ONLINE APPENDIX

Equilibrium Asset Pricing in Directed Networks

July 30, 2020

Abstract

This Online Appendix serves as a companion to our paper "Equilibrium Asset Pricing in Directed Networks". It provides additional results not reported in the main text due to space constraints.

A. Approximation quality

In this section, we assess the quality of the first-order approximations derived in the Theorems 1 and 2 in the main text. Specifically, we compare those against the results from the numerical solution of the model using the network and the parameters from Section 5 of the main paper.

As explained in Appendix B, MPJR** is based on two approximation steps, B^* and B^{**}. In the left of Figure A.1, the result of the first approximation step, B^* defined in Equation (B.2), is plotted against the numerical solution of Equation (A.4), B. The plot in the middle shows the results for the second approximation step, B^{**} given in (B.4). The right plot shows the approximated market prices of jump risk, MPJR** from Theorem 1 as a function of MPJR, the market prices of jump risk obtained from the numerical solution of Equation (6).

Regressing B^* (or B^{**}, respectively) on B yields the following parameter estimates, t-stats (in parentheses), R^2, and correlations:

$$\begin{array}{rcccccccl} B_i^* & = & \underset{(-43.8)}{-0.0010} & + & \underset{(383.7)}{0.8388} & B_i & + & u_i, & \qquad R^2 = 0.9998, \quad \text{Corr} = 0.9999, \\ B_i^{**} & = & \underset{(-277.3)}{-0.0015} & + & \underset{(383.7)}{0.3864} & B_i & + & u_i, & \qquad R^2 = 0.9998, \quad \text{Corr} = 0.9999. \end{array}$$

Performing a similar regression of MPJR** on MPJR gives:

$$\text{MPJR}_i^{**} = \underset{(-443.9)}{-0.0643} + \underset{(648.8)}{0.4037}\ \text{MPJR}_i + u_i, \qquad R^2 = 0.9998, \quad \text{Corr} = 0.9999.$$

Altogether, we see from the figures and the regression results that the first approximation step hardly affects the B coefficients at all. The second approximation step (approximating the Leontief inverse) changes all coefficients quantitatively, but not qualitatively. The ordering of the coefficients is preserved, the sign remains unchanged, the correlation between approximated and exact market prices of risk is 99%. Only the size and the dispersion are reduced.

Similarly, JEXP** is based on two approximation steps, C^* and C^{**}, and its approximation quality is shown in Figure A.2. The corresponding pooled regressions yield

$$\begin{array}{rcccccccl} C^*_{\cdot,\cdot} & = & \underset{(-48.5)}{-0.0182} & + & \underset{(165.2)}{0.9866} & C_{\cdot,\cdot} & + & u_{\cdot,\cdot}, & \qquad R^2 = 0.9932, \quad \text{Corr} = 0.9966. \\ C^{**}_{\cdot,\cdot} & = & \underset{(-30.5)}{-0.01044} & + & \underset{(343.5)}{0.9882} & C_{\cdot,\cdot} & + & u_{\cdot,\cdot}, & \qquad R^2 = 0.9946, \quad \text{Corr} = 0.9973. \\ \text{JEXP}^{**}_{\cdot,\cdot} & = & \underset{(8.3)}{0.0017} & + & \underset{(182.2)}{0.9954} & \text{JEXP}_{\cdot,\cdot} & + & u_{\cdot,\cdot}, & \qquad R^2 = 0.9884, \quad \text{Corr} = 0.9973. \end{array}$$

The ordering of the coefficients as well as the sign are preserved and the correlation between approximated and exact jump exposures is 99%.

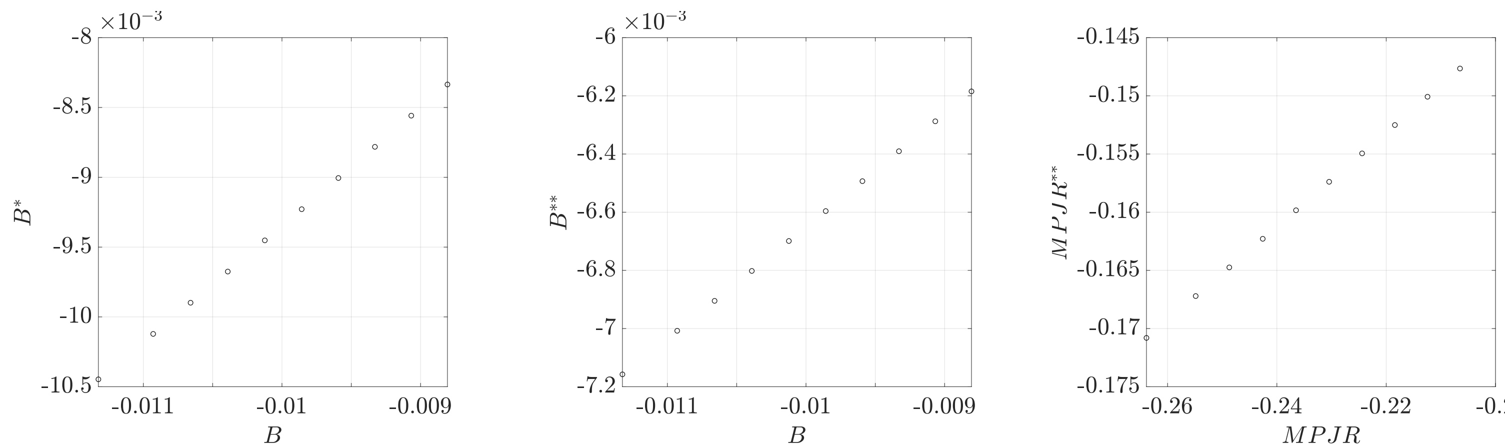

Figure A.1
Approximation quality of the market prices of jump risk

The plot on the left (in the middle) shows the approximated coefficient B^* (B^{**}) as a function of the coefficient B from the numerical solution. The graph on the right shows the approximation of the market price of jump risk defined in Theorem 1 of the main paper, MPJR**, as a function of the market prices of jump risk, MPJR, which have been computed numerically. The coefficients B^* and B^{**} are defined in Appendix B in the main paper. The network and the parameters are taken from Section 5 in the main paper.

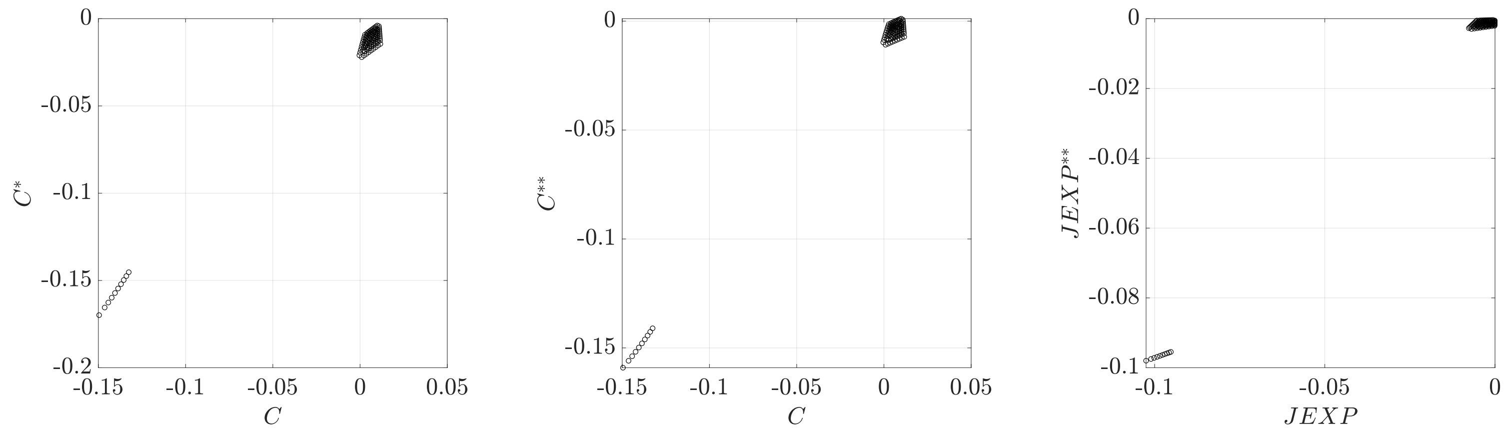

Figure A.2
Approximation quality of the jump exposures

The plot on the left (in the middle) shows the approximated coefficient C^* (C^{**}) as a function of the coefficient C from the numerical solution. The graph on the right shows the approximation of the jump exposures defined in Theorem 2 of the main paper, JEXP**, as a function of the jump exposures, JEXP, which have been computed numerically. The coefficients C^* and C^{**} are defined in Appendix B in the main paper. The network and the parameters are taken from Section 5 in the main paper.