UNIVERSITY OF LAUSANNE

Quantitative Portfolio Risk Analysis System: A Framework for Market Regime Detection and Risk Assessment in Semiconductor Equities

by

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I, NAME, declare that this thesis titled, 'TITLE' and the work presented in it are my own. I confirm that:

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Abstract

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Master of Science in Finance

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This research presents a comprehensive quantitative framework for analyzing portfolio risk in the semiconductor sector, with particular emphasis on regime detection methodologies and Monte Carlo simulations incorporating heavy-tailed distributions. The system implements sophisticated statistical approaches for risk assessment, including Value at Risk (VaR) and Expected Shortfall (ES) calculations, while accounting for regime-dependent volatility dynamics.

Current implementation status includes working data pipeline, Monte Carlo simulation, and regime detection components, with risk analysis under active development and planned improvements for visualization.

Acknowledgements

The acknowledgements and the people to thank go here, don't forget to include your project advisor.

Executive Summary

The executive summary should go here. Write about 2 pages...

Part I

Statistical Foundations and Methodology

Chapter 1

Introduction

1.1 Introduction

TEXT

Chapter 2

Theoretical Framework

Chapter 3

Data and Implementation

Part II

Empirical Analysis

Chapter 4

Market Regime Analysis

Chapter 5

Risk Management Results

Chapter 6

Monte Carlo Validation

Chapter 7

Conclusion

Chapter 8

Implementation Status

8.1 Project Components

Component	Status	Notes
Data Pipeline	Complete	Core functionality implemented
Monte Carlo	Complete	Module works as expected
Visualization	In Progress	Planned improvements
Signals	Pending	Development not started
Risk Analysis	In Progress	Under active development
Regime Detection	Complete	Core algorithms implemented

Table 8.1: Current Implementation Status (as of v0.3)

Bibliography

Tables

	PML2			
	$T = 25$		$T = 100$	
True parameters	$a = 1$	$b = 1$	$a = 1$	$b = 1$
Mean	0.996	0.915	0.994	0.956
STD	0.567	0.249	0.401	0.177
min	0.001	0.001	0.001	0.331
max	4.464	2.206	2.848	1.619
RMSE	0.567	0.263	0.401	0.182
	QGPML2			
	$T = 25$		$T = 100$	
True parameters	$a = 1$	$b = 1$	$a = 1$	$b = 1$
Mean	0.997	0.917	0.998	0.957
STD	0.552	0.247	0.393	0.176
min	0.001	0.001	0.001	0.330
max	3.880	2.200	2.543	1.641
ΔRMSE (%)	2.606	0.937	2.193	0.728

Table 4: This Table reports the results of the QGPML2 simulation described in model (1). The true parameters are $a = 1$, and $b = 1$. The RMSE is defined as $\left(\frac{1}{M}\sum_{j=1}^{M}(\hat{\theta}^{(j)} - \theta)^2\right)^{1/2}$, where $\theta = a$ or b. Here, the superscript $j = 1, \cdots, M$ denotes a simulation. We took $M = 30'000$. By ΔRMSE (%) we denote the percentage gain in the MSE if one uses QGPML2 instead of PML2.

Figures

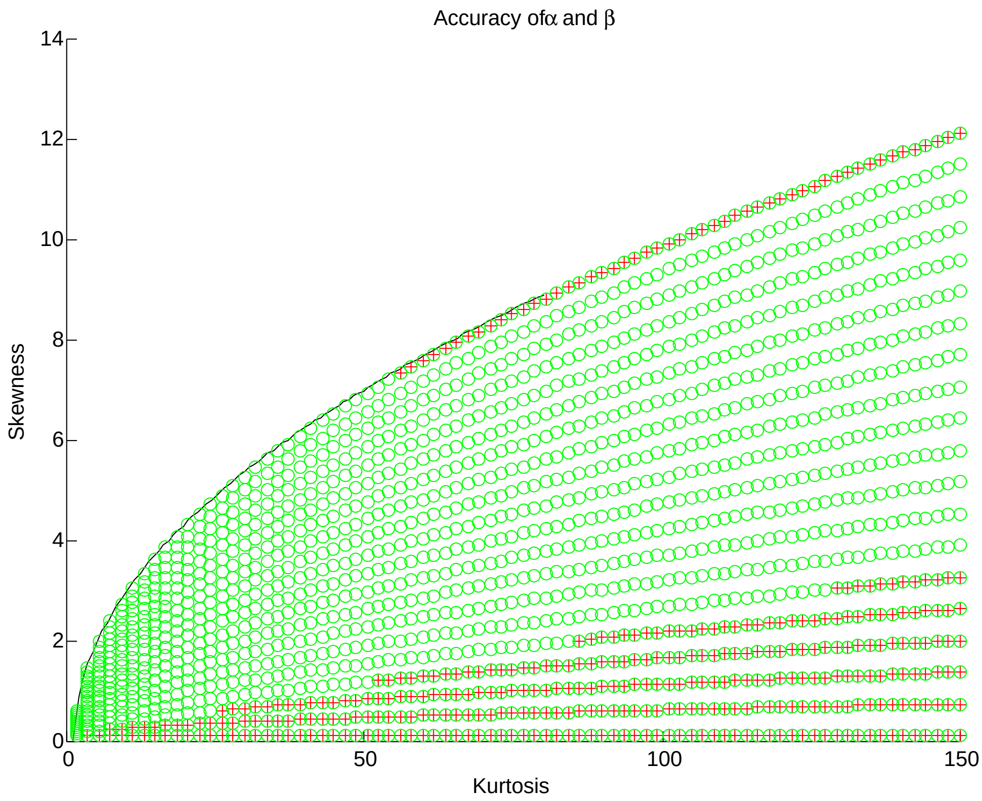

Figure 8.1: This figure represents the skewness-kurtosis domain for which a density exists (the domain is symmetric with respect to the horizontal axis). The circles represent those points for which we computed the parameters α and β. The symbol + represents those points for which the distance between the original skewness and kurtosis and the recomputed skewness and kurtosis (after evaluation of the α and β) is larger than 10^{-5}.