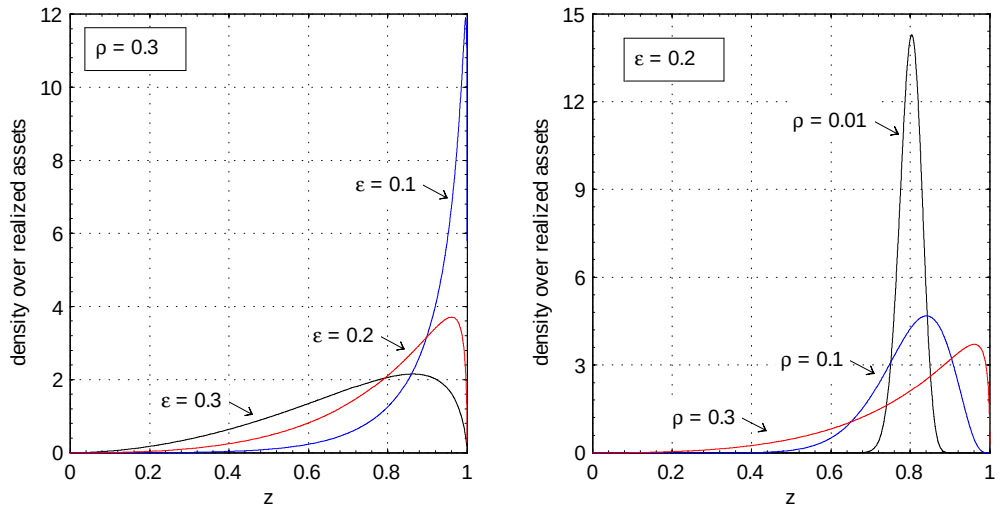

Figure 6. The two charts plot the densities over realised values of a loan portfolio with face value of 1 dollar. The left hand charts plots densities when $\rho = 0.1$ and ε is varied from 0.1 to 0.3. The right hand chart plots densities when $\varepsilon = 0.2$ and ρ varies from 0.01 to 0.3.

where ε is the probability of default of borrower j, defined as $\varepsilon = \Phi(-d_j)$ and Φ is the standard normal c.d.f.

Conditional on Y, defaults are independent. In the limit where the number of borrowers becomes large the realised value of the loan portfolio with face value of 1 dollar can be written as a deterministic function of Y, by the law of large numbers. Defaulted loans have zero recovery value. The realised value of one dollar face value of loans is the random variable $w(Y)$ defined as:

$$\begin{aligned} w(Y) &= \Pr\left(\sqrt{\rho}Y + \sqrt{1-\rho}X_j \geq \Phi^{-1}(\varepsilon)\,|Y\right) \\ &= \Phi\left(\frac{Y\sqrt{\rho}-\Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right) \end{aligned} \tag{8}$$

The c.d.f. of w is then given by

$$\begin{aligned} \Pr(w \leq z) &= \Pr\left(Y \leq w^{-1}(z)\right) \\ &= \Phi\left(w^{-1}(z)\right) \\ &= \Phi\left(\frac{\Phi^{-1}(\varepsilon)+\sqrt{1-\rho}\Phi^{-1}(z)}{\sqrt{\rho}}\right) \end{aligned} \tag{9}$$