## Technology Choice when Delay is Costly

"If later is better than never, is sooner better than later?"





$\nwarrow$ The issue: Should you wait to deploy a better/cheaper technology later?
$\nwarrow$ An asymmetric model
$\nwarrow$ A symmetric model
$\nwarrow$ An example with sensitivity analysis
$\nwarrow$ Conclusions

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「 In 1965 Gordon Moore (Intel cofounder) noticed that microchip capacity doubled each year!
$\mathbb{\pi}$ The pace of change has slowed down a bit over the past few years: doubling occurs "only" every 18 months.

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$\mathbb{\pi}$ A current technology exists and can be deployed now
$\nwarrow$ A new (better/cheaper) technology is on the near horizon
« The new technology may or may not become commercially deployable
$\nwarrow$ If you deploy the current technology now, then there is a cost to switch to the new technology later

К If you wait for the new technology, then your competitive position may be threatened, and you miss revenue from deploying the current technology
$\nwarrow$ You have opportunities in several markets
$\nwarrow$ Examples: digital video on cable, cable telephony, high speed internet access over cable, ...

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$\nwarrow$ Asymmetric tree
$\nwarrow$ Cumbersome to generate tree with more markets and/or time periods, e.g., 4 markets $=>16$ branches at first decision node
$\kappa$ Resolution:
$\boldsymbol{\Sigma}$ allow for choice of any technology
whenever it is available
$\boldsymbol{\pi}$ impose a switching cost if an earlier technology choice is superceded
$\boldsymbol{\pi}$ tree becomes symmetric, and is generated automatically by software

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$\nwarrow$ Customer attrition occurs if you do not deploy current technology immediately
$\nwarrow$ New technology will not succeed unless at least one town waits for it
$\nwarrow$ Benefit is per person
$\nwarrow$ Annuity multiple is for payoffs in period 1

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$\nwarrow$ Size of the benefit of the new technology
$\nwarrow$ Chance that the new technology will become deployable
$\kappa$ Cost of delay: lost revenue, lost customers
$\nwarrow$ Switching cost: from current to new technology
$\nwarrow$ Relative market sizes
$\nwarrow$ Influence of the deployment decision on
$\boldsymbol{\pi}$ the development of new technology
$\boldsymbol{\pi}$ technology choices of other firms (scale economies for vendors)

К Technology choice involves a trade-off between

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\begin{aligned}
& \mathbb{\pi} \text { benefits of a better technology later } \\
& \mathbb{\Omega} \text { benefits of an immediate market presence }
\end{aligned}
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$\nwarrow$ A deployment decision can influence the development of new technology
$\nwarrow$ Can simplify modeling by allowing for switching between technologies, even though it may not be optimal to switch
$\nwarrow$ "The wireless music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?" David Sarnoff's associates in response to his urgings for investment in radio in the 1920s.

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$\pi$ Population: smalltown $=30$, bigtown $=90$
$\mathbb{\wedge}$ Current benefit $\$ /$ sub $=5$
$\nwarrow$ New benefit $\$ /$ sub: base case $\$ 8$, high $\$ 12$, low \$5
$\nwarrow$ New technology success probability:
$\boldsymbol{\aleph} \mathbf{6 0 \%}$ if at least 1 market waits
$\boldsymbol{\Omega} 0 \%$ if neither market waits
$\nwarrow$ Attrition $=10 \%$ (reduction in period 1 subs due to waiting)
$\nwarrow$ Annuity multiple $=10$ (multiple for period 1 payoffs)
$\nwarrow$ Switching cost $=\$ 2000$

