# DCF: Firm income tax
# Modigliani-Miller adjustment formula

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This equation was the first published adjustment formula (1963). Two assumptions are necessary: constant amount of debt (autonomous financing!) and infinite lifetime.

Claims a nice formula:

$$WACC = (1-\tau l)k^{E,\mathrm{u}} \qquad \left(\text{remember MoMi: } V_0^{\mathrm{l}} = \frac{\mathrm{E}\left[\widetilde{CF}^{\mathrm{u}}\right]}{(1-\tau \mathrm{l}_0)k^{E,\mathrm{u}}}\right).$$

But this does not seem to relate to the Miles-Ezzell adjustment?!

**Theorem Contradiction MoMi**

*If*

- *the WACC type 2 (WACC) and*
- *the unlevered firm's cost of equity* ($k^{E,u}$) *are deterministic,*

*then the firm is financed based on market values.*

This is a **contradiction to autonomous financing**, hence the Modigliani-Miller formula is not applicable!

# Contradiction to Modigliani-Miller



In order to apply MoMi two costs of capital must be deterministic: $WACC$ and $k^{E,\mathrm{u}}$, otherwise the (nice) formula does not make sense.

But then the firm is financed based on market values (see above theorem).

This contradicts the assumption of MoMi (constant debt)!

Hence, there is no connection to Miles-Ezzell, since the nice formula is not applicable under any circumstances!

# Modigliani-Miller again

Is the original paper Modigliani-Miller (1963) flawed?

No, since for both (as for Miles-Ezzell as well) cost of capital was not conditional expected return (but discount rates. . . )!

Although you can use MoMi theorem, you cannot use MoMi adjustment formula.

Put differently: They used “discount rate” and “expected return” as different economic concepts.

Use MoMi theorem and the fact that cash flow are martingale-like

$$\left(1 - \tau \widetilde{\mathrm{l}}_t\right) \widetilde{V}_t^{\mathrm{l}} = \widetilde{V}_t^{\mathrm{u}}.$$

$$\left(1 - \tau \widetilde{\mathrm{l}}_t\right) \sum_{s=t+1}^{T} \frac{(1+g)^{s-t} \widetilde{CF}_t^{\mathrm{u}}}{(1+WACC)^{s-t}} = \sum_{s=t+1}^{T} \frac{(1+g)^{s-t} \widetilde{CF}_t^{\mathrm{u}}}{(1+k^{E,\mathrm{u}})^{s-t}}.$$

$\widetilde{CF}_t^{\mathrm{u}}$ cancels

$$\left(1 - \tau \widetilde{\mathrm{l}}_t\right) \widetilde{V}_t^{\mathrm{l}} = \widetilde{V}_t^{\mathrm{u}}.$$

$$\left(1 - \tau \widetilde{\mathrm{l}}_t\right) \sum_{s=t+1}^{T} \frac{(1+g)^{s-t} \widetilde{CF}_t^{\mathrm{u}}}{(1+WACC)^{s-t}} = \sum_{s=t+1}^{T} \frac{(1+g)^{s-t} \widetilde{CF}_t^{\mathrm{u}}}{(1+k^{E,\mathrm{u}})^{s-t}}.$$

everything except $\widetilde{\mathrm{l}}_t$ is deterministic, q.e.d.

$$\left(1 - \tau\widetilde{\mathrm{l}}_t\right) \widetilde{V}_t^{\mathrm{l}} = \widetilde{V}_t^{\mathrm{u}}.$$

$$\left(1 - \tau\widetilde{\mathrm{l}}_t\right) \sum_{s=t+1}^{T} \frac{(1+g)^{s-t}}{(1+WACC)^{s-t}} = \sum_{s=t+1}^{T} \frac{(1+g)^{s-t}}{(1+k^{E,\mathrm{u}})^{s-t}}.$$

# Summary



The adjustment by Modigliani-Miller is not applicable, although the Modigliani-Miller Theorem can be used.