability improvements (such as waste reduction). Such signals might then enable investors to better predict future returns.

ESG research analysts could also be better at identifying upcoming

RESEARCH HIGHLIGHTS

issues in the sustainable development area (for example, job satisfaction as a driver of performance). This might enable them to better predict changes in institutional investors' preferences and anticipate future trends in corporations' market valuations. For example, Edmans (2011) indicates that the "100 Best Companies to Work for America" have delivered positive abnormal returns over the past 20 years, and have attracted more and more responsible investors.

Various empirical studies have focused on SR mutual funds. Renneboog, Horst, and Zhang (2008) find that, in general, there is no difference in the performance of SR and traditional funds. Their data goes up to 2003: it would be interesting to see results from a more recent sample, now that SRI methodologies are more refined, SRI managers have more experience and ESG analysis is more mainstream.

ENGAGEMENT STRATEGIES

Engagement strategies reflect SR investors' willingness to improve corporations' behavior. Such willingness is a sign of the existence of conflicts among shareholders for control over firms' strategic decisions. If markets are complete, shareholders are unanimous in desiring that the firm maximize stock price value. When markets are incomplete, the situation is very different.

As an extreme example, consider that some investors would like to enjoy clean air over any other consumption of goods whereas others do not care much. Assume that a company has only two possible strategies: an irreversible polluting strategy that generates a lot of cash, and a clean strategy that generates less cash. If the polluting strategy is chosen, investors who want clean air can no longer find this service: markets are not complete. A conflict of interest emerges between shareholders. Such conflicts are likely to arise for firms that have potentially large impacts on goods, environmental or social, are not exchanged on markets or are not subject to Pigouvian taxes, and thus generate externalities.

Another potential source of shareholder conflict may emerge due to investors' differences of opinion regarding firms' adequate business strategies. In the sustainable development area, strategies based on environmental or social factors might be controversial among shareholders due to the question of future cashflows.

Shareholder conflicts may be settled through takeover activities, votes during shareholder meetings, and more generally, governance arrangements. The idea of engagement strategies is to acquire enough influence over firms to induce them to choose a SR investor's preferred business strategy, which best balances ESG and profitability aspects. Engagement is thus best suited to complement best-in-class or indexing-like strategies.

Absent shareholders' unanimity over strategic decisions, an investor might use an engagement strategy to boost corporate economic performance and market valuation. Such engagement strategies appear best suited for long-term investors.

WASHING MACHINES

However, as argued by Gollier and Pouget (2013), there is a possibility for engagement strategies to outperform standard strategies even in the short run. In a "washing machine" strategy, SR investors can invest in a so-called "dirty" business, then transform it so that it strictly adheres to SR standards. This strategy has a financial advantage if the company is more valued by the market when "cleaned" and

included in SR portfolios.

Gollier and Pouget (2013) identify three conditions for a successful "washing machine" strategy:

1. Investors implementing this strategy must be able to acquire enough influence over target companies to impose the necessary changes.
2. Only investors with a long-term outlook can implement this strategy. They must be able to credibly commit to remain involved in the business long enough for its SR standards to improve.
3. The fund must be able to provide guarantees of credibility with regard to SR. Otherwise, it will fail to convince the market, which will continue to value the company as dirty.

As already mentioned, several empirical studies reveal that firms with a higher level of SR trade at a premium on financial markets. Krüger (2013) finds that SR improvements, when not due to poor governance, positively affect stock prices. This suggests that the "washing machine" strategy may outperform standard ones.

Finally, several studies that evaluated the performance of engagement funds suggest that these funds earned abnormal returns when engaging on governance issues and, to a lesser extent, on environmental and social issues.

SUMMING UP

When markets are fully efficient, SR investors are not expected to outperform standard investors. However, driven by altruism or self-image concerns, SR investors may be ready to accept lower performance. There is thus a business case for SR investments, even in this classic view. In inefficient markets, SR investors can outperform standard investors if SR managers are able to acquire informational advantages regarding ESG issues. Engagement strategies might generate abnormal performance by investing in non-responsible firms and making them responsible. However, the profitability of SR investing also depends on important investments in extra-financial research and engagement capabilities.

Does responsible investment improve corporate behavior?

For successful engagement strategies, the answer is clearly positive. The impact of negative screening and best-in-class strategies is more indirect but the increase in the cost of capital they impose on excluded firms suggests that they may also affect these companies' behavior: these strategies reduce non-responsible firms' propensity to invest and increase their willingness to change.

FIND OUT MORE: Some of the insights offered here are drawn from Sébastien's paper 'On the Financial Performance of Socially Responsible Investments' published in *Bankers, Markets and Investors*, no 128, Jan-Feb 2014.

FINANCIAL LITERACY AND INVESTMENT

Lessons from French households

Milo Bianchi

RESEARCH HIGHLIGHTS

As ordinary citizens attempt to manage their domestic budgets and resolve complex financial problems, many find themselves poorly equipped to make efficient investment decisions. Combining administrative panel data with detailed survey data on French households, TSE researcher Milo Bianchi has shed new light on the impact of financial sophistication on household portfolio choices.

It is now established that a significant fraction of households exhibit low performance in their investment decisions as well as a poor understanding of basic principles governing financial markets. These behaviors can have important aggregate consequences in terms of investors' welfare, market efficiency and stability, and at a broader level on economic growth and inequality.

The mechanisms behind the relationship between lack of financial sophistication and investment performance are much less understood. This is key not only to assess the determinants and the consequences of financial vulnerability but also for any policy aimed at improving the households' ability to make the best use of financial services.

Part of the challenge is empirical. It is difficult to find data that combine detailed information on household portfolios with measures of household sophistication. Administrative data typically lack direct measures of financial sophistication. Survey data typically lack the details and the panel structure necessary to explore portfolio dynamics. An important dimension of heterogeneity may arise from how households rebalance their portfolios over time in response to market conditions or to their own returns.

NEW MECHANISMS

Milo's May 2017 paper, 'Financial Literacy and Portfolio Dynamics', due to be published in *Journal of Finance*, provides the first analysis of how financial literacy relates to rebalancing behaviors and uncovers new mechanisms connecting financial literacy and portfolio returns.

In this study, Milo combines portfolio data from a large French financial institution with survey responses to obtain a broader picture of clients' financial behavior. He focuses on a popular investment product called assurance vie, in which households decide to allocate their wealth between relatively safe assets and relatively risky assets – pre-defined bundles of bonds or stocks – and are free to change their portfolios over time. This data records the clients' portfolio at a monthly frequency for about nine years. In addition,

Milo was able to construct the returns of each portfolio and various counterfactual returns.

Depending on their answers to survey questions related to basic principles of household finance, Milo classifies each household on a 1-7 scale that serves as his main measure of financial literacy. Financial literacy correlates, as expected, with demographic variables (in particular, education and wealth) and with financial behaviors elicited in the survey (in particular, stock market participation and holdings of financial products).

LITERACY PAYS

He finds that more financially literate households experience higher portfolio returns. Controlling for various measures of portfolio risk, the most financially literate households experience approximately 0.4% higher yearly returns than the least literate households, relative to an average return of 4.3%. These magnitudes are in line with those estimated by Von Gaudecker (2015) for Dutch households.

Milo's results also show that more financially sophisticated households do not always take more risk. Instead, their risk exposure varies systematically with market conditions. More sophisticated households hold a larger fraction of risky funds in their portfolio when risky funds are expected to offer higher returns. According to Milo's estimates, a 1% increase in the expected excess return of risky funds is linked to an increase in the risky share by 2% for each unit of financial literacy. This result is distinct from the more common observation that stock market participation increases with financial literacy, and it suggests a specific mechanism whereby financially literate households obtain higher returns.

PORTFOLIO INERTIA

Inertia in household portfolios is often attributed to low financial sophistication. Milo's data allows a direct test of this claim. He breaks down the observed changes in the risky share over time into active

changes due to portfolio rebalancing and passive changes induced by differential returns of risky vs riskless funds. He shows that passive changes are relatively more important for less sophisticated households. For the least sophisticated households, the passive change accounts for 64% of the total change in the risky share over 12 months. For the most sophisticated households, the passive change accounts for 30%. These estimates provide the first direct evidence that households with lower financial literacy display greater portfolio inertia.

TREND CHASING

Trend-chasers, who move their wealth from funds that have experienced relatively lower returns to funds which have experienced relatively higher returns in the recent past, have been often associated with a lack of financial sophistication. Milo is able to directly test this by examining how households move their wealth between safe and risky funds. He shows that more literate households are more likely to act as contrarians: they tend to move their wealth toward funds that have experienced relatively lower returns in the past. This allows them to hold their risky share relatively constant over time. By contrast, less sophisticated investors appear to naively try to time the market.

REBALANCING REWARDS

Finally, Milo shows that rebalancing behaviors are an important determinant of portfolio returns: the returns experienced by more financially sophisticated households tend to exceed those that they would have earned without rebalancing their portfolios. More financially sophisticated households are more likely to buy funds that provide higher returns than the funds that they sell.

POLICY IMPLICATIONS

Can we think of policies to improve financial literacy, or to reduce the negative impact of illiteracy on households' choices? At the same time, what are the implications for financial institutions? Should financial literacy be elicited by financial institutions when advising individual investors (together, say, with their investment objectives and risk appetite)? How can this information be used to help investors make better choices?

Milo's results can help to guide the way individuals' sophistication is assessed by financial institutions. At the European level for instance, regulation requires financial institutions to gather information about clients' objectives and preferences before selling them financial products. Milo's results suggest that financial literacy should be carefully considered when advising investors. His discovery of new mechanisms relating financial literacy to financial outcomes can also inform the substantial policy debate on the effects of financial education.

Milo views his research as only a first step towards an empirical understanding of the relationship of financial literacy with financial choices. Getting richer investment data and finer survey measures is an obvious direction of improvement, for which close collaboration with financial institutions is vital.

SUMMING UP

Milo's research provides new insights into the relationship of financial literacy and household investment choices. He finds that more financially literate households experience higher returns, holding riskier positions when expected returns are higher. They are more likely to buy assets that provide higher returns than the assets they sell. Financially literate investors more actively rebalance portfolios, keeping their risk exposure relatively constant.

Ambiguity aversion

Milo's November 2017 paper, 'Ambiguity Preferences and Portfolio Choices: Evidence from the Field', co-authored with Jean-Marc Tallon (Paris School of Economics, CNRS) and due to be published in *Management Science*, is the first to provide evidence on the effect of ambiguity aversion on financial outcomes observed in administrative data.

Field evidence of how ambiguity affects households is still very scarce. Milo's paper attempts to fill this gap, combining data on portfolio choices with survey responses on ambiguity preferences. He finds that ambiguity-averse investors bear more risk, due to a lack of diversification. Their home bias leads to higher exposure to the domestic stock market. While more sensitive to market factors, the returns of ambiguity-averse investors are higher. They more actively rebalance portfolios, keeping their risk exposure relatively constant.



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