

Presentation of the INNODRIVE project

Dr. Felix Roth

EUKLEMS and beyond:
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Structure of Presentation:

1. Theoretical Background
2. The Data
3. Analytical Progress
4. Results
5. EU 2020 Strategy and Intangible Capital
6. Policy Implications

1. Theoretical Background

Highly developed countries are converging towards the knowledge economy in which *competitiveness, innovation and creativity* play a key role.

Importance of innovation recognized explicitly in the Lisbon strategy (2009) as well as the Europe 2020 strategy (2010), however their focus is on R&D.

Products [and services] are becoming more knowledge-intense (Corrado et al 2009).

⇒ How do we measure innovation? The range of indicators that should be included in a measure of innovation is still an open question.

The project is based on a concept of intangible capital originally proposed by Corrado, Hulten and Sichel (2005). Three main dimensions: (1) computerized information, (2) innovative property and (3) economic competencies.

⇒ Further steps for the future: enlarge the concept and include a social capital dimension (see a recent study by the World Bank 2006).

INNODRIVE Consortium

- Six teams do research on the Micro part of the project: Finland (Coordinator), Norway, UK, Germany, Czech Republic and Slovenia
- Micro-Researchers use LEED data
- Two teams have build up macro dataset for EU27 for the period 1995-2005: CEPS and LUISS (Belgium and Italy)
- Macro results of CEPS in WP9 will be shown in this presentation

2. The Data

The sample covers the EU-15 countries over the period 1995-2005.

Data on intangible capital were taken from the macro-approach of the INNODRIVE project (Jona, Iommi and Roth 2009) for the business sector NACE c-k+o; the measure includes R&D activities, product development in the financial service industry, market research, advertising, firm-specific human capital and organizational structure; we adjust the data to be expressed in 2000 prices.

Data on the macro variables in the model are taken from DG ECFIN's annual macro database AMECO - in particular, the physical capital stock, annual labour productivity growth (adjusted by including intangibles in the asset boundary).

A specificity: intangible capital data is measured for the business sector whereas growth and the control variables are measured for the whole economy
=> allows to capture spillover effects from the business sector to the whole economy (the exact mechanisms remain to be analyzed).

Further update of the data planned by LUISS University.

3. Analytical Progress

The model used: “Cross-country Growth Accounting” – Benhabib & Spiegel (1992) and Spiegel (1999). This methodology combines the two traditional approaches in this field - growth accounting and growth regression.

$$\Delta \ln Y_{it}^* = \alpha_{0i} - \eta \ln Y_{it-1} + \alpha \Delta \ln K_{it} + \beta \ln H_{it} + \gamma \Delta \ln I_{it} + \delta \Delta \ln N_{it} + \mu B_{it} + \lambda X_{it} + w_{it}$$

To our knowledge this methodology has not yet been applied in research on intangible capital and growth.

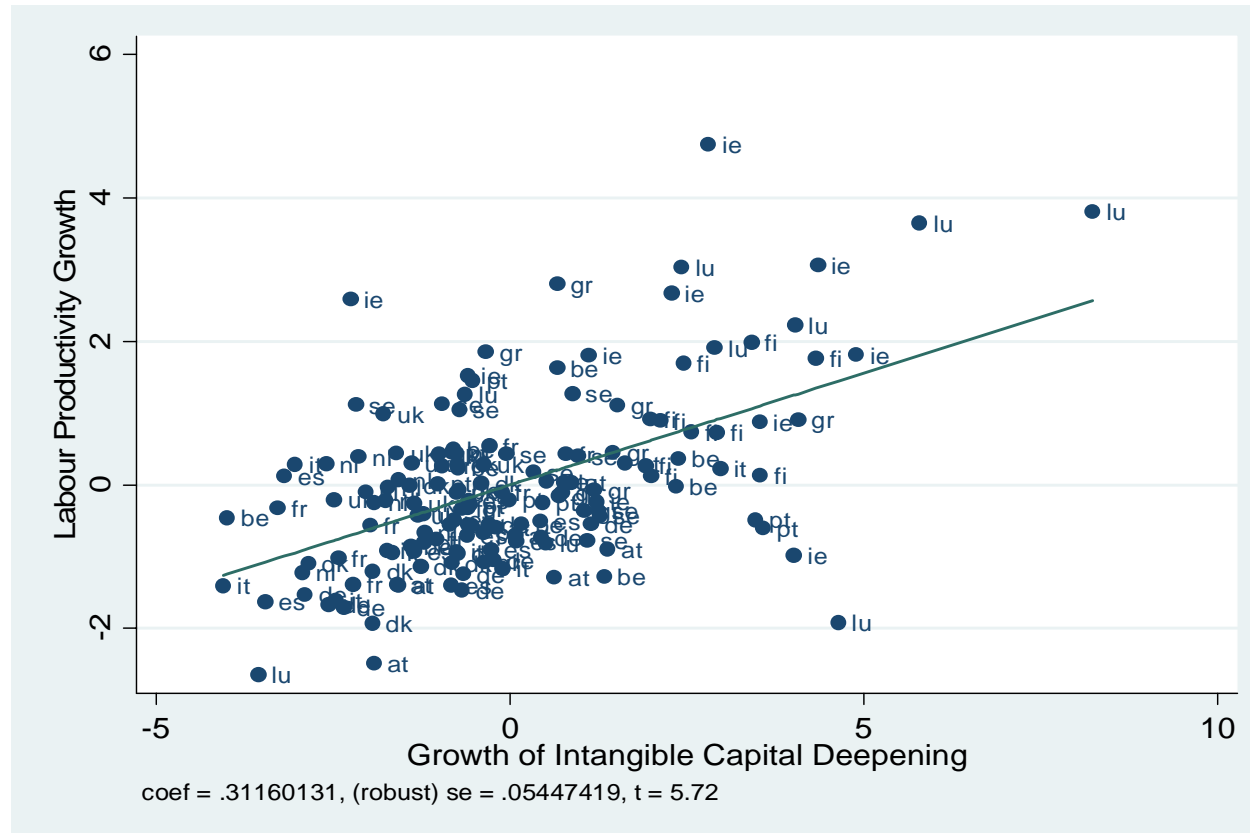
Advantages: Growth regression aims at explaining what determines economic growth – growth accounting is a preliminary step towards such an explanatory analysis (see Temple 1999 and Barro & Sala-i-Martin 2004). It allows the exploitation of cross-country variation and inclusion of non-monetary indicators such as human and social capital.

The inclusion of non-monetary indicators in growth regressions and innovation can be further elaborated upon: link to EU-funded research programs INDICSER, SERVICEGAP, IAREG.

4. Results

Fig. 1

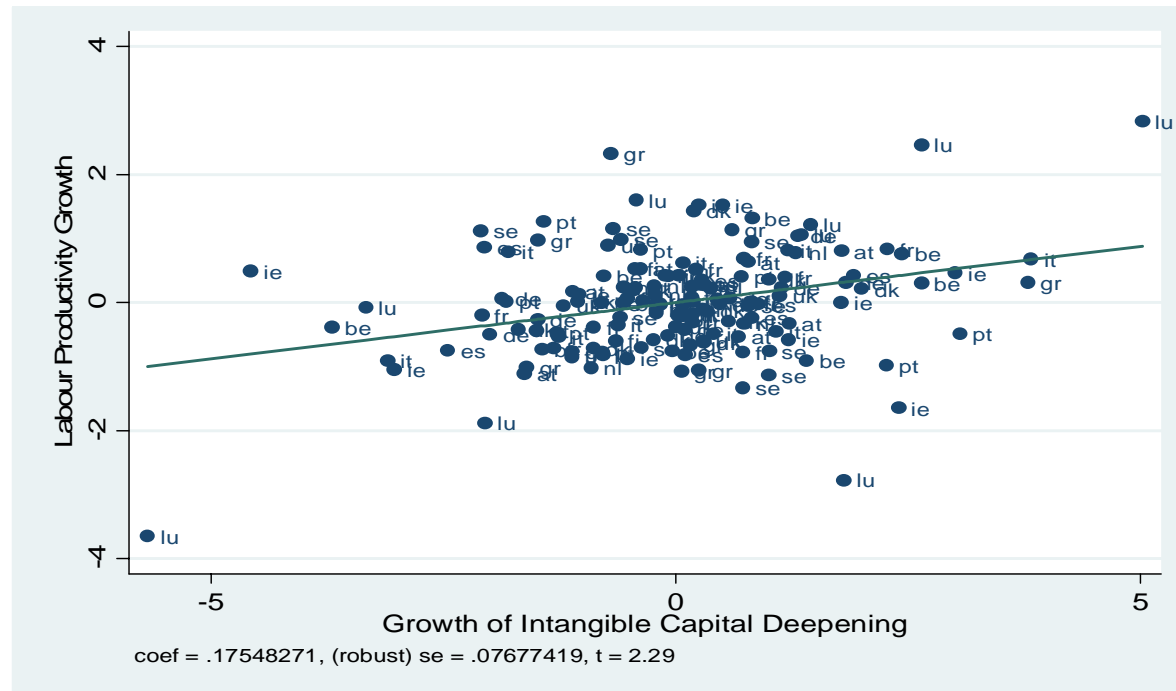
Partial regression plot between intangible capital deepening and labour productivity growth – pooled cross-section estimation for the EU-15 countries



Source: INNODRIVE: Published In: Roth, Felix and Anna Thum (2010). The Key Role of Education in the Europe 2020 Strategy, CEPS Working Document 338.

Fig. 2

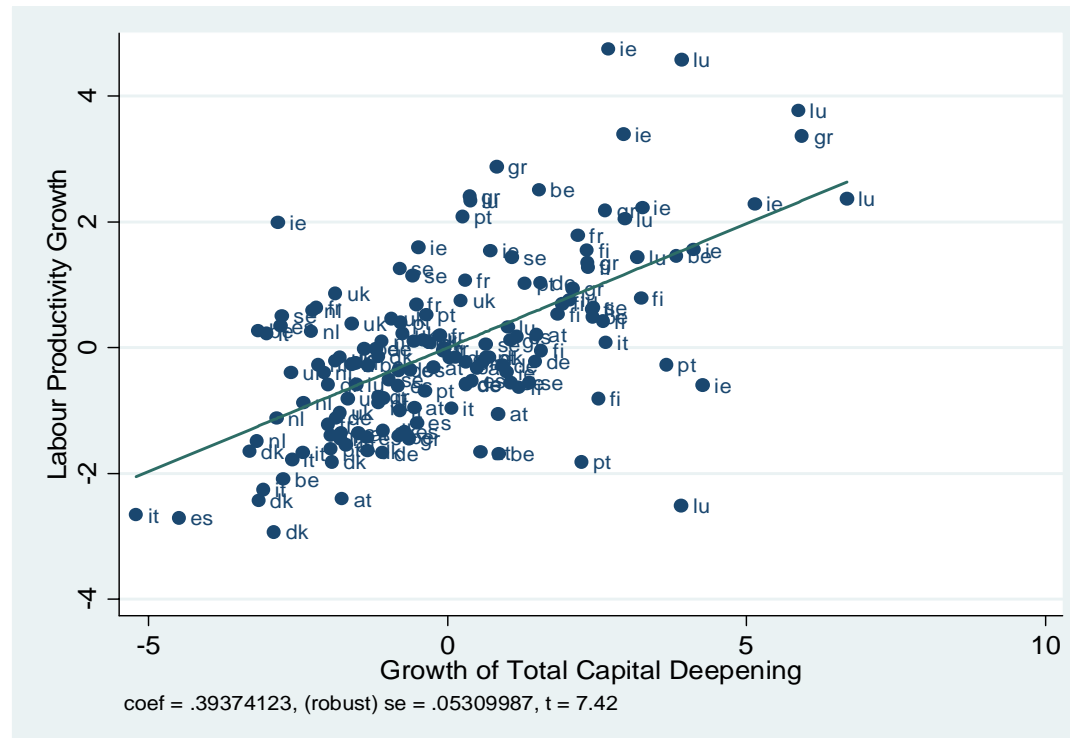
Partial regression plot between intangible capital deepening and labour productivity growth – fixed effects estimation for the EU-15 countries



Source: INNODRIVE: *Published In: Roth, Felix and Anna Thum (2010). The Key Role of Education in the Europe 2020 Strategy, CEPS Working Document 338.*

Fig. 3

Partial regression plot between total capital deepening and labour productivity growth – pooled cross-section estimation for the EU-15 countries



Source: INNODRIVE: Published In: Roth, Felix and Anna Thum (2010). The Key Role of Education in the Europe 2020 Strategy, CEPS Working Document 338.

Table 1: Regression Results

Estimation Method	OLS (1)	OLS (2)	RE (3)	RE (4)	GMM sys (5)	GMM sys (6)
Lagged Labour Productivity ^a	-2.040*** (0.511)	-1.192** (0.543)	-3.227** (1.319)	-1.545 (1.091)	-1.774* (1.037)	-0.654 (0.472)
Education	1.936*** (0.332)	1.477*** (0.326)	2.379*** (0.735)	1.658*** (0.580)	1.764** (0.697)	1.189*** (0.449)
Growth of Capital Deepening	0.662*** (0.0918)	0.438*** (0.0949)	0.679*** (0.0921)	0.488*** (0.116)	0.686*** (0.138)	0.459*** (0.117)
Growth of Intangible Capital Deepening		0.312*** (0.0545)		0.235*** (0.0703)		0.330*** (0.0731)
Proxy business cycle	-4.166 (3.162)	-9.440*** (3.010)	-16.21*** (6.190)	-13.00*** (4.792)	-6.769 (5.727)	-15.08* (8.224)
Constant	4.338 (3.016)	7.190*** (2.726)	17.74** (7.144)	10.40** (5.033)	5.485 (5.702)	11.44 (7.849)
Observations	150	150	150	150	135	150
R-squared ^b	0.472	0.587	0.4027	0.5607	-	-
Time effects	yes	yes	yes	yes	yes	yes
Number of countries	15	15	15	15	15	15

^a Labour productivity augmented by investment in intangible capital if intangible capital stock included in the regression.

^b The reported values for R squared are the overall value for the OLS and RE estimators and the within value for FE estimator.

Note: Robust standard errors are given in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Source: Innodrive: Roth and Thum (2010) "Does Intangible Capital affect Economic Growth?" Innodrive Working Paper No. 3.

Table 2: Sensitivity Analysis

Row	Specification Change	Coefficient on Intangible Capital	Standard Error	Countries	Observations	Coefficient on the additional variable	R squared ^b
<i>Influential Cases</i>							
(1)	None	0.330***	(0.0731)	15	150	-	0.5607
(2)	Out Luxemburg	0.193**	(0.0965)	14	140	-	0.5071
(3)	Out Ireland	0.285***	(0.0837)	14	140	-	0.6421
<i>Restructuring of data</i>							
(4)	1995-2000	0.390***	(0.0873)	15	75	-	0.5696
(5)	2001-2005	0.319***	(0.101)	15	75	-	0.6134
<i>Restructuring of Country Sample</i>							
(6)	Mediterranean	0.0854	(0.138)	4	40	-	0.8939
(7)	Coordinated	0.335***	(0.0935)	6	60	-	0.687
(8)	Scandinavian	-0.0370	(0.181)	3	30	-	0.8058
(9)	Liberal	-0.273	-	2	20	-	0.9735
<i>Specifications</i>							
(9)	Stocks of inward FDI ^a	0.235***	(0.0853)	14	121	0.0164***	0.6284
(10)	Openness to trade	0.255***	(0.0639)	15	135	0.0149***	0.5231
(11)	Stock Market Capitalization in % of GDP	0.291***	(0.0467)	15	139	0.00651**	0.6209
(12)	Inflation	0.269***	(0.0565)	15	150	-0.162**	0.6094
(13)	Income tax in % of GDP	0.327***	(0.0670)	15	150	0.0104	0.5568
(14)	Government Efficiency	0.286**	(0.118)	15	105	0.442	0.6294
(15)	Political Stability	0.260**	(0.127)	15	105	0.977*	0.6265
(16)	Government Expenditure in % of GDP	0.254***	(0.0635)	15	150	-0.0710***	0.5904
(17)	Education Expenditure in % of GDP	0.295***	(0.0644)	15	150	-0.0574	0.5602
(18)	Social Expenditure in % of GDP	0.214***	(0.0754)	15	149	-0.133***	0.5981

^a Data for Belgium is unavailable.

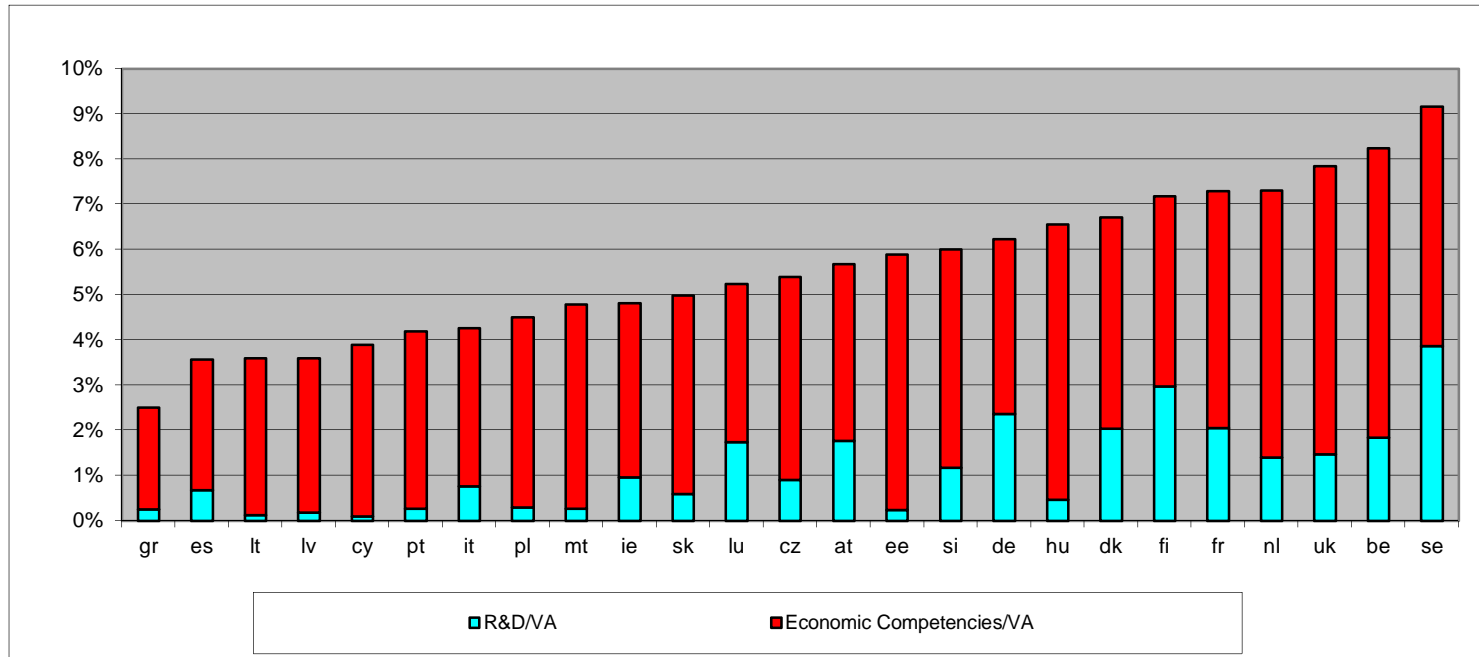
^b The values for R squares are retrieved from a random effects regression (overall R squared).

Note: Robust standard errors are given in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

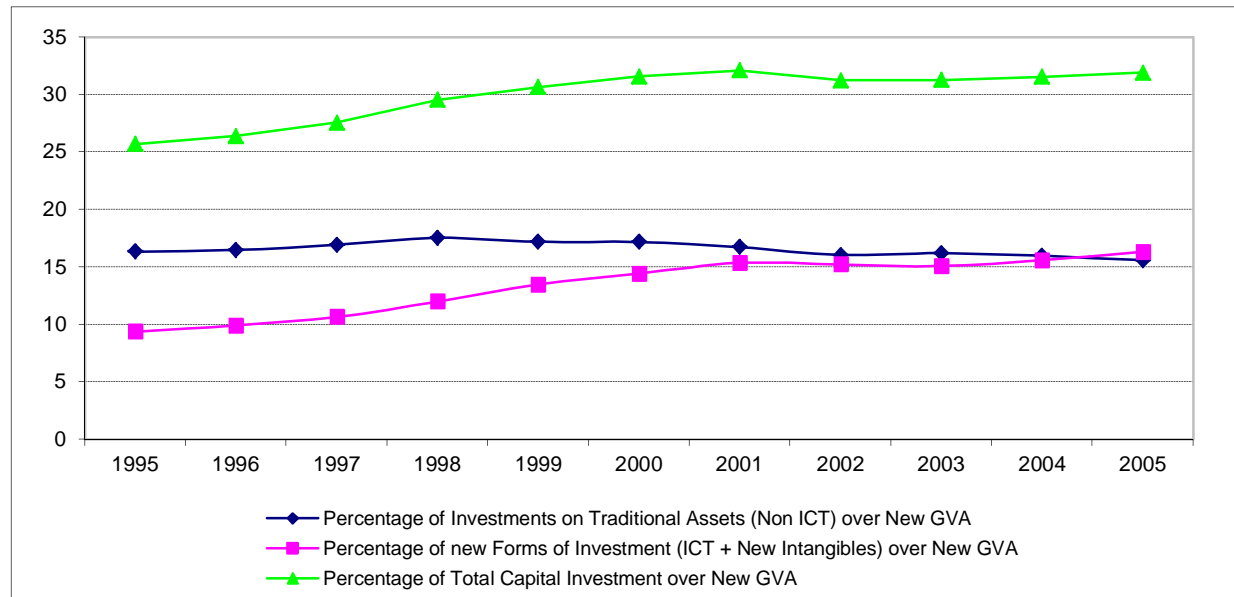
5. EU2020 Strategy and Intangible Capital

Fig. 4
Investment in Intangible Capital by Businesses in the
EU25 Compared to R&D



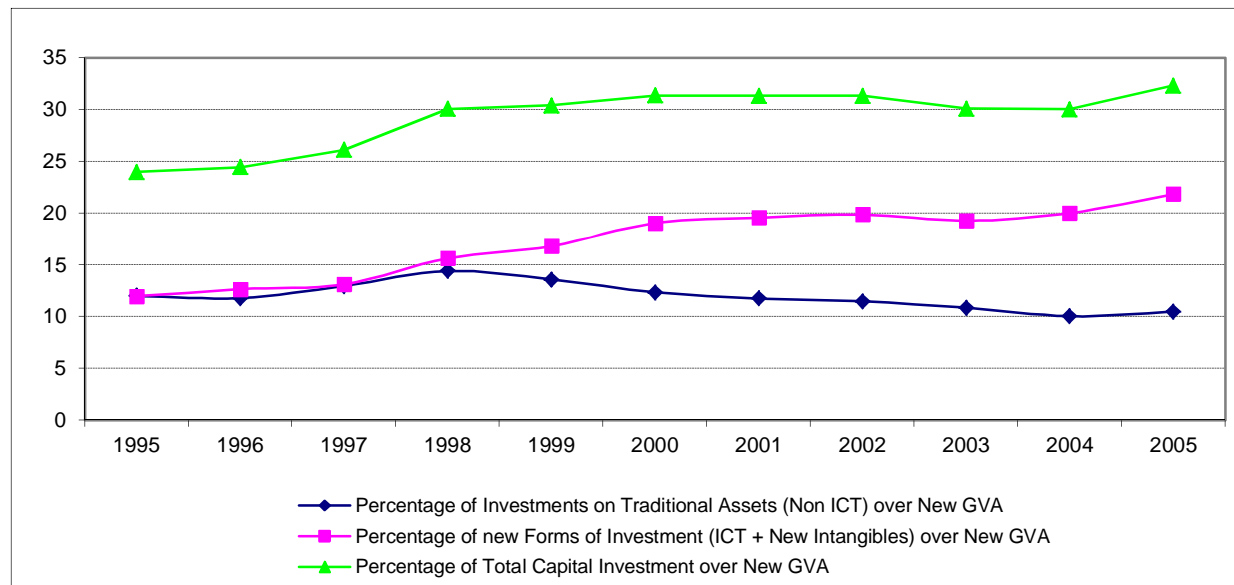
Source: INNODRIVE: *Published In: Roth (2010). Measuring Innovation - Intangible Capital Investment in the EU, Intereconomics 45: 273-277.*

Fig. 5
**Comparison of Business Investment in Traditional
Tangible Capital and New ICT and Intangible Capital
in an EU11 Country Sample**



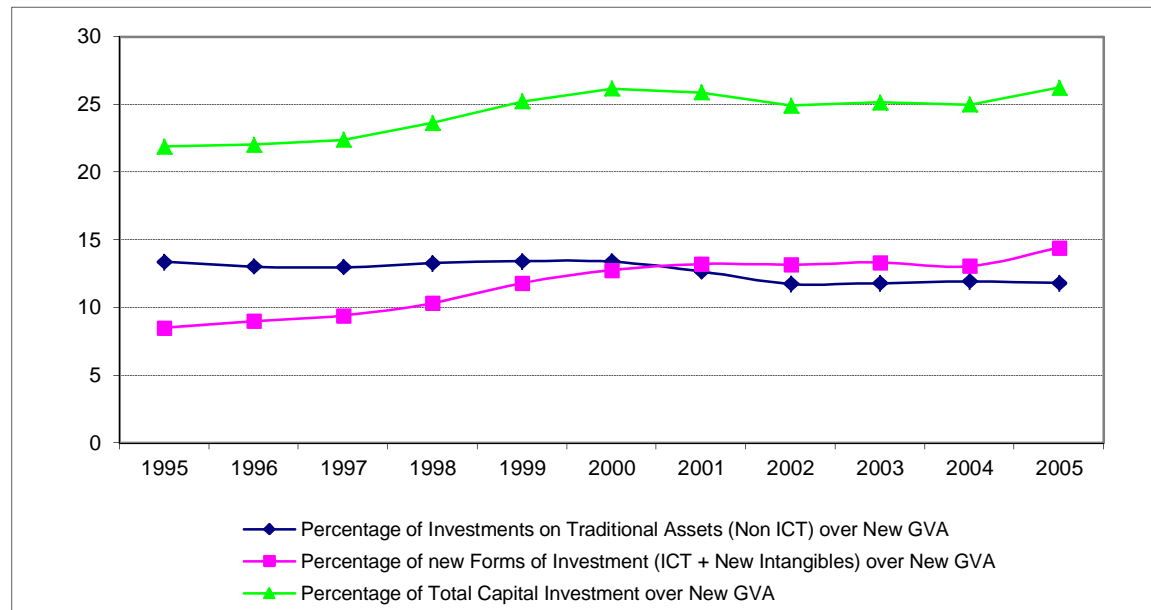
Source: INNODRIVE: Published In: Roth (2010). Measuring Innovation - Intangible Capital Investment in the EU, Intereconomics 45: 273-277.

Fig. 6
Comparison of Business Investment in Traditional Tangible Capital and New ICT and Intangible Capital in the UK



Source: INNODRIVE: Published In: Roth (2010). Measuring Innovation - Intangible Capital Investment in the EU, Intereconomics 45: 273-277.

Fig. 7
Comparison of Business Investment in Traditional Tangible Capital and New ICT and Intangible Capital in Germany



Source: INNODRIVE: Published In: Roth (2010). Measuring Innovation - Intangible Capital Investment in the EU, Intereconomics 45: 273-277.

6. Policy Implications

Business intangible capital proves to be positively and significantly related to labour productivity growth; The relation seems to be stronger across countries than within countries.

The relation is slightly stronger in 1995-2000 and in coordinated countries.

Labour productivity grows faster when including intangible capital in the asset boundary of the national accounting framework.

Capital deepening becomes more important when taking intangibles into account.

The Europe's 2020 focus on the sole innovative indicator R&D seems to be flawed. In particular economies with a large service sector and strong knowledge production, e.g. the UK, seem to be misspecified.

Capital investment rates are twice as high in the EU once accounting for intangible investments. There are growing steadily.

EU Structural Funds should stop supporting investments in traditional „brick and mortar“ capital but should instead invest in intangible and human capital.

1, Place du Congrès

B – 1000 Brussels

Tel: +32 2 229 3911

Fax: +32 2 219 4151

<http://www.ceps.eu>