

# INNOVATION AND PRODUCTIVITY OF EUROPEAN MANUFACTURING

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## Results:

10 ANALYTICAL RESULTS

COUNTRY PROFILES (SPINWEBS)

POLICY CONCLUSIONS

## TEN ANALYTICAL RESULTS:

- Result 1: R&D does impact on firm performance
- Result 2: Sectors with high research input increase productivity faster
- Result 3: Research intensity across sectors similar, but level higher for US
- Result 4: The pattern of productivity increase becomes more similar
- Result 5: The USA is forging ahead in productivity growth again
- Result 6: Growth performance of countries more different in nineties
- Result 7: Candidates for explaining growth differences are empirically relevant
- Result 8: Growth drivers indicate convergence in Europe
- Result 9: Europe does not catch up with the USA in general, top countries contest USA successfully
- Result 10: Country profiles and strategies differ

## RESULT 1: INNOVATION IS IMPORTANT FOR FIRMS

Specifically:

It is proven in a large amount of studies,  
and for a specific data base we use:

R&D expenditures of firms  
are significantly increasing sales

Robert Wieser is the author of this part

Private rate of return is between 7% and 69%

Mean 29%, median 27%

Own sample Global Vantage Database

Panel of 2198 firms

Private rate of return 12%

## RESULT 2: SECTOR WITH HIGH RESEARCH INPUT INCREASE PRODUCTIVITY FASTER

For EU:  $R = 0.69$  ( $p < 0.01$ )

For USA:  $R = 0.48$  ( $p < 0.05$ )

Period: Nineties

Innovation: R&D/Production (research intensity): STAN

Sectors: 23 sectors NACE (2 digits)

The result is given:

- For lagged and contemporaneous values
- For EU and for the USA
- Not for majority of countries
- This could be an indicator on spillovers

Table 5.5F (p. 105)

Figure 5.12F (p. 107)

# WHICH SECTORS ARE DRIVING PRODUCTIVITY / RESEARCH CORRELATION:

## Europe:

HH: Electronics, instruments, computer, chemicals, cars

LL: Food, leather, apparel, publishing & printing

## USA:

HH: Computer, other transports, electronics, cars

LL: Food, textile, publishing & printing

## Two qualifications

There is embodied research in capital intensive industries

- Pulp paper (general)

- Publishing and printing

- With the result: high productivity without R&D

There is increasing division of function within firm

- Textiles

- Other transport

- With the results: increasing R&D without direct results

Table 5.6F (p. 108)

Table A3.1 (p. 246)

## RESULT 3: RESEARCH INTENSITY ACROSS SECTORS SIMILAR, BUT LEVEL IS HIGHER IN THE USA

No 1 in Europe: telecom equipment, followed by other transport, instruments

No 1 in USA: computers, followed by other transport, telecom equipment

R&D intensity increases in Europe, decreases in USA

Europe: 1.6% (80s); 2.0% (90s)

USA: 3.2% (80s); 3.05% (90s)

- But level is one third higher
- USA leads in 16 out of 23 sectors
- Europe has higher R&D intensity in tobacco, textiles, basic metals, machinery, electronics
- Time pattern: first closer than diverging again
- 

Facit: Large persistent deficit; latest increase of difference cyclical

If growth depends on research, the USA manufacturing will grow faster

Figure 5.12F (p. 107)

Figure 5.11F (p. 104)

Figure time pattern

## RESULT 4: THE PATTERN OF PRODUCTIVITY GROWTH BECOMES MORE SIMILAR

Highest productivity increase in Europe in the nineties:

A: Capital intensive industries

B: Technology driven industries: electronics, motor parts

USA: Impact of technology stronger

Higher share of technology driven industries

Significant similarity in the nineties

$R = 0.51$  sectors ( $p < 0.5$ )

$R = 0.22$  industries ( $p < 0.5$ )

Closer for later years

Even acceleration 2<sup>nd</sup> half/ 1<sup>st</sup> half is correlated  $R = 0.42$

Facit: Innovation is driving productivity

Table 5.7F (p. 110)

Figure 5.10F (p. 103)

Figure 5.9F (p. 102)

## RESULT 5: THE USA IS FORGING AHEAD IN PRODUCTIVITY GROWTH AGAIN

This is true for:

- Labour productivity (actual)
- Trend adjusted labour productivity
- Total economy, manufacturing
- Multi-factor productivity (caveats below)
- Acceleration 2<sup>nd</sup> half/1<sup>st</sup> half nineties

It is the acceleration in USA vs. deceleration in Europe that raises concern

Since these results correlate with those in the Growth Project, we do not repeat them

Figure 5.2F (p. 89)

Figure 5.1F (p. 86)

Table 5.3F (p. 90)

Figure 5.4F (p. 91)

## RESULT 6: GROWTH PERFORMANCE OF COUNTRIES BECAME MORE DIFFERENT, SOME EUROPEAN COUNTRIES MATCH US PRODUCTIVITY GROWTH IN MANUFACTURING

Also similar to OECD Growth Project

Increasing diversity of growth rates:

Total economy	SD EU:	1.10 (2 <sup>nd</sup> half 80s)	→	1.63 (90s)
Manufacturing	SD EU:	1.91 (2 <sup>nd</sup> half 80s)	→	2.78 (90s)

Manufacturing: USA 4.1%, EU 1.7% (1991-2000)  
 EU-high: IR, SF, S, A  
 EU-low: UK, P, I, GR, D, SP

Productivity differences did not increase across countries

labour shedding in low growth countries: UK; D, GR

Four European countries could match productivity growth of USA in manufacturing the nineties: IR, SF, A, S

Facit: Performance different, what factors relate to performance differences

Easier to explain will be growth of output (more variance, less policy)

Table 5.2A F (p. 87)

Table 5.2B F (p. 87)

# RESULT 7: CANDIDATES FOR EXPLAINING GROWTH DIFFERENCES ARE EMPIRICALLY RELEVANT

## GROWTH DRIVERS:

Indicators for the following determinants

Research

Knowledge/human capital

ICT

Capabilities

Speed of change

## Results

Some of them are significant

Together they correlate significantly with growth and productivity increase

## Countries behind:

S, SF excellence for growth drivers and productivity

GR, SP, P, Italy low in both

Facit: Growth drivers – determinants predicted by theory – are correlated with growth differences in manufacturing

## RESULT 8: GROWTH DRIVERS INDICATE CONVERGENCE IN EUROPE

Strategy: 20 drivers of growth

First year (90, 91, 92), last year (1998, 1999, 2000)

Determine top 5 (for each indicator), low 5

Main results:

Bottom five improve position in 14 out of 20

Speed of convergence is high for ICT

Visible for education, research

Not for highest education, patents, skill intensive industries

Leads are persistent:

Top 5 positions in last (first) year:

S: in 19 (16) indicators

SF: in 15 (12) indicators

NL: in 8 (11) indicators

DK: in 11 (10) indicators

Increases of lead of the top 5:

Patents

Education

Research intensity manufacturing

Structure (technology driven and ICT industries)

Facit: There is some convergence, however slow

Catching up of lagging countries

Persistent lead of top countries

## RESULT 9A: EUROPE IN GENERAL DOES NOT CATCH UP WITH THE US

USA leads in 14 out of 16 indicators

Europe leads in mobile phones and telecom expenditures

Catching up fast:

- Publications

- Secondary, tertiary education

- PC and internet use

Gap is widening for

- IT expenditures

- Share of ICT, technology driven, skill intensive industries

Too close to call: research

- Difference is widening since large countries decreased research

- Difference become closer against unweighted mean

This picture maybe biased against Europe,

- since some of the drivers are not only determinants of growth, but also results of growth (f.e. procyclical research intensity)

However: This feedback may lead to path dependency

Table 5.11 (p. 150)

Figure 5.28 left (p. 147)

## RESULT 9B: TOP COUNTRIES DO SUCCESSFULLY CONTEST THE US

Leading European countries (top 5) improve position vs. USA in 12 out of 16 indicators

Surpassed USA in

- Publications,
- internet use,
- share of skill intensive industries
- + mobile phones
- + communication expenditures

Not improving

- Patents
- Share of IT expenditures
- Share of skill intensive industries
- Share of ICT industries

Similar good performance if we *fix the top 3* countries: S, SF, DK

The large countries are important for the non convergence result

Table 5.29 F (p. 149, left and right)

Figure 5.28 F (p. 147, right)

Figure 5.29 F, B (p. 149)

## RESULT 10: COUNTRY PROFILES AND STRATEGIES ARE DIFFERENT

Some results:

S, SF excellence in growth drivers and in productivity

DK, NL good position in growth drivers, but employment spreading

IRL excellence in growth, not based on own research

B, NL increasing productivity: in capital intensive industries, importing technology

P, SP catching up via inward FDI

Disappointing performance of Italy

# SUMMARY OF MAIN FINDINGS 1

Is innovation important for growth and productivity:

Suggested by theory, literature on KBE, ICT

Indicated for firms, for sectors, for countries

If anything ever more important for differences

Maybe impact of R&D proper larger in the USA

In the US technology, research, formal, high education are specifically important

- share of technology driven industries is high
- productivity in technology driven industries is specifically high
- productivity increase in technology driven industries is specifically high

In Europe growth and productivity is not that directly linked with research

- capital intensive industries boosted productivity in 1<sup>st</sup> half of 90ties
- growth of output and productivity is partly delinked
- productivity comes partly via inputs, embodied investment
- mainstream industries are specifically competitive
- firm capabilities (like innovation i.w.s., product innovations, co-operations) are important

The answer to question 1 is yes.

## SUMMARY OF MAIN FINDINGS 2

Is innovation behind growth differences/acceleration of productivity?

Growth differences related to productivity & intervening policies

Growth differences related to drivers of growth

Specifically to capabilities

Each driver may explain some small part of differences

Together they tell us a lot

Innovation is not just R&D

- human capital
- knowledge, skills
- property rights
- open borders to use spillovers
- multinational firms to spread technology
- mobility between universities and firms and countries

There are other ways to foster productivity

- competitive pressure
- embodied technology
- transfer of technologies via inputs, investment, multinational firms

The answer to question 2 is yes, to a substantial part

## SUMMARY OF MAIN FINDINGS 3

They USA are forging ahead in productivity

Total economy, manufacturing, actual, trend growth,  
labour productivity, MFP

Difference may not be too large,

it is connected with capital deepening  
related to cyclical performance,

not so strong that severe recession in USA may not change  
the picture

But: has to be assessed against prediction of convergence  
and past narrowing of difference

there can be path dependency: good results lead to  
investment in drivers

### Does Europe progress (enough)?

Some European countries are performing excellent in  
growth drivers and consequently in growth

S, SF, DK are increasing productivity

And contest the USA in factors important for tomorrow

Large European countries did not focus on growth in the  
past decade

The answer to question 3 is no (with qualifications)

# SUMMARY OF POLICY CONCLUSION

## (1) Europe needs higher growth

Lowering unemployment

Regaining fiscal stability

Keeping down inflation (potential growth  $> 2\%$ )

Securing pension systems in ageing society

Closing the gap in growth of output and productivity plus

Moving closer to technology frontier in cutting edge technologies  
are key elements for long run competitiveness

## (2) Europe will close gap towards the USA only if all of the following strategies are pursued

(i) increase activities determining the technological lead

(ii) accelerate diffusion of technologies/best practice

(iii) build on strength in skill, innovation, capabilities,  
mainstream industries

### (3) Activities determining the technological lead

Basic research

Open tendered research programs

Top universities

Competition of excellent research centres

Tax incentives to rise R&D intensity in manufacturing to US level

Higher priority of research in large countries

European strategies in ICT and life sciences

Mission oriented programs in health, environment, transport

### (4) Accelerate technology transfer and appropriability of spillovers

Increase and internationalise education

Increase complementary qualification to make use of inward FDI

Recurrent education, requalification

Higher mobility of labour, firms, management

Accelerate flexibilisation, liberalisation, Single Market Programs

Accelerate ICT use

Focus at the large and continued deficit in IT- expenditures

Increasing capabilities and absorptive capacity is strategy for low income countries

## (5) Build on current strengths

modernise vocational training

introduce/increase the share of bachelor degrees, politechnicals

raising quality of requalification, life long learning

build and upgrade clusters

tax incentives for firms, which invest in education

strengthen university-firms ties

support sabbaticals used for skill upgrade

enforce application for mobile devices

promote environmental industries

lead mainstream and skill intensive industries to world leaders

## (6) Look for best Innovation System and Best Practice

Some European countries managed to contest the US: S, SF, DK

They develop a coherent strategy, followed it with determination

They have an inclusive way of policy making

They put emphasis on research, education, ICT

They pursued their strategy in business troughs

The reformed institutions according to the new needs

They build on high level research and on diffusion

(7) It is a very important point of time for Europe

The USA have enjoyed a decade of high growth

The USA is leading in most variables important for long term growth

Europe had a hard time with currency crisis, shocks, budget deficits

Europe is now enjoying profits from

Single Market Program and

lowering of transaction costs through Monetary Union

upcoming dynamics of accession countries

Future success will depend how fast Europe can follow its leading economies in boosting determinants of long term growth

## THE QUESTIONS POSED:

- Is innovation important/increasingly important?
- Is innovation behind growth differences /acceleration of productivity?
- Does Europe progress (enough)?

The answers to the three questions is:

Yes

Partly, other factors too

No

## GROWTH DRIVERS:

- ❖ Important for long run growth
  - R&D
  - ICT
  - Knowledge
  - Capabilities (EU only)