



Endogenous Timing and Strategic Managerial Incentives in a Duopoly Game

Michael Kopel
Vienna University of Technology
Institute of Management Science

(joint work with Clemens Löffler)

MDEF 2008, Urbino, Sept 25-27



Competitive commitment strategies

- „First Move“: (Stackelberg-)Leader vs. Follower
- Building up Capacity
- Strategic delegation/Organizational mode: Hire a manager
- Technology: Investing in (process) innovation



Anecdotal evidence for FMA and SMA

- *“The early bird gets the worm... but the second mouse gets the cheese.”*
- First-Mover Advantage
 - Austrian Airlines is FM in Iraq
 - Neumann is FM with digital microphones
 - Airbus vs. Boeing and the A380
- Second-Mover Advantage
 - VHS vs. Betamax, MS Word vs. WordStar
 - GM und VW vs. Hyundai und Chery in China

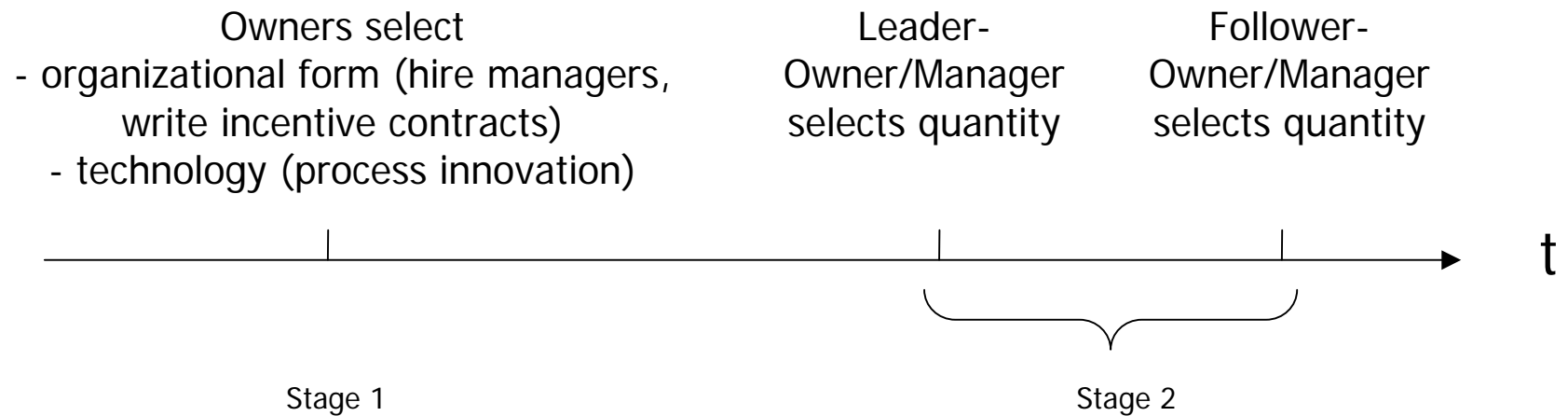


Research questions

- Are commitment strategies complements or substitutes?
- Can the leader or the follower profit from additional commitments?
- What is the incentive contract/organizational mode in a „dynamic“ production environment?



Time line of our model (The past)





The model

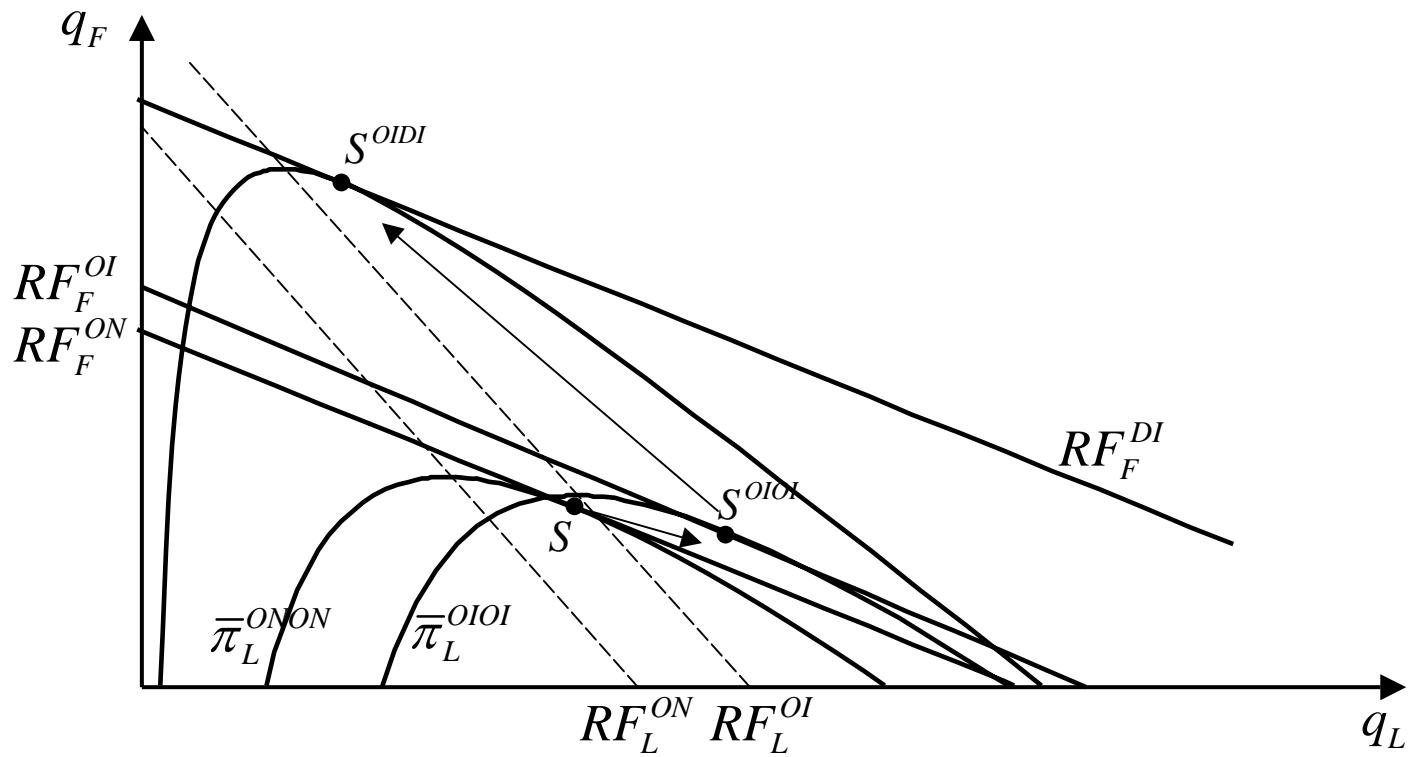
- Let $p = a - q_L - q_F$ und $C_k = cq_k$, $k = F, L$
- L-Owners und F-Owners
 - Delegate quantity choice to a manager
 - Select compensation contract = $s + \beta(\Pi_{L/F} + \alpha_{L/F}q_{L/F})$
($\geq U = 0$)
 - Select investment in process innovation $x_{L/F}$:
reduced cost $c - x_{L/F}$ with investment costs $rx_{L/F}^2/2$
- Leader-Manager/Owner determine q_L
- Follower-Manager/Owner determine q_F

Results

		<i>F</i>			
		<i>ON</i>	<i>DN</i>	<i>OI</i>	<i>DI</i>
<i>L</i>	<i>ON</i>	$\pi_L^{ONON}, \pi_F^{ONON}$	$\pi_L^{ONDN}, \pi_F^{ONDN}$	$\pi_L^{ONOI}, \pi_F^{ONOI}$	$\pi_L^{ONDI}, \pi_F^{ONDI}$
	<i>DN</i>	$\pi_L^{DNON}, \pi_F^{DNON}$	$\pi_L^{DNDN}, \pi_F^{DNDN}$	$\pi_L^{DNOI}, \pi_F^{DNOI}$	$\pi_L^{DNDI}, \pi_F^{DNDI}$
	<i>OI</i>	$\pi_L^{OION}, \pi_F^{OION}$	$\pi_L^{OIDN}, \pi_F^{OIDN}$	$\pi_L^{OIOI}, \pi_F^{OIOI}$	$\pi_L^{OIDI}, \pi_F^{OIDI}$
	<i>DI</i>	$\pi_L^{DION}, \pi_F^{DION}$	$\pi_L^{DIDN}, \pi_F^{DIDN}$	$\pi_L^{DIOI}, \pi_F^{DIOI}$	$\pi_L^{DIDI}, \pi_F^{DIDI}$

$$\alpha_F^{OIDI} > \alpha_L^{OIDI} = 0 \quad x_F^{OIDI} > x_L^{OIDI} \quad q_F^{OIDI} > q_L^{OIDI} \quad \Pi_F^{OIDI} > \Pi_L^{OIDI}$$

Intuition



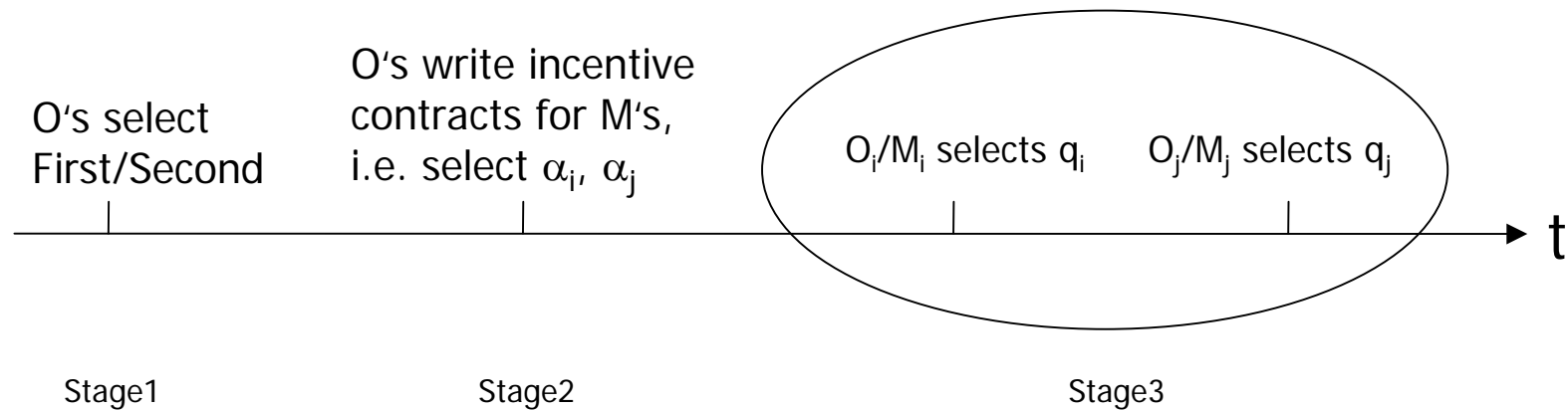


Conclusions

- Stackelberg + R&D complementary
- Stackelberg + Delegation are not!
- FMA can be reversed
- Organizational (or contract) forms differ

- However: Timing exogenous!

Extended game with observable delay (The present)

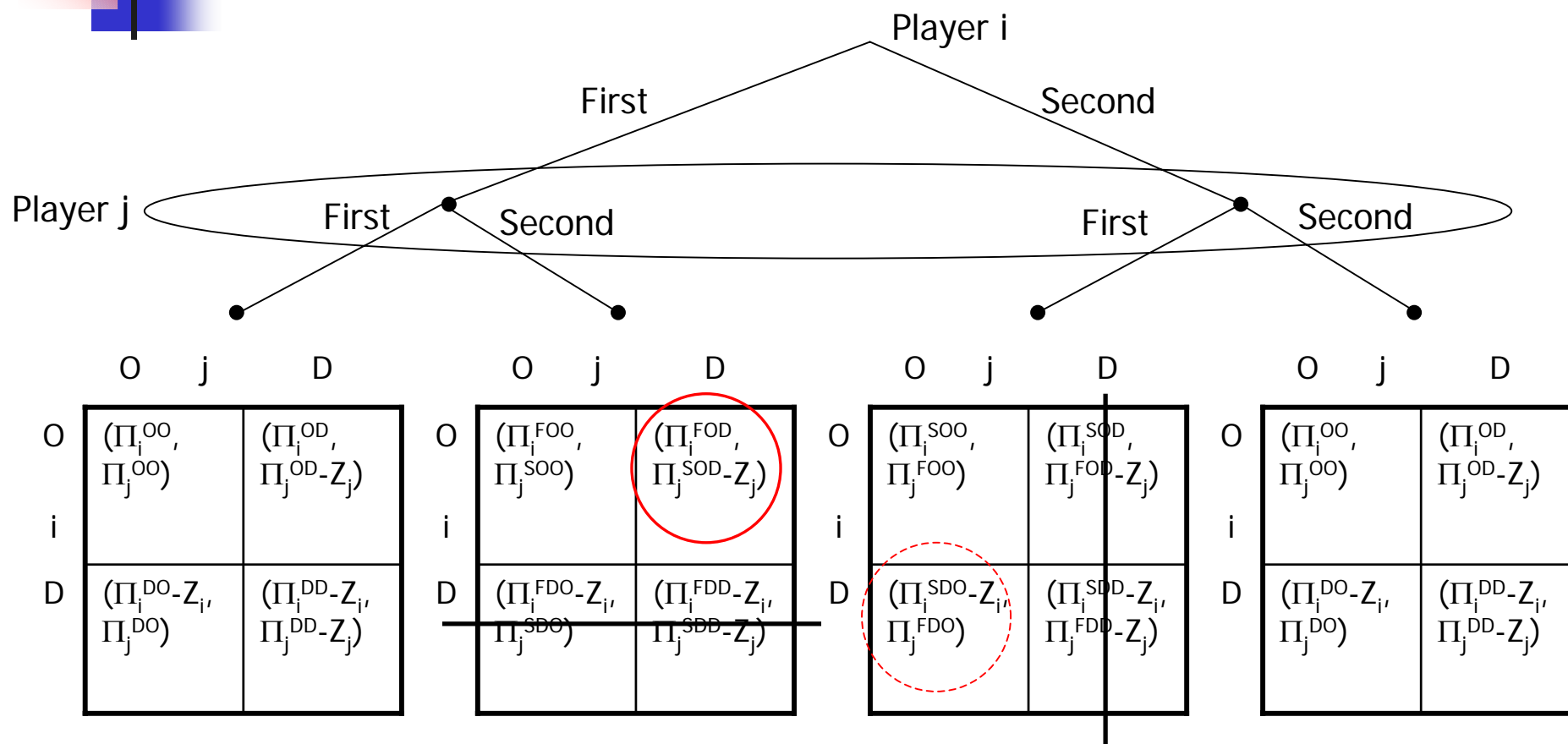




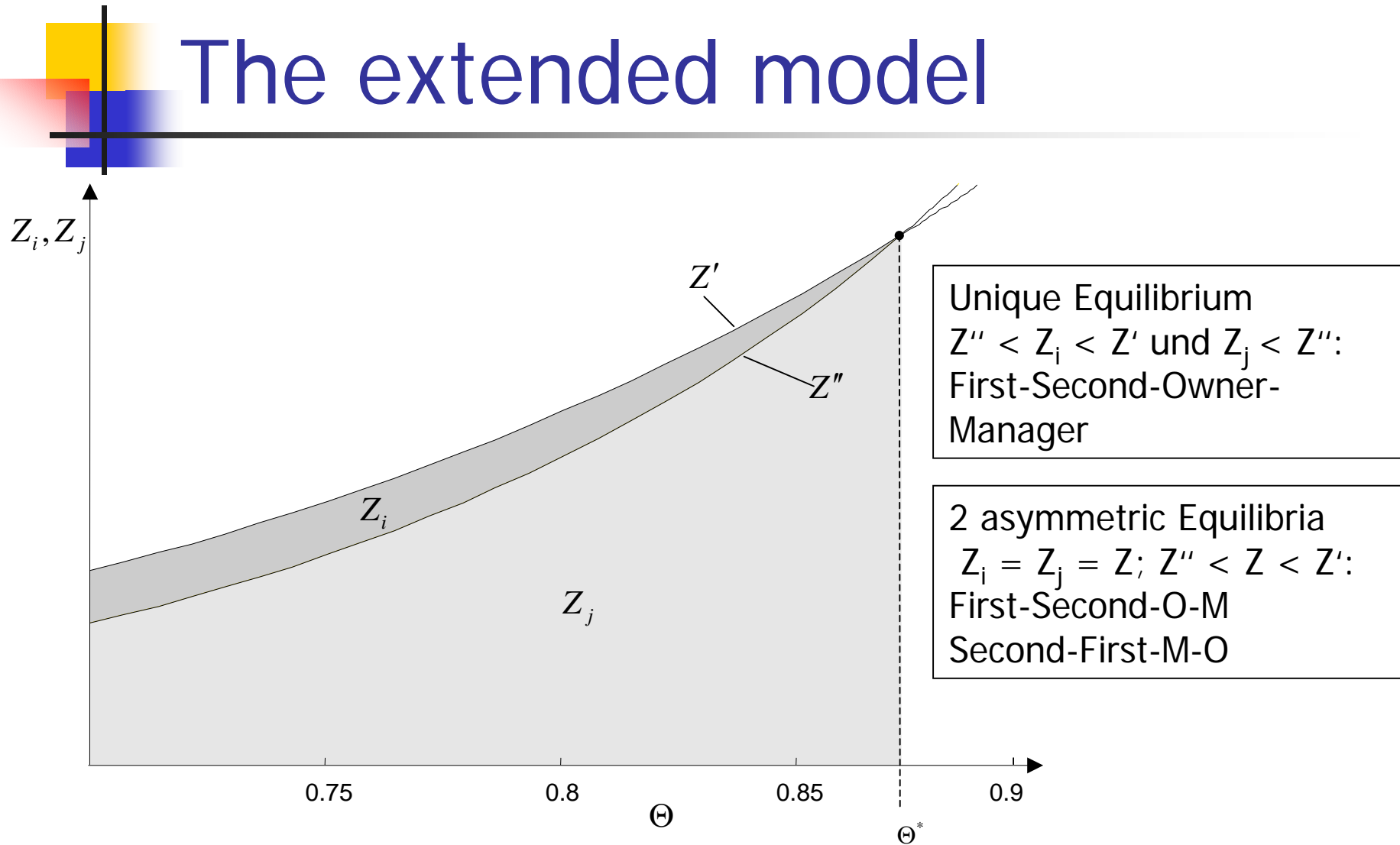
The extended model


- Let $p_i = a - q_i - \theta q_j$, $p_j = a - q_j - \theta q_i$ with $\theta \in (0, 1]$
- $C_k = cq_k$, $k = i, j$
- Owners choose First/Second
- Delegation + Compensation
 $s + \beta(\Pi_k + \alpha_k q_k) \quad (\geq Z_k > 0)$
- Manager/Owner selects q_L / q_F

Extended game with observable delay



The extended model





Dynamic versions of a Stackelberg game (The future)

- Let $p=f(\sum q_j)$, $C_k=cq_k$, $k=1,2,\dots,n$
- Each firm i strives to be a leader
- Assumes other firms behave as followers with Cournot expectations
- Leader firm anticipates this
- Works for nonlinear oligopolies with N firms!

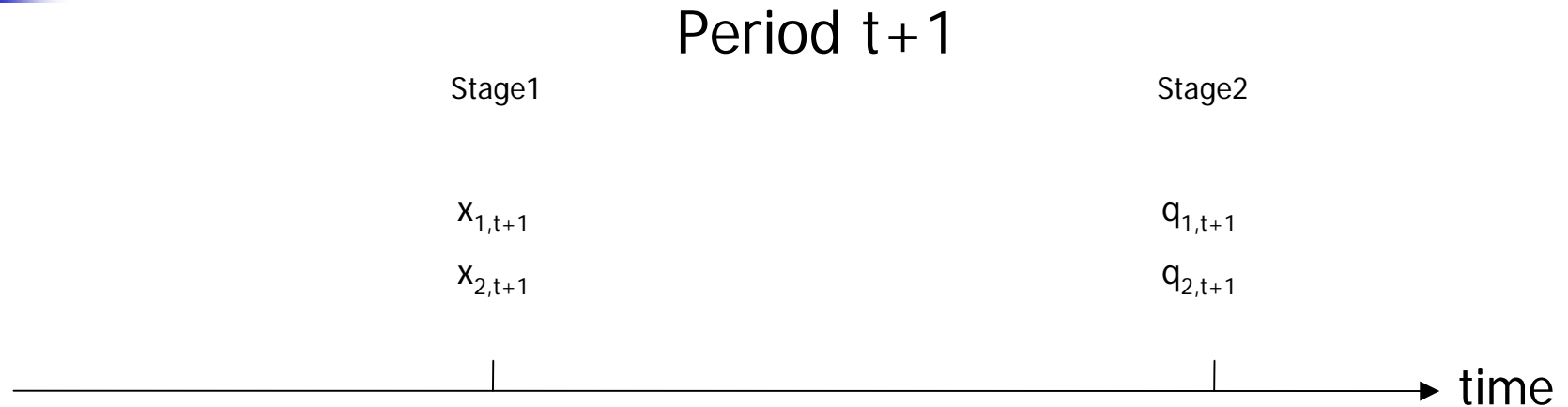


Dynamic versions of a 2-stage game with process innovation (The future)

- Let $p = a - q_1 - q_2$ und $C_k = cq_k$, $k = 1, 2$
- Investment in process innovation x_k :
reduced cost $c - x_k$ with investment costs $rx_k^2/2$
- Determine quantities q_1 and q_2 simultaneously



Dynamic versions of a 2-stage game with process innovation (The future)



How can we capture a dynamic evolution of such a
2-stage game?