

Supplementary Materials: Generalized Extreme Value Statistics, Physical Scaling and Forecasts of Oil Production in the Bakken Shale

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1 Supporting Online Materials-1: GEV Fits

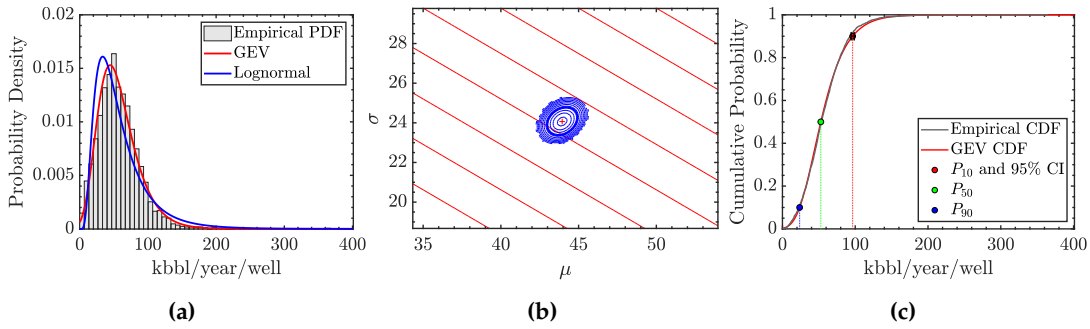


Figure S1. Distribution of oil production rates for 2540 horizontal wells with one year on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = -0.0274$, $\mu = 43.9421$, $\sigma = 24.0635$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

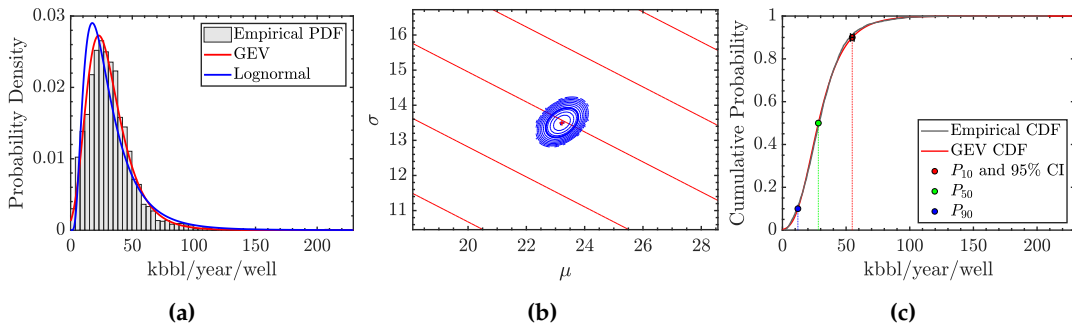


Figure S2. Distribution of oil production rates for 2534 horizontal wells with two years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.0350$, $\mu = 23.2199$, $\sigma = 13.4957$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

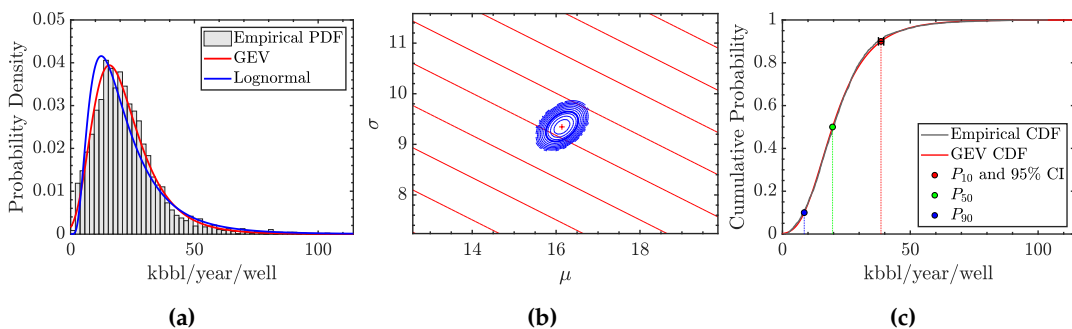


Figure S3. Distribution of oil production rates for 2525 horizontal wells with three years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.0558$, $\mu = 16.1383$, $\sigma = 9.3447$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

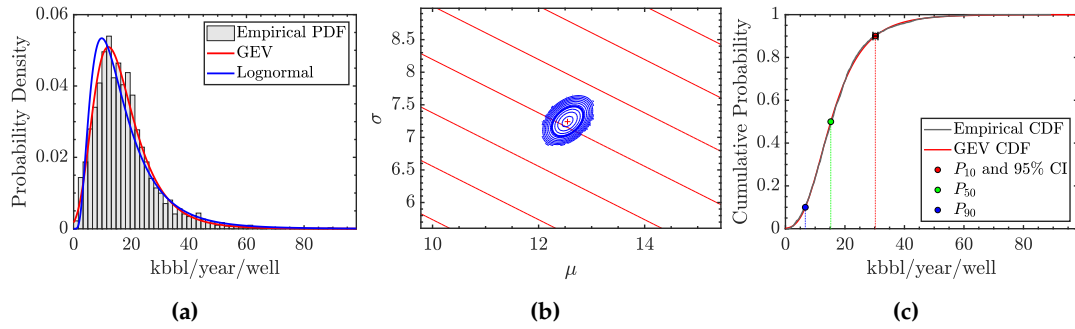


Figure S4. Distribution of oil production rates for 2515 horizontal wells with four years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.0711$, $\mu = 12.5448$, $\sigma = 7.2414$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

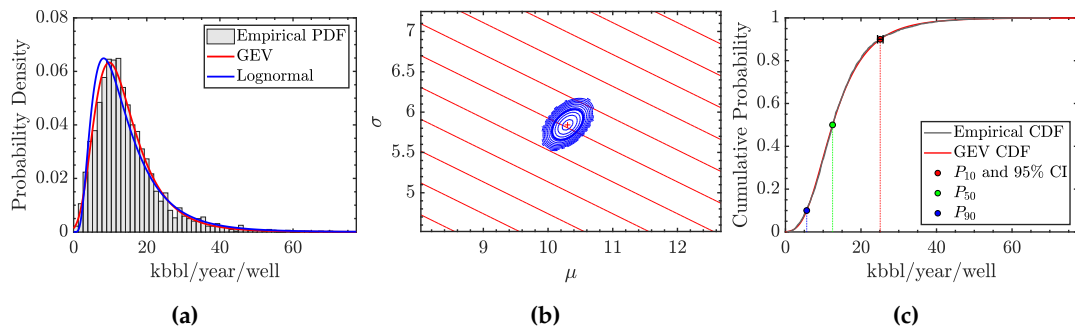


Figure S5. Distribution of oil production rates for 2501 horizontal wells with five years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.1028$, $\mu = 10.3013$, $\sigma = 5.8415$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

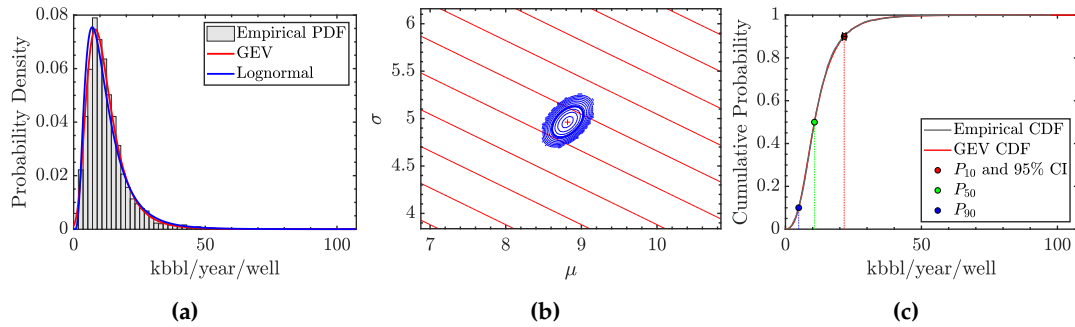


Figure S6. Distribution of oil production rates for 2470 horizontal wells with six years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.1177$, $\mu = 8.8175$, $\sigma = 4.9622$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

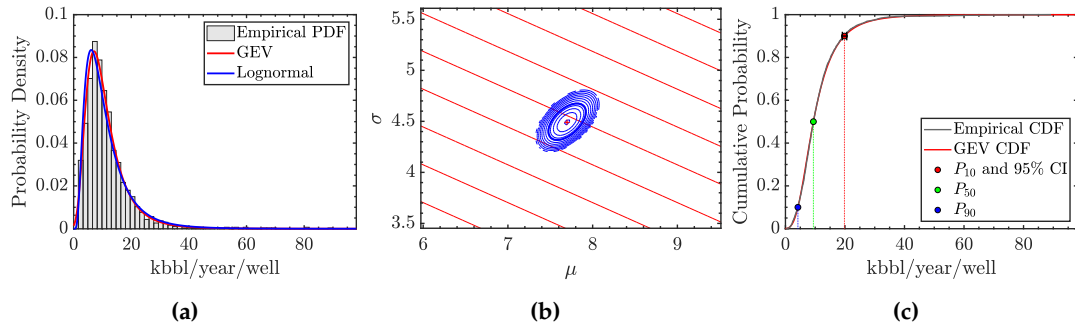


Figure S7. Distribution of oil production rates for 1839 horizontal wells with seven years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.1573$, $\mu = 7.6970$, $\sigma = 4.4909$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

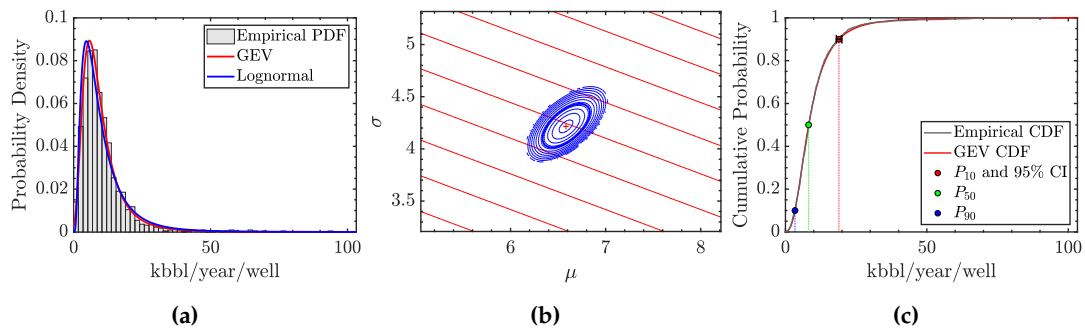


Figure S8. Distribution of oil production rates for 1285 horizontal wells with eight years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.2238$, $\mu = 6.5823$, $\sigma = 4.2151$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

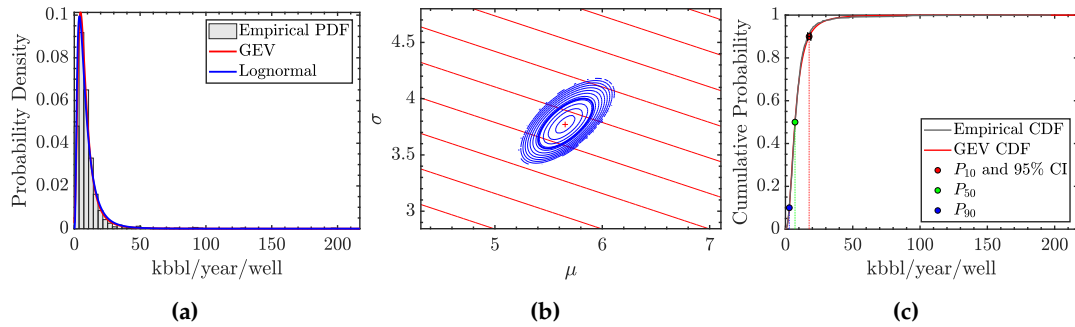


Figure S9. Distribution of oil production rates for 979 horizontal wells with nine years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.2883$, $\mu = 5.6542$, $\sigma = 3.7709$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

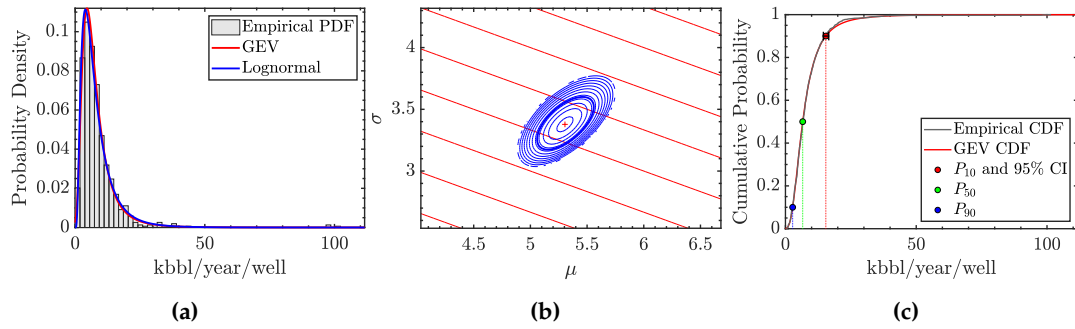


Figure S10. Distribution of oil production rates for 825 horizontal wells with ten years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.2443$, $\mu = 5.3047$, $\sigma = 3.3781$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

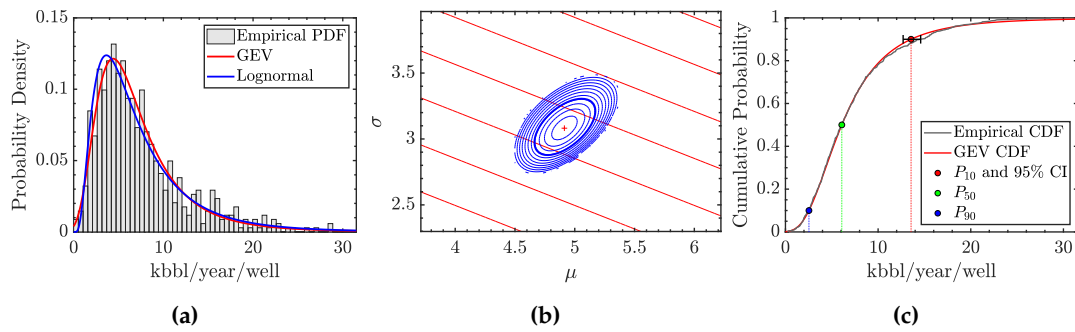


Figure S11. Distribution of oil production rates for 651 horizontal wells with eleven years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.1890$, $\mu = 4.9132$, $\sigma = 3.0817$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

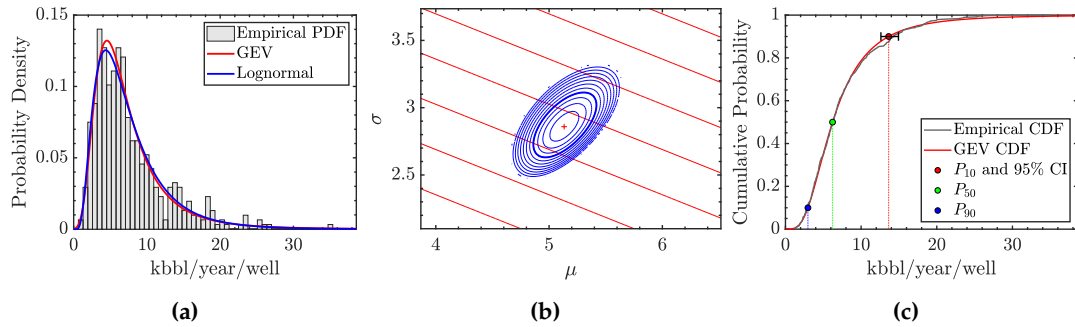


Figure S12. Distribution of oil production rates for 477 horizontal wells with twelve years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.2376$, $\mu = 5.1329$, $\sigma = 2.8589$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

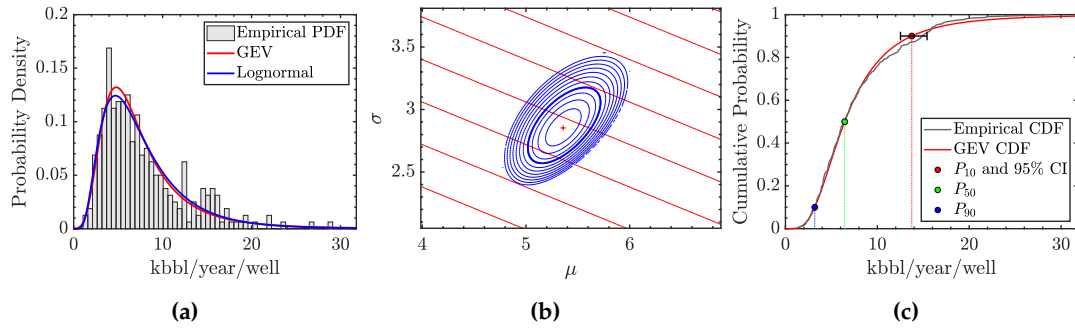


Figure S13. Distribution of oil production rates for 302 horizontal wells with thirteen years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.2284$, $\mu = 5.3582$, $\sigma = 2.8523$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

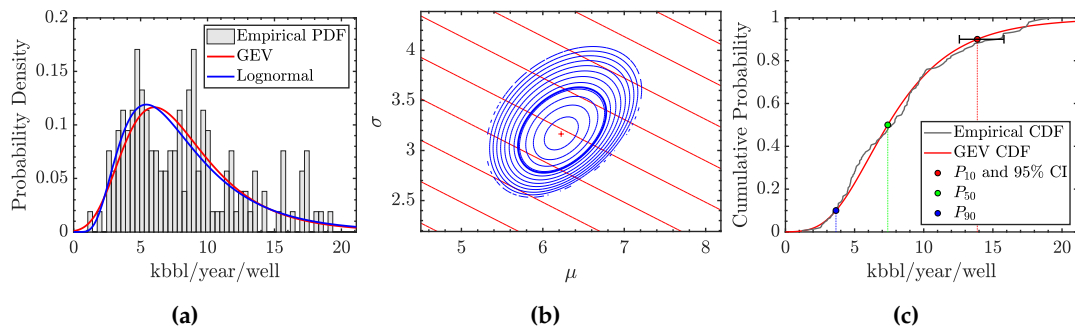


Figure S14. Distribution of oil production rates for 150 horizontal wells with fourteen years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.0627$, $\mu = 6.2251$, $\sigma = 3.1648$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

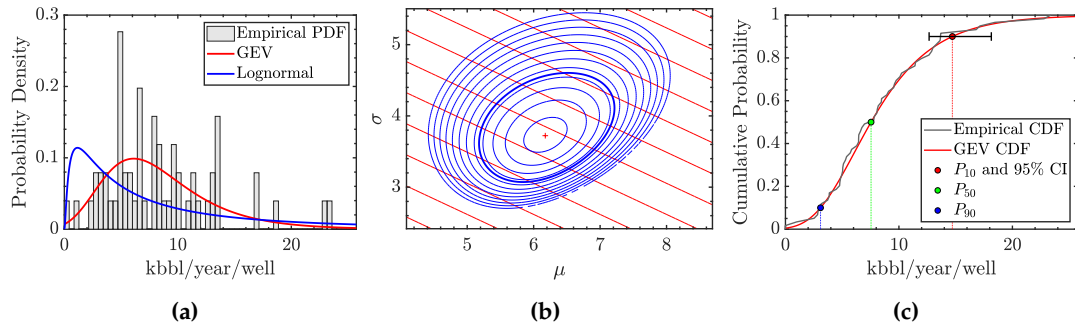


Figure S15. Distribution of oil production rates for 59 horizontal wells with fifteen years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.0164$, $\mu = 6.1751$, $\sigma = 3.7225$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

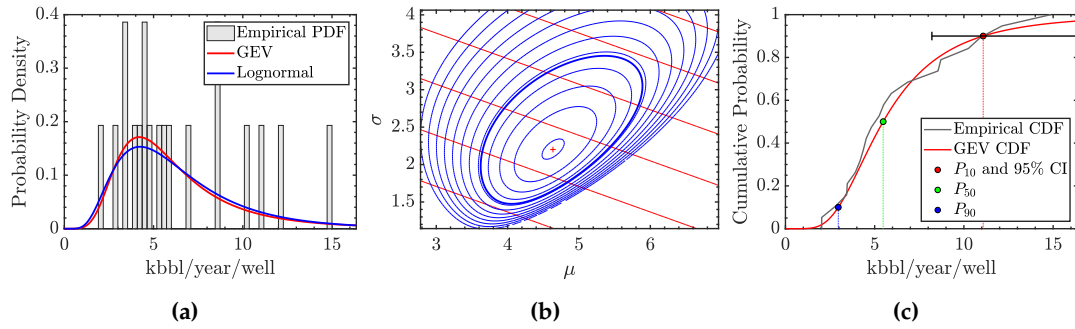


Figure S16. Distribution of oil production rates for 19 horizontal wells with sixteen years on production, completed between the year 2000 and 2012 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.2247$, $\mu = 4.6353$, $\sigma = 2.2005$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

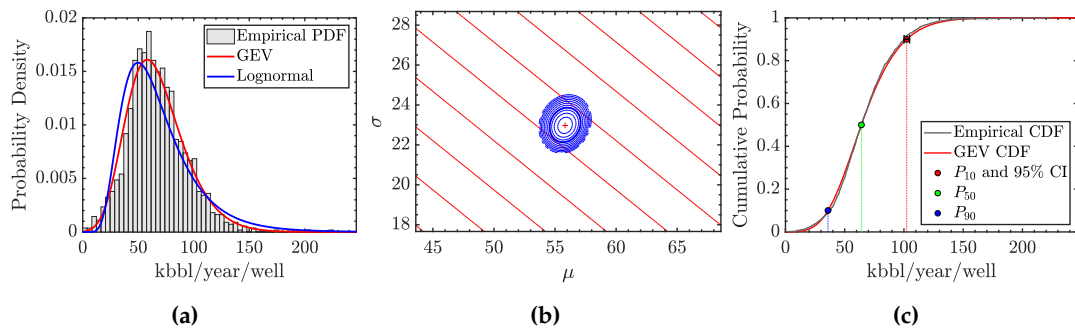


Figure S17. Distribution of oil production rates for 1352 horizontal wells with one year on production, completed between the year 2013 and 2016 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = -0.0950$, $\mu = 55.8250$, $\sigma = 22.9713$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

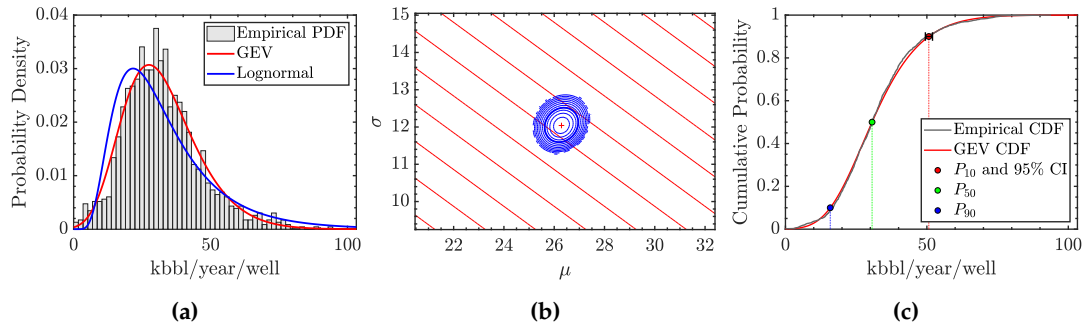


Figure S18. Distribution of oil production rates for 1348 horizontal wells with two years on production, completed between the year 2013 and 2016 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = -0.0950$, $\mu = 26.2886$, $\sigma = 12.0407$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

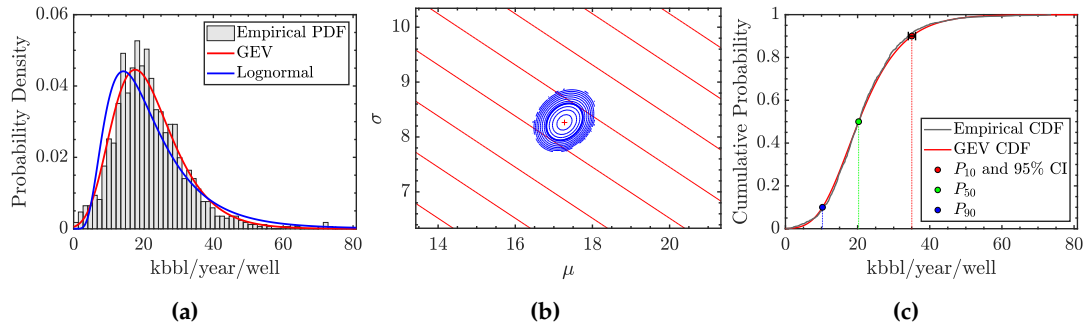


Figure S19. Distribution of oil production rates for 1267 horizontal wells with three years on production, completed between the year 2013 and 2016 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = -0.0419$, $\mu = 17.2759$, $\sigma = 8.2635$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

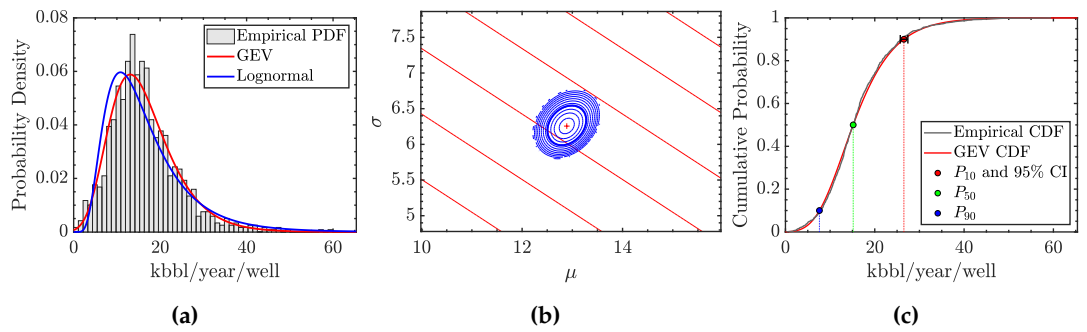


Figure S20. Distribution of oil production rates for 1094 horizontal wells with four years on production, completed between the year 2013 and 2016 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = -0.0288$, $\mu = 12.8894$, $\sigma = 6.2561$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

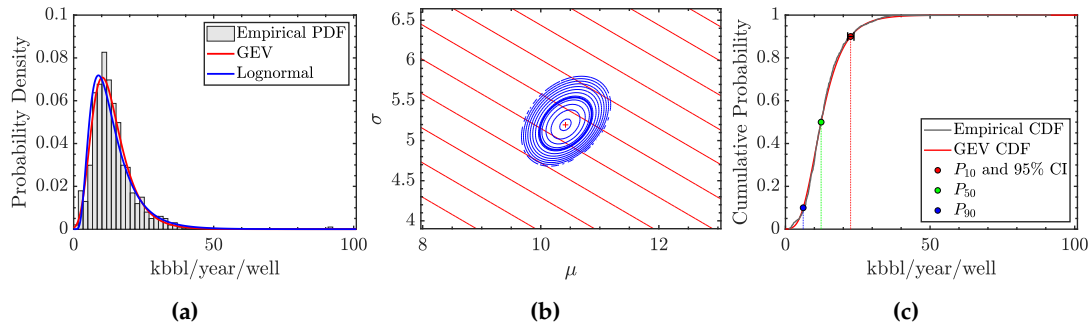


Figure S21. Distribution of oil production rates for 597 horizontal wells with five years on production, completed between the year 2013 and 2016 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = 0.0305$, $\mu = 10.4185$, $\sigma = 5.1962$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

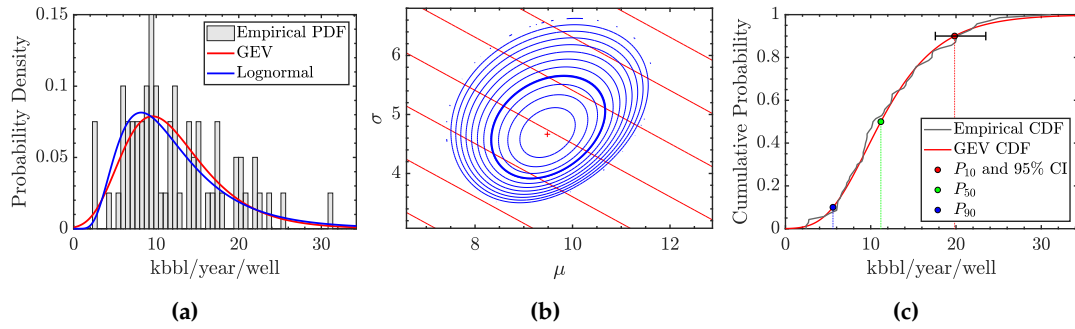


Figure S22. Distribution of oil production rates for 70 horizontal wells with six years on production, completed between the year 2013 and 2016 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = -0.0126$, $\mu = 9.4835$, $\sigma = 4.6646$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

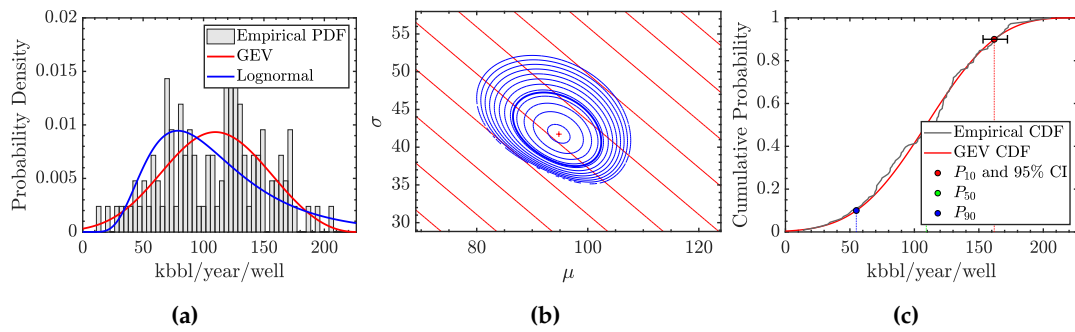


Figure S23. Distribution of oil production rates for 111 horizontal wells with one year on production, completed between the year 2017 and 2019 in the Middle Bakken noncore area. (a) GEV PDF: $\xi = -0.3168$, $\mu = 94.7978$, $\sigma = 41.7273$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

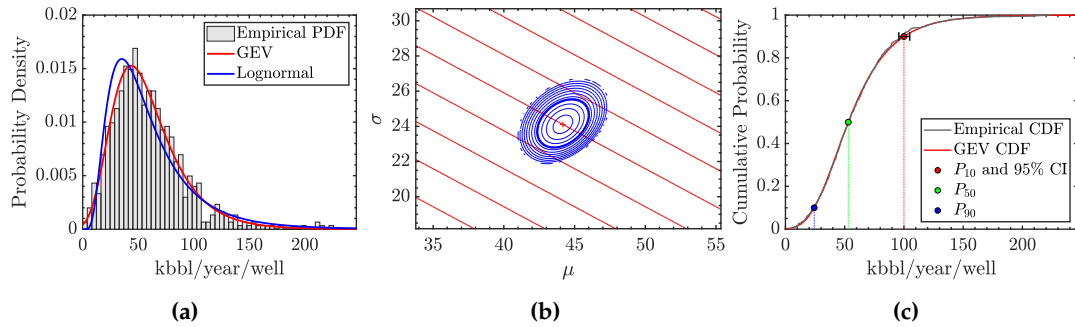


Figure S24. Distribution of oil production rates for 735 horizontal wells with one year on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0255$, $\mu = 44.1701$, $\sigma = 24.1066$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

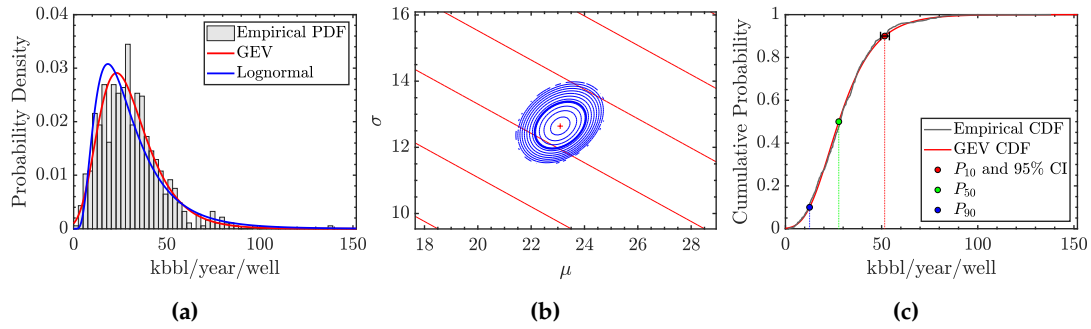


Figure S25. Distribution of oil production rates for 734 horizontal wells with two years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0015$, $\mu = 23.0894$, $\sigma = 12.6412$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

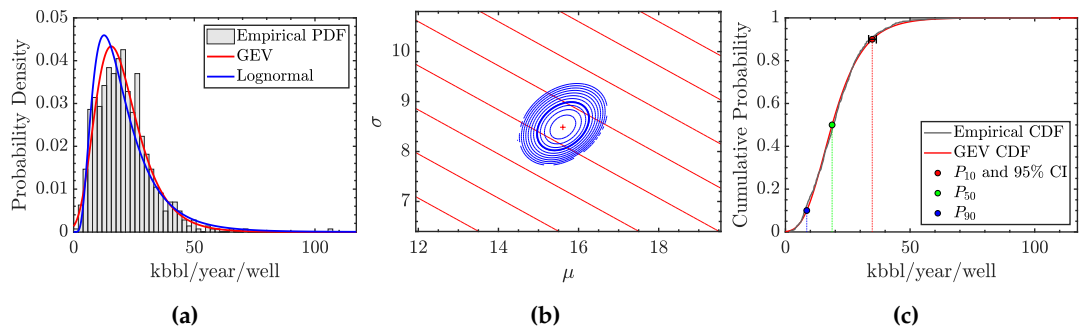


Figure S26. Distribution of oil production rates for 734 horizontal wells with three years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0054$, $\mu = 15.6076$, $\sigma = 8.4863$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

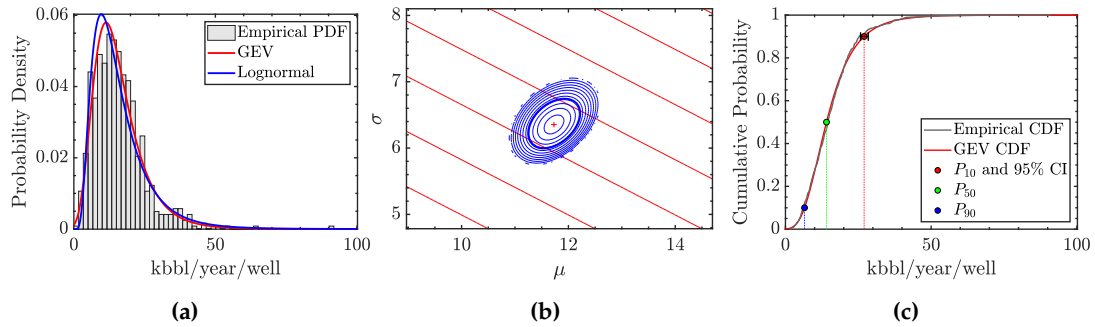


Figure S27. Distribution of oil production rates for 733 horizontal wells with four years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0581$, $\mu = 11.7288$, $\sigma = 6.3537$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

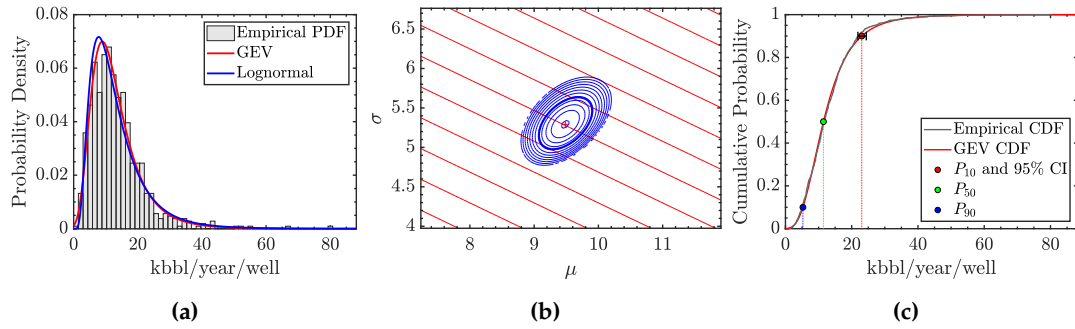


Figure S28. Distribution of oil production rates for 722 horizontal wells with five years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.1124$, $\mu = 9.4842$, $\sigma = 5.2917$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

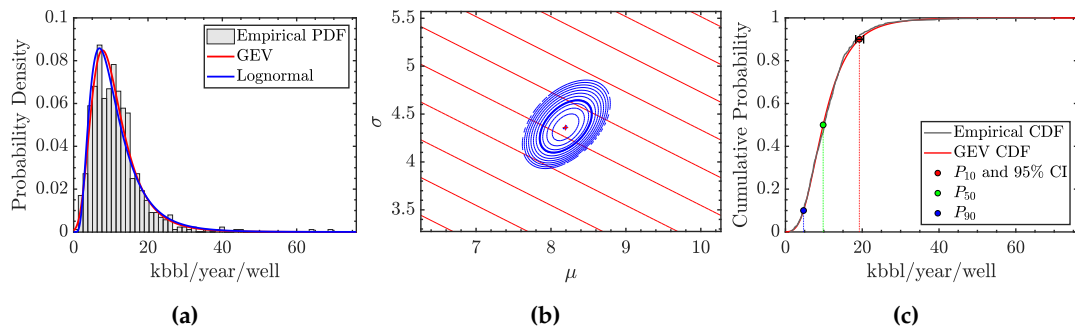


Figure S29. Distribution of oil production rates for 696 horizontal wells with six years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.1047$, $\mu = 8.1929$, $\sigma = 4.3587$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

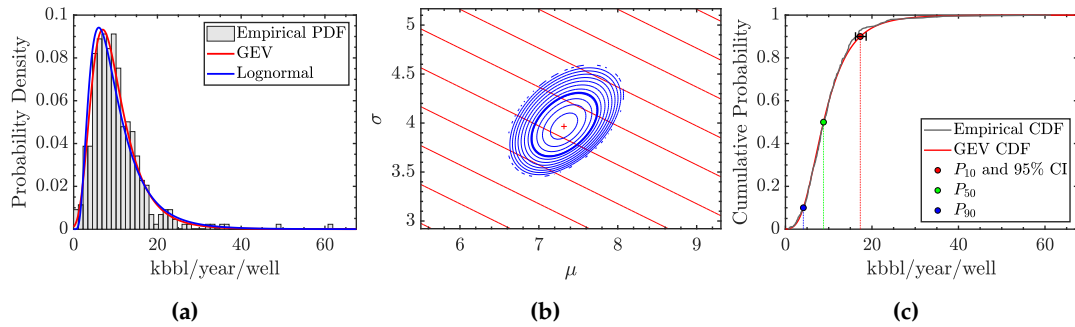


Figure S30. Distribution of oil production rates for 390 horizontal wells with seven years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0984$, $\mu = 7.3182$, $\sigma = 3.9652$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

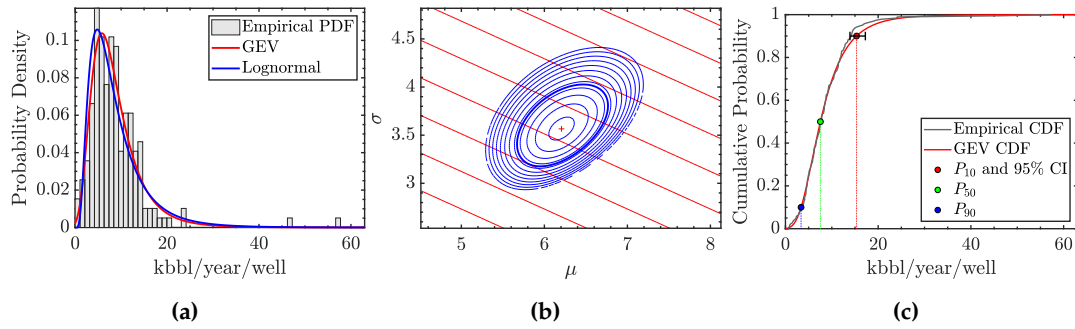


Figure S31. Distribution of oil production rates for 187 horizontal wells with eight years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.1127$, $\mu = 6.2062$, $\sigma = 3.5657$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

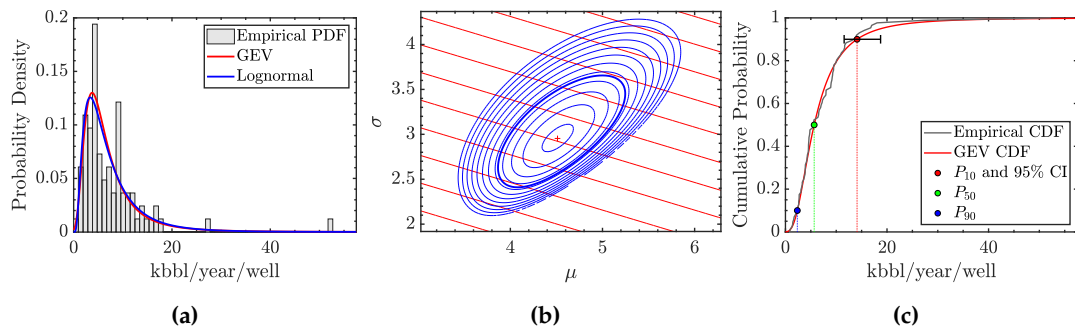


Figure S32. Distribution of oil production rates for 86 horizontal wells with nine years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.3080$, $\mu = 4.5119$, $\sigma = 2.9541$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

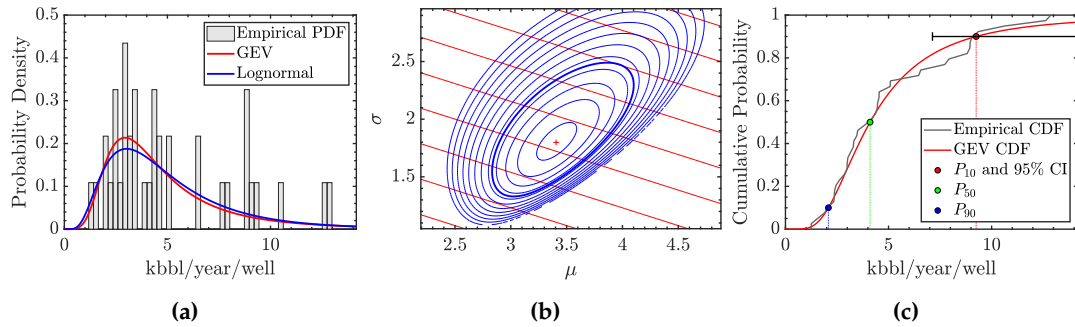


Figure S33. Distribution of oil production rates for 39 horizontal wells with ten years on production, completed between the year 2000 and 2012 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.3086$, $\mu = 3.4055$, $\sigma = 1.7988$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

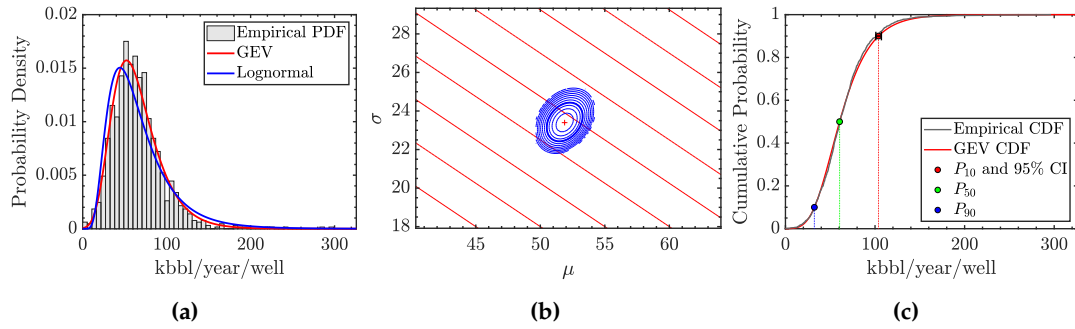


Figure S34. Distribution of oil production rates for 1199 horizontal wells with one year on production, completed between the year 2013 and 2016 in the Three Forks noncore area. (a) GEV PDF: $\xi = -0.0112$, $\mu = 51.8838$, $\sigma = 23.3963$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

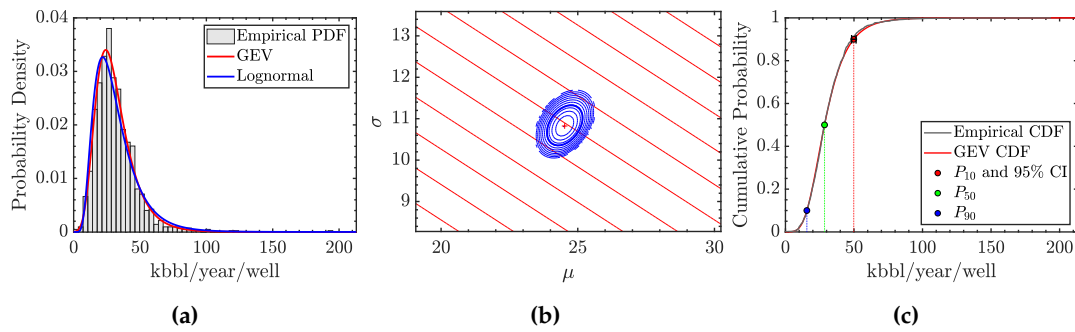


Figure S35. Distribution of oil production rates for 1193 horizontal wells with two years on production, completed between the year 2013 and 2016 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0337$, $\mu = 24.5201$, $\sigma = 10.8235$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

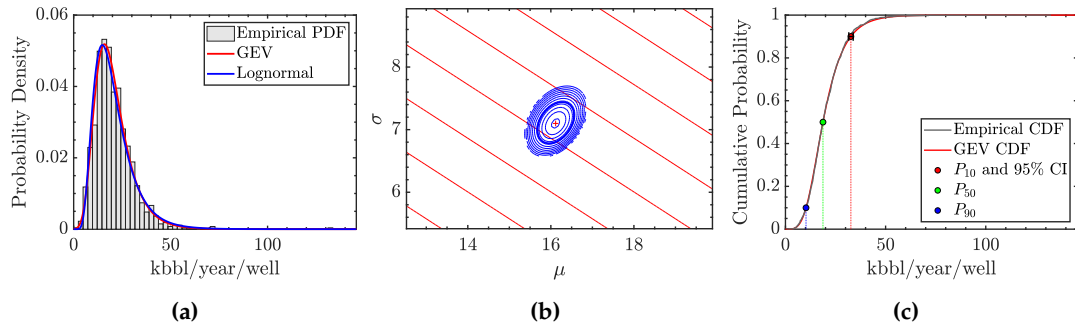


Figure S36. Distribution of oil production rates for 1114 horizontal wells with three years on production, completed between the year 2013 and 2016 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0313$, $\mu = 16.1152$, $\sigma = 7.0995$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

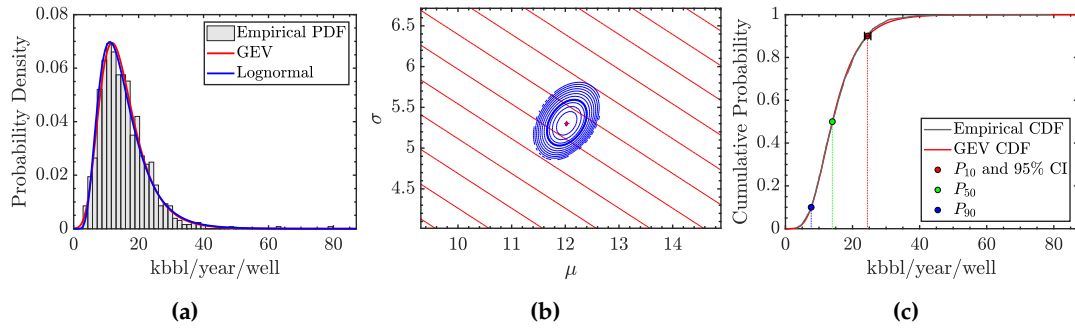


Figure S37. Distribution of oil production rates for 887 horizontal wells with four years on production, completed between the year 2013 and 2016 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0367$, $\mu = 12.0257$, $\sigma = 5.3011$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

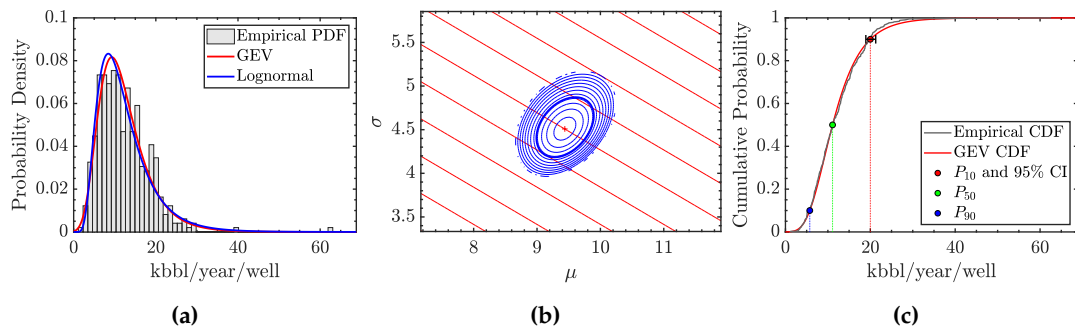


Figure S38. Distribution of oil production rates for 428 horizontal wells with five years on production, completed between the year 2013 and 2016 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.0356$, $\mu = 9.4385$, $\sigma = 4.5086$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

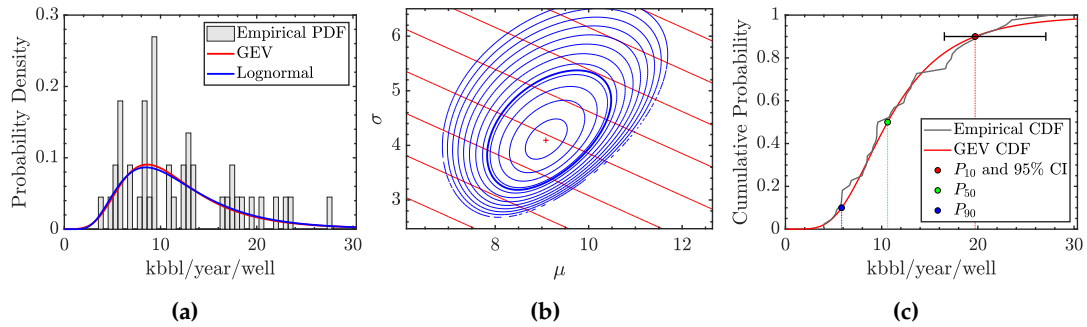


Figure S39. Distribution of oil production rates for 44 horizontal wells with six years on production, completed between the year 2013 and 2016 in the Three Forks noncore area. (a) GEV PDF: $\xi = 0.1246$, $\mu = 9.0841$, $\sigma = 4.0937$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

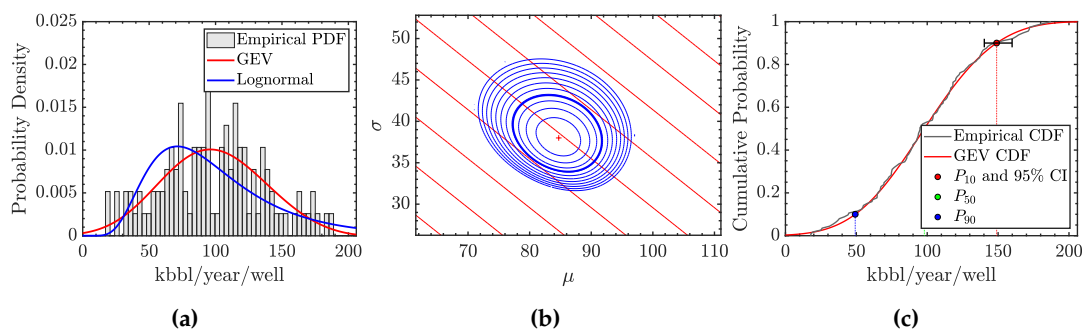


Figure S40. Distribution of oil production rates for 113 horizontal wells with one year on production, completed between the year 2017 and 2019 in the Three Forks noncore area. (a) GEV PDF: $\xi = -0.2675$, $\mu = 84.7197$, $\sigma = 37.9968$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

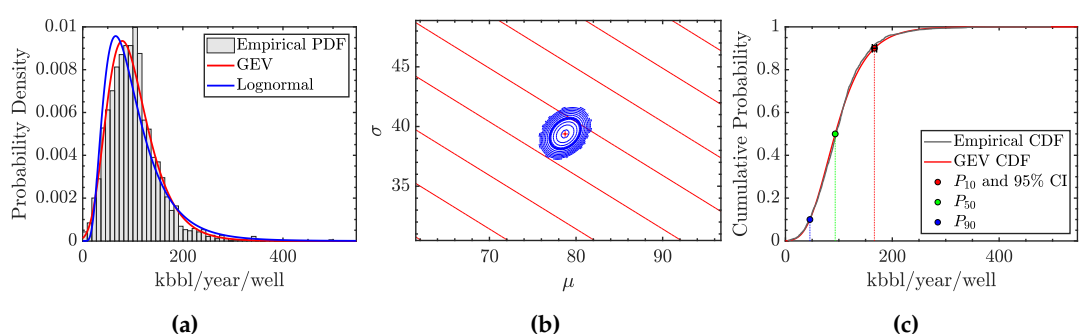


Figure S41. Distribution of oil production rates for 2081 horizontal wells with one year on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = -0.0088$, $\mu = 78.7381$, $\sigma = 39.3782$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

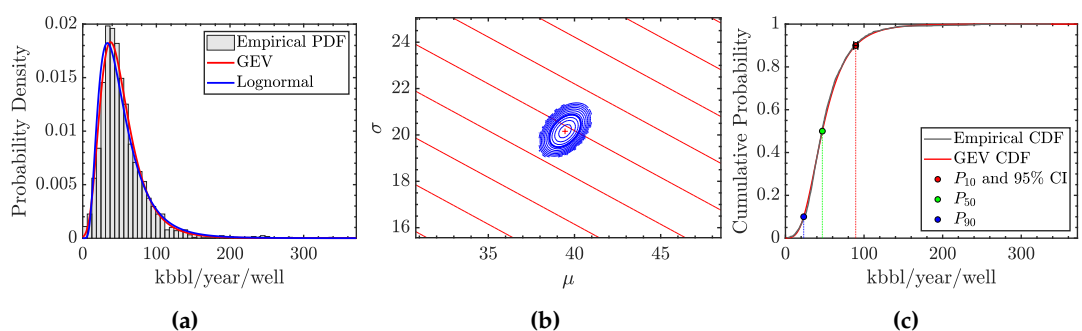


Figure S42. Distribution of oil production rates for 2077 horizontal wells with two years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.0840$, $\mu = 39.4513$, $\sigma = 20.1567$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

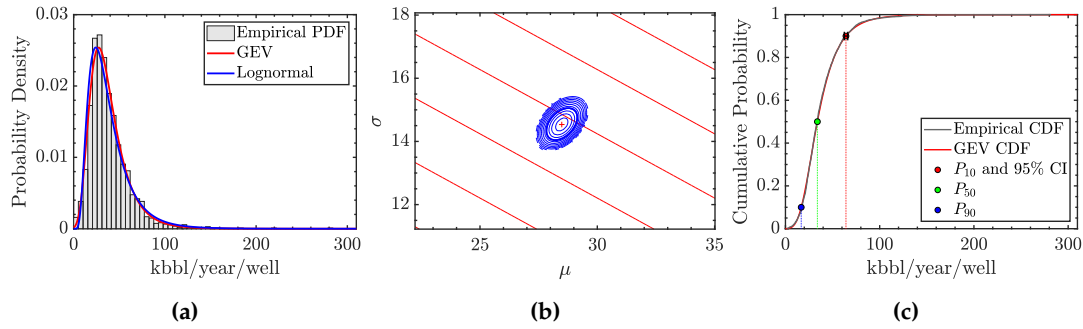


Figure S43. Distribution of oil production rates for 2075 horizontal wells with three years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.0772$, $\mu = 28.4853$, $\sigma = 14.5350$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

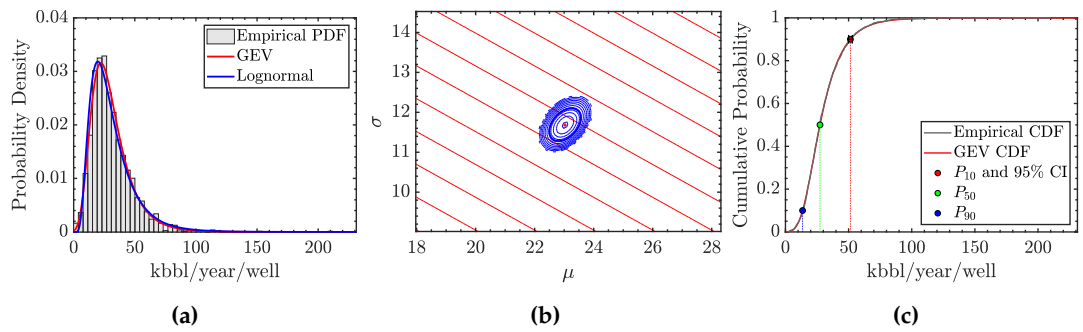


Figure S44. Distribution of oil production rates for 2068 horizontal wells with four years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.0679$, $\mu = 23.0291$, $\sigma = 11.6792$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

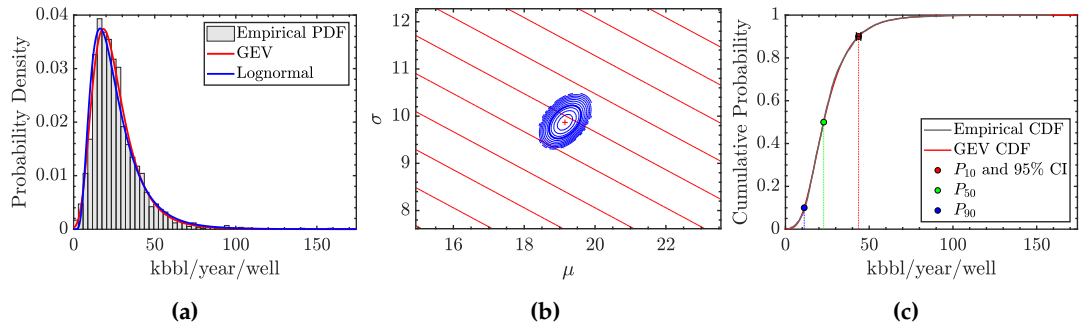


Figure S45. Distribution of oil production rates for 2048 horizontal wells with five years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.0857$, $\mu = 19.1505$, $\sigma = 9.8681$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

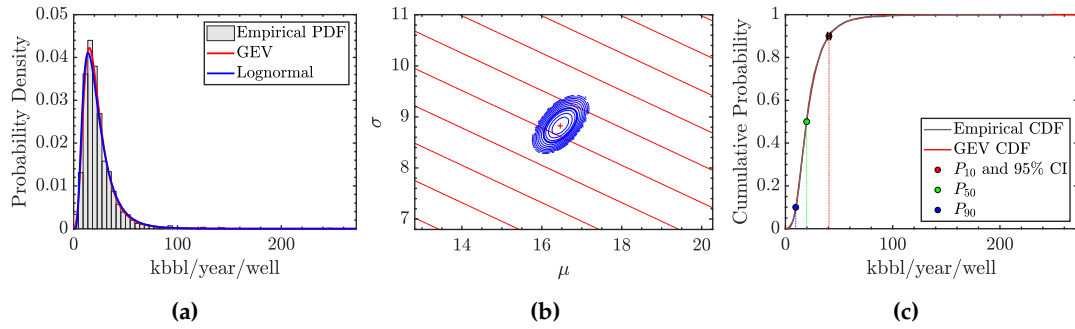


Figure S46. Distribution of oil production rates for 1969 horizontal wells with six years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.1671$, $\mu = 16.4612$, $\sigma = 8.8255$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

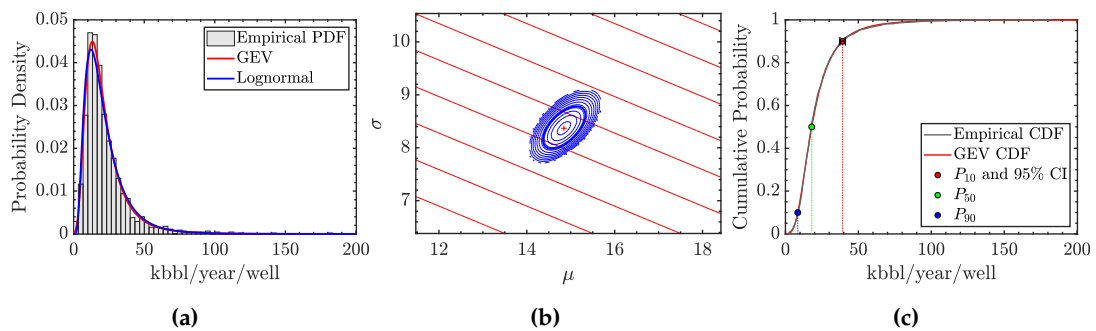


Figure S47. Distribution of oil production rates for 1339 horizontal wells with seven years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.2165$, $\mu = 14.8450$, $\sigma = 8.3690$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

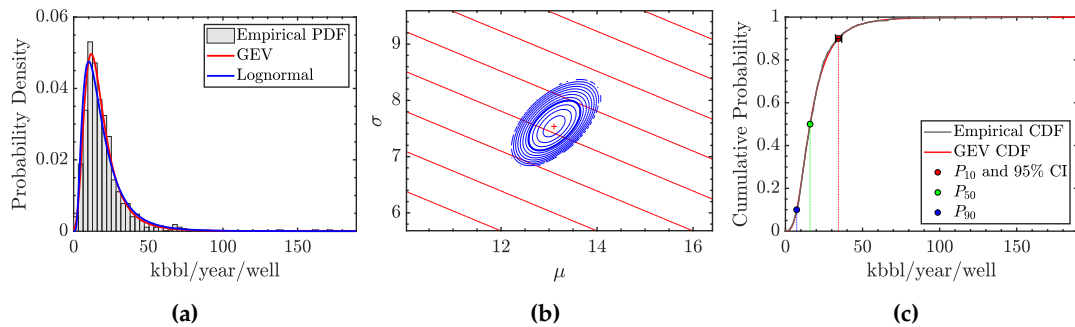


Figure S48. Distribution of oil production rates for 860 horizontal wells with eight years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.1927$, $\mu = 13.1039$, $\sigma = 7.5363$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

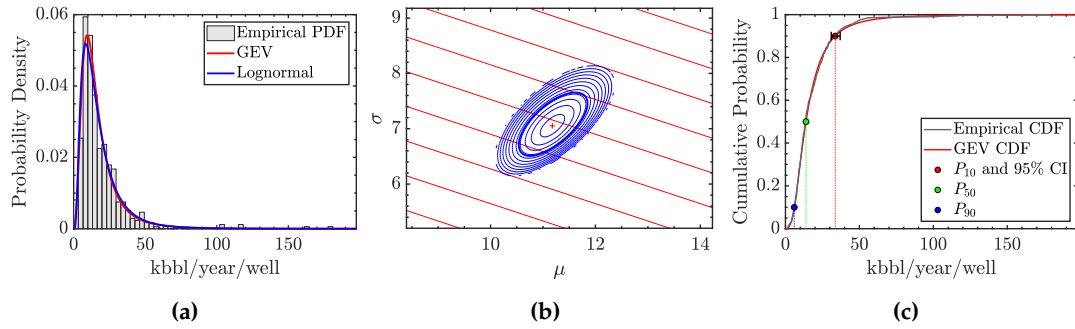


Figure S49. Distribution of oil production rates for 527 horizontal wells with nine years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.2935$, $\mu = 11.1776$, $\sigma = 7.0512$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

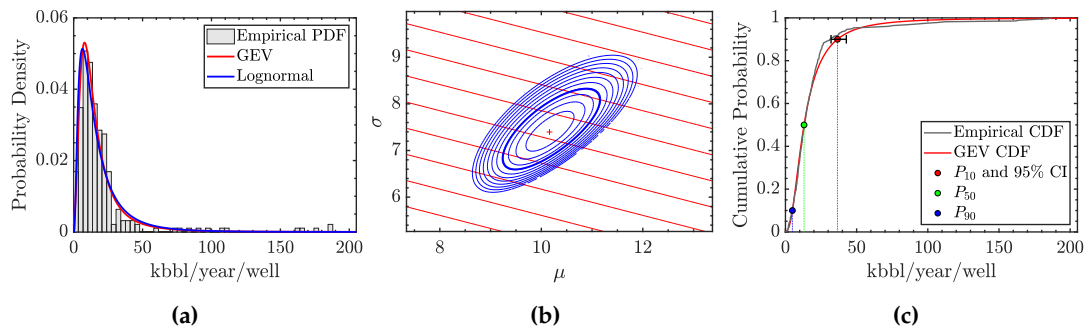


Figure S50. Distribution of oil production rates for 277 horizontal wells with ten years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.3819$, $\mu = 10.1612$, $\sigma = 7.3975$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

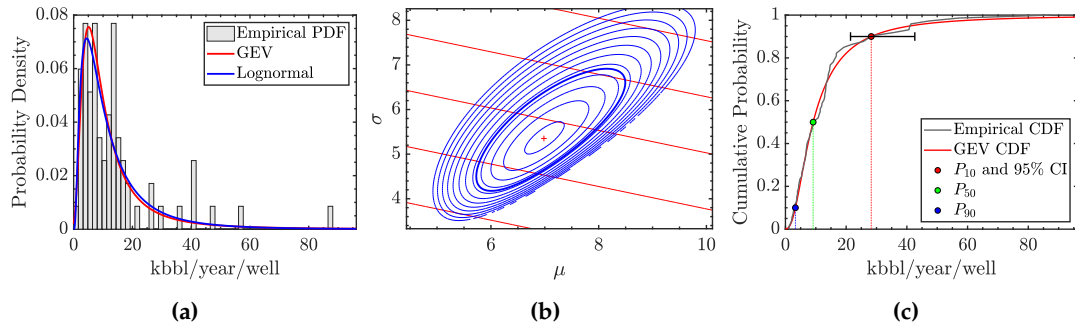


Figure S51. Distribution of oil production rates for 73 horizontal wells with eleven years on production, completed between the year 2000 and 2012 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.4657$, $\mu = 6.9834$, $\sigma = 5.3514$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

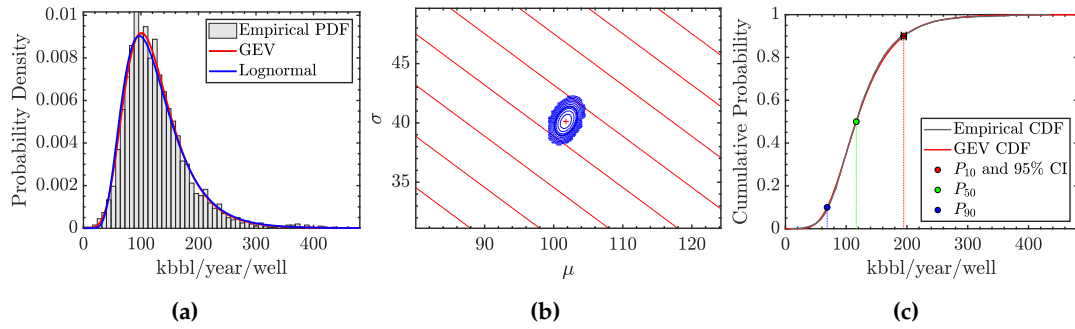


Figure S52. Distribution of oil production rates for 2532 horizontal wells with one year on production, completed between the year 2013 and 2016 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.0250$, $\mu = 101.7754$, $\sigma = 40.1247$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

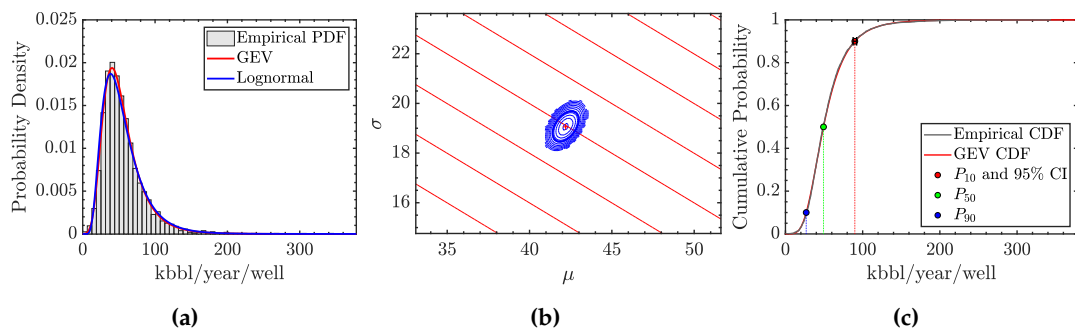


Figure S53. Distribution of oil production rates for 2510 horizontal wells with two years on production, completed between the year 2013 and 2016 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.0923$, $\mu = 42.1917$, $\sigma = 19.0582$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

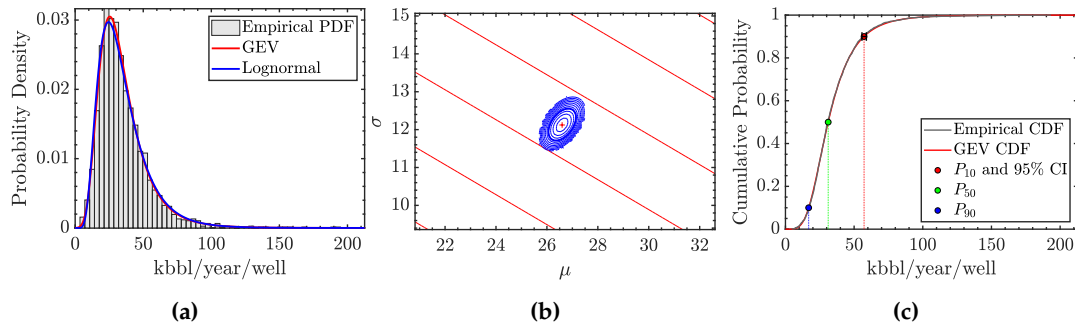


Figure S54. Distribution of oil production rates for 2168 horizontal wells with three years on production, completed between the year 2013 and 2016 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.1016$, $\mu = 26.5972$, $\sigma = 12.1223$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

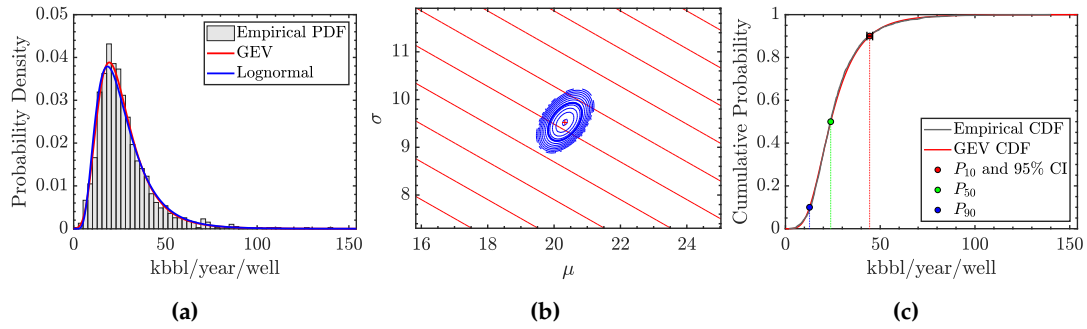


Figure S55. Distribution of oil production rates for 1525 horizontal wells with four years on production, completed between the year 2013 and 2016 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.1022$, $\mu = 20.3236$, $\sigma = 9.5202$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

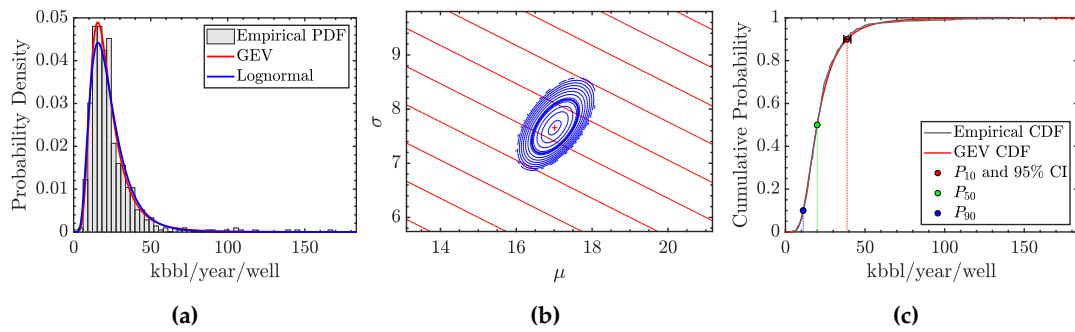


Figure S56. Distribution of oil production rates for 695 horizontal wells with five years on production, completed between the year 2013 and 2016 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.1975$, $\mu = 17.0128$, $\sigma = 7.6560$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

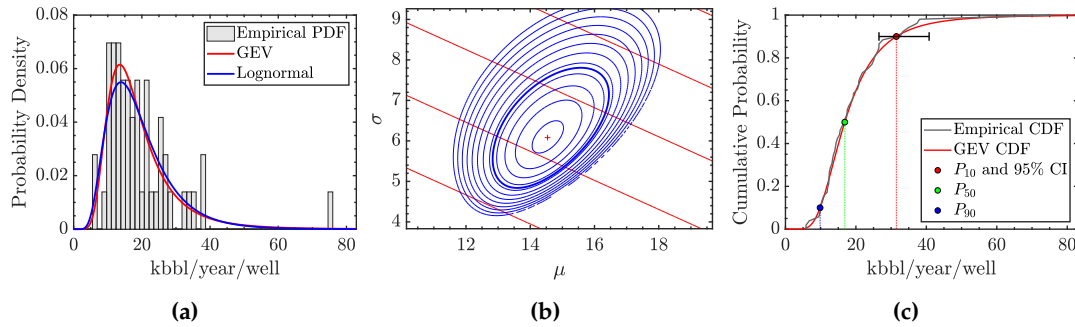


Figure S57. Distribution of oil production rates for 52 horizontal wells with six years on production, completed between the year 2013 and 2016 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.1835$, $\mu = 14.5393$, $\sigma = 6.0805$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

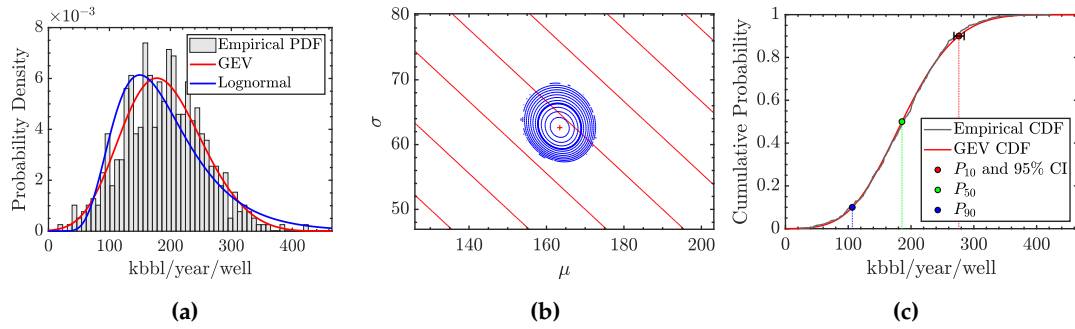


Figure S58. Distribution of oil production rates for 506 horizontal wells with one year on production, completed between the year 2017 and 2019 in the Middle Bakken core area. (a) GEV PDF: $\xi = -0.2064$, $\mu = 163.4423$, $\sigma = 62.6093$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

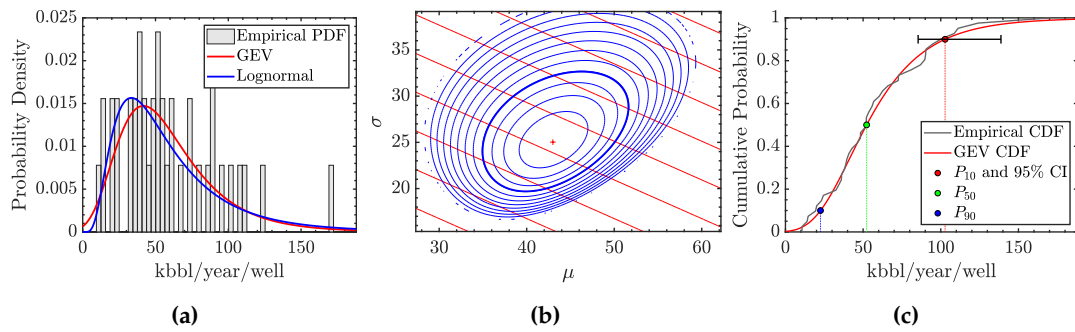


Figure S59. Distribution of oil production rates for 41 horizontal wells with two years on production, completed between the year 2017 and 2019 in the Middle Bakken core area. (a) GEV PDF: $\xi = 0.0523$, $\mu = 42.9929$, $\sigma = 25.0273$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

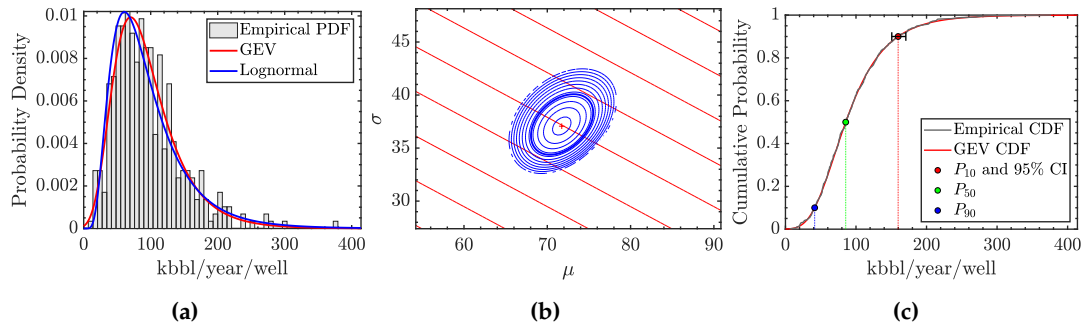


Figure S60. Distribution of oil production rates for 426 horizontal wells with one year on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.0474$, $\mu = 71.7351$, $\sigma = 37.0635$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

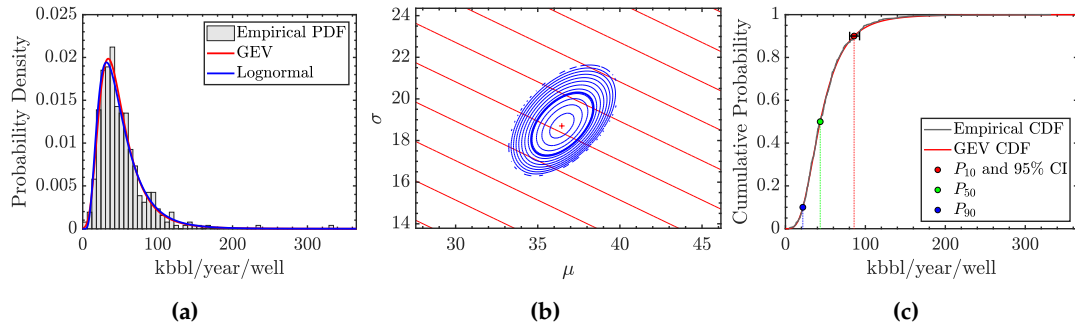


Figure S61. Distribution of oil production rates for 426 horizontal wells with two years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.1389$, $\mu = 36.4635$, $\sigma = 18.7013$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

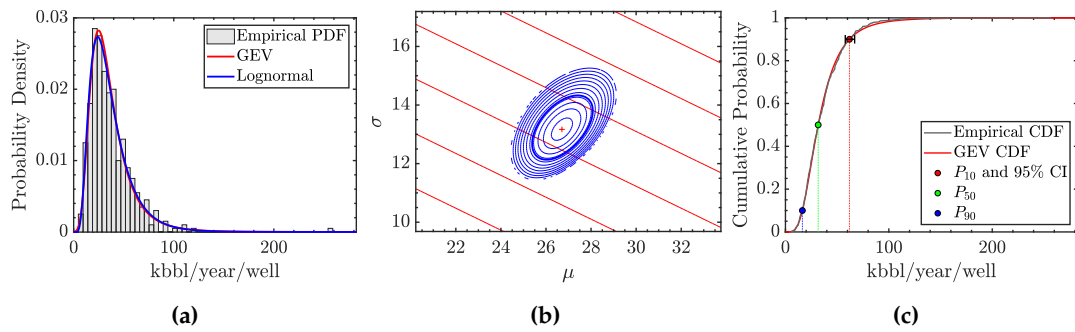


Figure S62. Distribution of oil production rates for 425 horizontal wells with three years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.1486$, $\mu = 26.7071$, $\sigma = 13.1692$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

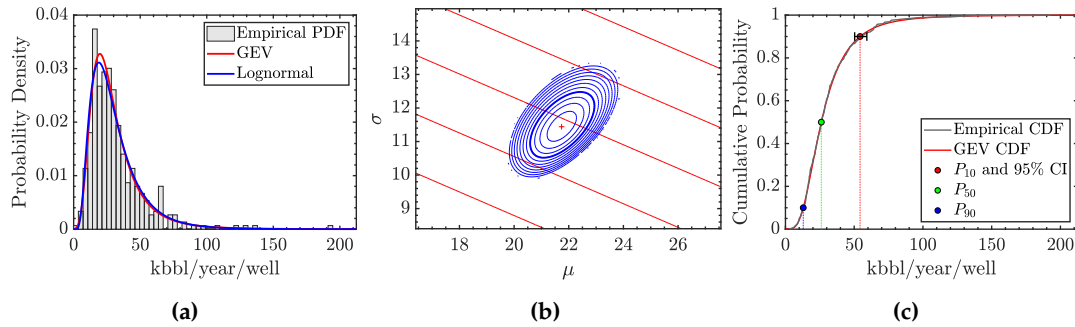


Figure S63. Distribution of oil production rates for 423 horizontal wells with four years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.2003$, $\mu = 21.7381$, $\sigma = 11.4412$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

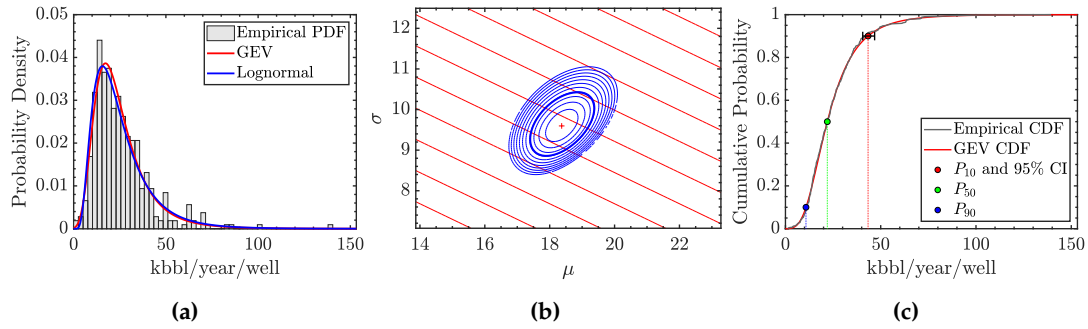


Figure S64. Distribution of oil production rates for 418 horizontal wells with five years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.1268$, $\mu = 18.3693$, $\sigma = 9.5965$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

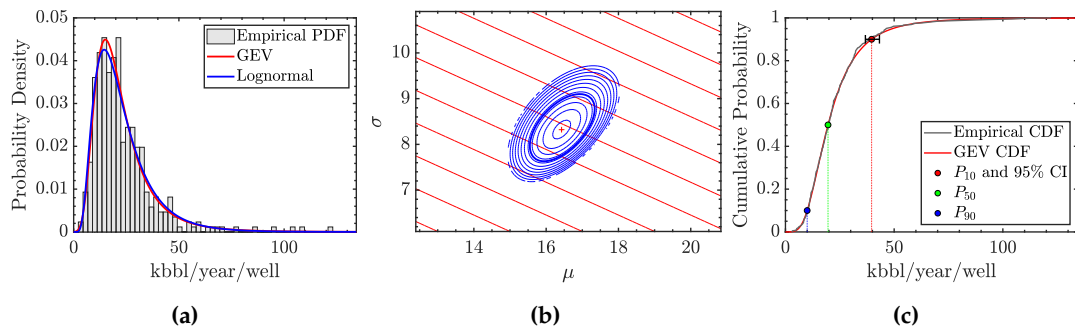


Figure S65. Distribution of oil production rates for 384 horizontal wells with six years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.1843$, $\mu = 16.4268$, $\sigma = 8.3212$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

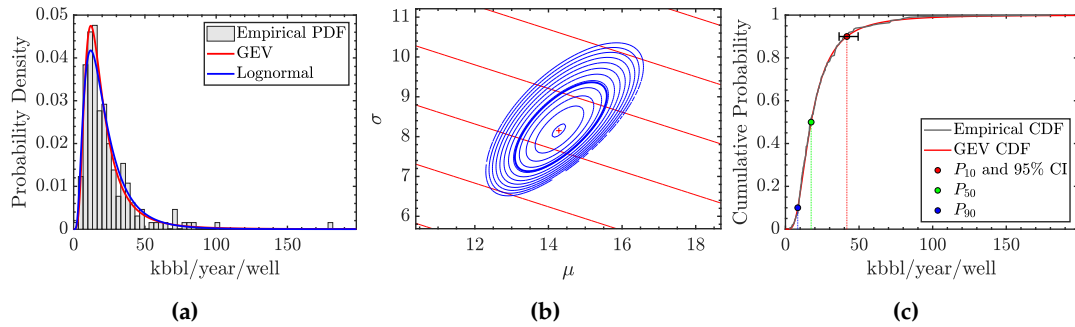


Figure S66. Distribution of oil production rates for 197 horizontal wells with seven years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.3368$, $\mu = 14.2825$, $\sigma = 8.1499$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

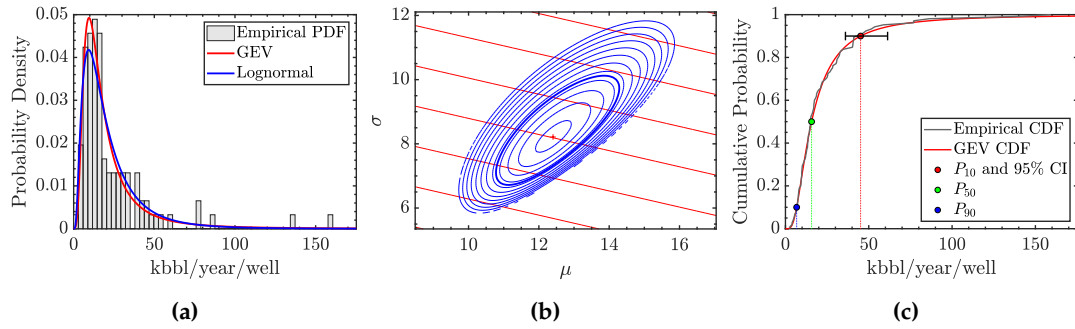


Figure S67. Distribution of oil production rates for 105 horizontal wells with eight years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.4664$, $\mu = 12.4026$, $\sigma = 8.2134$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

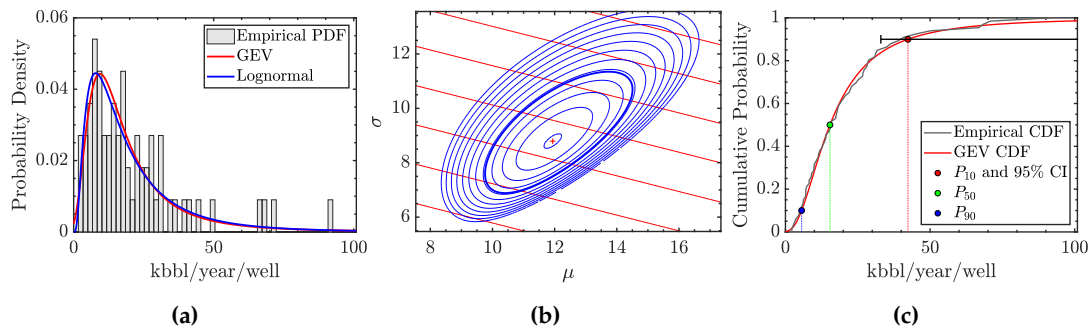


Figure S68. Distribution of oil production rates for 66 horizontal wells with nine years on production, completed between the year 2000 and 2012 in the Three Forks core area. (a) GEV PDF: $\xi = 0.3578$, $\mu = 11.9365$, $\sigma = 8.7922$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

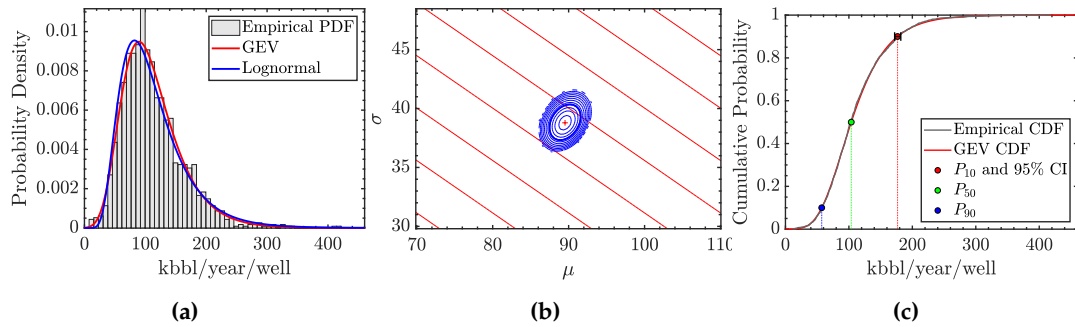


Figure S69. Distribution of oil production rates for 1495 horizontal wells with one year on production, completed between the year 2013 and 2016 in the Three Forks core area. (a) GEV PDF: $\xi = -0.0010$, $\mu = 89.5261$, $\sigma = 38.7894$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

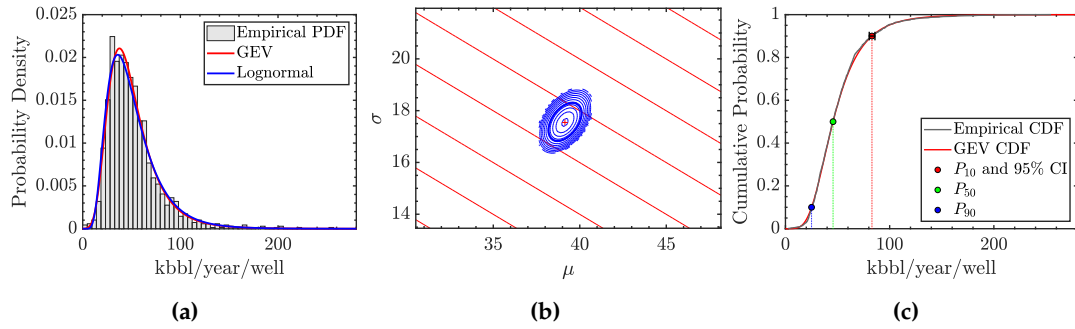


Figure S70. Distribution of oil production rates for 1479 horizontal wells with two years on production, completed between the year 2013 and 2016 in the Three Forks core area. (a) GEV PDF: $\xi = 0.0922$, $\mu = 39.1416$, $\sigma = 17.5436$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

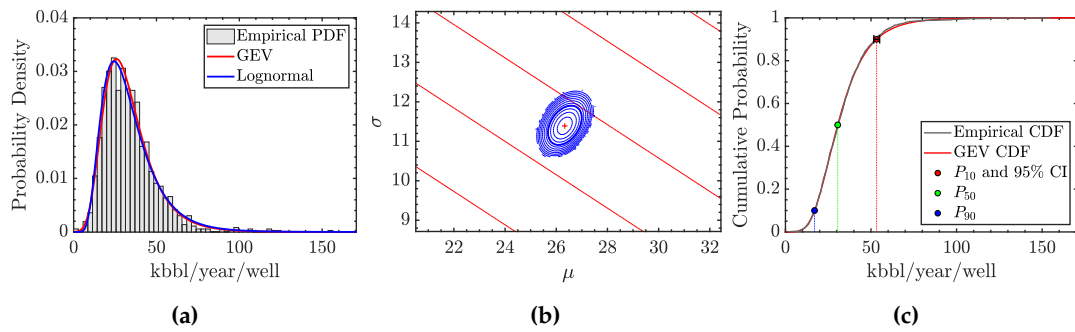


Figure S71. Distribution of oil production rates for 1276 horizontal wells with three years on production, completed between the year 2013 and 2016 in the Three Forks core area. (a) GEV PDF: $\xi = 0.0434$, $\mu = 26.3341$, $\sigma = 11.3894$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

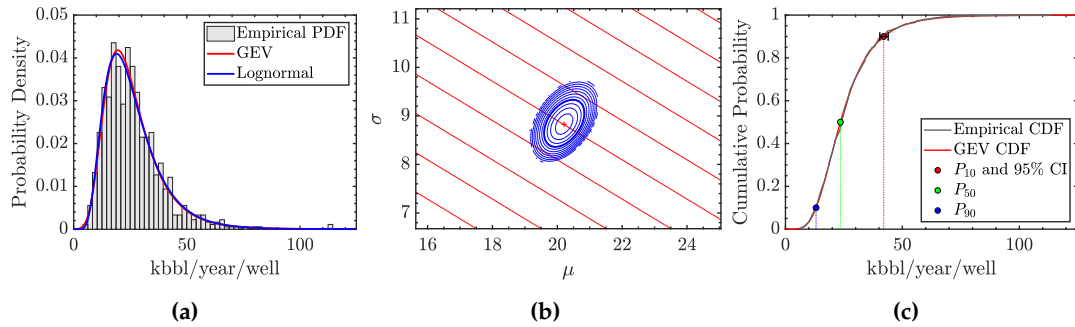


Figure S72. Distribution of oil production rates for 872 horizontal wells with four years on production, completed between the year 2013 and 2016 in the Three Forks core area. (a) GEV PDF: $\xi = 0.0818$, $\mu = 20.2079$, $\sigma = 8.8285$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

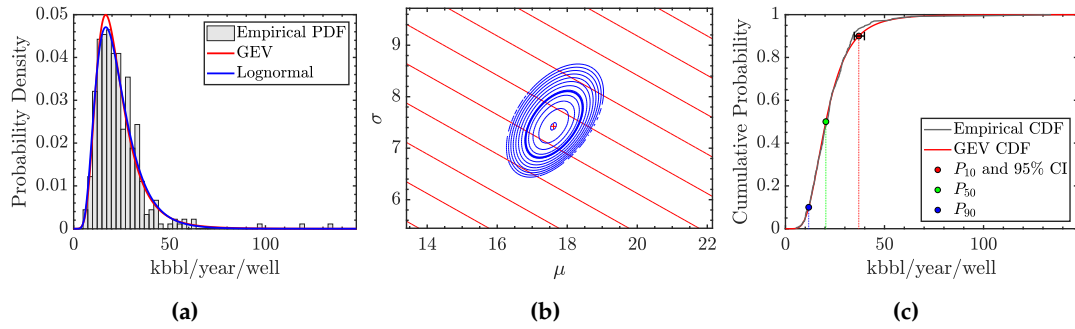


Figure S73. Distribution of oil production rates for 368 horizontal wells with five years on production, completed between the year 2013 and 2016 in the Three Forks core area. (a) GEV PDF: $\xi = 0.1300$, $\mu = 17.6085$, $\sigma = 7.4242$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

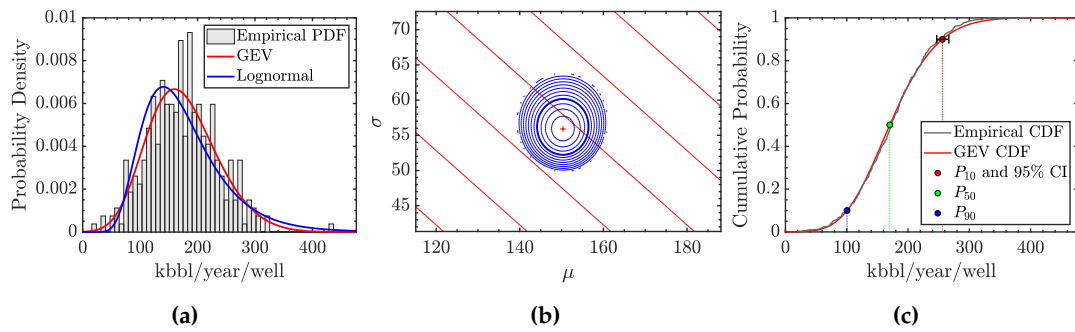


Figure S74. Distribution of oil production rates for 338 horizontal wells with one year on production, completed between the year 2017 and 2019 in the Three Forks core area. (a) GEV PDF: $\xi = -0.1585$, $\mu = 150.3367$, $\sigma = 55.9051$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.

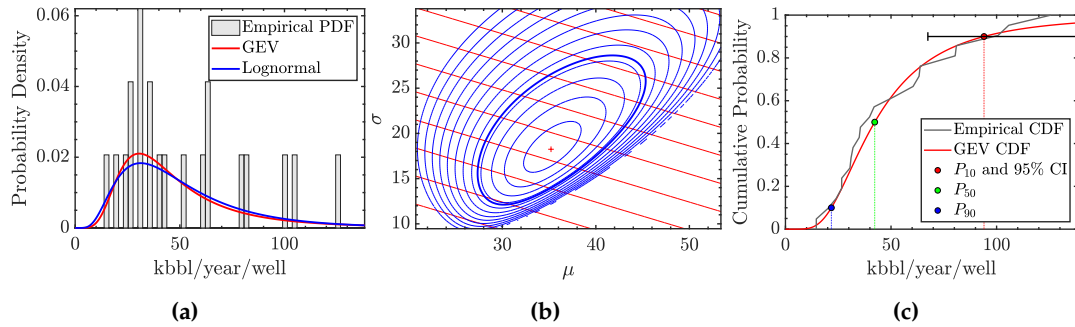


Figure S75. Distribution of oil production rates for 21 horizontal wells with two years on production, completed between the year 2017 and 2019 in the Three Forks core area. (a) GEV PDF: $\xi = 0.3026$, $\mu = 35.2056$, $\sigma = 18.2461$. (b) Maximum Likelihood Estimate, 95% CI for μ and σ . (c) GEV CDF with the 90% confidence limits (CIs) on the residual for the P_{10} well.