Andreas Krause



Chapter 11.2 Introduction of innovations

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 0000

#### Outline

- Problem and model assumptions
- Controversial innovations
- Phasing of innovations
- Selling innovations
- Optimal strategy for small banks

#### Summary

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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#### Problem and model assumptions

Controversial innovations

Phasing of innovations

Selling innovations

Optimal strategy for small banks

Summary

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Problem and assumptions Controversial innovations	Phasing	Sale	Small banks	Summary
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Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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Financial innovations can be copied by other investment banks

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Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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Financial innovations can be copied by other investment banks, but there might be a time delay

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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- Financial innovations can be copied by other investment banks, but there might be a time delay
- Clients delaying adoption might lose some benefits

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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- 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

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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- Financial innovations can be copied by other investment banks, but there might be a time delay
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Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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- They might also sell innovations to other investment banks

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Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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- Value of an innovation to the client is V
- Delaying the adoption of the innovation costs the client C<sub>D</sub>

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#### Controversial innovations

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# Equilibrium adoption

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Equilibrium adopt	ion				

 $\blacktriangleright$  The investment bank charges a price P for the innovation

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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Equilibrium adop	otion				

- $\blacktriangleright$  The investment bank charges a price P for the innovation
- Adopting the innovation gives the client benefits V P

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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Equilibrium ado	ption				

- $\blacktriangleright$  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

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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Equilibrium adopt	ion				

- $\blacktriangleright$  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

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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Equilibrium ado	ption				

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- The benefits are only available if the regulator does not interfere, and the delay costs are incurred

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 0000
Equilibrium ado	otion				

- ▶ 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
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- Delayed adoption is only considered if it is profitable

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- Equilibrium condition:  $V P = \max\{(1 p) V C_D, 0\}$

Problem and assumptions	Controversial innovations	Phasing	Sale	Small banks	Summary
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► This gives 
$$P = \begin{cases} V & \text{if } C_D \ge (1-p)V\\ pV + C_D & \text{if } C_D < (1-p)V \end{cases}$$

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▶ The price increases in the likelihood the regulator intervenes

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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 assumptions	Controversial innovations	Phasing 0●000	Sale 0000	Small banks 000	Summary 0000

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

Problem and assumptions	Controversial innovations	Phasing 0●000	Sale 0000	Small banks 000	Summary 0000
<b>.</b>					

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

Problem and assumptions	Controversial innovations	Phasing 0●000	Sale 0000	Small banks 000	Summary 0000

- ▶ Innovations can be split into T steps and  $V = \sum_{t=1}^{T} V_t$
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• Maximum price that can be charged for each innovation phase is  $\min \{V_t, C_D\}$ 

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Maximum price that can be charged for each innovation phase is min {V<sub>t</sub>, C<sub>D</sub>}, otherwise delaying is more beneficial

Problem and assumptions	Controversial innovations	Phasing 00●00	Sale 0000	Small banks 000	Summary 0000

- 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

Problem and assumptions	Controversial innovations	Phasing 00●00	Sale 0000	Small banks 000	Summary 0000

- Maximum price that can be charged for each innovation phase is min {V<sub>t</sub>, C<sub>D</sub>}, 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:  $\max \{\min \{V_t, C_D\} C_S, 0\}$

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- ▶ We have *N* clients

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

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

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## Total investment bank profits

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lf 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

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

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

▶ If selling the innovation in one step, they can gain the whole market if  $V > C_D + C_S$ 

• 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

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- $\blacktriangleright\,$  If selling the innovation in one step, they can gain the whole market if  $V>C_D+C_S$
- They charge  $C_D$  to prevent clients delaying adoption

• 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

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- They charge  $C_D$  to prevent clients delaying adoption
- Investment bank profits:  $\hat{\Pi}^i_B = NC_D$

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

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Choosing to intro	duce innovations	s phased			

• Investment banks phase innovations in if  $\hat{\Pi}^i_B \leq \Pi^i_B$ 

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► Investment banks phase innovations in if 
$$\hat{\Pi}_B^i \leq \Pi_B^i$$
  
► This gives  $\alpha_i \geq \alpha^* = \frac{pC_D - (1 - (1 - p)^T) \max\{C_D - C_S, 0\}}{(1 - (1 - p)^T) \min\{C_D, C_S\}} < 1.$ 

Problem and assumptions	Controversial innovations	Phasing 0000●	Sale 0000	Small banks 000	Summary 0000

► Investment banks phase innovations in if 
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Small investment banks prefer to introduce innovations in one step

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

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

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

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

- 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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- 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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## Sale price

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Sale price					

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

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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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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<sub>j</sub>

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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  $\alpha_j$
- Maximum price for selling the innovation to clients is  $C_D$

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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 \(\alpha\_j\)
- ▶ Maximum price for selling the innovation to clients is C<sub>D</sub> to avoid then delaying adoption

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0●00	Small banks 000	Summary 0000
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 \(\alpha\_j\)
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	Problem and assumptions	Controversial innovations	Phasing 00000	Sale 00●0	Small banks 000	Summary 0000
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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 00●0	Small banks 000	Summary 0000

► 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

Problem and assumptions	Controversial innovations	Phasing 00000	Sale ○○●○	Small banks 000	Summary 0000
High switching o	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  $P = \alpha_j N C_D$

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	Problem and assumptions	Controversial innovations	Phasing 00000	Sale 000●	Small banks 000	Summary 0000
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## Low switching costs

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Problem and assumptions	Controversial innovations	Phasing 00000	Sale ○○○●	Small banks 000	Summary 0000
Low switching c	osts				

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

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 000●	Small banks 000	Summary 0000
Low switching	costs				

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

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 000●	Small banks 000	Summary 0000
Low switching cos	ts				

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

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Low switching cos	ts				

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- The larger the buying investment bank, the larger the seller can be

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 000●	Small banks 000	Summary 0000
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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ●00	Summary 0000

- Problem and model assumptions
- Controversial innovations
- Phasing of innovations
- Selling innovations
- Optimal strategy for small banks



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Problem and assumptions Controversial innovations Phasing Sale Small Banks Summi ococ 0000 000 000 000 000 000 0000 0000	Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ○●○	Summary 0000
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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ○●○	Summary 0000

▶ 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

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ○●○	Summary 0000

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

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ○●○	Summary 0000

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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ○●○	Summary 0000

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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ○●○	Summary 0000

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Problem and assumptions Controversial innovations Phasing Sale Small banks Summ 000 00000 0000 000€ 000€ 000€ 0000	oblem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 00●	Summary 0000
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Sale and introduction strategy

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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks ○○●	Summary 0000

## Sale and introduction strategy

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## Sale and introduction strategy

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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 00●	Summary 0000

# Sale and introduction strategy

	$C_S >$	$> C_D$	$C_S \leq C_D$
	$\alpha_j \leq \overline{\alpha}$	$\alpha_j > \overline{\alpha}$	
$\alpha_i \le \alpha^*$	imme	diate intro	oduction
$\frac{\alpha^* < \alpha_i \le \alpha^{**}}{\alpha_i > \alpha^{**}}$	phased introduc	tion	

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 00●	Summary 0000

# Sale and introduction strategy

	$C_S > \alpha_j \le \overline{\alpha}$	$C_D = C_D$ $\alpha_j > \overline{\alpha}$	$C_S \le C_D$
$\alpha_i \le \alpha^*$	imme	diate intro	oduction
$\alpha^* < \alpha_i \le \alpha^{**}$ $\alpha_i > \alpha^{**}$	phased introduc	tion	sale

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 00●	Summary 0000

# Sale and introduction strategy

	$C_S > \alpha_j \le \overline{\alpha}$	$C_D = C_D$ $\alpha_j > \overline{\alpha}$	$C_S \le C_D$
$\alpha_i \le \alpha^*$	imme	diate intro	oduction
$\alpha^* < \alpha_i \le \alpha^{**}$ $\alpha_i > \alpha^{**}$	phased introduc	tion	sale

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary ●000

- Problem and model assumptions
- Controversial innovations
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#### Summary

Problem and assumptions Controversial innovations Phasing Sale Small banks Sum 000 000 000 000 000 000 000	Sale Small banks Summary
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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 0●00

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

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 0●00

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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 00●0

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Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 0000

**Small** investment banks are seen as offering significant innovations

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 0000

- Small investment banks are seen as offering significant innovations
- Larger investment banks are only making incremental improvements to existing processes and products

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 00●0

- 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

Problem and assumptions	Controversial innovations	Phasing 00000	Sale 0000	Small banks 000	Summary 00●0

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