Project 5 - FYS3150 Computational Physics

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Abstract

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Contents

1 Introduction

a,b) We start the simulation with the simplest model: Initial amount $m_0 = 1$ with no saving ($\lambda = 1$) and no preference for transaction partners ($\alpha = 0, \gamma = 0$). In this case, we expect the Gibbs distribution

$$w_m = \beta \exp(-\beta m)$$

where $\beta = \langle m \rangle^{-1} = m_0^{-1}$.

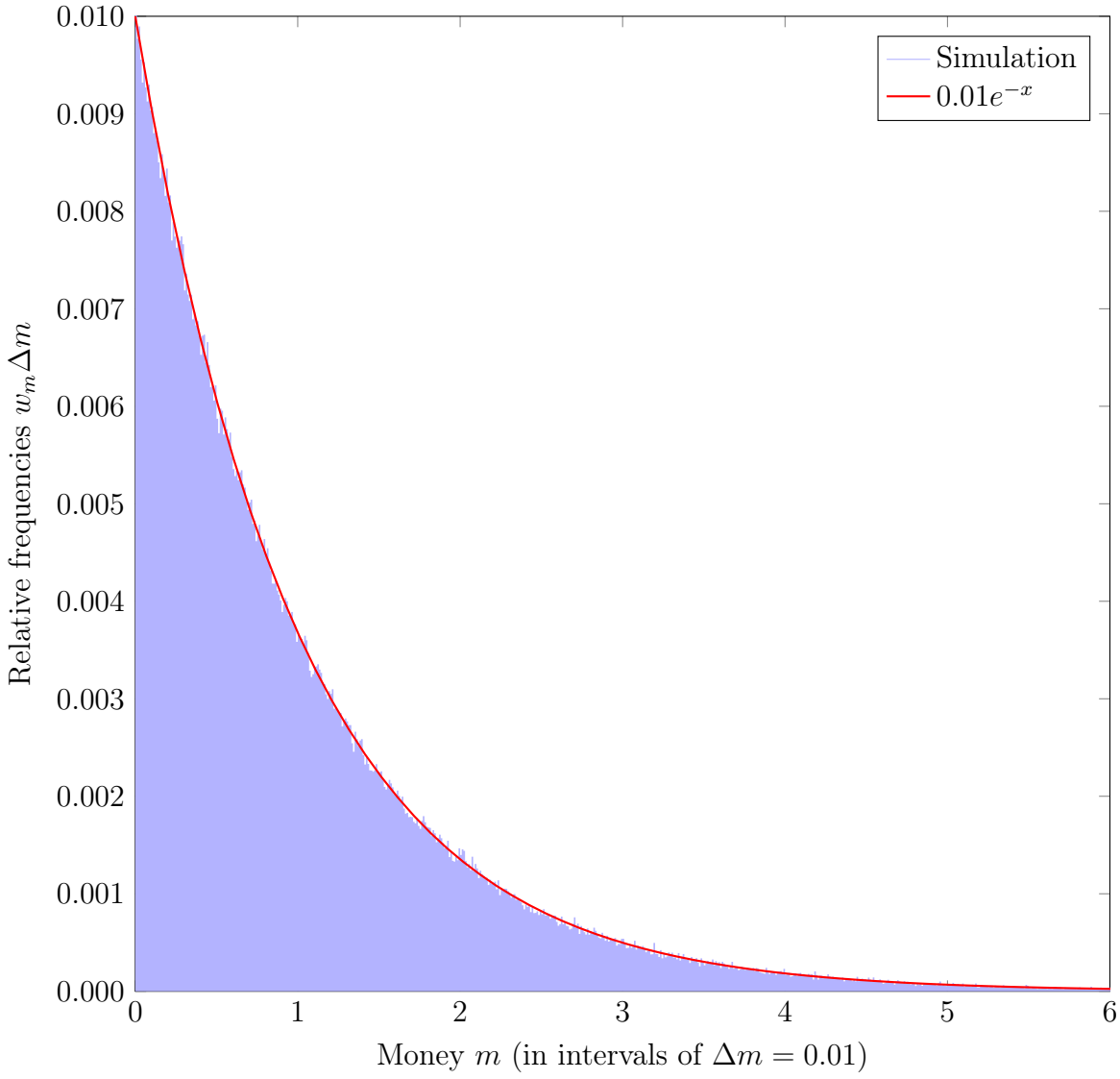
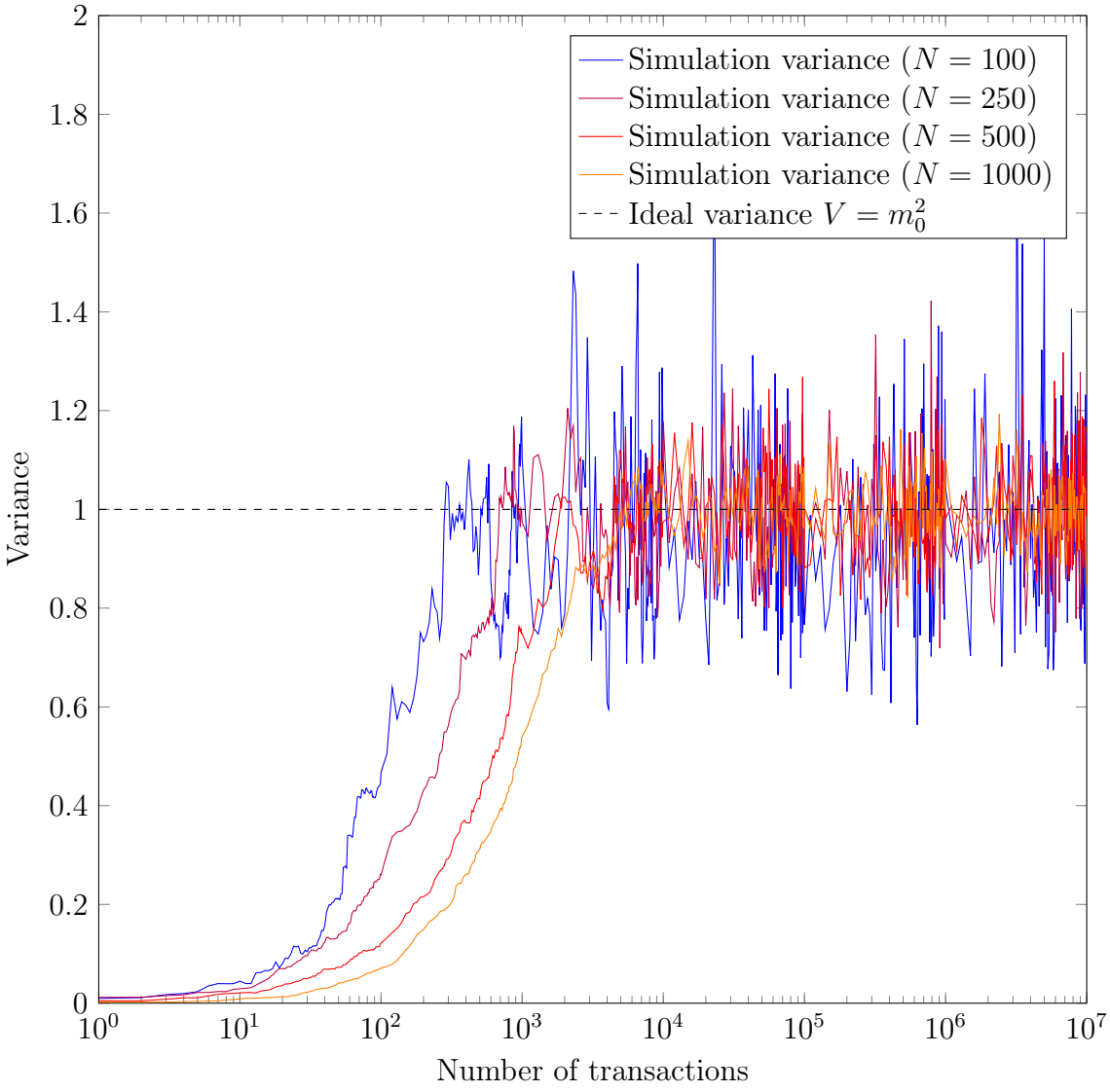
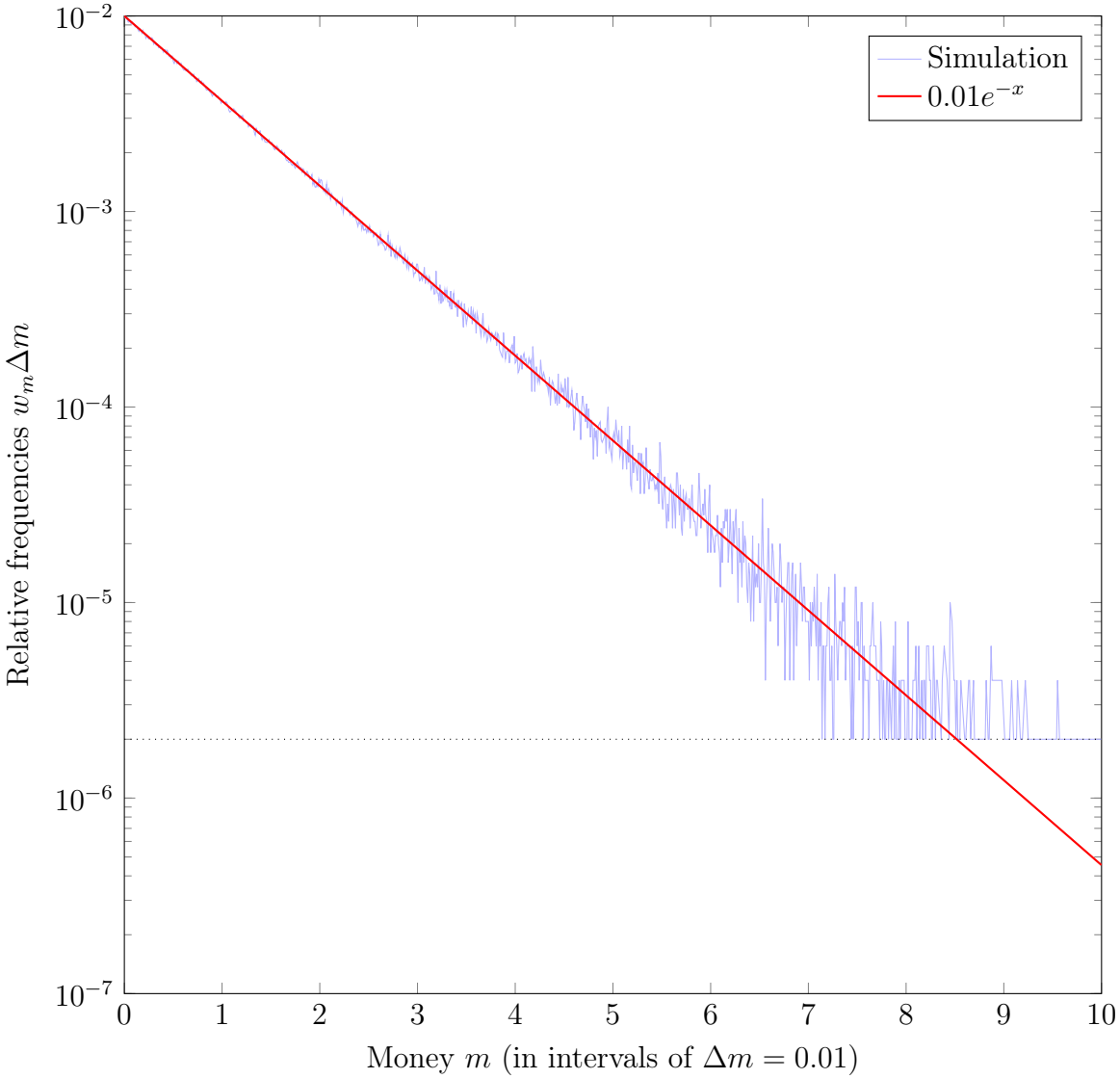


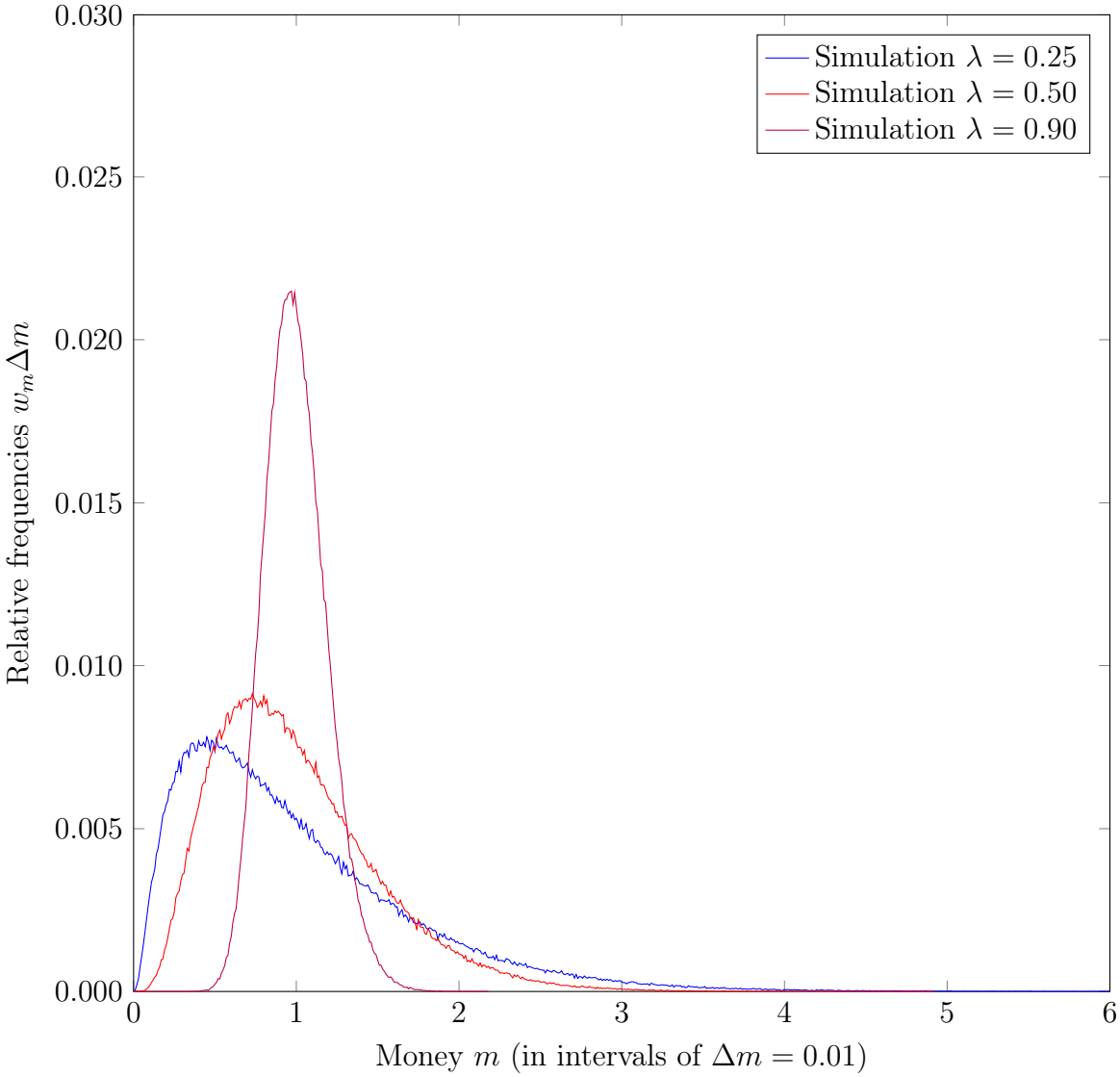
Figure 1

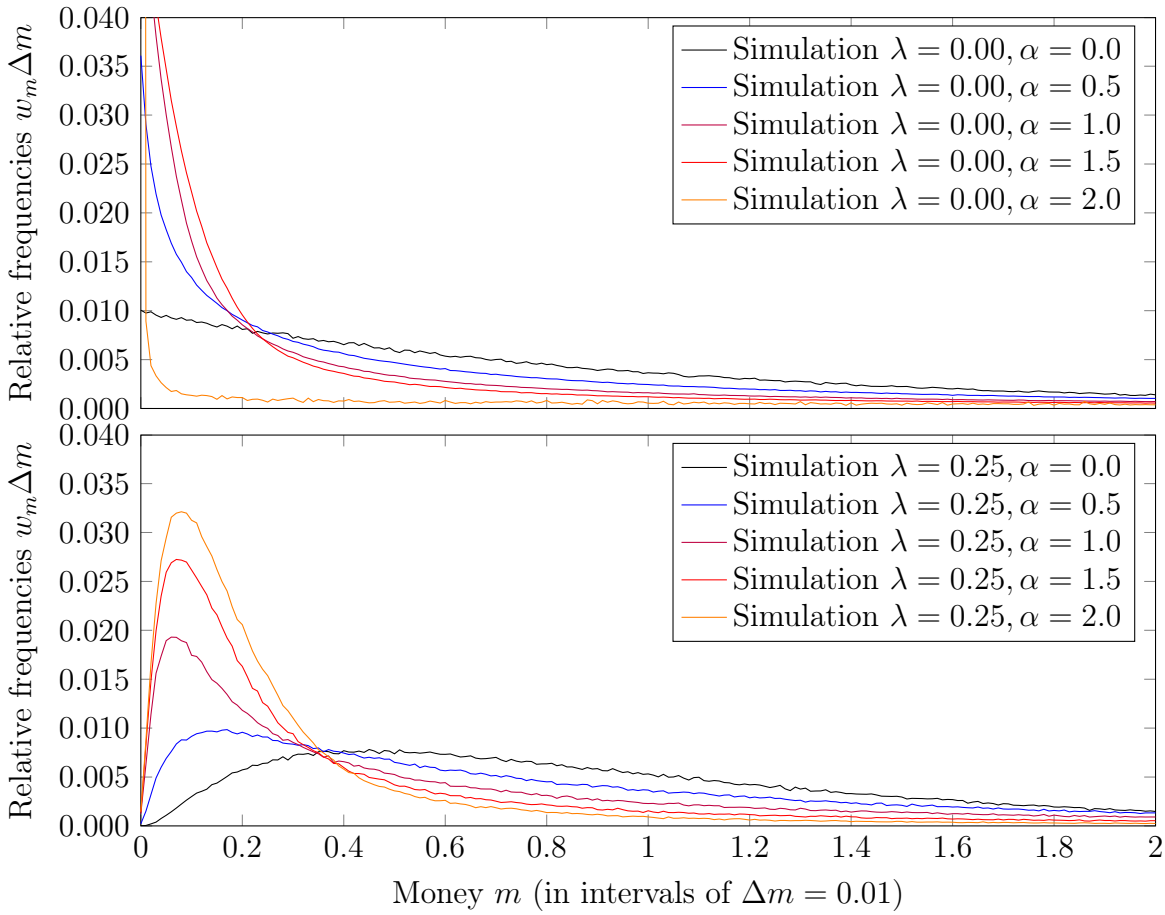
5d) $R = 10^3$, $K = 10^6$.

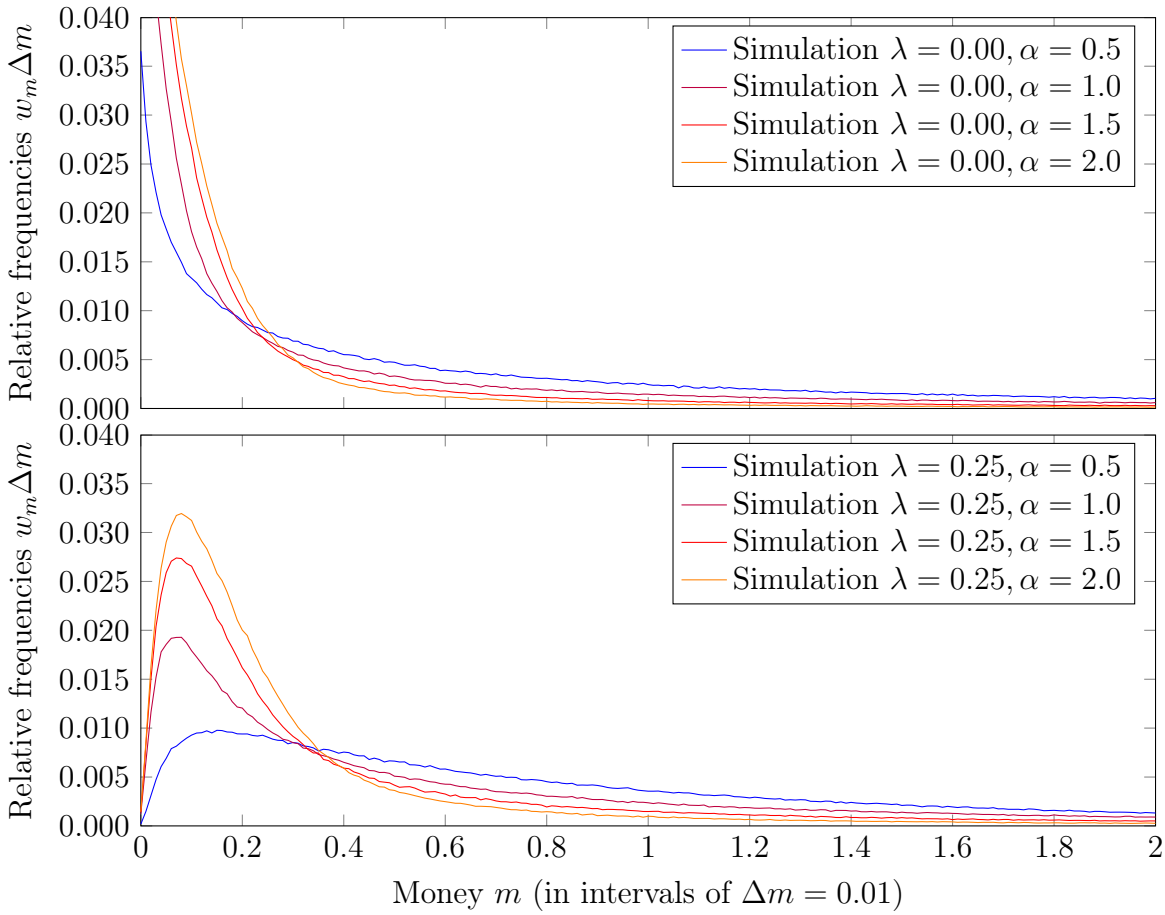
5e) $R = 10^3$, $K = 10^6$, $S = 1000$

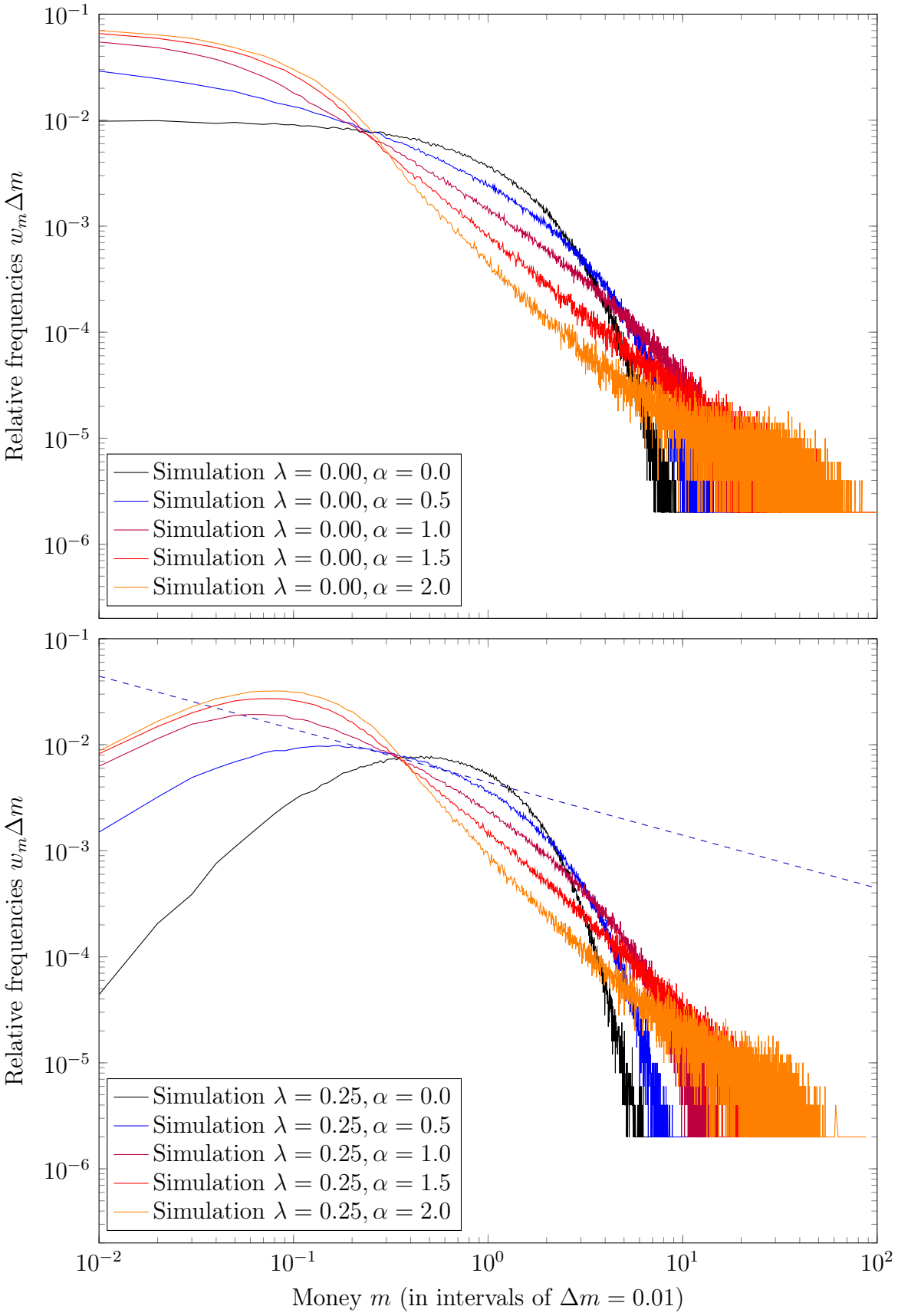

Simulation variance ($N = 100$)
Simulation variance ($N = 250$)
Simulation variance ($N = 500$)
Simulation variance ($N = 1000$)
Ideal variance $V = m_0^2$
Variance
Number of transactions
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7

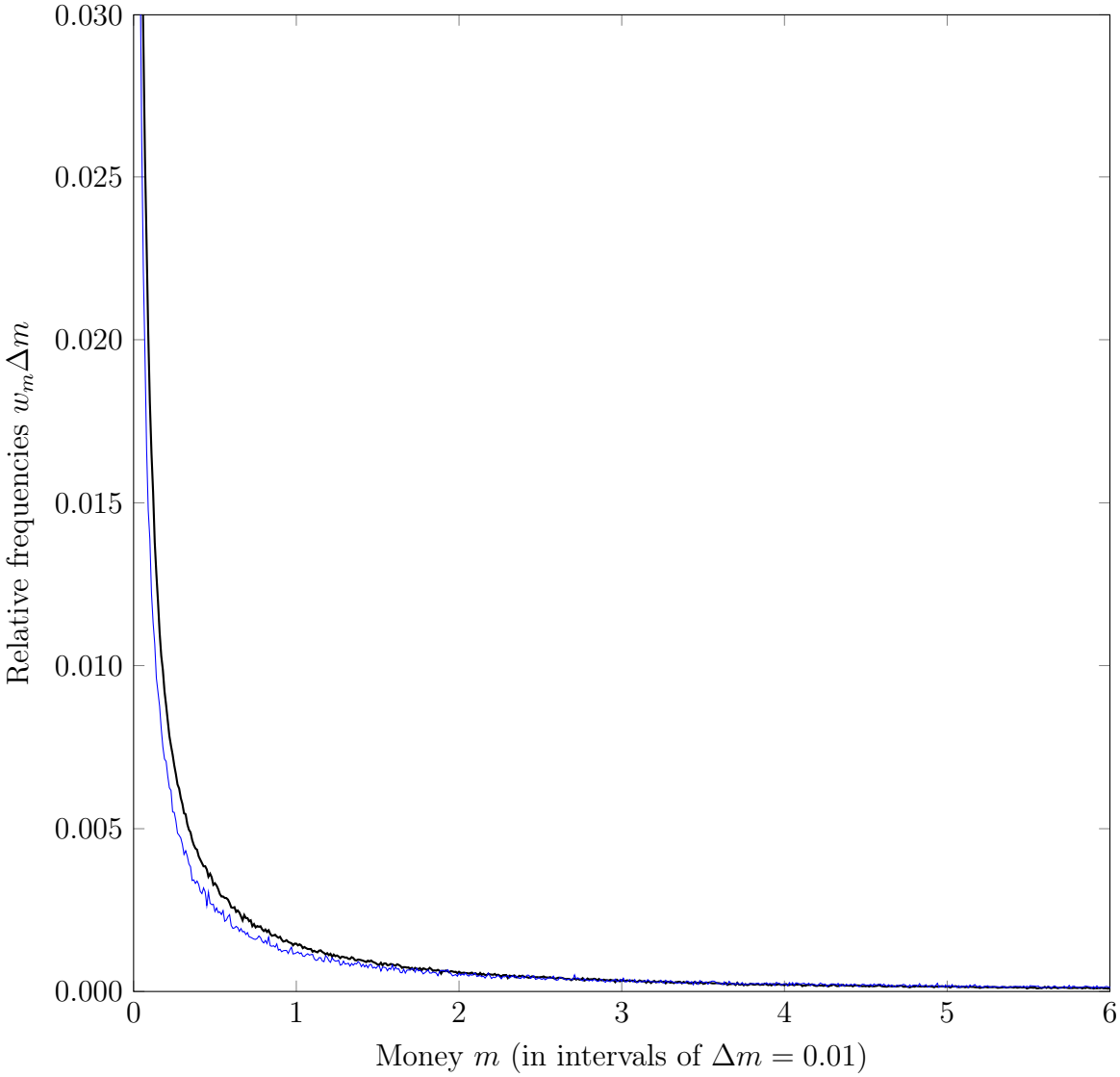

Simulation
$0.01e^{-x}$
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
Relative frequencies $w_m \Delta m$
0
1
2
3
4
5
6
7
8
9
10
Money m (in intervals of $\Delta m = 0.01$)


Simulation $\lambda = 0.25$
Simulation $\lambda = 0.50$
Simulation $\lambda = 0.90$
Relative frequencies $w_m \Delta m$
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0
1
2
3
4
5
6
Money m (in intervals of $\Delta m = 0.01$)


Relative frequencies $w_m \Delta m$
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Simulation $\lambda = 0.00, \alpha = 0.0$
Simulation $\lambda = 0.00, \alpha = 0.5$
Simulation $\lambda = 0.00, \alpha = 1.0$
Simulation $\lambda = 0.00, \alpha = 1.5$
Simulation $\lambda = 0.00, \alpha = 2.0$
Relative frequencies $w_m \Delta m$
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Simulation $\lambda = 0.25, \alpha = 0.0$
Simulation $\lambda = 0.25, \alpha = 0.5$
Simulation $\lambda = 0.25, \alpha = 1.0$
Simulation $\lambda = 0.25, \alpha = 1.5$
Simulation $\lambda = 0.25, \alpha = 2.0$
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Money m (in intervals of $\Delta m = 0.01$)


Relative frequencies $w_m \Delta m$
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Simulation $\lambda = 0.00, \alpha = 0.5$
Simulation $\lambda = 0.00, \alpha = 1.0$
Simulation $\lambda = 0.00, \alpha = 1.5$
Simulation $\lambda = 0.00, \alpha = 2.0$
Relative frequencies $w_m \Delta m$
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Simulation $\lambda = 0.25, \alpha = 0.5$
Simulation $\lambda = 0.25, \alpha = 1.0$
Simulation $\lambda = 0.25, \alpha = 1.5$
Simulation $\lambda = 0.25, \alpha = 2.0$
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Money m (in intervals of $\Delta m = 0.01$)


Relative frequencies $w_m \Delta m$
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
Simulation $\lambda = 0.00, \alpha = 0.0$
Simulation $\lambda = 0.00, \alpha = 0.5$
Simulation $\lambda = 0.00, \alpha = 1.0$
Simulation $\lambda = 0.00, \alpha = 1.5$
Simulation $\lambda = 0.00, \alpha = 2.0$
Relative frequencies $w_m \Delta m$
Simulation $\lambda = 0.25, \alpha = 0.0$
Simulation $\lambda = 0.25, \alpha = 0.5$
Simulation $\lambda = 0.25, \alpha = 1.0$
Simulation $\lambda = 0.25, \alpha = 1.5$
Simulation $\lambda = 0.25, \alpha = 2.0$
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Money m (in intervals of $\Delta m = 0.01$)


0.030
0.025
0.020
0.015
0.010
0.005
0.000
Relative frequencies $w_m \Delta m$
0
1
2
3
4
5
6
Money m (in intervals of $\Delta m = 0.01$)