

Chapter 15.3
Misrepresentation of trading outcomes

Ma 00

### Outline

- Problem and model assumptions
- Incentives for traders
- Incentives for managers
- Equilibrium outcome
- Summary

- Problem and model assumptions
- Incentives for traders
- Incentives for managers
- Equilibrium outcome
- Summary

000

# Hiding losses and reporting profits

Problem and assumptions

000

► Traders may hide losses from trading

Problem and assumptions

000

► Traders may hide losses from trading or exaggerate profits

- ► Traders may hide losses from trading or exaggerate profits
- Apart from fraud, this might be achieved by underreporting risks

- ► Traders may hide losses from trading or exaggerate profits
- Apart from fraud, this might be achieved by underreporting risks, delaying the realisation of losses

- ► Traders may hide losses from trading or exaggerate profits
- Apart from fraud, this might be achieved by underreporting risks, delaying the realisation of losses, or recognising unrealised profits

- ► Traders may hide losses from trading or exaggerate profits
- ► Apart from fraud, this might be achieved by underreporting risks, delaying the realisation of losses, or recognising unrealised profits
- ► The aim for traders is to increase their remuneration

- Traders may hide losses from trading or exaggerate profits
- Apart from fraud, this might be achieved by underreporting risks, delaying the realisation of losses, or recognising unrealised profits
- ► The aim for traders is to increase their remuneration

Problem and assumptions

000

▶ The position of a trader is worth  $V_H$  with probability  $\pi$ , or  $V_L < V_H$  otherwise

Problem and assumptions

000

- ▶ The position of a trader is worth  $V_H$  with probability  $\pi$ , or  $V_L < V_H$  otherwise
- ightharpoonup Traders are remunerated with a fraction  $w_T$  of this value

- ▶ The position of a trader is worth  $V_H$  with probability  $\pi$ , or  $V_L < V_H$  otherwise
- ightharpoonup Traders are remunerated with a fraction  $w_T$  of this value
- A trader can report any value, regardless of the actual outcome

- ▶ The position of a trader is worth  $V_H$  with probability  $\pi$ , or  $V_L < V_H$  otherwise
- ightharpoonup Traders are remunerated with a fraction  $w_T$  of this value
- ► A trader can report any value, regardless of the actual outcome, misrepresentations happens with probability p

- ▶ The position of a trader is worth  $V_H$  with probability  $\pi$ , or  $V_L < V_H$  otherwise
- ightharpoonup Traders are remunerated with a fraction  $w_T$  of this value
- A trader can report any value, regardless of the actual outcome. misrepresentations happens with probability p
- Monitoring of traders by managers or audits will reveal any misrepresentations

- ▶ The position of a trader is worth  $V_H$  with probability  $\pi$ , or  $V_L < V_H$  otherwise
- ightharpoonup Traders are remunerated with a fraction  $w_T$  of this value
- A trader can report any value, regardless of the actual outcome. misrepresentations happens with probability p
- Monitoring of traders by managers or audits will reveal any misrepresentations

0000

- Incentives for traders

ightharpoonup Assume the low value  $V_L$  is realised

- ightharpoonup Assume the low value  $V_L$  is realised
- lacktriangle If reporting the value truthfully, traders receive  $\Pi_T=w_TV_L$

- ightharpoonup Assume the low value  $V_L$  is realised
- lacktriangle If reporting the value truthfully, traders receive  $\Pi_T=w_T V_L$
- lacktriangle If they do not report truthfully, they might receive  $w_T V_H$

- ightharpoonup Assume the low value  $V_L$  is realised
- lacktriangle If reporting the value truthfully, traders receive  $\Pi_T=w_T V_L$
- lacktriangle If they do not report truthfully, they might receive  $w_T V_H$

Traders

lacktriangle Their misrepresentation will be caught if the manager monitors (probability  $\lambda_M$ )

- ightharpoonup Assume the low value  $V_L$  is realised
- lacktriangle If reporting the value truthfully, traders receive  $\Pi_T=w_TV_L$
- lacktriangle If they do not report truthfully, they might receive  $w_T V_H$

Traders

Their misrepresentation will be caught if the manager monitors (probability  $\lambda_M$ ) or an audit takes place (probability  $\lambda_A$ )

- ightharpoonup Assume the low value  $V_L$  is realised
- lacktriangle If reporting the value truthfully, traders receive  $\Pi_T=w_T V_L$
- lacktriangle If they do not report truthfully, they might receive  $w_T V_H$

- Their misrepresentation will be caught if the manager monitors (probability  $\lambda_M$ ) or an audit takes place (probability  $\lambda_A$ )
- $\blacktriangleright$  If misrepresentation is detected, they are fined  $F_T$  and receive no remuneration



- ightharpoonup Assume the low value  $V_L$  is realised
- ▶ If reporting the value truthfully, traders receive  $\Pi_T = w_T V_L$
- lacktriangle If they do not report truthfully, they might receive  $w_T V_H$

- Their misrepresentation will be caught if the manager monitors (probability  $\lambda_M$ ) or an audit takes place (probability  $\lambda_A$ )
- $\blacktriangleright$  If misrepresentation is detected, they are fined  $F_T$  and receive no remuneration
- ▶ This fine can represent the cost of dismissal or reduction in future bonuses

- ightharpoonup Assume the low value  $V_L$  is realised
- ▶ If reporting the value truthfully, traders receive  $\Pi_T = w_T V_L$
- lacktriangle If they do not report truthfully, they might receive  $w_T V_H$

- Their misrepresentation will be caught if the manager monitors (probability  $\lambda_M$ ) or an audit takes place (probability  $\lambda_A$ )
- $\blacktriangleright$  If misrepresentation is detected, they are fined  $F_T$  and receive no remuneration
- ▶ This fine can represent the cost of dismissal or reduction in future bonuses

0000

 $\blacktriangleright$  If the trader is monitored by his manager, he is fined  $F_T$ 

► Trader profits:  $\hat{\Pi}_T = -\lambda_M F_T$ 

- $\blacktriangleright$  If the trader is monitored by his manager, he is fined  $F_T$
- If the trader is not monitored, he will be fined  $F_T$  if an audit takes place
- ► Trader profits:  $\hat{\Pi}_T = -\lambda_M F_T + (1 \lambda_M) (-\lambda_A F_T)$

0000

- $\blacktriangleright$  If the trader is monitored by his manager, he is fined  $F_T$
- lacktriangle If the trader is not monitored, he will be fined  $F_T$  if an audit takes place
- lacktriangle If no auditing takes place, the trader is not detected and receives  $w_T V_H$
- ► Trader profits:  $\hat{\Pi}_T = -\lambda_M F_T + (1 \lambda_M) \left( -\lambda_A F_T + (1 \lambda_A) w_T V_H \right)$

 $\blacktriangleright$  If the trader is monitored by his manager, he is fined  $F_T$ 

0000

- If the trader is not monitored, he will be fined  $F_T$  if an audit takes place
- If no auditing takes place, the trader is not detected and receives  $w_T V_H$
- ► Trader profits:  $\hat{\Pi}_T = -\lambda_M F_T + (1 \lambda_M) \left( -\lambda_A F_T + (1 \lambda_A) w_T V_H \right)$

# Truthful reporting

# Truthful reporting

If  $\Pi_T \geq \hat{\Pi}_T$ , the outcome is reported truthfully

### Truthful reporting

If  $\Pi_T \geq \hat{\Pi}_T$ , the outcome is reported truthfully

Traders 0000

▶ This requires  $\lambda_M \geq \lambda_M^* = \frac{w_T((1-\lambda_A)V_H - V_L) - \lambda_A F_T}{(1-\lambda_A)(F_T + w_T V_H)}$ 

### Truthful reporting

▶ If  $\Pi_T \geq \hat{\Pi}_T$ , the outcome is reported truthfully

Traders

- ▶ This requires  $\lambda_M \geq \lambda_M^* = \frac{w_T((1-\lambda_A)V_H V_L) \lambda_A F_T}{(1-\lambda_A)(F_T + w_T V_H)}$
- ▶ If managers are sufficiently likely to monitor, traders will report truthfully

### Truthful reporting

If  $\Pi_T \geq \hat{\Pi}_T$ , the outcome is reported truthfully

Traders 0000

- ▶ This requires  $\lambda_M \geq \lambda_M^* = \frac{w_T((1-\lambda_A)V_H V_L) \lambda_A F_T}{(1-\lambda_A)(F_T + w_T V_H)}$
- If managers are sufficiently likely to monitor, traders will report truthfully

•000

- Incentives for managers

 $\blacktriangleright$  Managers receive a fraction  $w_M$  of what a trader declares

- $\blacktriangleright$  Managers receive a fraction  $w_M$  of what a trader declares
- ► Monitoring traders costs C

Managers

- lacktriangle Managers receive a fraction  $w_M$  of what a trader declares
- ► Monitoring traders costs *C*
- lacktriangle Traders misrepresent a low value  $V_L$  as  $V_H$  with probability p

റൈറ്

- Managers receive a fraction  $w_M$  of what a trader declares
- Monitoring traders costs C
- $\triangleright$  Traders misrepresent a low value  $V_L$  as  $V_H$  with probability p
- If the high outcome is realised, the manager gets  $w_M V_H C$

- $\blacktriangleright$  Managers receive a fraction  $w_M$  of what a trader declares
- ► Monitoring traders costs *C*
- lacktriangle Traders misrepresent a low value  $V_L$  as  $V_H$  with probability p

- lacksquare If the high outcome is realised, the manager gets  $w_M V_H C$
- ▶ If the low outcome is realised, he will receive  $w_M V_L C$

- $\blacktriangleright$  Managers receive a fraction  $w_M$  of what a trader declares
- ► Monitoring traders costs *C*
- lacktriangle Traders misrepresent a low value  $V_L$  as  $V_H$  with probability p

- lacktriangle If the high outcome is realised, the manager gets  $w_M V_H C$
- ▶ If the low outcome is realised, he will receive  $w_M V_L C$
- $\Pi_M = \pi (w_M V_H C) + (1 \pi) (w_M V_L C)$

Managers

If traders misrepresent the outcome and the manager does not monitor, he will be fined  $F_M$ 

If traders misrepresent the outcome and the manager does not monitor, he will be fined  $F_M$  if an audit detects this

▶ If traders misrepresent the outcome and the manager does not monitor, he will be fined  $F_M$  if an audit detects this

Managers ററററ്

▶ If the high outcome is realised, he receives  $w_M V_H$ 

 $\hat{\Pi}_M = \pi w_M V_H$ 



If traders misrepresent the outcome and the manager does not monitor, he will be fined  $F_M$  if an audit detects this

- ▶ If the high outcome is realised, he receives  $w_M V_H$
- ▶ if the low outcome is realised, and outcome is misrepresented, then is fined  $F_M$  if an audit takes place, without an audit receives  $w_M V_H$
- $\hat{\Pi}_M = \pi w_M V_H + (1 \pi) \left( p \left( -\lambda_A F_M + (1 \lambda_A) w_M V_H \right) \right)$



If traders misrepresent the outcome and the manager does not monitor, he will be fined  $F_M$  if an audit detects this

- ▶ If the high outcome is realised, he receives  $w_M V_H$
- ▶ if the low outcome is realised, and outcome is misrepresented, then is fined  $F_M$  if an audit takes place, without an audit receives  $w_M V_H$
- lacktriangle If the outcome is not misrepresented, he receives  $w_M V_L$
- $\hat{\Pi}_{M} = \pi w_{M} V_{H} + (1 \pi) \left( p \left( -\lambda_{A} F_{M} + (1 \lambda_{A}) w_{M} V_{H} \right) \right. + (1 p) w_{M} V_{L} \right)$



If traders misrepresent the outcome and the manager does not monitor, he will be fined  $F_M$  if an audit detects this

- ▶ If the high outcome is realised, he receives  $w_M V_H$
- $\triangleright$  if the low outcome is realised, and outcome is misrepresented, then is fined  $F_M$  if an audit takes place, without an audit receives  $w_M V_H$
- If the outcome is not misrepresented, he receives  $w_M V_L$
- $\hat{\Pi}_M = \pi w_M V_H + (1 \pi) \left( p \left( -\lambda_A F_M + (1 \lambda_A) w_M V_H \right) + (1 p) w_M V_L \right)$



Managers 000

# Monitoring incentives

Managers will monitor if  $\Pi_M \geq \hat{\Pi}_M$ 

Managers

- lacktriangle Managers will monitor if  $\Pi_M \geq \hat{\Pi}_M$
- ▶ This requires  $p \ge p^* = \frac{C}{\lambda_A(1-\pi)(F_M + w_M V_H)}$

- Managers will monitor if  $\Pi_M \geq \tilde{\Pi}_M$
- ▶ This requires  $p \ge p^* = \frac{C}{\lambda_A(1-\pi)(F_M+w_MV_H)}$
- If misrepresentation of outcomes is sufficiently common, managers will monitor

- ▶ Managers will monitor if  $\Pi_M \geq \hat{\Pi}_M$
- ▶ This requires  $p \ge p^* = \frac{C}{\lambda_A(1-\pi)(F_M+w_MV_H)}$
- If misrepresentation of outcomes is sufficiently common, managers will monitor

- Problem and model assumptions
- Incentives for traders
- Incentives for managers
- Equilibrium outcome
- Summary

▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully

▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p = 0

- ▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p = 0
- ▶ Of p = 0, then  $\Pi_M < \hat{\Pi}_M$

- If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p=0
- ightharpoonup Of p=0, then  $\Pi_M < \hat{\Pi}_M$  and monitoring does not occur,  $\lambda_M = 0$

- ▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p = 0
- ▶ Of p=0, then  $\Pi_M < \hat{\Pi}_M$  and monitoring does not occur,  $\lambda_M = 0$
- If  $\lambda_M = 0$ , then  $\hat{\Pi}_T > \Pi_T$

- ▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p = 0
- lackbox Of p=0, then  $\Pi_M<\hat{\Pi}_M$  and monitoring does not occur,  $\lambda_M=0$
- If  $\lambda_M = 0$ , then  $\hat{\Pi}_T > \Pi_T$  and all traders misrepresent outcomes, hence p = 1

- ▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p = 0
- lackbox Of p=0, then  $\Pi_M<\hat{\Pi}_M$  and monitoring does not occur,  $\lambda_M=0$
- If  $\lambda_M=0$ , then  $\hat{\Pi}_T>\Pi_T$  and all traders misrepresent outcomes, hence p=1
- This again would induce managers to monitor

- ▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p = 0
- ▶ Of p=0, then  $\Pi_M < \hat{\Pi}_M$  and monitoring does not occur,  $\lambda_M = 0$
- If  $\lambda_M=0$ , then  $\hat{\Pi}_T>\Pi_T$  and all traders misrepresent outcomes, hence p=1
- This again would induce managers to monitor
- Equilibrium requires  $\lambda_M = \lambda_M^*$  and  $p = p^*$

- ▶ If  $\lambda_M > \lambda_M^*$ , traders report truthfully, hence p = 0
- lackbox Of p=0, then  $\Pi_M<\hat{\Pi}_M$  and monitoring does not occur,  $\lambda_M=0$
- ▶ If  $\lambda_M=0$ , then  $\hat{\Pi}_T>\Pi_T$  and all traders misrepresent outcomes, hence p=1
- This again would induce managers to monitor
- lacktriangle Equilibrium requires  $\lambda_M=\lambda_M^*$  and  $p=p^*$

# Equilibrium misrepresentation of outcomes

### Equilibrium misrepresentation of outcomes

► We can combine these equilibrium conditions

Equilibrium

▶ We can combine these equilibrium conditions

$$p^* = \frac{\left(1 - \lambda_M^*\right) (F_T + w_T V_H) C}{(1 - \pi) (F_M + w_M V_H) \left(w_T (V_H - V_L) - \lambda_M^* (F_T + w_T V_H)\right)}$$

- ▶ We can combine these equilibrium conditions
- $p^* = \frac{(1 \lambda_M^*)(F_T + w_T V_H)C}{(1 \pi)(F_M + w_M V_H)(w_T (V_H V_L) \lambda_M^* (F_T + w_T V_H))}$
- Misrepresentations happen in equilibrium

- ▶ We can combine these equilibrium conditions
- $p^* = \frac{(1 \lambda_M^*)(F_T + w_T V_H)C}{(1 \pi)(F_M + w_M V_H)(w_T (V_H V_L) \lambda_M^* (F_T + w_T V_H))}$
- ▶ Misrepresentations happen in equilibrium, but is reducing in monitoring

- ▶ We can combine these equilibrium conditions
- $p^* = \frac{(1 \lambda_M^*)(F_T + w_T V_H)C}{(1 \pi)(F_M + w_M V_H)(w_T (V_H V_L) \lambda_M^* (F_T + w_T V_H))}$
- ▶ Misrepresentations happen in equilibrium, but is reducing in monitoring
- Auditing reduces misrepresentations directly

- ▶ We can combine these equilibrium conditions
- $p^* = \frac{(1 \lambda_M^*)(F_T + w_T V_H)C}{(1 \pi)(F_M + w_M V_H)(w_T (V_H V_L) \lambda_M^* (F_T + w_T V_H))}$
- Misrepresentations happen in equilibrium, but is reducing in monitoring
- ► Auditing reduces misrepresentations directly, but also reduces monitoring efforts

- ▶ We can combine these equilibrium conditions
- $p^* = \frac{(1 \lambda_M^*)(F_T + w_T V_H)C}{(1 \pi)(F_M + w_M V_H)(w_T (V_H V_L) \lambda_M^* (F_T + w_T V_H))}$
- Misrepresentations happen in equilibrium, but is reducing in monitoring
- ► Auditing reduces misrepresentations directly, but also reduces monitoring efforts, hence they are imperfect substitutes

- ▶ We can combine these equilibrium conditions
- $p^* = \frac{(1 \lambda_M^*)(F_T + w_T V_H)C}{(1 \pi)(F_M + w_M V_H)(w_T (V_H V_L) \lambda_M^* (F_T + w_T V_H))}$
- Misrepresentations happen in equilibrium, but is reducing in monitoring
- ► Auditing reduces misrepresentations directly, but also reduces monitoring efforts, hence they are imperfect substitutes

- Problem and model assumptions
- Incentives for traders
- Incentives for managers
- Equilibrium outcome
- Summary

► Traders have an incentive to misrepresent outcomes

▶ Traders have an incentive to misrepresent outcomes and this cannot be eliminated

▶ Traders have an incentive to misrepresent outcomes and this cannot be eliminated, even if monitoring or auditing is detecting this behaviour well

- Traders have an incentive to misrepresent outcomes and this cannot be eliminated, even if monitoring or auditing is detecting this behaviour well
- Any sanctions will only reduce the likelihood of misrepresentation as these are weighed against the benefits

- Traders have an incentive to misrepresent outcomes and this cannot be eliminated, even if monitoring or auditing is detecting this behaviour well
- Any sanctions will only reduce the likelihood of misrepresentation as these are weighed against the benefits
- Increasing the auditing of managers will reduce their monitoring efforts as it affects the misrepresentations by traders

- Traders have an incentive to misrepresent outcomes and this cannot be eliminated, even if monitoring or auditing is detecting this behaviour well
- Any sanctions will only reduce the likelihood of misrepresentation as these are weighed against the benefits
- Increasing the auditing of managers will reduce their monitoring efforts as it affects the misrepresentations by traders

Misrepresentation of trading outcomes is inevitable

- Misrepresentation of trading outcomes is inevitable
- ▶ The incentives of higher remuneration for managers after misrepresentation lead to limited monitoring, allowing misrepresentations to occur

Ma oc

- ▶ Misrepresentation of trading outcomes is inevitable
- ► The incentives of higher remuneration for managers after misrepresentation lead to limited monitoring, allowing misrepresentations to occur
- Managers are complicit in such behaviour as they benefit, too

- ▶ Misrepresentation of trading outcomes is inevitable
- ► The incentives of higher remuneration for managers after misrepresentation lead to limited monitoring, allowing misrepresentations to occur
- Managers are complicit in such behaviour as they benefit, too



#### This presentation is based on

Andreas Krause: Theoretical Foundations of Investment Banking, Springer Verlag 2024 Copyright @ 2024 by Andreas Krause

#### Picture credits:

Cover: The wub, CC BY-SA 4.0 https://creativecommons.org/licenses/by-sa/4.0, via Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Canary.Wharf.from.Greenwich.uriverside.2022-03-18.jpg
Back: Seb Tyler, CC BY 3.0 https://creativecommons.org/licenses/by/3.0, via Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Canary.Wharf.Panorama\_Night.jpg

Andreas Krause Department of Economics University of Bath Claverton Down Bath BA2 7AY United Kingdom

E-mail: mnsak@bath.ac.uk