STEVENS
INSTITUTE OF TECHNOLOGY
1870

Dual M.Sc. Degree in Statistics & Financial Analytics

AUEB & Stevens

Ionut Florescu

Director MSFA Stevens


150
STEVENS

Welcome to Stevens

STEVENS INSTITUTE *of* TECHNOLOGY

Colleges With the Best Return on Investment

At these colleges, a bachelor's degree has a net present value of more than $1 million after 40 years, one study found.

- **Stevens Institute of Technology (National Universities)**
- While not as highly ranked by U.S. News as some of the other institutions on this list, a degree from the Stevens Institute of Technology was found to be highly valuable in the long term. The net present value of a bachelor's from this New Jersey institution was $1,833,000 after 40 years. In 2019-2020, tuition and fees cost $54,014, and borrowers in the 2018 graduating class had an average of $40,588 in total debt.
- **U.S. News National Universities rank:** 83 (tie) (in 2021)
- MSFA Employment Statistics for 2022 graduates (25 students):
  - 65% employed at graduation, 100% employed in 6 months
  - Average annual starting salary $88K,
  - Average starting bonus $8500

Placement Results for the entire Business School 2022

Companies hiring our 2022 FA graduates

Why this program?

Financial Analytics at Stevens. Concentrations in Data Science, Fintech/Machine Learning, and Advanced Risk Analytics

- In **Finance** (the largest US industry) a data scientist needs to **truly understand** the models/data/methods as well as be **capable to explain** the results obtained
- Our students need to know how to explain to upper management (Board) as well as clients **why** their models work and what exactly are the model limitations
- The program started in **2015** as a certificate from a collaboration with Accenture Finance
- We continue to create **new courses** inspired by the industry. All courses are available here: https://fsc.stevens.edu/courses/
- Jobs after graduation: data scientist, research analyst, financial analyst, risk data scientist, forensic analyst, quantitative trader, etc.

Why Financial Analytics at Stevens?

- The work ethic. Stevens is known for the seriousness and diligence of its students
- The knowledge. We cover a wide range of topics in Finance in greater depth than most other programs.
- No problem is too complicated for our students!

- Placement: Direct connection with industry partners (Accenture, UBS, Jefferies, Goldman Sachs, JPMorgan Chase, etc.)
- 15 min from midtown Manhattan, 15 min from downtown Jersey City.

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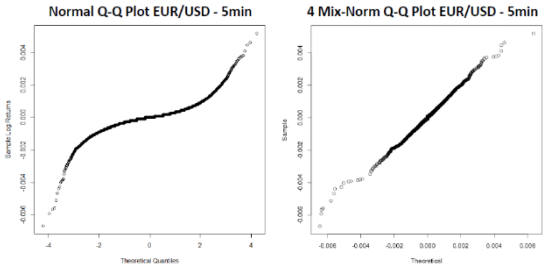
Research Projects (a small sample)

Sample research projects in the Capstone course (FE800)

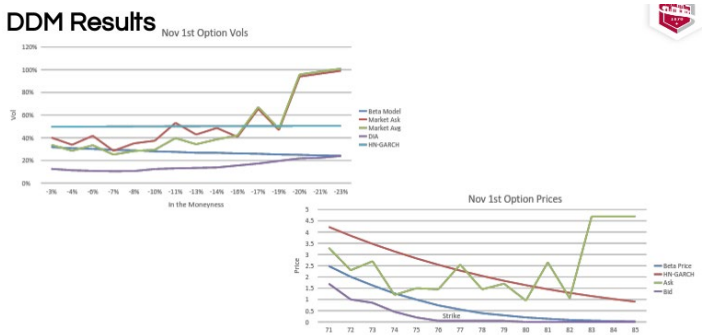
Exchange Rate Option Pricing (2015)

The aim of this project is to present evidence that exchange rates can be modelled by a jump-diffusion process, where the jump component is a log mixture of normals. The model is a reliable approach for pricing foreign exchange options. We derive an analytic solution for the price of a European FX option.
Nikolay Radev Advisor T. Lonon



GARCH Option Pricing and Volatility Scaling for Leveraged Exchange-Traded Funds (2016)

This project develops a new pricing method for options on Leveraged Exchange-Traded Funds. We compare the traditional *Heston-Nandi GARCH* (Heston and Nandi, 2000) with a new Beta-Leveraged method. The data set used are DDM (X2 Leverage on DIA ETF) and DOG (-X1 Leverage on DIA ETF). For DDM, the new model performs better than the traditional HN-GARCH method. For DOG, the two models are performing closely to each other.
Amit Kumar Singh, Mehrab Kooner. Advisor: Zhenyu Cui



Market Volatility Transmission (2017)

We construct volatility transmission measures based on BEKK GARCH model, extending the spillover framework of (Diebold and Yilmaz, 2012). Our major findings imply that volatility transmit more intense in overlapping market with higher data frequency, and vice-versa for non-overlapping markets. In addition, we find inter-market effect significantly dominate the volatility transmission.
Dan Wang, Cen Chen, Xiaotian Lin, Advisor: I. Florescu

Table 5: TVT during special events

	AS (15 min)	EU (15 min)	NA (15 min)	NO (Daily)
Before Brexit	0.12753	0.78574	0.42803	0.06614
Brexit	0.87223	1.54540	0.78737	1.80333
After Brexit	0.55400	0.14393	0.52425	0.61896
	AS (15 min)	**EU (15 min)**	**NA (15 min)**	**NO (Daily)**
Before Election	0.09211	0.08299	0.29506	0.07809
Election	0.36795	0.44843	0.68116	0.51680
After Election	0.1949	0.31614	0.09728	0.16497
	AS (Daily)	**EU (Daily)**	**NA (Daily)**	**NO (Daily)**
Before Oil Shock	0.34738	0.04543	1.78571	0.32002
Oil Shock	0.15976	0.96821	5.45109	1.80333
After Oil Shock	0.36916	0.13821	0.02959	0.05973

Deep Learning Applications in ETF – Volatility Pattern Recognition (2018)

The purpose of this study is to implement various machine learning and deep learning methods to recognize SPY, chosen from ETF, intraday volatility pattern based on second-level data. The methods used for data processing include principal component analysis (PCA), Auto-Encoder, Deep Auto-Encoder, One-Dimension Convolutional Auto-Encoder, LSTM Auto-Encoder (Long short-term memory), Restricted Boltzmann Machine (RBM) also Deep Belief Networks (DBNs).
Jin Xu, Yuchen Xie, Gerui Liu, Jie Bao.
Advisor: Khaldoun Khashanah

The results of the assessment of 7 dimensionality reduction methods are shown below. The left column is the DR methods we used and the top row is the metrics, the results are in the corresponding grid.

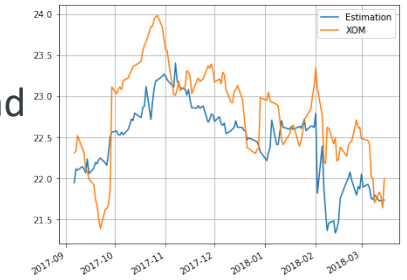
DR Method	reconstructure_rate	hopkins	improved_hopkins	mean_abs_coef	trustworthiness	continuity	LCMC
PCA	0.259845	0.678317	-0.0783055	0.118564-16	0.89302	0.91245	0.270232
Auto Encoder	0.719039	0.892181	0.18413	0.108108	0.669276	0.711217	0.0399001
Deep Auto Encoder	0.771933	0.832502	0.0247935	0.383348	0.761556	0.79228	0.122333
Convolution1D Auto Encoder	0.698324	0.652173	-0.120276	0.0281443	0.658259	0.657196	0.0551061
LSTM Auto Encoder	0.698694	0.97498	0.225263	0.793297	0.589122	0.545901	0.0315767
RBM Auto Encoder	0.668212	0.922415	0.218252	0.0135862	0.590783	0.515778	0.0366187
DBN Auto Encoder	0.710286	0.945788	0.164861	0.127765	0.580786	0.541433	0.0366082

Figure 29: Dimensionality Reduction Metrics Results.

Sample research projects in the Capstone course (FA 800)

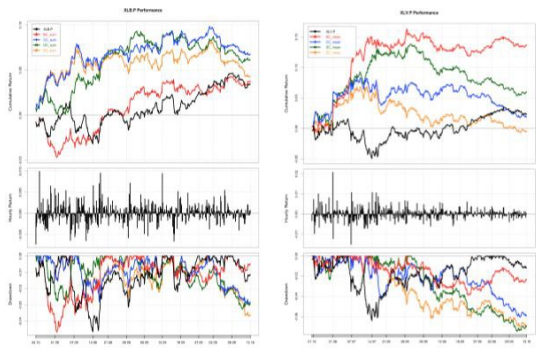
Fund Reconstruction Using Double Sampling Kalman Filtering

We use the newly created DSKF method to replicate unknown weights of portfolios.
We further apply to reconstruct Hedge Fund weights.
Z. Chen, O. Hui, Z. Wong, Q. Zhang, M.Tian
Advisor I. Florescu



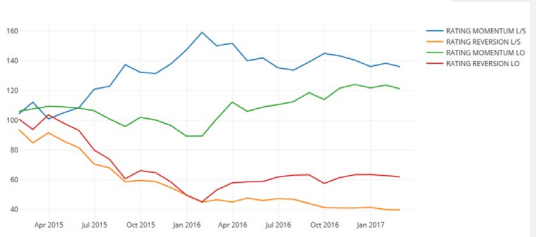
Relationship of Twitter Financial Sentiment to Stock Market Returns

This study examines the relationship between financial community (specifically the top 2844 users' tweets) and constructs a weighted sentiment measure that can be predict hourly stock market returns. The weighted sentiment measure is significantly correlated at the lag-1 level to various ETF returns. The study constructs a methodology where we observe profitable trading strategies for at least one centrality measure for every ETF.
R. Shah, D. Wixom Advisor: S. Yang



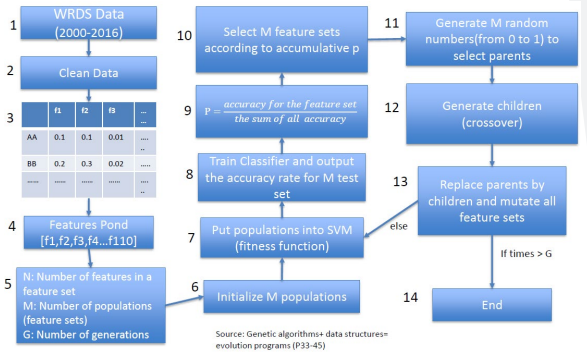
Credit Rating Prediction

We use Bond and Equity data to predict if a credit rating change takes place next month. The results are applied to a trading strategy which tries to take advantage of prior knowledge about a rating change. The results are showing a 40% profit figure over a 18 month period.
R. Mc Allister, P. Murphy, J. Teno
Advisors I. Florescu and P. Ndiaye



Genetic Algorithms applied to Credit Rating

The project uses a suitably modified genetic algorithm to identify and select the financial statements variables that are relevant for the credit rating of a corporation. The algorithm uses Random Forest and Support Vector Machine. GA perform well to select relevant variables and they are also good at identifying variables relevant for credit rating changes within the next quarter.
G. Zhang, Q. Liu Advisors I. Florescu and P. Ndiaye



SHIFT - a Market Replica for risk assessment & regulatory compliance

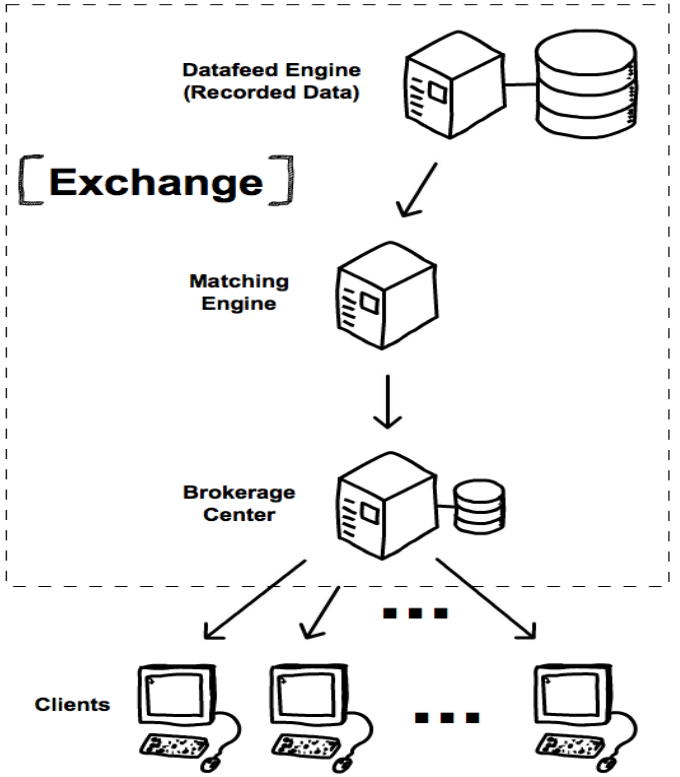
IF, Dragos Bozdog (SIT), George Calhoun (SIT)

- Financial markets today are interconnected. Events in one market (e.g., futures market) quickly translate into movements in other markets (e.g., equity or options markets). The increase in ETF trading further exacerbates these moves.
- There is a need for a tool that will allow testing algorithms/markets/regulations BEFORE they are implemented.
- SHIFT is one such tool. Basic schematic
- Two basic implementations:

  1. Replay of real market with new orders interacting with the historical replay
  2. Pure agent-based liquidity driven market
- Challenges.

  1. Simplifying the system – make it easy to use
  2. Deploy the system in a cloud environment for universal access
  3. Implement multiple interconnected types of market and asset exchanges

https://www.youtube.com/watch?v=-UjRLQYursE&ab_channel=HanlonFinancialSystemsCenter



Cluster Analysis of Liquidity Measures and Applications to HF Data

Dragos Bozdog & IF

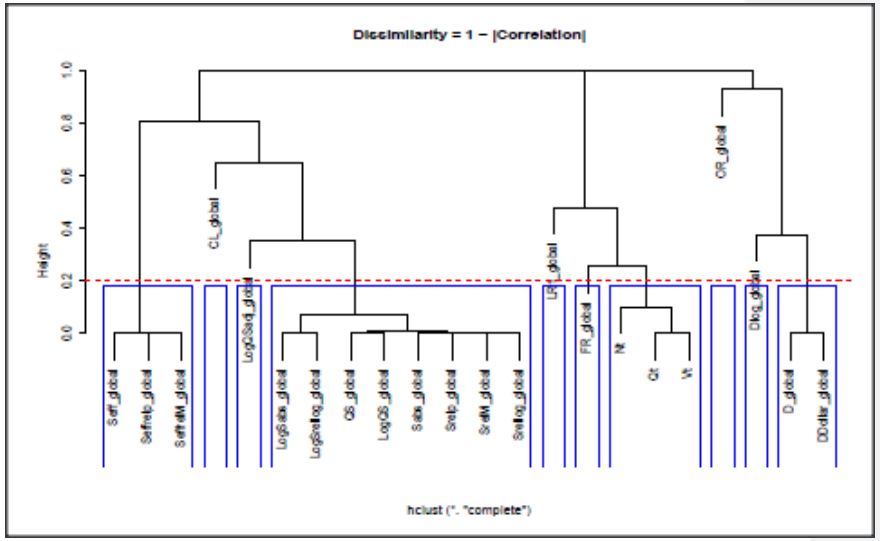
- Black (1971): "The stock market is liquid if the following conditions hold:
  - There are always bid and ask prices for the investor who wants to buy or sell small amount of stock immediately.
  - The difference between the bid and ask price (the spread) is always small.
  - An investor who is buying or selling a large amount of stock, in the absence of special information, can expect to do so over a long period of time at a price not very different from the current market price.“

Liquidity is easy to feel, but hard to define (O'Hara (2004)). Liquidity is a multidimensional variable (Liu (2006)

"Cluster Analysis of Liquidity Measures in A Stock Market Using High Frequency Data", A. Salighehdar, Y. Liu, D. Bozdog, and I. Florescu, Journal of Management Science and Business Intelligence, Vol. 2, No. 2, August 2017. (pdf)

"A Study on Brexit: Correlations and Tail Events Distribution of Liquidity Measures", M. Kong, A. Salighehdar and D. Bozdog, Journal of Management Science and Business Intelligence (JMSBI), Vol. 3, No. 1, July 2018. (pdf)

"Liquidity Risk and Asset Movement Evidence from Brexit", D. Mago, A. Salighehdar, M. Parekh, D. Bozdog, and I. Florescu, IEEE Symposium Series on Computational Intelligence (SSCI), pg. 1-8, 2017. (pdf)



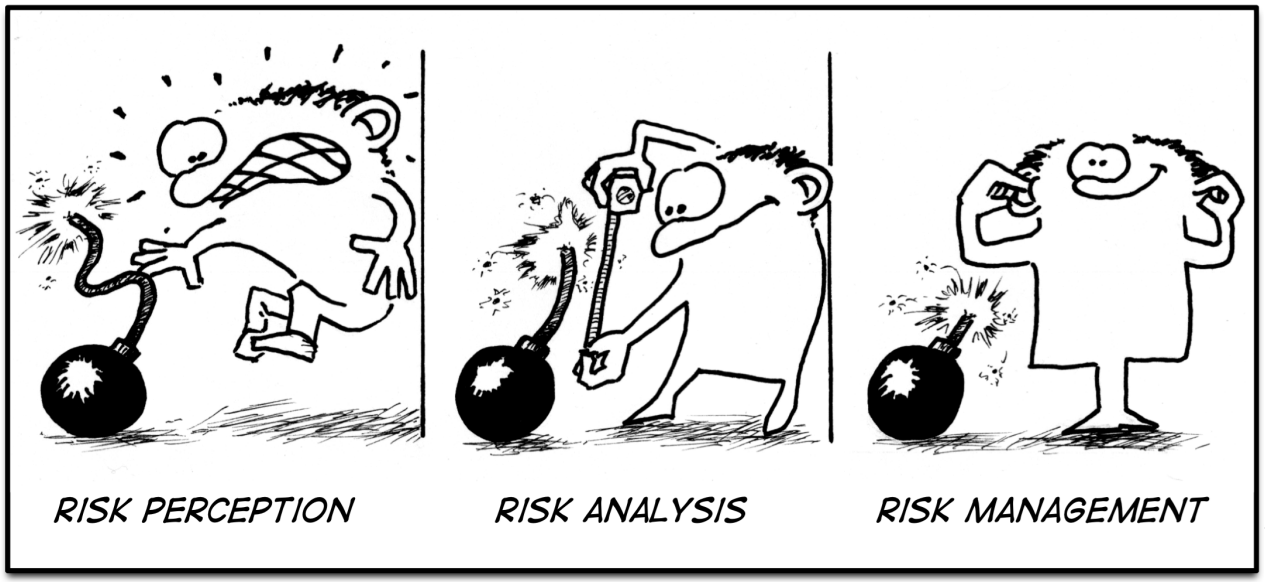
Clusters	Liquidity Measures
1	*Q, V, N*
2	*D, D$*
3	*Dlog*
4	*Sabs, LogSabs, SrelM, Srelp, Srellog LogSrellog, QS, LogQS*
5	*Seff, Seffrelp, SeffrelM*
6	*LogQSadj*
7	*CL*
8	*LR1*
9	*FR*
10	*OR*

Research on Financial Risk Management (FRM)

Majeed Simaan (https://sites.google.com/view/msimaan)

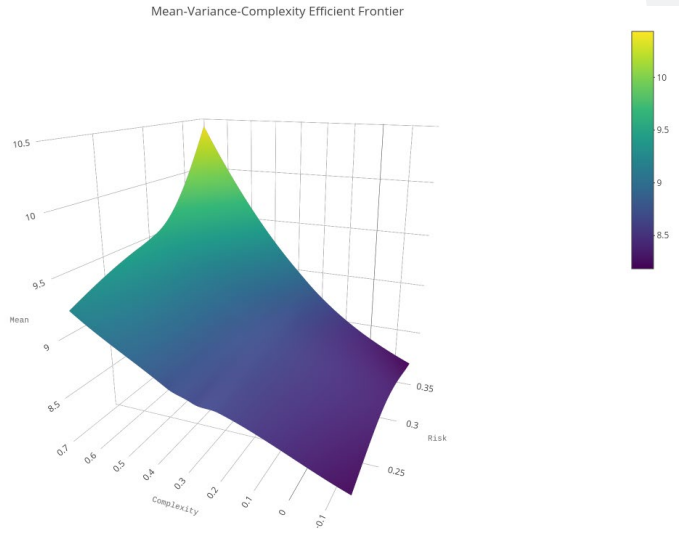
- Asset Allocation and Pricing Theory
- Financial Institutions
- Financial Networks and Analytics

Other interests
- Statistical Learning in Finance
- Textual Analysis and Data Analytics
- R Programming (see e.g. my Rpubs)



- Selected Publications

- Clark, Edirisinghe, & Simaan, 2021 - Quantitative Finance (forthcoming)
- Cui & Simaan, 2021 - Journal of Futures Markets
- Clark, Feinstein, & Simaan, 2020 - Operational Research Letters
- Simaan, Gupta, & Kar, 2020 - European Journal of Operational Research
- Simaan & Simaan, 2019 - Quantitative Finance
- Simaan, Simaan, & Tang, 2018 - International Review of Economics & Finance



CRAFT Center for Research toward Advancing Financial Technologies

SIT & Rensselaer Polytechnic Institute

CRAFT, founded by Stevens Institute of Technology and Rensselaer Polytechnic Institute is the first fintech-focused organization backed by the National Science Foundation.

https://www.stevens.edu/craft

https://www.stevens.edu/craft/industry-and-university-partners

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Dual Degree Logistics

AUEB -> Stevens

Dual degree logistics.

- The program transfers equivalent of 9 US credits from AUEB. At Stevens students can complete 7 courses (21 US credits).
- Stevens courses may be completed in two semesters, i.e., tuition is much reduced when compared with a full scheduled program (1.5-2 years).
- Stevens recognizes the strength of the AUEB students and thus there is no GRE/GMAT requirement. However, USCIS requires language proficiency demonstrated by aptitude tests such as TOEFL (>=90) IELTS (>=7) or Duolingo (>=100). Lower scores may need ELC completion within first semester.
- In order to transfer courses, students need to earn a B or better grade (i.e., 7,0 on the AUEB scale). Students also need an average of 7,0 or better in AUEB classes at the time of application.
- Students starting the program at AUEB should apply for admission to Stevens no later than March 15 for a start in the following Fall term. Applicants will be notified the admission decision by April 15. Students may apply for both programs in their initial application.

Grade conversion

The Credit rate conversion is established as follows. AUEB is using the European Credit System (ECTS) while Stevens is using the United States credit hours (USCH). The standard conversion 6 ECTS = 3 USCH assumes that a standard full time student load is 15 credit hours (USCH). While this is true at the undergraduate level, the standard load for a **graduate** student at Stevens is 12 credit hours (USCH) per semester. Thus, the conversion rate between the two Master programs is established at the rate: 2.5 ECTS = 1 USCH.
Therefore, a standard 3 USCH graduate course in US is equivalent with 7.5 ECTS at AUEB.

AUEB	AUEB Characterization	STEVENS
0-4,5	Fail	F
5	Good	C
5,5-6	Good	C+
6,5	Good	B-
7,0	Very Good	B
7-7,5	Very Good	B+
8-8,5	Very Good (Upper Second Class)	A-
9,0-10	Excellence/Dinstinction	A

Table 1: Available courses at AUEB (according to 2021-22 Curriculum can be changed according to AUEB decisions)

•A maximum of 9 USCH (22.5 ECTS) may be transferred from AUEB to Stevens to count for the Master of Science in Financial Analytics (MFA).

AUEB Courses	Semester	ECTS**	Transferable to MFA
Probability and Statistical Inference	A	7.5	
Computational Statistics	A	7. 5	
Generalized Linear Models	A	7.5	
Data Analysis	A	7.5	YES
Cycle 1: Applied Statistics (4 out of 5, 15 ECTS) *			
Biostatistics	B	4	
Epidemic Models	B	4	
Advanced Methods in Survey Sampling	B	3.5	
Statistical Process Control	B	3.5	
Topics in Applied Statistics (Statistical Genetics Bioinformatics for 2021-22)	B	3.5	
Cycle 2: Computational Statistics (4 out of 5, 15 ECTS) *			
Bayesian Models in Statistics	B	4	
Statistical Learning	B	4	YES
Statistics for Big Data	B	3.5	YES
Advanced Stochastic Processes	B	3.5	
Topics in Computational Statistics (Applied Stochastic Modeling for 2021-22)	B	3.5	
Cycle 3: Stochastics (4 out of 5, 15 ECTS)*			
Probability Theory	B	4	
Time Series Analysis	B	4	YES
Stochastic Modeling in Finance	B	3.5	YES-elective
Financial Econometrics	B	3.5	YES
Topics in Stochastics: Stochastic Models in Operations Research	B	3.5	YES-elective
Total	60	60	
*Select 2 out of 3 academic cycles in the 2nd semester (B)			
** 1 ECTS corresponds to 2.5 US/STEVENS credit hours (USCH)			

Table 2: Common M.Sc. Thesis

Master thesis

Participating students will complete the master thesis in English at AUEB or at STEVENS, under the supervision of an advisor from both partner institutions. The thesis must be discussed and presented both at AUEB and at STEVENS. Joint virtual or hybrid presentations are also possible with the approval of directors of the two programs and the examining committees of the two universities.

The master thesis written at the host university may be different in scope than the one written at the home university, in compliance with the rules of each university.

at STEVENS or AUEB	ECTS
Common M.Sc. Thesis	
• **M.Sc. thesis at AUEB**	30
• **FA 900 Master's Thesis in Financial Analytics at STEVENS**	
The thesis can be completed at the 2nd or 3rd year of the DD program at AUEB or STEVENS depending on the path and final agreement between the students and the supervising parties.	

Table 3: Transferable academic credits (Can be changed according to AUEB and STEVENS program changes)

AUEB Course	AUEB Course Cycle	ECTS	STEVENS Courses	USCH
• Time Series • Financial Econometrics	Cycle 3 – Stochastics	4 3.5	FA542 Time Series	3
• Probability Theory • Stochastic Models in Finance	Cycle 3 – Stochastics	4 3.5	FE610 Stochastic Calculus	3
• Statistical Learning • Statistics for Big Data	Cycle 2 – Computational Statistics	4 3.5	FA 590 Statistical Learning in Finance	3
• Data Analysis	Obligatory (1st semester)	7.5	FA 541 Applied Statistics with Applications in Finance	3
(Max) Total		30	(Max) Total	9
M.Sc. thesis at AUEB		30	FA 900 Master's Thesis in Financial Analytics at STEVENS	6

Table 4: Proposed Paths from AUEB to STEVENS and required academic credits

AUEB Cycle Selection	STEVENS-AUEB ECTS at AUEB	AUEB-STEVENS USCH at Stevens
Cycle 2 + 3 (with all proposed courses of Table 3)	30.0	21
Cycle 1 + 3 (with all proposed courses of Table 3)	37.5	21
Cycle 1 + 2 (with all proposed courses of Table 3)	45.0	24

- **Sample study plan while at Stevens**
- Semester 1

- FA582 Foundations of Financial Data Science (2 credits)
- FE513 Financial Lab: Practical Aspects of Database Design (1 credit)
- FE535 Introduction to Financial Risk Management (3 credits)
- FA900 Master Thesis (3 credits)
- For students who completed Cycle 3: FA 590 Statistical Learning in Finance (3 credits)
- For students who completed Cycle 2: FE 610 Stochastic Calculus (3 credits)
- For students who completed both cycles, an elective course will be chosen in consultation with the academic advisor

- Semester 2

- FA900 Master Thesis (3 credits)
- For students who completed cycle 2: FA542 Time Series with Applications to Finance (3 credits) and 2 other elective courses (6 credits)
- For students who completed cycle 3 or both cycles: 3 elective courses (9 credits)

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THANK **YOU**

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