Global

Quantitative Strategy
Academic Insights

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Academic research applicable to investing

Welcome to the September 2013 edition

Theme of the month

We highlight five interesting papers, linking top-down macro to bottom-up securities selection. For example, Inflation can be used to adjust nominal accounting entries, which provide profitable strategies on stock selection.

- Accounting and the Macroeconomy: The Case of Aggregate Price-level Effects on Individual Stocks
- Asset Allocation and Monetary Policy: Evidence from the Eurozone
- Corporate Social Responsibility Risk and Return in Portfolio Management
- The Devil in HML's Details
- Global Return Premiums on Earnings Quality, Value, and Size

The best of the rest

We also provide a list of 61 other papers that are quite interesting. We organize the papers by topics: equity investing, other asset classes, asset allocation/multi-asset, derivatives, and trading research. We also highlight upcoming conferences in the quantitative investing filed.

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I. Five key papers for this month

Paper 1: "Accounting and the Macroeconomy: The Case of Aggregate Price-level Effects on Individual Stocks"

- Author: Yaniv Konchitchki
- Link: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2293654
- Reviewed by Yin Luo

Why it's worth reading

This paper highlights two important focuses of our research: 1) linking macro and micro to develop investment strategies; and 2) building smarter new signals from existing database, even with accounting data. While the majority of previous research focused on the impact of inflation on the aggregate stock market, this paper studies how inflation affects firms differently in the cross-sectional context.

Data and methodology

This research is US only. Inflation data (CPI) is from Federal Reserve Bank of St. Louis. The stock universe is the intersection of CRSP and Compustat. The author uses annual financial statement data sourced from Compustat, from 1984 to 2012.

The raw ingredient of this research is to adjust financial statement data items for inflation effect, which can be complex and involved[1]. For example, to adjust the simplest item – inventory, from book value to market value, we would first calculate inventory turnover (cost of goods sold/average inventory) to determine the life cycle of year-end inventory. The year-end inventory will then be marked to market based on the average life and CPI over the year.

Konchitchki [2013] applies the typical hedged portfolios (e.g., Fama-French-Carhart-RONA) and regression approaches to test the strategy profitability.

Results

Konchitchki [2013] finds that companies with low inflation effects significantly outperform stocks with high inflation effects – an annual spread of 11%-12%. More importantly, Konchitchki [2013] suggests that most of the profit comes from nonmonetary holdings, which is intuitive, because nonmonetary holdings are held longer and more exposed to inflation risk.

Our take

We think this paper is quite interesting. Financial accounting is nominal, while economic reality is subject to inflation risk. It would be useful to test the analysis to other countries that have experienced high inflation in history.

[1] Please note that it's not the complexity in a mathematical sense; rather, it requires some heavy adjustment of accounting entries.

Paper 2: "Asset Allocation and Monetary Policy: Evidence from the Eurozone"

- Author: Harald Hau, Sandy Lai
- Link: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2293967
- Reviewed by Mehmet Beceren

Why it's worth reading

The role of monetary policy on the asset allocation decisions of investors has become an important topic for both academic and practitioner research, especially post-2008 global financial crisis. This paper approaches to the policy-market interaction from an interesting angle by focusing on the Eurozone economies – countries that share the same monetary policy but usually vary significantly in terms of economic fundamentals. By using the differences in local financial conditions, driven by different growth in inflation dynamics within the Eurozone countries, the authors investigate the role of monetary policy on equity fund flows in each country. They also try to tackle some serious econometric issues to reach a 'clean interpretation' of the data.

Data and methodology

The authors try to detect changes in investor behavior in each country by using the inflows/outflow data to locally domiciled and distributed funds. The strong home-bias among the local fund investors helps to create a 'clean' proxy for investor demand for these funds because of the clients of these funds have a narrow crow choice set. The final sample consists of 4939 equity funds and 1441 money market funds. Quarterly changes in total NAV measure the size and direction of flows to these funds. Taylor rule residuals (i.e., residuals obtained from regressions of short-term rates on GDP growth and inflation rate) are used to identify accommodative and restrictive monetary conditions.

Results

The results indicate that loose local monetary policy conditions relative to ECB policy within the Eurozone are associated with strong investor allocation out of money market funds into equity funds, which, in turn, generates stock price inflation relative to a benchmark group of stocks that are 'less prone to fund flows'. The strongest equity price reactions are observed in countries where domestic institutional investors represent a larger share of the total market.

Our take

We think this paper can inspire interesting ideas for macroeconomic signal design for cross-country asset allocations within the Eurozone. Especially, the Taylor rule residual of countries within the currency union could be a good quantitative indicator of relative economic conditions under the ECB umbrella. However, the relation between monetary policy and asset allocation is a very difficult empirical problem to tackle due to endogeneity issues that the authors also acknowledge.

Paper 3: "Corporate Social Responsibility Risk and Return in Portfolio Management"

- Authors: Amrollah Amini, Mostafa Emami, Alireza Emami
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2305778
- Reviewed by Javed Jussa

Why it's worth reading

Recently there has been a growing interest in the adoption of socially responsible investing (SRI).[2] A constant challenge faced by investment managers with an SRI mandate is the assessment of the fundamental characteristics of socially responsible companies. Understanding the fundamental makeup of these companies is critical because it enables managers to better gauge the impact of SRI compliancy on their portfolio strategy. In this paper, the authors add to this discussion by utilizing various time-series models to better understand the volatility dynamics.

Data and methodology and results

The authors study the time varying volatility effects of socially responsible companies based on a sample size of eight Greek companies. The data sample is from April 1999 to April 2004, a 5-year period, using weekly returns. The companies selected for this study represent 25% of the total Athens Stock Exchange (ASE) market capitalization, a significant share. The authors attempt to fit a symmetric GARCH and asymmetric EGARCH model to test whether these models can adequately describe and identify the volatility dynamics of socially responsible companies. Simply speaking, GARCH models capture the volatility clustering effect. EGARCH models can also fit asymmetric behavior where a negative stock price shock may cause volatility to increase more than a positive shock (i.e., the leverage effect). A range of statistical test statistics (e.g. Sign Bias, Joint Test) are used to assess whether the GARCH and EGARCH models validly describe the volatility dynamics of socially responsible companies.

Results

The EGARCH model was found to be a statistically satisfactory representation of the stock volatility of socially minded companies. The findings show that volatility effects are persistent within these companies. If the volatility increases for socially minded companies, then it is likely to remain high over several periods in the future. Interestingly, some of the companies also exhibited asymmetric volatility effects (i.e. the leverage effect).

Our take

The authors utilize a novel approach to explain the volatility characteristics of a small set of companies. We think this research is interesting and the approach outlined by the author can potentially be applied to a broader stock universe. The next step would be to test the methodology outlined in this paper to socially "irresponsible" companies. This will help to identify the more unique features of socially responsible companies, which can help managers to build more efficient portfolios.

[2] For our own work in the socially responsible investing space, see: Jussa et al., 2013, "Signal Processing: SRI Integration using Smart Beta", Deutsche Bank Quantitative Strategy, 20 August 2013.

Paper 4: "The Devil in HML's Details"

- Authors: Clifford Asness and Andrea Frazzini
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 49-68
- Reviewed by Miguel Alvarez

Why it's worth reading

Value, as a powerful and central concept in finance, is one of the most popular themes across fundamental and quantitative investment strategies. This paper proposes how a simple adjustment to the basic book-to-market used by Fama-French [1992][3] can significantly improve the performance of a multi-factor model. Specifically, the authors show that updating the traditional book-to-price measure by a company's current stock price and rebalancing the portfolio more frequently can improve returns by 305 to 378 basis points annually. While the authors admit that this adjustment is intuitive and straightforward, they go further to add considerable insight into the fundamental interaction of this more current book-to-price measure with the price return dynamics across stocks.

Methodology and results

The analysis covers both US and global developed markets. The US stock return and accounting data is derived from merging the CRSP and global Xpressfeed databases and ranges from July 1950 to March 2011. The global data includes all stocks from the Global Xpressfeed database and ranges from January 1983 to March 2011. The original book-to-price metric follows that from Fama and French [1992] and the new metric follows the same definition for book value with the difference that the current price is used at time of portfolio rebalance. In addition, they test two different rebalancing periods, annual and monthly.

The initial univariate results show that the standard book-to-price metric outperforms the proposed modified one. This is also the case when performance is controlled for market, size and reversal. However, once momentum is added as a control variable, the results change drastically; the new updated version of book-to-price significantly outperforms the standard measure. The authors link this phenomenon to the underlying relationship between the standard book-to-price metric and price momentum. The authors end the analysis by showing the turnover is not significantly higher for the new metric when combined with momentum.

Our take

The fact that this simple and intuitive modification is so additive to a composite model is quite impressive. However, while the additive performance is of primary importance, we find that the ancillary analysis underlying their results are compelling and yield decent insight. Given these promising results, we wonder how many other traditional stock measures have those "devil in the details" for which simple modifications can provide significant gains.

[3] See Fama, E.F. and French, K.R. [1992]. "The cross-section of expected stock returns", *Journal of Finance*, Vol XLVII, No. 2, June 1992, pp. 427-465.

Paper 5: "Global Return Premiums on Earnings Quality, Value, and Size"

- Author: Max Kozlov and Antti Petajisto
- Link: SSRN, available at http://ssrn.com/abstract=2179247
- Reviewed by Mehmet Beceren

Why it's worth reading

This paper is an addition to the finance practitioner literature that analyzes the performance of the global equity portfolios based on style factors. The authors present some practical and interesting results with a short and concise discussion. The findings are particularly interesting because they provide some additional support for our approach on developing the 'New Asset Allocation Paradigm' that proposes the active use of factor risk premia to achieve more efficient diversification in equity portfolios[4].

Data and methodology

The sample of the analysis consists of the market and accounting data from companies included in the MSCI World (23 developed countries). The data is sourced from, Worldscope, Barra, CRSP and Compustat. The authors follow the approach of Fama and French [1993, 2011][5] applied to the international portfolios. The Value-growth factor and the quality factor are constructed by using the conventional valuation ratios and the earnings accruals, respectively. The simple, standard design of the risk factor portfolios allows for direct comparison of empirical results across regions.

Results

The main result is that the superior risk-adjusted return of the quality factor is not limited to the US evidence. The nature of the relative performance of the quality factor is consistent among global and regional portfolios and it survives multiple business cycles in each region. The authors' global long-short quality factor portfolio that is controlled for market, size and value exposures is shown to earn a three-factor alpha of 3.5% per year. According to the out-of-sample tests, the quality factor also works well along with value-factor exposure because both value and quality factor generate positive alpha in the long term while are negatively correlated in the short-term. Therefore, the combined value-quality exposure has diversification benefits and robust alpha potential across time and across the international markets.

Our take

The results are very much in line with our own research about factor risk-premia. Factor exposures can provide a good way to hedge the cyclical and behavioral risks in the financial markets in a way that the conventional asset allocation rules can't. The systematic success of the factors such as value and quality is partially driven by the lack of simple, liquid instruments that prevent arbitrage. This paper strengthens the view that the factor-based portfolio allocation rules can successfully accumulate the attractively priced risk premia in different markets while providing efficient diversification.

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[4] See Mesomeris, et al [2012]. "A new asset allocation paradigm", Deutsche Bank Quantitative Strategy, July 5, 2012.

[5] See Fama, E.F. and French, K.R. [1993]. "Common risk factors in the returns on stocks and bonds", *Journal of Financial Economics*, 33, 3-56, pp. 3-56 and Fama, E.F. and French, K.R. [2011]. "Size, value, and momentum in international stock returns", SSRN Working paper.

II. Upcoming conferences

Americas

Figure 1: Upcoming conferences and events in the Americas

Date	Location	Conference
11 Septermber, 2013	Chicago	CQA Fall Conference http://www.cqa.org
19 September, 2013	New York	SQA Seminar – Country and sector effects drive low-volatility investing https://m360.sqa-us.org/frontend/portal/viewcalendar.aspx
8-9 October, 2013	New York	EDHEC-Risk Days North America 2013 http://www.edhec-risk.com/events/edhec_conferences
17 October, 2013	New York	SQA Seminar – The near-death experience of quant asset management https://m360.sqa-us.org/frontend/portal/viewcalendar.aspx
10-12 November, 2013	New Orleans, LA	FactSet Symposium http://www.factset.com/campaigns/symposium2013
3 January, 2014	Philadelphia	2014 AFA/AEA Meetings http://www.afajof.org
13 March, 2014	Newark, NJ	CQA Best Practices Seminar http://www.cqa.org
16 April, 2014	Las Vegas	CQA Spring Conference http://www.cqa.org

Source: Deutsche Bank

Europe/EMEA

Figure 2: Upcoming conferences and events in Europe/EMEA

Date	Location	Conference
8-11 September 2013	Oxford	London Quant Group Autumn Seminar http://www.lqg.org.uk/autumn-seminar-2013/
26 September 2013	London	Axioma Quant Forum http://www.axioma.com/seminars.htm
30 September – 3 October	London	CFA Institute – Implementing Fundamental Quantitative Techniques 2013 http://www.cfainstitute.org/learning/products/events/Pages/09302013_88259.aspx
27-29 October 2013	Munich	Inquire Europe Autumn Seminar http://www.inquire-europe.org/seminars.html
14-15 November 2013	London	CFA Institute Sixth Annual European Investment Conference http://eic.cfainstitute.org/?intCamp=homepage_banner_eic_pjs
14-16 December 2013	London	Computational and Financial Econometrics http://www.cfenetwork.org/CFE2013/

Source: Deutsche Bank

Asia

Figure 3: Upcoming conferences and events in Asia

Date	Location	Conference
30 October 2013	Melbourne	CIOS Australia 2013: Factors for Portfolio Success http://www.ai-cio.com/event/CIOSAus2013/
6 November 2013	Hong Kong	CQAsia Fall Conference http://www.cqa.org/
17-20 December 2013	Sydney	Quantitative Method in Finance 2013 Conference http://www.qfrc.uts.edu.au/qmf/

Source: Deutsche Bank

III. Other papers of interest

1. Equity investing

Standing Out From the Crowd: Measuring Crowding in Quantitative Strategies

- Rochester Cahan and Yin Luo
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 14–23
- Abstract: One of the most frequently cited criticisms of quantitative investing has been the charge that everyone uses the same factors and models. In other words, the popular strategies of the last few decades, such as value and momentum, have become crowded, leaving little room for investors to generate alpha. But is this actually true? The authors propose an empirical framework for measuring crowdedness, and use this to study the crowding in common systematic strategies.

Earnings Quality Revisited

- Jennifer Bender and Frank Nielsen
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 69-79
- Abstract: Earning quality as an investment signal has been popular among equity portfolio managers for the last decade. The basic idea behind this accruals anomaly is that stocks with high and increasing accruals tend to have low earnings quality, while stocks with low and decreasing accruals tend to have high earnings quality. The earnings quality signal stopped working in the mid-2000s, but has staged a remarkable rebound since the end of 2008. The authors evaluate whether earnings quality is a true alpha signal, a risk factor, or both. They find that, in the periods when the signal worked, the strategy was largely driven by stock selection, suggesting that earnings quality is indeed an alpha signal. The authors also find that earnings quality is not a good risk factor, in that it does not have high statistical significance when regressed cross-sectionally on returns, along with other well-known risk factors, and is not very volatile over time. Overall, their results indicate that earnings quality may be that rare example of a pure alpha factor.

The Surprising Alpha From Malkiel's Monkey and Upside-Down Strategies

- Robert D. Arnott, Jason Hsu, Vitali Kalesnik, and Phil Tindall
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 91-105
- Abstract: Recent index literature is replete with innovations that are based on quantitative strategies and predicated on sensible investment beliefs. Empirical studies confirm that these strategies deliver economically large and statistically significant excess returns over cap-weighted market benchmarks in nearly all regions and

countries, over long periods of time. In this article, the authors show that inverting these portfolio-construction algorithms does not reverse the out-performance. Indeed, the upside-down strategies often outperform the originals. This paradoxical result is driven by the phenomenon that seemingly unrelated, non-value-based strategies and their inverted counterparts often have unintended and almost unavoidable value and small-cap tilts. Even Burt Malkiel's legendary blindfolded monkey, throwing darts at the Wall Street Journal's stock page, would produce a portfolio with a substantial value- and small-cap bias that would have historically outperformed the S&P 500. The value and small-cap tilts stem from the fact that non-price-based weighting schemes sever the link between a company's share price and its weight in the portfolio. Clearly, the inverted strategy of a non-price-weighted strategy is still a non-price-weighted strategy, would consequently have a value and small-cap tilt, and would therefore have outperformed historically.

Is There Alpha in Institutional Emerging-Market Equity Funds?

- Wenling Lin
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 106-117
- Abstract: Can active fund managers outperform the passive index in the global emerging-markets equity arena? To answer this question, the author delineates emerging-market fund strategies and applies multifactor approaches to a unique data set, consisting of institutional emerging-market managers' returns from Russell Investments. This analysis produced five major findings from January 1997 to June 2011: 1) product varieties have proliferated in this asset class; 2) active management can work in this asset class, but investors have relied more on research to hire good managers; 3) value managers tend to have higher alphas historically, but the supply of value managers is smaller than that of growth-or market-oriented managers; 4) price momentum, valuation, Asia, and the resources sector are key risk drivers; and 5) active risks from this asset class are still present, so it's important to diversify across multiple strategies and styles to mitigate unwanted risks. Alphas are obtainable, but they are not free.

Fundamentally Weighted Global Small Companies

- Peter M. Bull
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 132-141
- Abstract: The author presents an empirical analysis into the issue of universe definition for a fundamentally weighted, global small-company equity strategy. Consistent with previous research on fundamental indexing for large companies, the author confirms the performance advantages of weighting securities by fundamental measures of company size, as opposed to market capitalization, for a variety of global small-company strategies. Beyond these results, the author provides evidence that small-company strategies that define their universe by market capitalization criteria, in the manner of traditional small-cap indices, enjoy a performance advantage over those that use fundamental-ranking criteria. Although this

improvement in risk-adjusted performance is accompanied by marginally increased total risk and turnover, rudimentary adjustments to the market cap-defined universe counteract both effects.

Academic Knowledge Dissemination in the Mutual Fund Industry: Can Mutual Funds Successfully Adopt Factor Investing Strategies?

- Eduard van Gelderen and Joop Huij
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2295865
- Abstract: In this study, we investigate if investors that have adopted investment strategies based on asset pricing anomalies documented in the academic literature (i.e., the low-beta, small cap, value, momentum, short-term reversal, and long-term reversal factors) consistently earn positive abnormal returns. For this purpose we evaluate the performance of a large sample of U.S. equity mutual funds over the period 1990 to 2010. We find evidence supporting the value added of investors adopting factor investing strategies: low-beta, small cap, and value funds earn significant excess returns. We also find that these excess returns are sustainable and have not disappeared after the public dissemination of the anomalies when more asset managers have started to adopt factor investing strategies. We propose some criteria that might be helpful to determine the successful application of academic insights in the context of investment strategies. Our findings have significant implications for the role of academic research and knowledge management in the investment management industry.

Momentum Investing and the GFC: The Case of the S&P/ASX100

- Bruce James Vanstone and Tobias Hahn
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2312114
- Abstract: This paper aims to contribute to the literature on momentum by documenting the performance of a variety of momentum strategies in the S&P/ASX100 index, and subsequently investigating whether the performance of these momentum strategies was affected by the Global Financial Crisis (GFC). Prior momentum studies in Australian equity markets have produced mixed results, describing performance ranging from startling out-performance to no effect. Firstly, we suggest that within Australia, a good strategy is to test the performance of momentum strategies within the constituents of specific S&P ASX indices. Membership in these indices is not solely dependent on market capitalization but also on liquidity, domicile and the S&P Membership Committee goal of minimizing turnover. This focus on liquidity in combination with market capitalization helps ensure that the implementation of momentum strategies within index constituents is feasible. Prior papers which test within strata of market capitalization alone do not carry this assurance. Secondly, we find that the performance of momentum strategies was affected during the GFC. Winner portfolios experienced a sharp drop in returns, and Loser portfolios performed very well. The combination WML (Winner Minus Loser) portfolios suffered during the GFC, but the effect was not persistent. Post-GFC performance of WML portfolios is not distinguishable from pre-GFC performance. We conclude that there

has not been a structural break within the momentum phenomena; rather there was a brief suspension during the worst of the GFC.

Options on Initial Public Offerings

- Thomas J. Chemmanur, Chayawat Ornthanalai, Padmaja Kadiyala
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2311317
- Abstract: Using a sample of IPOs from 1996 to 2008, we examine, for the first time in the literature, the determinants and consequences of option listing on the equity of newly public firms. We explore four important issues. First, we study the determinants of the time to list options following the IPO and find that options are listed earlier on venture backed firms and those with larger IPO proceeds, but later on IPOs with higher reputation underwriters. Second, we analyze the effect of option listing on subsequent long-run stock returns and find significant under-performance persisting for more than a year after listing. This under-performance is greater for venture backed firms, but smaller for IPOs underwritten with higher reputation underwriters. Third, we test three hypotheses regarding the causes of equity under-performance post option listing and find the following: a significant increase in the short-interest ratio after option listing, indicating a relaxation of the short-sale constraint on the IPO firm equity; a significant decrease in insider equity holdings in the IPO firm in the months following option listing, indicating significant insider selling of the stock; and significantly higher put prices relative to call prices for several months following option listing, indicating that informed speculators are using put options to take short positions in the IPO firm stock during this period. Finally, we analyze the profitability of investment strategies in the newly listed options on IPO firm equity, and find significant excess returns from investing in long-maturity put options and holding them to maturity.

Low-Volatility Cycles: The Influence of Valuation and Momentum on Low-Volatility

- Luis García-Feijóo, Lawrence Edward Kochard, Rodney Sullivan, Peng Wang
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2310353
- Abstract: Research showing that the lowest risk stocks tend to outperform the highest risk stocks over time has led to rapid growth in so-called low-risk equity investing in recent years. We provide evidence that both extends and contrasts with existing research on low-risk investing. First, we demonstrate that the low-risk anomaly might more accurately be referred to as the high-risk anomaly due to the fact that the anomalous returns are found primarily among those stocks in the highest risk quintile. Next, we demonstrate that the historical performance of low risk investing is strikingly cyclical and driven to a large degree by swings in the relative valuation levels of low risk versus high risk stocks and also by varying appetite for momentum driven investing. Furthermore, the current valuation cycle nears historically high levels, which, combined with high exposure to momentum, indicates greater uncertainty in low-risk investing future outcomes.

The Effects of the Reporting of Off-Balance-Sheet Investments on EPS Uncertainty, Leverage and Shareholders' Wealth

- Tomas Mantecon, James A. Conover, Ayca Altintig, Kyojik Song
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2307776
- Abstract: The degree of control over operations affects the quality of information provided to investors. Uncertainty about operating performance increases following the first equity method (EM) reporting of off-balance-sheet investments, but only when the investments are joint ventures (JVs). Partners in JVs report lower levels of debt. These results are not due to informational deficiencies of the EM, but to the riskier nature of JVs. Long-run stock performance analysis indicates that investors experience normal risk-adjusted returns when investing in firms with economically significant off-balance sheet investments.

A Survey of Low Volatility Strategies

- Tzee-man Chow, Jason C. Hsu, Li-Lan Kuo, Feifei Li
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2298117
- Abstract: This paper replicates various low volatility strategies and examines their historical performance using U.S., global developed markets, and emerging markets data. In our sample, low volatility strategies outperformed their corresponding cap-weighted market indexes due to exposure to the value, betting against beta (BAB), and duration factors. The reduction in volatility is driven by a substantial reduction in the portfolios' market beta. Different approaches to constructing low volatility portfolios, whether optimization or heuristic based, result in similar factor exposures and therefore similar long-term risk-return performance. For long-term investors, low volatility strategies can contribute to a considerably more diversified equity portfolio which earns equity returns from multiple premium sources instead of market beta alone.

Sovereign Wealth Funds and Socially Responsible Investing: An Emerging Public Fiduciary

- Benjamin J. Richardson
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2291760
- Abstract: The dramatic growth of sovereign wealth funds (SWFs) in recent decades has made them a significant phenomenon in global financial markets and raised the prospect of more enlightened investing that respects the environmental underpinnings of economic prosperity. Until the Global Financial Crisis of 2008, the movement for socially responsible investing (SRI) had been the only noteworthy dissenting voice to the traditional complacency about the financial economy's wider impacts. That financial calamity not only unveiled a systemic malaise in the financial alchemy of the global economy but also highlighted its social and environmental sequelae. The rise of SWFs, several of which are legally mandated to practice SRI, gives hope that states may reclaim some public oversight over finance capitalism. The purpose of this article is to investigate the governance of some SWFs with a view to assessing their capacity to contribute to

environmental sustainability. As public financial institutions empowered by a broader conception of investment that takes account of social and environmental factors, SWFs have the incipient markings of 'public fiduciaries'. SWFs could provide a novel way to interpolate the public trust environmental responsibilities of the state into the governance of the financial economy. This article focuses on the French and Norwegian SWFs, which arguably have the most comprehensive SRI practices of all SWFs. Both, however, have struggled to reconcile their ethical and financial mandates into a coherent investment philosophy. But their putative fiduciary responsibilities to society through an increasingly long-term investing perspective suggest a new normative direction to reconcile these tensions and to thereby help institutionalize the principles of intergenerational equity and sustainable development in the context of financial markets.

Information Spillovers Around Seasoned Equity Offerings

- Daniel J. Bradley and Xiaojing Yuan
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2276040
- Abstract: We examine information spillovers in the context of seasoned equity offerings (SEOs). Rival firms react significantly positively (0.26%) to primary SEO announcements, indicative of a competitive effect, but negatively (– 0.35%) to secondary share announcements, which is evidence of a contagion effect. Consistent with the view that primary equity offerings signal favorable industry prospects because firms presumably issue new shares to invest in profitable projects, we find that the rival response is positively related to analysts' EPS growth forecasts. However, when insiders are selling their shares through a secondary offer, this may suggest overvaluation and thus negatively impacts rival firms. Consistent with this view, we find when VCs sell through a secondary offerings, rivals experience a more significant negative reaction. We find rival firms are more likely to follow their peers and conduct a primary SEO if the market reacts favorably to their peer's SEO announcement. Finally, rival firms outperform secondary share issuers of equity, but not primary share issuers. Collectively, the findings support the view that insiders take advantage of windows of opportunity when they sell their own shares, but not when they raise capital for investing purposes.

The Role of Transitory Earnings for Managerial Effort Allocation to Intangibles

- Yoshie Saito
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2312217
- Abstract: There is a concern about the ability of earnings to adequately reflect managerial efforts to intangible-based activities. Agency theory suggests that when core earnings relay little information about managerial effort to certain activities, effort allocation will be insufficient. Risk averse managers consider costs of investing in R&D projects and determine their effort levels. I modify the analytical model of Bushman and Indjejikian (1993b) to examine the effect of the transparency of firms' operations and the information content of earnings on managerial effort allocation. The information content of earnings is how market participants perceive the future based on core

and transitory earnings. They assume that compensation contracts are based on two types of information, earnings and stock price, and there are two types of activities. My analysis differs from theirs because I decompose earnings into two components, (1) the core or persistent and (2) the transitory component that captures infrequent revisions to earnings. I show that when bonuses are tied to core earnings, under the current conservative accounting system, a large portion of total compensation in this form yields sub-optimal managerial effort exerted on intangible-based activities. I determine two conditions where transitory earnings can play an important incentive role; they can send signals about the future and security prices reflect information about them. This means that even though the accounting system creates weak value relevant core earnings concerning intangibles, if transitory earnings can provide some additional information, they can play a vital incentive role. For example, unsuccessful prior intangible investments or obsolete inventory would be reported as transitory earnings (e.g., disposal of a poorly performing line of operation, asset write-downs, inventory write-offs), which can send signals to markets about managerial effort to tackle problems. These can be useful to convey information about managerial efforts exerted on intangibles. I show that under these conditions, market-based compensation helps to mitigate inefficient effort allocation to intangible-based activities. However, the reflection of transitory earnings in market-based compensation can also encourage earnings management. Managers may allocate their effort to a nonproductive activity such as shifting operating expenses to non-operation expenses to avoid a sharp decline in security price or/and meet analyst forecasts. Such activities do not increase economic value. Thus, the ability of transitory earnings to produce proper managerial effort allocation has to be weighed against the possibility of encouraging earnings manipulation.

Socially Responsible Investment Performance: Impacts of Weighting by Capitalization

- Philippe Bertrand and Vincent Lapointe
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2282372
- Abstract: Because cap-weighted (CW) allocation suffers from weak diversification and favors large firms that are not neglected, we raise the issue that CW allocation strategy may not be the most efficient allocation strategy to build socially responsible portfolios, and to capture out-performance that could be generated by extrafinancial analysis. The inefficiency of CW allocation is an issue that has been recently tackled by promoters of smart beta allocation strategies. In our paper we investigate the value added of these smart beta asset allocations for performance of socially responsible portfolios. From March 15, 2002 to May 1, 2012 we study four smart beta strategies, the Equally Weighted (EW), the Most Diversified Portfolio (MD), the Minimum Variance (MV) and the Equal Risk Contribution (ERC) and we use three universes of stocks, the EuroStoxx, the ASPI and the complement of ASPI universe. We find that the answer depends on which performance is selected. If we look at relative performance the answer is rather positive. We find that the size bias created by extra-financial filtering is amplified by CW allocation and penalizes the latter. However if we decompose risk-adjusted performance the answer is

rather negative. We find that the CW and the ERC allocations have the largest extra-financial premium. Finally, though we stress out the usual limits of back-testing, our analyses show that the smart beta strategies can return interesting results from the perspective of investors interested in SRI strategies and benchmarked against CW indices.

Forward-Looking Robust Portfolio Selection

- Sara Cecchetti and Laura Sigalotti
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2281906
- Abstract: In this paper we develop a portfolio optimization strategy based on the extraction of option-implied distributions and the application of robust asset allocation. We compute the option-implied probability density functions of the constituents of the Euro Stoxx 50 Index. To obtain the corresponding risk-adjusted densities, we estimate the risk aversion coefficient through a Berkowitz likelihood test. The correlation structure among the stocks is computed via an ad hoc technique, which provides a correction term for the historical correlations. We implement a robust portfolio construction, in order to incorporate the uncertainty about the estimation error for the expected returns in the optimization procedure.

The Effects of Corporate Governance on Bank Performance

- Ahmed Mohsen Al-Baidhani
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2284814
- Abstract: Whereas banks operate under different management, board of directors, ownership structures, and government regulations, there is no specific optimal corporate governance model that may be applied to all banks. This study focuses on corporate governance and its effects on bank performance, regarding both conventional and Islamic banks, verifying the relationships between corporate governance and bank performance and consequent effects related thereto. The study focuses on internal corporate governance factors only. It concentrates on investigating the effects of corporate governance on bank performance in regard to the respective variables, which included investigating the effects of ownership structure, board structure, audit function, and other related variables, such as bank size, age and type, on bank's profitability, measured by each bank's ROE, ROA, and Profit Margin; analyzing it through using the Statistical Package for the Social Sciences (SPSS) software, in terms of descriptive statistics, Pearson correlation matrix, and regression analysis. The study focuses on conventional and Islamic banks operating in the Republic of Yemen and the six Gulf Cooperation Council (GCC) countries, namely Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates. The study indicates that there is a significant relationship between corporate governance and bank performance through profitability, measured by ROE, ROA, and Profit Margin. It is found that the two predictors, Age and Number of Board Meetings, have a positive and significant effect on bank's profitability measured by the outcome ROE; that the two predictors, Board Independence and Bank Size, have a negative and significant effect on bank's profitability, measured by ROA; and that there are three

corporate governance independent variables, Ownership Concentration, Age, and Board Committees, of which Age and Board Committees have positive and significant effects while Ownership Concentration has a negative and significant effect on bank's profitability, measured by the dependent variable Profit Margin. These results are consistent with the results of similar studies referred to hereunder.

2. Fixed income, currency, commodities, and other asset classes

The Predictive Power of the J-Curve

- Cyril Demaria
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2296967
- Abstract: Dealing with a recurring low level of data quality in private equity, we propose a novel approach of understanding the behavior of private equity funds (PEFs): we use PEFs' illiquidity as a factor of analysis. To do so, we measure the distance between PEF cash-flows ("J-Curves") and return categories ("ideal-types") that we have identified through our novel reasoning. As a result, our model excludes the attribution of a given fund from certain return categories in early years. It then attributes a fund to a specific category with a high level of confidence. By doing so, this model could help reducing solvency costs of investing in PEFs, as well as support the analysis of existing PEFs either by their current investor or for new investors on the secondary market.

Forecasting Exchange Rates: An Investor Perspective

- Michael Melvin, John Prins, Duncan D. Shand
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2267717
- Abstract: The popular scholarly exercise of evaluating exchange rate forecasting models relative to a random walk was stimulated by the well-cited Meese and Rogoff (1983) paper. Practitioners who construct quantitative models for trading exchange rates approach forecasting from a different perspective. Rather than focus on forecast errors for bilateral exchange rates, as in the Meese-Rogoff case, we present what is required for constructing a successful trading model. To provide more perspective, a particular approach to quantitative modeling is presented that incorporates return forecasts, a risk model, and a transaction cost constraint in an optimization framework. Since beating a random walk is not a useful evaluation metric for currency investing, we discuss the use of benchmarks and conclude that performance evaluation in currencies is much more problematic than in equity markets due to the lack of a passive investment strategy and the multitude of alternative formulations of well-known currency style factors. We then provide analytical tools that can be useful in evaluating currency manager skill in terms of portfolio tilts and timing. Finally, we examine how conditioning information can be employed to enhance timing skill in trading generic styles like the carry trade. Such information can be valuable in reducing the duration and magnitude of portfolio drawdowns.

Does it Pay to Invest in Art? A Selection-Corrected Returns Perspective

- Arthur G. Korteweg, Roman Kräussl, and Patrick Verwijmeren
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2280099
- This paper shows the importance of correcting for sample selection when investing in illiquid assets with endogenous trading. Using a

large sample of 20,538 paintings that were sold repeatedly at auction between 1972 and 2010, we find that paintings with higher price appreciation are more likely to trade. This strongly biases estimates of returns. The selection-corrected average annual index return is 7 percent, down from 11 percent for traditional uncorrected repeat-sales regressions, and Sharpe Ratios drop from 0.4 to 0.1. From a pure financial perspective, passive index investing in paintings is not a viable investment strategy, once selection bias is accounted for. Our results have important implications for other illiquid asset classes that trade endogenously.

Oil Price Density Forecasts: Exploring the Linkages with Stock Markets

- Marco Jacopo Lombardi and Francesco Ravazzolo
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2269233
- Abstract: In the recent years several commentators hinted at an increase of the correlation between equity and commodity prices, and blamed investment in commodity-related products for this. First, this paper investigates such claims by looking at various measures of correlation. Next, we assess to what extent correlations between oil and equity prices can be exploited for asset allocation. We develop a time-varying Bayesian Dynamic Conditional Correlation model for volatilities and correlations and find that joint modelling of oil and equity prices produces more accurate point and density forecasts for oil which lead to substantial benefits in portfolio wealth.

Currency Risk Premia and Uncovered Interest Parity in the International CAPM

- Ronald J. Balvers and Alina F. Klein
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2295716
- Abstract: Zero-investment uncovered interest parity (UIP) portfolio positions provide perfect factor-mimicking portfolios for currency risk in the International CAPM context. Their returns are the currency risk premia. Since the UIP positions on average provide low returns, the currency risk premia must be low so that currency risk appears not to be priced in an unconditional model. However, previous research has shown that UIP returns are predictable and may be quite substantial conditionally. We use this observation to generate a specific conditional version of the International CAPM. A GMM approach shows that the conditional model performs well, while the unconditional International CAPM is (marginally) rejected. The paper thus argues that previous rejections of the International CAPM stem from the fact that currency risk premia are by nature low over extended periods of time and do not provide evidence against the International CAPM.

Model Uncertainty and Exchange Rate Forecasting

- Roy Kouwenberg, Agnieszka Markiewicz, Ralph Verhoeks, and Remco C. J. Zwinkels
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2291394
- Abstract: In this paper, we propose a theoretical framework where investors focus on only a subset of the economic fundamentals that

drive the exchange rate. We show that the fundamentals chosen by investors feed back into the actual equilibrium exchange rate process. Any adjustment in the set of predictors used by investors leads to a change in the relation between the exchange rate and fundamentals. To test the validity of this framework empirically we design a backward elimination model selection rule, with the aim to capture the current set of fundamentals that best predicts the exchange rate. Out-of-sample forecasting tests show that the backward elimination rule significantly beats a random walk for four out of five currencies. Further, the currency forecasts generate economically meaningful investment profits.

Currency Premia and Global Imbalances

- Pasquale Della Corte, Steven J. Riddiough, and Lucio Sarno
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2280952
- Abstract: Global imbalances are a fundamental economic determinant of currency risk premia. We propose a factor that captures exposure to countries' external imbalances - termed the global imbalance risk factor - and show that it explains most of the cross-sectional variation in currency excess returns. The economic intuition of this factor is simple: net foreign debtor countries offer a currency risk premium to compensate investors willing to finance negative external imbalances. Investment currencies load positively on the global imbalance factor while funding currencies load negatively, implying that carry trade investors are compensated for taking on global imbalance risk.

Emerging Market Inflation-Linked Bonds

- Frank Benham and Colleen Smiley
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2279475
- Abstract: Investors have increasingly allocated assets to emerging markets in the past decade. This primarily took the form of investment in the sovereign debt of, and stocks based in, these countries. As these markets have evolved, sub-components have emerged as viable investment options. This includes a universe of inflation-linked bonds issued by emerging market governments. Because of the real yields they offer and the potential for higher inflation in some emerging market countries, these bonds may be particularly appealing to U.S. investors who are looking for relatively high yields and less sensitivity to U.S. interest rates, and protection from inflation and currency risks in emerging markets.

3. Asset allocation, multi-asset, GTAA, and global macro

Portfolio Concentration and the Geometry of Co-Movement

- Wesley Phoa
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 142-151
- Abstract: Understanding correlations and how they change over time is an important aspect of investing. But large correlation matrices are difficult or impossible to grasp intuitively. This article describes a method for transforming a correlation matrix into a point cloud in space, in which two points are close if the corresponding assets are highly correlated, and vice versa. Latent structures in the correlation matrix can thus be visualized geometrically. The method also provides an intuitive way to visualize how the correlation matrix changes over time, and can be used to derive quantitative measures of portfolio concentration.

Which Component of Treasury Yields Belongs in Equity Valuation Models? An Application to the S&P 500

- J. Benson Durham
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 80-90
- Abstract: Given a relaxation of the expectations hypothesis of interest rates and an estimate of the term premium, the remaining assumption that anticipated distant-horizon nominal expected short rates and projected earnings growth are equivalent implies novel cash-flow-based valuation models for shares. For example, an application of a simple dividend-discount framework to the S&P 500, under 600 alternative specifications (to avoid data mining), using a sample from January 1987 through January 2012, fits the data well. It suggests that the model errors correct; it also suggests the argument that estimated forward Treasury term premiums, not yields, belong in the discount factor.

Is the Diversification Benefit of Frontier Markets Realizable by Mean-Variance Investors? The Evidence of Investable Funds

- Dave Berger, Kuntara Pukthuanthong, and J. Jimmy Yang
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 36-48
- Abstract: The authors investigate whether the diversification benefits of frontier markets are realizable. They focus on investable frontier exchange-traded funds (ETFs) and their corresponding indices. Their analysis includes directly measuring the economic benefits of frontier-market diversification, as well as considering frontier-market trading dynamics. Evidence indicates that frontier markets offer diversification benefits through risk-reducing potential. The authors find that frontier market volatility tends to be largely idiosyncratic, which supports the risk-reducing role of frontier markets. Their comparison of funds and indices indicates that, to the extent that frontier-market indices offer

hypothetical benefits, traders can obtain these benefits by using investable funds.

Frontier Markets: The Last Tide

- Vishal Mhaiskar
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2268281
- Abstract: Historically, investors constantly look at newer avenues to unlock value. They relentlessly search for an investment story that most others have neglected. Imagine, investing in a country like China or India in 1980's. The Indian Equity Index (SENSEX: INDEX) had a base value of 100 in 1979 and has risen to around 19,000 till 10th July 2013, giving 16.80% CAGR for the past 34 years. So if you invested US$10,000 in the year 1979 your investment would have earned you US $1.9 Million by the year 2013 (Markets today are almost at same levels it was 5 years back in 2007). What if there is a similar opportunity today with markets that will be considered tomorrow's emerging markets? That even today lays an opportunity that existed a decade back? The awareness of the risks of investing in these markets would definitely be higher than they were decades back. Equity research analysts are constantly on the look for company stories. The stocks universe itself is so big that it is impossible to do justice at a global level and hence the need for sector and country specialists. This study intends to use a top's down approach. If a country index can give a 190x Times return, the individual stocks that form that index are bound to have much more potential. Hence a macro level conclusion is appropriate to this thesis objective. Equity has been the asset class that can be defined as a wealth creator. The thesis intends to probe further into the smaller intricacies of investing into the frontier markets and conclude if there still lays a risk worth taking with these markets and if investing does bring in the diversification benefits, aptly rewarding an investor for each unit of risk taken. Emerging markets today forms a part of most Investor's portfolios. This thesis study will try to explore all facets of investments that would help an investor make informed decision weather a Frontier market too should form a part of his Global allocation in the portfolio.

Effects of Quantitative Easing on Asia: Capital Flows and Financial Markets

- Dongchul Cho and Changyong Rhee
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2282304
- Abstract: This paper studies the effects of the United States' (US) quantitative easing on Asia by examining capital flows and financial markets. After the global financial crisis, Asian economies with more open and developed capital markets experienced greater swings in capital inflows. In particular, large capital flows were manifest more in portfolio investment and other investment such as bank loans than in foreign direct investment. Empirical analysis shows quantitative easing, in particular the first round, significantly contributed to the rebounding of capital inflows to the region after the onset of the crisis by lowering domestic yield rates as well as credit default swap premiums. Although the currency value responses differed across countries, it appears that economies with stable exchange rates roughly coincide with those in which housing prices have been rising,

suggesting that monetary easing of advanced countries have affected Asian countries through either appreciation of currency values or increases in the prices of housing.

Appetite for Risk in Emerging Stock Markets

- Paulina Roszkowska and Lukasz Prorokowski
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2278405
- Abstract: Based on qualitative empirical research, we examine the extent to which Central European emerging stock markets were affected by the recent international financial crisis, and how the current investment climate influences investments in Polish equities. We find that global financial crisis induced changes to domestic and international investors' appetite for risk related to equity investments in emerging stock markets: (i) investors are more prudent about emerging markets but Warsaw stock exchange still shows substantial growth potential and positively distinguishes itself among other Central European stock exchanges; (ii) capital market practitioners' feel that the risks attached to investing in the Warsaw stock exchange have evolved but have at their disposal tools to manage said risks; (iii) emerging markets equities are an attractive component of the international portfolio diversification, provided trading strategies are adjusted to the contemporary investment environment. With insights from practitioners we also contribute to the international debate on investor protection and regulations that can improve the investment processes.

Frontier Market Equity Investing: Finding the Winners of the Future (a Summary)

- Larry Speidell
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2277406
- Abstract: Frontier markets represent a multitude of distinct cultures and can be overwhelming to investors. The author examines the many opportunities for investing that exist in frontier countries. He reviews the stock markets, the listed companies, the potential returns, and the diversification benefits. He also considers economic and political fundamentals.

Co-Movements between Germany and International Stock Markets: Some New Evidence from DCC-GARCH and Wavelet Approaches

- Gazi Salah Uddin, Mohamed El Hedi Arouri, Aviral Kumar Tiwari
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2311724
- Abstract: The analysis of co-movements of stock market returns is a fundamental issue in finance. The aim of this paper is to examine the co-movement between Germany and major International Stock Markets in the time-frequency space. Our sample period goes from 01 June 1992 to 26 March 2013 and includes the financial crisis that erupted in US financial institutions in the summer of 2007 and spread beyond the US to other developed economies in the first half of 2008. We use DCC-GARCH and wavelet-based measures of co-movements which make it possible to find a balance between the time and

frequency domain features of the data. The results suggest that the difference in the co-movement dynamics could be the result of the different natures of the financial crises or a change in regime. The finding of this paper has relevant policy implications in asset allocation and risk management in designing international portfolios for investment decisions.

Portfolio Optimization Under Solvency II: Implicit Constraints Imposed by the Market Risk Standard Formula

- Alexander Braun, Hato Schmeiser, Florian Schreiber
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2291561
- Abstract: We consider the issue of optimizing an insurance company's asset allocation in the context of portfolio theory when the firm needs to adhere to the market risk capital requirements of Solvency II. The discussion starts with a brief review of the standard formula and the introduction of a parsimonious partial internal model. Subsequently, we estimate empirical risk-return profiles for the main asset classes held by insurers and run a quadratic optimization program to derive nondominated frontiers with budget, short-sale, and investment constraints. We then compute the respective capital charges under both solvency models and identify those efficient portfolio compositions that are permitted for an exogenously given amount of equity. Finally, we consider a systematically selected set of inefficient portfolios and check their admissibility, too. Our results document that the standard formula is unable to distinguish investments on the basis of risk-return profiles and does hence not produce economically sensible results. Therefore, the introduction of Solvency II in its current form might cause severe asset management biases in the European insurance sector.

Updating Views by Learning from the Others: Dynamically Combining Asset Allocation Strategies

- Bjoern Fastrich
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2309696
- Abstract: The well-known difficulties in obtaining satisfactory results with Markowitz' intuitive portfolio theory have lead to an innumerable amount of proposed advancements by researchers and practitioners. As different as these approaches are, they typically appear to exhibit a satisfactory out-of-sample performance; however, at the same time, studies show that the equally weighted portfolio still cannot be dominated by them. The starting point of our study is therefore not an(other) entirely new idea, which is based on a new strategy we claim performs well, but instead the acknowledgement that the strategies proposed in earlier studies have specific advantages, which, though not consistently apparent, might prevail in specific and possible rare situations of dynamic markets. We therefore propose a strategy that "learns from" a population of already existing strategies and dynamically combines their respective characteristics, resulting in a strategy that is expected to perform best in light of the expected/predicted market situation. We show that our approach is successful by carrying out an empirical backtest study applied in a multi-asset setting for investor clienteles with mean-variance, mean-

conditional value-at-risk, and maximum Omega utility functions. The improvements of our flexible approach, which include a higher mean return and lower volatility, stay (statistically) significant, even when we take into account transaction costs and improve the competing strategies by employing robust input parameter estimates.

What Drives Risky Investments Lower Around Retirement?

- Revansiddha Basavaraj Khanapure
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2308751
- Abstract: I solve the life-cycle portfolio allocation problem of a disappointment averse (DA) agent. DA agents overweight disappointing outcomes. Unlike expected utility investors, DA investors drastically cut their allocation to stocks around retirement due to a distinct effect associated with the drop in income risk. The effect is driven by the changing comovement between returns and the disappointment/elation realization. The allocations are consistent with empirical evidence on portfolio shares and the allocation rules of target-date retirement funds. Sufficiently disappointment-averse agents abstain from investing in stocks after retirement, which is consistent with the observed low rates of stock market participation among retirees.

Analysing the Effects of Tactical Overlays on Equal-Weighted and (Min CVAR) Equal Risk-Weighted Portfolios

- Sathish Umapathy
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2308318
- Abstract: Strategic asset allocations are based on the longer term view of the assets return and the tactical asset allocation captures the short term views from the market environment. Although numerous studies are conducted on these approaches separately, there are no studies which summarise the results of a combined approach. The studies conducted assume that the other model is readily available. In this paper, we would like to address this by analysing the effects of overlay approaches applied to the equal risk-weighted and equal-weighted portfolios. Minimum CVAR equal risk-weighted portfolio provides an attractive compromise between the good risk-adjusted return properties of the minimum risk portfolio and the positive return potential and low portfolio turnover of an equally weighted portfolio and this makes it a good candidate for a strategic portfolio. To enhance its returns, we constructed overlay approaches using value and momentum signals. We compared the results of the constructed portfolios against the equal-weighted portfolios with overlays and found that different overlays work well with different base portfolios. We found that the value strategy enhanced the risk-adjusted returns of an equal risk-weighted portfolio but not an equal-weighted portfolio. Similarly, we observed that a combined momentum-value strategy works well with the equal-weighted portfolio but not with the equal risk-weighted portfolio. We also found that the momentum strategy works well with both the portfolios. We extended our analysis to different crisis-periods and observed that the combined overlay has a positive effect on already well performing equal risk-weighted portfolios but not on the equal-weighted portfolios. We observed the

reverse during the bull periods. Thus we conclude that the overlays add value to the strategic portfolios and the challenge is in identifying the right one under a given macro-economic condition.

Feedback, Framing, Personality and Risk Attitude -- Experiments on Factors Affecting Financial Optimism

- Jiayi Balasuriya, Yaz Gulnur Muradoglu, and Peter Ayton
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2307068
- Abstract: This paper explores whether and how feedback, framing, personality, and risk attitude could affect financial optimism in an enclosed experimental environment. Evidence in this paper shows that feedback on investment performance affects financial optimism depending on whether people forecast returns in absolute values or in relative terms. Financial optimism is increased upon receiving negative feedback when participants forecast in absolute values, while receiving negative feedback reduces financial optimism when participants forecast in relative terms on portfolio return. We find framing of the experiments affects one's financial optimism level directly and forecasting in absolute terms is more likely to result in optimistic expectations. We also find financial optimism correlates with certain personality traits, such as extraversion, modesty and altruism. Financial optimism is also strongly positively associated with an attitude for risk tolerance.

Dynamic Liability Driven Investing Using Black-Litterman

- Giulia Pasquale, Alessandro Marca, Claudia Deglialberti, Domenico Mignacca
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2297795
- Abstract: In Liability Driven Investing (LDI) the profile of future liabilities is an explicit component of the asset allocation process. Similarly, Assets and Liabilities Management (ALM) deals with mismatches between assets and liabilities in banking books. Since extreme events have become the rule in financial markets, the usefulness of an LDI approach is now more appreciated. In fact, in the recent past, portfolios of institutional investors, such as pension funds and insurance companies, have been significantly invested in risky assets which were unable to absorb the impact of unexpected changes in the risk factors driving liabilities. These allocations where based on the naïve assumptions that most investment strategies had to converge towards a constant-mix portfolio and that equities would always perform well in the long run. As observed by many, unlike Asset Allocation, both LDI and ALM do not refer to a robust theoretical body and practitioners must often employ ad hoc solutions in order to adjust investment decisions for the complex interactions between asset allocation and liability hedging. The purpose of this paper is to propose and test the effectiveness of an LDI recipe which uses as main ingredients the probability of the funding ratio exceeding one at maturity and the expected returns vector derived within a Black-Litterman framework. The empirical performance of the LDI strategy is tested (in absolute terms and, preliminarily, against a passive investment alternative) in turbulent markets where the LDI approach is expected to generate superior risk-adjusted returns.

Cultural Influences on Domestic and Foreign Bias in International Asset Allocation

- Hans-Peter Burghof and Helena Kleinert
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2298992
- Abstract: This paper examines determinants of domestic (investors overweight their domestic market) and foreign bias (investors over- or underweight foreign markets) in international asset allocation from 26 developed and developing countries. In particular, we document robust evidence that country-specific variables on familiarity and cross-cultural variables have significant impact on portfolio allocation in country's equity portfolios. Furthermore, we confirm significant influence of economic development and stock market development on both domestic and foreign bias, while the effects of indirect channels such as capital control or investor protection are only slight.

Asset Market Participation and Portfolio Choice over the Life-Cycle

- Andreas Fagereng, Charles Gottlieb, Luigi Guiso
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2298631
- Abstract: We study the life cycle of portfolio allocation following for 15 years a large random sample of Norwegian households using error-free data on all components of households' investments drawn from the Tax Registry. Both, participation in the stock market and the portfolio share in stocks, have important life cycle patterns. Participation is limited at all ages but follows a hump-shaped profile which peaks around retirement; the share invested in stocks among the participants is high and flat for the young but investors start reducing it as retirement comes into sight. Our data suggest a double adjustment as people age: a rebalancing of the portfolio away from stocks as they approach retirement, and stock market exit after retirement. Existing calibrated life cycle models can account for the first behavior but not the second. We show that incorporating in these models a reasonable per period participation cost can generate limited participation among the young but not enough exit from the stock market among the elderly. Adding also a small probability of a large loss when investing in stocks, produces a joint pattern of participation and of the risky asset share that is similar to the one observed in the data. A structural estimation of the relevant parameters of the model reveals that the parameter combination that fits the data best is one with a relatively large risk aversion, small participation cost and a yearly large loss probability of around 1.3 per percent.

An Algorithm for Computing Risk Parity Weights

- Florin Spinu
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2297383
- Abstract: Given a set of assets (strategies, or sub-portfolios) with non-degenerate covariance matrix, the risk budget allocation problem seeks the unique long-only portfolio, fully invested in those assets, which has the following property: the contribution of each asset to the total risk of the portfolio equals a pre-determined weight. In the particular case when the pre-determined weights are all equal, the

solution is the risk parity portfolio. In general, the risk budget allocation problem (and the risk parity problem) is a non-linear equation which does not have an explicit solution when the cross-asset correlations are not all zero. However, a unique solution always exists, and an algorithm to compute it numerically is given in this paper. The solution can be identified with the global minimum of a convex function, and a refinement of Newton's algorithm for self-concordant functions is applied. The main theorem establishes that the algorithm always converges to the solution and gives an upper bound for the number of iterations. In practice, the algorithm is efficient even in large dimension: for the risk parity problem in dimension 1400, it typically converges after less than 6 iterations.

An Economic Evaluation of Model Risk in Long - Term Asset Allocations

- Christophe Boucher, Gregory Mathieu Jannin, Patrick Kouontchou, and Bertrand B. Maillet
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2294291
- Abstract: Following the recent crisis and the revealed weakness of risk management practices, regulators of developed markets have recommended that financial institutions assess model risk. Standard risk measures, such as the value - at - risk (VaR), emerged during the 1990s as the industry standard for risk management and become today a key tool for asset allocation. This paper illustrates and estimates model risk, and focuses on the evaluation of its impact on optimal portfolios at various time horizons. Based on a long sample of US data, the paper finds a non - linear relation between VaR model errors and the horizon that impacts optimal asset allocations.

Does Beta Explain Global Equity Market Volatility - Some Empirical Evidence

- Radosław Kurach
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2290146
- Abstract: The purpose of this study is to assess the diversification benefits resulting from international asset allocation. In this study, we examine Capital Asset Pricing Model (CAPM) in its international ontext (ICAPM) using the monthly equity returns for 26 countries (18 developed and 8 emerging markets) between July 1996 and June 2011 and adopting the US investor's perspective. We verify the beta-return trade-off employing two approaches: the unconditional trade-off and the conditional relationship. In this latter case, we find the country beta to be a significant variable explaining the cross-country variation of returns. Next, we test the degree of market integration in the light of the ICAPM. The results of this test indicate that country-idiosyncratic risks are generally not priced. In the subsidiary outcomes of our verification procedure, we argue that country betas are time-varying and that currently, global factors are the dominant source of equity market volatility. Consequently, the opinion regarding emerging market assets and their role in global portfolio management should be reconsidered. The results of the entire study may provide essential implications for fund managers because the decreasing international diversification gains have been identified.

The Pricing of Exchange Rate Risk and International Stock Market Segmentation

- C. Sherman Cheung, Clarence C.Y. Kwan, Jason Lee
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2281354
- Abstract: Empirical evidence by Eun and Resnick (1988), among others, has demonstrated the significance of exchange rate risk in the international asset allocation and they have noted that the risk is nondiversifiable. Yet, exchange rate risk was found by Jorion (1991) to be a risk factor that is not priced in the U.S. stock market. This study reexamines such counterintuitive results using data from the Toronto Stock Exchange. The evidence here weakly supports the pricing of the exchange rate risk. Further, the sample period in this study coincides with Jorion's to ensure that both studies examine the pricing of the exchange rate risk in the same global economic environment. The significant pricing of exchange rate risk in Canada and the insignificant pricing in the U.S. imply the possibility of market segmentation.

Strategic Asset Allocation

- Karl Eychenne, Stéphane Martinetti, and Thierry Roncalli
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2154021
- Abstract: To implement strategic asset allocation, we must determine risk and return expectations for the various asset classes. Starting from the paradigm that long-run asset returns are determined by the long-run fundamentals of the economy, a fair value approach to building expectations is crucial. This paper proposes to formalize a quantitative and systematic methodology for optimizing portfolios, from the determination of long-run fundamental pillars, through the modeling of asset returns and the assessment of market risks. We apply forecasting models and build in the specific of the main asset classes, (equities, bonds and alternative investments), depending on the uncertainties they represent for the risk-averse investor. Our resulting allocations, within the equity asset class and with regard to the place of alternative investments, question the choices of long-term institutional investors, such as pension funds that have shifted their long-run allocations in response to the recent financial crisis.

The Value of Stop-Losses and Stop-Gains in Enhancing Risk-Adjusted Return

- Austin Shelton
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2285222
- Abstract: Asset allocation strategies which utilize stop-loss and stop-gain rules may dramatically decrease risk and even increase long-term return relative to passive investing. I introduce an asset allocation strategy which shifts portfolio weights based on simplistic stop rules. The two-asset (S&P mutual fund and bond mutual fund) strategy tested from 1990-2012 produces an annual geometric return of 8.45% vs. 7.50% for the underlying S&P 500 Index fund, with 50% less volatility (9.41% annualized standard deviation of return vs. 18.76% for the S&P index fund). The strategy's strong results are robust to changes in the user-specified parameters, such as the level and number of stop placements. Hence, further development and

refinement of asset allocation and trading strategies which incorporate stop-loss and stop-gain rules may be a valuable area of future research.

The Determinants of International Commercial Real Estate Investment

- Karsten Lieser and Alexander Peter Groh
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2283657
- Abstract: We examine the determinants of international commercial real estate investment using a unique set of panel data series for 47 countries worldwide, covering the period from 2000 to 2009. We explore how different socio-economic, demographic and institutional characteristics affect commercial real estate investment activity by determining both cross-sectional and time-series estimators, running augmented random effect panel regressions. We provide evidence that economic growth, rapid urbanization and compelling demographics attract real estate investment, and also demonstrate that a lack of transparency in the legal framework, administrative burdens of doing real estate business, socio-cultural challenges and political instabilities reduce international real estate allocations.

Funding & Asset Allocation in Corporate Pension Plans: An Empirical Investigation

- Zvi Bodie, Jay Light, Randall Morck, and Robert A. Taggart
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2276223
- Abstract: This paper contrasts and empirically tests two different views of corporate pension policy: the traditional view that pension funds are managed without regard to either corporate financial policy or the interests of the corporation and its shareholders, and the corporate financial perspective represented by the recent theoretical work of Black (1980), Sharpe (1916), Tepper (1981), and Treynor (1971), which stresses the potential effects of a firm's financial condition on its pension funding and asset allocation decisions. We find several pieces of evidence supporting the corporate financial perspective. First, we find that there is a significant inverse relationship between firms' profitability and the discount rates they choose tor eport their pension liabilities. In view of this we adjust all reported pension liabilities to a common discount rate assumption. We then find a significant positive relationship between firm profitability and the degree ofpension funding, as is consistent with the corporate financial perspective. We also find some evidence that firms facing higher risk and lower tax liabilities are less inclined to fully fund their pension plans. On the asset allocation question, we find that the distribution of plan assets invested in bonds is bi-modal, but that it does not tend to cluster around extreme portfolio configurations to the extent predicted by the corporate financial perspective. We also find that the percentage of plan assets invested in bonds in negatively related to both total size of plan and the proportion of unfunded liabilities. The latter relationship shows up particularly among the riskiest firms and is consistent with the corporate financial perspective on pension decisions.

Survey of Reserve Managers: Lessons from the Crisis

- Aideen Morahan and Christian Mulder
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2276357
- Abstract: This paper reports in detail on a survey that was circulated to reserve managing central banks of IMF member countries in April 2012. The survey aims to gain further insight into how reserve managers have reacted to the crisis to date. The survey also aims to understand how reserve managers arrive at their strategic asset allocation and how they operate their risk management frameworks in practice. Some of the key themes that emerge from the survey include potential procyclical and counter cyclical behavior by reserve managers, increased focus placed on returns and wide variability across countries in how the currency composition of reserves is derived.

Optimal Portfolio Allocation for Corporate Pension Funds

- David McCarthy and David Miles
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2274519
- Abstract: We model the asset allocation decision of a stylised corporate defined benefit pension plan in the presence of hedgeable and unhedgeable risks. We assume that plan fiduciaries – who make the asset allocation decision – face non–linear payoffs linked to the plan's funding status because of the presence of pension insurance and a sponsoring employer who may share any shortfall or pension surplus. We find that even simple asymmetries in payoffs have large and highly persistent effects on asset allocation, while unhedgeable risks exert only a small effect. We conclude that institutional details are crucial in understanding DB pension asset allocation.

The Demand for Emerging Market Bonds

- Zaghum Umar and Laura Spierdijk
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2273060
- Abstract: We study the multi-period asset allocation problem for emerging-market investors whose asset menu consists of stocks, bonds and bills. We consider two types of investors: domestic investors who invest in emerging-market assets only (with returns in local currency) and international investors who invest in both US and emerging-market assets (with returns in US dollars). Our results show that emerging-market bonds with a maturity of one year and longer can provide attractive short-run and long-run investment opportunities to domestic and international investors with different risk preferences.

Optimal Investment Portfolios with Predictable Return Signs

- Joonas Hamalainen
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2279823
- Abstract: Expected returns of assets are notoriously difficult to estimate. However, previous research has shown that return directions, or signs, are easier to predict. I develop a new framework

for portfolio optimization when return signs can be predicted with certain probabilities. The resulting optimal portfolio compositions and favorable characteristics of assets are different and more versatile than those produced by the traditional mean-variance framework, resulting in interesting and surprising insights into portfolio optimization. Moreover, a trading simulation with real world market data shows that the new framework produces notably better performance compared to the traditional model.

4. Derivatives

When Do Derivatives Add Value in Pension Fund Asset Allocation?

- Jiajia Cui, Bart Oldenkamp, and Michel Vellekoop
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2271197
- Abstract: Recent surveys indicate that many pension-fund participants aim for higher retirement income security. We investigate the added value of including derivatives in the portfolio of pension funds to achieve this goal. To do so, we define preferences that incorporate specific features of pension funds, but we also report performance among several key criteria used in practice. Furthermore, we model explicitly that the equity market exhibits both jump risk and volatility risk. Our results show that even relatively small investments in derivatives can achieve improvements in certainty equivalent rates of return and other important performance measures. This confirms the intuition that the use of derivatives allows pension investors to make explicit risk and return tradeoffs and diversify between diffusion risk, jump risk, and volatility risk.

Optimal Architecture for Modern Analytics Platforms

- Mark Gibbs and Russell Goyder
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2311737
- Abstract: Financial derivatives are now in ubiquitous use around the globe to hedge exposure and as vehicles for speculation. Four years on from the worst financial crisis in almost a century, the world is still recovering. Yet the derivatives markets continue to grow, and have more than recovered from the slight pull-back after the crisis of 2008. The missing ingredient here is architecture; the overall design of a system informed by a deep understanding of the fundamental concepts which underpin the domain and the nature of the information that flows and interacts when problems are solved in the domain. It is architecture that facilitates true flexibility, modularity and sub-component reuse, and without a clear treatment of the concepts relevant to the problem domain, the goal of constructing an effective architecture remains elusive. A major cause of this deficiency is that individuals with the necessary rich architectural vision are rare and expensive, particularly outside the realm of top-tier sell-side institutions. In this paper, we tackle precisely this issue - the fundamental concepts and design ideas that must underpin the architecture of a modern analytics platform.

Inferring Volatility Dynamics and Risk Premia from the S&P 500 and VIX Markets

- Chris Bardgett, Elise Gourier, and Markus Leippold
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2296826
- Abstract: This paper provides a thorough analysis of the empirical performance of affine jump-diffusion models to jointly represent the values of the S&P 500 and VIX indices, and options on both markets with wide ranges of maturities and moneynesses. Based on the fine

relationship of the VIX squared with respect to the latent factors, we extend the Fourier Cosine Expansion to efficiently price VIX derivatives. Using efficient filtering methods, we investigate the behavior of the latent processes as well as the out-of-sample performance of sub-models depending on which products and markets are considered in the in-sample estimation procedure. We find that a stochastic central tendency improves significantly the representation of the tails of the returns' distribution and the term structure of the smiles of volatility in both the S&P 500 and VIX markets. Furthermore, jumps in volatility help reproduce the change of regime in the VIX derivatives market during the crisis and the tail of the variance risk-neutral distribution. We analyze the information contents of the S&P 500 and VIX markets and argue that they provide complementary information to estimate jumps, therefore calibrating models to only one market is not sufficient to price options on the other market. Finally, we investigate the risk premia of each factor and find that the positive equity risk premium is mainly determined by its continuous part, whereas the variance risk premium is only slightly negative and mainly affected by its jump part.

5. Trading research

Create or Buy: A Comparative Analysis of Liquidity and Transaction Costs for Selected U.S. ETFs

- Milan Borkovec and Vitaly Serbin
- *Journal of Portfolio Management*, Summer 2013, Vol. 39, No. 4: pp. 118-131
- Abstract: Examining 12 popular exchange-traded funds (ETFs), the authors find that ETFs and common stocks exhibit qualitatively different liquidity and cost characteristics. The limit order book for ETFs is deeper than that of common stocks, with similar daily share volume, price, spread, and volatility characteristics, especially at price levels immediately surrounding the prevailing mid-quote. The differences in trading mechanisms and liquidity provision between ETFs and common stocks affect transaction costs. In order to reflect these differences, an appropriate transaction cost model should be properly calibrated and parameterized. It should also consolidate the entire ETF liquidity accessible on the secondary market and through the creation/redemption procedure. The authors demonstrate that considering cost estimates for trading ETFs' underlying constituents provides additional clarity about an ETF's true cost. Their comparison of ETF and basket costs, in conjunction with a look at creation/redemption fees, indicates the need for monitoring relative ETF liquidity, as the optimal switching points between trading an ETF and creating/redeeming vary widely across ETFs and trading styles.

High-Frequency Trading

- Tarun Chordia, Amit Goyal, Bruce N. Lehmann, and Gideon Saar
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2278347
- Abstract: High-frequency traders in financial markets have been making media headlines. As a relatively new phenomenon, much of the discussion is not backed by solid academic research. In this special issue of the Journal of Financial Markets on High-Frequency Trading, we present several research papers that aim to inform the discussion on this important issue.

The Market Microstructure Approach to Foreign Exchange: Looking Back and Looking Forward

- Michael R. King, Carol L. Osler, and Dagfinn Rime
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2268871
- Abstract: Research on foreign exchange market microstructure stresses the importance of order flow, heterogeneity among agents, and private information as crucial determinants of short-run exchange rate dynamics. Microstructure researchers have produced empirically-driven models that fit the data surprisingly well. But FX markets are evolving rapidly in response to new electronic trading technologies. Transparency has risen, trading costs have tumbled, and transaction speed has accelerated as new players have entered the market and existing players have modified their behavior. These changes will have

profound effects on exchange rate dynamics. Looking forward, we highlight fundamental yet unanswered questions on the nature of private information, the impact on market liquidity, and the changing process of price discovery. We also outline potential microstructure explanations for long-standing exchange rate puzzles.

Default Prediction Around the World: The Effect of Constraints on Pessimistic Trading

- Mark G. Maffett, Edward L. Owens, and Anand Srinivasan
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2296992
- Abstract: Research examining cross-country differences in the ability of market participants to accurately assess a firm's likelihood of default using publicly available sources of information is virtually non-existent. This paper examines one potential source of such variation, constraints on pessimistic trading (i.e., trades made in anticipation of future price declines). On average, predictive accuracy is significantly greater in countries where pessimistic trading is less constrained. This relation is further identified using time-series variation in restrictions on short selling and the introduction of put option trading. Consistent with trading constraints limiting the extent to which prices reflect publicly available default risk information, the direct incorporation of accounting information in the default prediction model leads to a larger improvement in accuracy where pessimistic trading is limited. Finally, although fewer constraints consistently lead to more accurate identification of actual defaults, during periods of heightened macroeconomic uncertainty, default prediction models in countries with fewer pessimistic trading constraints inaccurately classify a greater proportion of non-default observations.

Market Microstructure and the Risks of High-Frequency Trading

- Irene Aldridge
- SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2294526
- Abstract: The current research assesses the risks commonly attributed to the presence of HFT in the context of different market structures deployed by the U.S. exchanges. In particular, we find that, by design, the so-called "normal" exchanges have the lowest market quality, including the highest proportion of limit orders cancelled, the lowest ability to detect spoofing market manipulation, the highest volatility and probability of market crashes, yet the highest liquidity. The so-called "inverted" exchanges have higher market quality, including a lower proportion of limit orders cancelled, higher ability to detect spoofing market manipulation, lower volatility and probability of market crashes, but lower liquidity levels. Finally, we show that "pro-rata" markets possess even higher market quality. We derive these results theoretically and then show that they hold empirically. We also derive the theoretical quality of markets with no-cancel ranges, and optimal order sizes in pro-rata markets.

Appendix 1

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