Calculation Example: IRR, Scale Effects, and Mutually Exclusive Projects

Question: A developer owns a block of land next to a highway. He can:

- Build a restaurant at a cost of \$1m now which will earn \$0.2m paid at the end of every year forever; Or, he can
- Build an apartment block at a cost of \$10m now which will earn \$1.5m paid at the end of every year forever.

He cannot build both, the local government won't allow it.

Both projects have the same level of risk and therefore the same cost of capital which is 10% pa. Which project should the developer pick?

Answer using IRR:

To calculate the IRR of the restaurant:

$$V_0 = C_0 + \frac{C_{1,2,3,\dots}}{r}$$
$$0 = -1m + \frac{0.2m}{r_{IRR}}$$
$$r_{IRR} = \frac{0.2m}{1m} = 0.2 = 20\%$$

To calculate the IRR of the apartments:

$$V_0 = C_0 + \frac{C_{1,2,3,\dots}}{r}$$
$$0 = -10m + \frac{1.5m}{r_{IRR}}$$
$$r_{IRR} = \frac{1.5m}{10m} = 0.15 = 15\%$$

Since the restaurant has the higher IRR, it looks like a better idea than the apartments. But this is a bad conclusion! Let's find the NPV's to see why.

Answer using NPV:

To calculate the NPV of the restaurant:

$$V_0 = C_0 + \frac{C_{1,2,3,\dots}}{r}$$
$$= -1m + \frac{0.2m}{0.1} = 1m$$

To calculate the NPV of the apartments:

$$V_0 = C_0 + \frac{C_{1,2,3,\dots}}{r}$$
$$= -10m + \frac{1.5m}{0.1} = 5m$$

Land Development Project Details

	Restaurant	Apartment block
Initial investment (\$m)	1	10
Perpetual annual cash flow (\$m)	0.2	1.5
NPV (\$m)	1	5
IRR (pa)	20%	15%

The apartments have a higher NPV than the restaurant, so the apartments will create more wealth for the developer, even though they have a lower internal rate of return (IRR).

The problem with using the IRR technique here is that the projects are mutually exclusive. The apartments are much bigger than the restaurant, so the IRR method leads to an incorrect conclusion about which project is better.