Andreas Krause

Chapter 4.2

Quality of securities issued

Outline

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- Investment banks provide information to their clients, which can be the company issuing securities or investors seeking to purchase these securities. We are here concerned with the latter and look at the impact the advice of investment banks has if provided to potential investors.
- Investors having more information about a security will alter the price they are willing to pay. This might induce companies to change the characteristics of the security, for example by reducing risks or exerting more effort to increase profits.
- This impact on the characteristics of securities we refer to as its quality.
- The impact of advice from investment banks will be particularly strong for newly issued securities as the price will directly affect the resources the company has available.
- For already issued securities, we can nevertheless expect an impact the behaviour of companies as high prices for securities, especially stocks, is beneficial to the company in that hostile takeovers are less likely to occur and takeovers by the company itself can be achieved at lower prices. In addition, senior management is often remunerated with shares or share options and have therefore an interest in high prices.
- We will here explore how the presence of investment banks affects the quality of securities and under which condition the quality will improve.

Outline

- We will firstly look in more detail at the specific setting of the model and the assumptions that are required.
- As a benchmark we will then look at the optimal security quality that companies issue if there was no investment bank present that provides information.
- Of course, after that we will look at the quality of securities in the presence of investment banks and investors receiving better information from them.
- Comparing these two scenarios, we can then assess under which conditions the quality of securities increases.

- We will be assessing how companies react to the presence of information and how they decide to determine the quality of their securities.
- We will establish that the precision of information plays an important role in the trade-off between improving the quality of securities and the cost of doing so.
- These costs will determine whether the quality of a security increases or decreases if investment banks provide information to investors.

Issuers affecting security quality

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→ In many models the characteristics of securities are taken as given and information given to investors will be about these given characteristics.

- However, companies can adjust how they conduct their business, affecting risks but also returns. This will affect they value of securities and we cannot take theheir characteristics as given anymore.
  - Making adjustments to the value of a security will be costly, for example the management might have to exert more effort or forego other benefits they have relied on.
  - We need to look at the benefits of increasing the quality, and hence the value, of a security net of any such costs.
- With information being imprecise, a change in the quality of the security, will have a small impact on its price as investors cannot be certain about the changes, but if information is more precise, then they can evaluate this changes better. Consequently, you will have a stronger reaction of the market price, or the price at which the security can be sold by the company.
- This stronger reaction of the market price might give an incentive for the company to improve the quality of the security. Hence with investment banks providing such more precise information to investors, the quality of securities might improve.

→ It is therefore likely that investors holding more precise information, obtained from investment banks, has an impact on the quality of the security.

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Model assumptions

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→ We now need to specify more precisely what is meant by an investor having information and also who has which knowledge about the qualities of a security.

- We assume that securities can be either high value, H, or low value L.
- The company issuing the security knows the type and the value V_i associated with it.

- Buyers of the security does not know the type of security and hence its true value. They only know that with probability p it has the high value, and with probability $1-p$ it has the low value. Thus there is an informational asymmetry between the issuer of the security and the buyer.
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  - Investors can obtain the security without seeking any advice from an investment bank, which is often referred to as obtaining it directly from the issuer.
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- Information takes the form of a signal whether the security is of high value, V_H, or of low value V_L. Hence the information provided is about which type of security the issuer is selling, once this is established, we know its value.
- The signal is not perfect, but it is correct only with a probability of p_j. This means that if the security is of type H, then the signal will reflect this with probability p_j. Similarly if the security is of type L, then the signal will reflect this with the same probability p_j. This implies that the signal, the information, is consistent with the true quality of the security with some probability p_j. This probability is also referred to as the precision of information.
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  - We assume that the difference between investors and investment banks is the precision of the information they obtain, investment banks are better informed and therefore obtain more precise information. We furthermore assume that for investors using investment banks, the information they obtain will be identical to that of investment banks. With investment banks providing advice, they will indirectly make the information they have obtained available to their clients.
  - Mathematically we express this by requiring that the probability that the signal is correct, is higher for investment banks than for investors seeking to purchase the securities directly. In order for information to be valuable, it needs to be correct as least half the time, hence we assume that signals are correct more often than they are incorrect. (We could interpret a signal with precision of less than $\frac{1}{2}$ as a situation in which a signal with precision $1-p_j$ is obtained for the other possible outcome. For example a signal H with probability p_j $\frac{1}{2}$ is equivalent to a signal L with probability $1-p_j > \frac{1}{2}$.)

→ We have discussed the precision of information, but will now have to use this information in decision-making. To this effect we will have to use the signal to know the quality of the security.

Model assumptions

- The security can be of high or low value, V_i

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- Buyers can obtain the security directly

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- The buyer only knows the issuer has security H with probability p
- Buyers can obtain the security directly or through an investment bank

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Model assumptions

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- The buyer only knows the issuer has security H with probability p
- Buyers can obtain the security directly or through an investment bank
- Buyers and investment banks receive a signal $s \in \{H, L\}$

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- The buyer only knows the issuer has security H with probability p
- Buyers can obtain the security directly or through an investment bank
- Buyers and investment banks receive a signal $s \in \{H, L\}$
- Signal has precision $Prob\,(s = H|H) = Prob\,(s = L|L) = p_j$

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- Mathematically we express this by requiring that the probability that the signal is correct, is higher for investment banks than for investors seeking to purchase the securities directly. In order for information to be valuable, it needs to be correct as least half the time, hence we assume that signals are correct more often than they are incorrect. (We could interpret a signal with precision of less than $\frac{1}{2}$ as a situation in which a signal with precision $1-p_j$ is obtained for the other possible outcome. For example a signal H with probability p_j $\frac{1}{2}$ is equivalent to a signal L with probability $1-p_j > \frac{1}{2}$.)

→ We have discussed the precision of information, but will now have to use this information in decision-making. To this effect we will have to use the signal to know the quality of the security.

Model assumptions

- The security can be of high or low value, V_i, and the issuer knows the type of security it sells
- The buyer only knows the issuer has security H with probability p
- Buyers can obtain the security directly or through an investment bank
- Buyers and investment banks receive a signal $s \in \{H, L\}$
- Signal has precision $Prob\,(s = H|H) = Prob\,(s = L|L) = p_j$
- Investment banks have more precise information than direct buyers

Model assumptions

→ We now need to specify more precisely what is meant by an investor having information and also who has which knowledge about the qualities of a security.

▶
- We assume that securities can be either high value, H, or low value L.
- The company issuing the security knows the type and the value V_i associated with it.

▶ Buyers of the security does not know the type of security and hence its true value. They only know that with probability p it has the high value, and with probability $1-p$ it has the low value. Thus there is an informational asymmetry between the issuer of the security and the buyer.

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- Investors can obtain the security without seeking any advice from an investment bank, which is often referred to as obtaining it directly from the issuer.
- Alternatively, investors can use investment banks who will provide their clients, which here is the investor, with information about the security.

▶ Information takes the form of a signal whether the security is of high value, V_H, or of low value V_L. Hence the information provided is about which type of security the issuer is selling, once this is established, we know its value.

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Bayesian learning

→ What we have obtained is the probability of the signal being identical to the type of security. What we need, however, is the probability of having a specific type of security, given the signal. It is the signal we observe and we need to determine the type of security. The probability the type of security, given the signal can be obtained using Bayes' theorem, also referred to as Bayesian learning.

- We denote this conditional probability by p_j^s.
- High quality: The probability that the security is high quality is given by p and this is consistent with the signal of the signal is correct, which has probability p_j. This gives us the probability that the security has high value and the signal reflects this. A high signal can also be obtained if the security is of low value, this is with probability $1-p$, and the signal is wrong, which has probability $1-p_j$. Therefore a high signal can be obtained if the security has high value and the signal is correct, pp_j, and if the security has low value and the signal is wrong $(1-p)\left(1-p_j\right)$.
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- Inserting the assumption that investment banks have more precise information, $p_B > p_D$, gives that the probabilities an investment bank assigns to the security being high or low value after receiving the corresponding signal, are more extreme than for investors themselves. Hence on receiving information, investment banks will adjust their beliefs more than investors.

→ After knowing how investors and investment banks process information, we can now proceed to see how they will use this information and what its implications are.

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→ After knowing how investors and investment banks process information, we can now proceed to see how they will use this information and what its implications are.

- We will first look at the case where investors do not make use of investment banks.
- This will serve as a benchmark to evaluate the influence of investment banks on the outcomes of security quality.

Expected value to the buyer

Expected value to the buyer

→ We have established the probability of the security to be of high value, given the signal that has been received by the investor. We will now use this probability to determine the expected value of the security.

- The way buyers use the information is to form expectations on the value of the security. We therefore need to obtain the expected value of the security, given the signal they have obtained.
- We first look at a situation in which we obtain the high signal.
  - We know if the security has high value, it is V_H, and this value will be realised if the signal is correct.
  - We know if the security has low value, it is V_L, and this value will be realised if the signal is incorrect.
- *Formula*
- Similar considerations apply if we obtain the low signal.
  - We know if the security has low value, it is V_L, and this value will be realised if the signal is correct.
  - We know if the security has high value, it is V_H, and this value will be realised if the signal is incorrect.
- *Formula*

→ We have now the expected values of the security, depending on the signal the investor receives. We used the updated beliefs on the probability of the security being of high and low value, respectively for this purpose. This information can now be used to determine the profits of investors when purchasing the security and from there the price the company will obtain when selling it.

Expected value to the buyer

- Buyers will use their signal to assess the value of the security

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Expected value to the buyer

- Buyers will use their signal to assess the value of the security
- If receiving the high signal, the security is worth V_H if the signal is correct
- $E_D[V|H] = p_D^H V_H$

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Expected value to the buyer

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- If receiving the high signal, the security is worth V_H if the signal is correct and V_L if it is incorrect
- $E_D[V|H] = p_D^H V_H + \left(1 - p_D^H\right) V_L$

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- If receiving the low signal, the security is worth V_L if the signal is correct

- $E_D[V|L] = p_D^L V_L$

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Expected value to the buyer

- Buyers will use their signal to assess the value of the security
- If receiving the high signal, the security is worth V_H if the signal is correct and V_L if it is incorrect
- $E_D[V|H] = p_D^H V_H + \left(1 - p_D^H\right) V_L$
- If receiving the low signal, the security is worth V_L if the signal is correct and V_H if it is incorrect
- $E_D[V|L] = p_D^L V_L + \left(1 - p_D^L\right) V_H$

Expected value to the buyer

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→ We have now the expected values of the security, depending on the signal the investor receives. We used the updated beliefs on the probability of the security being of high and low value, respectively for this purpose. This information can now be used to determine the profits of investors when purchasing the security and from there the price the company will obtain when selling it.

Expected value to the buyer

- Buyers will use their signal to assess the value of the security
- If receiving the high signal, the security is worth V_H if the signal is correct and V_L if it is incorrect
- $E_D[V|H] = p_D^H V_H + \left(1 - p_D^H\right) V_L$
- If receiving the low signal, the security is worth V_L if the signal is correct and V_H if it is incorrect
- $E_D[V|L] = p_D^L V_L + \left(1 - p_D^L\right) V_H$

Expected value to the buyer

→ We have established the probability of the security to be of high value, given the signal that has been received by the investor. We will now use this probability to determine the expected value of the security.

- The way buyers use the information is to form expectations on the value of the security. We therefore need to obtain the expected value of the security, given the signal they have obtained.
- We first look at a situation in which we obtain the high signal.
  - We know if the security has high value, it is V_H, and this value will be realised if the signal is correct.
  - We know if the security has low value, it is V_L, and this value will be realised if the signal is incorrect.
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- Similar considerations apply if we obtain the low signal.
  - We know if the security has low value, it is V_L, and this value will be realised if the signal is correct.
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Competitive prices and profits

Competitive prices and profits

→ We now will look at the profits any buyer of the security would make and how this determines the price that they are willing to pay.

- The profits of the investor are the difference between the value they have obtained, $E_D[V|s]$, and the costs of obtaining the security, which here is the price P_s. For simplicity we assume here that information is free and hence there are no additional costs for obtaining the signal. Similarly there are no other transaction costs, such as fees to purchase the security.
- If we assume that there are a large number of potential investors, they will compete to obtain the security as long as it is profitable to do so. In line with standard economic theory, competition will eliminate any profits.

⇒ The price the issuer obtains will then be the expected value of the security, depending on the signal of the investor.

- The profits of the issuer are then the price they obtain, less any costs.
  - If a high signal is obtained by the investor, the price the issuer obtains is P_H and this happens with probability p, the probability with which the security is of high value.
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  The expected price is then $pP_H + (1-p)P_L$.
- We now assume that the probability with which issuers have a security of high value, p, characterises the quality of the security; the higher this probability, the higher the quality as it is more likely to be of high value. Achieving higher quality is costly and these costs reduce the profits of the issuer.
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→ We have used the profits of the investors to determine the price they are willing to pay for the securities in a competitive market and we have now obtained the profits of the issuer, which will allow us to determine the optimal quality of the security.

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- The signal is high with probability p

- The seller profits are then $\Pi_S = pP_H$

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Optimal security quality

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→ Having identified the quality of a security with its probability of having a high value, we can now determine the quality that maximizes the profits of the issuer.

- Maximizing the profits over the quality of the security requires the usual first-order condition as shown here.

⇒ We simply solve the first order condition and obtain that the marginal costs of increasing the quality of the assets has to equal the marginal benefits of doing so, thus the marginal increase in the expected price they obtain.

- We can now analyze the properties of this solution, which will be used later to compare the results with those obtained in the presence of investment banks. Inserting for the prices, we can get expressions that include the quality of the security, p.
  - If we use the extreme cases that high security values never occur or always occur, we can show that the marginal benefits on the right-hand side are zero.
  - In between those extremes, the marginal benefits are positive and have a maximum at $p = \frac{1}{2}$. Thus we have established that the marginal benefits are exhibiting an inverse U-shape.

→ We do not solve for the equilibrium directly, but will compare the expression with that emerging if the introduce an investment bank to allow investors to be better informed.

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- Having established some properties of the equilibrium quality of securities without investment banks, we will now introduce investment banks
- This will allow us to compare the results and make an assessment of the impact investment banks have on security quality.

Competition between direct buyers and investment banks

Competition between direct buyers and investment banks

→ Even if investment banks are present, not all investors might have access to them; there will be buyers left who will buy directly from the issuer and thus be not better informed. We therefore have competition between two different types of buyers: investors with access to investment banks and those without such access.

- The expected values are determined as before, what is different is only that the more precise information p_B is used.
- *Formula*
- *Formula*

⇒ We can now compare expected values of investors using investment banks with those not using investment banks. We find that investors using investment banks are having more extreme valuations, they are higher than those of investors using no investment banks if receiving a high signal, and lower if they receive a low signal.

- These more extreme valuations have an impact in who obtains the securities and which price is achieved. For low signals, direct buyers will have a higher valuation and will therefore be able to offer a higher price, obtaining all securities from the issuer.
- In contrast, for high signals, the valuation of those using investment banks are higher and they can pay more to the issuer, resulting in them obtaining all securities.

→ The introduction of an investment bank, and hence better informed investors, leads to competition for securities and who obtains them will depend on the signals received.

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- $E_B[V|L] = p_B^L V_L + \left(1 - p_B^L\right) V_H$

$\Rightarrow E_B[V|H] > E_D[V|H] > E_D[V|L] > E_B[V|L]$

Competition between direct buyers and investment banks

→ Even if investment banks are present, not all investors might have access to them; there will be buyers left who will buy directly from the issuer and thus be not better informed. We therefore have competition between two different types of buyers: investors with access to investment banks and those without such access.

- The expected values are determined as before, what is different is only that the more precise information p_B is used.
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⇒ We can now compare expected values of investors using investment banks with those not using investment banks. We find that investors using investment banks are having more extreme valuations, they are higher than those of investors using no investment banks if receiving a high signal, and lower if they receive a low signal.

- These more extreme valuations have an impact in who obtains the securities and which price is achieved. For low signals, direct buyers will have a higher valuation and will therefore be able to offer a higher price, obtaining all securities from the issuer.
- In contrast, for high signals, the valuation of those using investment banks are higher and they can pay more to the issuer, resulting in them obtaining all securities.

→ The introduction of an investment bank, and hence better informed investors, leads to competition for securities and who obtains them will depend on the signals received.

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Seller profits

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→ Using the competition between different types of buyers, those using investment banks and those not using investment banks, we can now assess the profits the sellers of the security make.

- If the true value of the security is high, the issuer will not sell below its value $E_B[V|H]$. A high signal to the investment bank will ensure that the issue is sold, but a low signal means the securities are not sold. The issuer will keep the securities and make no profits from its sale.
- If the true value is low, the valuation of those investors who do not use investment banks are higher. If the signal received is correct, the direct buyers will obtain the securities. However, obtaining the securities means that the investment bank also had a low signal, implying that the true value is lower and they will only pay this lower value $E_B[V|H]$.
- If the signal is incorrect and they have obtained the high signal, the buyer will be from those using the investment bank and they are paying $E_B[V|H]$. They will not adjust the price as they would have obtained the securities if the true value was high, too.
- As before, we again assume that issuers face costs in achieving a certain quality of the security.
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→ We have now obtained the profits of sellers as buyers with different information precision compete with each other. These profits can now be maxmized to obtain the optimal quality of the security.

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- If the value is high, the seller receives $\hat{P}_H = E_B[V|H]$
- The expected profits are $\hat{\Pi}_S = p\hat{P}_H$

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Optimal security quality

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→ We can now determine the optimal security quality the seller chooses in the presence of investment banks.

- Maximizing the profits over the quality of the security requires the usual first-order condition as shown here.

⇒ We solve the first order condition and obtain that the marginal costs of increasing the quality of the assets has to equal the marginal benefits of doing so, thus the marginal increase in the expected price they obtain.

- If we compare the expression in the first line with that in the absence of investment banks, we replace P_s by $\hat{P}_s$ and the first term has the term p_B added. Inserting for all expressions and assessing the extremes of security quality, $p = 0$ and $p = 1$, we get the same properties. Similarly, we get a maximum at $p = \frac{1}{2}$.
- The expression in the second line is new and shifts the maximum of the inverted U-shape above $\frac{1}{2}$.

→ We have obtained a similar expression for the optimal quality of securities in the presence and absence of investment banks, however, there are some differences. These differences and the implications these have for the equilibrium quality are analysed next.

Optimal security quality

- The seller's optimal security quality maximizes his profits, thus we need $\frac{\partial \Pi_S}{\partial p} = 0$

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- The second line is positive and shifts the maximum of this expression to $p > \frac{1}{2}$

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- We now have all the elements together to compare the equilibrium security quality with and without investment banks.
- Rather than providing an analytical solution, we will use a graphical illustration to derive out main results.

Effect of introducing investment banks

Effect of introducing investment banks

→ We assess the impact investment banks have by comparing the first order conditions in the case with and without investment banks.

- We can firstly compare the first line of the expression with investment banks with the whole expression where investment banks do not exist.
  - Depending on the exact parameter constellations, this expression with investment banks can be larger or smaller, so no general results can be obtained.
  - However, if the precision of information buy investment banks is sufficiently high, p_B, then this expression is typically higher.
-
  - If this expression is larger, a high information precision by investment banks, the second line with investment banks is positive, this makes the whole marginal benefits are higher. This then implies that for the optimal security quality the marginal costs, who are equal to this have to be higher.
  - With the reasonable assumption that marginal costs are increasing in security quality, this implies that a higher quality of securities. This result requires a high information precision by investment banks. In this case, their introduction increases security quality.
- If the information precision of investment banks is not that high, the first line might be smaller than without investment banks. The overall effect will then depend on the magnitude of these two effects.
- While for investment banks obtaining highly precise signals, their introduction increases security quality, the more interesting case emerges if the information precision is lower. It is this case that we will analyse graphically.

Effect of introducing investment banks

- The first line can be larger or smaller than in direct trade

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Effect of introducing investment banks

- The first line can be larger or smaller than in direct trade, if investment banks are highly skilled (high p_B) this is likely to be larger

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- The first line can be larger or smaller than in direct trade, if investment banks are highly skilled (high p_B) this is likely to be larger
- If it is larger, then as the second line is positive, marginal costs are higher

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- While for investment banks obtaining highly precise signals, their introduction increases security quality, the more interesting case emerges if the information precision is lower. It is this case that we will analyse graphically.

Effect of introducing investment banks

- The first line can be larger or smaller than in direct trade, if investment banks are highly skilled (high p_B) this is likely to be larger
- If it is larger, then as the second line is positive, marginal costs are higher, hence security quality is higher

Effect of introducing investment banks

→ We assess the impact investment banks have by comparing the first order conditions in the case with and without investment banks.

- We can firstly compare the first line of the expression with investment banks with the whole expression where investment banks do not exist.
  - Depending on the exact parameter constellations, this expression with investment banks can be larger or smaller, so no general results can be obtained.
  - However, if the precision of information buy investment banks is sufficiently high, p_B, then this expression is typically higher.
-
  - If this expression is larger, a high information precision by investment banks, the second line with investment banks is positive, this makes the whole marginal benefits are higher. This then implies that for the optimal security quality the marginal costs, who are equal to this have to be higher.
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- If it is smaller, then the change of quality when introducing an investment bank depends on the magnitude of these effects

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Reduced security quality with high marginal costs

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→ We are now looking at the case where the investment bank does not have overly precise information and analysing it graphically. We will initially look at a case where issuers face high marginal costs of improving the quality of securities.

- We are depicting the marginal benefits and costs on the vertical axis, while the horizontal axis represents the security quality.
- The marginal benefits from direct trade we had seen as having an inverse U-shape with a maximum at $\frac{1}{2}$.
- Let us assume the marginal costs of increasing the quality of the security to be increasing.
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- Ignoring the other terms, we would get the equilibrium again where the marginal benefits and costs are equal.
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- The final terms, however would increase the marginal benefits and tilt it towards larger security quality.
- This gives us the final equilibrium in the presence of investment banks.
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→ Overall we observe a reduction in the quality of securities if we introduce investment banks.

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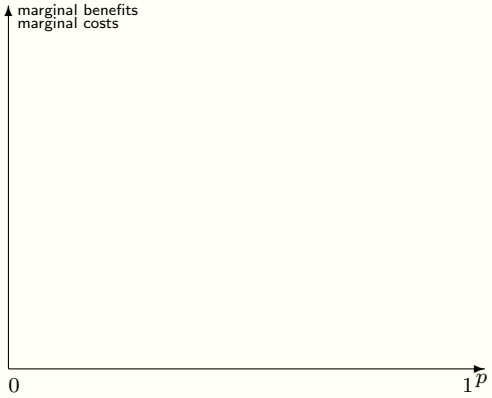

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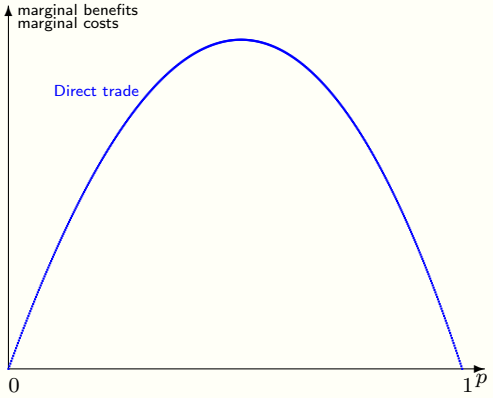

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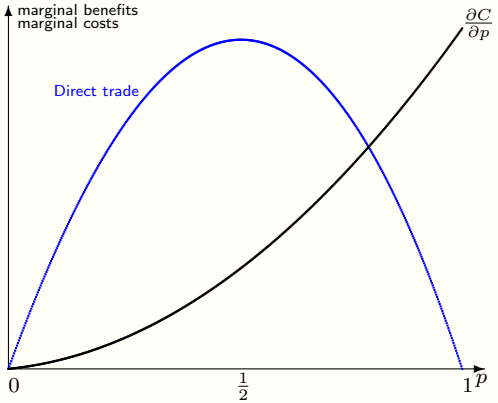

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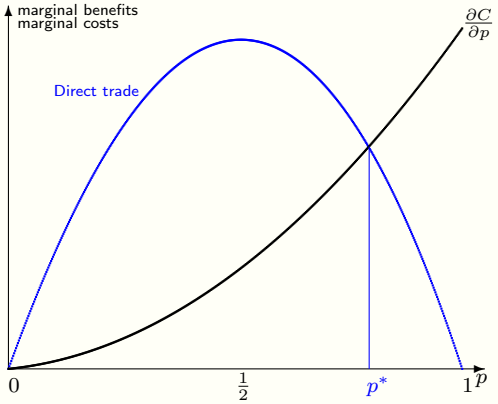

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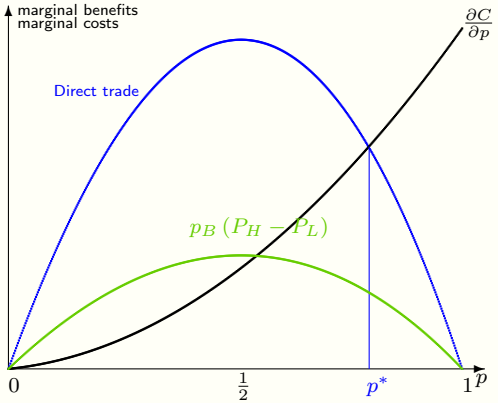

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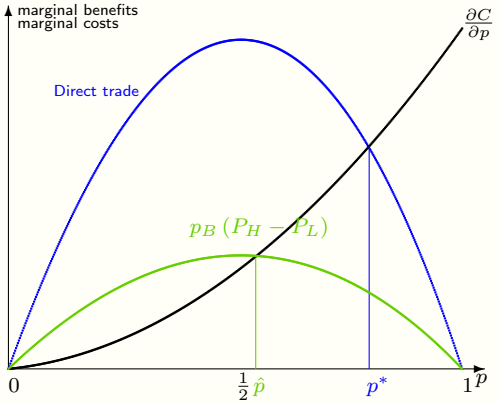

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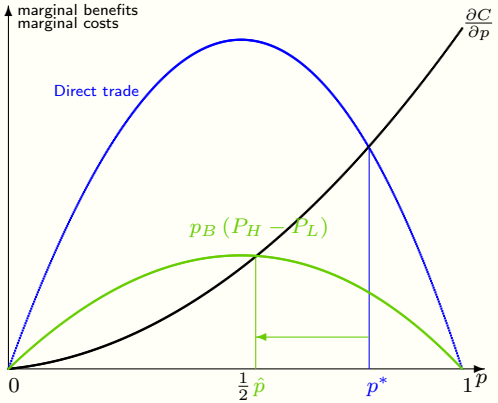

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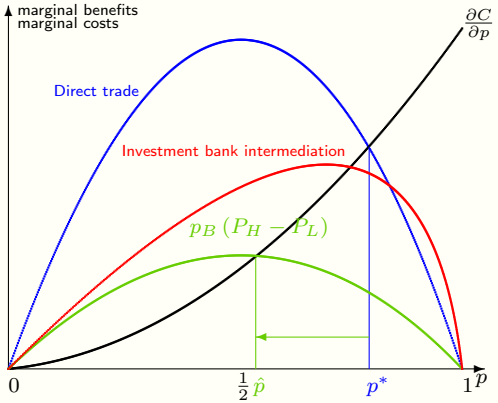

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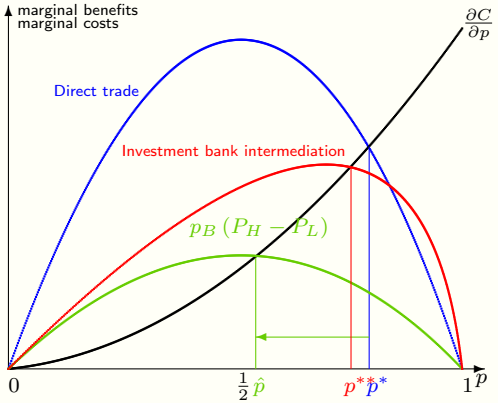

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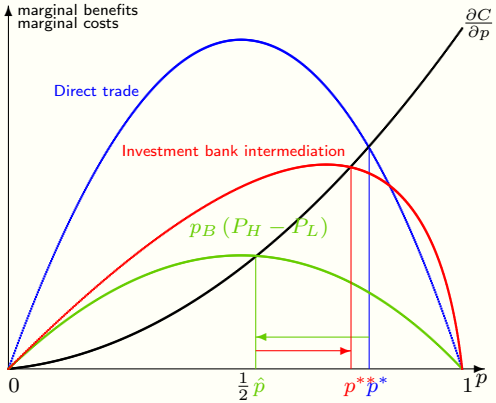

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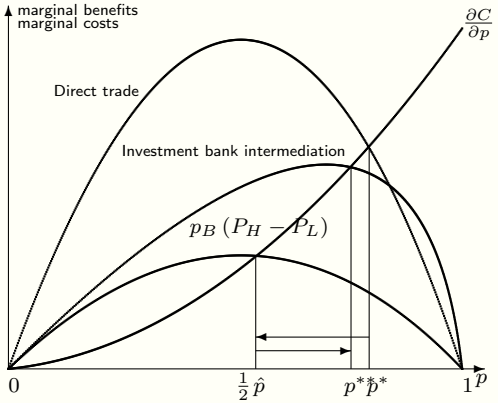

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Increased security quality with low marginal costs

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- The marginal benefits all remain unchanged from what we had before.
- The only difference to the previous case is that the marginal costs are now lower. We still assume that they are increasing, but at a lower rate than before.
- For direct trade, the equilibrium security quality is again given where the marginal benefits and marginal costs are equal. Due to the lower marginal costs of issuers, it is easy to see that the security quality will be higher than in the case of higher marginal costs.
- In the presence of investment banks, we again separate the two terms of the marginal benefits. The lower first term reduces the security quality again, but the resulting security quality will be higher with lower marginal costs to the issuer.
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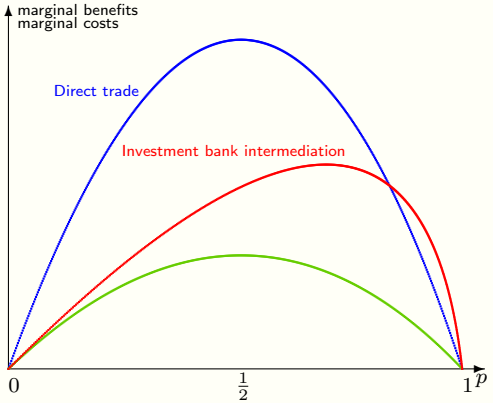

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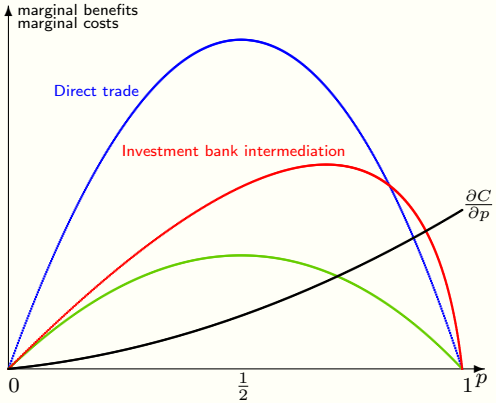

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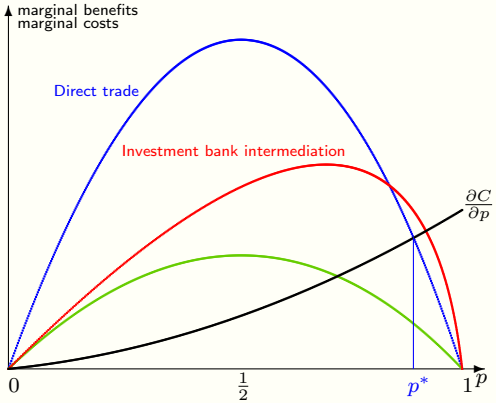

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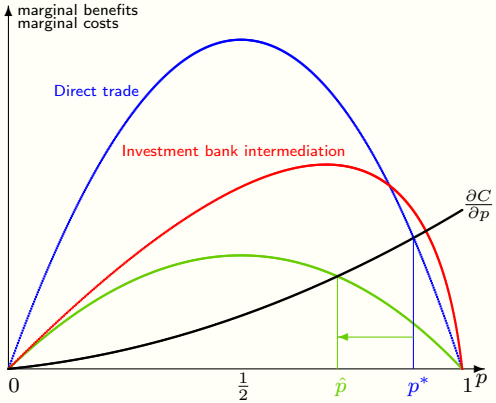
- The only difference to the previous case is that the marginal costs are now lower. We still assume that they are increasing, but at a lower rate than before.
- For direct trade, the equilibrium security quality is again given where the marginal benefits and marginal costs are equal. Due to the lower marginal costs of issuers, it is easy to see that the security quality will be higher than in the case of higher marginal costs.
- In the presence of investment banks, we again separate the two terms of the marginal benefits. The lower first term reduces the security quality again, but the resulting security quality will be higher with lower marginal costs to the issuer.
- The second term of the marginal benefits now compensates for this reduction in security quality and, in contrast to the case with high marginal costs, leads to an overall increase in security quality.

→ We thus see that with low marginal costs, the quality of securities increases, while for higher marginal costs, it would decrease if introducing an investment bank. However, compared to the case with high marginal costs, the security quality is higher with and without investment banks; the difference is only if we compare the effect investment banks have on the security quality. There it is increasing for low marginal costs and decreasing for high marginal costs.

Increased security quality with low marginal costs



Increased security quality with low marginal costs

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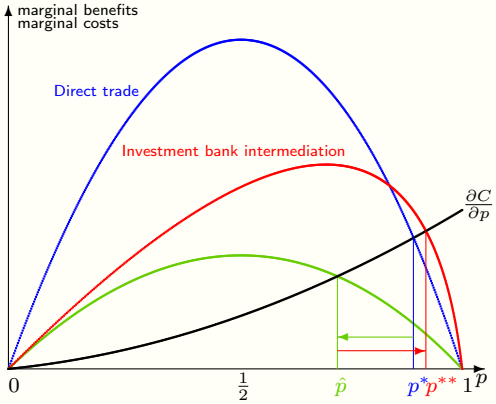

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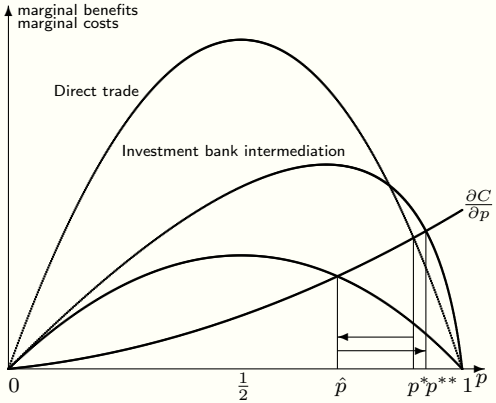

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Analysing the effects

Analysing the effects

→ Having established that the effect investment banks have on security quality differs depending on the marginal costs of issuers to increase security quality, we will now see to explain where this difference arises from. Looking at the case where investment banks are present, the graphical illustration showed two effects: one was a reduction in the security quality and the other an increase. Depending on which effect was larger, the combined effect was positive or negative.

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  - In direct trade, issuers benefit from securities of low value being misidentified as high value, this happens if the signal is wrong. With investment banks having more precise information, this possibility is reduced, but so is the risk of a high-value security to be misidentified as being of low value.
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Analysing the effects

- Focus only on the first terms of the first order condition and take the difference: $(P_H - P_L) - p_B \left(\hat{P}_H - \hat{P}_L \right)$

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- The first term shows the additional revenue to the seller from misidentifying low-quality securities as high quality

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Analysing the effects

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Combined effect

Combined effect

→ We need to balance the benefits of increasing the security quality against the costs of doing so. Depending on the size of these costs, one or the other effect will dominate.

- With low marginal costs, having a larger difference between securities dominates and security quality increases. Here the increased difference in security prices will have a large positive effect on security quality, even after taking into account the costs of increasing this quality; the profits will increase significantly when increasing security quality as the costs are not increasing much. The negative effect on security due to the misidentification is much smaller in this case.
- With high marginal costs this relation ship reverses. The high costs lead only to a small increase in the security quality due to larger price differences between them; the profits from increasing the quality are small due to the high cost increase. This allows the negative effect arising from the misidentification of securities to dominate and the overall effect is that the security quality falls.

→ We see that the benefits of investment banks are primarily in increasing the differences in the prices securities of different qualities obtain. This gives an incentive to increase the security quality, but the net benefits of doing so is limited by the costs; with high costs the net-benefits are small only. A disincentive to increase security quality is the possibility that securities are misidentified and the issuer obtains a high price for a low-value security. With high costs, these disincentives outweigh the net-benefits of larger price differences between securities.
We have only considered the first part of the marginal benefits here as this is where the most significant differences is between situations where investment banks are present and not present. Including the other terms does only reconfirm our analysis.

Combined effect

- If marginal costs are low, the impact of having larger differences in values between securities in the presence of investment banks dominates and security quality increases

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Combined effect

- If marginal costs are low, the impact of having larger differences in values between securities in the presence of investment banks dominates and security quality increases
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Combined effect

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- With low marginal costs, having a larger difference between securities dominates and security quality increases. Here the increased difference in security prices will have a large positive effect on security quality, even after taking into account the costs of increasing this quality; the profits will increase significantly when increasing security quality as the costs are not increasing much. The negative effect on security due to the misidentification is much smaller in this case.
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→ We see that the benefits of investment banks are primarily in increasing the differences in the prices securities of different qualities obtain. This gives an incentive to increase the security quality, but the net benefits of doing so is limited by the costs; with high costs the net-benefits are small only. A disincentive to increase security quality is the possibility that securities are misidentified and the issuer obtains a high price for a low-value security. With high costs, these disincentives outweigh the net-benefits of larger price differences between securities.
We have only considered the first part of the marginal benefits here as this is where the most significant differences is between situations where investment banks are present and not present. Including the other terms does only reconfirm our analysis.

- We can now summarize the key model results and look at some implications this model has

Investment banks do not always increase security quality

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→ Wile reducing the informational advantage of issuers of securities, investment banks do not only have a positive influence on security quality. We have seen that in some instances the security quality will reduce if investment banks are present.

- If investment banks are highly capable of identifying the qualities of securities, then issuers have a strong incentive to improve the quality of their securities. They do so to obtain a higher price by providing higher-quality securities. The precise information of the investment bank will increase these incentives.
- However, if investment banks are not that capable and the information they have access to is not sufficiently precise, the positive effect of investment banks might not materialise. The differences in prices between securities are low and with high costs of increasing the quality of securities, the net benefits will be small.
- There are benefits of reducing costs by lowering the quality of securities and relying on the misidentification of low-value securities as high-value. This effect will outweigh the net benefits of increasing the security quality to make prices more distinct.

→ The effect an investment bank has on security quality will depend on the costs the issuer has on increasing its quality. Highly capable investment banks or low costs will ensure that the quality of securities increases, while lower ability investment banks, or companies/industries that are more difficult to analyse, in combination with high costs to issuers will reduce the quality of securities.

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Instances of lower security quality with investment banks

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→ We can make some additional observations on parameter constellations in which the presence of investment banks can reduce the quality of securities. These results can be obtained by assessing the marginal benefits issuers obtain from increasing the quality of securities.

- We have previously mentioned that investment banks who find it difficult to accurately assess a security, the security quality might be reduced as the issuer will save costs by investing less into security quality.
- Of course, if investors are already very skilled and have precise information such that investment banks cannot improve their information significantly, their presence can have the same detrimental effect on security quality for the same reason. It is not the precision of information itself that is mainly relevant, but the improvement the investment bank can bring.
- If the differences between different securities are small, the benefits of investment banks in form of increasing price differences between them, will be small too. With small benefits, the net-benefits of increasing security quality are likely to be very small, making the reliance on this effect to increase security quality futile. Issuers are more likely to reduce security quality and increase their profits due to lower costs.

→ We see that the presence of investment banks affect the quality of securities that are issued. This effect might be positive or negative, depending on the properties of the issuer and its securities and the ability of the investment bank as well as investors. The important drive of these results was that investment banks provide information to investors and this information provision affects the prices issuers can obtain for their securities, which in turn affects their incentives to increase or decrease the security quality. Unlike many other intermediaries, investment banks are not neutral in respect to the qualities of the 'goods' they are offering, but they can affect this quality.

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