

Macroeconomic Assessment of innovation policies: Sensitive points and new perspectives



PAUL ZAGAME

&

PIERRE LE MOUËL & BORIS LE HIR

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I

Sensitive parameters for the Innovation mechanisms

I.1) R&D decision

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- What R&D investment for 1€ subsidy (direct subsidy, tax credit, interest premium, etc.) Importance for policy assessment and incentive evaluations
- In principle: endogeneously calculated by model
 - ✦ Max. value of firms NEMESIS
 - ✦ Other mechanisms involving households for QUEST: rise in the demand for patents and increase in R&D
- But this is too simple and mechanical:
 - ✦ Role of risk? Of institution? The econometric works show that the source and the way of financing matters a lot on R&D decision.
- The role of other policies - for instance ERA

I.1) R&D decision

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- What is important here is that all measures that modify the productivity of research either directly or indirectly (for instance by enhancing spillovers) will modify leverage effect
- For all these reasons, the endogenous leverage effect is very often « disconnected » and introduced exogenously in the model:
 - ✦ Either based on results of econometric studies: Hall and Tool (2000); Van Pottelsberghe (2003); Aerts and Schmidt (2009);
 - ✦ Or based on experts groups: ERA (2014) for instance
- The organization of research is very important for instance for an European action that enhances spillovers and transfer of best practices the additionality is more important. (cf ERA, FP, H2020)
- The origin of incentive is also important
- Works in the framework of Simpatic: different papers of Czarnitzki, Huergo, Köhler, Mohnen, Pacher, Takalo and Toivanen (Simpatic Project 2015; several paper)

I.2) Knowledge spillovers

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- Intersectoral and international spillovers
 - ✦ The evaluation of these spillovers had been improved by DEMETER project (Meijers and Verspagen 2010)
 - ✦ The primary mechanism for assessing technology (or knowledge) flows are patent citations from EPO and USPTO
 - ✦ The main idea is that cited sends a piece of knowledge to the citing patent and that each patent can be assigned to a sector and a country
 - ✦ The result is a square matrix with country-sector combinations in the rows and the columns

I.2) Knowledge spillovers

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- But needs for further developments:
 - ✦ For instance if we look at the ERA priorities (2) optimal transnational competition (3) open labour market for researchers (5) optimal circulation, access to knowledge and transfer of scientific knowledge: How to translate in terms of knowledge spillovers modifications?
 - ✦ For SIMPATIC a deepening work was achieved by Belderbos and Mohnen (D7.1, 2013)

I.3) Performance of R&D and Knowledge

- Two theoretical references:
 - ✦ Endogenous growth approach: Romer (1990); Aghion & Howitt (1992), etc. ; The rate of growth of productivity depending on the level of R&D
 - ✦ But counterfactual scale effect and proposition of two new scheme:
 - Semi-endogenous growth models: Jones (1995), Kortum (1997) Segerström (1998); an increase in the production fo new idea (R&D) will not increase long term growth rate of TFP
 - New fully endogenous growth (Aghion & Howitt, 1998), Peretto (1998): the long term rate of growth of productivity depends on the research intensity R/Y . Several econometric works confirm this second reference: Zachariodis (2003); Laincz and Peretto (2004), Ha & Howitt (2005). Since other works are more ambiguous: Madsen (2008).
 - ✦ For the models, GEM E3 and QUEST uses a semi endogenous approach and NEMESIS and RHOMOLO an endogenous one

I.3) Performance of R&D and knowledge

- Calibration and data collections

- ✦ The calibration uses the different works by Hall, Mairesse & Mohnen in Handbook of the economics of innovation (Hall & Rosenberg 2010):

- HALL, Bronwyn, Jacques MAIRESSE and Pierre MOHNEN, « Measuring the returns to R&D », in the Handbook of the Economics of Innovation, B. H. Hall and N. Rosenberg (editors), Elsevier, Amsterdam, 2010, 1034-1082.

MAIRESSE, Jacques and Pierre MOHNEN, « Using innovation surveys for econometric analysis », in the Handbook of the Economics of Innovation, B. H. Hall and N. Rosenberg (editors), Elsevier, Amsterdam, 2010, 1130-1155

- ✦ The link between productivity gains and level of R&D intensity is an “ex-ante” lack; at the end, the rate of growth of the economy will depend on all the economic feed backs

II

Macroeconomic Feedbacks

II.)

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- At the end, the internal demand and competitiveness will be enhanced by:
 - ✦ Process innovation (price decrease)
 - ✦ Product innovation (quality for NEMESIS, variety for QUEST)
- All that jeopardizes these effects will induce a diminution of macroeconomic performance. It is the case for “inflationary pressures”. Several mechanisms can be at the origin of inflationary pressures; but two are more important:
 - ✦ Labour market and especially for high skilled
 - ✦ Financing of R&D expenditures

II.1) Labour market

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- The rigidity of high skilled supply can at first make to vanish the R&D efforts in wage increase and then to engage inflationary pressures.
- In NEMESIS in former studies were adopted a fairly elastic supply of skilled labour supply. Some prospective studies NEUJOBS (02014) adopt the same hypothesis?. Even in some “normative studies” (Barcelona objectives, BreCARD et al. 2006) the availability of researchers was total: the assessment was: if we increase R&D effort up to 3% what would be the results in terms of competitiveness, growth, employment and what would be the need for high skilled?
- A contrario in QUEST, like in the canonical model the high skilled labour supply is rigid (fixed). More high skilled for research means less for other sectors: in the short run the GDP may decrease. If supply of high skilled is increased, the GDP decrease vanishes.

II.1) Labour market

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- This hypothesis on the labour market is a main source of divergences between the different assessments: cf Roeger et al. (2008, 2013) or Veugelers (2014)
 - ✦ In case of flexibility of supply with QUEST the increase in productivity growth is twice more than with rigidities.
 - ✦ At the end, the long term diagnosis will depend on the comparison between labour productivity gains and the real wage rate increase (due to unemployment fall)
 - ✦ A main challenge for assessment of R&D policies to link this elasticity to educational policies; for instance the link with some objectives of ERA priorities such as PhD students, open labour market for researcher (priority (3)), etc.

II.2) Financing R&D

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- The way of financing R&D is important on the macroeconomic results according to the inflationary consequences of this financing
- In NEMESIS, the public research effort and the subsidies are financed by tax increase (on households or firms). The Private R&D increase production cost and then prices.
- In QUEST the subsidies are financed by taxation and the households support directly the cost of private research
- Simulation tests that we have implemented in NEMESIS and showed the sensitiveness of results to the way of financing
- Challenge: to take into account more precisely the financing conditions (risk, institution, etc.) (Ex. RSFF)

II.3) Lags: three periods for macrodynamics

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- From incentives to R&D
- From R&D to knowledge
- From knowledge to innovation
- From Innovation to economic performance

- Several estimation of the lags: very heterogenous

- In Simpatic the study by Mairesse and Mulkey gives some result on the lag from incentives to R&D expenditures

II.3) Lags: three periods for macrodynamics

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- First phase: R&D expenditures
 - ✦ Finance + labour market for high skilled + lags = inflationary pressures without innovation : External deficits, low GDP increase eventually decrease if too much rigidity
- Second phase: Innovation
 - ✦ Productivity growth, competitiveness, GDP growth employment
- Third period: toward the long run
 - ✦ If semi endogenous growth: the TFP gains will converge asymptotically
 - ✦ If full endogenous growth: Theoretically the productivity growth is ex-ante maintained at a level depending on the increase in R&D effort. But macroeconomic feedbacks and mainly labour market incurve the rate of growth

III

New perspectives

III.1) the importance of extending the innovation concept

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- Several important works of SIMPATIC on
 - ✦ Social innovation, social capital (Sessa 2013)
 - ✦ Inequality indicators (Bossier and Melon 2014)
 - ✦ Role of services in innovation (Metka and Damijan 2014)
- All these works pay attention to the extension of innovation up to non technological one.
 - ✦ The role of social capital and social innovation in productivity gains and growth
 - ✦ The role of Services in innovation productivity and growth
 - ✦ Baumol's disease

III.2) New conceptual approaches and data

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- The role of R&D but also of the intangibles through organizational capital; computerized information (Corrado, Hulten and Sichel, 2005, 2006)
- The concept of GPT and intangible spillovers between users of same technology
- Innovation by users increases the incentives for GPT innovators; $ICT = GPT$

III.2) New conceptual approaches and data

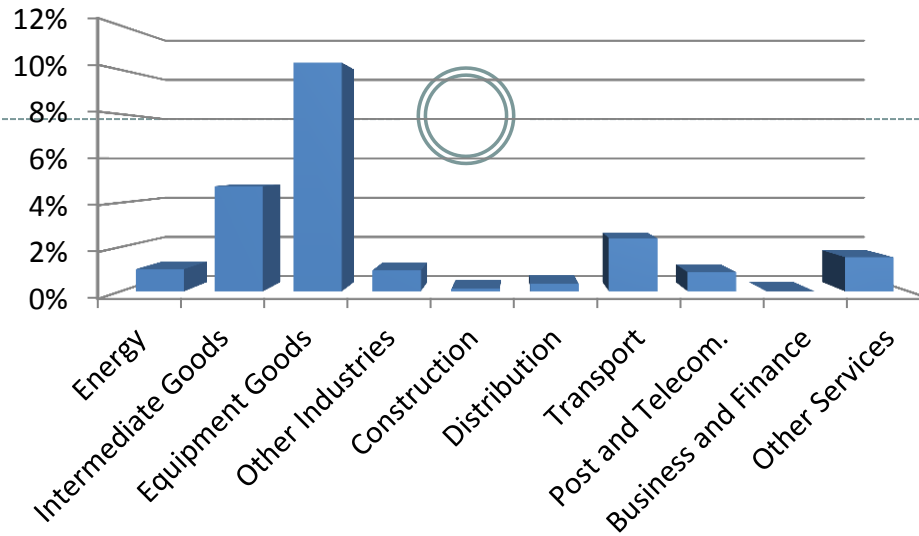
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○ Sources:

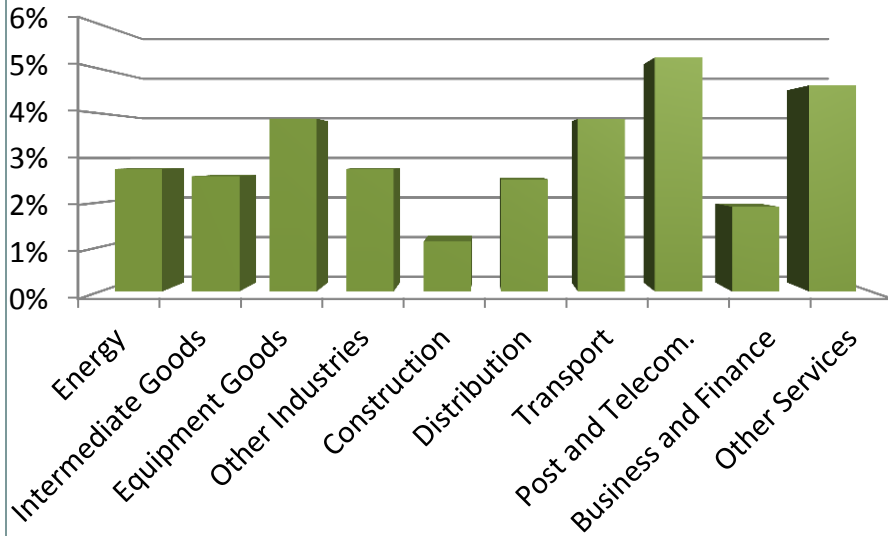
- ✦ R&D: Eurostat, OECD STAN database, INTAN-Invest
- ✦ ICT: IT+CT: EUKLEMS
- ✦ Other Intangibles: INTAN-Invest -- we use only Softwares + Training (Firms specific investment in human capital)
- ✦ Patent citation matrices
 - PATSTAT database
 - OECD technology / sector concordance table

○ Importance of databases such as EUKLEMS and INTAN-Invest

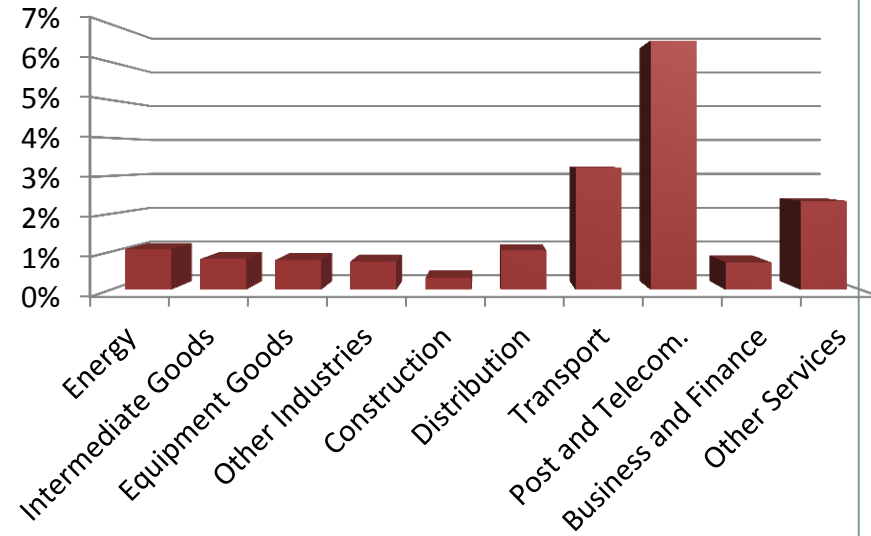
a) Sectoral R&D intensities



b) Sectoral Other Intangibles intensities



c) Sectoral ICT intensities



III.3) Preliminary results with NEMESIS

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- New Input of innovations in NEMESIS model:
 - ✦ R&D
 - ✦ Other Intangibles (Training + Software)
 - ✦ ICT

- Taking into account the strategic complementarities between innovation inputs
 - ✦ Strong ripple effect of ICT on OI and R&D investments
 - ✦ Low ripple effect of R&D on ICT and OI investments

III.3) Preliminary results with NEMESIS

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- Preliminary results: comparison of two policy cases
 - ✦ Scenario 1 : Implementation of the National Action Plan 2014 for R&D
 - +0.6 point of GDP in R&D in Europe at the horizon 2024
 - ✦ Scenario 2: Implementation of a general innovation policy based on NAP and fostering convergence between countries
 - +1 point of GDP in all innovation inputs at the horizon 2024

III.3) Preliminary results with NEMESIS

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- Preliminary results: comparison of two policy cases
 - ✦ Scenario 1 : Implementation of the National Action Plan for R&D
 - Significant positive impacts in the long run
 - +4.4% of GDP in 2045 (+0.2% of GDP growth rate)
 - +2,6 million employments (+1.5 million HS and +1.1 million LS)
 - Three phases:
 - 1st financing R&D: inflationary pressure
 - 2nd Efforts start bearing fruit: improvement of productivity and competitiveness
 - 3rd Convergence to long term path
 - Consistent with previous studies

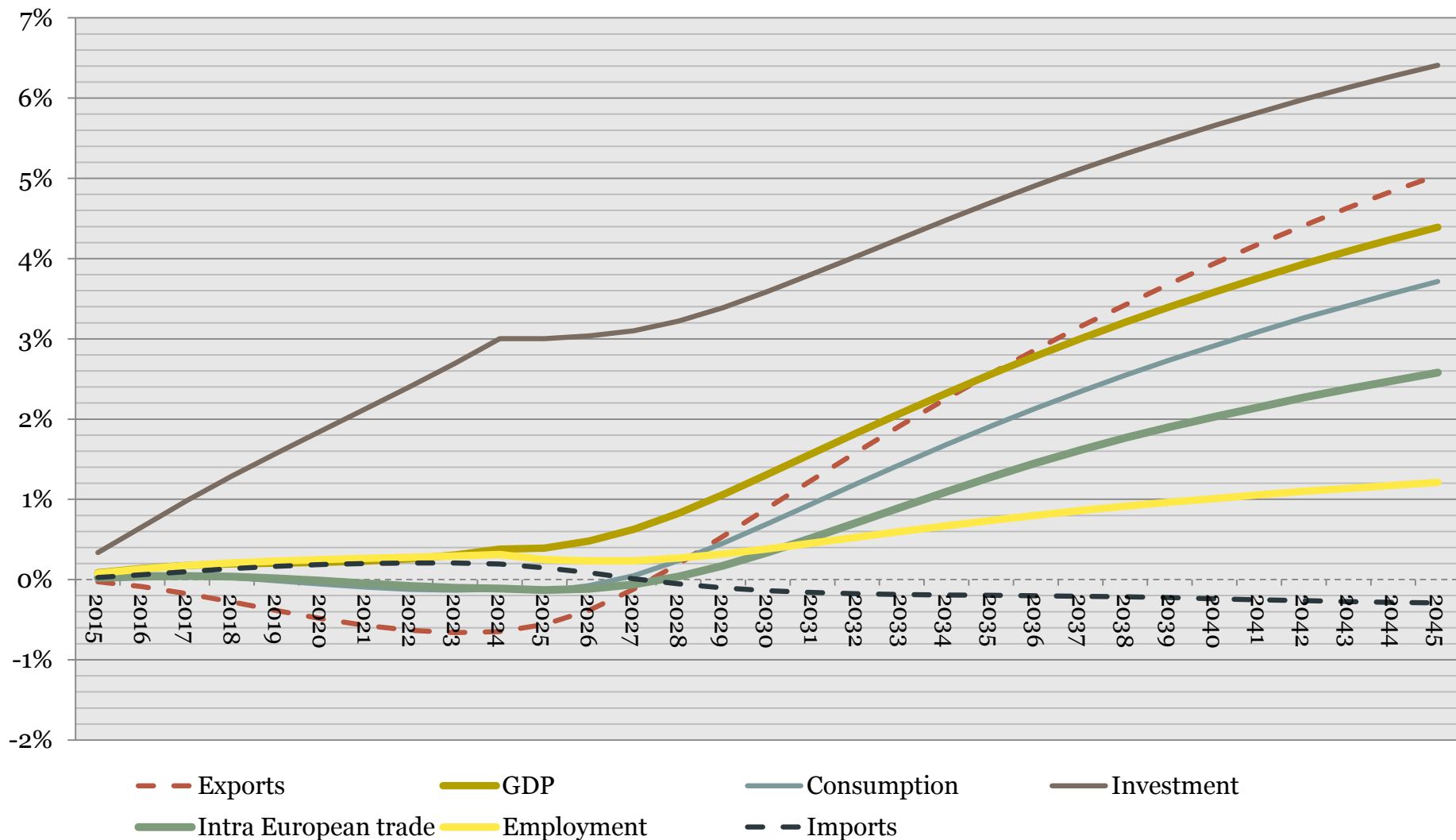
III.3) Preliminary results with NEMESIS

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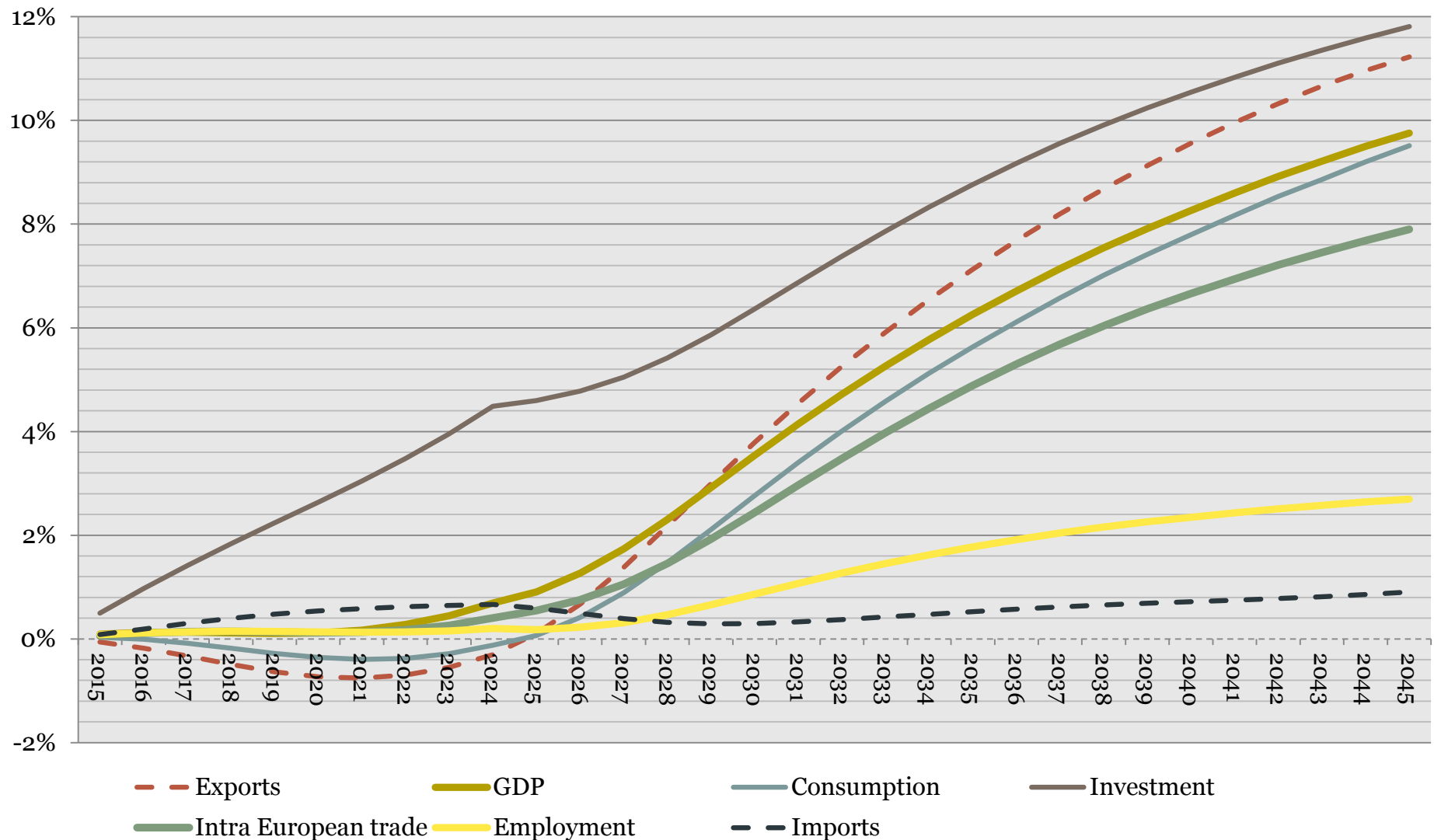
- Preliminary results: comparison of two policy cases
 - ✦ Scenario 2: Implementation of a policy targeting all innovation inputs based on NAP and fostering convergence between countries
 - Higher impact in the long run
 - Three phases again but:
 - Less inflationary pressure in the first phase
 - Evidence of the importance of strategic complementarities
 - More inclusive both for countries and sectors

III.3) Preliminary results: Scenario 1

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III.3) Preliminary results: Scenario 2



III.3) Preliminary results with NEMESIS

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- Main conclusion on policy recommendation issued from our new simulations:
 - ✦ R&D investments are always a major factor explaining the TFP growth and, investment policies are important for competitiveness, growth and employment
 - ✦ The way to increase the incentives of R&D policies is to accompany them by measures favourable to ICT and Intangibles development. In addition, these measures would also enhance R&D efficiency

Conclusion

Conclusion

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- Substantial works have been done on R&D decision, additionally, knowledge spillovers, decision lags; on new views on innovation, extending innovation to social, intangibles and services. The approach allows also to encompass the ICT and then all the components of the new accounting for growth are now included in the NEMESIS model.
- But great uncertainties remain and claim for a systematic sensitivity analysis
- The big challenges for modelling will be to adapt the mechanisms of the model to European and National policies. How ERA will modify spillovers? How will it change the supply for high skilled? Etc.

Conclusion

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- These challenges can be taken up if a certain continuity is reached to maintain the necessary databases (ERA survey EUKLEMS, INTAN-Invest) and the models, databases and models representing the “infrastructures” of assessment
- In spite of the needs for improvements and these risky challenges, nowadays, thanks to the different programs, EUKLEMS, INTAN-Invest DEMETER ,SIMPATIC, we have figures for assessment of research policies that can give rise to discussions to shed light on Euro 2020 Strategies and to give a contribution to the current debate on deleveraging.