Andreas Krause

Chapter 11.2

Introduction of innovations

Problem and assumptions
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Controversial innovations
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Phasing
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Sale
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Small banks
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Summary
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Outline

■ Problem and model assumptions

■ Controversial innovations

■ Phasing of innovations

■ Selling innovations

■ Optimal strategy for small banks

■ Summary

- Investment banks often develop new securities, some of which become widespread as they have a lasting appeal to a wide range of clients, such as credit default swaps, while others are developed to exploit a specific regulatory gap or allows the reduction of tax payments. The latter type of financial innovations will be of interest only to a small number of clients and with the closing of regulatory gaps and the change of tax rules, their usefulness will often be short-lived.
- We will look here at financial innovations that are likely to be short-lived and will assess how investment banks will introduce such securities.

- We will now look at the incentives to introduce so-called 'controversial' financial innovations, that is financial innovation who are likely to trigger a regulatory response or a response in taxation rules that would eliminate the value of the innovation.
- Will then look at how such an innovation is best introduced, as a large innovation or whether it is better to be introduced in smaller steps to stay ahead of regulator and tax authorities, followed by the incentives of banks to sell the innovation to other investment banks rtaher than offering it only to their own clients.
- Will then look at the optimal strategy of smaller banks in particular.

■ **Problem and model assumptions**

■ Controversial innovations

■ Phasing of innovations

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■ Summary

- We will start by introducing the key considerations in the introduction of financial innovations by investment banks.
- We will not analyse in detail the reasons for clients to request such innovation or see to determine their value to the client. Instead we will take it as given that using financial innovations provides a benefit to clients.

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Theoretical Foundations of Investment Banking
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- ▶ Clients delaying adoption might lose some benefits, such as tax avoidance

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  • Copying such financial innovation will, however, not be instantly as the other investment banks need time to understand and replicate the innovation; they will also need time to develop methods for pricing the innovation adequately.

▶ • If clients do not use the innovation instantly as it becomes available, they will not gain the benefits associated with the innovation. Thus delaying the adoption of the innovation imposes opportunity costs on the client.
  • Such opportunity costs could be that they have to pay higher taxes than when using the financial innovation.
  • They might also benefit from circumventing existing regulations, which might give them direct benefits in the form higher profits or increased market share. There might also be indirect benefits such as higher remuneration for managers or higher stock prices that may be of benefit in a merger.

▶ Once an innovation has been introduced, regulators might change the rules such that the benefits associated with it are diminished or completely eliminated; they might also ban the innovation outright. Such a regulatory change will take time as the regulator only reacts once it observes the innovation being used.

▶ Investment banks might decide to split an innovation into smaller innovations, for example each addressing a specific aspect only. The reaction of the regulator in that case will commonly be limited to this specific step in the innovation only. It is quite unlikely that the regulator will have the foresight to anticipate future further steps. The same is often the case with investment banks copying innovations from their competitors; their focus in the first instance will be to reproduce the innovation that has been introduced, while at that time the original investment bank will already work on the next step in the innovation. For this reason, investment banks might phase in their innovation in smaller steps to not reveal their innovation fully at first and thereby retain a head start for longer.

▶ Investment banks are competing for clients and meeting the demands of their clients with innovative solutions might be a competitive advantage that leads to attracting new clients. These clients are also more likely to choose the investment bank then for advice in mergers, their IPO (if not yet listed), or other major corporate decision.

▶ Investment bank could not only sell an innovation to their clients, but also share the innovation with another investment bank, who could then offer it to their own clients.

→ We will look at the incentives for investment banks to phase in innovations, but also to share they innovation with other investment banks.

Phased introduction and sale of innovations

► Financial innovations can be copied by other investment banks, but there might be a time delay

► Clients delaying adoption might lose some benefits, such as tax avoidance or circumventing regulations

► Regulators might intervene to prohibit an innovation

► Innovations might be split and introduced in phases

► Investment banks are competing and clients might be switching to take advantage of innovations

► They might also sell innovations to other investment banks

Phased introduction and sale of innovations

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Costs and benefits of innovations

Costs and benefits of innovations

→ From the client's perspective, financial innovations provide them with benefits and not using them imposes opportunity costs.

▶ We take the value of the innovation to the client as given and do not model its origin here.

▶ We also suggest that a client not taking up the innovation faces costs, these would be the opportunity costs from paying higher taxes or being subjected to more regulatory constraints.

▶ Clients can switch investment banks if their own investment bank does not offer an innovation the client seeks; switching investment bank to obtain this innovation imposes costs, which might consist of negotiating with a new and unknown investment bank, or the deteriorating relationship with their current investment bank if using services elsewhere.

▶ In addition, we assume that an innovation may be rendered worthless by a regulator after one time period, but there is degree of uncertainty about that, for example the view of a regulator might not be known or the speed at which they move to change regulations may not be known.

→ We can now look at the incentives for investment bank s to introduce financial innovations and how they are priced.

Costs and benefits of innovations

▶ Value of an innovation to the client is V

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Costs and benefits of innovations

▶ Value of an innovation to the client is V

▶ Delaying the adoption of the innovation costs the client C_D

Costs and benefits of innovations

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Costs and benefits of innovations

- ▶ Value of an innovation to the client is V
- ▶ Delaying the adoption of the innovation costs the client C_D
- ▶ Switching investment banks imposes costs of C_S on clients

Costs and benefits of innovations

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Costs and benefits of innovations

▶ Value of an innovation to the client is V

▶ Delaying the adoption of the innovation costs the client C_D

▶ Switching investment banks imposes costs of C_S on clients

▶ An innovation is rendered worthless by regulators after one time period with probability p

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Costs and benefits of innovations

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- Problem and model assumptions

- **Controversial innovations**

- Phasing of innovations

- Selling innovations

- Optimal strategy for small banks

- Summary

- We consider here 'controversial' innovations, that is innovations that a regulator might prohibit or where regulatory changes will eliminate any benefits to clients.

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Equilibrium adoption

Equilibrium adoption

→ Clients are free to adopt an innovation instantly as it is offered to them by their investment bank, delay the adoption of the innovation to a later point in time, or not adopt the innovation at all.

▶ The investment bank will offer the innovation at some price to their client; this price will include the genuine costs of the innovation, thus the value of the security they developed, and a mark-up on this value that generates profits to the investment bank. For simplicity we here assume that the value of the security the investment bank has developed is zero, as it would be with forwards and swaps.

▶ The net benefits to the client when obtaining the innovation will the difference between the value if generates and the price paid.

▶ We assume that perfect competition between investment banks will eliminate and bank profits once the other banks are able to copy the innovation. This implies that the price of innovation will be zero. If the client can wait with obtaining the innovation until other investment banks offer their own products, they can obtain the innovation for free.

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  • In addition they face costs from delaying the adoption of the innovation, this might be the benefits they have lost out on in the initial time, or the indirect losses due to a weakened competitive position relative to other companies that have adopted the innovation.

▶ Delaying the adoption is only beneficial if it is more profitable than adopting it instantly.

▶ The bank will seek to extract any surplus from their client adopting the innovation, such that the client is indifferent between adopting and not adopting the innovation instantly. The benefits from adopting the innovation instantly is given by $V - P$, while delaying the adoption gives the benefits, but only if the innovation is not rendered worthless, less the costs of delaying the adoption; if this value is negative, the client will not obtain the innovation at all, having neither benefits nor costs.

→ We have to note that when delaying the adoption we had assumed that the innovation becomes available for free.

Equilibrium adoption

▶ The investment bank charges a price P for the innovation

Equilibrium adoption

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Equilibrium adoption

▶ The investment bank charges a price P for the innovation

▶ Adopting the innovation gives the client benefits $V - P$

▶ Equilibrium condition: $V - P =$

Equilibrium adoption

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Equilibrium adoption

- The investment bank charges a price P for the innovation
- Adopting the innovation gives the client benefits $V - P$
- If delaying the adoption, the innovation can be obtained for free

- Equilibrium condition: $V - P =$

Equilibrium adoption

$\rightarrow$ Clients are free to adopt an innovation instantly as it is offered to them by their investment bank, delay the adoption of the innovation to a later point in time, or not adopt the innovation at all.

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Equilibrium adoption

▶ The investment bank charges a price P for the innovation

▶ Adopting the innovation gives the client benefits $V - P$

▶ If delaying the adoption, the innovation can be obtained for free

▶ The benefits are only available if the regulator does not interfere

▶ Equilibrium condition: $V - P = \qquad (1 - p) V$

Equilibrium adoption

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Equilibrium adoption

- The investment bank charges a price P for the innovation
- Adopting the innovation gives the client benefits $V - P$
- If delaying the adoption, the innovation can be obtained for free
- The benefits are only available if the regulator does not interfere, and the delay costs are incurred

- Equilibrium condition: $V - P = (1 - p) V - C_D$

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Equilibrium adoption

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- If delaying the adoption, the innovation can be obtained for free
- The benefits are only available if the regulator does not interfere, and the delay costs are incurred
- Delayed adoption is only considered if it is profitable
- Equilibrium condition: $V - P = \max\left\{ \left(1 - p\right) V - C_D, 0 \right\}$

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▶ The net benefits to the client when obtaining the innovation will the difference between the value if generates and the price paid.

▶ We assume that perfect competition between investment banks will eliminate and bank profits once the other banks are able to copy the innovation. This implies that the price of innovation will be zero. If the client can wait with obtaining the innovation until other investment banks offer their own products, they can obtain the innovation for free.

▶
  - If they delay the adoption of the innovation, they will obtain the benefits in the future only, if the innovation is not rendered worthless by the regulator.
  - In addition they face costs from delaying the adoption of the innovation, this might be the benefits they have lost out on in the initial time, or the indirect losses due to a weakened competitive position relative to other companies that have adopted the innovation.

▶ Delaying the adoption is only beneficial if it is more profitable than adopting it instantly.

▶ The bank will seek to extract any surplus from their client adopting the innovation, such that the client is indifferent between adopting and not adopting the innovation instantly. The benefits from adopting the innovation instantly is given by $V - P$, while delaying the adoption gives the benefits, but only if the innovation is not rendered worthless, less the costs of delaying the adoption; if this value is negative, the client will not obtain the innovation at all, having neither benefits nor costs.

→ We have to note that when delaying the adoption we had assumed that the innovation becomes available for free.

Equilibrium price

Equilibrium price

→ We can now determine the equilibrium price of the innovation based on the previous expression.

▶ The price the investment bank can charge to clients adopting the innovation instantly is the value of the innovation if the costs of delaying the adoption are sufficiently high. For lower costs of delaying the adoption of the innovation, the price will be increasing in the delay costs. In both cases, the investment bank exploit its temporary monopoly by extracting any surplus the innovation generates to their client, taking into account the ability of the client delaying the adoption of the innovation.

▶ The more likely the regulator is rendering the innovation worthless (p), the higher the price the investment bank charges. This is because if the innovation is not available in the future, its entire value is only available now; it is unlikely that the regulators change regulations retrospectively and once the innovation has been adopted its value can be obtained in full.

▶ If we assume that the costs of developing a financial innovation is fixed, the price obtained, and hence the profits of the investment bank, are increasing in the likelihood of regulatory intervention and costs of delay. If an innovation is likely to be rendered worthless, it is usually because regulators do not approve of their use, either as they reduce their revenue, increase risks, or have other effects that are deemed undesirable. Such innovations are often seen as 'controversial'.

→ We thus have seen that investment bank make most profits from the developing controversial innovations, as the likelihood of them being rendered worthless by regulators increases the pressure on their clients to not delay their adoption during the time where the investment bank developing the innovation has a monopoly and can extract all surplus from the client.

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Equilibrium price

▶ This gives $P = \begin{cases} V & \text{if} & C_D \geq (1-p)\,V \\ pV + C_D & \text{if} & C_D < (1-p)\,V \end{cases}$

Equilibrium price

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Equilibrium price

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Equilibrium price

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▶ If costs to develop innovations are fixed, this is an incentive to develop controversial innovations

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■ Problem and model assumptions

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■ Phasing of innovations

■ Selling innovations

■ Optimal strategy for small banks

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- We will now focus our attention more on the behaviour of the investment bank when introducing financial innovations.
- We will in particular focus on the ability of the investment bank to introduce an innovation in multiple steps and when it is optimal to do so.

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Dividing innovations

→ We assume that we can divide an innovation into a certain number of steps that can be introduced one-by-one. We assume that neither regulators nor competitors can anticipate the full innovation and copying of innovations will only affect the currently available innovations, while regulatory changes would render any future phases worthless.

▶ If an innovation is split into multiple steps, the total benefits are independent of the number of steps taken, and each step provides a part of the benefits.

▶ We assume that the cost of delaying the adoption of each step is costly and that this cost does not depend on the number of steps; thus costs are not divided by steps, while the benefits are. The justification for this assumption might be that competitive advantages are similar, regardless the size of the innovation

▶ Indirectly the number of steps the investment bank uses is determined such that the total costs of delaying the adoption of the innovation

▶ The number of steps of an innovation is set such that waiting until the full innovation is revealed would eliminate all benefits from using the innovation.

→ We can now use these assumptions to determine the profits of investment banks from introducing financial innovations.

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Dividing innovations

▶ Innovations can be split into T steps and $V = \sum_{t=1}^{T} V_t$

Dividing innovations

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Dividing innovations

▶ Innovations can be split into T steps and $V = \sum_{t=1}^{T} V_t$

▶ Delaying the adoption each step costs C_D

Dividing innovations

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Dividing innovations

- Innovations can be split into T steps and $V = \sum_{t=1}^{T} V_t$
- Delaying the adoption each step costs C_D
- T is such that $V = TC_D$

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Dividing innovations

▶ Innovations can be split into T steps and $V = \sum_{t=1}^{T} V_t$

▶ Delaying the adoption each step costs C_D

▶ T is such that $V = T C_D$

▶ Waiting for the full innovation eliminates all benefits to clients

→ We assume that we can divide an innovation into a certain number of steps that can be introduced one-by-one. We assume that neither regulators nor competitors can anticipate the full innovation and copying of innovations will only affect the currently available innovations, while regulatory changes would render any future phases worthless.

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Dividing innovations

- Innovations can be split into T steps and $V = \sum_{t=1}^{T} V_t$
- Delaying the adoption each step costs C_D
- T is such that $V = TC_D$
- Waiting for the full innovation eliminates all benefits to clients

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→ We can now use these assumptions to determine the profits of investment banks from introducing financial innovations.

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Investment bank profits in each step

Investment bank profits in each step

→ We commence by determining the profits of the investment bank for step of the innovation.
  - ▶
    - The investment bank has a monopoly with the current phase of the innovation and can therefore extract all surplus from their clients. As such the investment bank can charge at most the value that this step generates or the cost of delaying the adoption, whichever is less.
    - The investment bank cannot extract more than the surplus the innovation provides, but it can also not extract more than the cost of delaying the adoption as then the client would delay and the bank would not make any profits.
  - ▶
    - They may not only offer the innovation to their own clients, but they might be able to attract additional clients from other investment bank that do not offer the innovation.
    - When offering the innovation to clients of other banks, they need to take into account the costs of switching investment banks. As the pricing for existing clients extracted all surplus, the switching of investment banks reduces the surplus to any new clients and the bank has to reduce its price accordingly.
  - ▶
    - Assume the market consists of a pre-determined number of clients, across all investment banks, that might benefit from the financial innovation.
    - The innovating investment bank has a market share α_i and will thus be able to extract the full surplus from their clients.
    - From the remaining clients, which are with other investment banks, they will be able to extract the lower surplus, taking into account switching costs.
  - ▶ *Formula*
  - ▶
    - In such a set-up, we can show that it is optimal to phase innovations into steps that provide equal benefits in each step. Any other strategy will lead to less profits as can be shown.
    - This implies that the benefits in each step are equal to the costs of delay. This arises from the equal size of the steps for the benefit creation and our assumption that the total costs of delaying adoption is equal to the total benefits of the full innovation: $V = TV_i = TC_T$.
  - ▶ We can insert this relation and obtain the *formula*.
→ Having determined the profits of the investment bank in each step, assuming the costs of developing such innovations is nil, we can now determine the profits of the investment bank over time.

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Investment bank profits in each step

▶ Maximum price that can be charged for each innovation phase is $\min\{V_t, C_D\}$

▶ Profits: $\Pi_B^{i,t} = \quad \min\{V_t, C_D\} +$

Investment bank profits in each step

→ We commence by determining the profits of the investment bank for step of the innovation.
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  - The investment bank has a monopoly with the current phase of the innovation and can therefore extract all surplus from their clients. As such the investment bank can charge at most the value that this step generates or the cost of delaying the adoption, whichever is less.
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  - They may not only offer the innovation to their own clients, but they might be able to attract additional clients from other investment bank that do not offer the innovation.
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Investment bank profits in each step

▶ Maximum price that can be charged for each innovation phase is $\min\{V_t, C_D\}$, otherwise delaying is more beneficial

▶ Profits: $\Pi_B^{i,t} = \quad \min\{V_t, C_D\} +$

Investment bank profits in each step

→ We commence by determining the profits of the investment bank for step of the innovation.
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Investment bank profits in each step

▶ Maximum price that can be charged for each innovation phase is $\min\{V_t, C_D\}$, otherwise delaying is more beneficial

▶ They can attract new clients from investment banks not innovating

▶ Profits: $\Pi_B^{i,t} = \qquad \min\{V_t, C_D\} +$

→ We commence by determining the profits of the investment bank for step of the innovation.

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- The investment bank has a monopoly with the current phase of the innovation and can therefore extract all surplus from their clients. As such the investment bank can charge at most the value that this step generates or the cost of delaying the adoption, whichever is less.
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- In such a set-up, we can show that it is optimal to phase innovations into steps that provide equal benefits in each step. Any other strategy will lead to less profits as can be shown.
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→ Having determined the profits of the investment bank in each step, assuming the costs of developing such innovations is nil, we can now determine the profits of the investment bank over time.

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Investment bank profits in each step

▶ Maximum price that can be charged for each innovation phase is $\min\{V_t, C_D\}$, otherwise delaying is more beneficial

▶ They can attract new clients from investment banks not innovating by charging a lower price that is reduced by the switching costs: $\max\{\min\{V_t, C_D\} - C_S, 0\}$

▶ Profits: $\Pi_B^{i,t} = \min\{V_t, C_D\} + \max\{\min\{V_t, C_D\} - C_S, 0\}$

Investment bank profits in each step

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Investment bank profits in each step

▶ Maximum price that can be charged for each innovation phase is $\min\{V_t, C_D\}$, otherwise delaying is more beneficial

▶ They can attract new clients from investment banks not innovating by charging a lower price that is reduced by the switching costs: $\max\{\min\{V_t, C_D\} - C_S, 0\}$

▶ We have N clients

▶ Profits: $\Pi_B^{i,t} = \quad N\min\{V_t, C_D\} + \quad\quad N\max\{\min\{V_t, C_D\} - C_S, 0\}$

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- Profits: $\Pi_B^{i,t} = \alpha_i N \min\{V_t, C_D\} + N \max\{\min\{V_t, C_D\} - C_S, 0\}$

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Total investment bank profits

$\rightarrow$ We now need to consider the total profits of the investment bank.

▶ The innovation will be prohibited, or rendered worthless, with some probability in each step. In this case, the innovation will not provide any benefits from adopting future phases. This also implies, that if no regulatory changes are made, the investment bank can continue to sell future phases of the innovation.

▶ The profits of the investment bank from the entire innovation is then given by the profits from each phase, where we take into account that the innovation can only continue of no regulatory changes are made.

▶ Rather than phasing in the innovation, they could sell the innovation in a single step ($T = 1$) and they could obtain the entire market if the benefits are higher than the costs of delaying the adoption and the switching costs, as only then will they be able to attract clients from other investment banks.

▶ As long as this is the case, the investment bank can charge a price that prevents the delay of adoption from all clients, new and old.

▶ *Formula*

$\rightarrow$ We can now compare the incentives to phase in innovations compared to the immediate introduction of the full innovation.

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Total investment bank profits

▶ If the innovation is prohibited in each time period with probability p, the investment bank can continue to sell it with probability $1 - p$ until T steps are used

▶ Total profits: $\Pi_B^i = \sum_{t=0}^{T} (1 - p)^t \, \Pi_B^{i,t}$

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▶ They charge C_D to prevent clients delaying adoption

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Choosing to introduce innovations phased

→ By comparing the profits of the phased and full introduction of innovations, we can now determine the condition under which a phased introduction is preferred.

▶ If the profits to investment banks of phased introductions are higher than those of a immediate introduction, then the phased introduction is used.

▶ We can solve the condition for the minimum market share required to introduce innovations phased. To obtain this, we also solve the geometric sum and note that $C_D - \max\{C_D, C_S\} = \min\{C_D, C_S\}$.

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- • The benefit to small investment banks of phasing in innovations immediately is that they obtain the full market share at a price that is equal to the cost of delaying adoption.
- • Using a single step will generate only a small profit as the maximum price that can be charged is the delay costs, while for a phased introduction, this price can be charged multiple times. However, with a phased introduction, the price charged to new clients would have to be reduced by their switching costs, reducing the revenue on a large fraction of their sales. Hence, small investment banks will make larger profits from a single sale of the innovation to the remaining market, than charging lower amounts to the large fraction of new clients repeatedly.

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Choosing to introduce innovations phased

▶ Investment banks phase innovations in if $\hat{\Pi}_B^i \leq \Pi_B^i$

Choosing to introduce innovations phased

→ By comparing the profits of the phased and full introduction of innovations, we can now determine the condition under which a phased introduction is preferred.

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Choosing to introduce innovations phased

▶ Investment banks phase innovations in if $\hat{\Pi}_B^i \leq \Pi_B^i$

▶ This gives $\alpha_i \geq \alpha^* = \frac{pC_D - \left(1 - (1-p)^T\right)\max\{C_D - C_S, 0\}}{\left(1 - (1-p)^T\right)\min\{C_D, C_S\}} < 1.$

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Choosing to introduce innovations phased

▶ Investment banks phase innovations in if $\hat{\Pi}_B^i \leq \Pi_B^i$

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Choosing to introduce innovations phased

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▶ Small investment banks prefer to introduce innovations in one step, large investment banks prefer to phase in innovations

▶ Small investment banks attract the large remaining market

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Choosing to introduce innovations phased

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- Small investment banks prefer to introduce innovations in one step, large investment banks prefer to phase in innovations

- Small investment banks attract the large remaining market, even though they make little profits from the single step

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Choosing to introduce innovations phased

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- Small investment banks prefer to introduce innovations in one step, large investment banks prefer to phase in innovations
- Small investment banks attract the large remaining market, even though they make little profits from the single step
- Large investment banks do not gain that much market share

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Choosing to introduce innovations phased

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- Small investment banks prefer to introduce innovations in one step, large investment banks prefer to phase in innovations

- Small investment banks attract the large remaining market, even though they make little profits from the single step

- Large investment banks do not gain that much market share and prefer to make multiple profits from phasing in the innovation

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■ Problem and model assumptions

■ Controversial innovations

■ Phasing of innovations

■ Selling innovations

■ Optimal strategy for small banks

■ Summary

- Investment banks do not necessarily have to sell their innovations directly to the clients of other investment banks. Instead they may sell the innovation to other investment banks, who then in turn sell the innovation to their own clients.
- We will explore the desirability of following such a strategy now.

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Sale price

→ We will look first at the price the investment bank can obtain when selling an innovation to another investment bank.

▶ We assume here that the innovating investment bank may sell the innovation to one other investment and that investment bank has then exclusive use of the innovation; the purchaser of the innovation is itself not allowed to sell the innovation to the clients of other investment banks, just its own client base. We assume further that the original innovator selling the innovation forfeits its right to sell the innovation, it will only be the purchaser of the innovation who is able to sell the innovation; this is done to avoid perfect competition between the two (or more) banks for clients, eroding profits.

▶ • The highest price that can be obtained for selling the innovation is the profits the purchaser obtains.
  • These profits are given by its own client base, thus its own market share is relevant for the assessment of the price.

▶ • The innovation cannot be sold for more than the cost of delaying its adoption
  • as otherwise the clients would delay adopting the innovation.

▶ • The price the purchaser can charge can also not exceed the switching costs,
  • as we also need to prevent the clients of the purchaser of switching to the original innovator.

▶ The maximal price that can be charged will thus be the charge the purchaser will make to each of its clients, where we take into account the number of clients the investment bank in the market. Although the purchaser has obtained the exclusive right to the sell the innovation to its own clients, we assume that they would not charge a price that is higher makes clients worse off than when they had purchased the innovation from the innovator directly; this is done to prevent the clients accusing their investment bank of profiteering at their expense.

→ We will now look at the profits the innovating investment bank will make when not selling the innovation.

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Sale price

▶ An investment can sell an innovation to another investment bank rather than introducing it itself

Sale price

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Summary
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Sale price

- An investment can sell an innovation to another investment bank rather than introducing it itself
- The most it can be sold for is the profit it gives the buyer

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→ We will now look at the profits the innovating investment bank will make when not selling the innovation.

Sale price

▶ An investment can sell an innovation to another investment bank rather than introducing it itself

▶ The most it can be sold for is the profit it gives the buyer, who has market share α_j

▶ Price: $P = \alpha_j N$

Sale price

→ We will look first at the price the investment bank can obtain when selling an innovation to another investment bank.
▶ We assume here that the innovating investment bank may sell the innovation to one other investment and that investment bank has then exclusive use of the innovation; the purchaser of the innovation is itself not allowed to sell the innovation to the clients of other investment banks, just its own client base. We assume further that the original innovator selling the innovation forfeits its right to sell the innovation, it will only be the purchaser of the innovation who is able to sell the innovation; this is done to avoid perfect competition between the two (or more) banks for clients, eroding profits.

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  - The highest price that can be obtained for selling the innovation is the profits the purchaser obtains.
  - These profits are given by its own client base, thus its own market share is relevant for the assessment of the price.

- ▶
  - The innovation cannot be sold for more than the cost of delaying its adoption
  - as otherwise the clients would delay adopting the innovation.

- ▶
  - The price the purchaser can charge can also not exceed the switching costs,
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Sale price

- An investment can sell an innovation to another investment bank rather than introducing it itself
- The most it can be sold for is the profit it gives the buyer, who has market share α_j
- Maximum price for selling the innovation to clients is C_D

- Price: $P = \alpha_j N \qquad C_D$

Sale price

→ We will look first at the price the investment bank can obtain when selling an innovation to another investment bank.
▶ We assume here that the innovating investment bank may sell the innovation to one other investment and that investment bank has then exclusive use of the innovation; the purchaser of the innovation is itself not allowed to sell the innovation to the clients of other investment banks, just its own client base. We assume further that the original innovator selling the innovation forfeits its right to sell the innovation, it will only be the purchaser of the innovation who is able to sell the innovation; this is done to avoid perfect competition between the two (or more) banks for clients, eroding profits.
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Sale price

▶ An investment can sell an innovation to another investment bank rather than introducing it itself

▶ The most it can be sold for is the profit it gives the buyer, who has market share α_j

▶ Maximum price for selling the innovation to clients is C_D to avoid then delaying adoption

▶ Price: $P = \alpha_j N \qquad C_D$

Sale price

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▶ The most it can be sold for is the profit it gives the buyer, who has market share α_j

▶ Maximum price for selling the innovation to clients is C_D to avoid then delaying adoption

▶ It can also not be over C_S

▶ Price: $P = \alpha_j N \min\{C_D, C_S\}$

Sale price

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High switching costs

→ We first consider the case where switching costs are high, namely above the costs of delaying the adoption of the innovation.

► If the costs of switching are higher than delaying the adoption, it is clear that clients rather wait to adopt the innovation than switch to another investment bank to obtain the innovation immediately. Thus the original investment bank will only be able to sell the innovation to its own clients and they will seek to extract all surplus by charging the delay costs to each of its clients.

► Using that the switching costs are higher than the delay costs, the price the investment bank can obtain from selling the innovation is given by the formula.

► Comparing profits, it is clear that the innovating bank would sell its innovation to the largest bank in the marke a that would give the larger profits, provided the largest investment bank is larger than the innovator itself.

► We thus find that, except for the case of the larger investment bank, an innovation will always be sold of switching costs are high. This is because the innovating bank cannot attract new clients and hence would benefit from the larger market share of other investment banks.

→ The market share of investment banks here have to be interpreted as the market share in the clients to who the innovation is providing benefits, it would not be the size of the investment bank overall in terms of client numbers; we have to focus on the fraction in the relevant part of the market for the specific innovation.

High switching costs

- If $C_S > C_D$, no clients will switch, seller i obtains $\Pi_B^{i,t} = \alpha_i N C_D$ if retaining the innovation

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High switching costs

- If $C_S > C_D$, no clients will switch, seller i obtains $\Pi_B^{i,t} = \alpha_i N C_D$ if retaining the innovation
- If selling, they obtain $P = \alpha_j N C_D$

High switching costs

$\rightarrow$ We first consider the case where switching costs are high, namely above the costs of delaying the adoption of the innovation.

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High switching costs

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▶ If selling, they obtain $P = \alpha_j N C_D$

▶ They sell to the largest bank with $\alpha_j > \alpha_i$

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High switching costs

- If $C_S > C_D$, no clients will switch, seller i obtains $\Pi_B^{i,t} = \alpha_i N C_D$ if retaining the innovation
- If selling, they obtain $P = \alpha_j N C_D$
- They sell to the largest bank with $\alpha_j > \alpha_i$
- Except for the largest bank making the innovation, the innovation will always be sold

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High switching costs

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Low switching costs

Low switching costs

$\rightarrow$ We now turn to the more realistic case of low switching costs; those that are below the costs of delaying the adoption of the innovation.

► In the case of low switching costs, the innovating bank would attract new clients from other investment banks and makes profits as outlined above.

► The purchaser would charge the lower price to avoid any of their clients wanting to switch to the original innovator. It is clear that the innovating investment bank would sell the innovation to the largest possible investment bank as that would give it the highest price.

► The profits of the innovating investment bank is the price it obtains from selling the innovation and it would do so only it is more profitable than selling the innovation itself.

► This condition solves for this *formula*.

► We thus see that small investment banks prefer to sell their innovations, while larger investment banks sell the innovation to clients directly. The reason is similar to before in that the larger client base of the purchasing investment bank allows them to make higher profits, even though the original would be able to attract new clients, albeit at a low profit margin due to switching costs. We easily see that for this condition to be fulfilled, the purchasing investment bank has to be larger than the selling investment bank.

► The larger the purchasing investment bank is, α_j, the larger the selling investment bank can be. However, it is now not only the largest investment bank that would not sell the innovation, but due to the attraction of new clients, some smaller - but still relatively large, investment bank might also not sell their innovation.

$\rightarrow$ We have thus established that small investment banks tend to sell their innovations to larger investment banks rather than sell directly to clients.

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Low switching costs

- If $C_S \leq C_D$, then the revenue from not selling is
  $$\Pi_B^{i,t} = \alpha_i N C_D + (1 - \alpha_i) N \max \{C_D - C_S, 0\}$$

Low switching costs

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$\Pi_B^{i,t} = \alpha_i N C_D + (1 - \alpha_i) N \max \{C_D - C_S, 0\}$

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Low switching costs

- If $C_S \leq C_D$, then the revenue from not selling is
  $\Pi_B^{i,t} = \alpha_i N C_D + (1 - \alpha_i) N \max \{C_D - C_S, 0\}$
- If selling they obtain $P = \alpha_j N C_S$
- The investment bank sells the innovation is $P > \Pi_B^{i,t}$

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Low switching costs

- If $C_S \leq C_D$, then the revenue from not selling is
  $\Pi_B^{i,t} = \alpha_i N C_D + (1 - \alpha_i) N \max \{C_D - C_S, 0\}$
- If selling they obtain $P = \alpha_j N C_S$
- The investment bank sells the innovation is $P > \Pi_B^{i,t}$
- This requires $\alpha_i \leq \alpha^{**} = 1 - (1 - \alpha_j) \frac{C_D}{C_S} < 1$

Low switching costs

$\rightarrow$ We now turn to the more realistic case of low switching costs; those that are below the costs of delaying the adoption of the innovation.
► In the case of low switching costs, the innovating bank would attract new clients from other investment banks and makes profits as outlined above.
► The purchaser would charge the lower price to avoid any of their clients wanting to switch to the original innovator. It is clear that the innovating investment bank would sell the innovation to the largest possible investment bank as that would give it the highest price.
► The profits of the innovating investment bank is the price it obtains from selling the innovation and it would do so only it is more profitable than selling the innovation itself.
► This condition solves for this *formula.*
► We thus see that small investment banks prefer to sell their innovations, while larger investment banks sell the innovation to clients directly. The reason is similar to before in that the larger client base of the purchasing investment bank allows them to make higher profits, even though the original would be able to attract new clients, albeit at a low profit margin due to switching costs. We easily see that for this condition to be fulfilled, the purchasing investment bank has to be larger than the selling investment bank.
► The larger the purchasing investment bank is, α_j, the larger the selling investment bank can be. However, it is now not only the largest investment bank that would not sell the innovation, but due to the attraction of new clients, some smaller - but still relatively large, investment bank might also not sell their innovation.
$\rightarrow$ We have thus established that small investment banks tend to sell their innovations to larger investment banks rather than sell directly to clients.

Problem and assumptions
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Controversial innovations
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Sale
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Summary
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Low switching costs

- If $C_S \leq C_D$, then the revenue from not selling is
  $\Pi_B^{i,t} = \alpha_i N C_D + (1 - \alpha_i) N \max \{C_D - C_S, 0\}$

- If selling they obtain $P = \alpha_j N C_S$

- The investment bank sells the innovation is $P > \Pi_B^{i,t}$

- This requires $\alpha_i \leq \alpha^{**} = 1 - (1 - \alpha_j) \frac{C_D}{C_S} < 1$

- Small banks will prefer to sell the innovation

Low switching costs

$\rightarrow$ We now turn to the more realistic case of low switching costs; those that are below the costs of delaying the adoption of the innovation.

▶ In the case of low switching costs, the innovating selling bank would attract new clients from other investment banks and makes profits as outlined above.

▶ The purchaser would charge the lower price to avoid any of their clients wanting to switch to the original innovator. It is clear that the innovating investment bank would sell the innovation to the largest possible investment bank as that would give it the highest price.

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- This requires $\alpha_i \leq \alpha^{**} = 1 - (1 - \alpha_j) \frac{C_D}{C_S} < 1$
- Small banks will prefer to sell the innovation
- The larger the buying investment bank, the larger the seller can be

Low switching costs

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▶ In the case of low switching costs, the innovating bank would attract new clients from other investment banks and makes profits as outlined above.

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Low switching costs

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Low switching costs

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■ Controversial innovations

■ Phasing of innovations

■ Selling innovations

■ Optimal strategy for small banks

■ Summary

- Having established that small investment banks are introducing financial innovations immediately and selling the innovation to larger investment banks, we can now compare the profits from selling an innovation and its phased introduction.
- From this comparison, we can then derive the optimal strategy of small investment banks.
- We have already seen that larger investment banks would not sell their innovations and use a phased introduction.

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Selling, phasing in, immediate release

→ We can now use the profits generated to innovating investment banks to sell the innovation, or retain it and then either phase it in or release the innovation immediately.

▶ For small switching costs, we see that the profits from immediate release of the innovation and obtaining the full market share, is preferable to selling the information to an investment bank that is only able to capture a part of the market. Hence, the investment bank will introduce the innovation immediately and not sell it.

▶ We also know that larger investment banks will phase in the innovation, regardless of switching costs.

▶ We also know that smaller investment banks will sell their innovations, regardless of switching costs.

▶
  • We can now show that the choice between phasing in innovations and selling them is made in favour of selling the innovation, if the *formula* is fulfilled.
  • This condition requires that the investment bank purchasing the innovation, α_j, is sufficiently large.

→ The smallest investment banks never sell their innovations but release it immediately to gain the full market share

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Selling, phasing in, immediate release

▶ If $C_S \leq C_D$, then $\Pi_B^{i,t} = NC_D \geq \alpha_j NC_D$ and the innovation is not sold but immediately introduced

→ We can now use the profits generated to innovating investment banks to sell the innovation, or retain it and then either phase it in or release the innovation immediately.

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► We also know that larger investment banks will phase in the innovation, regardless of switching costs.

► We also know that smaller investment banks will sell their innovations, regardless of switching costs.

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Selling, phasing in, immediate release

▶ If $C_S \leq C_D$, then $\Pi_B^{i,t} = NC_D \geq \alpha_j NC_D$ and the innovation is not sold but immediately introduced

▶ If $\alpha_i \geq \alpha^*$, innovations are phased in

$\rightarrow$ We can now use the profits generated to innovating investment banks to sell the innovation, or retain it and then either phase it in or release the innovation immediately.

▶ For small switching costs, we see that the profits from immediate release of the innovation and obtaining the full market share, is preferable to selling the information to an investment bank that is only able to capture a part of the market. Hence, the investment bank will introduce the innovation immediately and not sell it.

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Selling, phasing in, immediate release

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► If $\alpha_i \geq \alpha^*$, innovations are phased in

► If $\alpha_i \leq \alpha^{**}$, innovations are sold

Selling, phasing in, immediate release

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→ The smallest investment banks never sell their innovations but release it immediately to gain the full market share

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Selling, phasing in, immediate release

- If $C_S \leq C_D$, then $\Pi_B^{i,t} = NC_D \geq \alpha_j NC_D$ and the innovation is not sold but immediately introduced
- If $\alpha_i \geq \alpha^*$, innovations are phased in
- If $\alpha_i \leq \alpha^{**}$, innovations are sold
- If $\alpha^* \leq \alpha^{**}$, innovations are not phased in, but sold

$\rightarrow$ We can now use the profits generated to innovating investment banks to sell the innovation, or retain it and then either phase it in or release the innovation immediately.

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$\rightarrow$ The smallest investment banks never sell their innovations but release it immediately to gain the full market share

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Selling, phasing in, immediate release

- If $C_S \leq C_D$, then $\Pi_B^{i,t} = NC_D \geq \alpha_j NC_D$ and the innovation is not sold but immediately introduced

- If $\alpha_i \geq \alpha^*$, innovations are phased in

- If $\alpha_i \leq \alpha^{**}$, innovations are sold

- If $\alpha^* \leq \alpha^{**}$, innovations are not phased in, but sold, this requires $\alpha_j \geq \overline{\alpha} = \frac{p}{1-(1-p)^T}$ to be feasible

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• This condition requires that the investment bank purchasing the innovation, α_j, is sufficiently large.

→ The smallest investment banks never sell their innovations but release it immediately to gain the full market share

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Selling, phasing in, immediate release

- If $C_S \leq C_D$, then $\Pi_B^{i,t} = NC_D \geq \alpha_j NC_D$ and the innovation is not sold but immediately introduced
- If $\alpha_i \geq \alpha^*$, innovations are phased in
- If $\alpha_i \leq \alpha^{**}$, innovations are sold
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Selling, phasing in, immediate release

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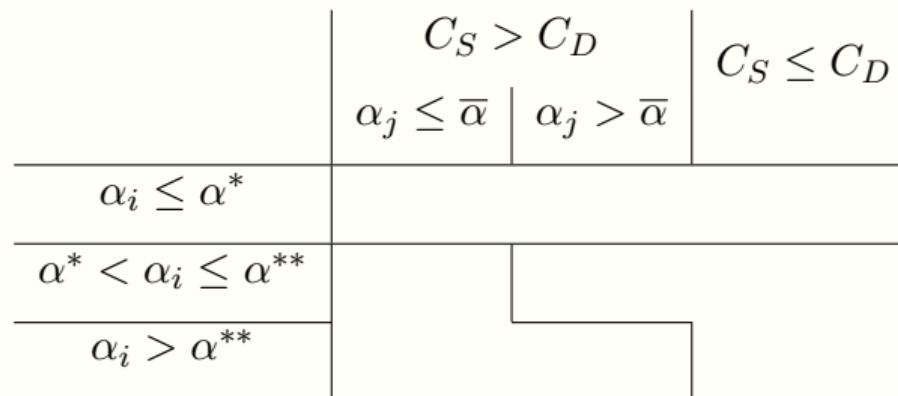→ The smallest investment banks never sell their innovations but release it immediately to gain the full market share

Sale and introduction strategy

$\rightarrow$ We can now summarize the different strategies that are employed by investment banks when developing financial innovations.

► We can look at innovating investment banks of different sizes and clients with different switching costs, as well as different sizes of the bank purchasing the innovation, if applicable.

► Very small investment banks would introduce innovations immediately and thereby attract the entire market, making selling the innovation not attractive.

► Larger investment banks would phase in the introduction of the innovation rather than sell it, provided they are either relative large ($\alpha_i > \alpha^{**}$) or the largest investment bank willing to purchase the innovation is relatively small ($\alpha_j \leq \overline{\alpha}$). Here the benefits from a sale or low as the market of the innovating investment bank itself is already sufficiently large.

► If their switching costs are small or the purchasing investment bank is large, the innovating investment bank would sell the innovation.

$\rightarrow$ We can thus conclude that small investment bank will tend to either immediately introduce innovations or sell them; the large an investment bank becomes the more likely it is that they would phase in the innovation instead.

Sale and introduction strategy

	$C_S > C_D$		$C_S \leq C_D$
	$\alpha_j \leq \overline{\alpha}$	$\alpha_j > \overline{\alpha}$	
$\alpha_i \leq \alpha^*$			
$\alpha^* < \alpha_i \leq \alpha^{**}$			
$\alpha_i > \alpha^{**}$			

Sale and introduction strategy

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Sale and introduction strategy

	$C_S > C_D$		$C_S \leq C_D$
	$\alpha_j \leq \overline{\alpha}$	$\alpha_j > \overline{\alpha}$	
$\alpha_i \leq \alpha^*$	immediate introduction		
$\alpha^* < \alpha_i \leq \alpha^{**}$			
$\alpha_i > \alpha^{**}$			

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Sale and introduction strategy

	$C_S > C_D$		$C_S \leq C_D$
	$\alpha_j \leq \overline{\alpha}$	$\alpha_j > \overline{\alpha}$	
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Sale and introduction strategy

	$C_S > C_D$		$C_S \leq C_D$
	$\alpha_j \leq \overline{\alpha}$	$\alpha_j > \overline{\alpha}$	
$\alpha_i \leq \alpha^*$	immediate introduction		
$\alpha^* < \alpha_i \leq \alpha^{**}$	phased introduction		sale
$\alpha_i > \alpha^{**}$			

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Sale and introduction strategy

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	$\alpha_j \leq \overline{\alpha}$	$\alpha_j > \overline{\alpha}$	
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$\alpha_i > \alpha^{**}$			

Sale and introduction strategy

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- We can now summarize the key results we have obtained about the way investment banks introduce financial innovations.

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Strategies for banks of different sizes

Strategies for banks of different sizes

→ We can differentiate the strategies banks should following, depending on their size. Size here refers to their market share in the number of clients that would benefit from the specific financial innovation that has been developed. While there will in general be a correlation between the general size of an investment bank, for example in terms of its revenue, there can be substantial differences, especially for innovations that are aims at the needs to clients in specific countries, industries, or with other specific characteristics.

▶ We have seen that the smallest investment banks will always introduce financial innovations themselves and immediately in full. This allows them to gain the full market for their innovation by attracting a large number of new clients.

- • Slightly larger investment banks will either seek to extract more surplus from clients by phasing in the innovation, even if they attract only few new clients with this strategy.
- • If another, sufficiently large investment bank will buy their innovation, they might sell it.

▶ Larger investment banks will always phase in innovations as selling it would not give them sufficient additional revenue, given the large market share they already have.

▶ If clients have low switching costs, then phasing in innovations is not feasible as a sale of the innovation gives the investment bank a higher profit.

→ We also see from this result that large investment bank will either phase in their own financial innovations or acquire financial innovations that have been developed by smaller investment banks.

Strategies for banks of different sizes

▶ Investment banks with small market share will always seek to introduce innovations immediately to gain market share

Strategies for banks of different sizes

→ We can differentiate the strategies banks should following, depending on their size. Size here refers to their market share in the number of clients that would benefit from the specific financial innovation that has been developed. While there will in general be a correlation between the general size of an investment bank, for example in terms of its revenue, there can be substantial differences, especially for innovations that are aims at the needs to clients in specific countries, industries, or with other specific characteristics.

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- • Slightly larger investment banks will either seek to extract more surplus from clients by phasing in the innovation, even if they attract only few new clients with this strategy.
- • If another, sufficiently large investment bank will buy their innovation, they might sell it.

▶ Larger investment banks will always phase in innovations as selling it would not give them sufficient additional revenue, given the large market share they already have.

▶ If clients have low switching costs, then phasing in innovations is not feasible as a sale of the innovation gives the investment bank a higher profit.

→ We also see from this result that large investment bank will either phase in their own financial innovations or acquire financial innovations that have been developed by smaller investment banks.

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Strategies for banks of different sizes

▶ Investment banks with small market share will always seek to introduce innovations immediately to gain market share

▶ Medium-sized investment banks will either phase in any innovations to extract more surplus from their clients

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Innovative investment banks

Innovative investment banks

→ We can now look at the implications of these strategies for the perception of investment banks in the market.

▶ Small investment banks will be seen as the most innovative investment banks due to them introducing any innovations in a single step, making it look like they have developed a significant financial innovation.

▶ In contrast to that, larger investment banks will often be seen as only offering small, incremental innovations that improve existing products or process. Financial innovations might also include innovations in the process such as making payments, online facilities, the use of artificial intelligence to the benefit of clients, and similar.

▶ For mid-sized investment banks it seems that they are often cooperating with larger investment banks; often the sale of an innovation is marketed as a cooperation between the two investment banks such that the purchasing investment bank is seen in a more positive light as (wrongly) implying that they have contributed to the financial innovation in a meaningful way. they might have used their larger client base to adjust the details of the financial innovations to a larger number of clients, while the key innovations might well have been provided by the smaller investment bank.

→ Thus the optimal strategies for the investment banks on how to introduce financial innovations will have an impact on how they are perceived in the market.

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Innovative investment banks

- Small investment banks are seen as offering significant innovations
- Larger investment banks are only making incremental improvements to existing processes and products
- Mid-sized investment banks are cooperating with larger competitors to spread an innovation

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