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Technological Change and (Health) Insurance

Peter Zweifel

Plan of the Presentation

1. Introduction and motivation
2. The impact of general innovation on health insurance
3. Technological change in medicine and its impact on insurance in general
4. Technological change in medicine and its impact on health insurance
5. The impact of general insurance on general technological change

Plan of the Presentation (cont'd)

6. The impact of general insurance on technological change in medicine
7. The impact of health insurance on general innovation
8. The impact of health insurance on technological change in medicine
9. Concluding remarks

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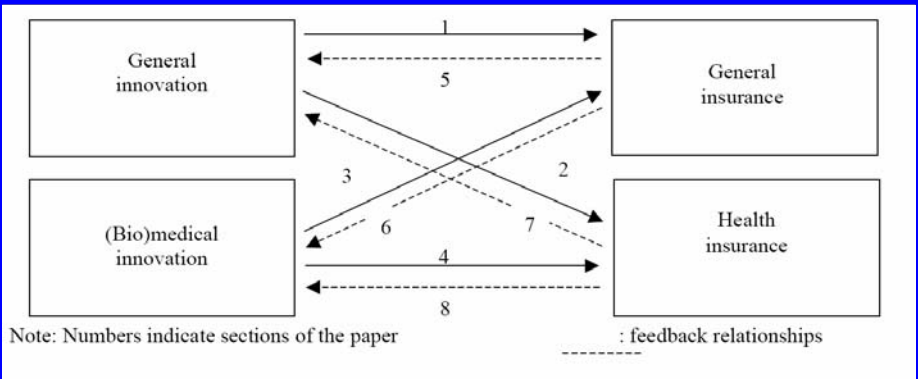
1. Introduction and Motivation I

- Dual causal link: Innovation impacts on the insurance industry; insurance coverage encourages innovation
- Figure 1: Relationships between innovation and insurance



1. Introduction and Motivation II

- Giarini and Stahel (1993) discuss the impact of innovation on insurance
- Increased vulnerability of society caused by finer division of labor (induced by process innovation)
- Product innovation may pose risks to consumers; increased demand for liability insurance
- Conclusion 1:

  Both types of innovation, process and product innovation, may trigger demand for several types of insurance.

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2. The impact of general innovation on health insurance

- Process innovation: Has mainly reduced the risks at the workplace
- Product innovation: May pose health risks
- Both types cause incomes to increase, also in retirement
- Current systems of collective provision for old age have a spillover effect on health insurance

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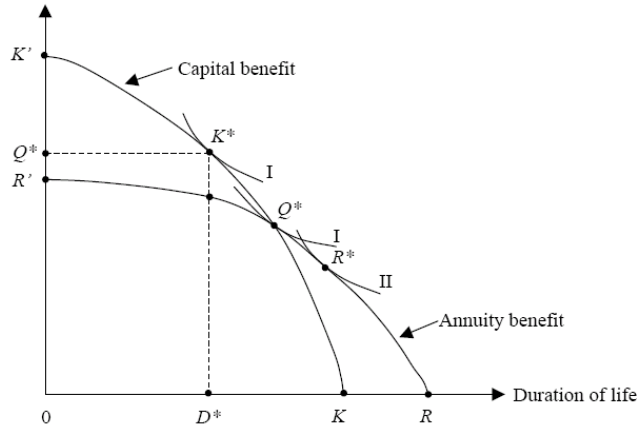
2. The impact of general innovation on health insurance II

Figure 2: Trade-offs between quality and duration of life



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2. The impact of general innovation on health insurance III

- If a capital were paid out, there would be a marked tradeoff between quality and duration of life
- If a pension benefit is paid, beneficaries must live on if they are to obtain one more year's work of pension income (Philipson and Becker, 1998)
- There is a point Q^* that can be reached by both type I (interested in quality) and II (interested in duration) give a capital benefit

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2. The impact of general innovation on health insurance IV

- But type II is predicted to move to a point that contains more duration if the alternative 'annuity benefit' becomes available
- Conclusion 2:

  General innovation both of the product and the process type has both a direct and an indirect effect on health insurance. The direct one is due to possible health effects of innovation, while the indirect one works through a heightened interest in long life induced by collective provision for old age.

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3. Technological change in medicine and its impact on insurance in general I

- Innovation in medicine increases longevity
- Individuals may work longer and be more active in general
- This induces more demand for insurance
- But: Demanders of insurance are a biased selection who have more accidents and sinisters
- This adverse selection is a challenge to (competitive) health insurers

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3. Technological change in medicine and its impact on insurance in general II

- (Bio)medical innovation contributes also to the 'medicalization' of the 'production of health'!
- This puts pressure on public budgets (medical education, hospitals). Infrastructure may be cut back ➡ demand for insurance (liability, building) decreases.
- Conclusion 3:

  Innovation in medicine has effects on insurance in general which however typically are of the indirect type.

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4. Technological change in medicine and its impact on health insurance I

- Given: Innovation in medicine of the product innovation type
- How demand for treatment alternative (usually more costly) and health insurance
- However each additional product is the source of moral hazard

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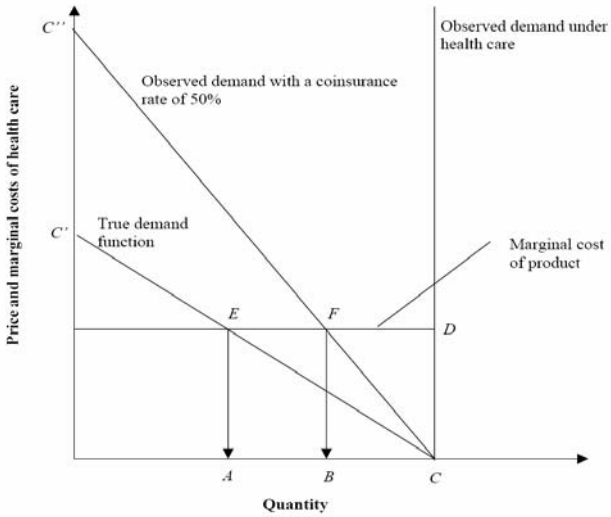
4. Technological change in medicine and its impact on health insurance II

Figure 3: The ex-post moral hazard effect of health insurance



4. Technological change in medicine and its impact on health insurance III

- With a rate of coinsurance of 50 percent (say), maximum WTP doubles
- Rotation upward of entire demand curve
- This is true of each product that is covered by health insurance
- Price elasticity of demand is crucial
- Conclusion 4:

  Innovation in medicine, being mainly of the product innovation type, causes the demand for health insurance to increase but also aggravates ex-post moral hazard.

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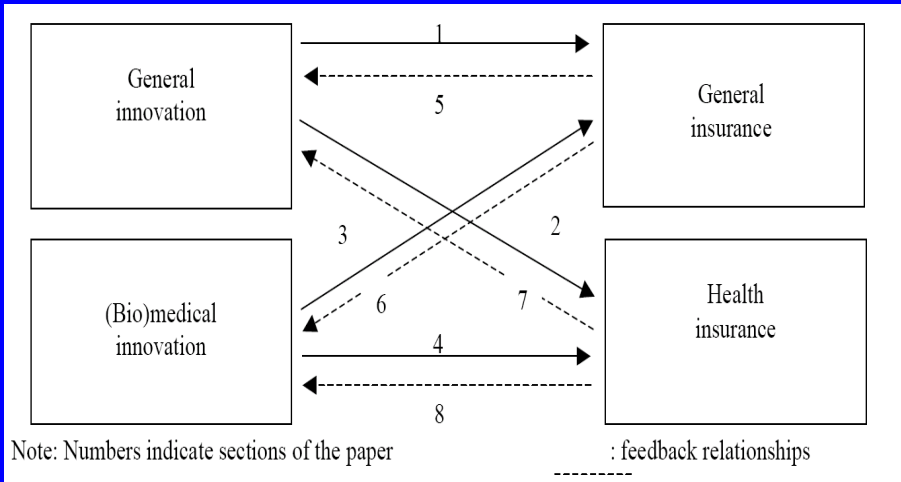
5. The impact of general insurance on general techological change

- Figure 1 (see also slide 4):



5. The impact of general insurance on general technological change II

- Example:
- Launch of a biomedical innovation costing $ 480 mn. (Grabowski et al., 2002)
- With probability p_1=0.9, there are no liability cases, and given success/no liability (q_1=0.656), the present value of returns is $ 1,850 mn. (Gabrowski et al., 2002)
- However, let there be a probability p_2=0.095 of 1 to 10 liability cases costing $ 100mn. each (expected value, $ 500mn.), causing returns to drop to $ 1,350 mn.
- Also, will p_3 =0.05, there are 10 to 100 liability cases, causing returns to drop $ -5,550 mn.

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5. The impact of general insurance on general technological change III

- Example (cont'd):
- But the innovator could have bought liability insurance of the stop loss type
- The image loss worth $ 1,850 mn. (assumption) is non-insurable, and the first 10 claims must be borne by the innovator
- The actuarially fair premium then is $ 27.75 mn. (=11+100)/2· 100 mn.· 0.005)
- If the innovator has liability insurance, returns are still $ 1,272mn. in present value rather than $ -5,550 mn.

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5. The impact of general insurance on general technological change IV

- Example (cont'd):
- Alternative: invest in securities; at 6 percent real interest, this has present value (20 years) of $ 1,540 mn., discounted at 3 percent, $ 852mn.
- With favorable economic development (r_1=0.25) this becomes $ 1,788mn., with unfavorable development (r_2=0.35), $ 582mn.
- Figure 4 (next slide)

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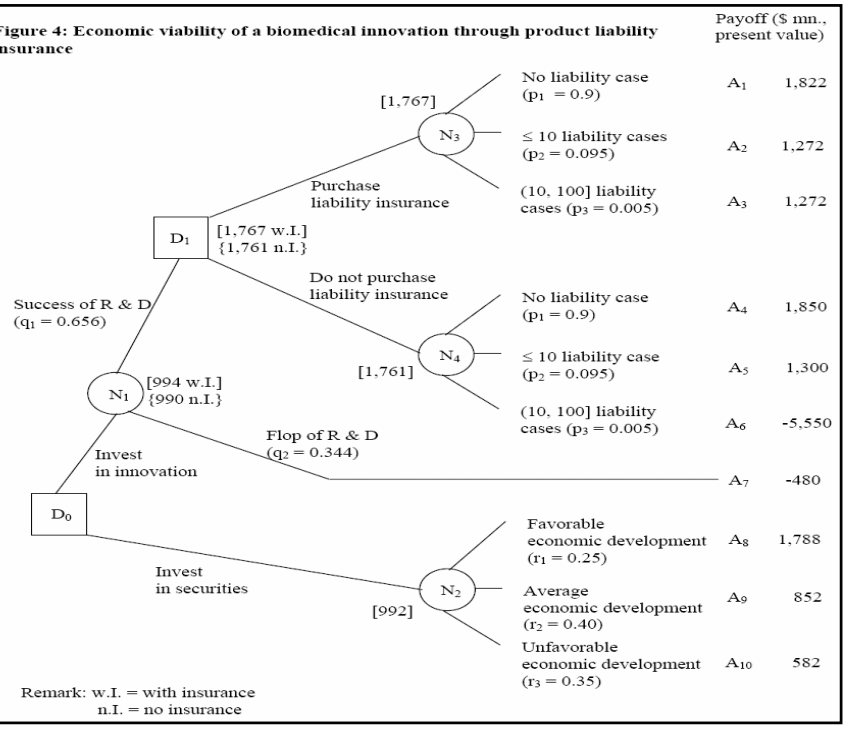
Figure 4: Economic viability of a biomedical innovation through product liability insurance



5. The impact of general insurance on general technological change V

- Example (cont'd):
- The estimate of success q_1=0.656 reflects that only 1 out of 7 innovations is successful in the pharmaceutical industry (Hansen, 1979; but see more favorable estimates by DiMasi et al., 2002)
- Through backward induction, one obtains the following present values:

  $ 994 mn. for {R&D, insurance}

  $ 990 mn. for {R&D, no insurance}

  $992 mn. For {invest in securities}
- Thus, the availability of liability insurance tips the balance in favor of the innovation

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5. The impact of general insurance on general technological change VI

- Insurance also has an influence on the mix of product innovation (i) and process innovation (e)
- Model of innovating firm:

$$\max_{i,s} E\Pi = \pi\{Y(i) - C(e)\} + (1-\pi)\{\overline{Y} + I(i) - C(e)\} - P(\lambda, i, e) - i - e.$$

- π: probability of success
- i: innovative effort (at the price of 1)
- Y(i): revenue if success
- λ : loading contained in premium
- *C*: production cost
- *e*: cost reducing effort
- *I*: insurance benefit
- *P*: insurance premium

5. The impact of general insurance on general technological change VII

- Comparative statics yields the predictives,
- $di/d\lambda < 0$ almost always: If insurance becomes available or less costly ($d\lambda < 0$), product innovation benefits
- $de/d\lambda < 0$ only for a subset of firms for which Y(i) is not very large: process innovation **may benefit** from insurance

6. The impact of general insurance on technological change in medicine

- Biomedical innovation is often of the 'breakthrough' type
- It creates a product with a unique new attribute but is weaker in some existing attribute
- However, authorities tend to require an innovation to dominate on all attributes
- This makes biomedical innovation especially risky
- Environmental impairement liability insurance (e.g.) may facilitate innovation in this situation

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7. The impact of health insurance on general innovation

- Hardly ever researched topic!
- However, a beneficial effect is likely
- Innovation often driven by individuals who would not dare to be independent workers without health insurance coverage
- This could be another instance of 'benign moral hazard' (Pauly and Held, 1990)
- Conclusion 7:
- Health insurance may well have an accelerating effect on innovation in general, although the magnitude of its effect is unknown.

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8. The impact of health insurance on technological change in medicine I

- Health insurance imparts a bias in favor of product innovation rather than process innovation
- Recall predictions of the model, $di/d\lambda$ and $de/d\lambda$
- However, a product innovation may even be cost-saving to the insured patient

- Example:
- Let the time needed to administer a drug drop from 1 hr. a week to 0.5 hr., thanks to a product innovation

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8. The impact of health insurance on technological change in medicine II

- Table 1: Biomedical innovation and effective cost to the insured

Existing product	**U.S.$**
Willingness to pay of insured (assumed)	60
Maximum price of product on the market (assumed rate of coinsurance 10 per cent	200
Time cost to patient (assumed 1 hour at U.S.$ 30)	30
Total effective cost to patient	*50*
Product innovation	
Maximum willingness to pay of insured (assumed)	80
Maximum price of product on the market (assumed rate of coinsurance of 10 per cent)	250
Time cost to patient (assumed 0.5 hour at U.S.$ 30)	15
Total effective cost to patient	*40*

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8. The impact of health insurance on technological change in medicine III

- The example may explain why health insurers are nervous about product innovation in medicine
- The total effective cost to patients drops, enhancing demand for the innovation
- Due to higher willingness to pay of patients, the innovation has a higher price
- For the insurer, the net price of the product increases (from $ 180 to $ 225 in the example)

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9. Concluding Remarks

- Basic hypothesis: Insurance encourages especially product innovation, but in turn innovation affects insurance
- In particular, health insurers see (bio) medical innovation as a threat to the financial viability of their business
- However, they need to take into account that willingness to pay for product innovation in medicine is high
- Disrete Choice Experiments suggest that waiting for just 3 years to have access to new therapies would have to be compensated by 30 percent of average premium in Switzerland (Zweifel et al., 2006)

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