

# FORESIGHT WITH QUANTITATIVE MODELLING

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# FORESIGHT WITH QUANTITATIVE MODELLING

- Foresight covers the whole complexity of society
- Quantitative modelling gives a restricted view but is more operational (D.Rossetti)
- The aim of this paper is to show that it is possible to make foresight with quantitative modelling
- With an exemple on foresight for R&D

# FORESIGHT WITH QUANTITATIVE MODELLING

- ❑ From classical Use of Modelling to Foresight
- ❑ The NEMESIS Model
- ❑ Foresight for R&D during Crisis and beyond

# 1-From classical Use to Foresight

## □ 1.1-Classical Use for Models

### □ **First use: the B.A.U. (Business as Usual)**

□ Projection of past trends of drivers or exogenous variables

□ Policy variables

□ International

□ In order to reveal the opportunities, the difficulties and the challenges

□ To make a reference Scenario

**Ex: G.H.G. emissions, competitiveness, Growth, employment**

# 1-From classical Use to Foresight

## □ 1.1-Classical Use for Models

### □ **Second uses: variants simulations**

□ Modification of exogenous variables and comparison of New Scenario to B.A.U.

□ Policy assesment : taxation; subsidies, public expenditures...

□ International variations: price of oil, world growth

# 1-From classical Use to Foresight

- ❑ 1.2-Widening of Use and Foresight:
  - ❑ First widening: Break-through scenarios
    - ❑ Break-through on exogenous drivers:
      - ❑ Radical modification of policies
      - ❑ International shocks or radical evolution of Economic Area
    - ❑ Modifications of Behaviour (relationship)
      - ❑ Consumption
      - ❑ Investment
      - ❑ Supply of labour

# 1-From classical Use to Foresight

## □ 1.2-Widening of Use and Foresight

### □ **Second widening: goal seeking**

- To make an endogenous variable (growth, employment, R&D) exogenous i.e, « a priori » determined
- Easier use with a specific algorithm that chooses the group of exogenous variables that must be determined endogenously

# 1-From classical Use to Foresight

## □ 1.2-Widening of Use and Foresight

### □ **Second widening: goal seeking**

□ Allows normative policy simulations:

**Ex if we reach 3% RTD Barcelona Objective, what are the economic consequences?**

□ May also determine economic instruments (exogenous variables) that lead to the goal



# 1-From classical Use to Foresight

## □ 1.2-Widening of Use and Foresight

### □ **Second widening: goal seeking**

- Allows to put in an interactive way experts views on endogenous variables

Ex: for a sectoral Model (NEMESIS)

- Metal products
- Transports equipment
- Expert views can be transformed in a coherent system of quantitative data

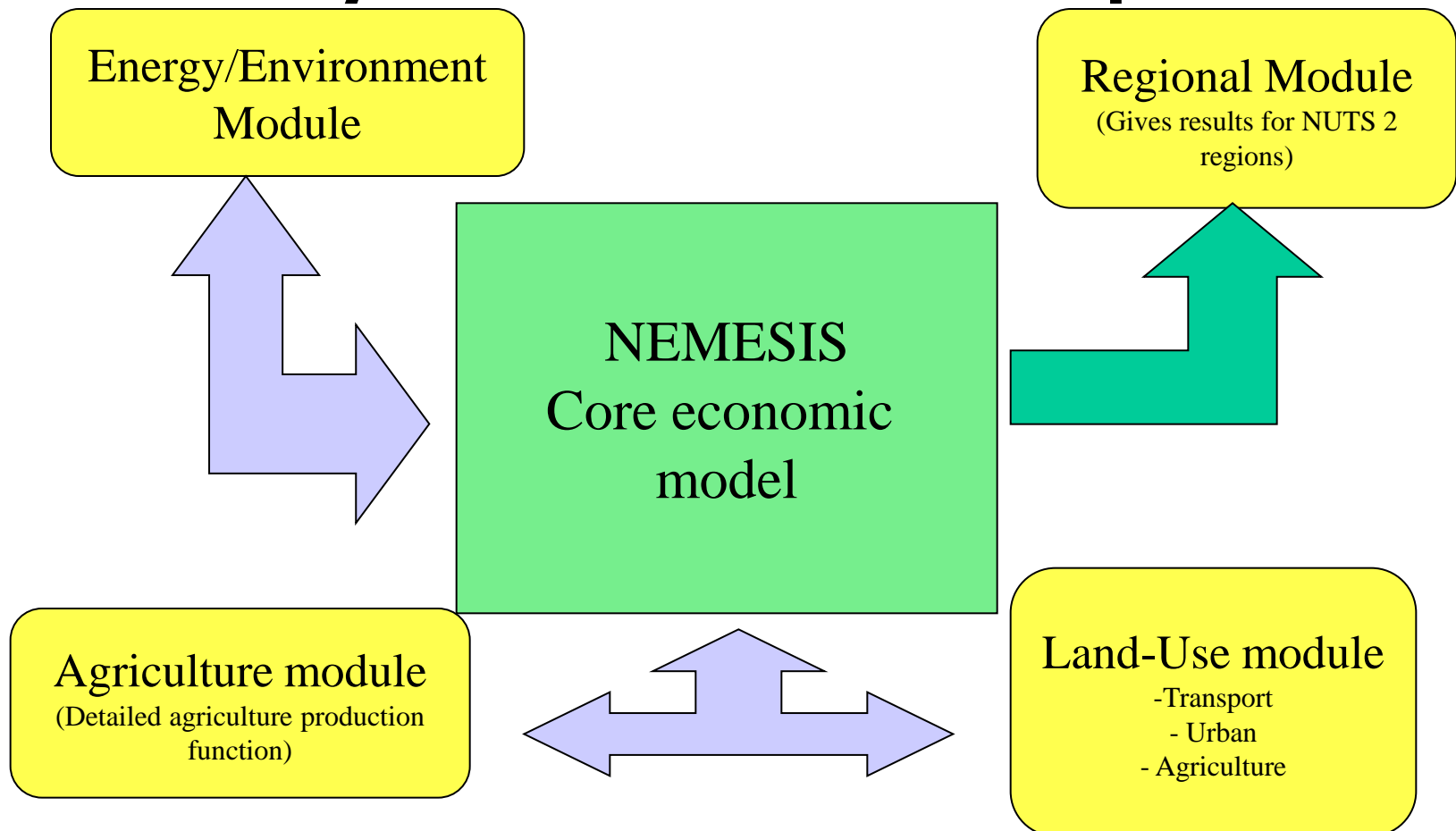
# 1-From classical Use to Foresight

- ❑ 1.2-Widening of Use and Foresight
  - ❑ The widening of Models allows to make true Foresight
  - ❑ Qualitative Foresight is unavoidable to imagine new scenarios, new behaviours for economic agents
  - ❑ Modelling is necessary to give coherency to these new views
  - ❑ Needs for collaboration between the two methods

# 1-The NEMESIS Model:

## 2.1-General dynamic

### Physico Economic interdependancies



# 2- The NEMESIS Model

## 2.1-General dynamic

- ❑ Intersectoral Economic Interdependancies: up to Knowledge
- ❑ (30 sectors)
  - ❖ Price and substitution effects on final demand
  - ❖ Exchange of goods and services for production (input-output)
    - ✓ Intermediary
    - ✓ Capital
    - ✓ Knowledge spillovers
  - ❖ Strong heterogeneity of sectors from a dynamic point of view (employment, knowledge, Environment, Energy...)
  - ❖ Economic track: the result of strong interdependancies of most progressive sectors (I.C.I, biotechnologies, and less ones (some services, agriculture)

# 1-The NEMESIS Model

## 2.1-General dynamic

### □ Macro-sectoral (hybrid)

- ❖ Bottom-up sector approach: GDP, revenues are the sum of sectors
- ❖ Top down: macro Economic Saving Consumption arbitrage
- ❖ Hybrid result: dynamic loop is generally sectoral: productions, prices, investment, employment, revenues but with a macroeconomic feedback by consumption
- ❖ Complex result for the dynamic

## 2- The NEMESIS Model

### 2.1-General Dynamic

#### □ International interdependancies

- ❖ 27 distinct models for Europe
- ❖ Simplified models for Areas of rest of the World
- ❖ International exchanges of goods and services
- ❖ International knowledge spillovers

# 2- The NEMESIS Model

## 2.2- Econometric based mechanisms

### □ Econometrics

- ❖ Mainly on chronological data or panel data (sectors, countries)
- ❖ Based on implicit maximisation behaviour, (utility profit) but not on explicit maximization conditions and with a choice of relationship based on econometric criteria
- ❖ Then different from applied general equilibrium approach that is based on:
  - ✓ Maximization
  - ✓ Calibration
  - ✓ Equilibrium on every market

## 2- The NEMESIS Model

### 2.2- Econometric based mechanisms

#### □ Inconvenients

- ❖ Can be rejected by strict orthodoxy
- ❖ No explicit utility functions and then impossibility to calculate surplusses variations associated to policies
- ❖ Dependant on statistics availability that is not case for G.E.M. approach that is calibrated



## 2- The NEMESIS Model

### 2.2-Econometric based mechanisms

#### □ Advantages

- Modelling is more based on data recent tendencies and in this sense « more realistic »
- Allow forecasts and easier link with the present conjuncture conditions for the start of Baseline
- Allow easier adaptation to specific mechanisms (pricing for zero marginal cost activities)

## 2- The NEMESIS Model

### 2.2-Econometric based mechanisms

#### □ Advantages (following)

- ❖ Structure more « flexible » allowing easy removal of mechanisms
  - ✓ More adaptable to heterodox theories
  - ✓ Suited for prospective of « break through scenario ».

# 3-Foresight for R&D during crisis and beyond

## 3.1- R&D policies are useful during crisis

3.1.1- R&D effort is lowering during crisis  
(procyclical):

❑ Countercyclical view:

- ❖ Need for efficiency
- ❖ Opportunity cost
- ❖ Bental and Piled (1960)
- ❖ François Lloyd Ellis (2003)

❑ But majority for pro-cyclical view:

- ❖ Financial constraints
- ❖ Demand driven
- ❖ François Lloyd Ellis (2009)

# 3-Foresight for R&D during crisis and beyond

## □ 3.1- R&D policies are useful during crisis

□ 3.1.2-The research effort for economic  
recovery

Three scenarios:

(1) Forecast before crisis

(2) Forecast including crisis

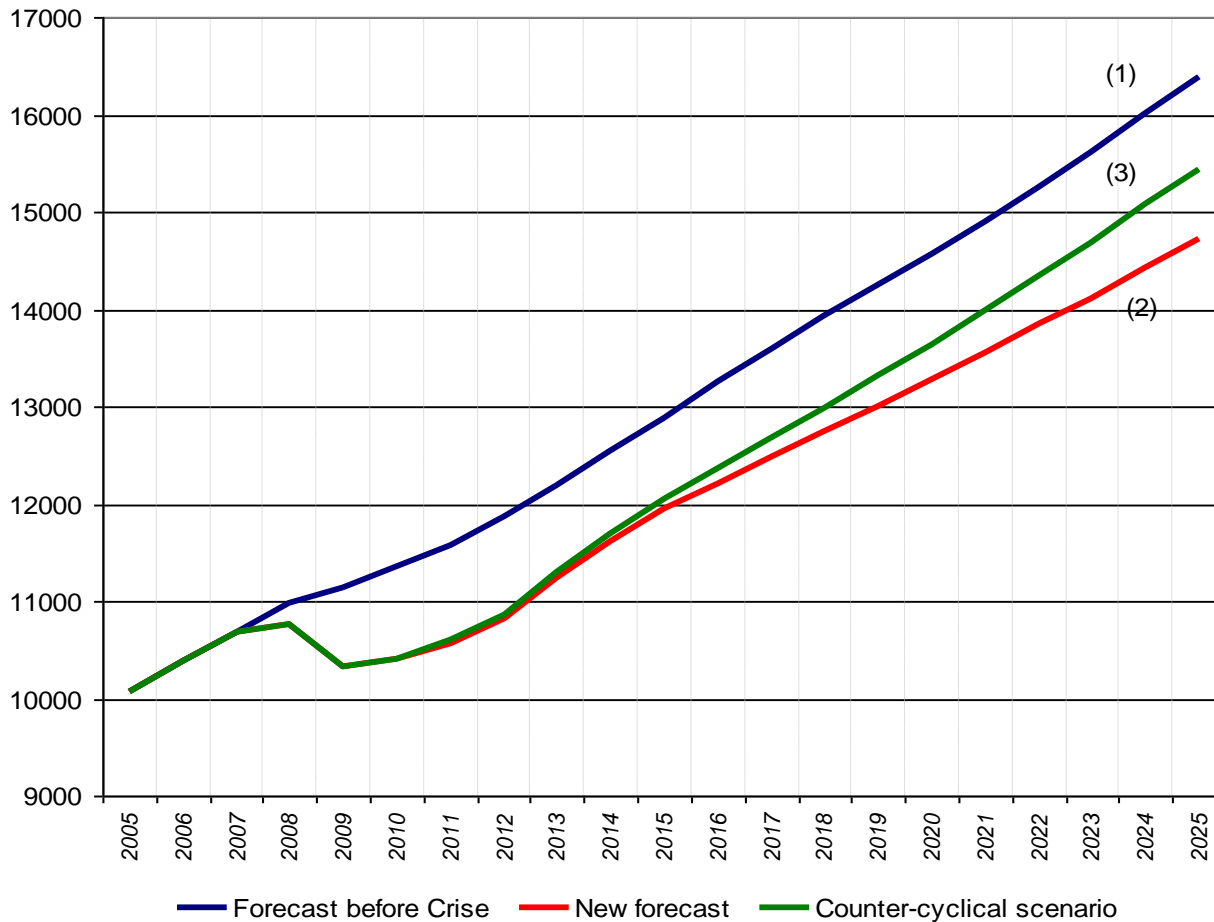
(3) Crisis scenario with countercyclical R&D:

- Increase of R&D effort up to 3% G.D.P.

# 3-Foresight for R&D during crisis and beyond

- **3.1- R&D policies are useful during crisis**
  - **3.1.2- The research effort for economic recovery**

Evolution of GDP (Billion € 2000)



# 3-Foresight for R&D during crisis and beyond

## □ 3.1- R&D policies are useful during crisis

### □ 3.1.2- The research effort for economic recovery

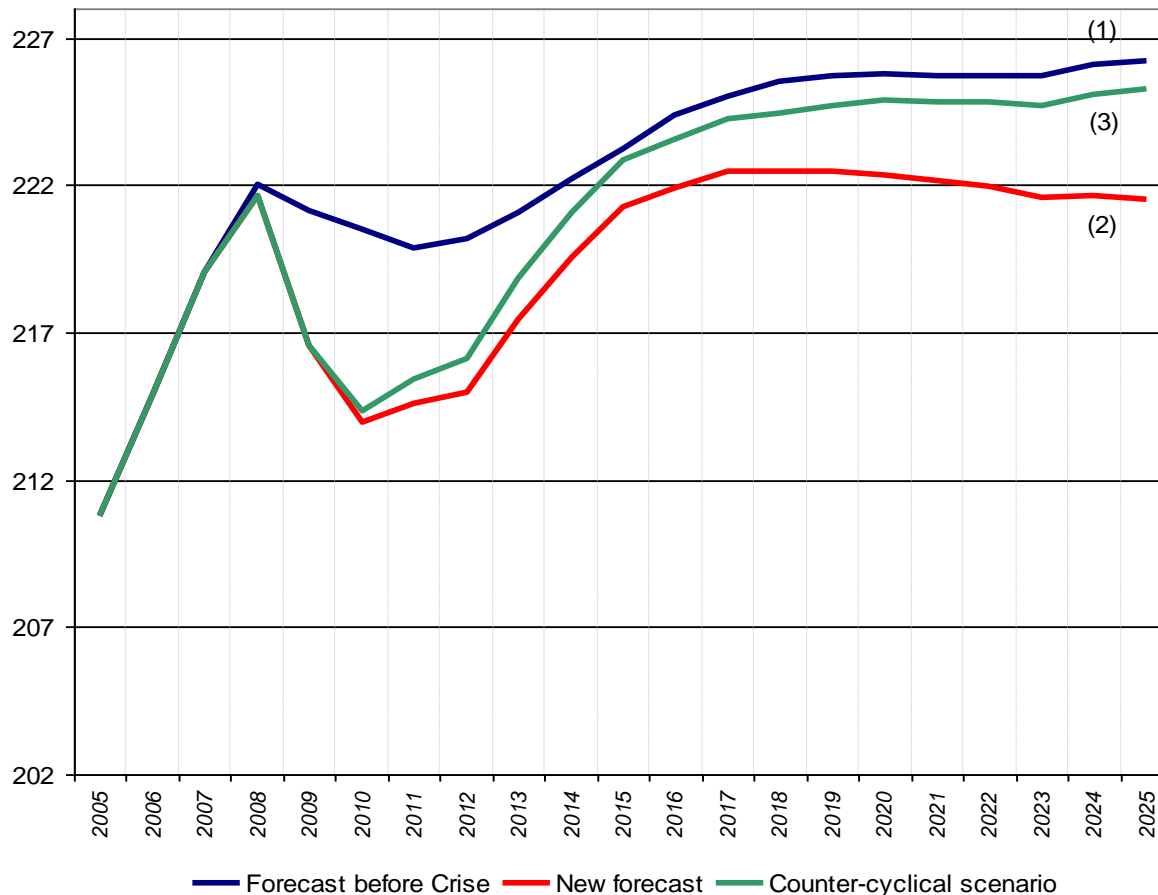
- ❖ 43% of GDP gap is filled in 2025
- ❖ but GDP growth is faster and GDP gap reduced compared to the post-crisis scenario without counter-cyclical R&D

# 3-Foresight for R&D during crisis and beyond

## □ 3.1- R&D policies are useful during crisis

### □ 3.1.2- The research for economic recovery

Evolution of employment (Millions)



## **3-Foresight for R&D during crisis and beyond**

- 3.1.2- R&D policies are useful during crisis**
  - 3.1.2- The research effort for economic recovery**
    - ❖ The employment Gap is almost filled in 2015.
    - ❖ The reduction of wages during crising stimulates employment, the increase in R&D effort boosts growth: Economic recovery is rich in jobs creation



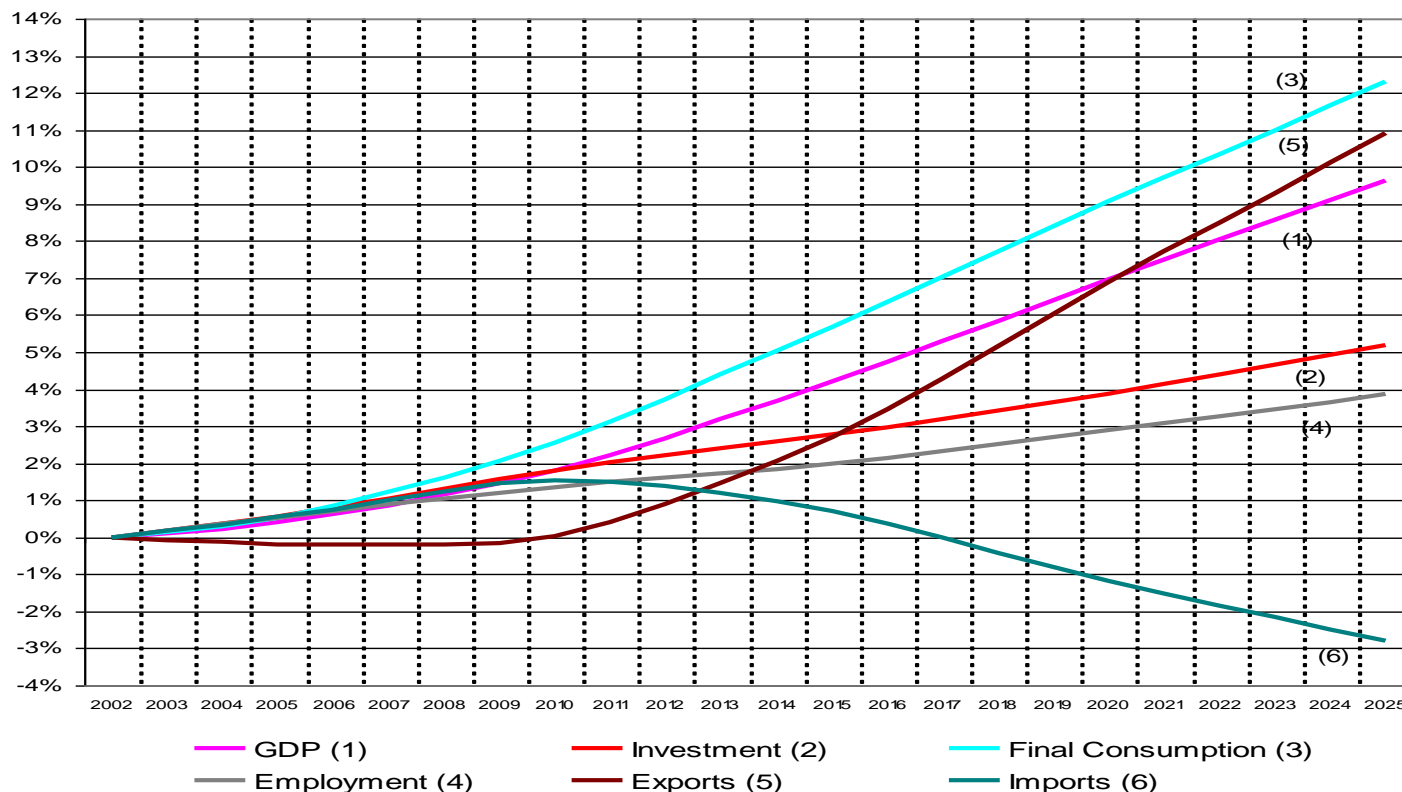
# 3-Foresight for R&D during crisis and beyond

- 3.2- A new scenario for Barcelona 3% objective : the lowering of R&D Policies costs during crisis**
  - Former assessment in 2002 for EU15**
  - Extension to new member States**
  - New agenda**
  - Crisis**

# 3-Foresight for R&D during crisis and beyond

## 3.2- A new scenario for Barcelona 3% objective: the lowering of R&D Policies costs during crisis

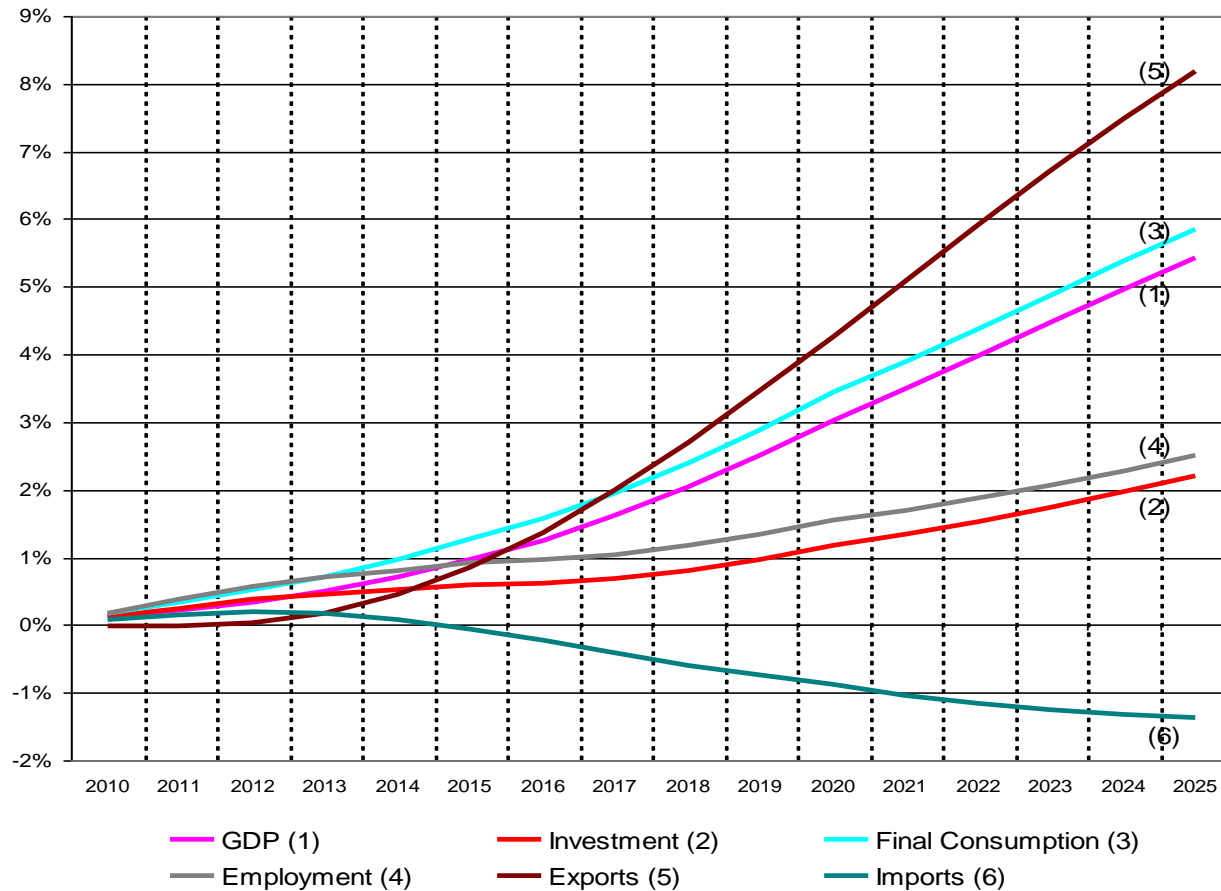
□ GDP and its counterparts in the 2002 assessment for EU15



# 3-Foresight for R&D during crisis and beyond

## 3.2- A new scenario for Barcelona 3% objective: the lowering of R&D Policies costs during crisis

□ GDP and its counterparts in the new Barcelona scenario for EU27



# 3-Foresight for R&D during crisis and beyond

## □ 3.2- A new scenario for Barcelona 3% objective

- **Crisis reduces R&D efforts in the model in 2009**
- **The new assessment shows less deficits in the first phase due to low inflationary pressure in reason of:**
  - ❖ High unemployment rate
  - ❖ Low production capacity utilisation rate
- **In the long term the major driver for GDP growth are first exportations and second final consumption**
  - ❖ It was the reverse in the former assessment
  - ❖ The lowering of wages during crisis stimulates external competitiveness but hampers final consumption

# Conclusion

- ❑ Foresight can help Modellers to conceive and imagine new hypothesis on Society and Behaviour
- ❑ Modelling can give coherency to Foresight
- ❑ Foresight on R&D shows the necessity of implementing to day active R&D policies