SIMPATIC

SIMPATIC working paper
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# Minutes of the first SIMPATIC annual conference

The SIMPATIC project is coordinated by Bruegel (Belgium) and involves the following partner organisations: KU Leuven (Belgium), UNU-Merit (Netherlands), SEURECO (France), E3MLab (Greece), Univesidad Complutense de Madrid (Spain), Federal Planning Bureau (Belgium), Imperial College (United Kingdom), Institut za ekonomska raziskovanja (Slovenia). Project website: http://simpatic.eu/


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# DELIVERABLE 2.2

# FIRST SIMPATIC ANNUAL CONFERENCE

The First SIMPATIC Annual Conference was organised on 25-26 March 2013 in Brussels at Bruegel. It consisted of two micro/macro joint sessions, one individual micro session, one individual macro session and a policy panel. Keynote speeches were delivered by Philippe Aghion, Bruegel fellow, Professor of Economics at Harvard University and member of the SIMPATIC Scientific Advisory Committee and by Dirk Pilat, Head, Science and Technology Policy Division, OECD Directorate for Science, Technology & Industry, and member of the Policy Advisory Committee. For practical reasons, all sessions took place at Bruegel premises, except the macro-economic sessions organised at FBP premises.

**As the project outputs were still limited at the time of the conference, it was decided that the scale of the event should remain relatively small, focusing on expert feed-back and highly technical discussions (with the exception of the policy panel). This is why no press conference was organised.**

The invitation was sent out to a total number of 4,009 recipients. The event was attended by 61 participants, composed of partners, EU officials, representatives of international corporations, members of academia.

Promotion activities for the conference included:

- Dedicated banner on the SIMPATIC website

- Dedicated banner on the Bruegel website

- Promotion in the SIMPATIC newsletter

- Promotion in the Bruegel newsletters – Bruegel Update and Bruegel Update for members

- Promotion on the SIMPATIC and Bruegel Twitter accounts before and during the event

# 1st SIMPATIC ANNUAL CONFERENCE

## *@Bruegel, 25-26 March 2013*

*All Power Point presentations are available on SIMPATIC website (www.simpatic.eu).*

## MINUTES OF THE CONFERENCE

**(25 March)**

### 12:15-14:00 Lunchtalk "Bridging the clean energy R&D"

*Speaker: Massimo Tavon, FEEM; Discussants: Georg Zachmann,Bruegel; Ralf Martin, Imperial*

Massimo Tavoni presented the work that has been carried out at FEEM on innovative strategies for climate change control.

The first part of the presentation dealt with **the challenge of climate change mitigation**. Historical data show that global emissions are on the rise, with estimates for 2010-2011 pointing to a growth rate of 3%. However, the data is affected by some reporting problems, especially for China. The speaker underlined the fact that, in order to stabilize climate, it is not only necessary to stop emissions from growing, but also to try to decrease them.

In order to assess climate **mitigation strategies**, the researchers worked on integrated assessment models (IAMs). The speaker presented the WITCH IAM model, in which economic sectors that play a role in emissions are incorporated and world countries are grouped into 14 regions which interact among each other. The model tracks the actions which impact the mitigation pathways of climate and thus allows for the evaluation of the equilibrium responses triggered by different climate policy tools. The estimates suggest that climate stabilization requires a major departure in emissions, with reduction close to a rate of 3% per year, as opposed to the current increase at 3%. The transformation challenge entails the need for an increased capacity in all low carbon technologies.

**Technological change** in the model is considered as endogenous, as driven by innovation and diffusion processes, both of which featuring cross-regional spillovers. Including technological change in an endogenous way is challenging, due to computational and calibration issues and different preferences of modellers and econometricians. For these reasons, most of the IAM models make a lot of exogenous assumptions on technological changes, with a subset of models featuring policy induced technical change. One way to try to estimate technological change is to ask experts' opinions about what is the future of

technology and to incorporate this in the models. The models are calibrated in different ways, and try to answer a series of questions.

A first question is related to *stand-alone innovation policies*: do they have the potential to reduce emissions and stabilize climate? In order to answer, the model is run with different R&D subsidy programmes of different size and aimed at different technologies. A second question is related to *climate policy induced R&D*: to what extent market based climate policies induce innovation? The researchers looked at different scenarios in terms of policy, running the model with a carbon tax/emission quota which achieves different climate objectives with different policy structures; results show a 15$ billions/year gap for Europe in terms of cumulative investment in R&D for the next 20 years. A third question is related to the *optimal policy mix*: what welfare improvement can be achieved by combining innovation and climate policies? In order to answer, the model was run with both market based carbon tax as well with R&D subsidies; in the optimal policy scenario, world investment would increase and an economic efficiency gain in term of policy cost reduction of about 6$ trillions can be achieved. A fourth question is related to *second best policies*: what are the welfare implications of constraining the set of mitigation technologies? The model was run with a nuclear phase out, which implicitly subsidizes renewable technologies, with and without fixing R&D levels. In a similar vein, the researchers found that restricting international carbon trading to at most 15 or 20 percent of domestic abatement can be Pareto efficient, as it speeds up technological development in some parts of the world.

The speaker then moved to the last part of the presentation, related to **alternative mitigation strategies**. Emissions mitigation at the levels required to attain climate stabilization would require a global commitment and, while technological change might make the transition possible, it will take time to materialize. Alternative strategies envisaged by the researchers are adaptation and geo-engineering, such as carbon dioxide removal (CDR) and solar radiation management (SRM). Simulations show that these strategies are effective in compensating the worldwide temperature increase, even at regional scale. However, they might also have negative health and environmental impacts. This raises the question of whether it would be efficient to invest in R&D to further develop these alternative technologies.

The **main conclusions** of the work imply that climate stabilisation requires dramatic reductions in emissions. Moreover, the rate and direction of technical change plays a major role on the feasibility of achieving climate stabilization. There is a 50$ billions global gap in terms of clean energy R&D that has to be filled up. Rising carbon price would only partially fill this gap, while R&D subsidies could provide non negligible efficiency gains. As far as alternative strategies are concerned, CDR might allow a decrease of the stock of CO2 in the atmosphere at some point in the future, but should not fundamentally change the current mitigation strategy. At the same time, the uncertainty about SRM effectiveness and costs provides a sufficient argument for a substantial mitigation effort.

The future **research agenda** includes the incorporation of endogenous technological change, uncertainty and complementary strategies into the IAMs model. Among the

**activities and collaborations**, the speaker mentioned two EU funded projects: "ENTRACTE", which deals with policy instrument choice after EU 2020, and "ADVANCE" on model development.

The discussion focused on issues such as the types of cooperation to achieve the objective of emissions reduction (e.g. massive R&D effort by countries or knowledge transfer cooperation) and on the political economy of climate change, as R&D investments and coordination entails not only domestic benefits, but also spillovers from neighbouring countries. In addition, the audience raised the issue of radical technological changes that might not be incorporated in the model but can have great potential in the future, and the issue of green technological innovation as opposed to more general R&D.

## 14:00-16:30 Macro/Micro Joint Session

### *MICRO Matrix of sectors and country-specific spillover transmission coefficients.*

*Pierre Mohnen, Rene Belderbos UNU-MERIT*

This session discussed the challenges of constructing a relevant matrix to measure intersectoral and international spillovers. The session started by exploring some of the conceptual issues related to measuring spillovers, discussed some of the stylised facts related to that, and concluded with some recommendations on the best matrix to use and ways of constructing it.

Discussion of spillovers often includes a measure of distance and there is debate on ideas of how distance affects spillovers: distance could either work advantageously or could have a negative effect of being 'too close'. There is also debate about the nature of spillovers, which could either be pure rent or pecuniary: pure rent spillovers refer to the public, non-rival nature of knowledge; pecuniary are the externalities that arise as firms trade in property rights, etc. It is tough to disentangle the two effects, and the SIMPATIC agenda adopts an inclusive approach which takes both effects into account.

The big discussion on which information to use for measuring spillovers is between trade or patent data. The trade measure has a large, developed literature and captures some specifics of knowledge transfer like capital goods. FDI is another possible measure. Patent data has some advantages as a measure of spillovers in terms of being systematically available across countries and technology classes over time; researchers also have the option of using patent citations which function as indicators of knowledge flows. Survey data such as CIS would be useful for knowing direct users, but it is not systematically available.

Patent data fits the stylised facts well: patents broadly capture the degree of relevance of knowledge which is important when considering technology proximity; also patent data does not face the same bias as trade in terms of penalising geographical proximity, removing the need to control for factors such as distance and language. Some potential limitations of

patent data include the fact that citations are added by examiners, so inventors might not necessarily know of existing patents. Patent data is gnerally more useful for the manufacturing sector than for services.

Taking these features into account, the authors propose an adaptation of an existing spillovers matrix developed by Meijers and Verspagen. They suggest using citation intensity instead of raw citation numbers because industries exhibit different propensities to patent. It is also possible to make a concordance between patent classes and industries. One possibility is to use the existing Johnson concordance; however, there are concerns that it might be outdated. Further work could use such a matrix to answer questions about how specific patents are used across sectors and countries. Next steps are to update matrices to be consistent with the SIMPATIC timeframe, compare different matrix specifications, and to try a range of weights.

The discussion evolved around the problems with using trade data as a measure of spillovers because trade spillovers could be working through the channel of improved ways of doing, which will be reflected in more competitive positions, not necessarily because of new technical knowledge. Overall, patents might give the best single indicator, but they should be used with caution.

### *Keynote speech: Prof Philippe Aghion*

Harvard Professor and Bruegel fellow Philippe Aghion's research covers many of the issues SIMPATIC tries to address, with particular importance on making the links between micro and macro analyses and examining the impact of (green) innovation. Joining the SIMPATIC meeting via conference call, he presented some of his current research of relevance for SIMPATIC. One strand deals with finding the optimal taxation level for innovation and growth. There is an important link between innovation and fiscal policy over the business cycle. Both labour and capital should be taxed, but capital at a lower rate than labour. There are also questions to be asked about the links that can be made between innovation and industrial and competition policy. Various links could be made to the broader SIMPATIC work: notably an exploration of the effects which general tax policy has on innovation, next to dedicated R&D tax (credits). There could also be scope to run the NEMESIS model with optimal taxation results.

### *MACRO Endogenising technical change in applied modelling: a survey and the advancement of SIMPATIC models.*

*Gilles Koleda, Boris le Hir*

This session presented some of the methodologies of R&D policy assessment and their current successes and limitations. Analysis is principally fed through NEMESIS, but the results are broadly consistent with other models. The presentation included a discussion of R&D channels and a discussion of the appropriate policy measures for economic

performance. It is important to remember that a range of different effects are considered – potential benefits of R&D include windfalls, crowding in, crowding out, amongst others.

The R&D decision could be modelled as either exogenous, or partially or fully endogenous. In a partially endogenous setting, an exogenous additionality or leverage effect is included in the model. In a fully endogenous setting, the policy implementation is endogenously followed by R&D carried out by a representative firm.

The next challenge is to take the step from R&D to knowledge spillovers. The challenges here include measuring knowledge flows and externalities. Measuring pure knowledge spillovers fits well with the goals of SIMPATIC, although there are different ways to capture innovation spillovers. Previous models included knowledge flows using information from Johnson concordance matrices. A further limitation of patent indicators is that the services sectors are underrepresented since most services innovations are non-patentable. With respect to some of these challenges, international trade flows can be a good measure for capturing cross-border spillovers.

It is also important to consider general purpose technologies and the types of spillovers they create.

Some important issues that are left to be explained by macro models include the efficiency gains from improvements in the governance of R&D and other institutional factors such as legal frameworks.

Any model assessing innovation including technological innovation must be careful about using a Cobb-Douglas production function because in this case, technological progress must be neutral and it will be challenging to include a temporary wave of technical progress.

Another potential worry is the fact of using patent data when there is a shortfall of service sector coverage. Most present European economic activity is concentrated in the service sector, so this shortage is very pertinent. More generally on interpretation of model results, it is important to look closely at effects on employment and the interplay with changes in the real wage.

Another important issue is whether the models are budgetary neutral. Also the different impacts on high versus low skilled labour. A further cautionary point was raised about incorporating the difference between improvements in quality and improvements in quantity that comes from increased productivity.

## 17:00 -19:00 Micro Individual Session

### *Application behavior of firms and agency decisions in the German R&D subsidy system*

*Mila Beyer, KU Leuven.*

The speaker presented a study on the application behaviour of firms to R&D subsidies and the decision to provide the subsidy by the agencies in Germany. In Germany, R&D subsidies are mainly distributed in two ways: through technology-specific programs and through generic programs (often related to infrastructure investments). The researchers carrying out the project decided to focus on the first type of program.

The data used for the study consists of a random sample of firms from the Mannheim Innovation Panel (MIP) of the Centre of European Economic Research (ZEW), that was matched with the PROFI database from the Federal Ministry of Education and Research, which contains information on successful applications for technology-specific R&D subsidies over the years 1969-2011, obtaining a total of 3174 observations.

The study models two types of decision. The first one is the decision of firms to apply to the program; the evidence shows that large firms are more likely to apply and receive a R&D subsidy and that having received funding in the past has a positive effect on the decision to apply. Different model specifications suggest that firms that have a more international oriented approach are also more likely to apply. The second one is the decision of the agency to grant the subsidy; the evidence shows that firms' characteristics play an important role: subsidy rates are higher for SMEs, but this also depends on the fact that they can receive a mark-up over the maximum level of subsidy allowed. The effect increases over time, but this might also be due to policy changes, as, for instance, in 2002 programs specifically targeted to SMEs have been introduced.

### *Impact assessment of R&D subsidies in Spain: some preliminary evidence*

*Elena Huergo, UCM.*

Elena Huergo presented insights from the study of R&D subsidies in Spain. Business R&D expenditure as a share of GDP has been very low in the past; increases were mainly due to the rise in public support, which however has decreased again in the past four years, with huge asymmetries among autonomous communities. The main non-business source of funding for firms' R&D projects is CDTI (Centre for the Development of Industrial Technology). Between 2002 and 2005, the CDTI managed three different types of projects through zero interest credits to provide firms with incentives to increase their R&D profile: Technological Development Projects (TDPs), Technological Innovation Projects (TIPs) and Concerted Industrial Research Projects.

The data used in the project comes from two different sources: the CDTI database, which is very similar to the German database used in the previous study and contains information on applicants to the three types of project, and the SABI database, containing company accounts information, for a total of 2.000 proposals and around 70.000 observations. The characteristic of the proposal is summarized with variables such as the R&D budget of the project and the screening of the agency by two variables, namely risk and technological change. The subsidy rate is defined at the ratio of the loan to the total R&D cost of the project. One drawback of the analysis is that the data are not weighted to take into account

the different representativeness of firms by size in the control sample of non-applicants, leading to results that are biased towards large firms. Preliminary evidence from the model suggests that past experience of firms in projects has a positive effect on the probability of applying to the program, as well as the fact of being an exporting firm.

Future streams of work include the creation of a new dataset that combines the CTDI with the CSI database with information on the control sample of non-participants.

### *Evaluation of R&D subsidies in the Netherlands*

*Pierre Mohnen, UNU- MERIT*

The speaker presented the work carried out on R&D subsidies in the Netherlands. The institutional setting in the country is characterized by a rather steady subsidy policy that did not delivered effective results in terms of support to firms' R&D projects. In 2010 there has been a major shift from specific to general policy instruments. Among these generic tools, there are three systems: the "innovation box", which focuses on giving tax benefits on returns to innovative sales, the "RDA", which provides a deduction to costs and investments directly related to R&D, and the WBSO, which provides a fiscal facility to reduce wage costs for R&D employees. Specific policy instruments focus on cooperation between SMEs and are designed to promote the entry of new R&D performing firms, stimulate R&D activities of SMEs and increase R&D in the corporate and public sector. However, after 2010 they have been replaced by a new Top Sector Approach.

The subsidy data covers 1248 observations on accepted and rejected applications. Each project is targeted at multiple firms with groups of up to 30 organizations. Applications are differentiated according to the type of project (which can be R&D and feasibility studies and innovation oriented research projects) and can occur on a continuous basis or by tendering. In the latter case, the application has to be evaluated by an expert committee. Around 90 percent of the subsidy data has been matched to ABR data and PS data by the CBS. The control sample of non-applicants has been selected from the ABR/PS database and the final sample contains around 9 thousands observations. The data shows that many of the non-applicant firms are the youngest ones, while successful firms are the oldest, and the same occurs with employment. Moreover, different types of programs differ dramatically in terms of age, employment and size of the participating firms. Successful applicants have a much higher project costs and the subsidy rate which they are granted is around 34 percent.

Estimation results show that the age of the firm has a positive effect on the decision to apply, while the employment variable has a negative impact, as well as the fact of being an SME. Moreover, applications display an upward trend over time. The subsidy rate equation displays a negative and significant effect of the 2010 dummy. After controlling for industry and program dummies the results do not change significantly.

### *Application behavior of firms and agency decisions in the Flemish R&D subsidy system*

*Otto Toivanen, KU Leuven*

The speaker presented some insights from the work that has been carried out on Flemish data on R&D subsidies. The Flemish system is characterized by the presence of one agency that allocates subsidies to the firms. Rules for the subsidies imply a maximum rate of 35 percent, which can go up to 45 percent for SMEs and to 55 percent if the firm engages in cooperation. The decision to provide the subsidy is based on the evaluation of the risks of the project, and is now being complemented with an economic evaluation. In addition, Belgium has other instruments (e.g. the "Innovation Box", investment deductions, tax exemptions for researchers, etc.), but they are constrained by an institutional divide between federal and regional governments.

The data used in the study comes from the matching of two different datasets: the IWT database with information for the region of Flanders, and the CIS database for Belgium, which contains detailed information on firms' characteristics.

Descriptive statistics show that applicant firms are usually larger and display more patents per employee. Moreover, they usually have an exporter status, are older and are worse with respect to other firms in terms of labour productivity. Successful and rejected applicants are comparable within each group in terms of size, number of patents, exporter status and productivity. As for the decision of the agency to grant the subsidy, the distribution is humped shaped, as there are no firms getting very small subsidies. The agency uses discretionary powers to tailor the subsidy rates.

Estimation results show that firms more likely to apply are exporters, member of a group (as long as it is not a foreign group) and older. The probability to apply is centred on 2 percent. The subsidy rate equation shows that firms that are part of a group get smaller subsidies and that the higher the labour productivity of the firm the higher is the subsidy.

## 17:00 -19:00 Macro Individual Session – event @Federal Planning Bureau

The breakaway session held at the Federal Planning Bureau (FPB) focused on the presentation of the results of policy cases with applied modelling. Two types of models were presented, an econometric one, NEMESIS, and a General Equilibrium one, GEM-E3. The policy cases presented were assessments for R&D, budgetary and climate change policies. We notice that the methodology of the modelling is based on the supply block of the models, including an endogenous technical change based on R&D and learning.

## *The main characteristics of the NEMESIS model and recent simulation results. Case studies for Europe and Belgium.*

*Francis Bossier and Antoine Melon, FPB*

The first originality of the NEMESIS model is its structure grounded on a detailed Core Economic Model in interaction with four modules: Energy/Environment, Agriculture, Land-Use, Nuts-2 Regions, this last module being a simple Downscaling of national results.

The second original characteristic of NEMESIS is its supply block with endogenous innovations and firms' R&D decisions. The process, from R&D decision to economic performance, is calibrated from the econometric works available in the literature, and it is useful to assess different R&D policies as subsidies, tax credits and interest premium.

The variable that plays a major role in that endogeneization of technical change is the knowledge variable resulting from the own R&D and innovations efforts of firms belonging to the different production sectors, and from intersectoral and international spillovers resulting from scientific and technological activities in other industries and countries. These knowledge spillovers, which are the principal vector of innovation, are calibrated from the work of UNU-MERIT with PATSTAT database.

The endogenous technical change in NEMESIS enables to describe macro-economic trajectories for the different EU countries. In those countries, short and medium term is conditioned by demand, revenue and budgetary conditions. As for long term results, along with active population evolution, they are dependent on investment in knowledge which increases labour productivity and non-price competitiveness.

After this short overview of the NEMESIS model, the FPB presented the consequences for Belgium of a change in the field of public expenditures of its main trade partners: Germany, Finland, Denmark and Sweden. This simulation showed that a shock of public expenditures calibrated to 1% GDP in every countries listed above may destroy, in the medium term, about 1 million jobs in the whole EU27, depending if one consider a rise or a reduction of expenditures, and may provoke a variation of EU GDP of about 0.66%. Jobs creations are concentrated in the Northern countries where the shock is introduced, with a variation of 700.000 jobs, whereas the impact on job creation in Belgium is about 20.000.

Another question addressed by the FPB with the NEMESIS model was the impact for Belgium of the slowing down of economic activity in Germany, in the Netherlands and in France that is expected to represent about 1% GDP over the period 2012-2020. This will of course impact negatively the exports and GDP growth of Belgium, and should be compensated by policies aiming to restore price competiveness in Belgium in the medium term, where wage inflation appeared to be quite strong in the recent years compared with its trade partners.

The second presentation, by FPB, presented the results of longer term policy cases related to R&D: the impact of a reinforcement of R&D and innovation activities on EU competitiveness. The presentation showed the impacts on GDP and employment of the

realization by EU-27 Member States of their National Plans for RTD as published by EU Commission in April 2011. According to the simulation results, it could lead to 5% additional GDP and over 5 million additional jobs at the EU level at the horizon 2030. Thus, the impact of R&D on potential growth could be a way to counterbalance the unfavourable effects of the ageing of the European population and the subsequent decrease of its working population. It illustrated also the fact that strong incentives to RTD activities could stimulate significantly the activity in the key sectors which produce today and tomorrow technological s, of which the iPhone example is the most famous. The issue is fraught with method*The*

### *The R&D Policies Assessment with applied modelling.*

*A. Fougeyrollas, P. Le Mouël and P. Zagamé, SEURECO/ERASME*

The third presentation by the team SEURECO/ERASME shed light on the precise way EU RTD policy could help fostering EU competitiveness and erase the negative impact of the economic crisis, such as reducing significantly investment, and potential growth. The speaker emphasised the importance of R&D policies during crisis through the results of a simulation of NEMESIS. It showed that strong R&D policies, as the realization of Barcelona objective, would help closing the GDP gap if they are implemented by 2020. R&D policy impacts economic performances through a causal chain based on the creation and the diffusion of new knowledge and technological externalities. The speaker helped understanding how R&D expenditure impacts the economy by presenting the "virtual case" of a one-off shock on R&D. It revealed that these impacts operate in time in four distinct phases:

1. The R&D expenditure phase, implies job creations in research labs, and installation of new equipment, increasing together the final demand. This generates inflation as there are no impacts on productivity during this initial phase.
2. The innovation and restructuration phase. The maturation of new knowledge gives the first innovation results in term of enhanced productivity and improved products characteristics, that phenomenon has a positive impact on competitiveness and on demand addressed by consumers to EU firms. But during this second phase, these positive supply effects are insufficient to maintain employment above the reference scenario.
3. The demand increase and diffusion. During this third phase, the fully developed innovations lead to important productivity and products characteristics increases. It enhances external and internal demands, which results in important net GDP gains, and putting employment well above the reference scenario.
4. The knowledge obsolescence phase. This last phase is the result of scrapping new knowledge. It leads to a decrease of innovation, with negative impacts on external and internal demands. Employment is again below the reference scenario level, as for GDP.

This "dissection" by a sequential analysis of RTD policy measures, realized here with the example of the 2010 FP for Research call for proposals, clearly revealed all the positive and

negative effects, of R&D policies. What is important is that the integral of the impact of GDP and employment stays nevertheless largely positive after 15 years.

A fourth presentation by SEURECO/ERASME illustrated more accurately the impact of EU RTD policies on EU growth, with an assessment of EU FP and horizon 2020 for EU Research Policy**.** The speaker, A. Fougeyrollas, started clarifying the role played by two key parameters which determine the assessment results of this kind of public policies:

1. The additionally effect describes the amount, x, of additional R&D that each € of public subsidies will provoke, leading to a total amount of R&D expenditures of 1+x. This effect can be calculated by the endogenous technical change module of NEMESIS, or introduced exogenously in it, as its magnitude revealed to be very dependant of the source of the subsidy. It is actually influenced by quantity of factors, such as externalities linked to the transfer of best practices among the participants to the research programme, or the overall performance, i.e. the expected return of the precise R&D activities which are subsidised. In mean, the econometric literature such as David, Hall and Toole, Guellec and van Pottelsberghe (2003) and Czarnitsky (2006) gives a value comprised between 0.6 and 0.9 for x - for example.
2. The second important parameter concerns the research efficiency. Some research reports that European funded research is more efficient that nationally funded one - Cf. at European level EPEC (2009), Rietschel (2009) compared to National level VINNNOVA (2008), Forfas (2009), Zabala (2010)... An assumption must consequently be made on this research efficiency.

Then A. Fougeyrollas presented the results of a first simulation consisting to demonstrate the impact of the FP by considering the situation that may result if it was abandoned, for given values of the two key parameters listed above. The result of this “abandonment” are compared to a reference scenario that stabilizes to FP7 2012 value of 8.3 billion per year, adjusted for inflation, with an additionally parameter value of 0.9 for private research and 0.5 for public one, a research efficiency of FP funding 6% superior to national funding, and an allocation of the public funding like in FP7. The results confirm, as if in a mirror, the important impacts of EU RTD policy, with at the horizon of 2030 a loss of EU GDP of 0.4% and the destruction of -400.000 jobs if the FP were to be abandoned after 2013.

The second policy case presented, was the symmetric case consisting in a reinforcement of EU RTD policy as in the Horizon 2020 for Research, compared to the present EU funding with the FP. Three main assumptions did support the scenario: (1) an increase of funds from 2014 and onward up to 23 billion € in 2030, (2) an increase of the transfer of best practices, and (3) an allocation of funds toward the more innovative countries. These assumptions implied new values for the policy parameters, with an increase from 0.9 to 1.1 for the additionally effect, for the private sector, and an efficiency factor for EU funding 15 % (against 9% previously) superior to national one. The impacts on EU economy are, in 2030, a gain of 0.5%

for GDP, with a big heterogeneity of results for the different countries, and 460.000 job creations.

The combination of the two scenarios, the "abandonment" and the "reinforcement" give the benefit that Europe gain from its RTD funding, that is for 2030 about 0.9% GDP, that is to say about 140 billion every year - seven times the EU RTD funding. At the end of the presentation, a sensitivity analysis showed the influence of the value retained for the key parameters on the results of the simulations, and the specific role played by knowledge spillovers.

### *GEM-E3-R&D: Energy policies assessment with endogenous technical progress.*

*Leonidas Paroussos, ICCS*

The speaker did first overviewed the main mechanisms of the model and then presented the results of two policy scenario focusing on climate mitigation and the specific role played by endogenous technical change.

In the first scenario, "EU alone", Europe engage alone stabilizing climate, with a reduction target in 2050 for CO2 emissions of 84% compared to 2005 level. This objective is reached with a carbon tax that goes up to 500 € per ton in 2050. The revenues of the taxation are re-invested in the economy by reducing labour taxes (employers' social contributions are lowered). The EU GDP is in 2050 0.62% below the reference level.

In the second scenario, "Grand Coalition" all non EU countries participate to the CO2 emissions reduction effort, and adopt the same 84% emissions reduction objective than Europe. EU economy in 2050 is not better in this scenario compared to the first one, as word economic activity is reduced, import prices rise, what would increase production cost and, together with the fall in world growth, decrease exports.

Then an alternative option for recycling the taxation revenues, a progressive subsidy to R&D, was simulated up to 2050. The results did show that the returns to R&D are positive, but decrease over a certain threshold of subsidy, and fall to zero when 60% of the carbon taxation revenues go to R&D. This result illustrates the semi-endogenous growth properties of the supply block of the model.

Finally two question were raised, one on the explanation of the identical impact of the scenarios on exports and imports, which results from the closing rule of the model, and the second on the interpretation of the fall of GDP that, by including the positive impacts on environment and on product characteristics resulting from technological innovations, could not necessarily be viewed as an overall welfare loss.

**(26 March)**

## 08:30-10:30 Micro Session (Public access on website)

### *An assessment of the impact of the R&D tax credit in France on firm decision to engage in R&D.*

*Jaques Mairesse, UNU - MERIT*

The speaker presented work on methods to assess the impact of the French R&D tax credit on firms' decisions to engage in R&D. Most of the analysis at this point is on the internsive margin, i.e. looking at the impact of the tax credit on firms who already engage in R&D. Future work might hope to include analysis of the extensive margin and to further disentangle the effects of marginal versus fixed costs on R&D decisions.

The analysis uses administrative data. Firms must include the amount spent on R&D as part of their tax declarations in order to benefit from the credit. There might be more comprehensive sources of data, but the most obvious ones (e.g. firm surveys, etc.) tend to under-sample small firms. Declarations of R&D are compulsory but may be undereported for a variety of reasons such as barriers to the amount of tax relief. The final dataset is produced by merging R&D data with other firm account data and covers more than 10 thousand firms over a time period from 1993 – 2007. The main variable of interest is an indicator of whether a firm has engaged in R&D. R&D shows some surprising patterns, with many firms engaging in R&D only at certain points in the time period, others exhibiting a surprising amount of entry or exit, some that have always engaged in R&D and others that have never engaged in R&D. The latter two categories are dropped from the analysis as they are uninformative for the estimation of interest.

R&D persistence shows a marked increase after 2004, which might be indicative of a response to a reform in that year which made tax credits volume based. Two specifications were presented – the first, a standard probit with *indRD* as the dependent variable; the second a multinomial logit with four classes of potetial R&D patterns in consecutuve years (*indRD = 00, 01, 10, 11*). Summarising results across the two estimations, the authors find a surprising degree of autocorrelation, and a persistent negative sign on the intial condition. Additionally, subsidiaries seem to engage in more R&D than non-subsidiaries and effects do seem to be stronger in the years after 2004.

Discussion included questions of the negative initial condition, which can be explained by the fact that many firms in the sample did not do any R&D in the first year, but later begun R&D. The authors proposed the following next steps: inclusion of more quantitative variables, making comparisons of the estimation results with survey data, introducing some sort of selection equation, and eventually developing a fuller structual model. A suggestion for identifying the selection model was to exploit nonlinearities introduced by various

reforms over the period of the dataset. These reforms might be expected to affect the costs of doing R&D, but not necessarily the benefits, and could therefore give an indication of the decision of whether or not to engage in R&D.

### *Comparison of cross-country results.*

*Otto Toivanen, KU Leuven*

A cross-country comparison aims to provide a sort of counterfactual analysis. If a Spanish firm behaved like a German one, what is the probability that it would apply for a subsidy. If the Dutch agency behaved like the German one, what is the probability that a Spanish firm would be granted a subsidy. This interesting analysis reveals some good information about the relative preferences of agencies and firms across countries.

The decision models have been estimated on the individual country's data and the resulting coefficients have been shared to run the counterfactual analyses. Some assumptions of the general model: firms and agencies are optimising decisions meaning that agencies' ideas about spillovers are built into their decision; subsidies can be made in a range of amounts - generally 0-80%; firms discount expected costs of applying for R&D and receiving it with doing R&D versus doing R&D without any subsidy.

The results are still preliminary, but interesting. For example, regression coefficients across countries showed Spanish firms exhibiting weakened preferences for SMEs. Another example from the set of counterfactual analyses show that German firms would get a higher expected subsidy in the Netherlands than Dutch firms, implying that there are characteristics of German firms that the Dutch agency finds attractive. These results are open to change with new data. As is, Spanish results are quite surprising – they show that very few German or Dutch firms would apply to the Spanish agency or receive subsidies.

Some comments on the Spanish data: SMEs in Spain have a separate agency, so SMEs applying to the general loan category might be penalised in a sense, perhaps explaining the negative sign on the SME indicator. Further, many specific features of the Spanish proposal are important, so it might be necessary to take these into account. This specificity of proposals might also explain the high variability reflected in the Spanish data.

Concerns about the cross-country analyis include the comparability of data. For example, the agencies in Spain and the Netherlands rate and rank firms respectively. To address this, it might be possible to use the ratings or rankings information from the countries to predict scores for other nations. It might also be interesting to think about how agency behaviour changes – if many German-type firms operated in Spain, would the Spanish agency change its behaviour?

Some proposed next steps include redoing comparions for firms grouped according to firm size – we might expect big firms to behave more homogenously across countries etc.

### *Additionality and social returns.*

*Tuomas Takalo, KU Leuven*

This was a presentation of a more theoretical model. The model setup would provide a means of estimating the additionality effect. A key question to answer on assessing R&D policies is whether the policies are welfare-improving. The model aims to examine the assumtion that additionality is at least a sufficient condition for an R&D policy to be welfare improving. The model is set up as a two-stage game where a public agency chooses a subsidy rate and a firm choses a level of R&D seeking to maximise its expected returns to R&D. The game has a subgame-perfect Nash equilibrium. This particular set up means that the agency's decision is modelled as an innovation reform as opposed to a decision of whether or not to grant a subsidy. The solution of the model shows that under the assumption that R&D generates positive spillovers, additionality is a necessary condition for a policy to be welfare improving, but it is not sufficient.

There was some debate about this finding. It is possible to conceive of a situation with multiple firms, where there is a positive net benefit to all of them doing R&D, but there is no additionality. There were also questions of the spillover assumption - R&D could generate *negative* spillovers, which would change the significance of additionality. These points could possibly be further explored by extending analysis beyond one firm, perhaps by elaborating the model to have two firms who could either cooperate or not. It is also important to consider how the welfare function accounts for consumption – here it is captured by the externalities assumed to be included in the agency's optimisation decision.

## 11:00-12:00 Micro/Macro joint session

### *IER, Services and innovation*

*Metka Stare, IER*

Service innovation has some distinct features traditional technological innovation including specific characteristics such as being more intangible, making them less measurable. When measured by traditional methods, there seems to be lower R&D investment in services; but for services it is particularly important to also measure other non-technological innovations, such as marketing and organizational ones. As CIS surveys show, there has been an increase in non-technological innovation across sectors.

There was further discussion about the challenge of identifying services for knowledge spillovers. The Johnson tables include a services category which could be helpful here. It might also be useful to extract information from the sector of use dimension, which would allow researchers to know which sectors are using particular services.

It is important to remember the broader range of IP rights which include brands, designs, trademarks etc. whose features could be used to identify knowledge spillovers. Lastly, input-output tables provide a source of information that is increasingly important as increasingly more services are traded.

### *Drivers and characteristics of "clean technology" innovation*

*Antoine Dechezleprêtre, LSE Ralf Martin, Imperial*

As relates to green innovation, there are many exciting questions to consider. The presentation focused on three particular issues. Firstly, does the ETS induce green innovation? Secondly, do green innovations generate more spillovers? And finally, what is the degree of path dependency of green innovation.

The eligibility requirements of ETS mean that it is possible to find non-ETS firms with similar characteristics as those that are regulated by ETS. These similarities can be exploited to match firms and create a control group. Analysis of the matched groups shows a greater propensity to patent by ETS firms by approximately 2%. There is no evidence of a crowding out effect. Interesting points to note include the fact that the increase in low-carbon activity in both ETS and non-ETS firms closely tracks the increase in oil prices; exploring technology networks (suppliers, copatenters, etc.) is a possible direction for future work.

The potential that green innovation has greater spillovers is interesting because it addresses the question of whether green technologies need special R&D support policies. The OECD 'Y' classification provides a means of identifying green patents and citations can then be used as a measure of spillovers. The study excludes own citations and includes citations from other countries and technology classes. The results show a greater degree of patent citations in clean technologies. One idea is that this is because technologies classified as 'clean' might be more general purpose; however, a test of citations received within the same sector versus citations received across the sector show a greater level of within sector citations. When green technologies are compared with other emerging fields (robots, biotech, etc.) the effect is weakened indicating that the main driver might be 'new technology'.

Path dependency was illustrated with evidence from the auto industry, where the change in clean or dirty knowledge stock was regressed on a set of features including existing stock of clean or dirty patents and various policy measures. Results indicate a measure of both clean and dirty path dependency, but no significance on the coefficients of policy measures. However, the fuel price is significant across both clean and dirty technologies indicating a possible role for price intervention.

## 12.15-14.00 Lunchtalk "Drawing knowledge from investments in knowledge-based capital"

*Dirk Pilat, OECD*

Dirk Pilat presented the work that the Science and Technology Policy Division at the OECD has recently carried out of relevance for SIMPATIC, drawing insights from three topics: knowledge-based capital, business dynamics in a knowledge-based economy and the role of knowledge in Global value Chains. The projects outlined are different, but are strongly connected and entailed a huge effort in terms of data gathering and measurement.

The first project focuses on **knowledge-based capital as a new source for growth**. The speaker introduced a definition of knowledge-based capital, based on the distinction between three types of assets: computerized information (including software and data), innovative property (related to patents, copyrights, trademarks and designs) and economic competencies (such as firm-specific human capital, business networks). The key aspect of these assets is their duration, which is usually longer than four years. Investment in knowledge-based capital is increasing over time, and firms are shifting their investments from tangible to intangible assets. The importance of these assets is proven by the evidence of a positive correlation between investment in knowledge-based and GDP per capita, as well as by its role as a driver of productivity growth.

But what is the reason behind the rise in such investments? Competition in advanced economies is driven by knowledge: as the links in terms of IT rise, they require additional investments in complementary assets, as well as in organizational factors and skills. In the automotive industry, approximately 40 percent of development costs are estimated to be related to the use of software and electronics.

The speaker then moved to the discussion of the policy implications of the rising importance of knowledge-based capital. Since knowledge is a non-rival asset, the initial cost in development does not get re-incurred during the production process, leading to increasing returns to scale. However, given that firms cannot easily exclude their competitors from knowledge spillovers, the level of investment might not correspond to the social optimum. A number of policy issues arise from the previous considerations. The first one is that the focus of research has been too narrow so far and there is a need to go beyond the view in which R&D investments are prominent. The second one is related to the need for a broad skill and human capital strategy, as there is a growing shortage of skills in many areas of the world. The third one is related to Intellectual Property Rights, as the issue has been overlooked in the past, but it is gaining increasing importance. The fourth issue is related to the growing value from personal data, requiring improvements in measurement and increasing attention to privacy risks. The last issue is related to the challenges faced by competition in industries founded on knowledge-based capital.

The speaker then introduced the second project, related to **Business dynamics and resource allocation.** There are large differences across countries in terms of allocative efficiencies and the evidence shows that more productive firms have also larger market shares. Another important issue is whether resources are actually shifting to the most innovative firms. A second issue that has been addressed is measuring the returns to patenting. Once again, there are many differences across countries, largely driven by what happens to young firms, which are more likely to experiment with disruptive technologies, and by "radical" innovators. The speaker underlined the importance of looking at the age of firms and not only at their size: for instance, young firms account for the bulk of job creation, while job destruction mainly comes from incumbent firms. When trying to compare US and EU firms in terms of employment growth distribution, Europe appears to be less dynamic, with a large share of static firms and smaller shares of shrinking as well as growing firms.

As for policies affecting business dynamism, the speaker identified three main challenges. The first one is related to bankruptcy legislation that might discourage entrepreneurs to take risks but might reassure financiers about their ability to recoup their investment in case of failure. The second one is related to R&D tax credits: fiscal incentives might play a role in explaining employment growth in R&D intensive sectors and some firms might benefit more than others. The last issue refers to employment protection legislation: if the level of protection of workers is high, it might affect firms' willingness to take risks when growth opportunities are uncertain, but at the same time it might insure employers about retaining their investment in the workforce.

The third project is related to the rise of **Global Value Chains**. Typically, GVC are analysed on the basis of case studies, of which the iPhone example is the most famous. The issue is fraught with methodological challenges, as the measurement of GCVs is very tricky: every time that a product crosses a border, it gets counted in national statistics. One possible way to overcome the problem is to measure trade in value added, as this gives interesting insights. For instance, when looking at the value added in trade, the trade deficit of China with respect to the US goes down by 25%. Moreover, the evidence suggests that imports are of growing importance for exports, in particular for China and Mexico. Sometimes it is not so much what firms are actually selling, but what they are actually doing within the GVC that matters. As a matter of fact, China used to have very little value added, but now it is shifting to different activities and trying to create more value. Services account for over 50% of the value added generated through trade, as a great part of value creation is linked to them.

The speaker envisaged several challenges for trade policy, the most important one being related to the "magnification" effect of tariffs along the value chains, as their effect becomes cumulative and can be larger at the end of the value chain, as it is the case in China.

Finally, he focused on the strong connection between GVCs and knowledge-based capital. Much of the value of a product is being created at the beginning (for instance, with design) and at the end (for instance, with marketing) of the value chain, while tasks at the middle of the value chain in principle can be carried out anywhere. Therefore, the capabilities in supplying non-replicable products is essential in retaining value and making the value "stick"

to a location, through a favourable institutional and business environment, including links between firms and knowledge institutions. Over time, the evidence shows that value added derived from GVCs has been increasing in Europe, especially within the manufacturing sector, as well as in services.

The speaker claimed for the need to adjust policies in some areas in view of the changes to which the global economy is subject, such as the growing importance of knowledge, and in view of the interactions between economies and the changing role of firms. Moreover, he stressed the need for a proper updating of investment measurement, cross-country flows and micro data.

The discussion focused on different issues, among which the increasing importance of intangible assets as a new source of growth, that can be linked to the way knowledge-based capital is measured. Moreover, the issue of how to disentangle human capital in the production function has been raised and the speaker agreed this is something that has to be further investigated. The issue related to the role of EPL (employment protection legislation) has also been raised, as it might not be very clear whether a less stringent EPL would stimulate accumulation of knowledge-based capital, as firms might be better off with more labour stability. Some questions on Global Value Chains were addressed, as the work focused more on value creation, but the next step of research should be to look at where the income generated in the value chains actually goes.

## 14.00-15.30 Policy Panel "Challenges for Europe's Research and Innovation Policy"

*Chair: Reinhilde Veuglers; Speakers: Marion Dewar, Luc Soete*

The last session of the conference brought together the views of different speakers: Marion Dewar, Member of Cabinet of Commissioner Máire Geoghegan-Quinn on Research, Innovation and Science, Luc Soete, Rector Magnificus of Maastricht University, as well as members of the Policy and Scientific Advisory Committees of SIMPATIC.

***Marion Dewar*** started by saying that the innovation unit at the Cabinet of Commissioner Máire Geoghegan-Quinn is on track in terms of implementing actions. Nevertheless, plenty of work still needs to be done in the current mandate, including a legacy document for the next Commissioner. The speaker outlined several issues that are of utmost importance in her view. The first one is related to *demand side innovation policy*. The cabinet has tried to build on the topic with the EU innovation partnership and has produced several results. However, putting into practice demand side innovation policy is a tall order, as it has to do with governance and requires improvements in the regulatory framework. The Cabinet wants to carry out a review as part of the legacy exercise. The second issue is the one of *open innovation* and, related to that, open access to scientific publications. Companies are changing their strategies and policy makers should adequately respond. The main issue is

whether policy-makers want to encourage open innovation. The whole discussion on copyrights has several implications for competition policy. The third and last issue is related to *skills*, as they are a critical input for innovation. The main challenge related to skills and human capital is the lack thereof, including the shortage of engineers especially in the UK and Germany.

***Luc Soete*** contributed to the discussion and stressed the attention on two interesting lines of work, wondering whether the SIMPATIC project will take on the issues at some point. The first stream of work is related to the supply side and the topic of *research funding* within Europe, which raises the following issues: open access to research, the role of excellence (including scientific integrity), long term investment, research integration (e.g. integration of European Research Area with NSF or Asian research centres). The second stream relates to the demand side and *the notion of innovation*. The speaker stressed the importance of the issue of research integration. He suggested that it would be interesting to look at the differentiated growth path associated with local agglomeration effects and the link of research with EU Structural Funds. In addition, he mentioned that an impact analysis of research would be interesting, especially given the current debate on austerity, as it is of utmost importance for a good interaction with policy makers.

***Dirk Pilat (OECD)*** outlined five issues that should be tackled in the context of EU research and innovation policy. The first one is the *impact of funding for science innovation*. Since this is a rather important topic in many countries, the speaker said it would be interesting to study the actual outcome of funding and what are the returns of these policies. Microeconometric work is important to understand how the policies work and to assess their effects. The second issue is the link between *innovation and job creation*, as there is currently a debate on whether the link between innovation, productivity growth and employment is getting broke. The third issue deals with the *entrepreneurship dimension* with respect to the policy dimension, as there is a considerable gap between people dealing with the two different aspects. The fourth issue is the one of *financing*, as it is a concern for many countries because risk capital has decreased and institutional investment has stepped back. The last issue, which according to the speaker has been overlooked in the EU discussion, is the one of *inclusive innovation*. This is particularly the case for countries such as India, but maybe the issue also has to be address in the context of EU.

The representative member from the ***Netherlands*** also presented his perspective, emphasizing the issues of low R&D investment and of poor diffusion of knowledge from universities and research institutions to companies. He also mentioned the debate on the relative importance of general versus specific R&D policies, saying that after 2010 there has been a shift to more generic policies. The speaker said that SIMPATIC is a very ambitious program, with an interesting focus on firms' characteristic rather than on projects, and he stressed the importance of keeping the focus of the analysis on the impact of subsidies on innovation and productivity.

SIMPATIC researchers contributed to the discussion, addressing the need for more integration between the micro and the macro approaches.