Rescale comparisons

August 29, 2022

1 Introduction

This document studies whether setting `rescale = TRUE` helps with estimation using the same examples as described in the document titled *Matrix Decomposition Comparisons* (available here).

The `rescale` option was originally developed to address stability issues in the QCQP problem through rescaling the Gram matrix. Currently, `ivmte` only allows rescaling in the QCQP problems. I will allow rescaling in LP problems in the future.

`ivmte` performs the following procedure whenever `rescale = TRUE`. The package first rescales the variables so that the minimum magnitude of each column in the linear constraint matrix is -3. The package then rescales the variables so that the minimum magnitude of each row in the linear constraint matrix is -3.

Contents

1 Introduction **1**

2 Optimal upper and lower bounds **4**

2.1 Case 1, QCQP, unscaled 4

2.2 Case 1, QCQP, rescaled 4

2.3 Case 2, QCQP, unscaled 5

2.4 Case 2, QCQP, rescaled 5

2.5 Case 3, QCQP, unscaled 6

2.6 Case 3, QCQP, rescaled 6

2.7 Case 4, QCQP, unscaled 7

2.8 Case 4, QCQP, rescaled 7

3 Min. order of mag. in linear constraint matrix **8**

3.1 Case 1, QCQP, unscaled 8

3.2 Case 1, QCQP, rescaled 8

3.3 Case 2, QCQP, unscaled 9

3.4 Case 2, QCQP, rescaled 9

3.5 Case 3, QCQP, unscaled 10

3.6 Case 3, QCQP, rescaled 10

3.7 Case 4, QCQP, unscaled 11

3.8 Case 4, QCQP, rescaled 11

4 Range of order of mag. in linear constraint matrix **12**

4.1 Case 1, QCQP, unscaled 12

4.2 Case 1, QCQP, rescaled 12

4.3 Case 2, QCQP, unscaled 13

4.4 Case 2, QCQP, rescaled 13

4.5 Case 3, QCQP, unscaled 14

4.6 Case 3, QCQP, rescaled 14

4.7 Case 4, QCQP, unscaled 15

4.8 Case 4, QCQP, rescaled 15

5 Min. order of mag. in quadratic constraint matrix **16**

5.1 Case 1, QCQP, unscaled 16

5.2 Case 1, QCQP, rescaled 16

5.3 Case 2, QCQP, unscaled 17

5.4 Case 2, QCQP, rescaled 17

5.5 Case 3, QCQP, unscaled . . . 18
5.6 Case 3, QCQP, rescaled . . . 18
5.7 Case 4, QCQP, unscaled . . . 19
5.8 Case 4, QCQP, rescaled . . . 19

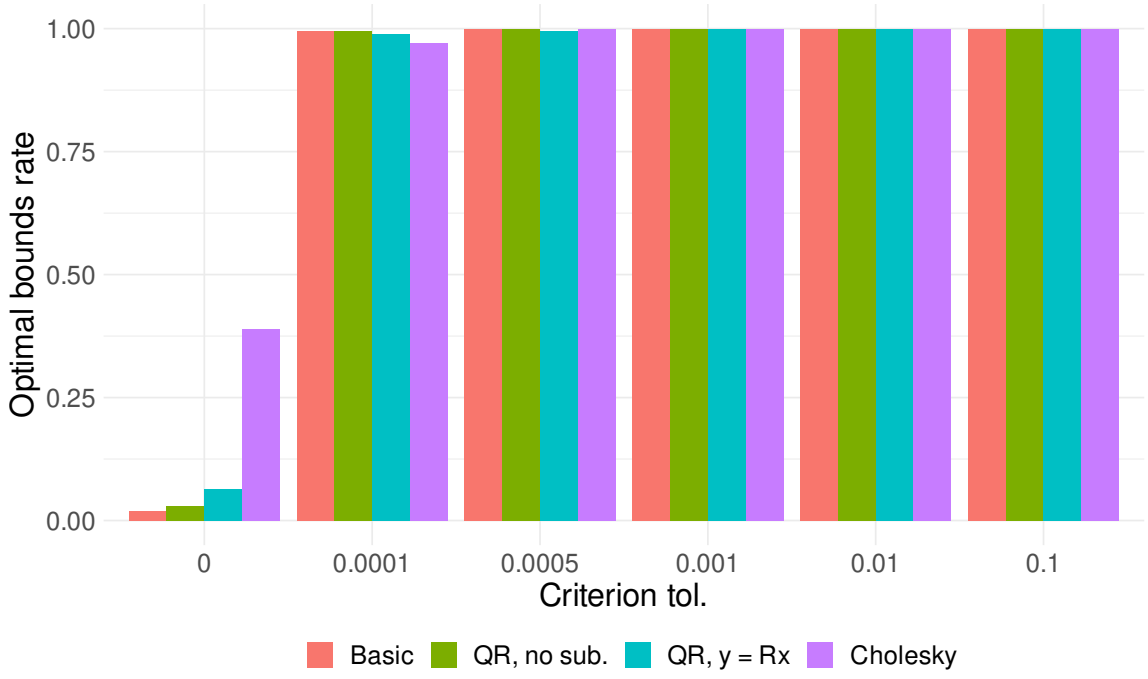
6 Range of order of mag. in quadratic constraint matrix 20
6.1 Case 1, QCQP, unscaled . . . 20
6.2 Case 1, QCQP, rescaled . . . 20
6.3 Case 2, QCQP, unscaled . . . 21
6.4 Case 2, QCQP, rescaled . . . 21
6.5 Case 3, QCQP, unscaled . . . 22
6.6 Case 3, QCQP, rescaled . . . 22
6.7 Case 4, QCQP, unscaled . . . 23
6.8 Case 4, QCQP, rescaled . . . 23

7 Min. order of mag. in quadratic constraint vector 24
7.1 Case 1, QCQP, unscaled . . . 24
7.2 Case 1, QCQP, rescaled . . . 24
7.3 Case 2, QCQP, unscaled . . . 25
7.4 Case 2, QCQP, rescaled . . . 25
7.5 Case 3, QCQP, unscaled . . . 26
7.6 Case 3, QCQP, rescaled . . . 26
7.7 Case 4, QCQP, unscaled . . . 27
7.8 Case 4, QCQP, rescaled . . . 27

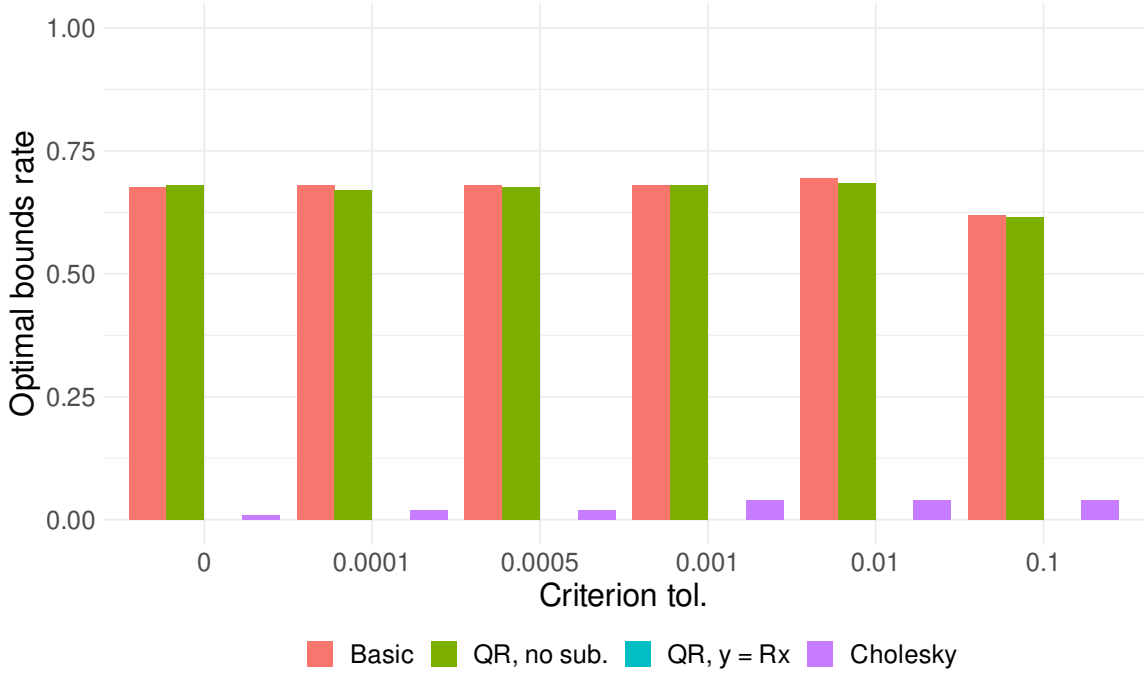
8 Range of order of mag. in quadratic constraint vector 28
8.1 Case 1, QCQP, unscaled . . . 28
8.2 Case 1, QCQP, rescaled . . . 28
8.3 Case 2, QCQP, unscaled . . . 29
8.4 Case 2, QCQP, rescaled . . . 29
8.5 Case 3, QCQP, unscaled . . . 30
8.6 Case 3, QCQP, rescaled . . . 30
8.7 Case 4, QCQP, unscaled . . . 31
8.8 Case 4, QCQP, rescaled . . . 31

2 Optimal upper and lower bounds

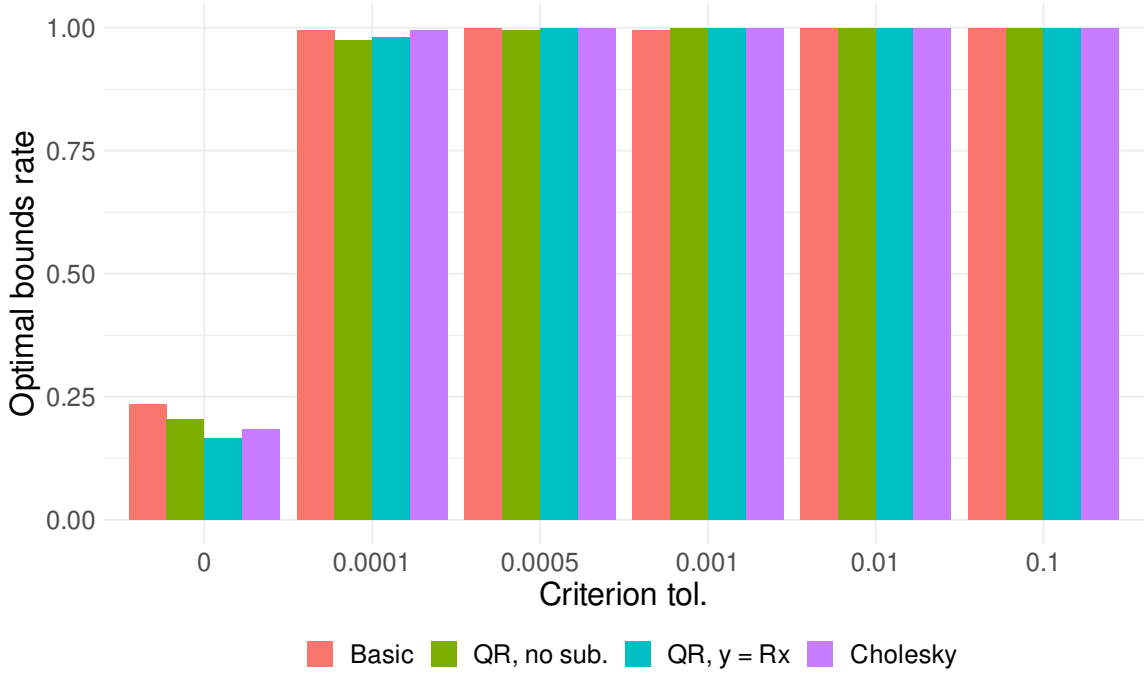
2.1 Case 1, QCQP, unscaled



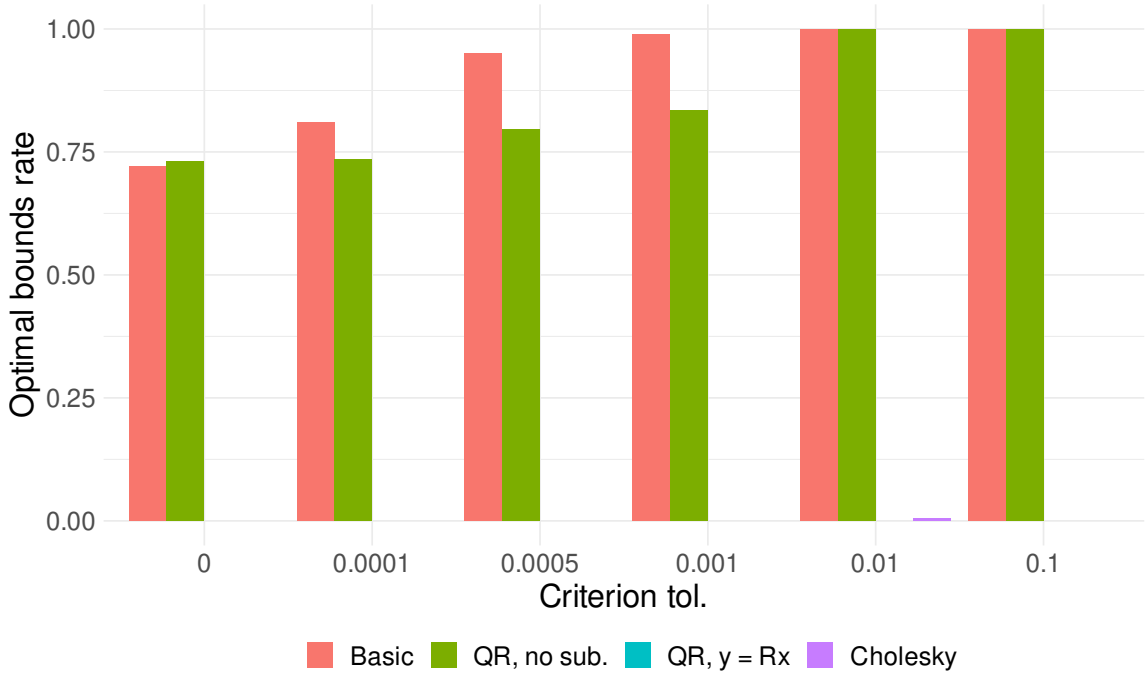
2.2 Case 1, QCQP, rescaled



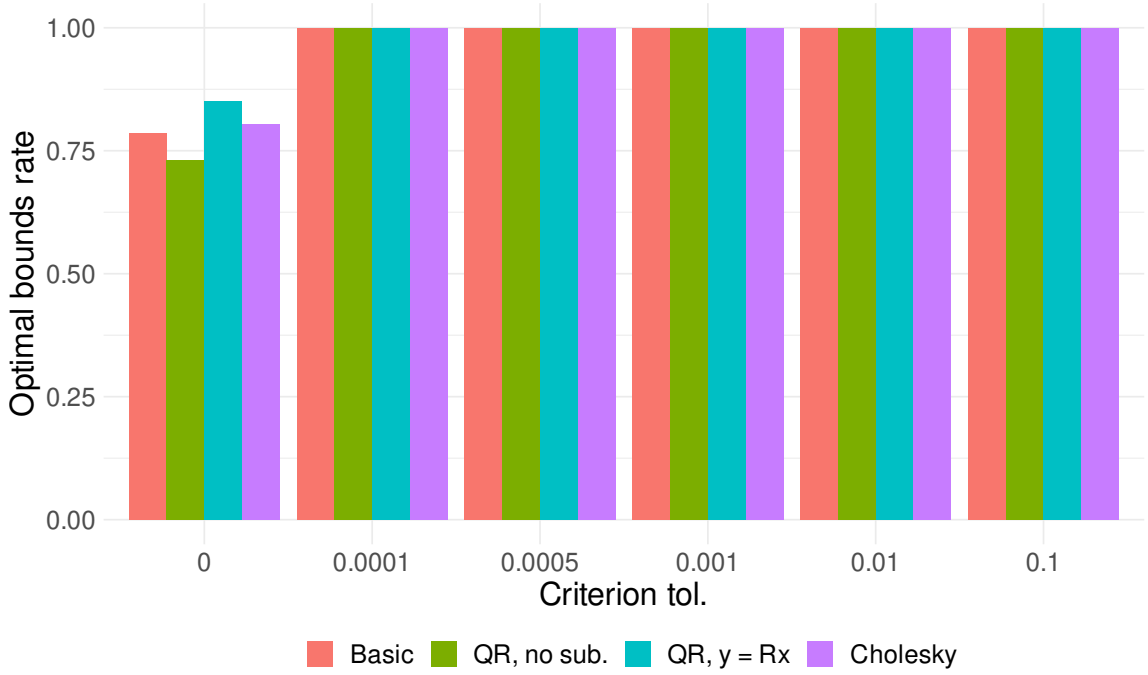
2.3 Case 2, QCQP, unscaled



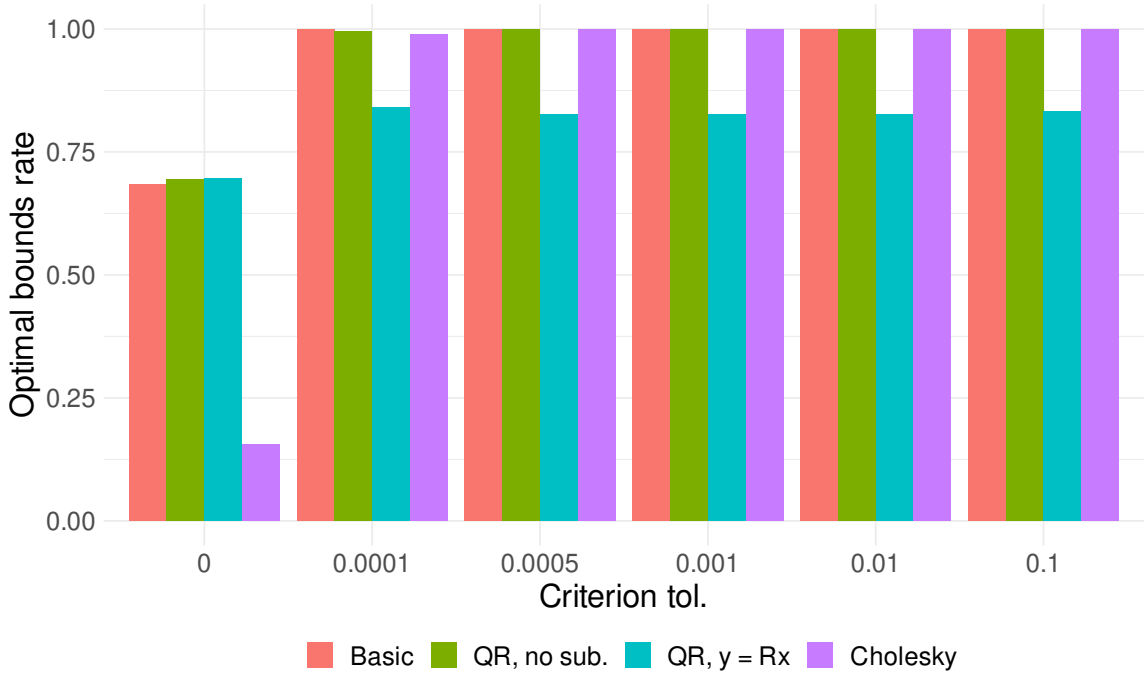
2.4 Case 2, QCQP, rescaled



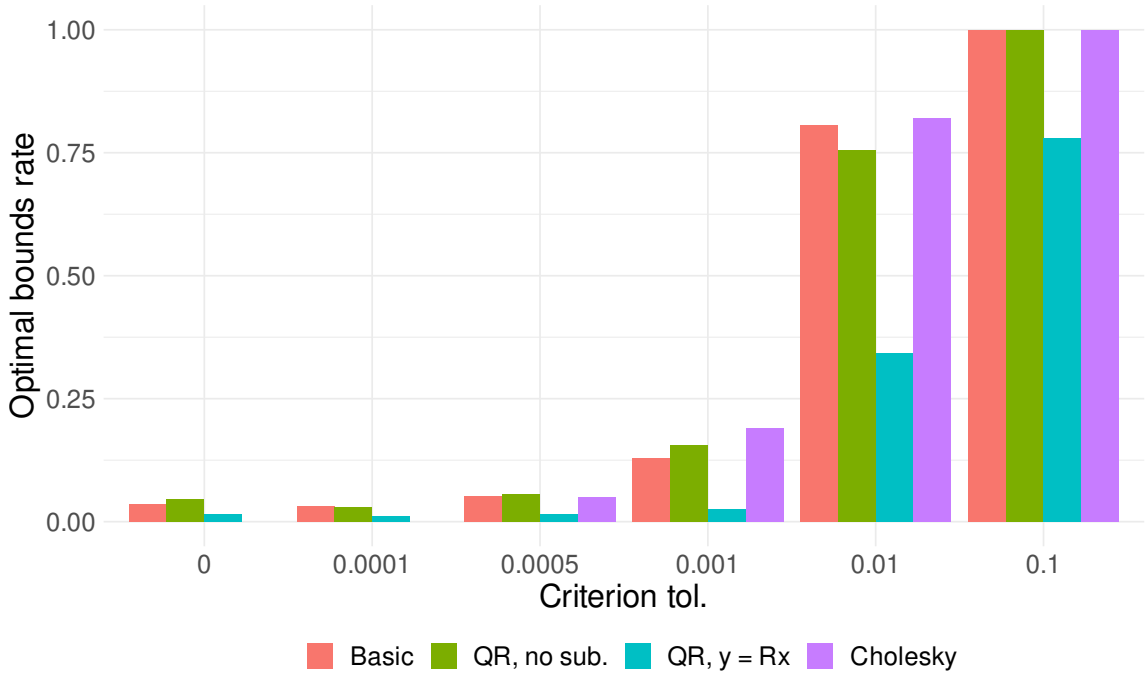
2.5 Case 3, QCQP, unscaled



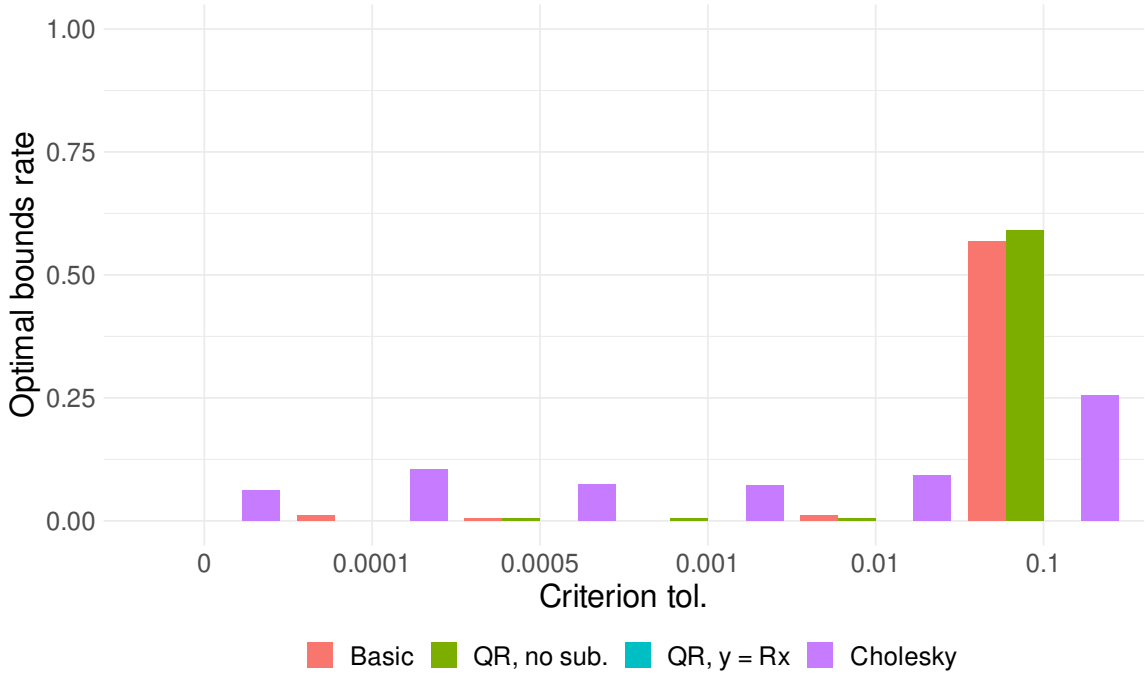
2.6 Case 3, QCQP, rescaled



2.7 Case 4, QCQP, unscaled

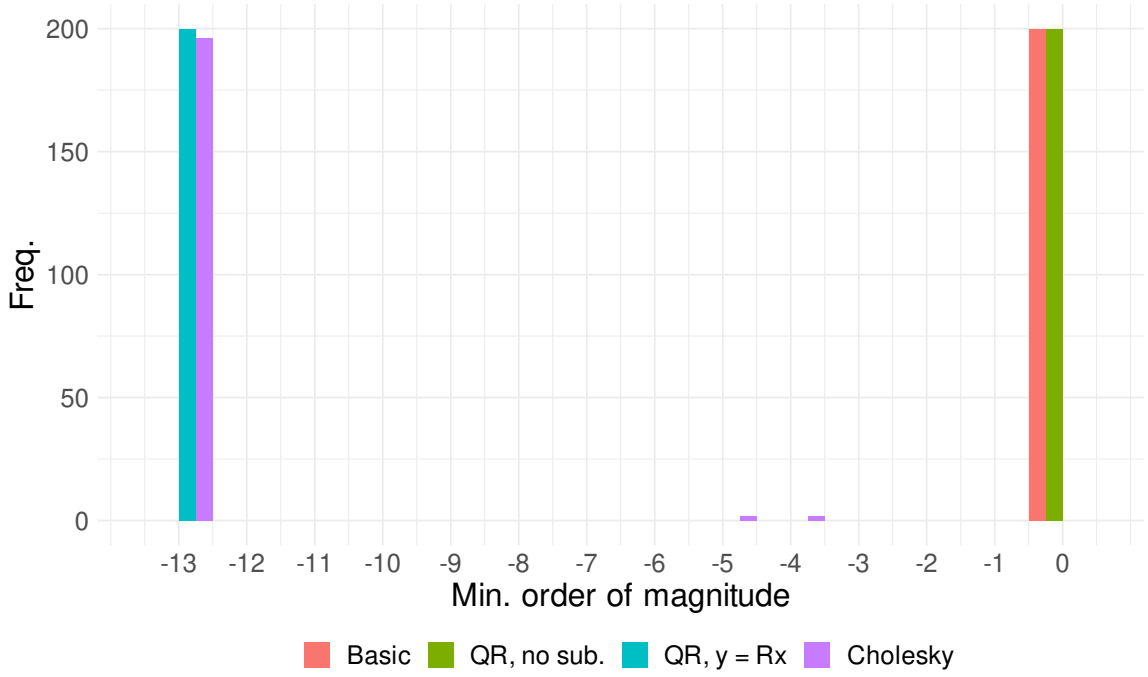


2.8 Case 4, QCQP, rescaled

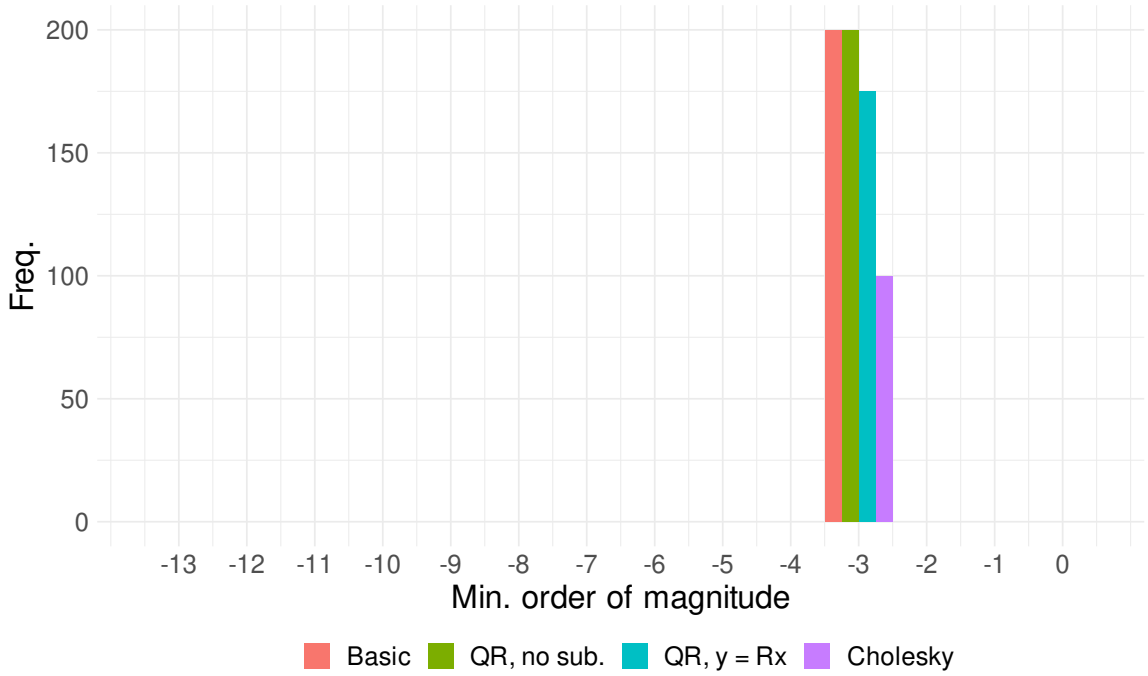


3 Min. order of mag. in linear constraint matrix

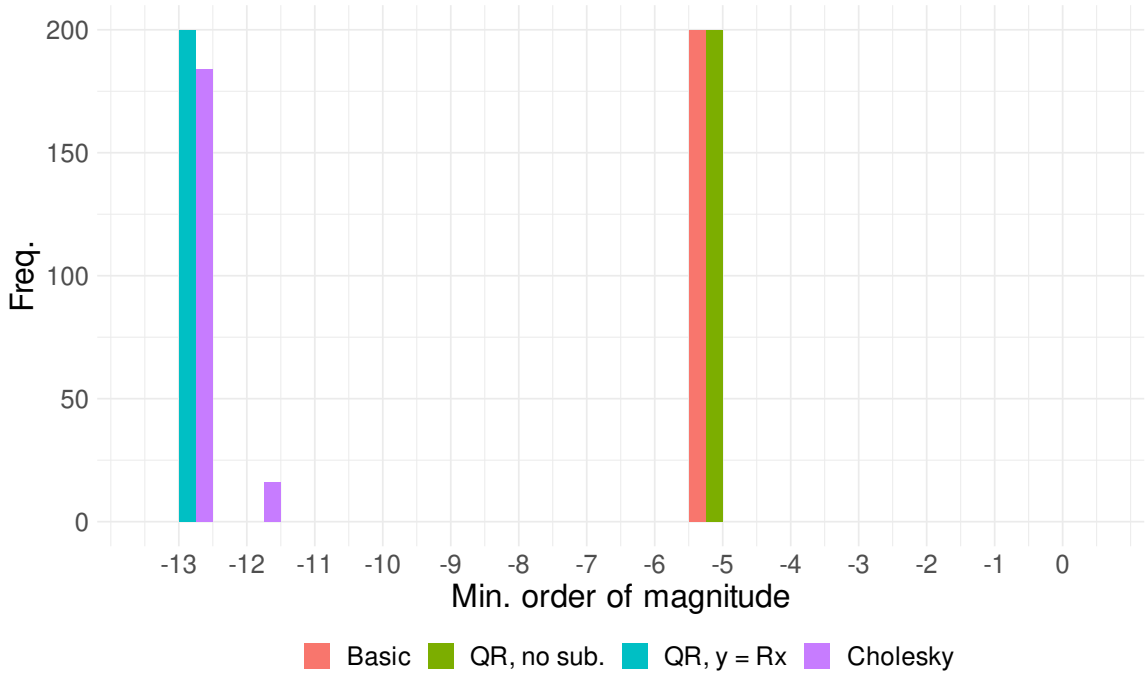
3.1 Case 1, QCQP, unscaled



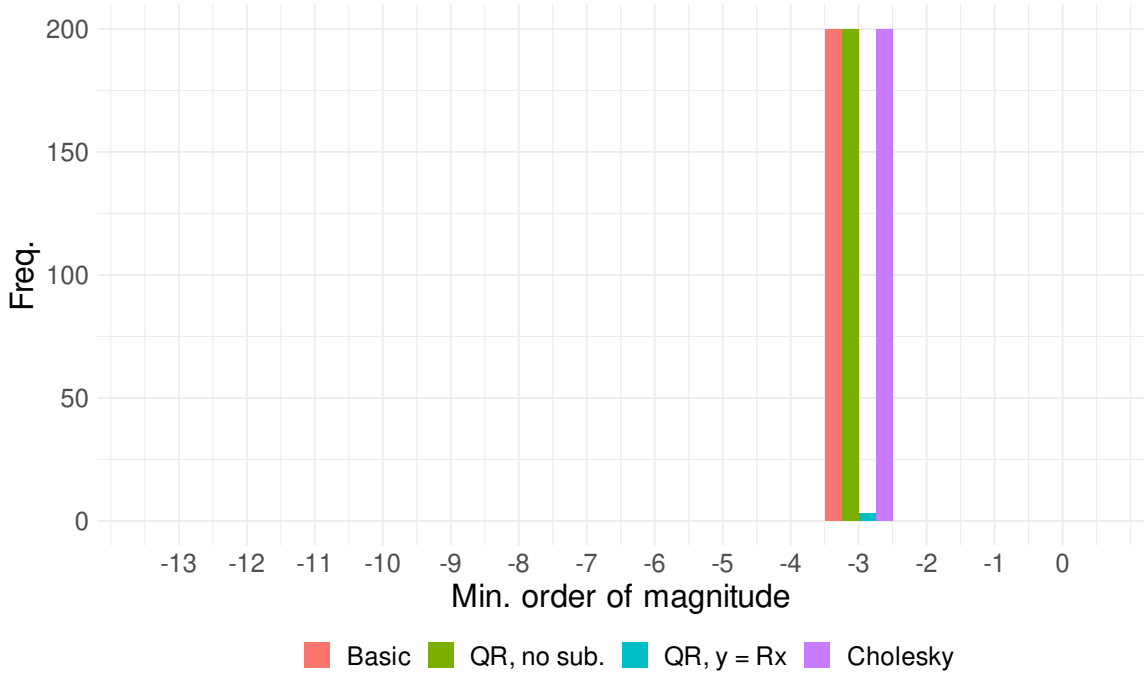
3.2 Case 1, QCQP, rescaled



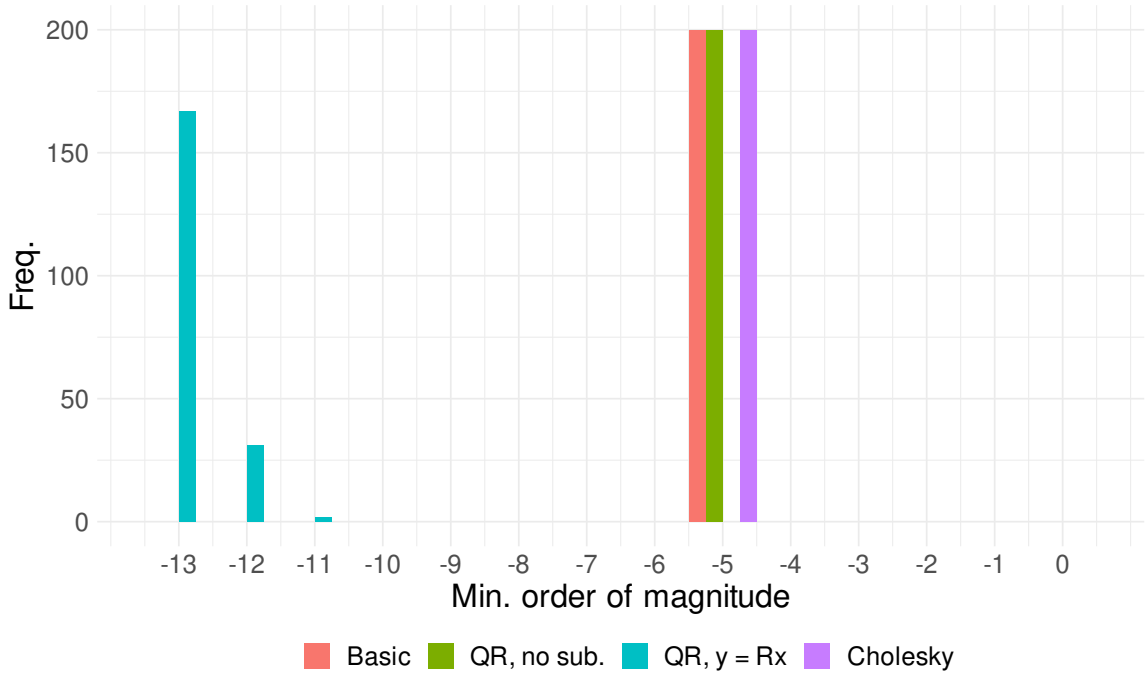
3.3 Case 2, QCQP, unscaled



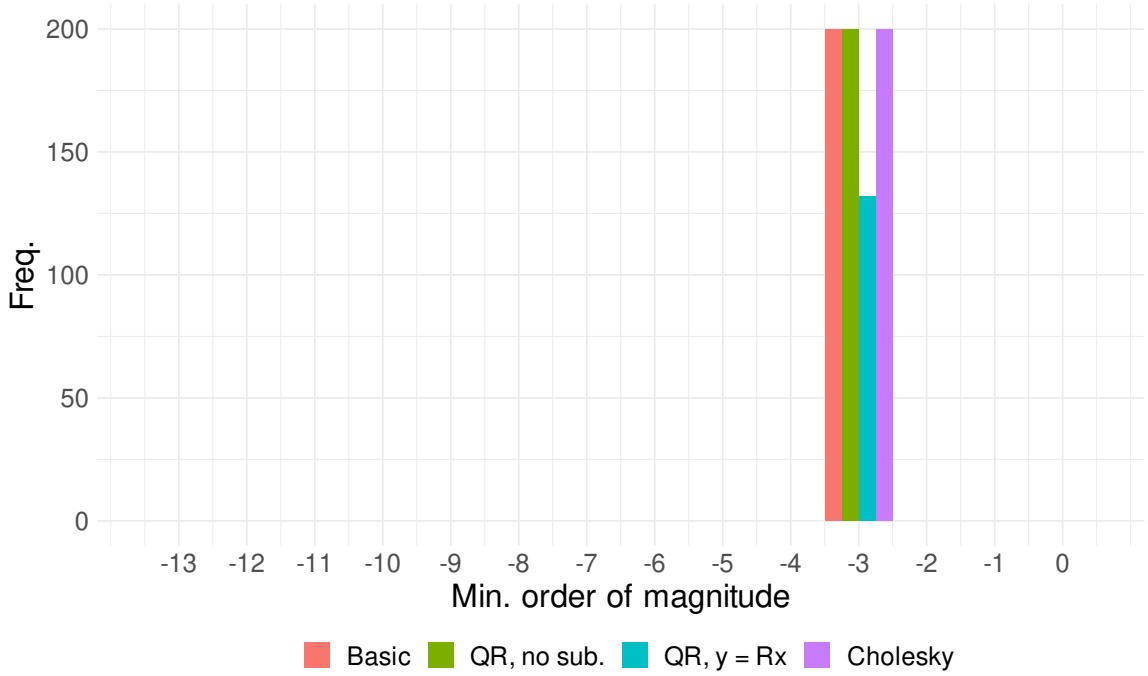
3.4 Case 2, QCQP, rescaled



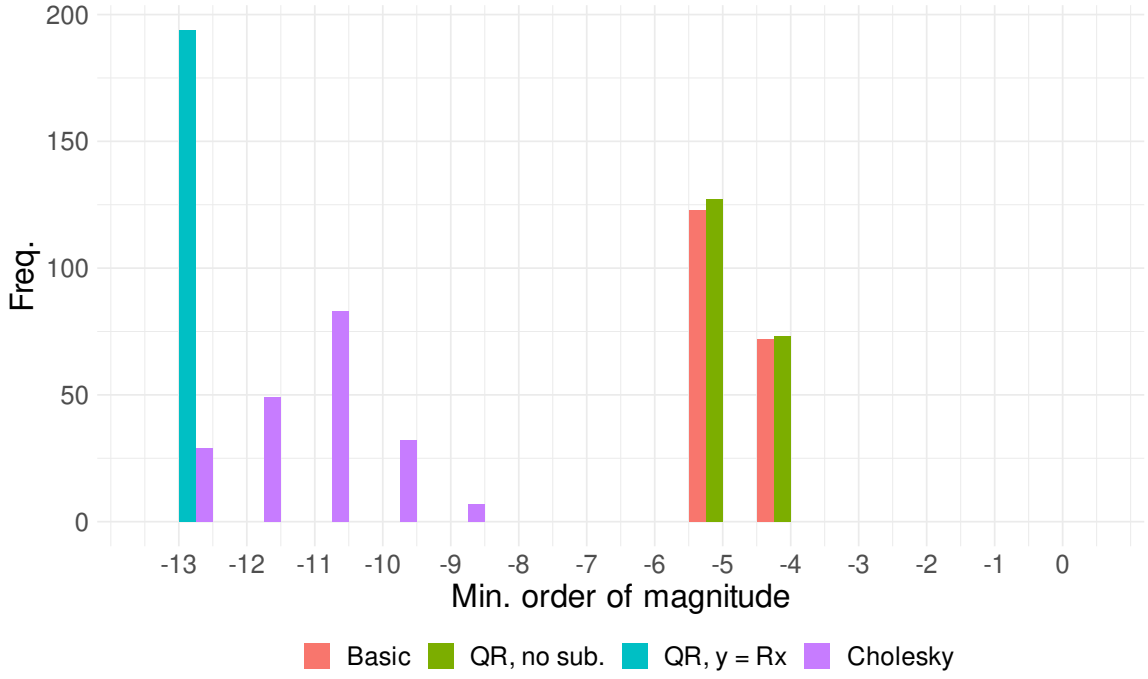
3.5 Case 3, QCQP, unscaled



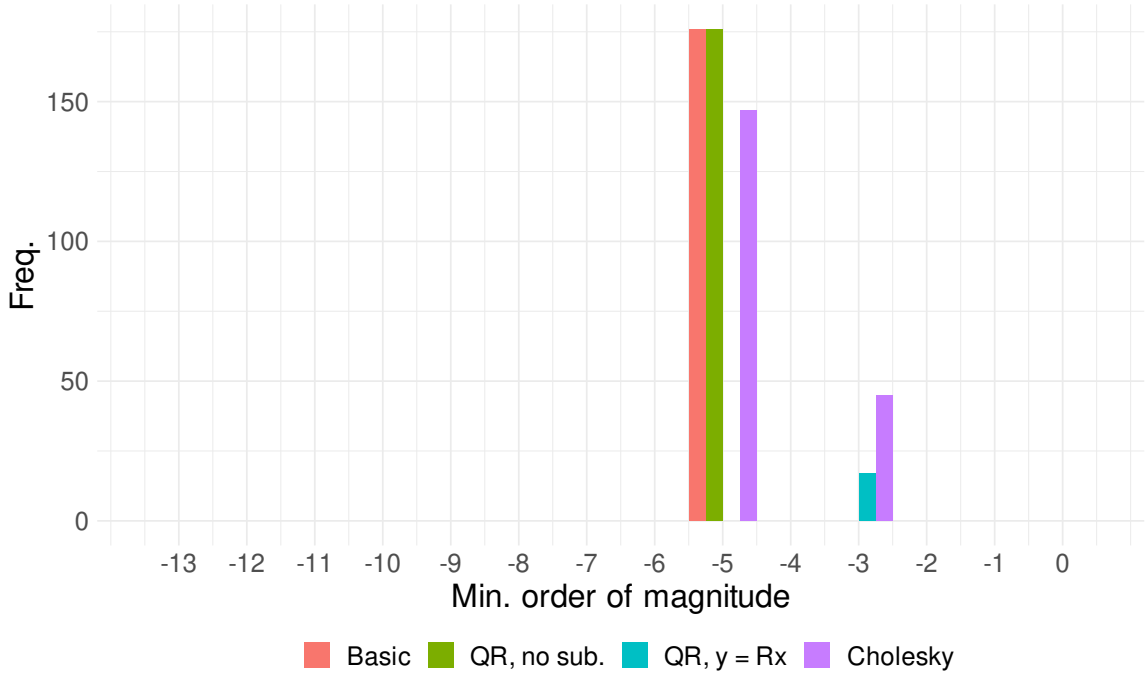
3.6 Case 3, QCQP, rescaled



3.7 Case 4, QCQP, unscaled

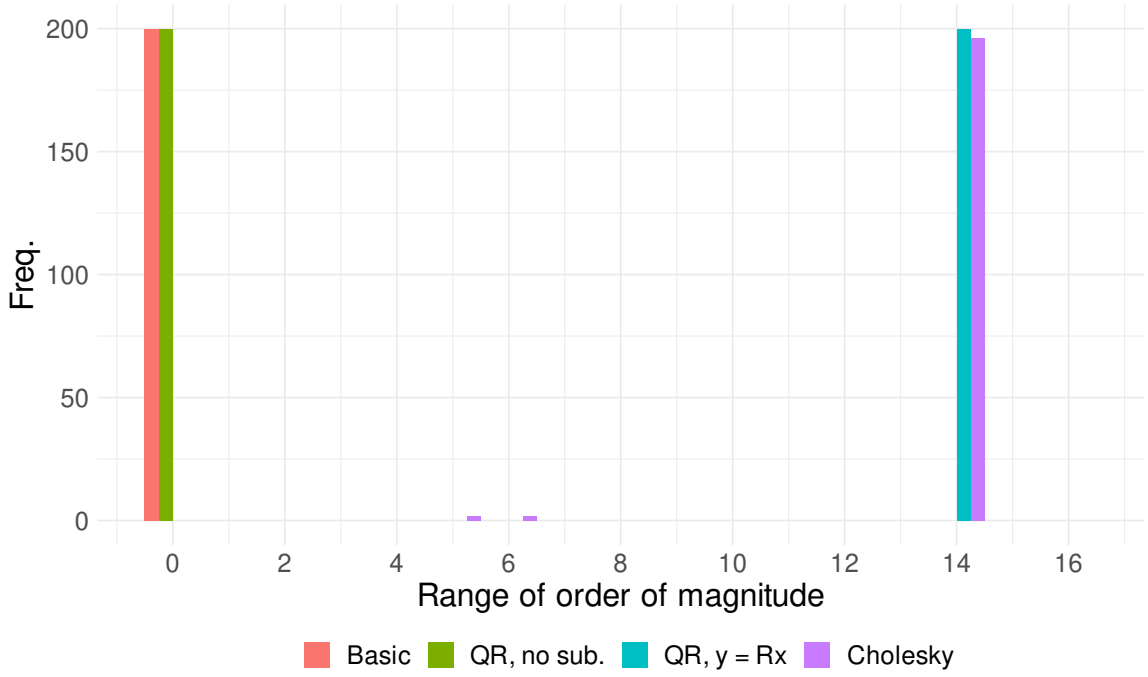


3.8 Case 4, QCQP, rescaled

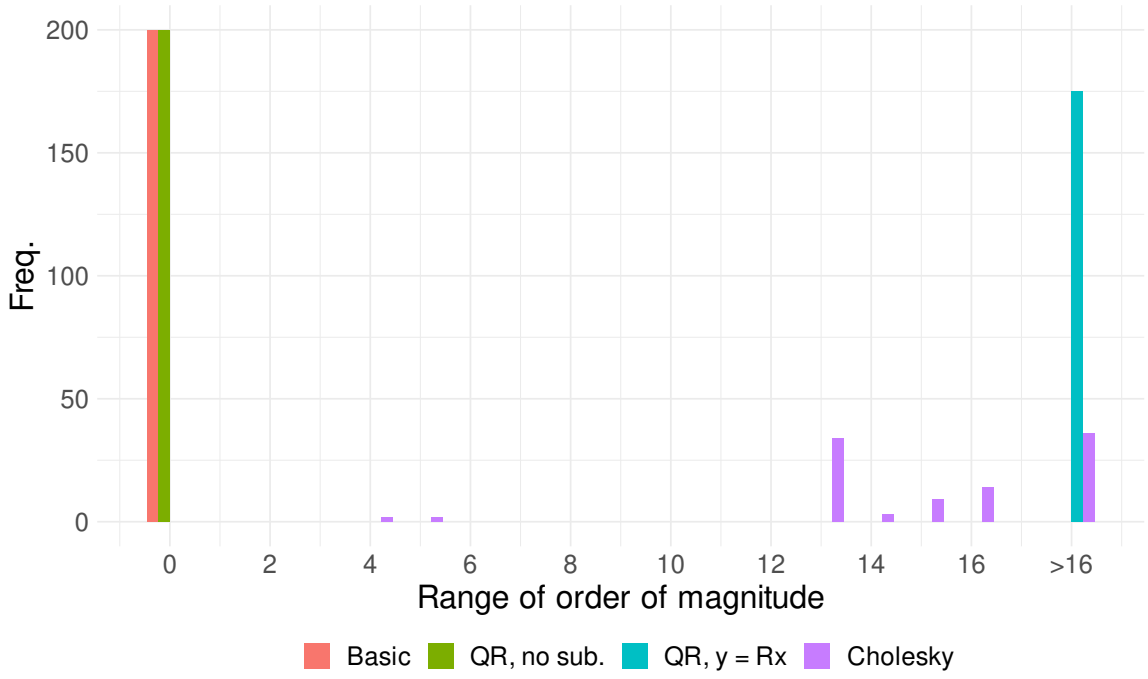


4 Range of order of mag. in linear constraint matrix

4.1 Case 1, QCQP, unscaled



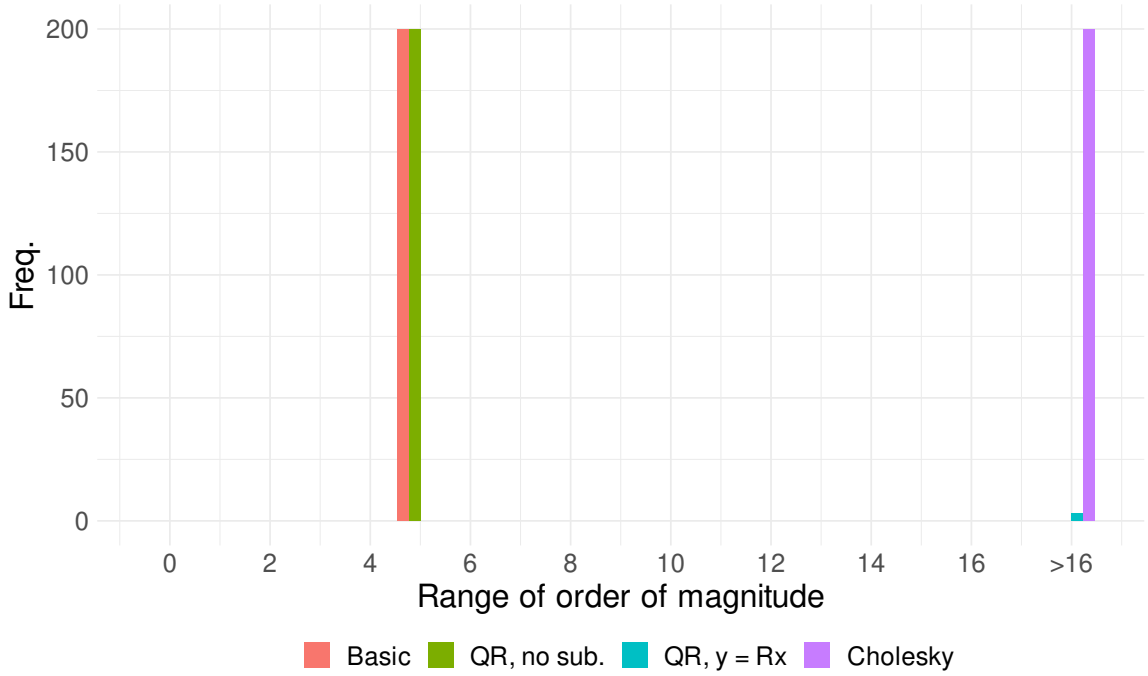
4.2 Case 1, QCQP, rescaled



Note: When `rescale = TRUE`, ranges go up to as high as 30 orders of magnitude.

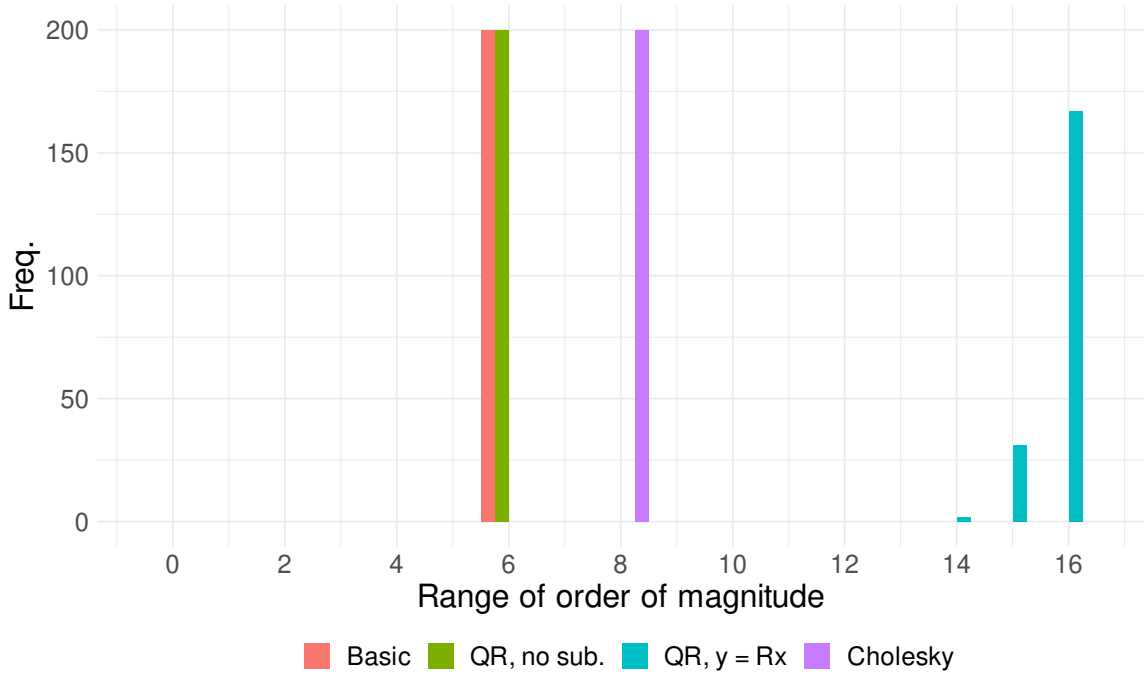
4.3 Case 2, QCQP, unscaled

4.4 Case 2, QCQP, rescaled

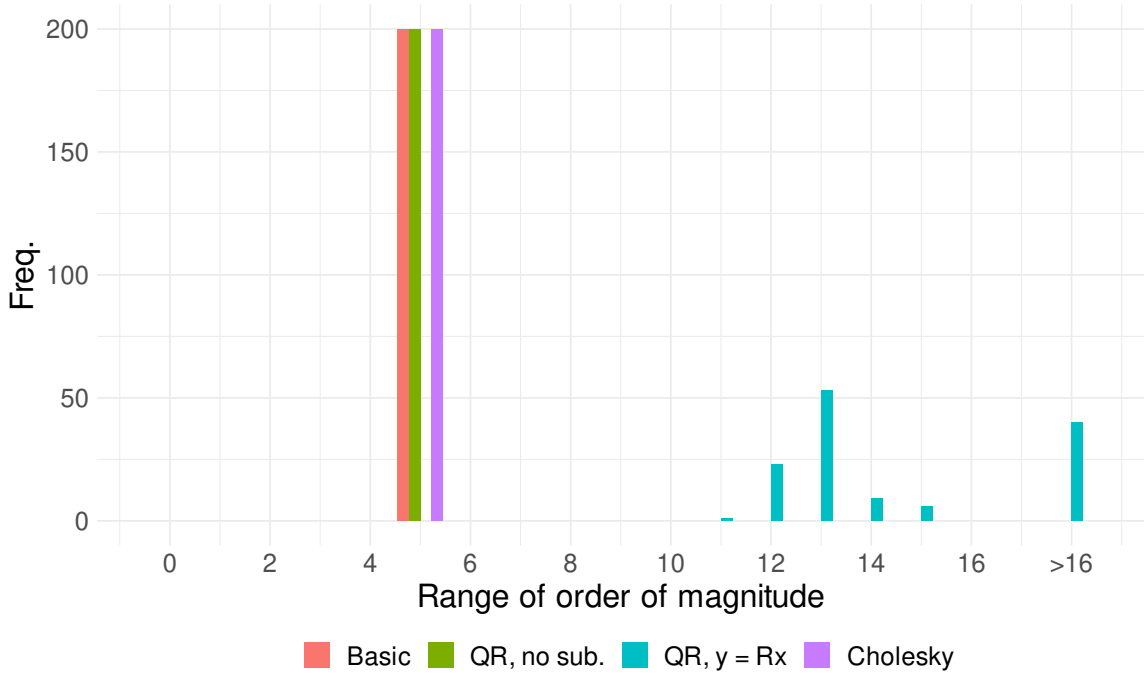


Note: When `rescale = TRUE`, ranges go up to as high as 30 orders of magnitude.

4.5 Case 3, QCQP, unscaled

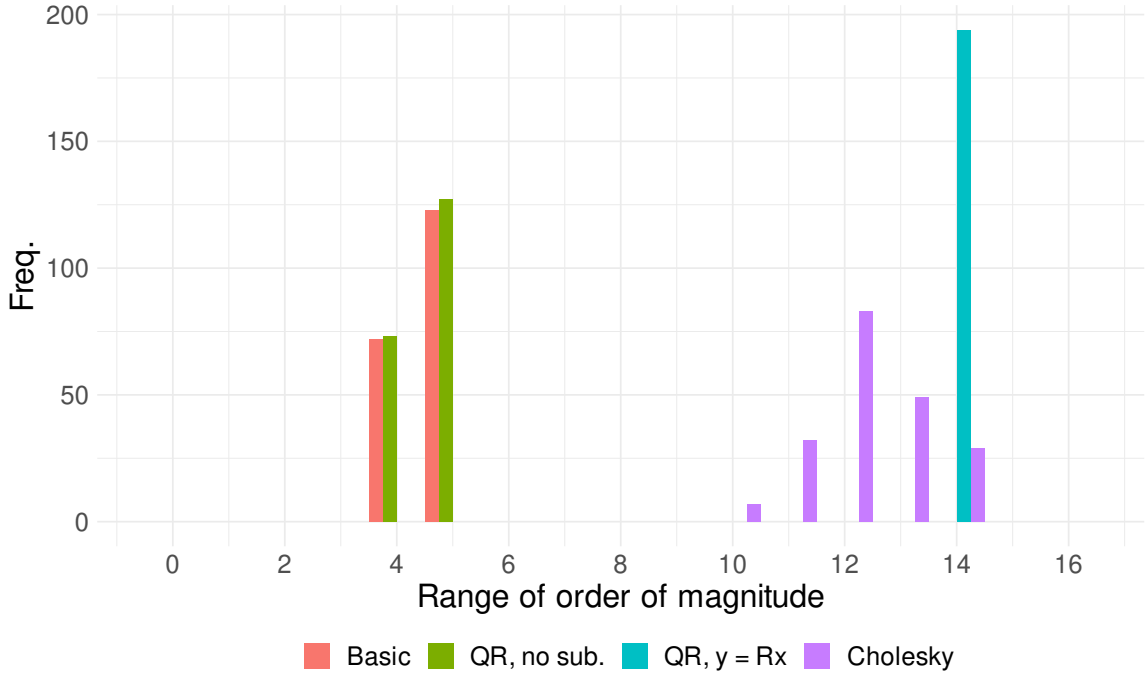


4.6 Case 3, QCQP, rescaled

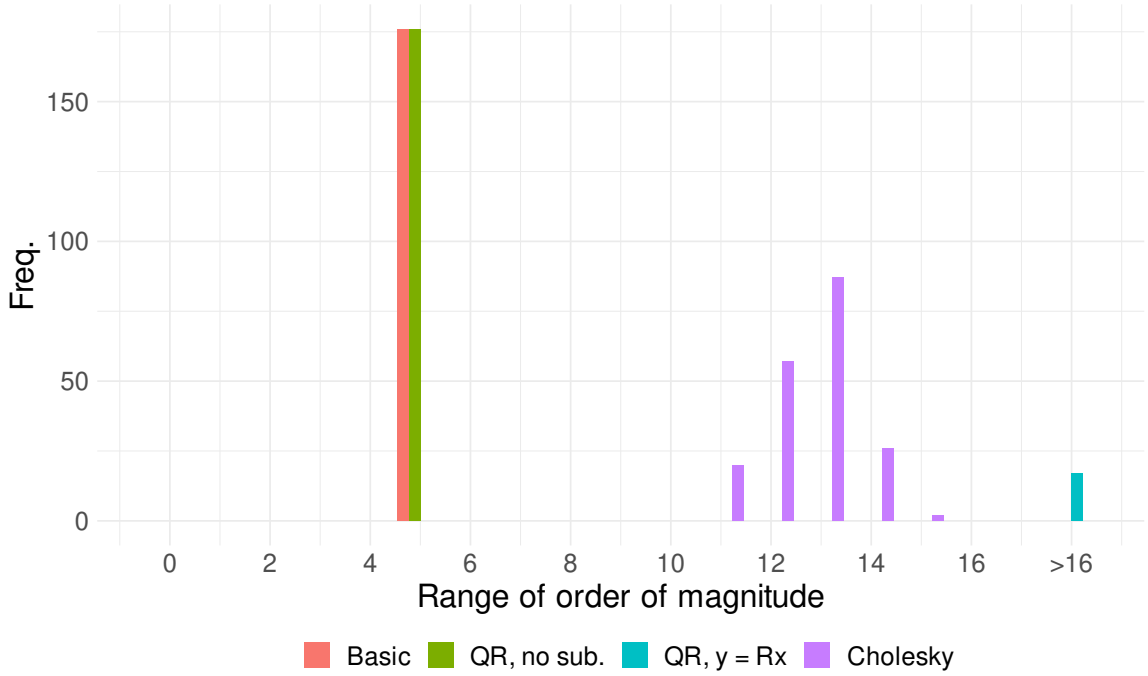


Note: When `rescale = TRUE`, ranges go up to as high as 30 orders of magnitude.

4.7 Case 4, QCQP, unscaled



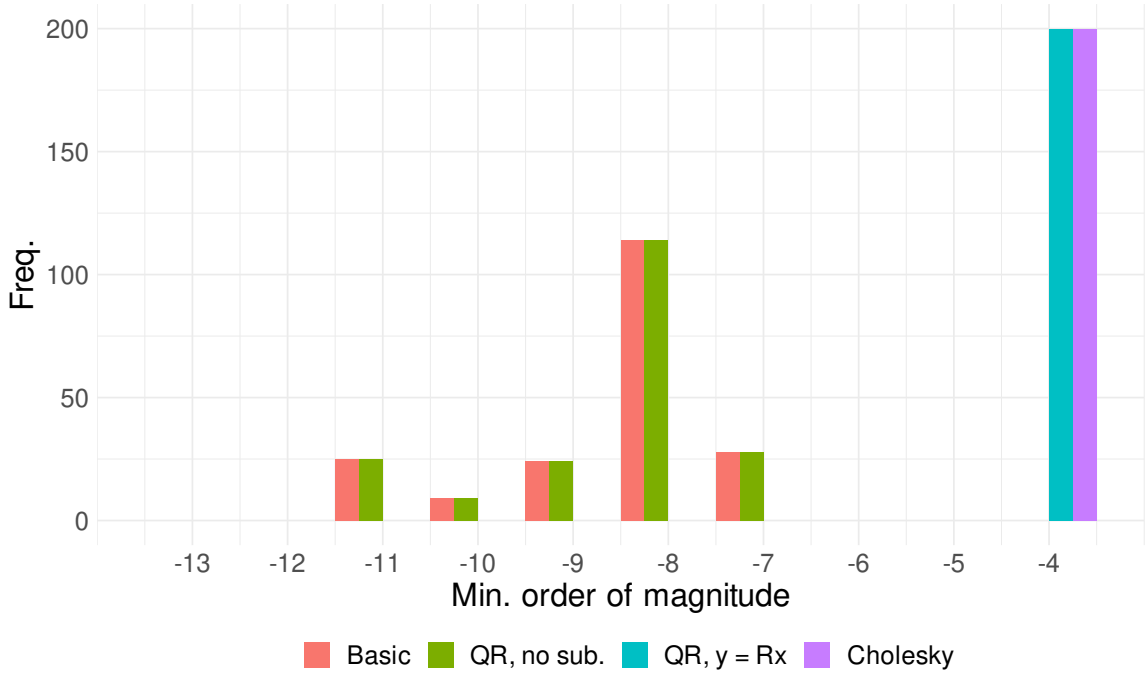
4.8 Case 4, QCQP, rescaled



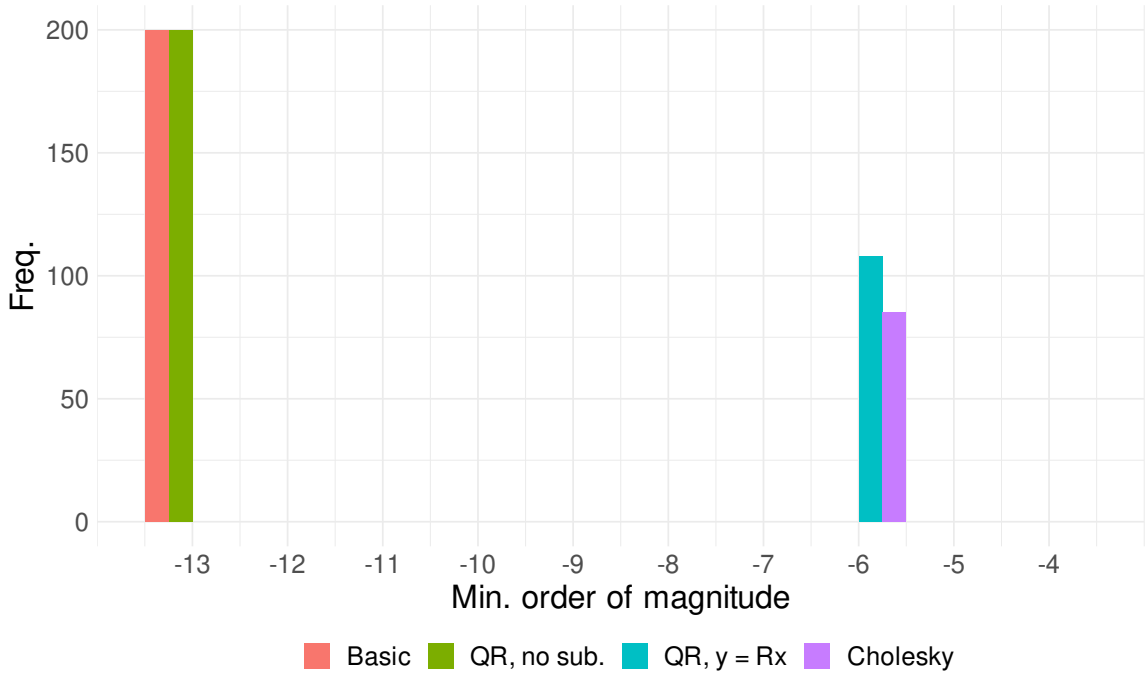
Note: When `rescale = TRUE`, ranges go up to as high as 30 orders of magnitude.

5 Min. order of mag. in quadratic constraint matrix

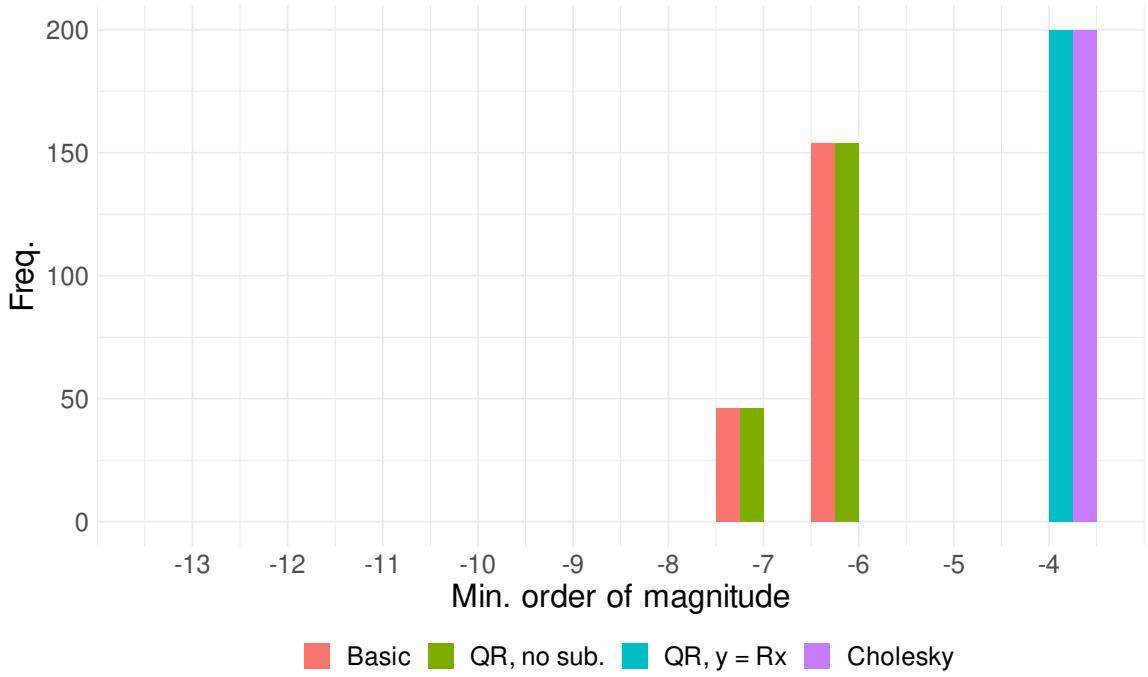
5.1 Case 1, QCQP, unscaled



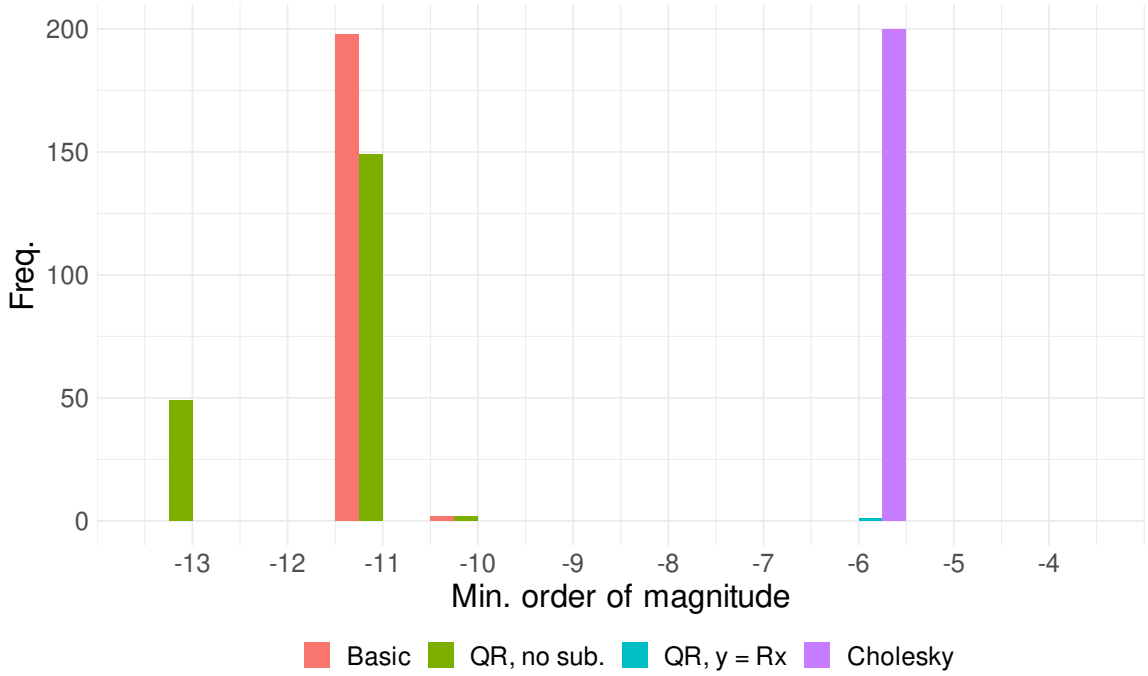
5.2 Case 1, QCQP, rescaled



5.3 Case 2, QCQP, unscaled

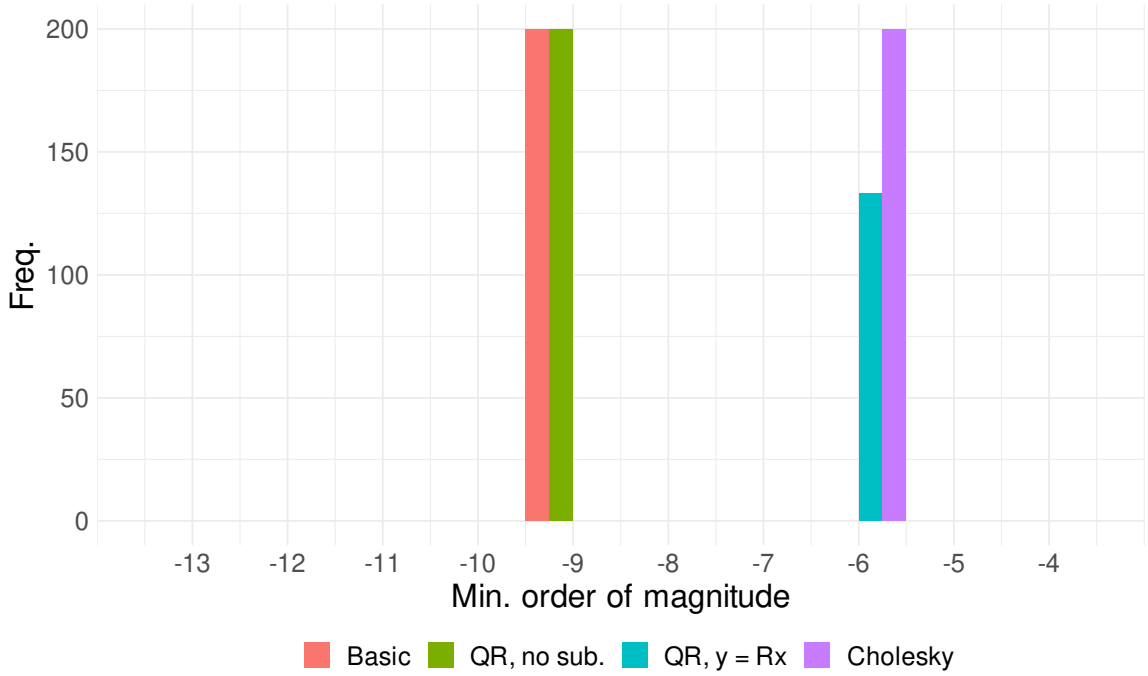


5.4 Case 2, QCQP, rescaled

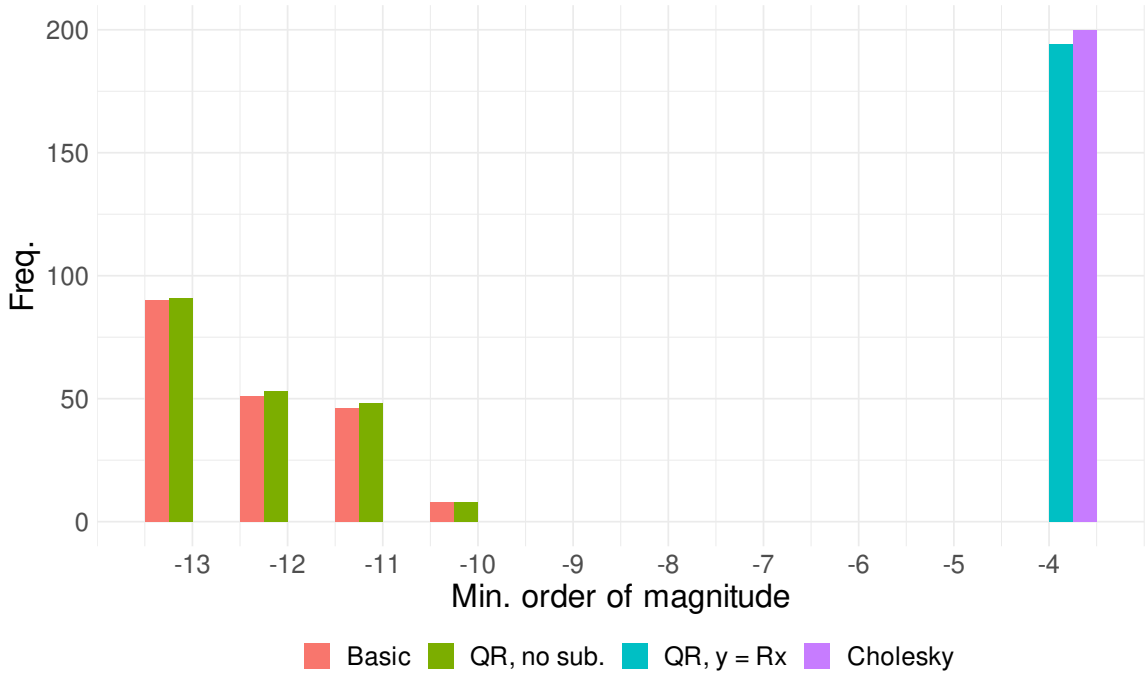


5.5 Case 3, QCQP, unscaled

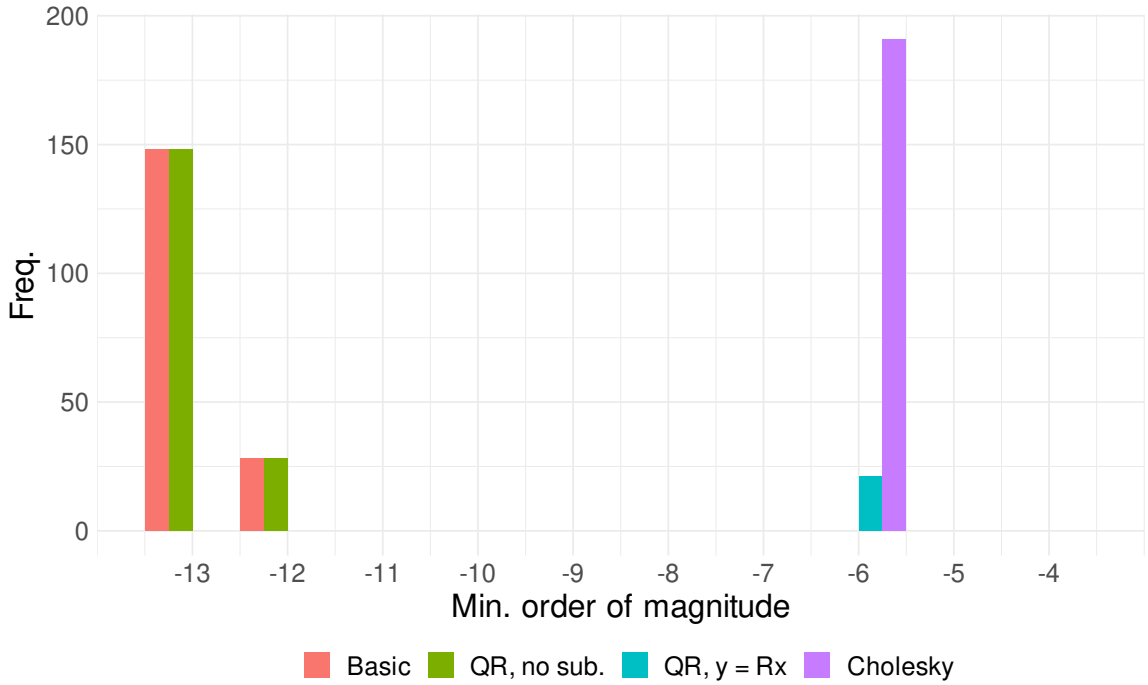
5.6 Case 3, QCQP, rescaled



5.7 Case 4, QCQP, unscaled



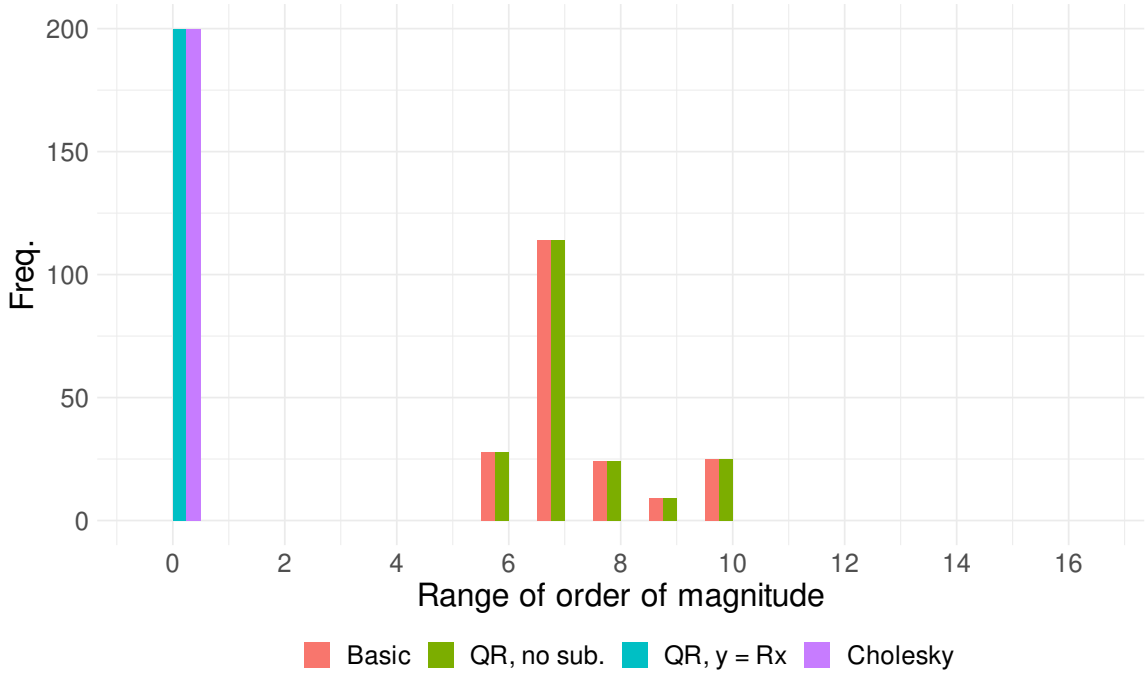
5.8 Case 4, QCQP, rescaled



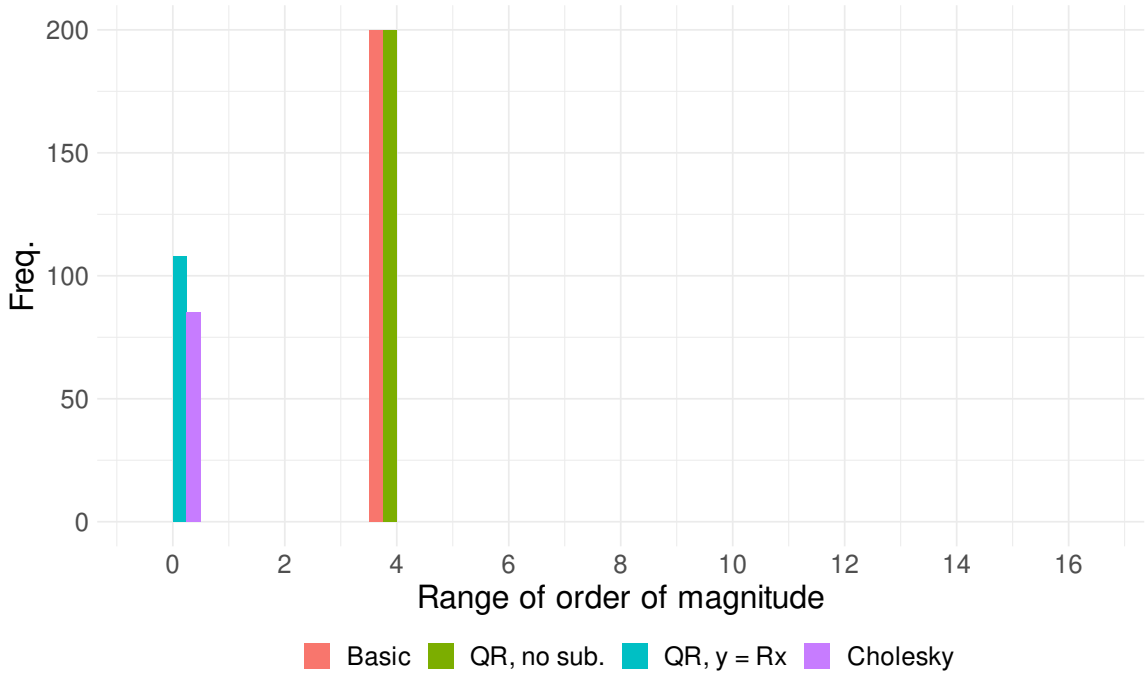
Note: Blue bar does not sum to 200 (total number of simulations) because some simulations returned errors and the QCQP model could not be saved.

6 Range of order of mag. in quadratic constraint matrix

6.1 Case 1, QCQP, unscaled

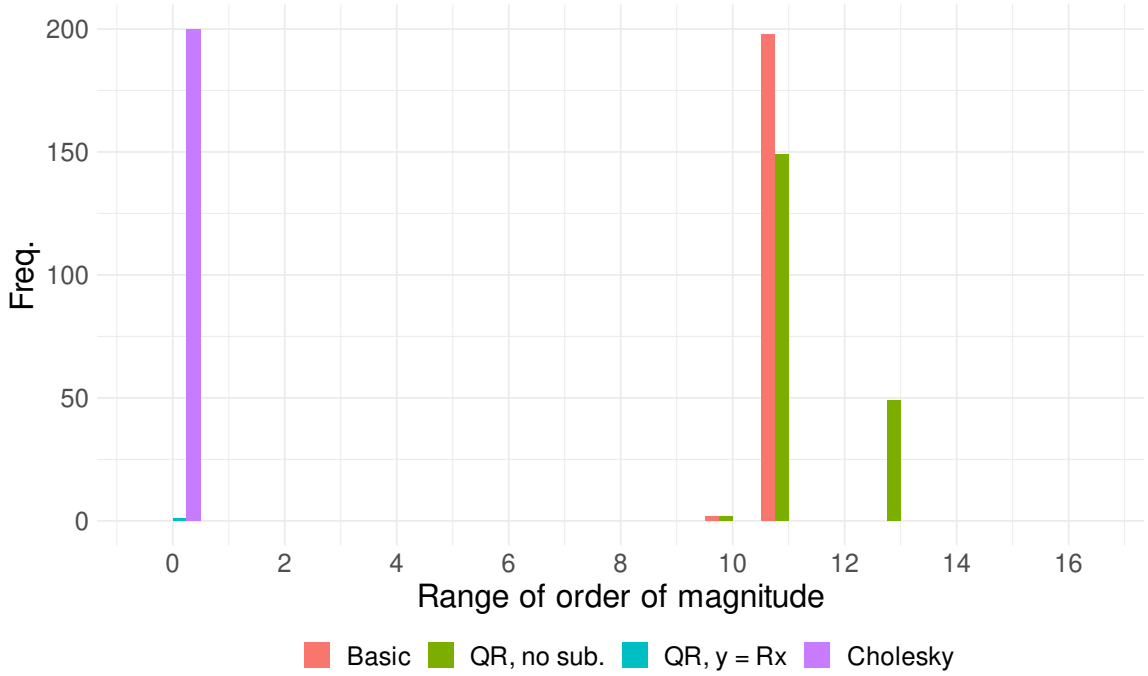


6.2 Case 1, QCQP, rescaled

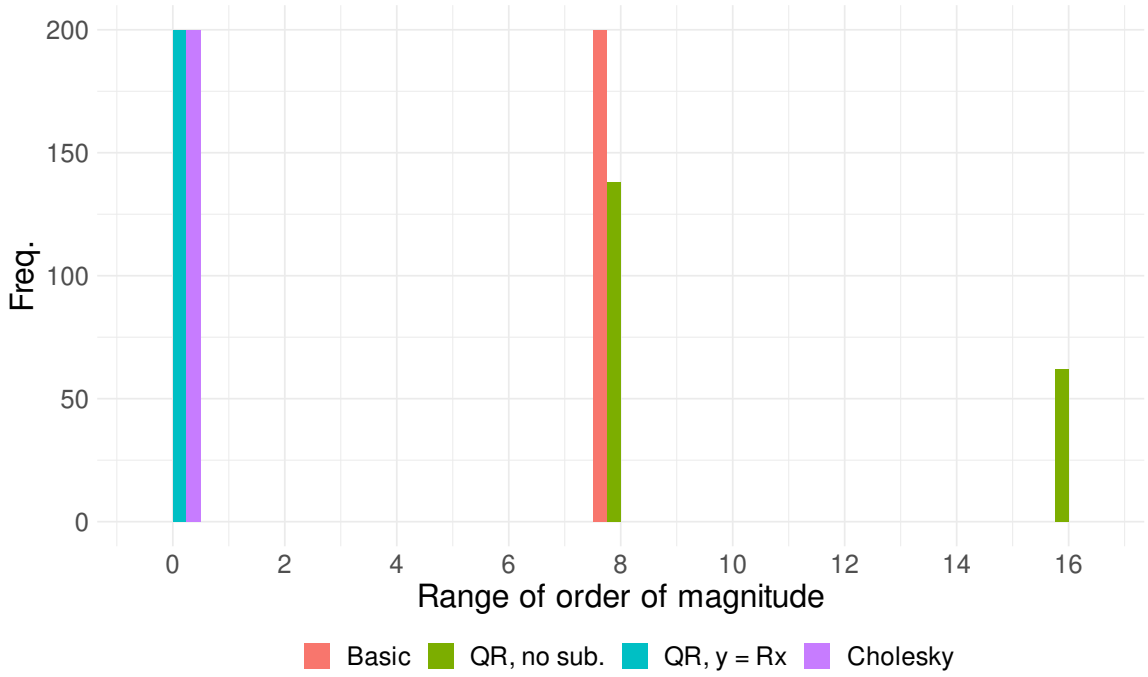


6.3 Case 2, QCQP, unscaled

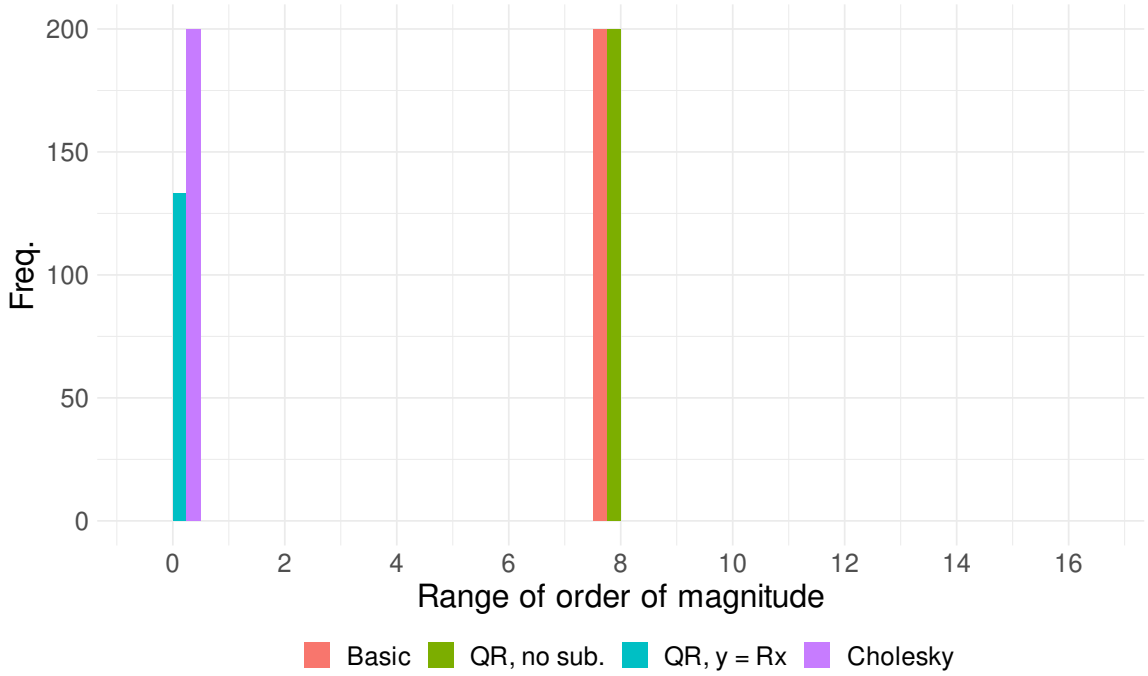
6.4 Case 2, QCQP, rescaled



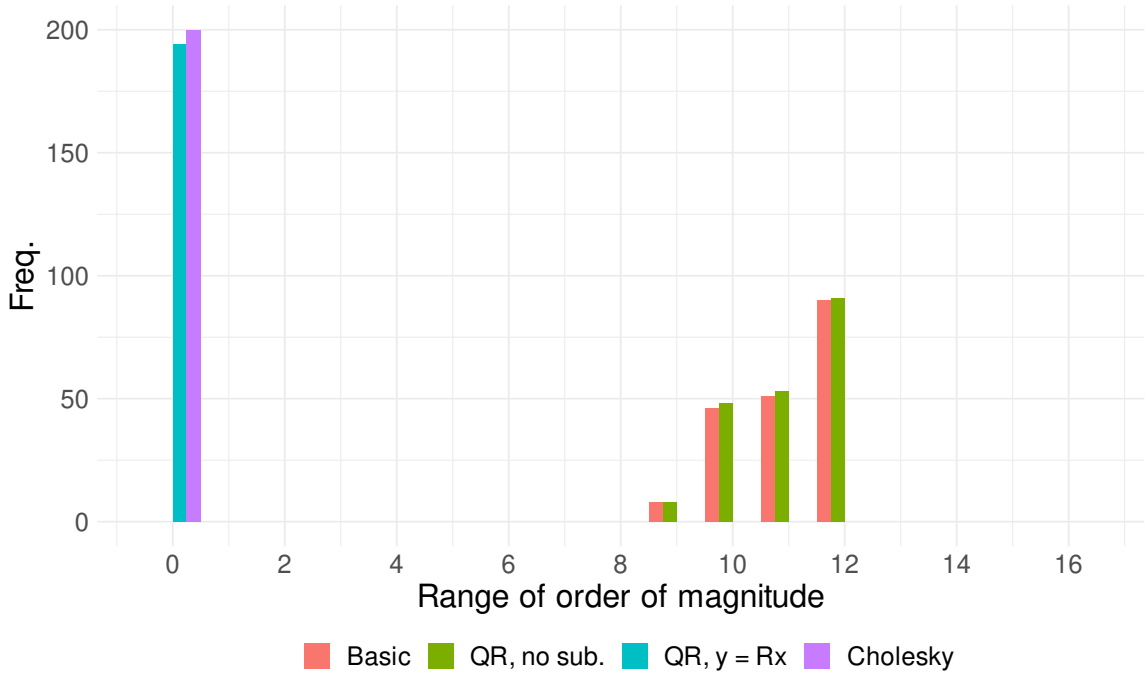
6.5 Case 3, QCQP, unscaled



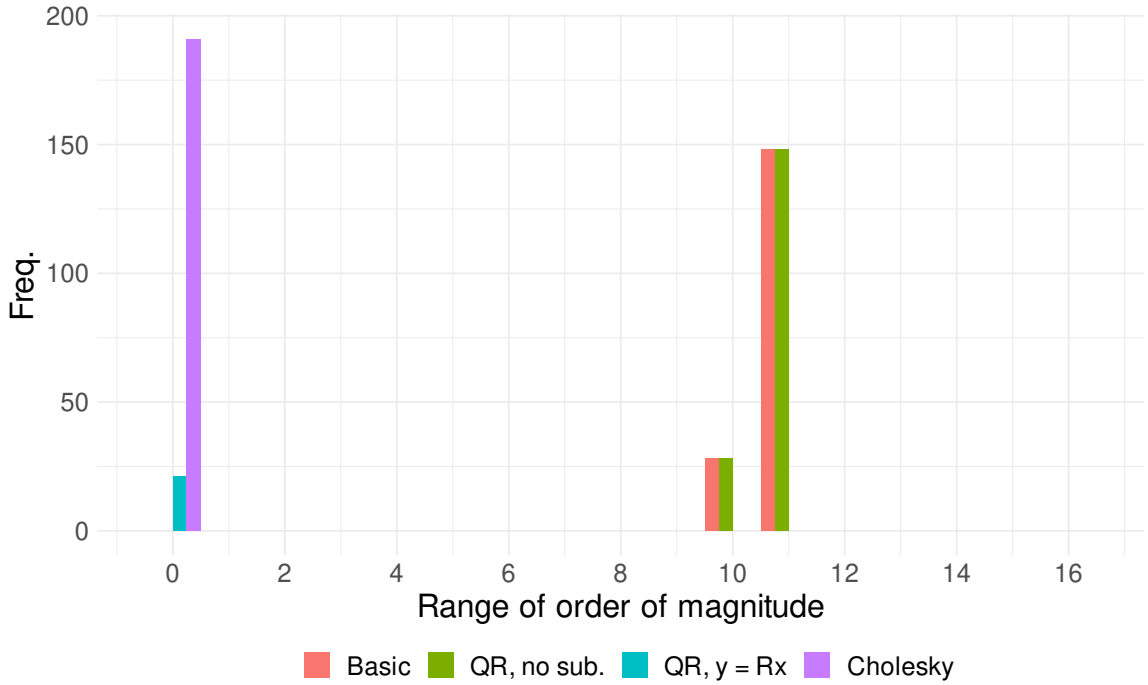
6.6 Case 3, QCQP, rescaled



6.7 Case 4, QCQP, unscaled



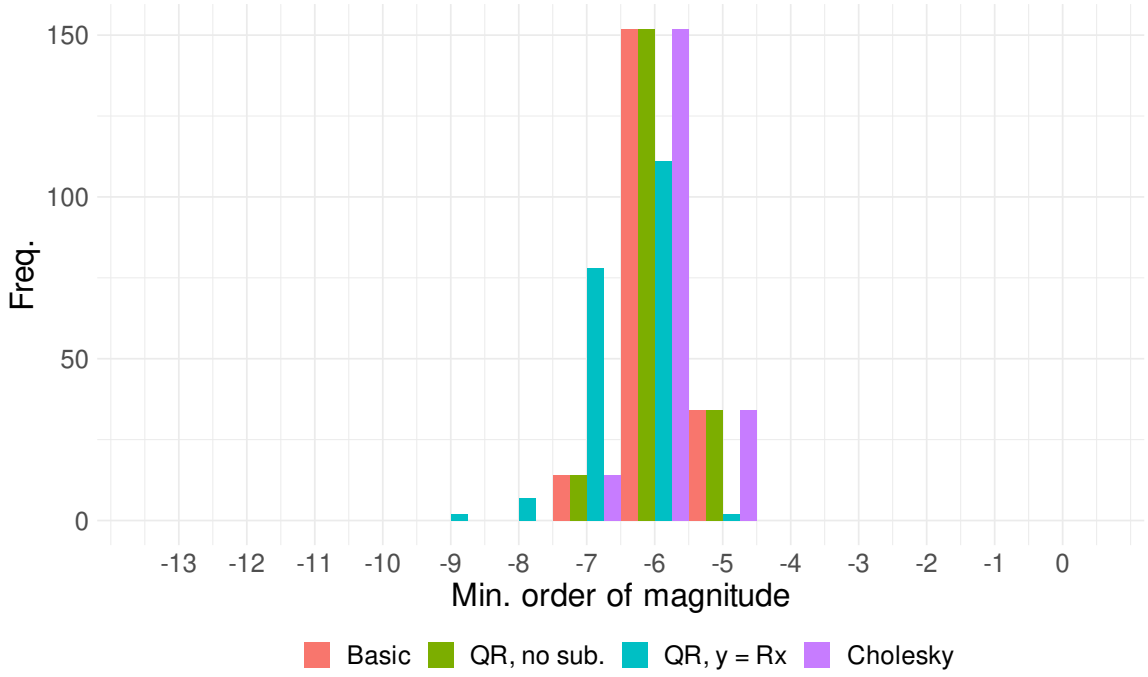
6.8 Case 4, QCQP, rescaled



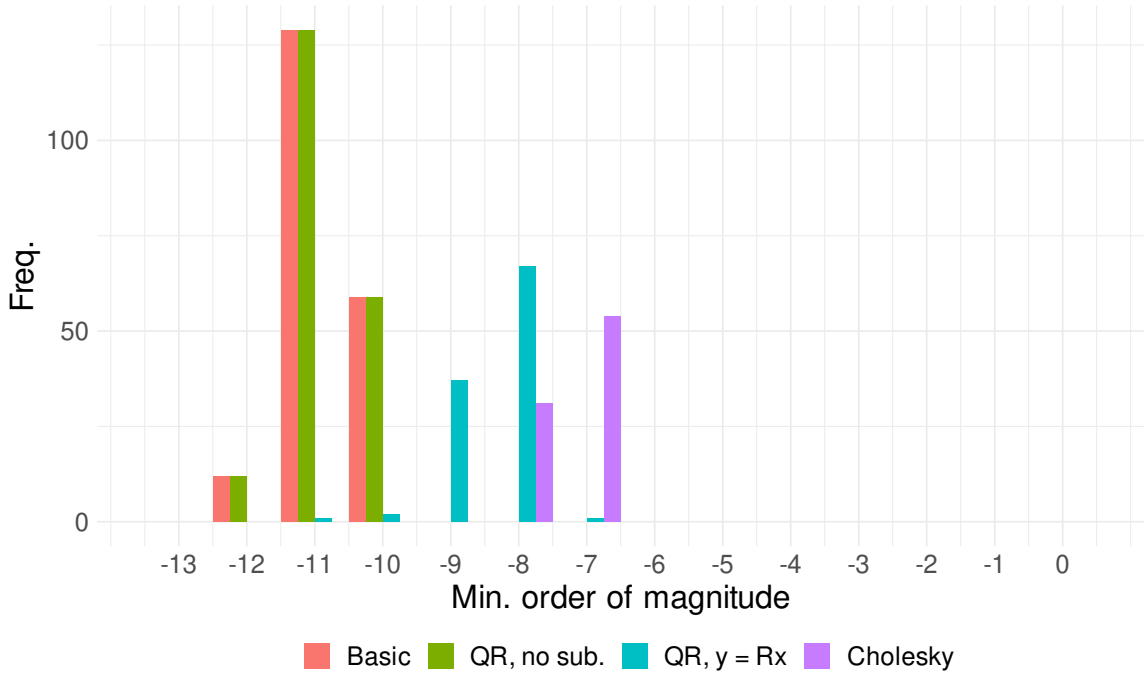
Note: Blue bar does not sum to 200 (total number of simulations) because some simulations returned errors and the QCQP model could not be saved.

7 Min. order of mag. in quadratic constraint vector

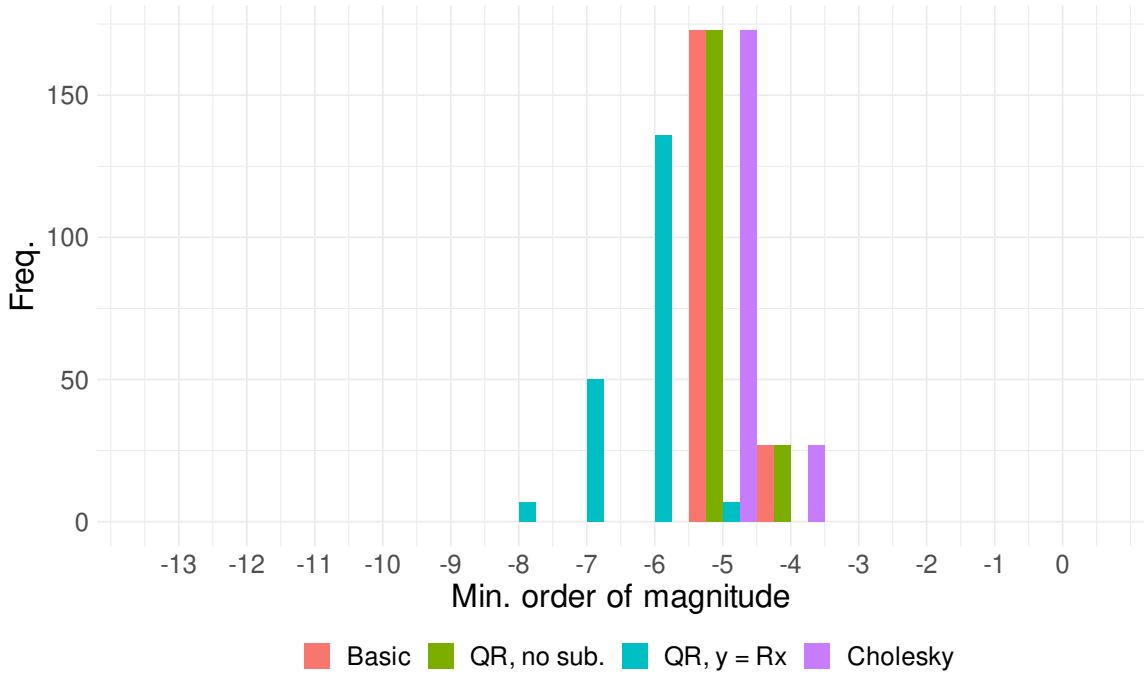
7.1 Case 1, QCQP, unscaled



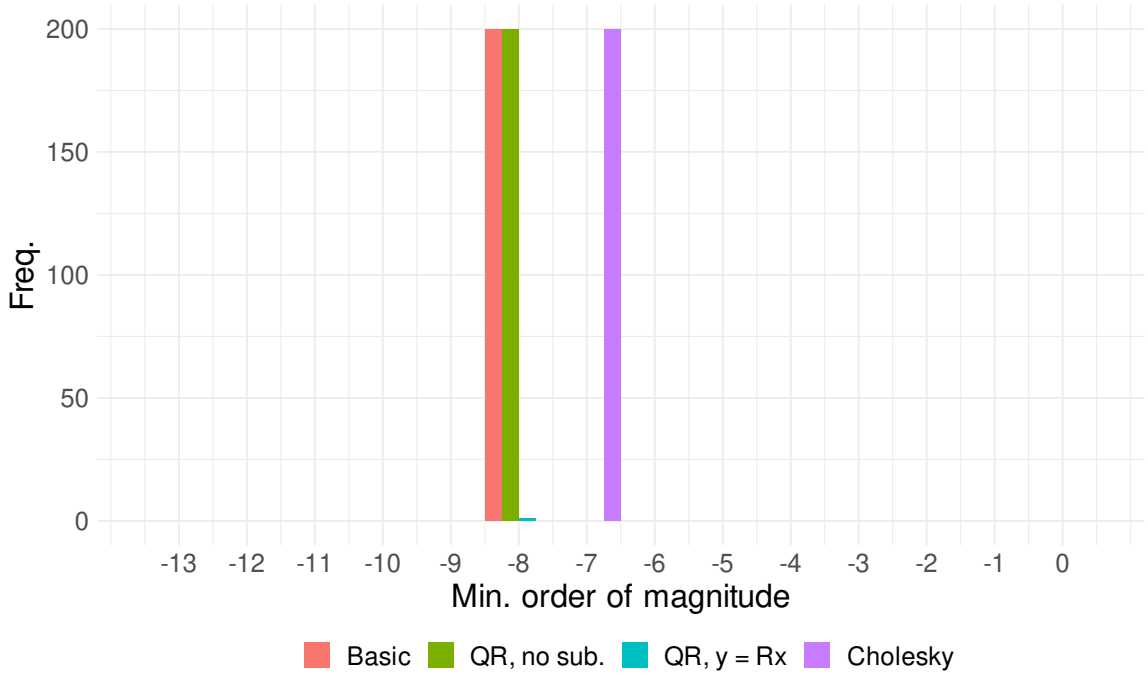
7.2 Case 1, QCQP, rescaled



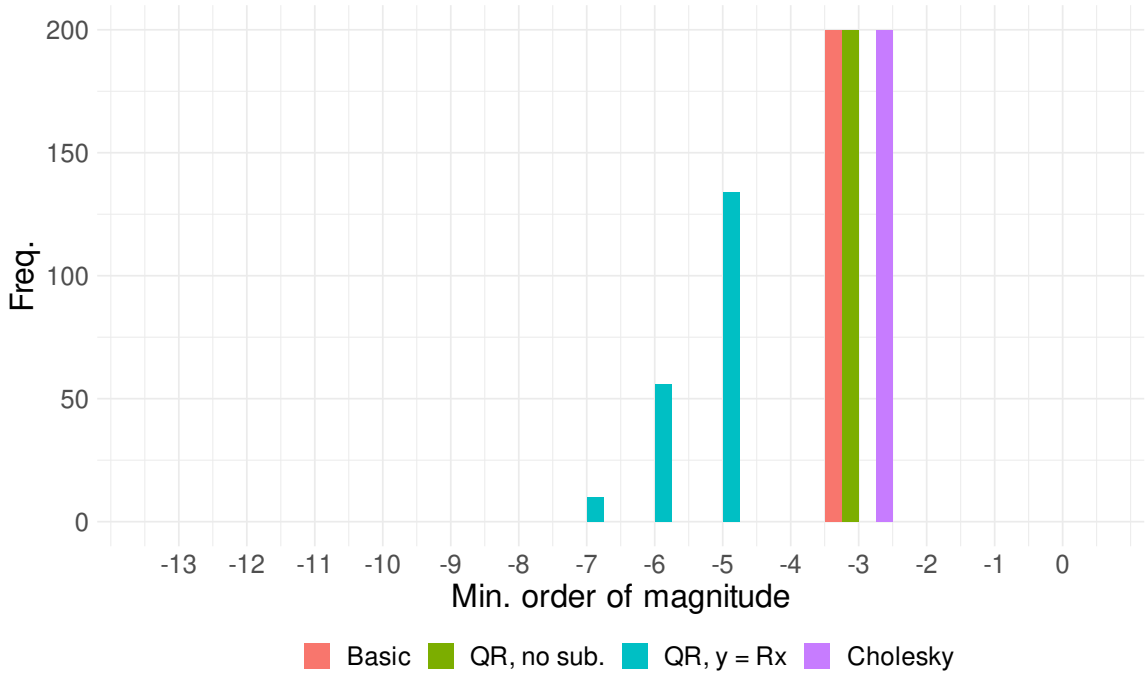
7.3 Case 2, QCQP, unscaled



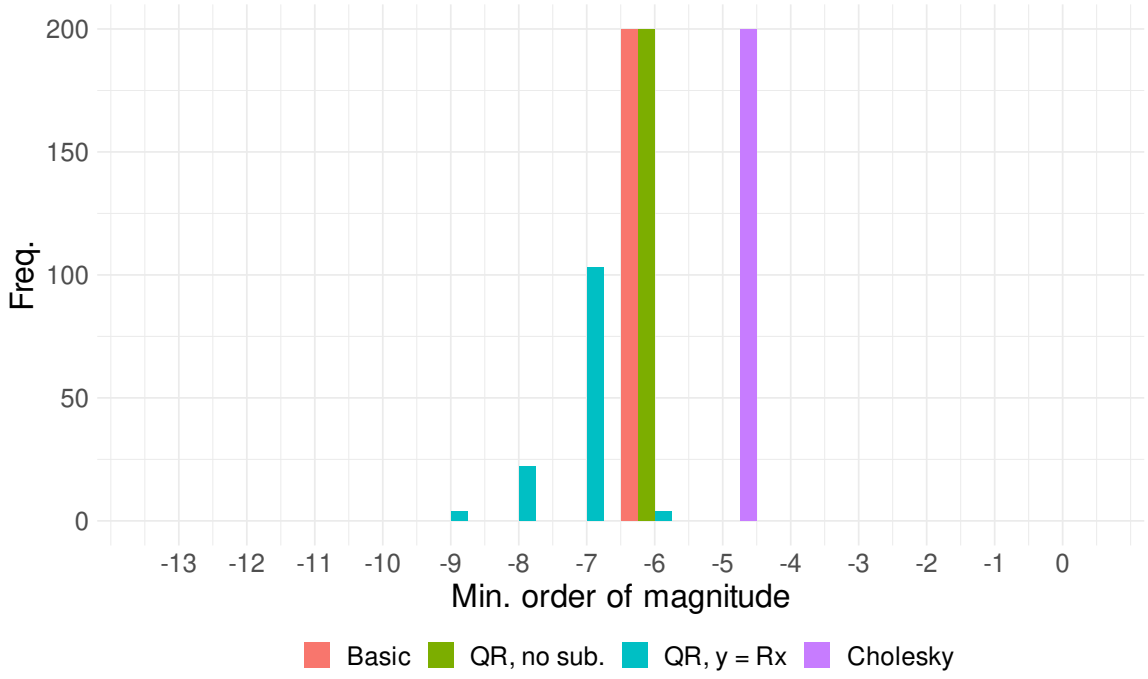
7.4 Case 2, QCQP, rescaled



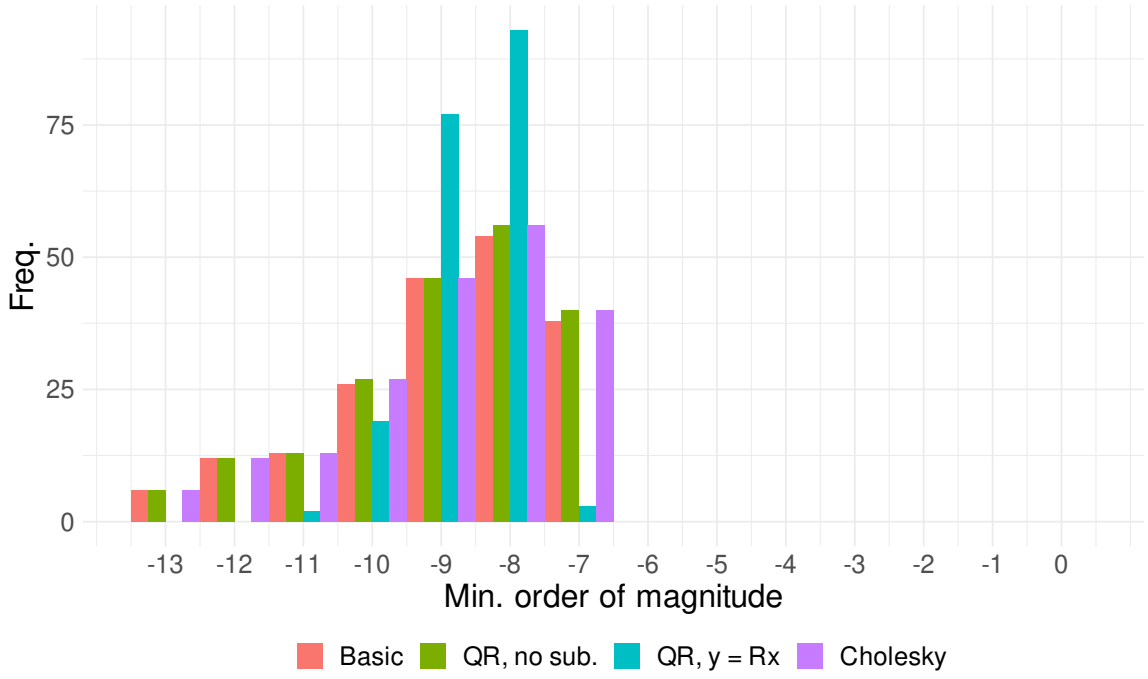
7.5 Case 3, QCQP, unscaled



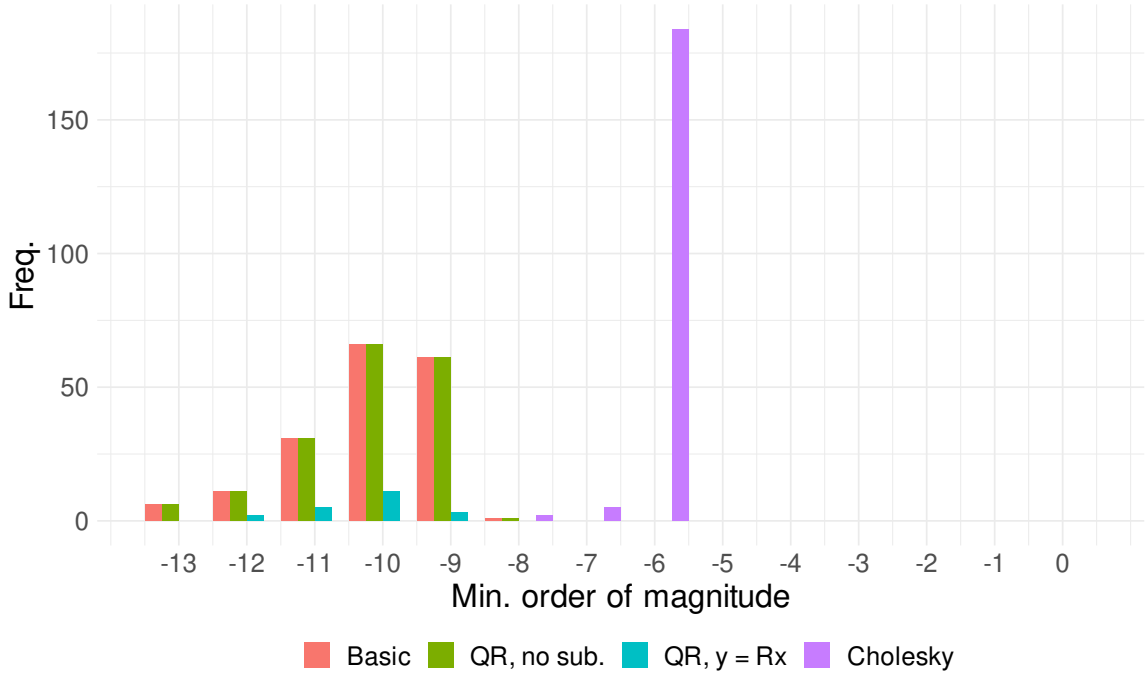
7.6 Case 3, QCQP, rescaled



7.7 Case 4, QCQP, unscaled



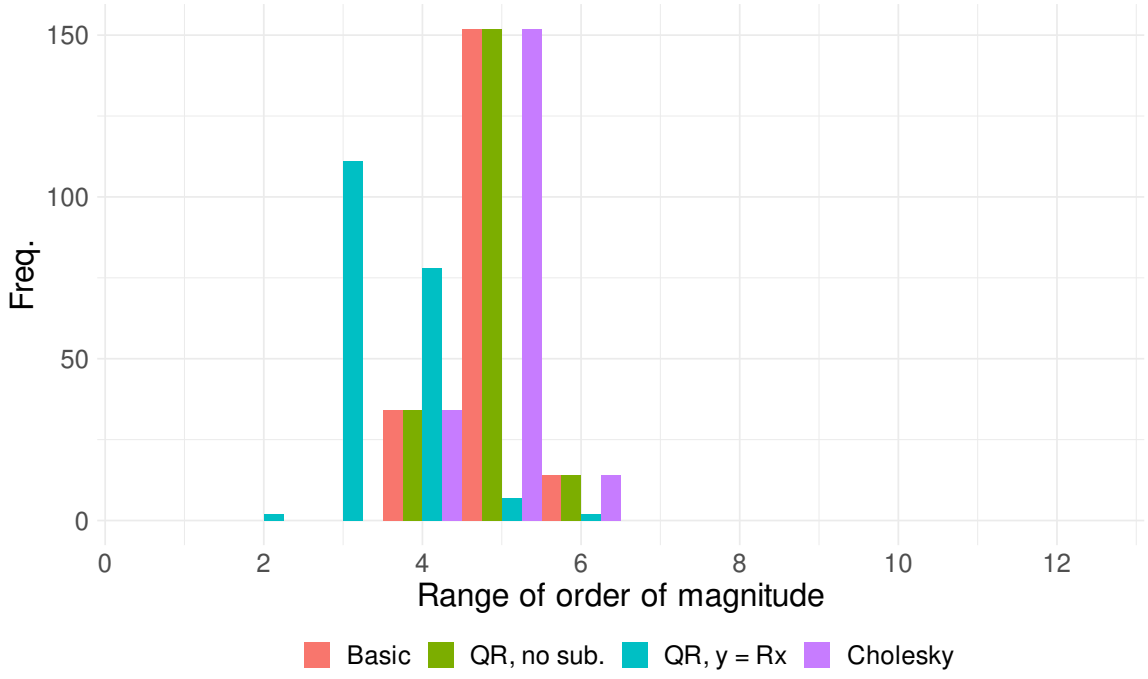
7.8 Case 4, QCQP, rescaled



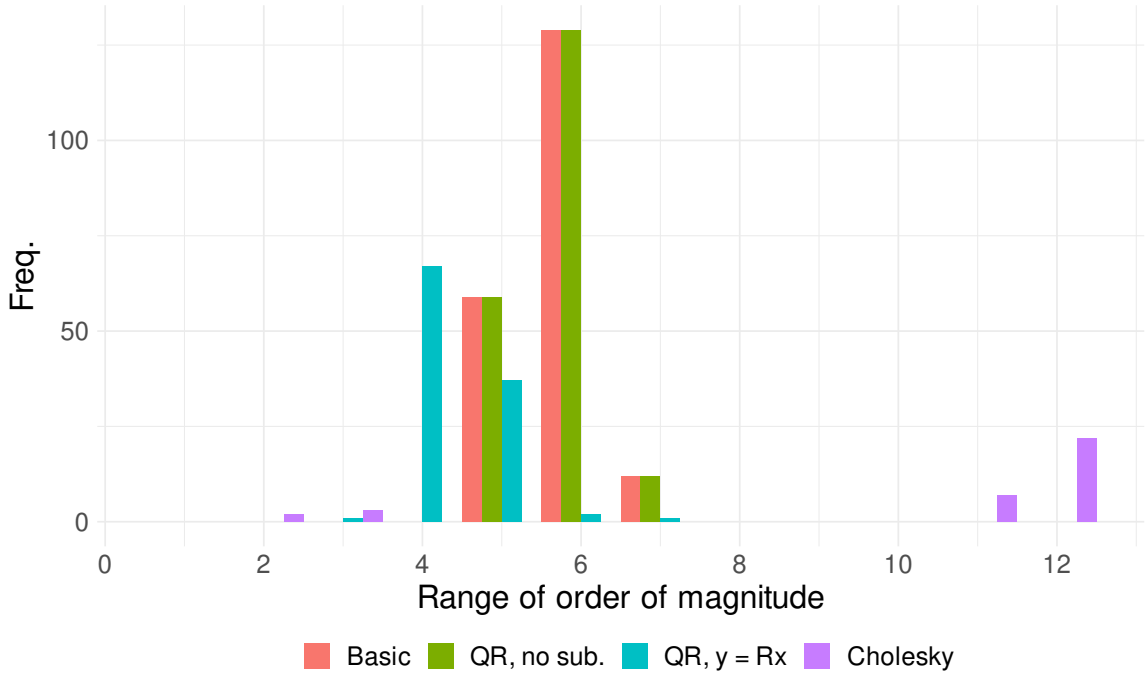
Note: Blue bar does not sum to 200 (total number of simulations) because some simulations returned errors and the QCQP model could not be saved.

8 Range of order of mag. in quadratic constraint vector

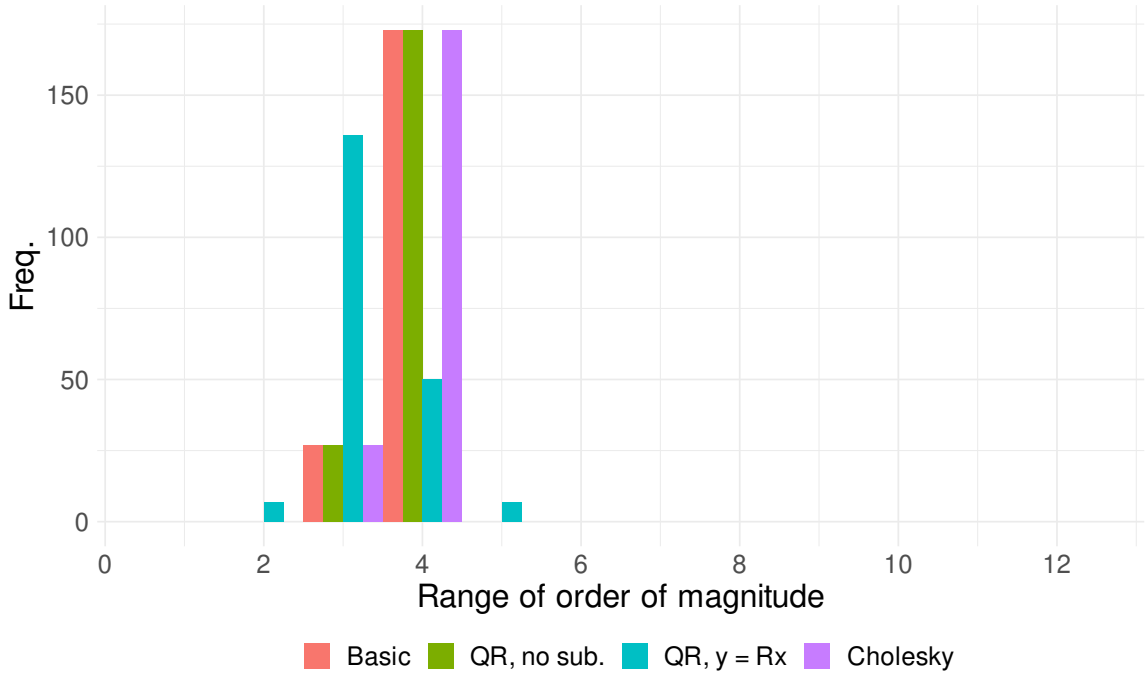
8.1 Case 1, QCQP, unscaled



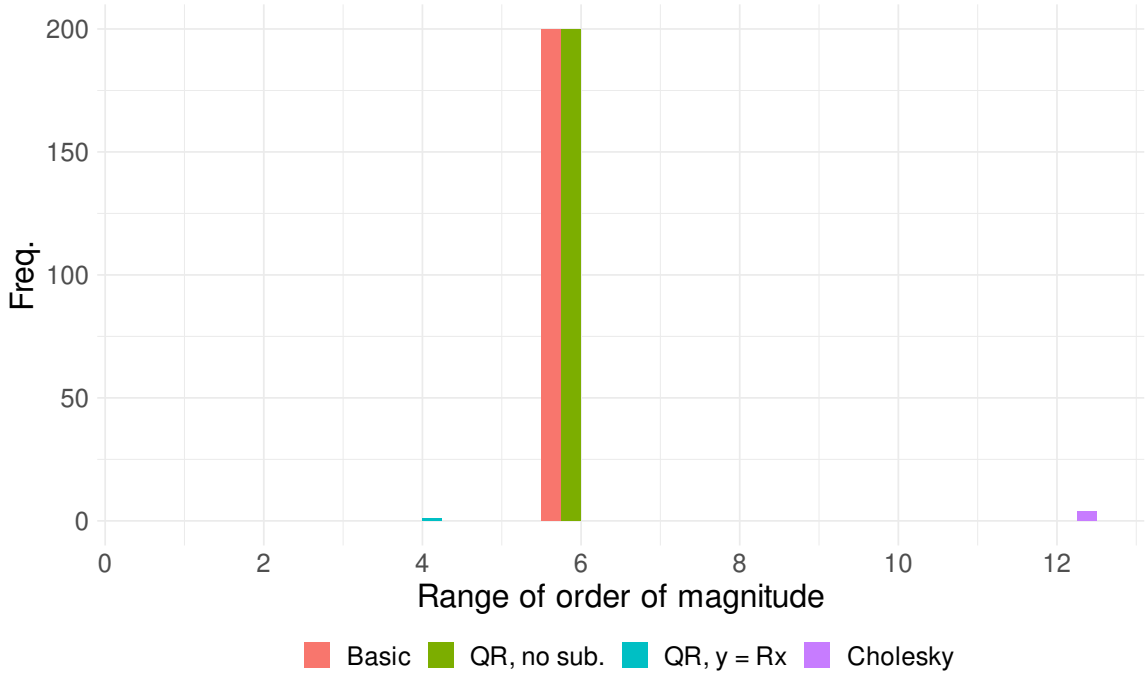
8.2 Case 1, QCQP, rescaled



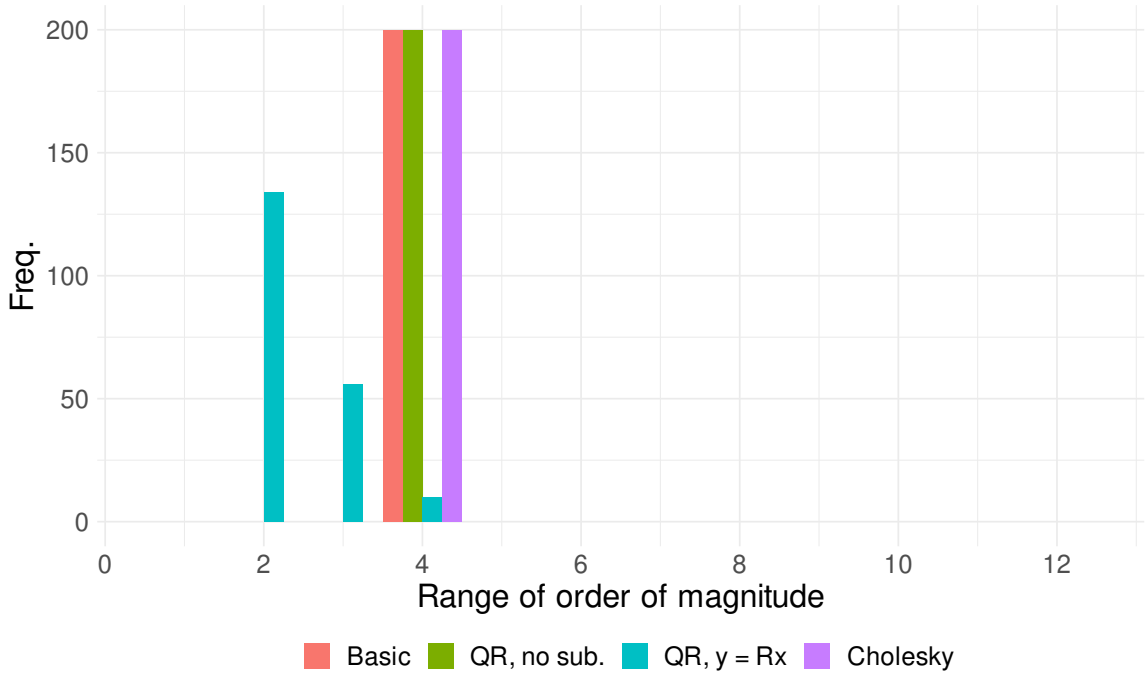
8.3 Case 2, QCQP, unscaled



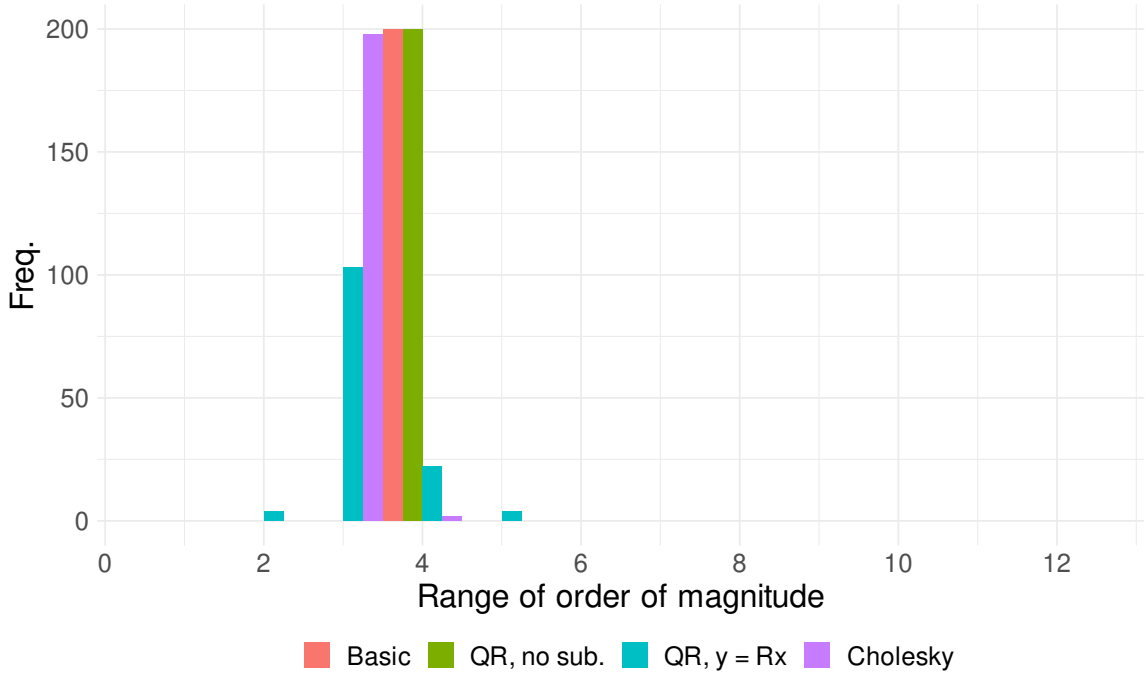
8.4 Case 2, QCQP, rescaled



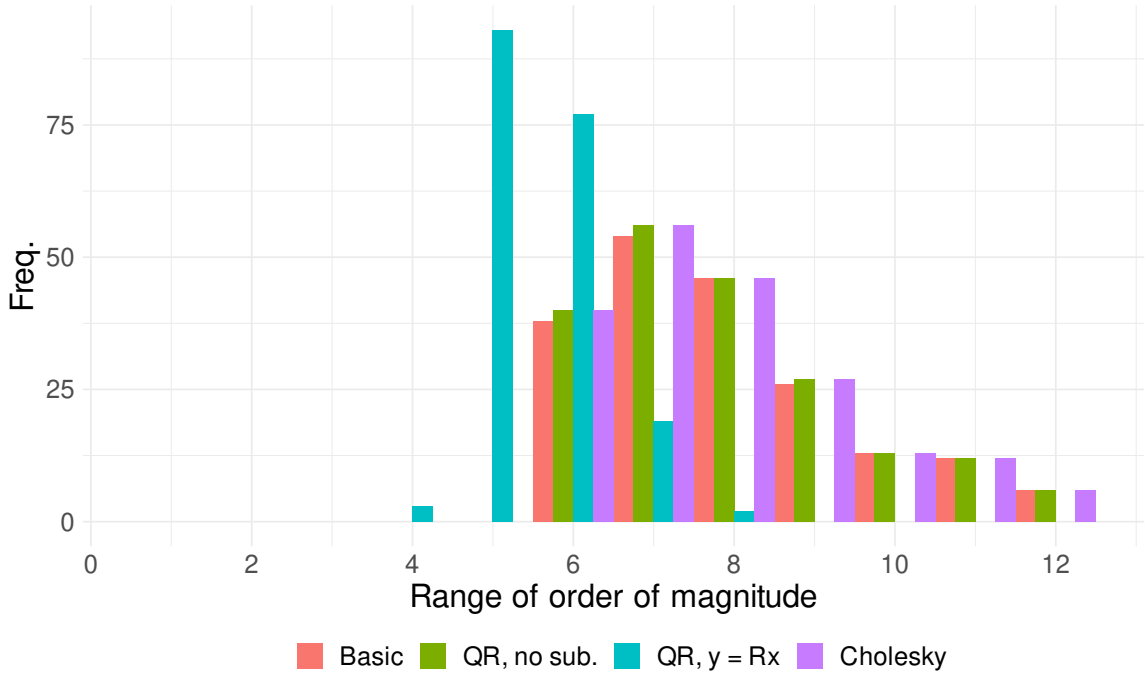
8.5 Case 3, QCQP, unscaled



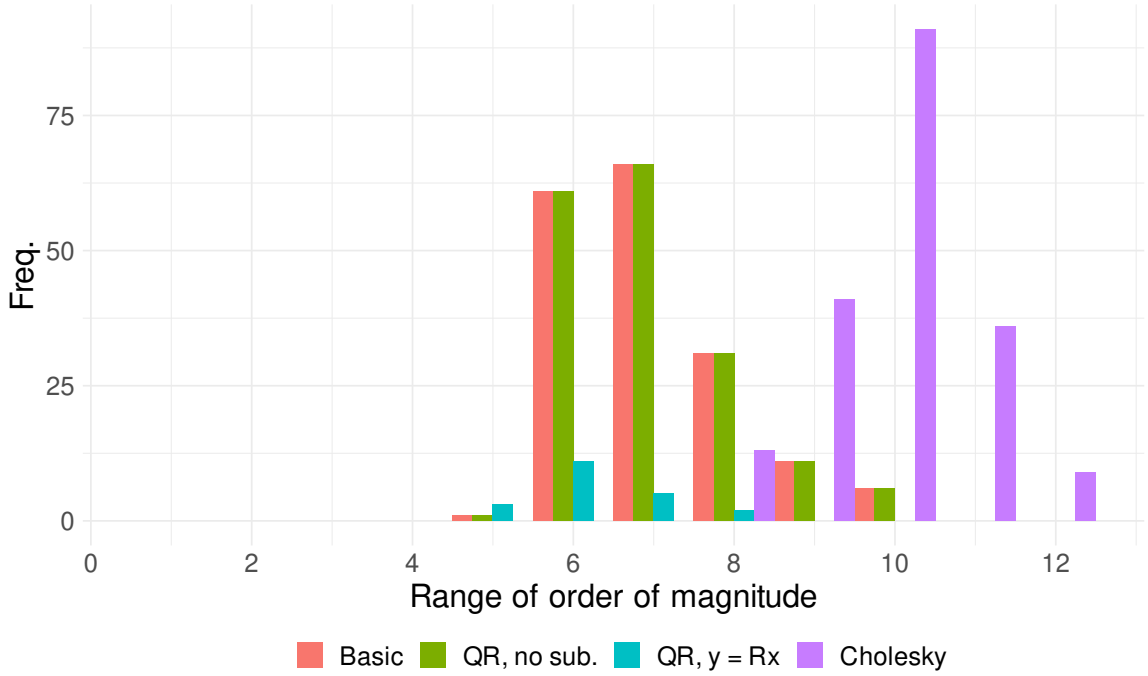
8.6 Case 3, QCQP, rescaled



8.7 Case 4, QCQP, unscaled



8.8 Case 4, QCQP, rescaled



Note: Blue bar does not sum to 200 (total number of simulations) because some simulations returned errors and the QCQP model could not be saved.