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Chapter 15.2

Remuneration of traders

Outline

Traders as employees

- Investment banks' trading desks employ traders, who require remuneration
- Traders can be informed or uninformed, the investment bank will not be able to determine this when employing them
- Investment banks commonly remunerate traders based on their performance rather than on fixed salaries
- This is often seen as an incentive device to exert effort, but also leads to moral hazard in risk-taking
- It might be the most profitable way of paying traders

Trader types

- Traders are informed with probability γ
- Informed traders know the change in value of the security, ΔV, uninformed traders know its expected value $E[\Delta V] = 0$ and variance $Var[\Delta V] = \sigma_V^2$
- Noise traders trade for exogenous reasons with expected trading demand $E[U] = 0$ and variance $Var[U] = \sigma_U^2$

Price setting

- The price is set such that it mirrors the inference of the change in the value, given the demand: $\Delta P = E\left[\Delta V | D\right]$
- The relationship is assumed to be linear: $\Delta P = \lambda D$
- This is a regression of the demand on the price change, the coefficient being $\lambda = \frac{Cov[\Delta V, D]}{Var[D]}$

Trader profits

- A trader not employed by an investment bank can trade independently and faces a trading fee f
- If the trader is uninformed he will not trade as he will not make a profit against informed traders, $Q_U = 0$
- Total demand is then $D = Q_I + U$
- Trading profits: $\Pi_T = E\left[\left(\Delta V - (1+f)\,\Delta P\right) Q_I | \Delta V\right] = \left(\Delta V - (1+f)\,\lambda Q_I\right) Q_I$

Optimal demand

- Traders will maximize their profits with first order condition $\frac{\partial \Pi_I}{\partial Q_I} = 0$
- Optimal demand: $Q_I = \frac{\Delta V}{2(1+f)\lambda}$
- Profits: $E[\Pi_T] = \frac{\sigma_V^2}{4(1+f)\lambda}$

Demand for employed traders

- Investment banks will pay enough to induce informed traders to join them: $w = E[\Pi_T]$
- Uninformed traders cannot be identified, hence will also be hired and will trade as to not be detected
- They will assume the change in security value to be $\Delta\hat{V}$
- Traders at the investment bank do not face trading costs, thus $f = 0$
- For informed traders: $Q_I = \frac{\Delta V}{2\lambda}$
- For uniformed traders: $Q_U = \frac{\Delta\hat{V}}{2\lambda}$

Total demand

- If an informed trader is not employed, he will demand $\hat{Q}_I = \frac{\Delta V}{2(1+f)\lambda}$
- Trading demand arises if the informed trader is employed, or the uninformed trader is employed, with the informed trader acting independently, plus noise traders
- $D = \gamma Q_I + (1-\gamma)\left(Q_U + \hat{Q}_I\right) + U$

Equilibrium pricing

- Uniformed traders cannot infer security values: $Cov\left[\Delta V, \Delta\hat{V}\right] = 0$ and $Var\left[\Delta V\right] = Var\left[\Delta\hat{V}\right]$
- They will trade randomly giving the impression having received $\Delta\hat{V}$
- This gives $Cov\left[\Delta V, D\right] = \frac{\sigma_V^2(1+\gamma f)}{2(1+f)\lambda}$ and $Var\left[D\right] = \frac{\sigma_V^2(1+\gamma f)^2}{4(1+f)^2\lambda^2} + \frac{(1-\gamma)^2}{4\lambda^2} + \sigma_U^2$
- Solving for $\lambda = \frac{1}{2}\frac{\sigma_V}{\sigma_U}\sqrt{2\frac{1+\gamma f}{1+f} - \left(\frac{1+\gamma f}{1+f}\right)^2 - (1-\gamma)^2}$

Investment bank profits

- Trading profits are from the profits of informed traders and losses of uniformed traders
- $\Pi = \gamma E\left[\left(\Delta V - \Delta P\right) Q_I | \Delta V\right] + \left(1-\gamma\right) E\left[\left(\Delta V - \Delta P\right) Q_U\right]$
- Profits: $\Pi_B = E\left[\Pi\right] - w = \left(\gamma - \frac{1}{2}\frac{2+f}{1+f}\right) \frac{\sigma_U \sigma_V}{\sqrt{2\frac{1+\gamma f}{1+f} - \left(\frac{1+\gamma f}{1+f}\right)^2 - (1-\gamma)^2}}$

Operating a trading desk

- Investment banks will only operate a trading desk if $\Pi_B \geq 0$
- This requires $\gamma \geq \frac{1}{2}\frac{2+f}{1+f}$
- We need sufficient informed traders that trade profitably to ensure the losses made by uninformed traders are covered
- For reasonably low trading costs f, this threshold is very high

Total demand

- Investment banks will only pay traders according to the profits they make
- Informed traders will receive a schedule that induces them to join the investment bank
- Uniformed traders will not trade as they make losses
- Total demand is from the informed traders employed by the investment bank, informed traders not employed, and noise traders
- $D = \gamma Q_I + (1 - \gamma)\,\hat{Q}_I + U$

Trading profits

- We get $Cov\left[\Delta V, D\right] = \sigma_V^2 \frac{1+\gamma f}{2(1+f)\lambda}$ and $Var\left[D\right] = \sigma_V^2 \frac{(1+\gamma f)^2}{4(1+f)^2\lambda^2} + \sigma_U^2$
- Solving for $\lambda = \frac{1}{2}\frac{\sigma_V}{\sigma_U}\frac{\sqrt{(1+\gamma f)(2(1+f)-(1+\gamma f))}}{1+f}$
- Trading profits are from the informed traders employed: $\Pi = \gamma\left(\Delta V - \Delta P\right) Q_I$

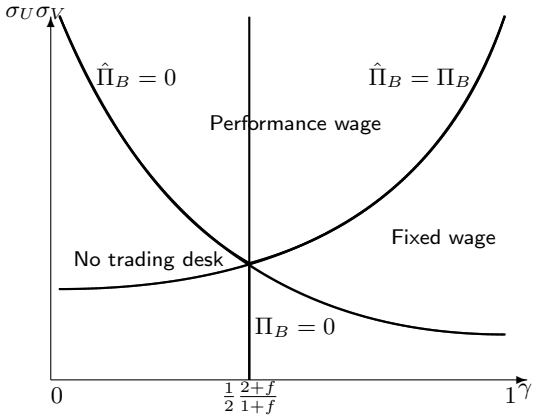
Investment bank profits

- Performance needs to be evaluated, this costs investment banks C
- Investment banks obtain trading profits, pay the wages to informed traders only, and face costs of evaluating trader performance
- Profits: $\hat{\Pi}_B = E[\Pi] - \gamma w - C$
- Investment banks will only operate a trading desk if $\hat{\Pi}_B \geq 0$
- This requires $\sigma_U \sigma_V \geq \frac{2C}{\gamma f} \sqrt{(1+\gamma f)(2(1+f)-(1+\gamma f))}$
- Only if the uncertainty is large enough can informed traders generate enough profits to cover the costs of monitoring

Performance and fixed wages

- If a trading desk is operated, the bank needs to decide how to pay traders
- They will prefer paying a performance wage if $\hat{\Pi}_B \geq \Pi_B$
- This gives $\sigma_U \sigma_V \geq \dfrac{C}{\frac{\gamma f}{2} \frac{1}{\sqrt{(1+\gamma f)(2(1+f)-(1+\gamma f))}} - \frac{\gamma - \frac{1}{2}\frac{2+f}{1+f}}{\sqrt{2\frac{1+\gamma f}{1+f} - \left(\frac{1+\gamma f}{1+f}\right)^2 - (1-\gamma)^2}}}$
- If many informed traders are present, the costs of fixed wages are low as few uninformed traders are rewarded, making fixed wages more attractive
- If the uncertainty is high, uninformed traders will make more losses, making the performance wage more attractive as then they do not trade and incur no losses

Equilibrium remuneration contracts for traders



Impact of informed traders and uncertainty

- For few informed traders, the losses from employing uninformed traders are too high to allow a fixed wage
- For few informed traders, the profits from employing informedtraders are too low to cover monitoring costs in performance wages
- For low uncertainty, the profits made by informed traders are too low to cover the evaluation costs in performance wages
- For many informed traders, the costs of paying uninformed traders is low compared to monitoring costs, making fixed wages more profitable

Dominance of remuneration forms

- Investment banks will operate trading desks only if there is sufficient uncertainty in the market and they can employ enough informed traders
- Markets with lower uncertainty and easily identified informed traders will see fixed wages being paid, but the threshold is very high
- Highly volatile markets with fewer informed traders will see performance wages dominate
- We will mainly observe performance wages or no trading desk

Markets with trading desks

- Trading in well-understood securities will be less attractive to investment banks
- If traders can be identified as understanding a market sufficiently well, they will be paid performance wages
- This should be reflected in the importance of bonus payments in the total remuneration of traders

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