

Contents

Abstract	iii
Zusammenfassung	v
Acknowledgements	ix
Contents	xi
List of Figures	xvii
List of Tables	xix
List of Listings	xxi
1. Introduction	1
I. Minimal Winning Coalition's Force of Expression	9
2. Mathematical Framework - Basics on Voting Systems	11
2.1. Foundations	11
2.2. Some useful voting rules	14
2.3. Weighted voting	15
2.4. Decisiveness - influence as political power	19
2.5. Minimal winning coalitions	21
2.6. Measurement	23
2.7. On the ability to act	26
3. $\mathcal{M}(\mathcal{G})$ as Indicator for WVSs	29
3.1. Trade robustness	29
3.2. The Deegan-Packel index	31

3.3. A construction manual for vector-weighted VSs	33
3.4. Conclusions	33
4. Power Profiles	35
4.1. A new calculation formula for the Banzhaf score, η	36
4.2. A new calculation formula for the SSI, ϕ	39
4.3. An alternative calculation formula for the Coleman indices, Col_V and Col_V^*	41
4.4. Example CMEC	42
4.5. Conclusions	44
5. Mathematical Framework - Symmetry and Symmetry Classes	45
5.1. Symmetry	45
5.2. Classes of power profiles	46
5.3. Remarks on dual VSs	48
6. Implementation	51
6.1. Preliminaries	51
6.2. Computation	54
6.3. Results	55
 II. Fair Distributions in Two-Tier Voting Systems	 59
7. Mathematical Framework - Fair Distribution of Voting Power in Two-Tier VSs	61
7.1. Two-tier voting systems	62
7.2. Fair distribution	64
8. Invariably Suboptimal - An Attempt to Improve the Treaties of Nice and Lisbon	69
8.1. Two VSs for the CMEU	69
8.1.1. Treaty of Nice	70
8.1.2. Treaty of Lisbon	70
8.1.3. A first discussion	71
8.2. Voting power and the Jagiellonian Compromise	71
8.3. Penrose versus the Treaties of Nice and Lisbon	73
8.3.1. A second discussion	73
8.4. Improvements	75
8.4.1. Investigations	76
8.4.2. Results for Nice	76

8.4.3. Results for Lisbon	77
8.4.4. Discussion of the results	77
8.4.5. Investigations and results for JC+	79
8.5. Conclusions	80
9. Improvements for the BVK of the Friedrich-Ebert-Stiftung	83
9.1. Introduction	83
9.2. One Student. One Vote.	84
9.3. Conclusions	86
 III. Probabilistic Investigations on Efficiency and the Democracy Deficit	 89
10. Mathematical Framework - Probabilistic Investigations	91
10.1. Models	92
10.1.1. The General Model	92
10.1.2. The Independence Model	95
10.1.3. The Collective Bias Model	96
10.1.4. The Cooperation Model	98
10.2. Efficiency and blocking power	101
10.3. Some theory on large deviations	103
10.3.1. Moments	104
10.3.2. The central limit theorem	106
10.3.3. Large deviations	106
10.3.4. Laplace's method	110
10.4. Democracy deficit	111
 11. Efficiency	 115
11.1. Preliminaries	115
11.2. The Independence Model	118
11.2.1. Homogeneity	118
11.2.2. Heterogeneity	119
11.3. The Collective Bias Model	122
11.3.1. Homogeneity	122
11.3.2. Heterogeneity	123
11.4. The Cooperation Model	125
11.4.1. Homogeneity	125
11.4.1.1. Estimation of the first factor	126
11.4.1.2. Estimation of the second factor	129

11.4.1.3. Combining the results	131
11.4.2. Heterogeneity	133
11.4.2.1. Behavior of LT_N	136
12. On the Democracy Deficit in Two-Tier VSs	139
12.1. Preliminaries	139
12.2. Independent voting in the council	143
12.2.1. Independent voting within the countries	145
12.2.2. Correlated voting within the countries	146
12.2.3. Cooperations within the countries	148
12.2.3.1. Weak cooperations, $0 < \beta < 1$	149
12.2.3.2. Phase transition, $\beta = 1$	150
12.2.3.3. Strong cooperations, $\beta > 1$	151
12.3. Collective bias across country borders	152
13. Improvement Proposals for the CMEC of 1958	157
14. Conclusions	163
IV. Appendix	169
15. Appendix	171
A. Power profiles	171
A.1. Java programs	171
A.1.1. Generation of antichains	171
A.1.2. Calculations of BzI, SSI and Coleman index for VSs with $1 \leq N \leq 6$ voters.	174
A.2. Tables	180
A.2.1. Essentially different BzI profiles for VSs with $1 \leq$ $N \leq 6$ voters.	180
A.2.2. Coleman indices for VSs with $1 \leq N \leq 6$ voters . .	226
B. Invariably suboptimal	231
B.1. Java programs	231
B.1.1. Calculations for the Treaty of Nice	231
B.1.2. Calculations for the Treaty of Lisbon	236
B.2. Tables	241
C. Hyperbolic Math Puzzle	247
D. Remarks on the Cooperation Model	249
References	251

Index	261
Glossary	265