

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>The Automotive Industry</b>	<b>7</b>
2.1	Relevance of the Industry and of the Captive Financial Companies . . . . .	7
2.2	Risk Management in Industry and Commerce . . . . .	9
2.2.1	Risks and Risk Management in Banking . . . . .	10
2.2.2	Risks in Industry and Commerce . . . . .	12
2.2.3	Risk Management in Industry and Commerce . . . . .	13
2.2.4	Risks and Risk Management in the Automotive Industry . . . . .	14
2.3	Stakeholders in the Automotive Industry . . . . .	16
2.3.1	Classical Stakeholders and Captive Finance Companies . . . . .	16
2.3.2	The Regulator as Additional Stakeholder . . . . .	18
2.3.3	Conflict of Interest . . . . .	20
2.4	Summary . . . . .	21
<b>3</b>	<b>Credit Risk Models</b>	<b>23</b>
3.1	Model Requirements in the Automotive Industry . . . . .	24
3.1.1	Types of Products in Car Financing and Leasing . . . . .	24
3.1.2	Credit Portfolios in the Automotive Industry . . . . .	26
3.1.3	Data Availability, Empirical and Modeling Requirements . . . . .	27
3.2	Elements of Credit Risk Modeling . . . . .	28
3.2.1	Conceptual Issues . . . . .	30

3.2.2	Parameter Specification . . . . .	31
3.2.3	Backtesting and Alternatives for Validation . . . . .	32
3.2.4	Implications for the Automotive Industry . . . . .	33
3.3	Model Selection . . . . .	34
3.3.1	Short History of Credit Risk Models . . . . .	34
3.3.2	Classification of Credit Risk Models . . . . .	35
3.3.3	Comparability and Mixtures of Models . . . . .	37
3.3.4	Applicability of Model Types to Auto Portfolios . . . . .	38
3.3.5	Implementations of CR+ . . . . .	39
<b>4</b>	<b>CreditRisk+ and the Regulatory Model</b>	<b>41</b>
4.1	The Original CreditRisk+ Model . . . . .	41
4.1.1	Introduction and Survey . . . . .	41
4.1.2	Data Requirements . . . . .	42
4.2	Framework of CreditRisk+ . . . . .	42
4.2.1	Probability Generating Functions . . . . .	43
4.2.2	Assumption I : Default independence conditional on individual default rates . . . . .	44
4.2.3	Assumption II : Approximation of probability generating function . . . . .	44
4.2.4	Assumption III : Functional form of the individual default rates . . . . .	45
4.2.5	Idiosyncratic Sectors . . . . .	46
4.2.6	Assumption IV : Independent gamma distributions of sector default rates . . . . .	46
4.2.7	Assumption V : Rounding and standardizing of exposures . . . . .	47
4.2.8	Computation of the Unconditional Loss Distribution . . . . .	48
4.2.9	Implied Dependency Structure . . . . .	49
4.2.10	Discussion . . . . .	51
4.3	Extensions of CreditRisk+ . . . . .	53
4.3.1	Incorporation of Rating Migrations . . . . .	53
4.3.2	Default and Loss Correlations . . . . .	54

4.4	Implementation of CreditRisk+ . . . . .	57
4.4.1	Determination of Loss Distribution . . . . .	57
4.4.2	Further Issues . . . . .	65
4.5	The Regulatory Model . . . . .	67
<b>5</b>	<b>Credit Risk Management</b>	<b>71</b>
5.1	Risk Measures and Contributions . . . . .	71
5.1.1	Portfolio Risk Measures . . . . .	71
5.1.2	Examples for Portfolio Risk Measures . . . . .	73
5.1.3	Risk Contributions . . . . .	75
5.2	Portfolio Risk Measures and Contributions in CreditRisk+ . . . . .	77
5.2.1	Portfolio Risk Measures . . . . .	77
5.2.2	Risk Contributions . . . . .	78
<b>6</b>	<b>A Model for Securitization</b>	<b>81</b>
6.1	Capital and the Management of Financial Institutions . . . . .	82
6.1.1	Capital . . . . .	82
6.1.2	Views on Capital at Financial Institutions . . . . .	83
6.2	Securitization . . . . .	87
6.2.1	Introduction . . . . .	87
6.2.2	Proceedings, Classifications, and Structures of Securitization . . . . .	88
6.2.3	Motivation for Securitizations . . . . .	92
6.2.4	Excursion: Moody's Approach to Asset-backed Securities . . . . .	95
6.3	Securitization in the Automotive Industry . . . . .	100
6.3.1	Issuer's View . . . . .	100
6.3.2	Investors's View . . . . .	100
6.3.3	Securitization Example: DC Auto Trust 2002-C . . . . .	103
6.3.4	Employment of Credit Derivatives . . . . .	104
6.4	A Model for the Securitization of Car Financing Contracts . . . . .	106

6.4.1	General Setting . . . . .	106
6.4.2	Short Survey of Objectives . . . . .	110
6.4.3	Objective 1: Minimizing Regulatory Capital . . . . .	111
6.4.4	Objective 2: Regulatory Capital Arbitrage . . . . .	112
6.4.5	Objective 3: Optimization of RoE and RoRaC . . . . .	114
6.4.6	Alternative Problem Formulations . . . . .	115
6.4.7	Extensions of the Model . . . . .	116
6.5	Regulatory Framework . . . . .	117
6.5.1	Alignment of the Model in the Regulatory Framework . . . . .	117
6.5.2	Inputs for the Calculation of Regulatory Capital for Securitized Loans . . . . .	118
6.5.3	The Supervisory Formula Approach SFA . . . . .	120
<b>7</b>	<b>Empirical Analysis</b>	<b>123</b>
7.1	Implementation . . . . .	124
7.1.1	Model Choice, Parameterization and Implementation . . . . .	124
7.1.2	Implementation of Framework and Problems . . . . .	125
7.1.3	Simulation of Loss Distribution . . . . .	127
7.2	Data Information and Manipulations . . . . .	128
7.2.1	Loss Rate Information . . . . .	128
7.2.2	Default Rate Information . . . . .	131
7.2.3	Borrower Information . . . . .	133
7.3	Results . . . . .	135
7.3.1	Loss Distribution and Risk Contributions . . . . .	135
7.3.2	Optimization Results . . . . .	138
7.4	Conclusion . . . . .	142
<b>8</b>	<b>Summary and Topics for Future Research</b>	<b>145</b>
	<b>Appendix: Explicit Calculations for the CR+ Model</b>	<b>149</b>

**Appendix: Abbreviations**

**153**

**Appendix: Variables**

**155**

**Bibliography**

**157**