6. Category Asset Pricing

Title: Media and the Stock Market
Supervisor: Peiran Jiao (p.jiao@maastrichtuniversity.nl)
Short text: Many papers suggest that market reactions to news in media can deviate from Bayesian prescriptions. For instance, investors are prone to react to "stale news" which merely repeat previous revelations (Tetlock, 2011), and to focus on "attention- grabbing" stocks in the media rather than considering all available information (Barber and Odean, 2008). More generally, sentiments in news and online searches predict stock returns and trading volumes (Tetlock, 2007), stocks with low coverage have higher returns (Fang and Peress, 2009). Beyond traditional news media, activity in specialist chat rooms (e.g. *RagingBull*) predicts high volatility and trading volume (Antweiler and Frank, 2004), and sentiment indicators extracted from online forums and searches can predict returns (Chen et al., 2014). A growing economic literature also compares online and offline news (Gentzkow, 2011). Open questions remain in this field regarding social media: How is social media content processed? Is it processed differently from traditional online and offline news? Which models best describe the role of information from different sources? This project relies on proprietary data of media content (quantity of coverage and sentiments) to analyse the differential impacts of social and traditional news media on financial markets.
References:
Antweiler, W., & Frank, M. Z. (2004). Is all that talk just noise? The information content of internet stock message boards. *The Journal of Finance*, *59*(3), 1259-1294.
Barber, B. M., & Odean, T. (2007). All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *The Review of Financial Studies*, *21*(2), 785-818.
Chen, H., De, P., Hu, Y., & Hwang, B. H. (2014). Wisdom of crowds: The value of stock opinions transmitted through social media. *The Review of Financial Studies*, *27*(5), 1367-1403.
Fang, L., & Peress, J. (2009). Media coverage and the cross-section of stock returns. *The Journal of Finance*, *64*(5), 2023-2052.
Gentzkow, M., & Shapiro, J. M. (2011). Ideological segregation online and offline. *The Quarterly Journal of Economics*, *126*(4), 1799-1839.
Tetlock, P. C. (2007). Giving content to investor sentiment: The role of media in the stock market. *The Journal of Finance*, *62*(3), 1139-1168.
Tetlock, P. C. (2011). All the news that's fit to reprint: Do investors react to stale information?. *The Review of Financial Studies*, *24*(5), 1481-1512.

Thesis topic: Profitable trading strategies using statistical learning algorithms
Supervisor: Peter Schotman (p.schotman@maastrichtuniversity.nl)
Short text: Once asset pricing and portfolio selection were simple. An optimal portfolio was a combination of the riskfree asset and the market portfolio, and its risk and expected returns were given by the CAPM beta. Nowadays hundreds of profitable trading strategies have been discovered that appear to outperform the market. With the advance of sophisticated statistical learning algorithms the pace of new discoveries increases.
Many strategies share common characteristics. Therefore investors have become interested in summarising the multitude of trading strategies in a few factors. Constructing factors has also benefited from learning techniques. Seeking exposure to particular factors is called factor investing.
Many promising trading strategies fail to deliver, however, after being discovered. This

could be because many investors implement the strategy, and thereby arbitrage it away, or because the strategy was a statistical illusion from the start. The latter are called false discoveries.
These are three areas for thesis topics: (i) prediction methods for returns, (ii) factor and portfolio construction, (iii) performance evaluation. Each offers many opportunities for a thesis. Both the academic as well as the practitioner literature has abundant suggestions for new techniques and new promising strategies. Possibilities seem endless. For this you need your own creativity. For a finance thesis, the emphasis must be on the finance application, not on mathematical or statistical proofs. How useful are techniques for finance?
Two things are important for a feasible project. First, it must be possible to obtain the necessary data. Through the library the school has access to many databases. In addition the Ken French Data Library is a rich, freely available, online database on asset returns. Second. working with statistical learning techniques requires some programming skills. Most methods are available as packages in the statistical language R. An alternative is Matlab, which also has many useful packages. When packages are available, you don't need to program the algorithms, but you must be able to use the packages. Relying solely on Excel will not be sufficient.
References: Below are a few recent examples of academic studies that offer some background.
DeMiguel, V., A. Martın-Utrera, F.J. Nogales and R. Uppal (2018) A Portfolio Perspective on the Multitude of Firm Characteristics, SSRN working paper 2912819.
Gu, S., B. Kelly and D. Xiu (2018) Empirical Asset Pricing via Machine Learning, SSRN working paper 3159577
Harvey, C. R., (2017) The Scientific Outlook in Financial Economics, Journal of Finance 72, 1399-1440.
Hodges, P.H., K.E. Hogan, J.R. Peterson and A. Ang (2017) Factor Timing with Cross-Sectional and Time-Series Predictors, Journal of Portfolio Management Fall 2017, 30-43

Title: Is there a climate risk premium in financial markets?
Supervisor: Stefan Straetmans (s.straetmans@maastrichtuniversity.nl)
Short text: Climate change (or alternatively 'global warming') seems to be considered as an empirical stylized fact nowadays. However, can one think of generally accepted measures or indicators for that? And if one can define such a measure, can it be used to assess whether there is any impact of climate change in financial markets? One possible way to proceed could be to use the cross sectional extremes approach from Kelly et al. (2014). Looking at the tail behavior of cross sections of stock returns, these authors managed to identify a common factor in tail risk of US stock returns. Next, they investigate whether that tail risk premium is priced in the cross section of stocks and whether one can use it to predict stock market downturns. The aim of the current project would be to apply their technique to climate data in order to quantify some common factor of tail risk in climate variables. We would characterize climate change by looking at the tails of climate variables like temperature, rainfall etc. and by studying whether the commonality in the occurrence of extremes has increased over time. Next, it would be interesting to see whether that common factor is taken into account by financial markets.
Reference:
Kelly, B., Jiang, H. , 2014. Tail Risk in Asset Prices. The Review of Financial Studies 27(10), 2841-2871.

Title: Macro stress tests and disaster risk
Supervisor: Stefan Straetmans (s.straetmans@maastrichtuniversity.nl)
Short text: The aim of this project would be to assess the likelihood of sharp downfalls in macro variables. It is well known that financial returns and losses are nonnormally distributed. However, whether this is also the case for real variables (the macro economy) remains unclear as to date. Very little empirical research has been done on the tail behaviour of real variables, partly because the data frequency of these series is much lower which implies that it is hard to assess what is going on in the tails. This project aims to fill this gap and to assess the tail behaviour of variables like GDP growth, changes in unemployment or inflation. Correctly assessing the likelihood of extreme downfalls in real economic activity may be relevant for e.g. the asset pricing literature on "disaster risk" or for stress testing.
References:
Janssen, D., de Vries, C.G., 1991. On the frequency of large stock returns: putting booms and busts into perspective. Review of Economics and Statistics 73, 19-24.
Engle, R.J., 1982. Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of UK Inflation, Econometrica, 50 (4), pp. 987-1007.
R.J. Barro, 2006. Rare Disasters and Asset Markets in the Twentieth Century. 121(3), 823-866.

Title: Finite endpoint distributions in economics and finance
Supervisor: Stefan Straetmans (s.straetmans@maastrichtuniversity.nl)
Short text: The boundedness of economic or financial variables is often open to discussion: is there a lower or upper bound and if so does it increase or decrease over time? For example, since the 1960s and the birth of the 'eco-movement' (even long before the discussions on the climate crisis even started), economists started to question the limits to (long run) growth and productivity given the limited resources of the earth. Are there boundaries to industrial output and productivity (probably yes) but (more importantly), how did these bounds change over time? Another example where boundedness plays a role is efficiency measurement (governmental institutions, banking sector etc). Do these institutions produce their goods and services at the lowest possible costs or are there 'inefficiencies' in the system? The estimation of finite endpoints provides an alternative methodology to measuring these inefficiencies within an institutional context. But as indicated above, the same techniques can be used to assess the boundedness of e.g. macro-variables or weather variables like temperature, rainfall etc. Shifts in the finite endpoint of the latter variables could be interpreted as additional evidence for climate change.
- Jesson J. Einmahl, John H. J. Einmahl & Laurens de Haan (2019) Limits to Human Life Span Through Extreme Value Theory, Journal of the American Statistical Association, 114:527, 1075-1080, DOI: 10.1080/01621459.2018.1537912
- Daouia, A., Florens, JP, Simar, L. (2010). Frontier estimation and extreme value theory. Bernouilli. 16(4), 1039–1063, DOI: 10.3150/10-BEJ256

Title: Returns and return fundamentals
Supervisor: Stefan Straetmans (s.straetmans@maastrichtuniversity.nl)
Short text: The classic approach in asset pricing towards testing return predictability is to regress (excess) returns on past returns or other publically available information (financial or macroeconomic variables, see e.g. Goyal and Welch (2008) for predictors of stock returns). In this project we would like to investigate return predictability when predictors (i.e. the 'signal') take on extreme values (spikes). For example, although parity conditions in foreign exchange markets often do not hold in normal times, relative inflation

differentials or interest differentials have more to say about spot returns when fundamentals are large in absolute value. The same question can be asked about other risky asset classes like stocks, bonds, housing etc. Do extreme swings in fundamentals transfer to returns? And if so, what does it imply for return predictability? Obviously, given that regressions are by definition average relations between dependent and independent variables, one needs to resort to other methodologies. In this project, one could focus on quantile regressions or tail dependence measures like the Marginal Expected Shortfall (MES) which has been widely used to measure systemic risk of financial institutions, see e.g. Brownlees and Engle (2017). Also limited dependent variable methods (logit or probit) may be useful in this context.

References:

Brownlees, C.T., Engle R. , 2017. SRISK: A Conditional Capital Shortfall Measure of Systemic Risk. The Review of Financial Studies 30(1), 48-79.
Cumparayot, P., de Vries, Casper G., 2017. Linking Large Currency Swings to Fundamentals' Shocks. Working paper. HArtmann P, Straetmans S, Vries CG de., 2004. Asset market linkages in crisis periods. Review of Economics and Statistics 86 (1):313-326.
Welch, I., Goyal, A., 2008. A comprehensive look at the empirical performance of Equity Premium Prediction. The Review of Financial Studies 21(4), 1455-1508.

Title: Trading volume and equity prices

Supervisor: Sjoke Merk (j.merk@maastrichtuniversity.nl)

Short text: Fundamental shocks to the economy drive both the supply and demand of financial assets and their prices. Thus, any asset-pricing model that attempts that to establish links between prices and quantities such as trading volume. In fact, asset-pricing models link the joint behavior of prices and quantities with economic fundamentals such as the preferences of investors and the future payoffs of the assets. Therefore, the construction and empirical implementation of any asset-pricing model should involve both price and quantities as its key elements. Even from a purely empirical perspective, the joint behavior of price and quantities reveals more information about the relation between asset prices and economic factors than prices alone. Yet the asset-pricing literature has centered more on prices and much less on quantities. For example, empirical investigations of well-known asset-pricing models such as the capital asset pricing model (CAPM) and its intertemporal extensions (ICAPM) have focused exclusively on prices and returns, completely ignoring the information contained in quantities. This thesis proposal aims at uncovering valuable information about price dynamics from trading volume.

References:

Lo and Wang (JFE2000), Lo and Wang (JF2006), Cremers and Mei (RF2008)

Title: Volatility modelling with high-frequency data

Supervisor: Hugo Schyns (h.schyns@maastrichtuniversity.nl)

Short text: The ability to properly model the volatility of financial returns is an important element that researchers care about. It is also often observed that bond returns and stock returns have the tendency to exhibit jumps but these jumps do not have the same nature. The following question may then be asked: does the explicit inclusion of jumps in the volatility model improves the quality of the estimation? To answer the question, high-frequency financial returns will be investigated. These data are very rich in terms of information provided but it will be important to make appropriate choices (risk measure, frequency, for instance) before starting the volatility modelling. The thesis will require to compare different volatility models and to be able to do some statistical coding (using the software R, for instance).

References:
Andersen, T., Bollerslev, T., & Diebold, F. (2007). Roughing It Up: Including Jump Components in the Measurement, Modeling and Forecasting of Return Volatility. *Review of Economics and Statistics, 89* (4), 701-720.
Christiansen, C., & Ranaldo, A. (2007). Realized bond—stock correlation: Macroeconomic announcement effects. *Journal of Futures Markets, 27*(5), 439-469.

Title: Extracting meaningful information out of machine learning techniques
Supervisor: Hugo Schyns (h.schyns@maastrichtuniversity.nl)
Short text: Machine learning techniques have gained a lot of attention in the last few years, due to the increasing importance of big dataset and cloud computing, among other reasons. These methods, despite being very powerful, are often referred to as "black boxes", because of the lack of interpretability provided by their output. A good starting point would be to have a look at Varian (2014), which provides a (very) general overview of machine learning techniques that can be used to handle big data. An interesting application would be the attempt to predict financial returns in a specific market, based on returns in markets that opened earlier in the day (for instance, predicting US returns, using European returns). The implementation of these techniques will require some programming knowledge (in R, preferably).

I am also willing to supervise students that are interested in the field of Financial Econometrics and Machine Learning (with a finance focus, obviously).

References:
Varian, Hal R. 2014. Big Data: New Tricks for Econometrics. *Journal of Economic Perspectives*, 28 (2): 3-28.

Title: The Role of Ego in Investor Behavior
Supervisor: Katrin Gödker (k.godker@maastrichtuniversity.nl)
Short text: The process of how people form beliefs is not exclusively guided by a desire for accuracy. Instead, the literature on motivated reasoning argues that desires to hold a positive self-view or to maintain a certain conviction constitute strong motives to manipulate own beliefs in a self-serving way. One of the most prominent consequences of such motives is overconfidence, i.e., the systematic overestimation of one's skills and abilities. People want to believe that they are able or skilled, for instance, due to motivational reasons (Bénabou and Tirole, 2002) or ego-utility (Köszegi, 2006), and thus deceive themselves in order to reach such beliefs. Why is this relevant? Overconfidence is an important feature in financial markets. Aggregate investor overconfidence increases market trading volume and volatility (Odean 1998). Overconfidence can also lead investors to make greater use of leverage (Barber, Huang, Ko, and Odean 2019) and has been shown to affect corporate decision making (Gervais, Heaton, and Odean, 2011, Malmendier and Tate, 2005, 2008, 2015).
Promising areas for thesis projects:
i) The "supply side" of motivated beliefs in investment settings: How do investors manage, or at least attempt to, hold such beliefs even though they obtain conflicting feedback. For example, it has been shown that a vast majority of day traders are unprofitable, and many persist despite an extensive experience of losses (Barber, Lee, Liu, Odean, and Zhang, 2020).
ii) Motives versus heuristics: When are deviations from accurate beliefs rather driven by motivation than by the more purely mechanical mistakes in inference associated to the "heuristics and biases" view (Tversky and Kahneman, 1974)?

Students will design an experiment or survey to address questions related to these two areas.

References:

Barber, B. M., Huang, X., Ko, K. J., & Odean, T. (2019). Leveraging Overconfidence. Available at SSRN 3445660.
Barber, B. M., Lee, Y. T., Liu, Y. J., Odean, T., & Zhang, K. (2020). Learning, Fast or Slow. *Review of Asset Pricing Studies, 10*(1), 61-93.
Bénabou, R., & Tirole, J. (2002). Self-Confidence and Personal Motivation. *Quarterly Journal of Economics, 117*(3), 871-915.
Gervais, S., Heaton, J. B., & Odean, T. (2011). Overconfidence, Compensation Contracts, and Capital Budgeting. *Journal of Finance, 66*(5), 1735-1777.
Köszegi, B. (2006). Ego Utility, Overconfidence, and Task Choice. *Journal of the European Economic Association, 4*(4), 673-707.
Malmendier, U., & Tate, G. (2005). CEO Overconfidence and Corporate Investment. *Journal of Finance, 60*(6), 2661-2700.
- (2008). Who Makes Acquisitions? CEO Overconfidence and the Market's Reaction. *Journal of Financial Economics, 89*(1), 20-43.
- (2015). Behavioral CEOs: The Role of Managerial Overconfidence. *Journal of Economic Perspectives, 29*(4), 37-60.
Odean, T. (1998). Volume, Volatility, Price, and Profit When All Traders Are Above Average. *Journal of Finance, 53*(6), 1887-1934.
Tversky, A., & Kahneman, D. (1974). Judgment Under Uncertainty: Heuristics and Biases. *Science, 185*(4157), 1124-1131.

Title: Narrative Economics: How Investment Ideas Spread

Supervisor: Katrin Gödker (k.godker@maastrichtuniversity.nl)

Short text: Robert Shiller, Nobel laureate: "The human brain has always been highly tuned towards narratives, whether factual or not, to justify ongoing actions, even such basic actions as spending and investing. Stories motivate and connect activities to deeply felt values and needs. Narratives 'go viral' and spread far, even worldwide, with economic impact. The 1920-21 Depression, the Great Depression of the 1930s, the so-called 'Great Recession' of 2007-9 and the contentious political-economic situation of today, are considered as the results of the popular narratives of their respective times. Though these narratives are deeply human phenomena that are difficult to study in a scientific manner, quantitative analysis may help us gain a better understanding of these epidemics in the future."

Promising areas for thesis projects:

i) What kind of stories do investors tell? Exploratory analysis of common narratives used by private investors.
ii) Peer effects: How do social networks determine the types of stories told by individual investors?

Students will design an experiment or survey to address questions related to these two areas. In addition, students will have the opportunity to work with textual data already collected, using textual analysis.

References:

Shiller, R. J. (2017). Narrative economics. *American Economic Review, 107*(4), 967-1004.

Further readings:

Bursztyn, L., Ederer, F., Ferman, B., & Yuchtman, N. (2014). Understanding Mechanisms Underlying Peer Effects: Evidence from a Field Experiment on Financial Decisions. *Econometrica, 82*(4), 1273-1301.

Title: Impact of Covid-19 on Risk-Neutral Distributions
Supervisor: Paulo Rodrigues (p.rodrigues@maastrichtuniversity.nl)
Short text: The Coronavirus outbreak caused not only severe health problems but also major economic disruptions. Derivative markets allow us to estimate market implied expectations of the size of economic disruptions. One such paper that does this is "Coronavirus: Impact on Stock Prices and Growth Expectations". In this project you are asked to use the method proposed by Breeden and Litzenberger (1978) to get option implied estimations of risk-neutral distributions of major stock market indices on days before and after the implementations of lockdowns and stimulus packages. Students that want to take this topic are expected to have a basic knowledge of option pricing, be willing to do extensive data work, and be familiar with a programming language like, e.g., Matlab, R, Python.
References:
Douglas T. Breeden and Robert H. Litzenberger (1978): "Prices of State-Contingent Claims Implicit in Option Prices". The Journal of Business
Vol. 51, No. 4, pp. 621-651.
Niels Joachim Gormsen and Ralph S. J. Koijen (2020): "Coronavirus: Impact on Stock Prices and Growth Expectations". University of Chicago, Becker Friedman Institute for Economics Working Paper No. 2020-22

Title: Inflation is Dead, Long Live Inflation Hedging
Supervisor: Nils Kok (n.kok@maastrichtuniversity.nl)
Short text: The extent to which an asset provides a hedge against inflation is an important consideration for institutional investors with indexed liabilities (i.e. defined-benefit pension funds). There are quite a few studies that investigate how stocks, bonds and real estate can provide such hedge, but most studies took place when inflation rates were still (very) high. Over the past 20 years, inflation rates have been moderate, and some would even say "inflation is dead." The question is how hedging capabilities of assets have changed over the past decades, and in particular, how that has evolved for real estate. Because even though inflation may be dead, there are many investors that fear the beast will come alive again, after the current crisis. This thesis topic studies the inflation hedging capabilities of different types of real estate, with a focus on developed economies, including REITs, commercial real estate, and the housing market. Some of the data is readily available, but some of the data will still need to be collected.

Data Sources:
- Housing: BIS, Case Shiller, NCREIF.
- Commercial: NCREI, MSCI/IPD.
- REITs: FTSE EPRA Nareit, GPR.

References and background reading:
- See "Brounen et al. 2014. Inflation Protection from Homeownership: Long-Run Evidence, 1814–2008. Real Estate Economics." for an overview and references to other relevant papers.

Requirements:
- Strong statistical proficiency, using R or Stata.

Starting Date: July 1, 2020, number of Students: 2

Title: Profitable trading strategies using statistical learning algorithms
Supervisor: Peter Schotman (p.schotman@maastrichtuniversity.nl)
Short text: Once asset pricing and portfolio selection were simple. An optimal portfolio was a combination of the riskfree asset and the market portfolio, and its risk and expected returns were given by the CAPM beta. Nowadays hundreds of profitable trading strategies have been discovered that appear to outperform the market. With the advance of sophisticated statistical learning algorithms the pace of new discoveries increases.
Many strategies share common characteristics. Therefore investors have become interested in summarising the multitude of trading strategies in a few factors. Constructing factors has also benefited from learning techniques. Seeking exposure to particular factors is called factor investing.
Many promising trading strategies fail to deliver, however, after being discovered. This could be because many investors implement the strategy, and thereby arbitrage it away, or because the strategy was a statistical illusion from the start. The latter are called false discoveries.
These are three areas for thesis topics: (i) prediction methods for returns, (ii) factor and portfolio construction, (iii) performance evaluation. Each offers many opportunities for a thesis. Both the academic as well as the practitioner literature has abundant suggestions for new techniques and new promising strategies. Possibilities seem endless. For this you need your own creativity. For a finance thesis, the emphasis must be on the finance application, not on mathematical or statistical proofs. How useful are techniques for finance?
Two things are important for a feasible project. First, it must be possible to obtain the necessary data. Through the library the school has access to many databases. In addition the Ken French Data Library is a rich, freely available, online database on asset returns.
Second. working with statistical learning techniques requires some programming skills. Most methods are available as packages in the statistical language R. An alternative is Matlab, which also has many useful packages. When packages are available, you don't need to program the algorithms, but you must be able to use the packages. Relying solely on Excel will not be sufficient.
References:
Below are a few recent examples of academic studies that offer some background.

DeMiguel, V., A. Martın-Utrera, F.J. Nogales and R. Uppal (2018) A Portfolio Perspective on the Multitude of Firm Characteristics, SSRN working paper 2912819.
Gu, S., B. Kelly and D. Xiu (2020) Empirical Asset Pricing via Machine Learning, *Review of Financial Studies* 33, 2223-2273.
Harvey, C. R., (2017) The Scientific Outlook in Financial Economics, *Journal of Finance* 72, 1399-1440.
Hodges, P.H., K.E. Hogan, J.R. Peterson and A. Ang (2017) Factor Timing with Cross-Sectional and Time-Series Predictors, *Journal of Portfolio Management* Fall 2017, 30-43

Title: Trading performance in a financial crisis
Supervisor: Peter Schotman (p.schotman@maastrichtuniversity.nl)
Short text: Every now and then financial markets undergo a crisis with a large drop in stock returns. For the thesis topic you study how well known anomalies perform in a crisis period. For some strategies there is evidence from previous crises, but the recent 2020 corona crisis offers an opportunity to update some of the empirical evidence.
Times of crises are often very informative. Some strategies that appear to provide anomalous returns in normal times, may turn out disastrous around times of strong market declines. Momentum is an example. Normally past winners outperform past losers. Daniel and Moskowitz (2016, DM16) show that after a major financial crisis the opposite

happens: losers strongly outperform the winners. Just after the 2008 financial crisis the `loser' portfolio had a return of 163\%. Digging deeper, DM16 find that the beta's of the winner and loser portfolios change dramatically around a crisis. In times of high volatility the beta's of loser stocks tend to increase, and so do their returns. The DM16 data end in 2013, so a question is how the strategy behaved during and just after the current 2020 crisis

An important part of the analysis are time-varying beta's. As explanatory variables for beta DM16 define two indicators (`bear-market', `up-market') and the realized variance. With more recent data the VIX is available as a forward looking indicator of uncertainty. A deeper study on how beta's with respect to various risk factors change in times of crisis is a further thesis topic. Knowing how beta's change in a crisis also offers opportunity for defining an enhanced strategy with better risk management.

Another direction for the thesis is a study of how different anomalies behave before, during and after a crisis. If there are effects on momentum, then we should also expect that "Reversal", the extension of momentum to longer horizons, behaves differently.

Another direction for a thesis is more technical. Time-varying beta's in the model of DM16 depend linearly on a small number of dummy indicators. A more flexible model would start from a general nonlinear relation. To implement this, you need more flexible regressions and machine learning tools to keep the complexity within bounds.

Reference:

Daniel, K., and T. Moskowitz (2016) Momentum Crashes, *Journal of Financial Economics* 122, 221–247.

Title: Tracking portfolios

Supervisor: Peter Schotman (p.schotman@maastrichtuniversity.nl)

Short text: A recurring question in finance research is which macroeconomic factors represent the systematic risk in stock returns. Macro variables are the ultimate sources of systematic risk. But in finance we often take a shortcut, stating that a well-diversified portfolio contains only systematic risk. But what is this systematic risk? Risks that may be of interest are economic growth, inflation, interest rates and others. We think of stock prices as the present value of future dividends. Since dividends must be related to production and consumption, returns should say something about the real economy. Unfortunately, empirical finance research usually concludes that the correlation between financial returns and macroeconomic risks is very low. One of the problems is that macroeconomic variables are subject to large measurement errors, and often only available at low frequencies such as quarterly. Early work in this area is the classic study by Chen, Roll and Ross (1986). They look at typical macroeconomic factors such as inflation, term spread, default spread, production growth and similar variables.

The focus of this thesis topic is methodologically very different. The idea is to construct tracking portfolios, also called mimicking portfolios. From a time series perspective we look at how well the return on a portfolio of assets can explain the shocks in a macro variable. Which portfolio of stocks is most highly correlated with a particular macro variable? The concept of mimicking portfolios goes back to Huberman, Kandel and Stambaugh (1987). The methodology is very well documented in Lamont (2001). New applications for tracking portfolios have been explored by Lönn and Schotman (2018). What is still missing in this research is a detailed empirical analysis.

Let y_{it} be the excess returns on stock i in period t, and let z_t be shocks to some macro variable. As an approximation of such shocks we use the residuals from regressing the macro variable on a few lags. A tracking portfolio is defined by the regression

$$z_t = w_0 + \sum_i w_i y_{it} + e_{it}$$

The coefficients w_i can be interpreted as portfolio weights. They define the tracking portfolio $Y_t = \sum_i w_i y_{it}$. The risk premium of the factor portfolio is then the risk premium of the macroeconomic factor.

Interesting questions are:

- How much of the variance of the macroeconomic news can be explained by returns?
- Which systematic return factors capture important macroeconomic risk? Systematic return factors are the risk factors identified in much of the empirical finance literature. Examples are the 5 Fama-French factors, momentum, liquidity, and volatility. Many more are listed in Harvey, Liu and Zhu (2016).
- Which macroeconomic factors are priced?
- Most likely the portfolio weights will vary over time, and different stocks or portfolios of stocks will be important in different periods.

Methodologically this topic involves regressions with potentially many explanatory variables and time varying coefficients. It will require some machine learning techniques to do model selection in order to identify the most relevant financial market information related to macro data.

References:

Chen, N., R. Roll and S. Ross (1986) Economic Forces and the Stock Market, *Journal of Business* 59, 383—403.

Harvey, C. R., Y. Liu and H. Zhu (2016) ... and the cross-section of expected returns, *Review of Financial Studies* 29, 5-68.

Huberman, G., S. Kandel and R.F. Stambaugh (1987) Mimicking portfolios and exact arbitrage pricing, *Journal of Finance* 42, 1-9.

Lamont, O.A., (2001) Economic Tracking Portfolios, *Journal of Econometrics* 105, 161-184.

Lönn, R. and P.C. Schotman (2018) Empirical asset pricing with many assets and short time series, SSRN working paper 3278229.

Title: Gold price during crises

Supervisor: Dirk Broeders (d.broeders@maastrichtuniversity.nl)

Short text: This involves an empirical study into the evolution of gold prices during periods of economic and financial crises. How does the gold market operate and how does the price of gold change during financial crises?

References: tbd

Title: Do stock prices respond to climate change news?

Supervisor: Dirk Broeders (d.broeders@maastrichtuniversity.nl)

Short text: This involves an empirical study. Do prices of European large cap stocks respond to climate change news?

References:

Robert F. Engle, Stefano Giglio, Bryan T. Kelly, Heebum Lee, Johannes Stroebel (2019), Hedging Climate Change News, NBER Working Paper No. 25734