LTIA: Does it Work?

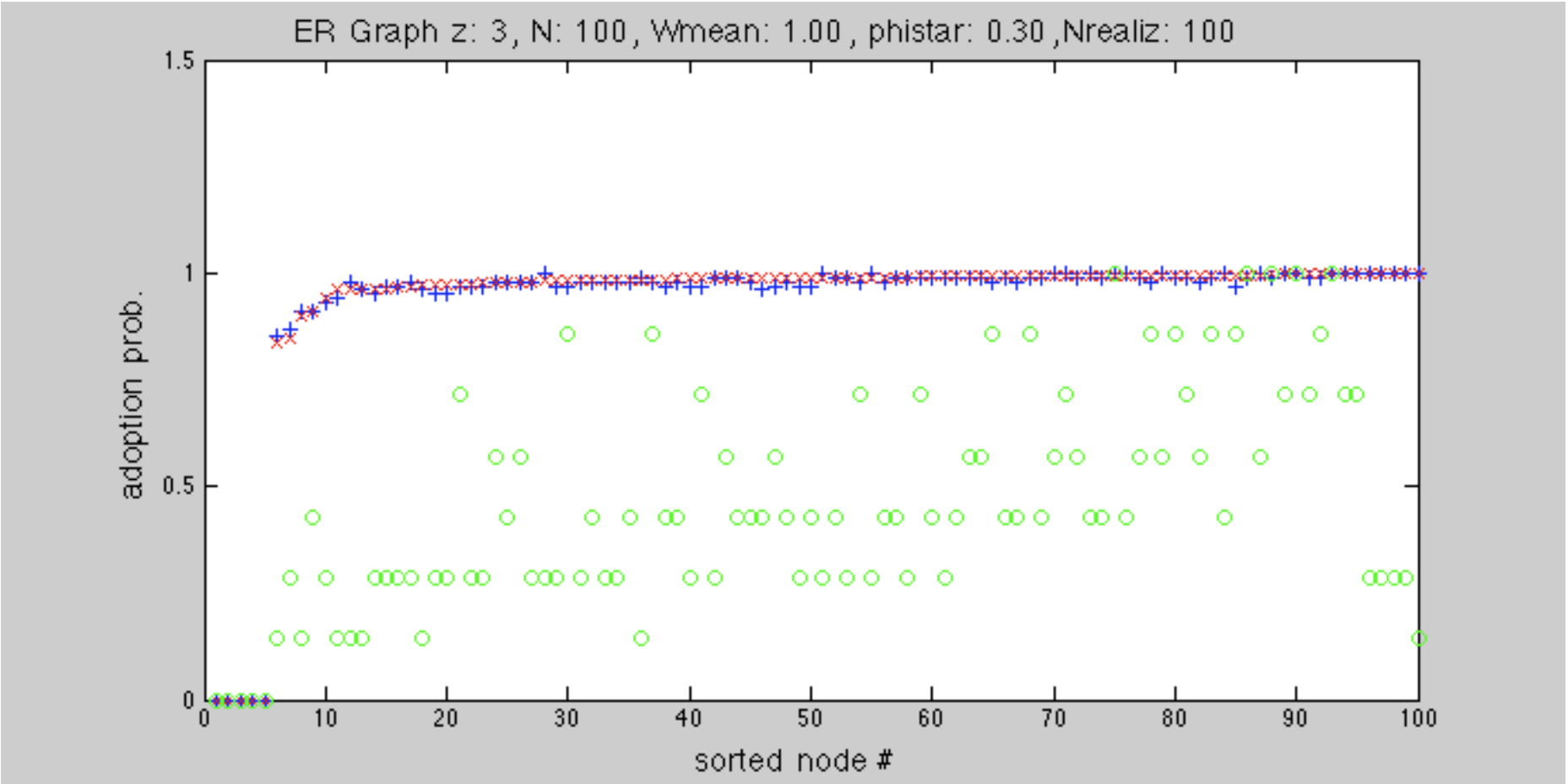
LTIA is exactly true in

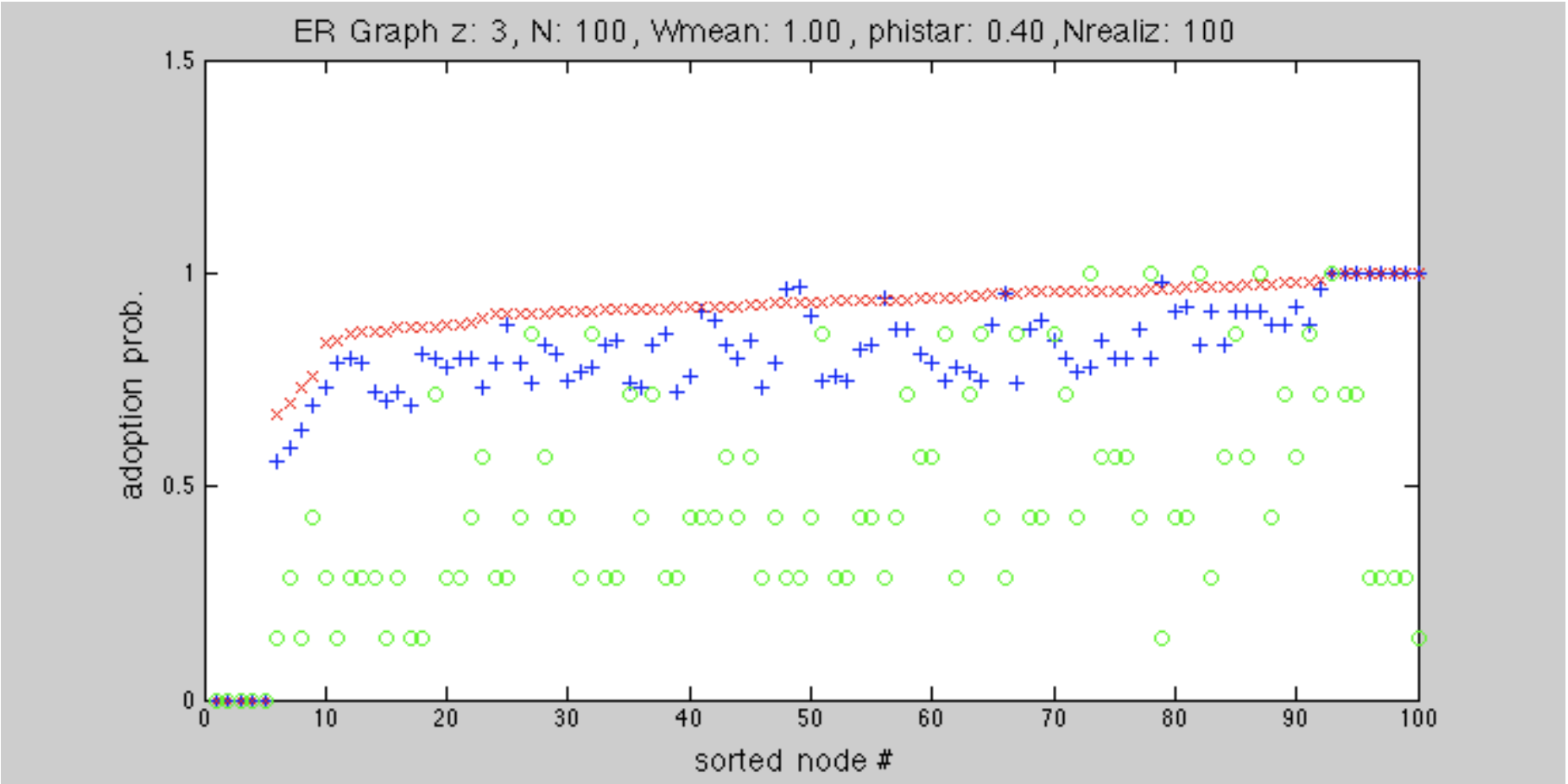
1. $N = \infty$ configuration models;
2. $N < \infty$ tree graph models;
3. $N < \infty$ deterministic models.

Watts' Model Experiments

Typical Erdös-Renyi real-world skeleton graphs with $N = 100$.

- Buffer distributions were log normal with means $0.18 \times k$;
- Edge distributions were log normal with means 1;
- A random subset of nodes "early adopt".
- Analytic formulas (with LTIA) were compared with MC estimators;


ER Graph z: 3, N: 100, Wmean: 1.00, phistar: 0.30, Nrealiz: 100
adoption prob.
sorted node #
0
0.5
1
1.5
0
10
20
30
40
50
60
70
80
90
100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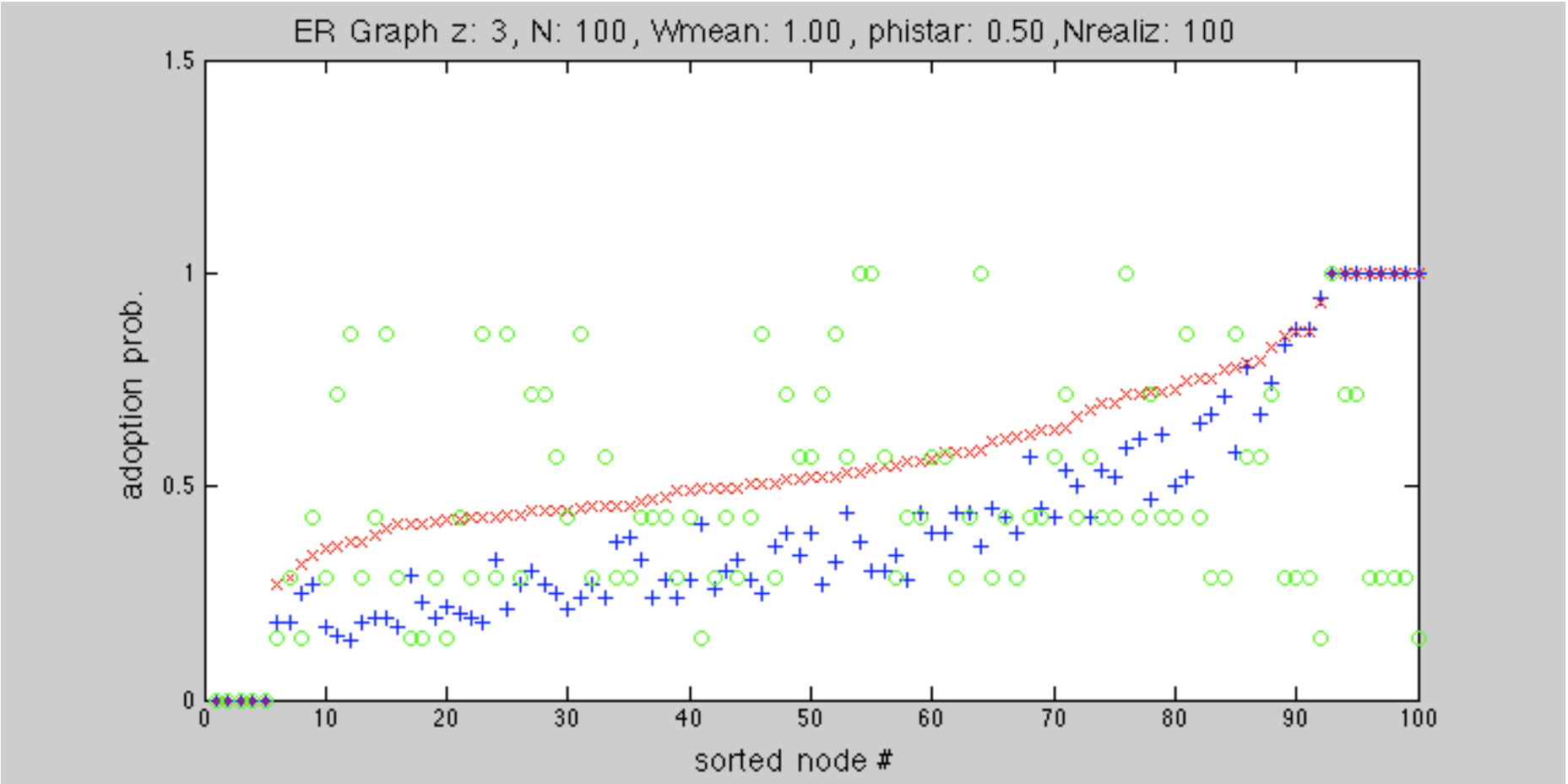
adoption prob.
sorted node #
0
0.5
1
1.5
0
10
20
30
40
50
60
70
80
90
100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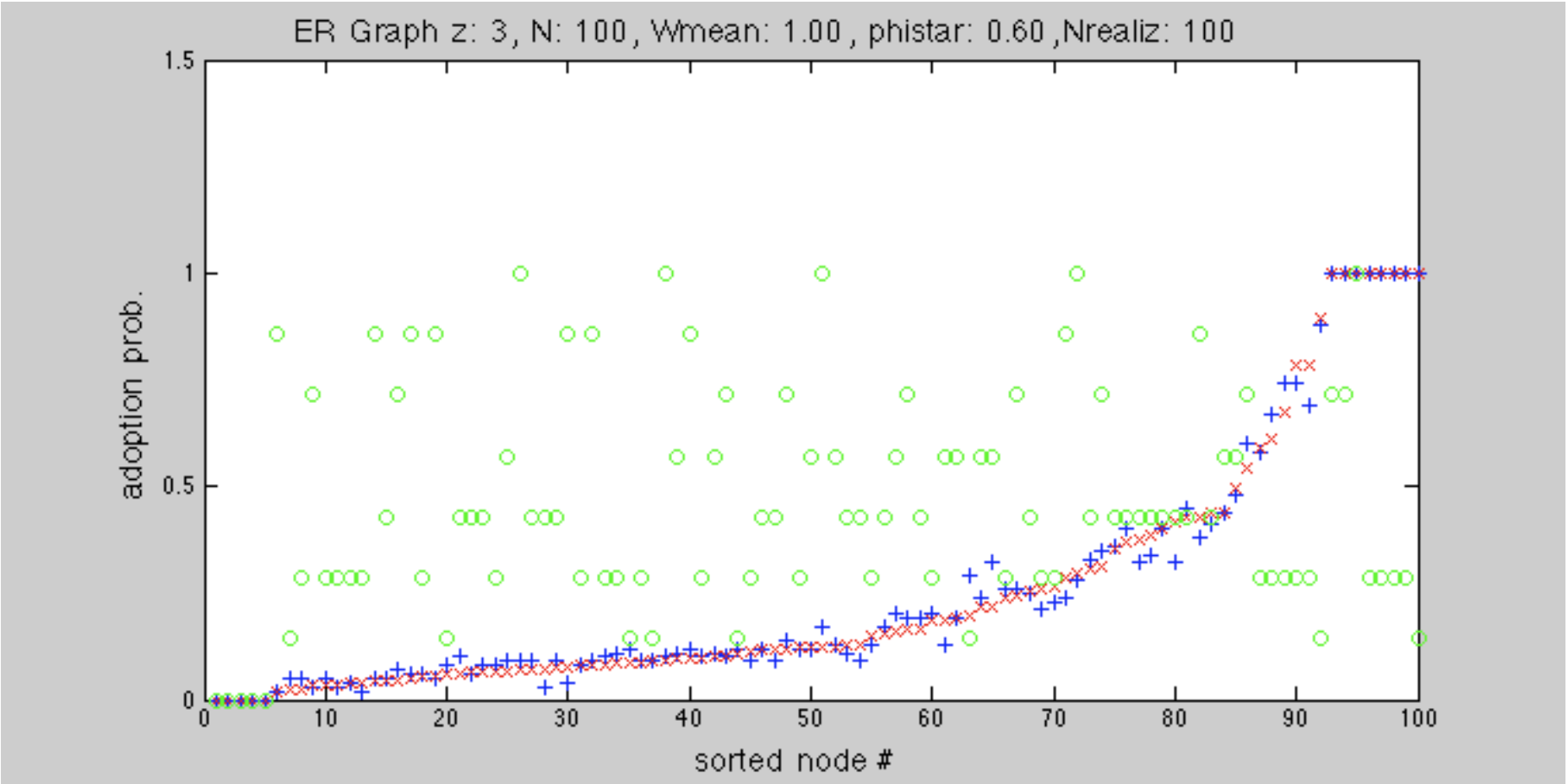
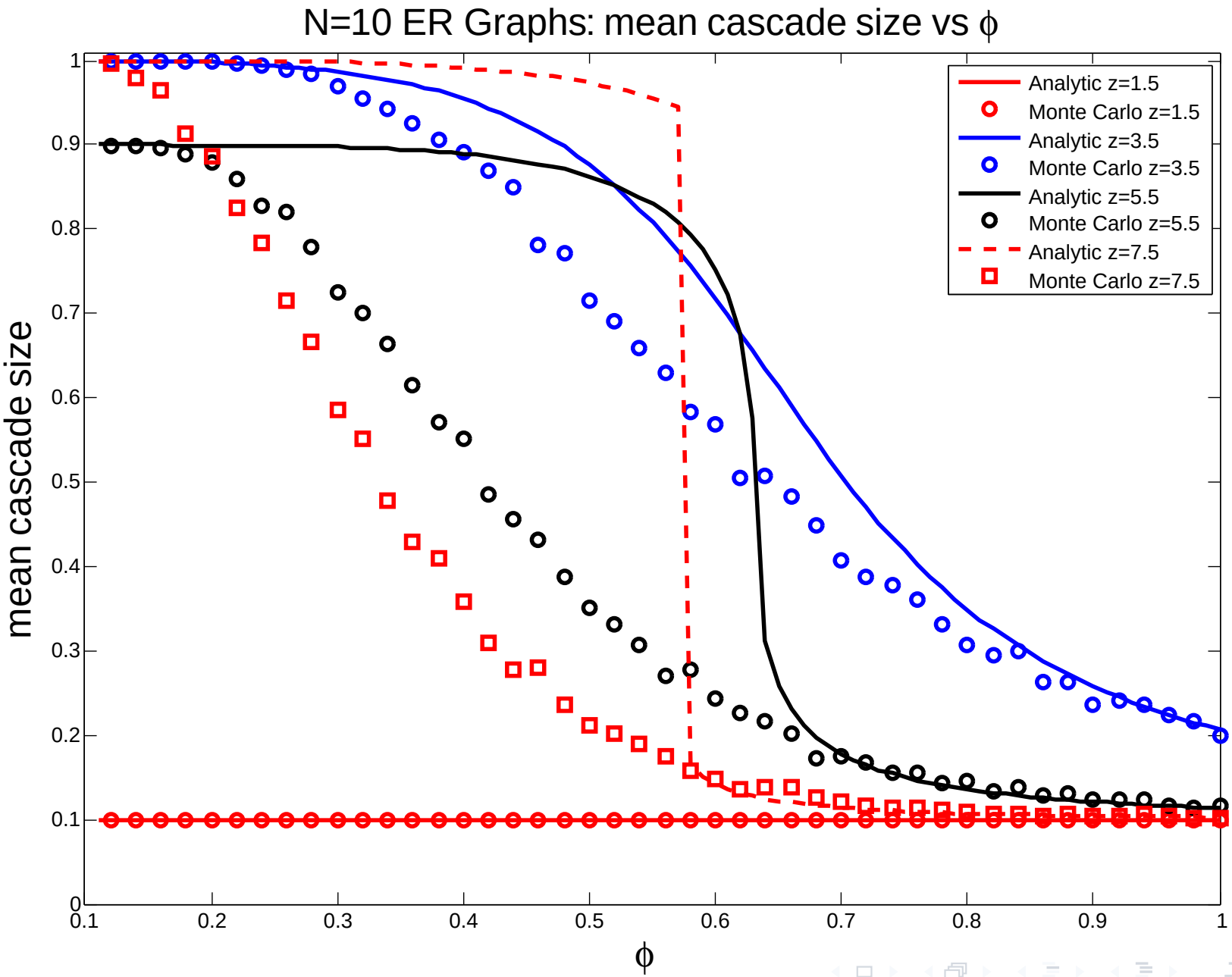
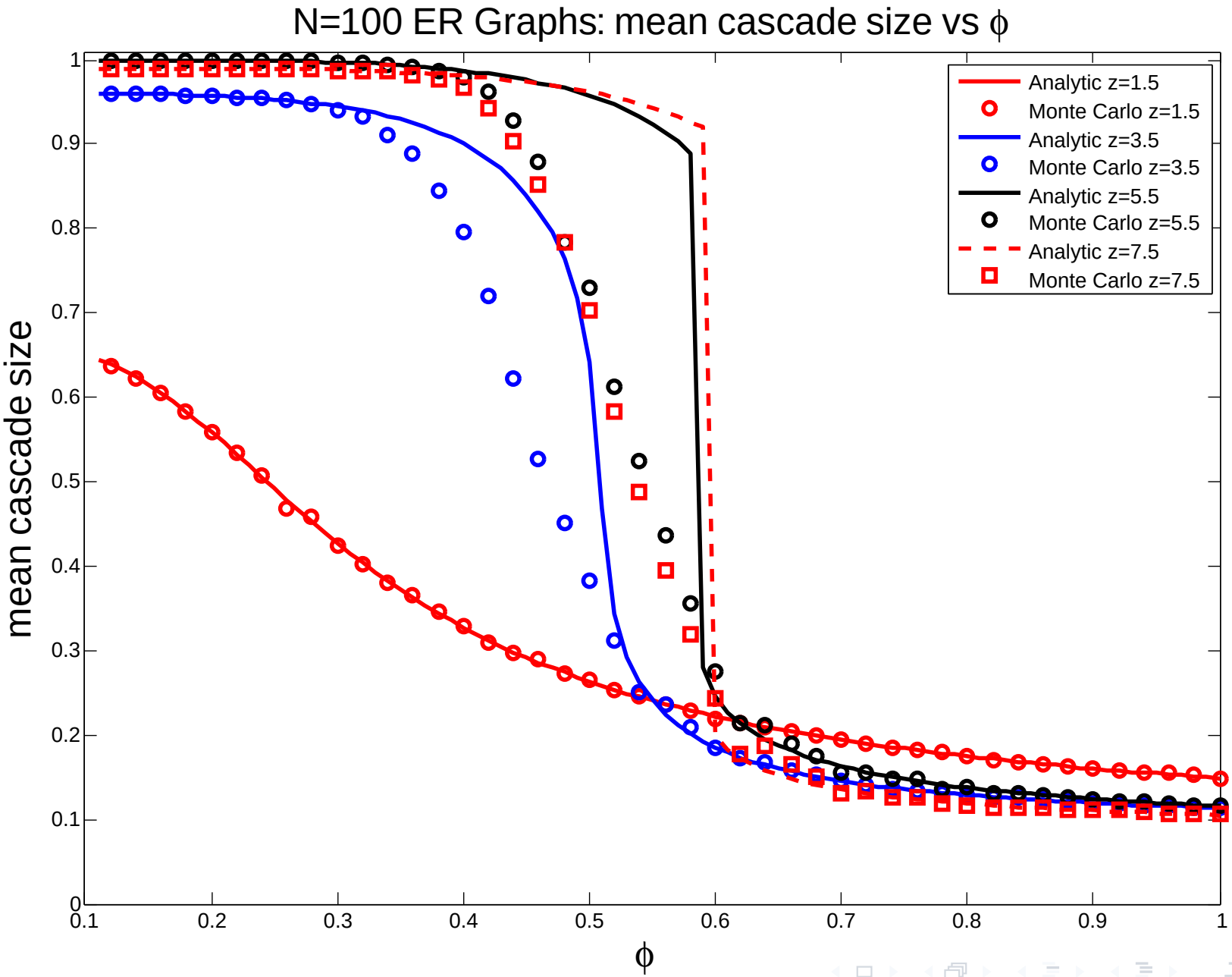
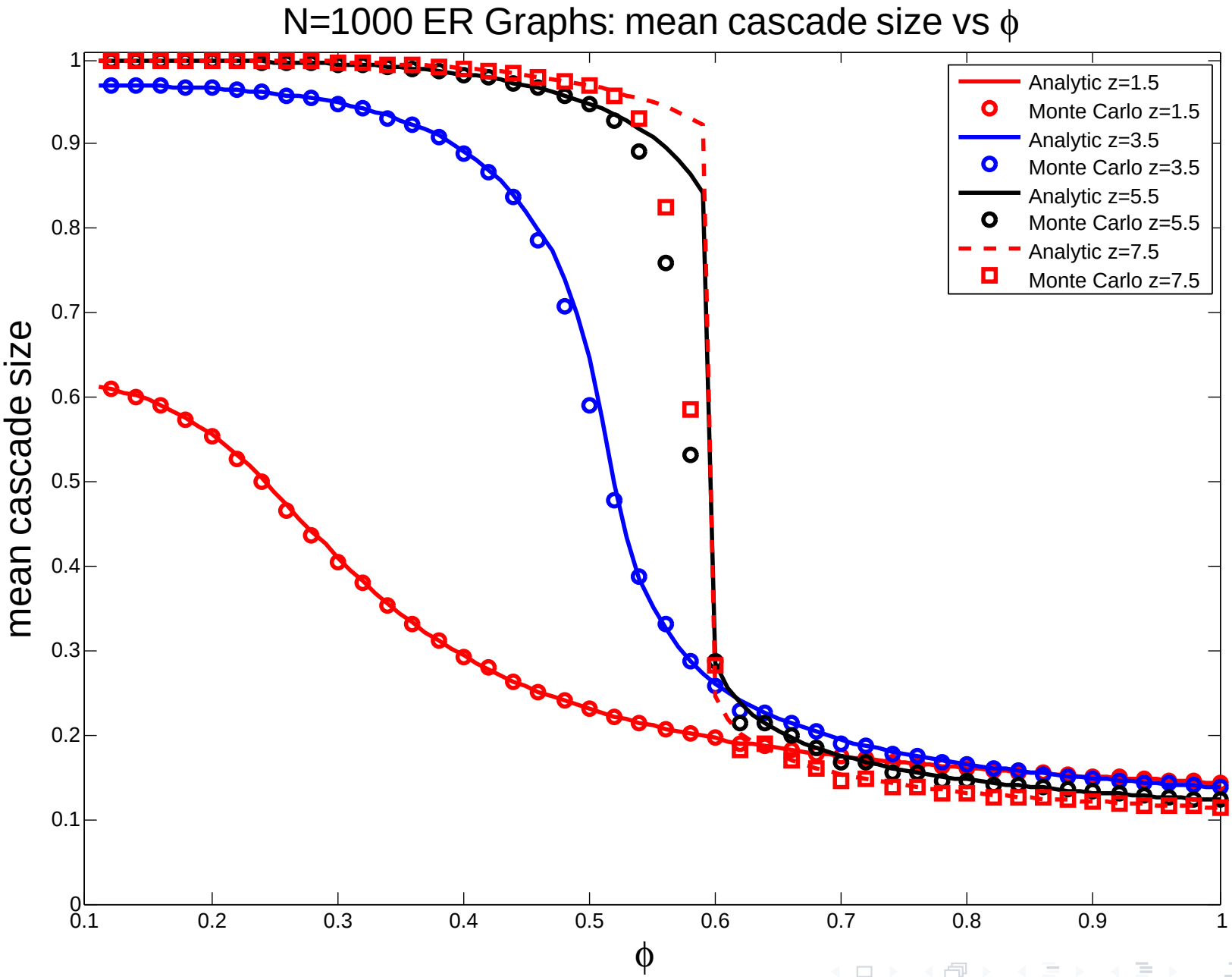
adoption prob.
sorted node #
0
0.5
1
1.5
0
10
20
30
40
50
60
70
80
90
100


ER Graph z: 3, N: 100, Wmean: 1.00, phistar: 0.60, Nrealiz: 100
adoption prob.
sorted node #
0
0.5
1
1.5
0
10
20
30
40
50
60
70
80
90
100


N=10 ER Graphs: mean cascade size vs ϕ
mean cascade size
ϕ
Analytic z=1.5
Monte Carlo z=1.5
Analytic z=3.5
Monte Carlo z=3.5
Analytic z=5.5
Monte Carlo z=5.5
Analytic z=7.5
Monte Carlo z=7.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

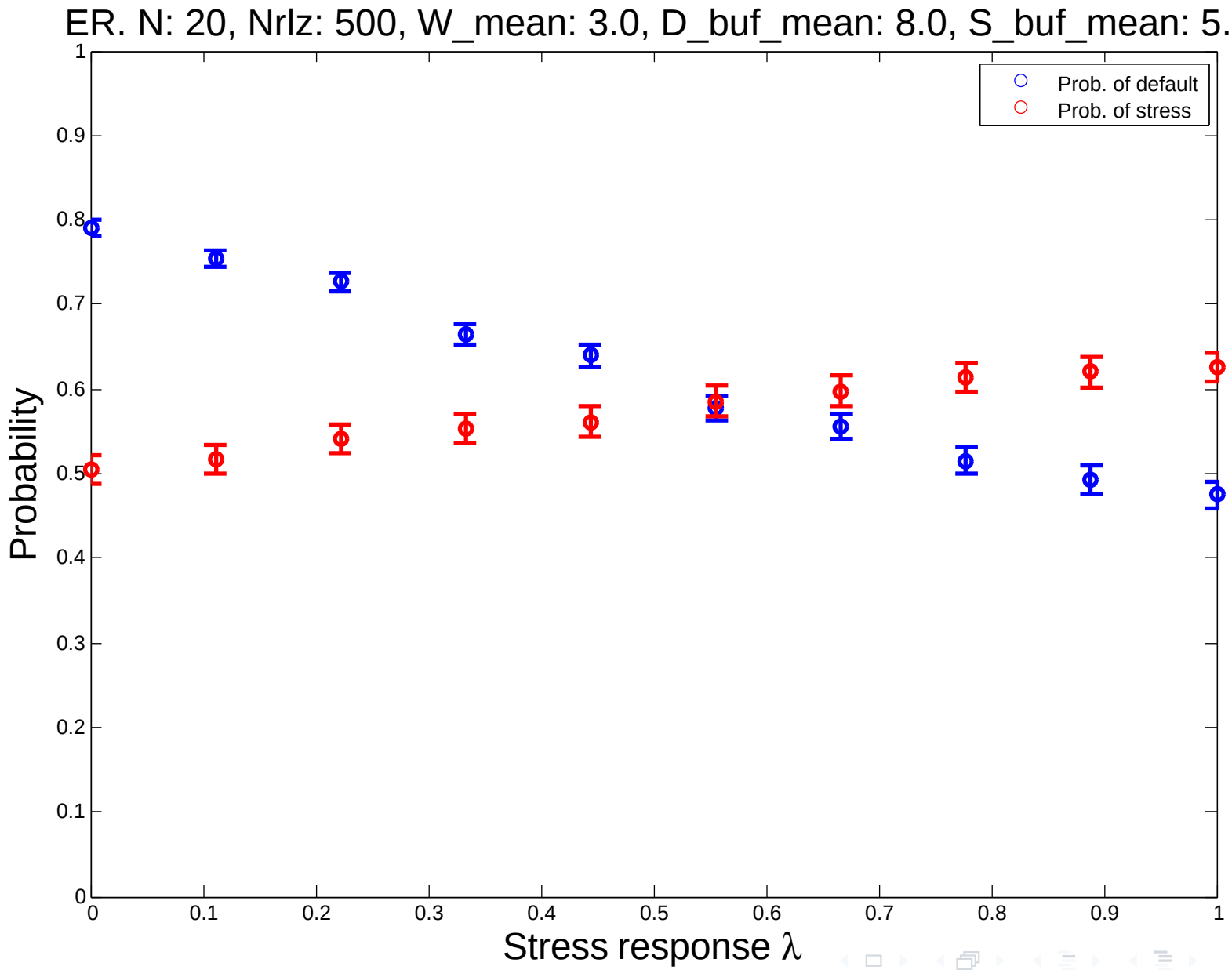

N=100 ER Graphs: mean cascade size vs ϕ
mean cascade size
ϕ
Analytic z=1.5
Monte Carlo z=1.5
Analytic z=3.5
Monte Carlo z=3.5
Analytic z=5.5
Monte Carlo z=5.5
Analytic z=7.5
Monte Carlo z=7.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


N=1000 ER Graphs: mean cascade size vs ϕ
mean cascade size
ϕ
Analytic z=1.5
Monte Carlo z=1.5
Analytic z=3.5
Monte Carlo z=3.5
Analytic z=5.5
Monte Carlo z=5.5
Analytic z=7.5
Monte Carlo z=7.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

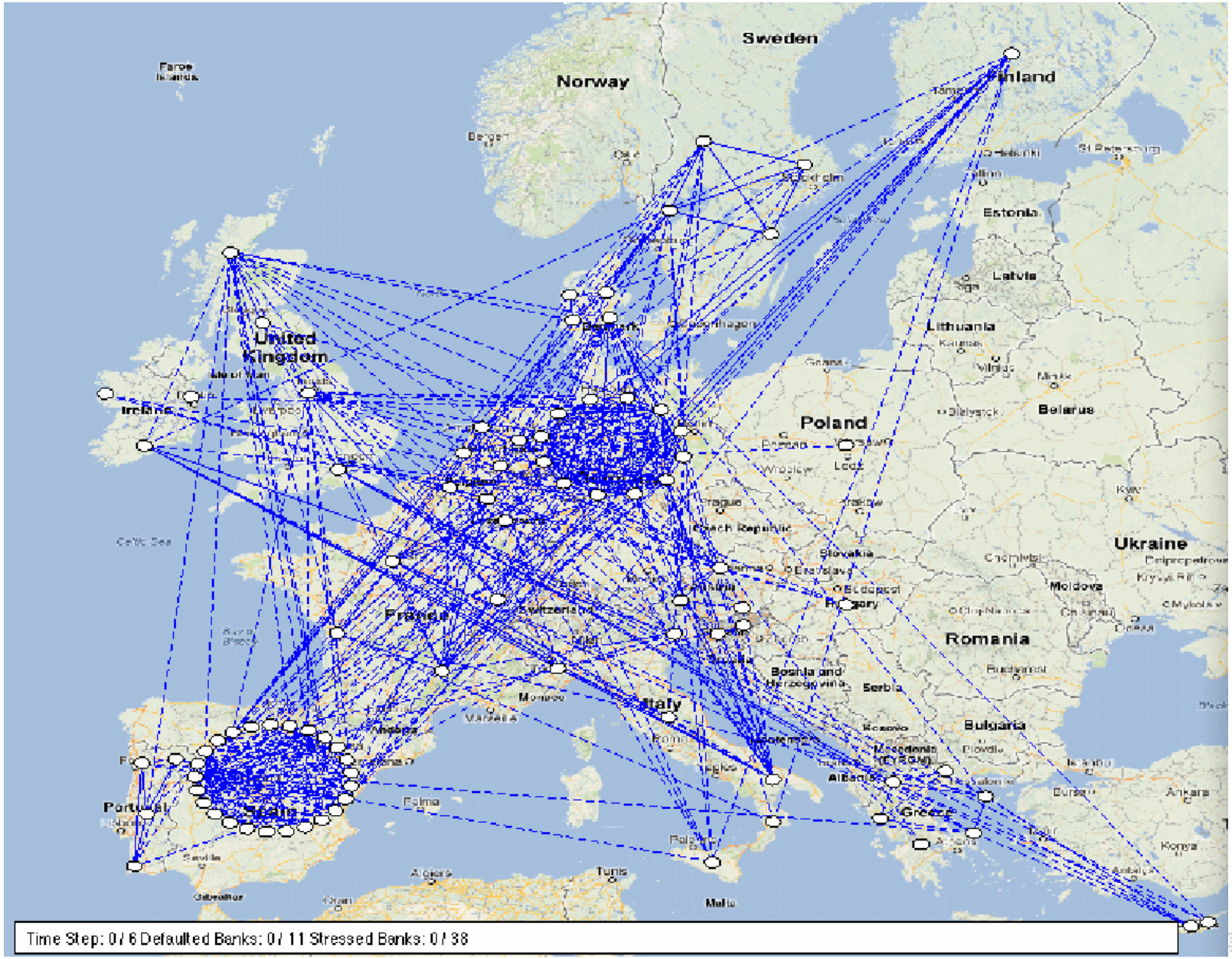
GK+GHK Model of Illiquidity and Insolvency

- We tested the interplay between upstream illiquidity cascade and downstream insolvency cascade.
- $\lambda > 0$ measures the strength of banks' stress response.
- We are now trying to work with EU network data.

Extended GHK: Stress and Default



A Schematic Europe in 2012



Overall Summary

- We can understand how systemic stability is related to the structure of the network;
- We might be able to learn a lot from "Deliberately Simplified Models".
- Open questions abound.

Some References

1. Andrew G Haldane's 2009 talk "Rethinking the Financial Network";
2. C. Upper, "Simulation methods to assess the danger of contagion in interbank markets", Journal of Financial Stability, forthcoming, 2011.
3. L. Eisenberg and T. H. Noe, "Systemic risk in financial systems". Management Science, 47(2):236 249, 2001.

Some More References

1. Duncan Watts, "A simple model of global cascades on random networks", Proc. Nat. Academy Sciences, **99**, 2002.
2. P. Gai, S. Kapadia, "Contagion in Financial Networks", Proc. R. Soc. A, **466**, 2010.
3. J. Gleeson, T. Hurd, S. Melnik, A. Hackett, "Systemic Risk in banking networks without Monte Carlo simulation", working paper, 2011.
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5. P. Gai, A. Haldane, S. Kapadia, "Complexity, Concentration and Contagion", Journal of Monetary Economics, **58**, 2011.