

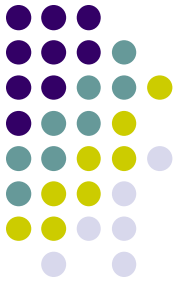
5th EUROPEAN ENERGY FORUM



“New” view on growth theory and
consequences for RI policies

Paul Zagamé – Université Paris 1 & Seureco

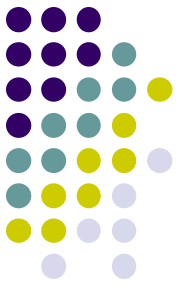
Overview



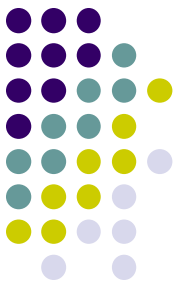
1. “New” view on growth theory
2. Knowledge spillovers
3. Consequences for Research Policies

1. New view on growth theory

1.1 From exogenous to endogenous growth



- ❑ Exogenous growth: impossibility to modify the long term rate of growth whatever be the policy
- ❑ The growth is blocked by decreasing returns and depends only on the (exogenous) labour force increase
- ❑ If non decreasing returns: possibility to increase the growth of accumulative factors (capital, R&D, other intangibles, skills, etc.) then to **endogeneize** long term rate of growth by adequate policies (R&D, human capital, etc.)



1. New view on growth theory

1.2 Knowledge spillovers increase returns

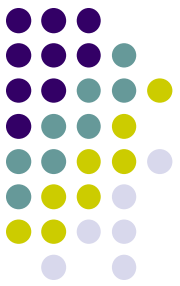
- ❑ P. Romer takes this hypothesis and then starts the endogenous growth theory
- ❑ But how to conciliate the necessity of decreasing returns for the microeconomic equilibrium with these macro non decreasing ones?
- ❑ The brilliant idea of Romer (1990) is to think to the knowledge « externalities » or knowledge « spillovers » or « transfer » : A R&D effort or innovation that appears in a firm gives information to other firms and then increase their productivity
- ❑ Macro economic productivity of research is then superior to private one



1. New view on growth theory

1.3 Three families of new growth theory

- Ha and Howitt (2007) distinguish three families:
 - Fully endogenous (I) Romer (1990), Grossman and Helpman (1991), Aghion and Howitt (1992)
 - Growth is increasing with the level of R&D
 - Semi endogenous growth (exhaustibility of innovations: Jones (1995), Kortum (1997), Segestrom (1998), etc.)
 - Growth is decreasing with the stock of knowledge



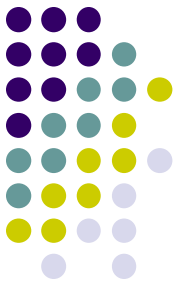
1. New view on growth theory

1.3 Three families of new growth theory

- Fully endogenous growth (II) Schumpeterian (Aghion and Howitt (1998), Thomson (1998), Laincz and Peretto (2006), Barcenilla (2010), etc.
 - Growth depends on intensity of R&D
- In the three families R&D is the sole factor of growth but new extension on other innovation assets: ICT, other intangibles,...
- However we must keep in mind that the knowledge spillovers are in the core of the new theories

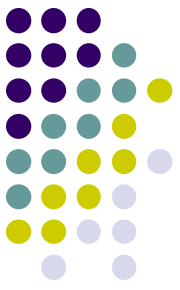
2. Knowledge spillovers

2.1 Characterization



- ❑ Whenever research and innovation appears in a firm there is knowledge transfers to:
 - ❑ Other firms of the sector
 - ❑ Other sectors
 - ❑ Other countries

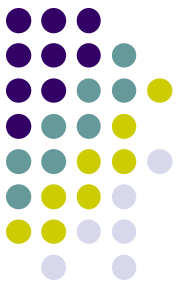
- ❑ These transfers are conveyed by:
 - ❑ Patenting
 - ❑ Conferences, Publications
 - ❑ Network organizations
 - ❑ Workers mobility, etc.



2. Knowledge spillovers

2.2 How to measure knowledge spillovers?

- ❑ General methodology for assessing knowledge flow is patent citations from EPO and USPTO
- ❑ The main idea: the cited patent sends a piece of knowledge to the citing patent and each patent can be assigned to a sector and a country
- ❑ For instance a patent that describes improvement in a steam turbine used to generate electricity is a knowledge transfer from power equipment sector to the electricity generation sector.
- ❑ At the end square matrix with country sector (cf. Belderbos and Mohnen (2013) for the SIMPATIC project)

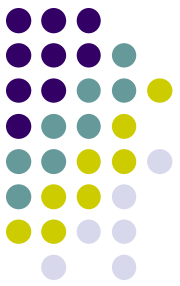


2. Knowledge spillovers

2.3 Some key figures on R&D and knowledge spillovers

Mansfield (1977), Hall Mairesse and Mohnen (2009) based on microeconomic works:

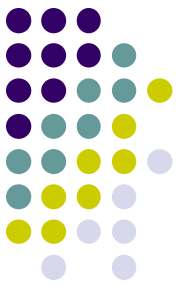
- ❑ The rate of return on private R&D (10-30%) is higher than the return on physical capital
- ❑ When including knowledge spillovers the social rate of return of R&D is twice larger than the private rate (~50%)
- ❑ The cost-benefit analysis of R&D expenditures must include these externalities



3. Consequences for Research Policies

3.1 Needs for research policies

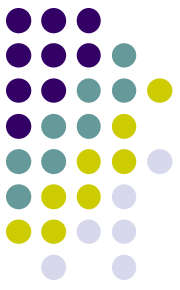
- ❑ All these new ideas and results make economists believe that the level of R&D efforts (~1,9% in EU and ~3% in US) is too low
- ❑ The positive knowledge externalities call for “redressing policies”
 - ❑ Aids and subsidies: tax cut, CIR, National and European grants, structural funds for research, Investissements d’avenir, etc.
- ❑ High risk level of investment in R&D creates difficulties of access to financial markets
 - ❑ New financial instruments to reduce risk:
 - ❑ Risk sharing finance facility (Commission, EIB)
 - ❑ Business Angel
 - ❑ Venture Capital



3. Consequences for Research Policies

3.2 Needs for assessment of research policies

- ❑ Not limited to direct and indirect productivity of research but to the whole socio economic aspects: GDP, employment, revenues, inequalities and even on sustainable development
- ❑ For this reason, assessment will be based on micro economic studies but also on macro models



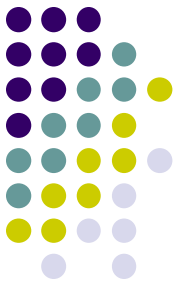
3. Application to Research Policies

3.3 An example: The Barcelona objective of 3% effort

- Two phases
 - 1) Maturation period
 - Inflationary pressure
 - Deficits
 - GDP expenses related (Multiplier effect)
 - Employment above GDP
 - 2) Innovation
 - Competitiveness
 - Internal demand
- Results after 20 years (NEMESIS model):
 - 11% more GDP
 - 10 millions more jobs created

3. Consequences for Research Policies

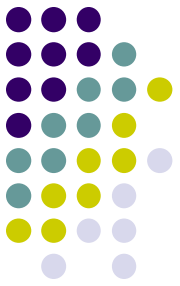
3.4 Conditions for a successful research policy



- Generally simulations give good economic results although it appears some divergences between models' results: R&D policies may create growth and jobs
- However R&D policies may not be successful. It is not due to R&D and innovation properties, that are favourable, but to conditions that prevail at the times of the implementation of policies:
 - Will the public aid be a substitute to private finance for a project that would have been undertaken anyway?
(Crowding-in or “leverage effect)

3. Consequences for Research Policies

3.4 Conditions for a successful research policy



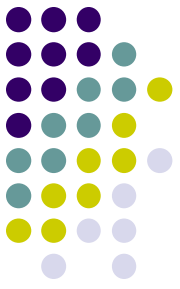
- ❑ Is there enough scientist, engineers very high skilled, to implement extra R&D? If it is not the case, R&D effort will increase the cost of research
- ❑ Are the goods and services market structures adapted to absorb the new products issued from innovation (problem of normalization)
- ❑ Are the financial instruments efficient enough to avert the risk
- ❑ Are the public subsidies allocated with efficiency?
- ❑ Are the other innovation assets (O.I, ICT) adapted to policy

Conclusion

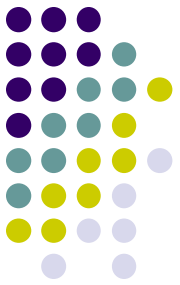


- ❑ The theoretical virtues of R&D investment allowed a “renewal” of growth theories
- ❑ We have seen that the knowledge externalities are in the core of this new vision. These externalities need strong research policies to redress the market failure
- ❑ We have also noticed that the assessments of R&D policies give fairly good macro results
- ❑ But we know also that R&D policies need rather stringent conditions to be successful

Conclusion



- ❑ However, although some areas need very important structural reforms it is vital that these reforms do not prevent the implementation of R&D policies, especially the “deleveraging” must not imply to cut the finance for these policies
- ❑ John and Williams computed in 1998 what would have been the optimal level of research for the US, taking into account knowledge spillovers: more than four times the current level with almost 12% of GDP
- ❑ The future of research is to extend to other innovation factors than R&D such as ICT, competencies, organization, etc.



Thank you for your attention

Paul.zagame@erasme-team.eu