



International Association for the  
Study of Insurance Economics

# Études et Dossiers

---

Extract from

## Études et Dossiers No. 336

**Technology, Innovation and change in  
Health and Healthcare**

18-19 October 2007  
Geneva

November 2007

**Working Paper Series of  
The Geneva Association**

© Association Internationale pour l'Etude de l'Economie de l'Assurance

The Geneva Association - General Secretariat - 53, route de Malagnou - CH-1208 Geneva  
Tel.: +41-22-707 66 00 - Fax: +41-22-736 75 36 - [secretariat@genevaassociation.org](mailto:secretariat@genevaassociation.org) - [www.genevaassociation.org](http://www.genevaassociation.org)

The Geneva Association Working Paper Series “Études et Dossiers” appear at irregular intervals about 10 - 12 times per year. Distribution is limited.

The “Études et Dossiers” are the working paper series of The Geneva Association. These documents present intermediary or final results of conference proceedings, special reports and research done by The Geneva Association. As they contain work in progress or summaries of conference presentations, the material must not be cited without the express consent of the author in question.

Layout & Distribution: Valéria Kozakova

# Ageing and Pharmaceutical Innovations

Roland Eisen

## Ageing and Pharmaceutical Innovations

- 1. Motivation
- 2. The Process of Innovating
- 3. Hypotheses
- 4. Econometric Model: Data Base & Estimators
- 5. Some Results
- 6. Conclusions

## Ageing and Pharmaceutical Innovations

- 1. Motivation

Relationship between population ageing and pharmaceutical innovations:

- 1) General health conditions of the elderly,
- 2) remaining life expectancy,
- 3) Substitution between surgical invasion and pharmaceuticals.

## Ageing and Pharmaceutical Innovations

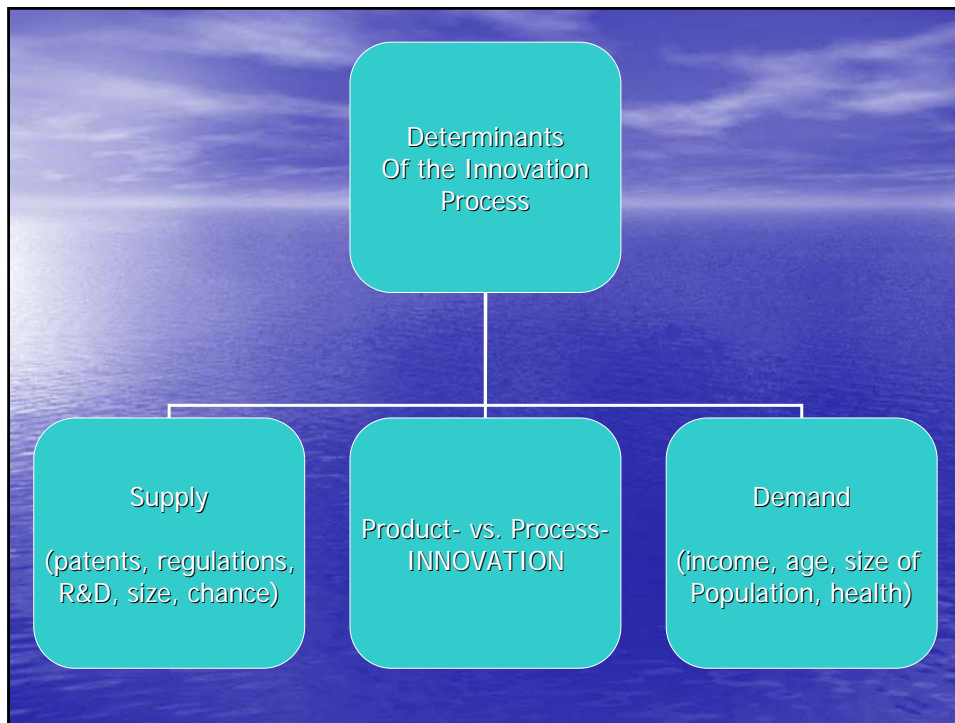
- 2. The Process of Innovating

J. Schumpeter's „Process of creational destruction“ :

(1) „New combination“ of production factors and products (product innovations) as well as new production methods (process innovations)

(2) what is new and (3) market aspects.

Invention – innovation - imitation



### Ageing and pharmaceutical innovations

- „induced“ technical progress:
- „factor-price induced“ tp relates to process innovations, however in pharmaceutical research
- Product innovations.
- Rate of return or profits determined by demand or willingness to pay.
- And then we are back to the relationship between health (or drug) expenditures and age.

## Ageing and Pharmaceutical Innovations

- 3. Hypotheses

1st Hypothesis:

- If the share of 65+ and the remaining life expectancy increase, then the share of pharmaceutical expenditures will increase.

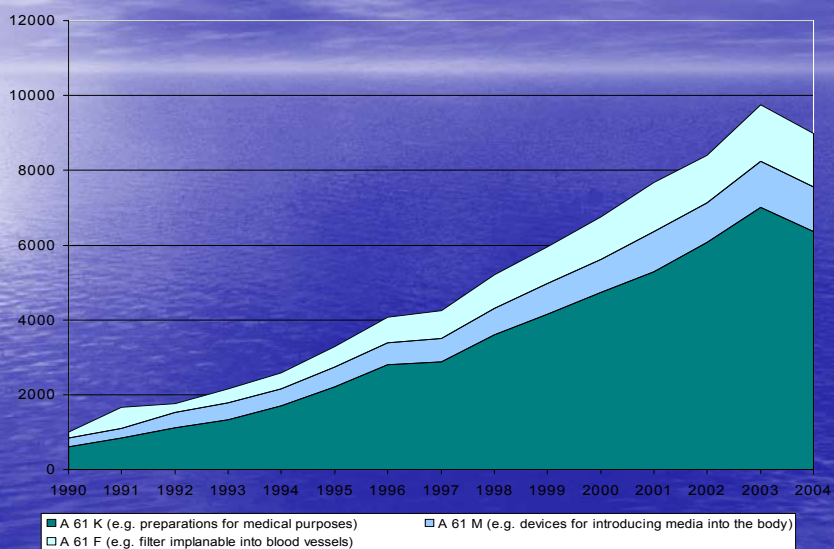
2nd Hypothesis:

- R&D expenditures increase if the share of 65+ and the remaining life expectancy increase.

3rd Hypothesis:

- Pharmaceutical innovations (patents) increase if R&D expenditures, the share of 65+, and remaining life expectancy increase.

## Medical Patent Applications in the 30 EPC Member States



## Ageing and pharmaceutical innovations

- 4. Econometric Model: Data Base and Estimators
- Date Base  
OECD Health Data 2005  
European Patent Office – Annual Report 2004  
Panel Data for 7 Countries  
(Australia, Canada, Finland, France, Germany, Japan, USA)  
Period of 11 years (1991 – 2001)
- We applied three different methods (OLS, fixed effects and ) First-differenced GMM.

## First-differenced GMM Estimations

<i>Endogenous Regressor</i>	H1	H2	H3.1	H3.2
HCE <sub>t-1</sub>	1.024***			
HCE <sub>t-2</sub>	- 0.408***			
DRUG <sub>t-1</sub>		0.646***		
DRUG <sub>t-2</sub>		- 0.017		
PATENT <sub>t-1</sub>			0.451***	0.421***
PATENT <sub>t-2</sub>			0.297***	0.250**
<i>Predetermined Var.</i>				
Δ PHARM_R&D	- 0.002**	0.005*	0.166*	0.259**
PHARM_R&D <sub>t-1</sub>			- 0.293**	- 0.315***
<i>Regressor</i>				
ΔPOP65	0.005***	0.018**		
Δ LIFEXP65			0.018***	- 0.007
Δ DOC	0.010*	- 0.024**		
Δ GDP				0.006*

## Ageing and pharmaceutical innovations

- Conclusions:
  - 1) Our results with respect to HCE and PhE are clear cut: both are highly significantly depending on 65+ and further life expectancy. Interesting is the negative sign of doctoral visits.
  - 2) R&D expenditures depend highly significantly on further life expectancy (of women).
  - 3) Patent development is highly significant depending on further life expectancy and on the R%D expenditures.

## Ageing and pharmaceutical innovations

- Some critical aspects should be mentioned:
  - Different intervals with respect to age,
  - Managed care influences,
  - Patent statistics with respect to „age specific illnesses.