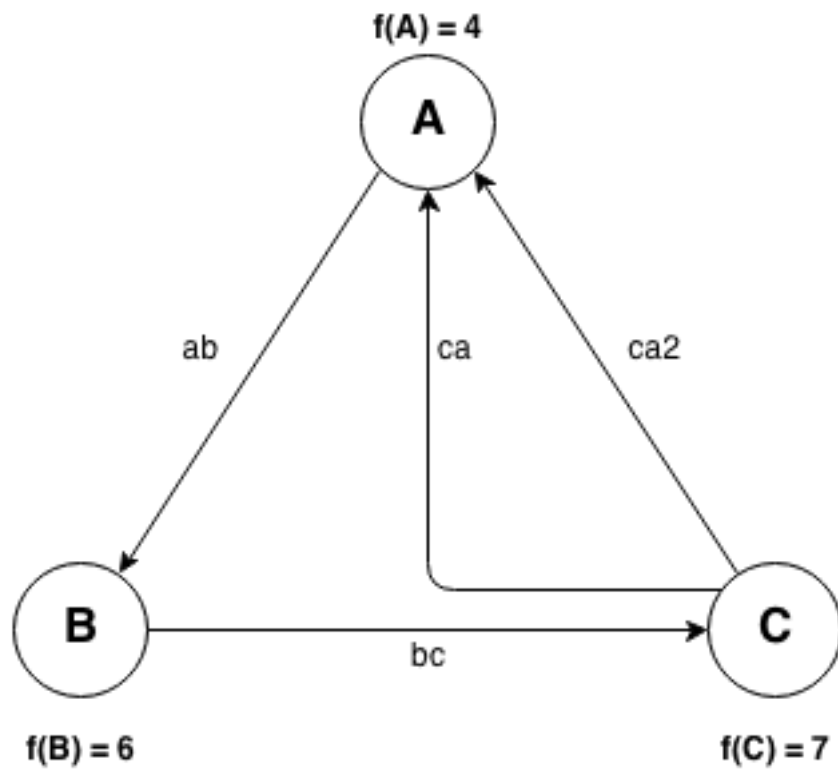


Computing debt cuts leading to global zero-equity - example

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ab $(3, 0.14, \infty, 1)$,
bc $(2, 0.11, 4, 1.4)$,
ca $(2.5, 0.05, 6, 0.5)$,
ca2 $(1, 0.27, \infty, 1.7)$.

Equilibrium equation for node A :

$$\begin{aligned}
& \Xi(ab)e^{0.14(11.7-6)} - \Xi(ca)\left(1 + \frac{0.05}{6}\right)^{\lfloor 6(11.7-4) \rfloor} - \Xi(ca2)e^{0.27(11.7-4)} = \\
& \quad \frac{2.221 \Xi(ab) - 1.464 \Xi(ca) - 7.996 \Xi(ca2)}{\mathfrak{C}_{T_G}(3e^{0.14(6-1)}, 0.14, \infty, 6) -} \\
& \quad \mathfrak{C}_{T_G}(2.5\left(1 + \frac{0.05}{6}\right)^{\lfloor 6(4-0.5) \rfloor}, 0.05, 6, 4) -} \\
& \quad \mathfrak{C}_{T_G}(e^{0.27(4-1.7)}, 0.27, \infty, 4) = \\
& \mathfrak{C}_{T_G}(6.041, 0.14, \infty, 6) - \mathfrak{C}_{T_G}(2.975, 0.05, 6, 4) - \mathfrak{C}_{T_G}(1.861, 0.27, \infty, 4) = \\
& \quad 13.417 - 4.358 - 14.881 = \underline{-5.822}.
\end{aligned}$$

Equilibrium equation for node B :

$$\begin{aligned}
& \Xi(bc)\left(1 + \frac{0.11}{4}\right)^{\lfloor 4(11.7-7) \rfloor} - \Xi(ab)e^{0.14(11.7-6)} = \\
& \quad \frac{1.629 \Xi(bc) - 2.221 \Xi(ab)}{\mathfrak{C}_{T_G}(2\left(1 + \frac{0.11}{4}\right)^{\lfloor 4(7-1.4) \rfloor}, 0.11, 4, 7) - \mathfrak{C}_{T_G}(3e^{0.14(6-1)}, 0.14, \infty, 6) =} \\
& \quad \mathfrak{C}_{T_G}(3.632, 0.11, 4, 7) - \mathfrak{C}_{T_G}(6.041, 0.14, \infty, 6) = \\
& \quad 3.632\left(1 + \frac{0.11}{4}\right)^{\lfloor 4(11.7-7) \rfloor} - 6.041e^{0.14(11.7-6)} = \\
& \quad 5.918 - 13.417 = \\
& \quad \underline{-7.499}
\end{aligned}$$

Equilibrium equation for node C :

$$\begin{aligned}
& \Xi(ca)\left(1 + \frac{0.05}{6}\right)^{\lfloor 6(11.7-4) \rfloor} + \Xi(ca2)e^{0.27(11.7-4)} - \Xi(bc)\left(1 + \frac{0.11}{4}\right)^{\lfloor 4(11.7-7) \rfloor} = \\
& \quad \frac{1.464 \Xi(ca) + 7.996 \Xi(ca2) - 1.629 \Xi(bc)}{\mathfrak{C}_{T_G}(2.5\left(1 + \frac{0.05}{6}\right)^{\lfloor 6(4-0.5) \rfloor}, 0.05, 6, 4) + \mathfrak{C}_{T_G}(e^{0.27(4-1.7)}, 0.27, \infty, 4) -} \\
& \quad \mathfrak{C}_{T_G}(2\left(1 + \frac{0.11}{4}\right)^{\lfloor 4(7-1.4) \rfloor}, 0.11, 4, 7) = \\
& \quad \mathfrak{C}_{T_G}(2.976, 0.05, 6, 4) + \mathfrak{C}_{T_G}(1.861, 0.27, \infty, 4) - \mathfrak{C}_{T_G}(3.633, 0.11, 4, 7) = \\
& \quad 4.359 + 14.881 - 5.920 = \\
& \quad \underline{13.32}
\end{aligned}$$

Next, the matrix:

$$\begin{bmatrix} 2.221 & 0 & -1.464 & -7.996 & -5.822 \\ -2.221 & 1.629 & 0 & 0 & -7.499 \\ 0 & -1.629 & 1.464 & 7.996 & 13.32 \end{bmatrix}.$$

Add the first row to the second one:

$$\begin{bmatrix} 2.221 & 0 & -1.464 & -7.996 & -5.822 \\ 0 & 1.629 & -1.464 & -7.996 & -13.32 \\ 0 & -1.629 & 1.464 & 7.996 & 13.32 \end{bmatrix}.$$

Now add the second row to the third:

$$\begin{bmatrix} 2.221 & 0 & -1.464 & -7.996 & -5.822 \\ 0 & 1.629 & -1.464 & -7.996 & -13.32 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

Divide the 1st row by 2.221:

$$\begin{bmatrix} 1 & 0 & -0.659 & -3.600 & -2.621 \\ 0 & 1.629 & -1.464 & -7.996 & -13.32 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

Divide the 2nd row by 1.629:

$$\begin{bmatrix} 1 & 0 & -0.659 & -3.600 & -2.621 \\ 0 & 1 & -0.899 & -4.908 & -8.177 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

Now, $\Xi(ca), \Xi(ca2)$ are the independent variables, and

$$\begin{aligned} \Xi(ab) &= -2.621 + 0.659\Xi(ca) + 3.600\Xi(ca2) \\ \Xi(bc) &= -8.177 + 0.899\Xi(ca) + 4.908\Xi(ca2). \end{aligned}$$

Also,

$$\begin{aligned} 0 \leq \Xi(ca) &\leq 2.5 \left(1 + \frac{0.05}{6}\right)^{\lceil 6(4-0.5) \rceil} &= 2.976 \\ 0 \leq \Xi(ca2) &\leq e^{0.27(4-1.7)} &= 1.861 \\ 0 \leq \Xi(ab) &\leq 3e^{0.14(6-1)} &= 6.041 \\ 0 \leq \Xi(bc) &\leq 2 \left(1 + \frac{0.11}{4}\right)^{\lceil 4(7-1.4) \rceil} &= 3.535 \end{aligned}$$

The last two inequalities are equivalent to

$$\begin{aligned} 0 &\leq -2.621 + 0.659\Xi(ca) + 3.600\Xi(ca2) &\leq 6.041 \\ 0 &\leq -8.177 + 0.899\Xi(ca) + 4.908\Xi(ca2) &\leq 3.535 \end{aligned}$$

Now, we obtain:

$$\begin{aligned} 2.621 &\leq 0.659\Xi(ca) + 3.600\Xi(ca2) \leq 8.662 \\ 8.177 &\leq 0.899\Xi(ca) + 4.908\Xi(ca2) \leq 11.712 \end{aligned}$$

The objective function is

$$\Xi(ab) + \Xi(bc) + \Xi(ca) + \Xi(ca2) = 2.558 \Xi(ca) + 9.508 \Xi(ca2).$$

The optimal solution is $\Xi(ca) = 0$, $\Xi(ca2) = 1.665$ so the cuts are:

$$\Xi(ab) = 3.373$$

$$\Xi(bc) = 0$$

$$\Xi(ca) = 0$$

$$\Xi(ca2) = 1.665$$

Now, the contracts become:

$$\begin{aligned} ab : & \left(3e^{0.14(6-1)} - 3.373 \right) e^{0.14(11.7-6)} = 2.668e^{0.14(11.7-6)}, \\ ca2 : & \left(e^{0.27(4-1.7)} - 1.665 \right) e^{0.27(11.7-4)} = 0.196e^{0.27(11.7-4)}, \\ bc : & \left(2 \left(1 + \frac{0.11}{4} \right)^{\lfloor 4(7-1.4) \rfloor} \right) \left(1 + \frac{0.11}{4} \right)^{\lfloor 6(11.7-7) \rfloor} = 3.633 \left(1 + \frac{0.11}{4} \right)^{\lfloor 4(11.7-7) \rfloor}, \\ ca : & \left(2.5 \left(1 + \frac{0.05}{6} \right)^{\lfloor 6(4-0.5) \rfloor} \right) \left(1 + \frac{0.05}{6} \right)^{\lfloor 6(11.7-4) \rfloor} = 2.976 \left(1 + \frac{0.05}{6} \right)^{\lfloor 6(11.7-4) \rfloor}. \end{aligned}$$