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Intangible Investments in Germany - An Overall Perspective

Bettina Peters
ZEW Centre for European Economic Research, Mannheim

The French-German Round Table,
Paris, 26th September 2011

Results established within the COINVEST project that was funded by the European Commission under the Seventh Framework Programme, Grant No 217512

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Background

- Knowledge capital has become a key input factor for firms around the world to gain competitive advantage.
- EU has started initiatives to better reap benefits from the knowledge economy (Lisbon strategy by 2010, Europe 2020)
- Knowledge capital is more than R&D (Corrado et al. 2006):
  - Computerized information
    - Computer software and computerized hardware
  - Innovative property
    - R&D, mineral exploration, copyright and license costs (creative industries), new product development costs in the financial industry, new architectural and engineering designs
  - Economic competences
    - Brand equity, firm-specific human capital, organizational structure
- Challenging task: Knowledge is of intangible nature which makes it hard to measure its amount, quality or effects.
- FP7 project COINVEST: Collecting time series of intangible capital in Germany and exploring its contribution to economic growth at the macro, sector and micro level

Structure

1. **Intangibles and Their Contribution to Growth at the Macro Level**
2. Intangibles and Their Contribution to Growth at the Sector Level
3. Impact of Intangibles on Productivity Growth at the Micro Level

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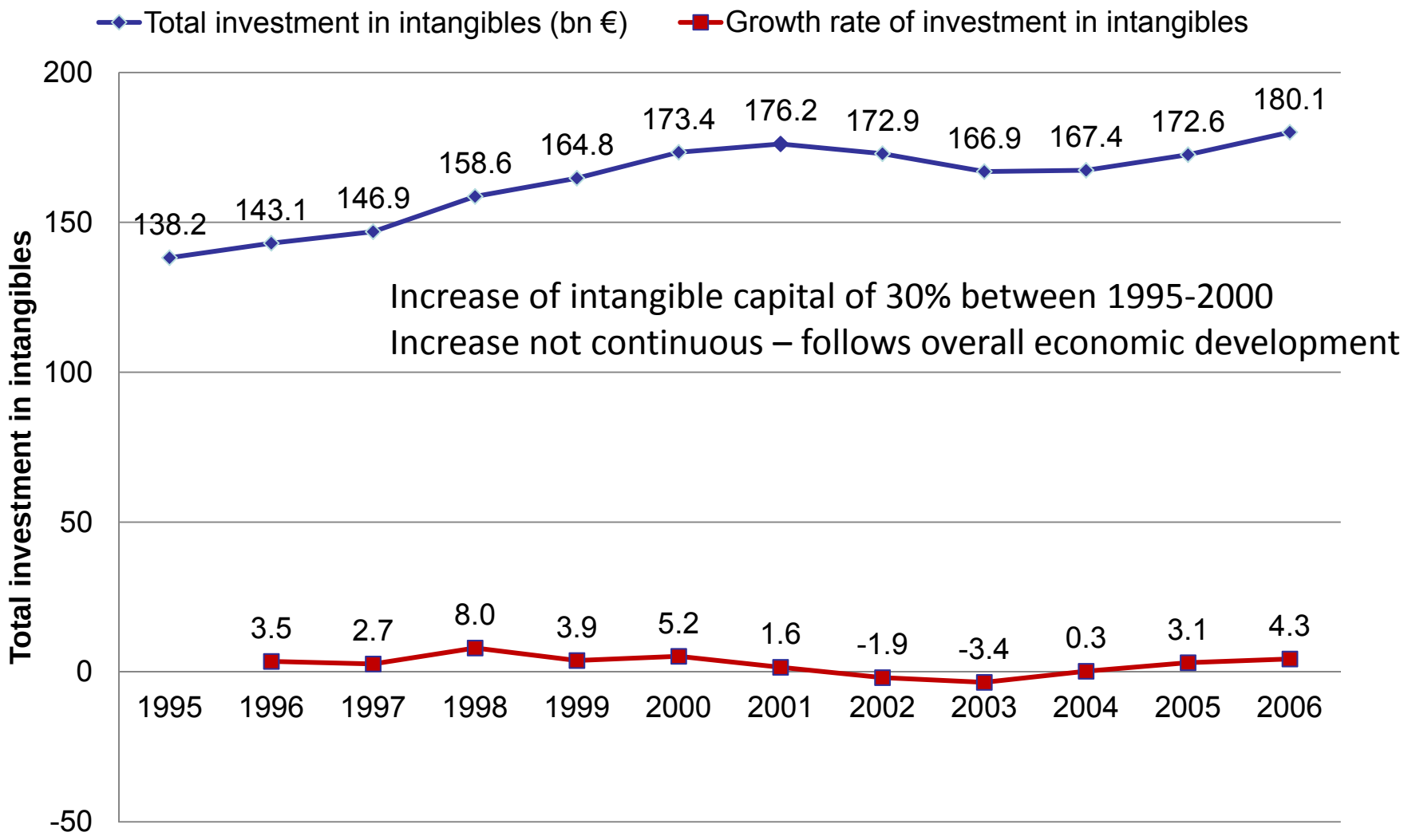
Investments in Intangibles in Germany



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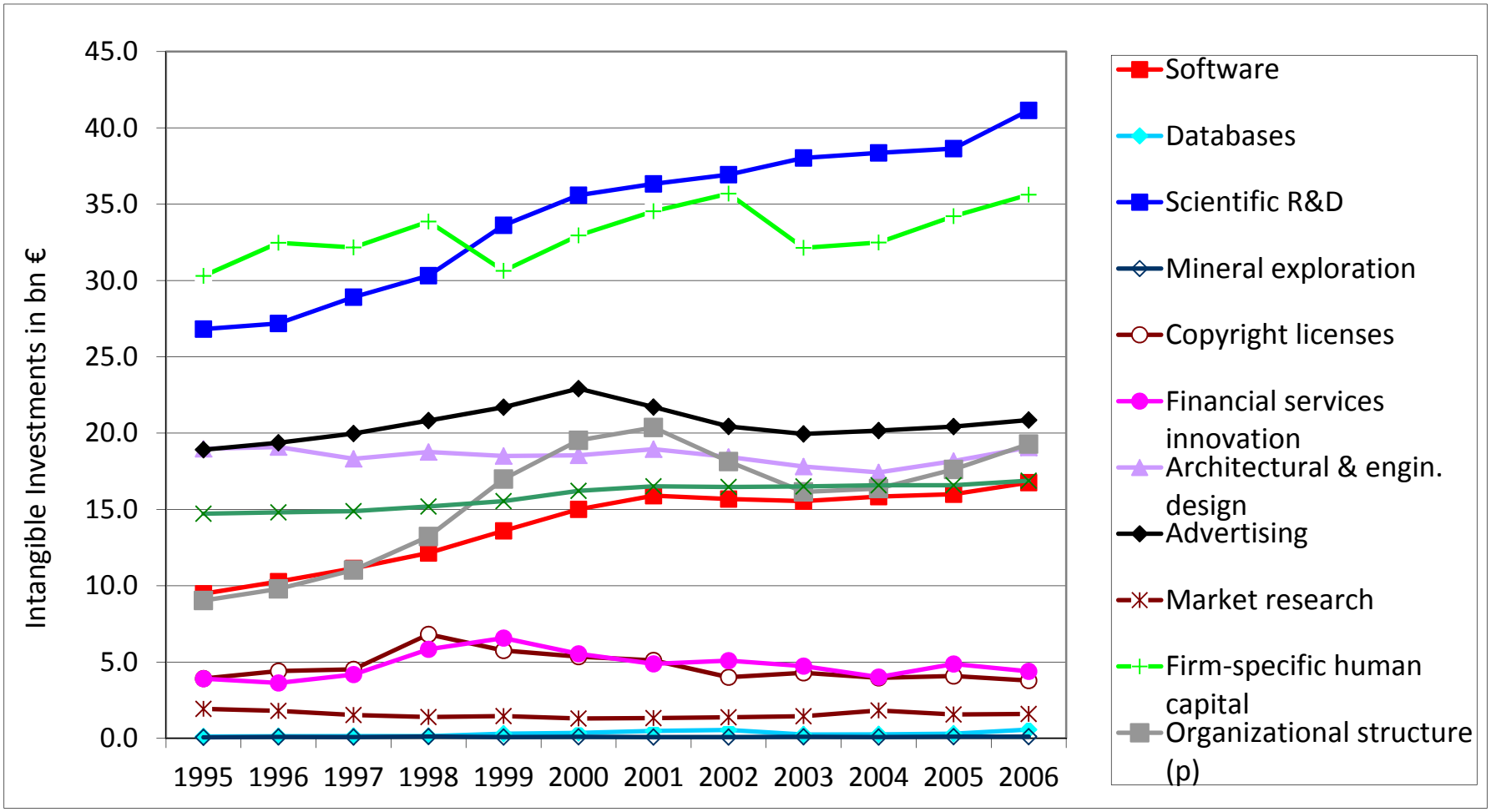
Intangible Investment by Category



Overall increase roots in R&D (+54%), software (+81%), firm-specific human capital (+18%) and purchased organizational structure (+114%)

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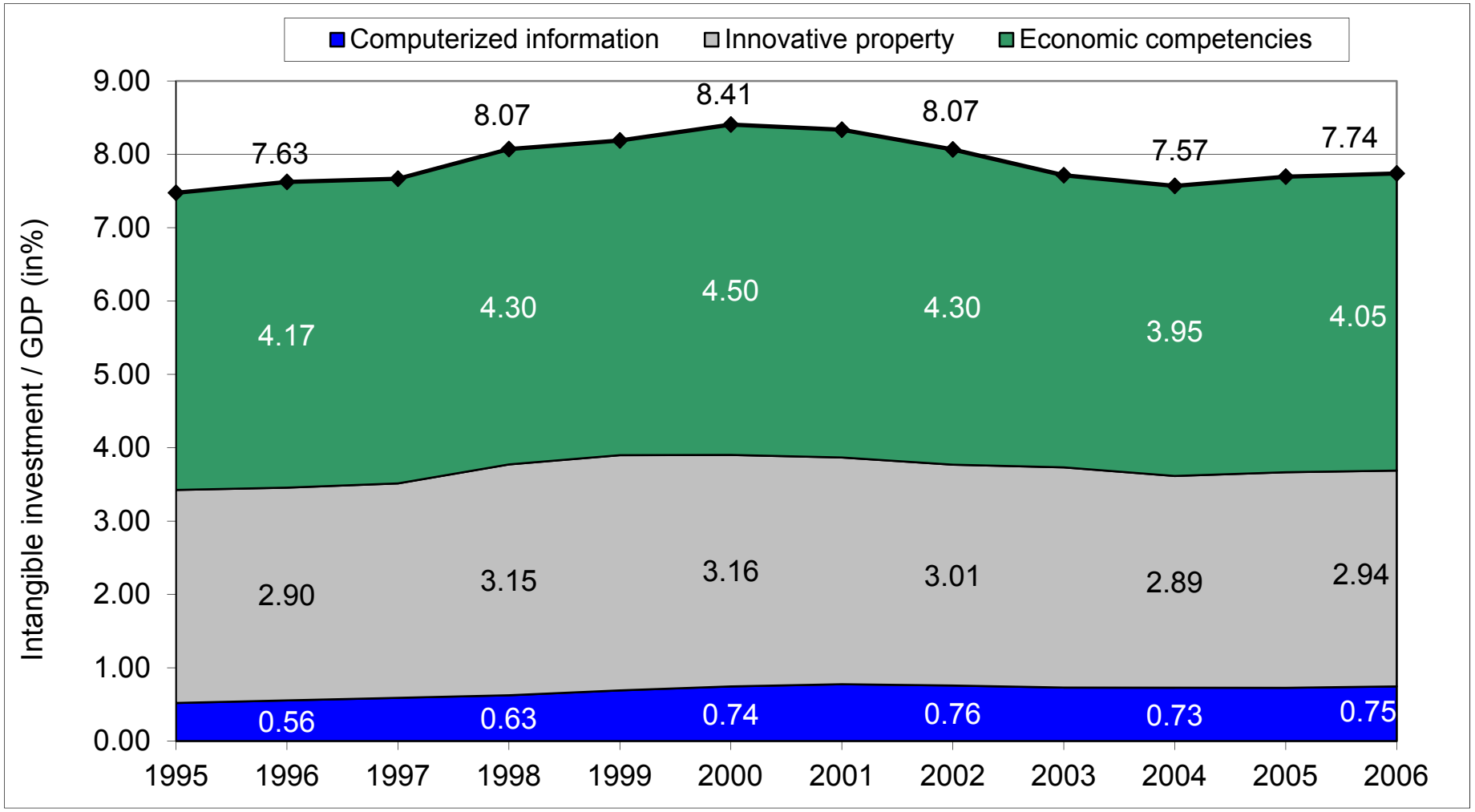
Intangible Investment as Share of GDP in Germany



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International Comparison

	DE	FR	IT	ES	UK	PT	US	SE
	2004	2004	2004	2004	2004	2004	1998-2000	2004
Computerized information	**0.73**	**1.57**	**0.66**	**0.74**	**1.70**	**0.83**	**1.65**	**1.83**
Innovative property	**2.89**	**3.12**	**2.26**	**2.51**	**3.23**	**4.34**	**4.57**	**5.39**
Scientific R&D	1.74	1.29	0.52	0.55	1.09	1.08	2.06	2.60
Mineral exploration	0.00	0.00	0.04	0.04	0.04	0.40	0.19	0.01
Copyright licenses	0.18	0.15	0.10	0.19	0.21	1.34	0.81	0.11
Financial services innovation	0.18	0.04	0.79	0.35	0.69	1.00	0.79	0.25
Archit. & engin. design	0.79	0.95	0.80	1.38	1.20	0.52	0.73	2.42
Economic competencies	**3.95**	**3.85**	**2.67**	**2.19**	**5.95**	**2.63**	**6.91**	**3.32**
Brand equity	0.99	1.35	1.19	0.58	1.59	1.16	2.53	1.61
Advertising	*0.91*	*1.24*	*0.91*	*0.33*	*1.20*	*1.06*	*2.33*	*1.43*
Market research	*0.08*	*0.11*	*0.28*	*0.25*	*0.39*	*0.10*	*0.20*	*0.18*
Firm-specific human capital	1.47	1.21	1.00	0.83	2.45	0.60	1.25	1.05
Cont. Vocational training	*1.14*		*0.69*	*0.73*		*0.60*		
apprentice training	*0.33*		*0.31*	*0.11*				
Organizational structure	1.49	1.29	0.48	0.78	1.91	0.87	3.13	0.67
purchased	*0.74*		*0.11*	*0.25*	*0.60*	*0.85*	*0.87*	*0.20*
own account	*0.75*		*0.37*	*0.53*	*1.31*	*0.02*	*2.26*	*0.47*
Total Spending	**7.57**	**8.54**	**5.58**	**5.44**	**10.88**	**7.85**	**13.13**	**10.55**
Total Investment	**7.05**		**5.15**	**5.20**	**10.10**		**11.70**	

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Contribution of Intangible Capital to Aggregate Labour Productivity Growth, 1997-2006

	Excluding Intangibles				Including Intangibles			
	97-00	**00-03**	**03-06**	**Total**	**97-00**	**00-03**	**03-06**	**Total**
Gross output	1.87	-0.14	2.11	1.34	1.89	-0.15	2.11	1.34
Hours worked	-0.48	-1.73	-1.55	-1.18	-0.48	-1.73	-1.55	-1.18
Labour Productivity	**2.35**	**1.59**	**3.66**	**2.51**	**2.38**	**1.58**	**3.66**	**2.52**
Capital deepening	0.52	0.33	0.27	0.39	1.17	0.56	0.35	0.74
ICT capital	0.16	0.09	0.06	0.11	0.17	0.09	0.06	0.11
Non-ICT capital	0.35	0.24	0.21	0.28	0.38	0.26	0.21	0.29
Intangible capital	**-**	**-**	**-**	**-**	**0.62**	**0.21**	**0.08**	**0.33**
Labour quality	-0.06	0.13	-0.08	-0.01	-0.06	0.13	-0.08	-0.01
Intermediate input deepening	1.41	1.11	2.40	1.62	1.25	1.17	2.27	1.53
TFP	0.48	0.02	1.07	0.52	0.03	-0.28	1.11	0.26

Important contribution of intangible capital to LP growth.

But: Contribution has decreased since 2000

Structure

1. Intangibles and Their Contribution to Growth at the Macro Level

2. **Intangibles and Their Contribution to Growth at the Sector Level**

3. Impact of Intangibles on Productivity Growth at the Micro Level

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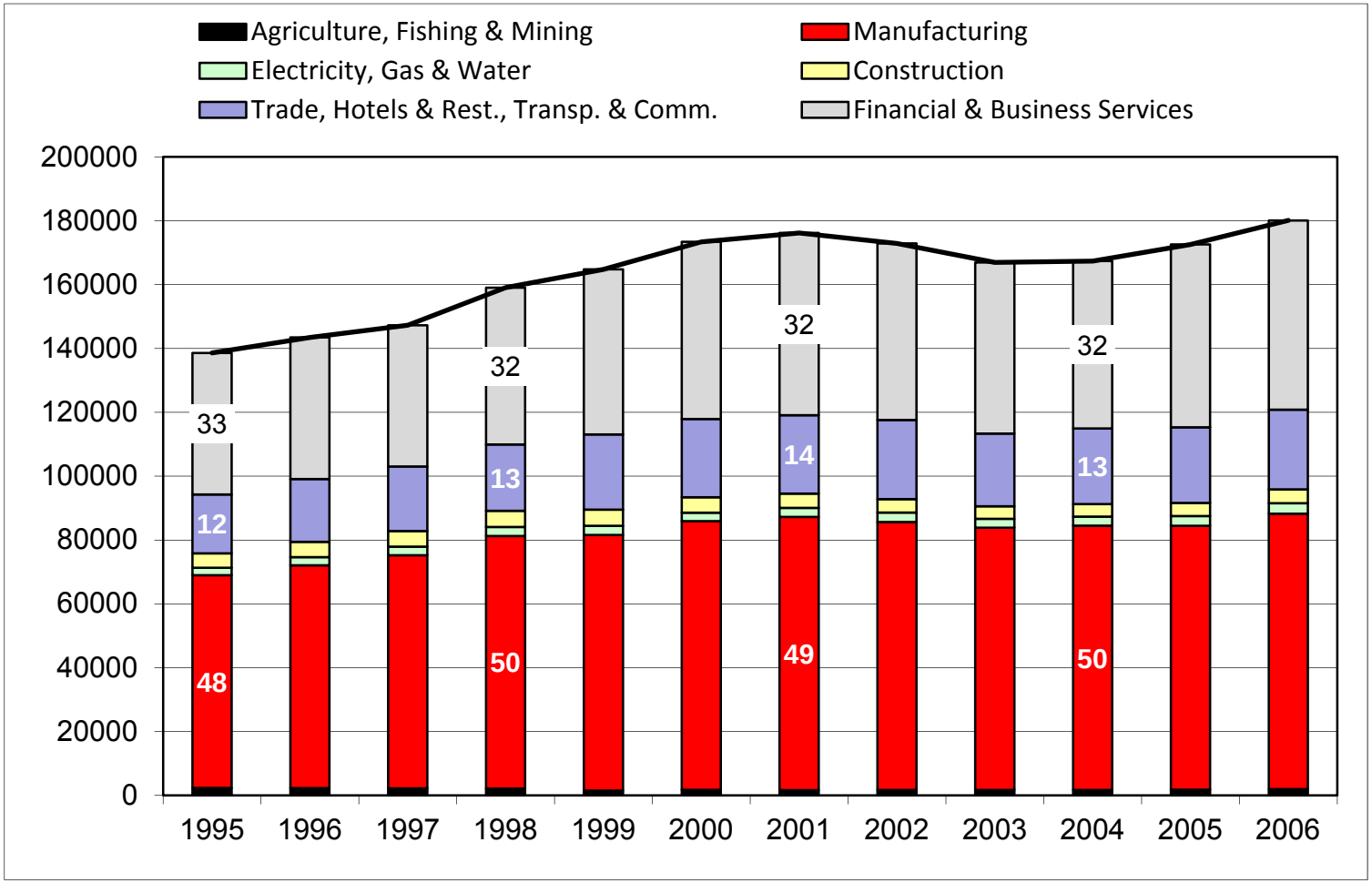
Which Industries Contribute to What Extent to Intangible Investments ?

Stable distri-bution across industries over time

Nearly half of the investment in intangibles is carried out by manufacturing (proportion > than its share in gross output, VA or labour input).



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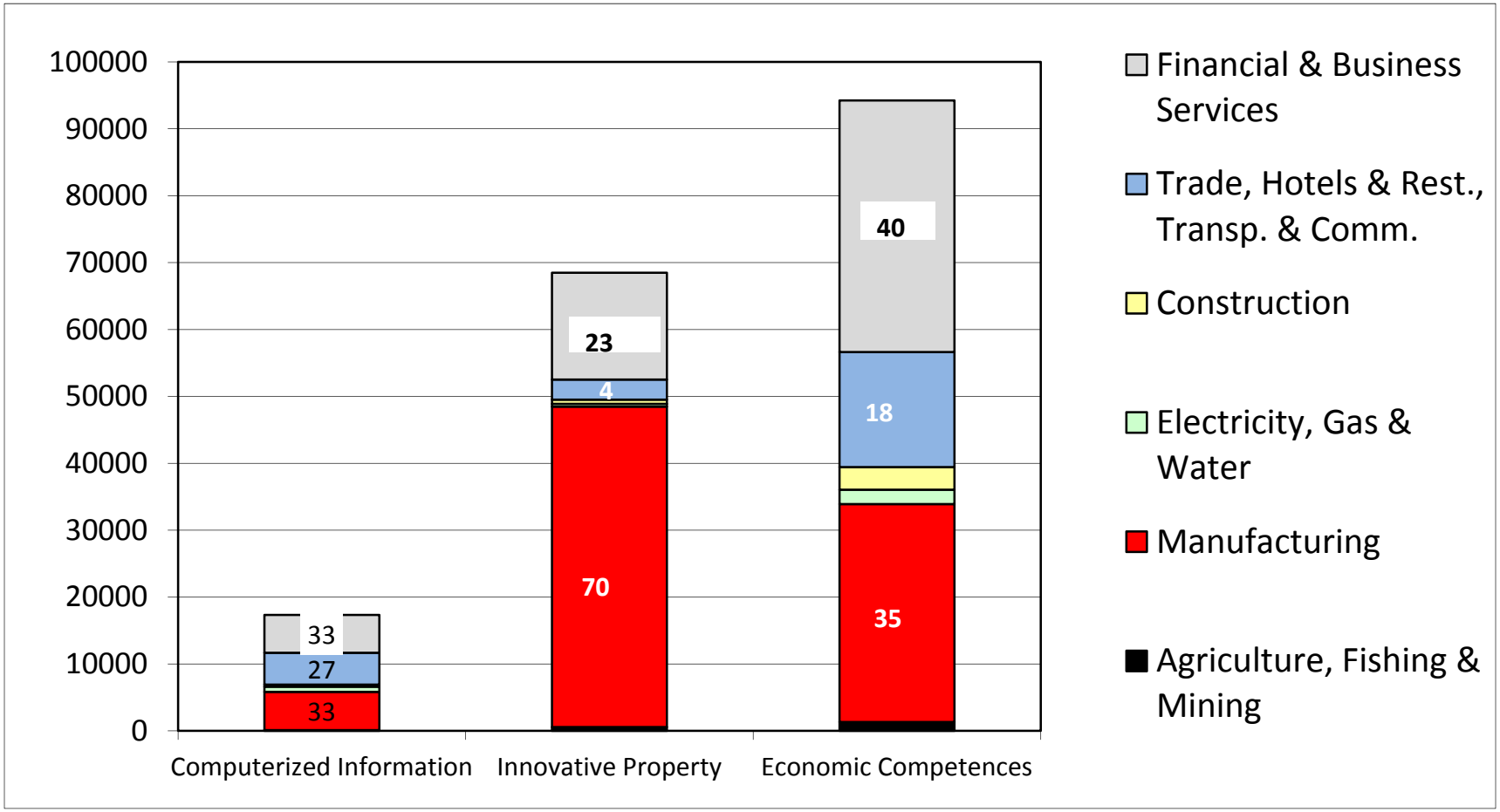
Concentration Across Industries By Asset Class



Innovative property highly concentrated in two industries (manufacturing, fin&business services)

Computerized information and economic competencies more equally spread across industries

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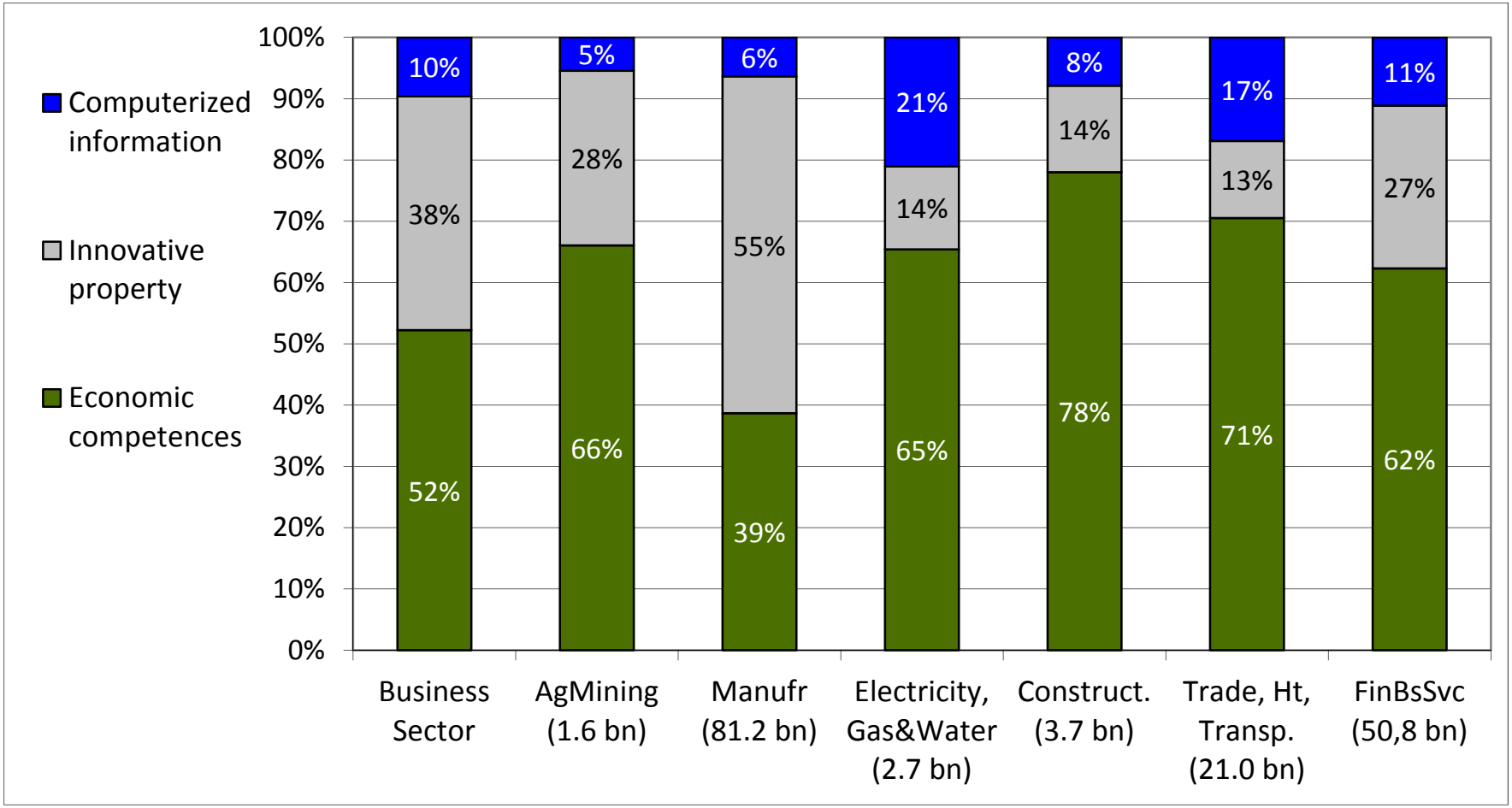
Relative Importance of Types of Intangible Investments by Sector, 2004



High variation in relative importance of computerized information, innovative property and economic competencies across sectors.

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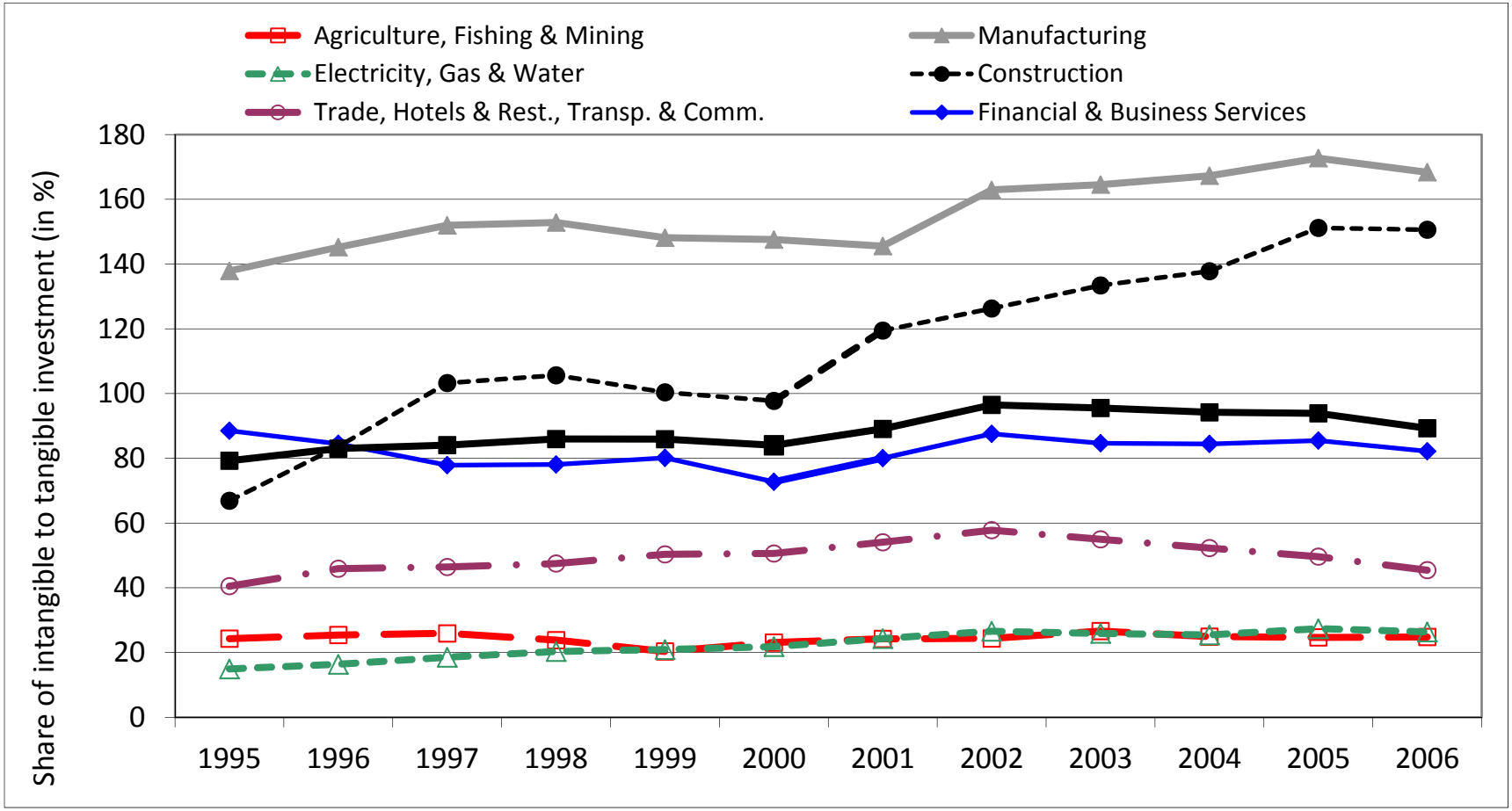
Proportion of Intangible to Tangible Investments



Intangible investment gained importance relative to tangible investment (from 80% to 89%)
Driver: Manufacturing and construction

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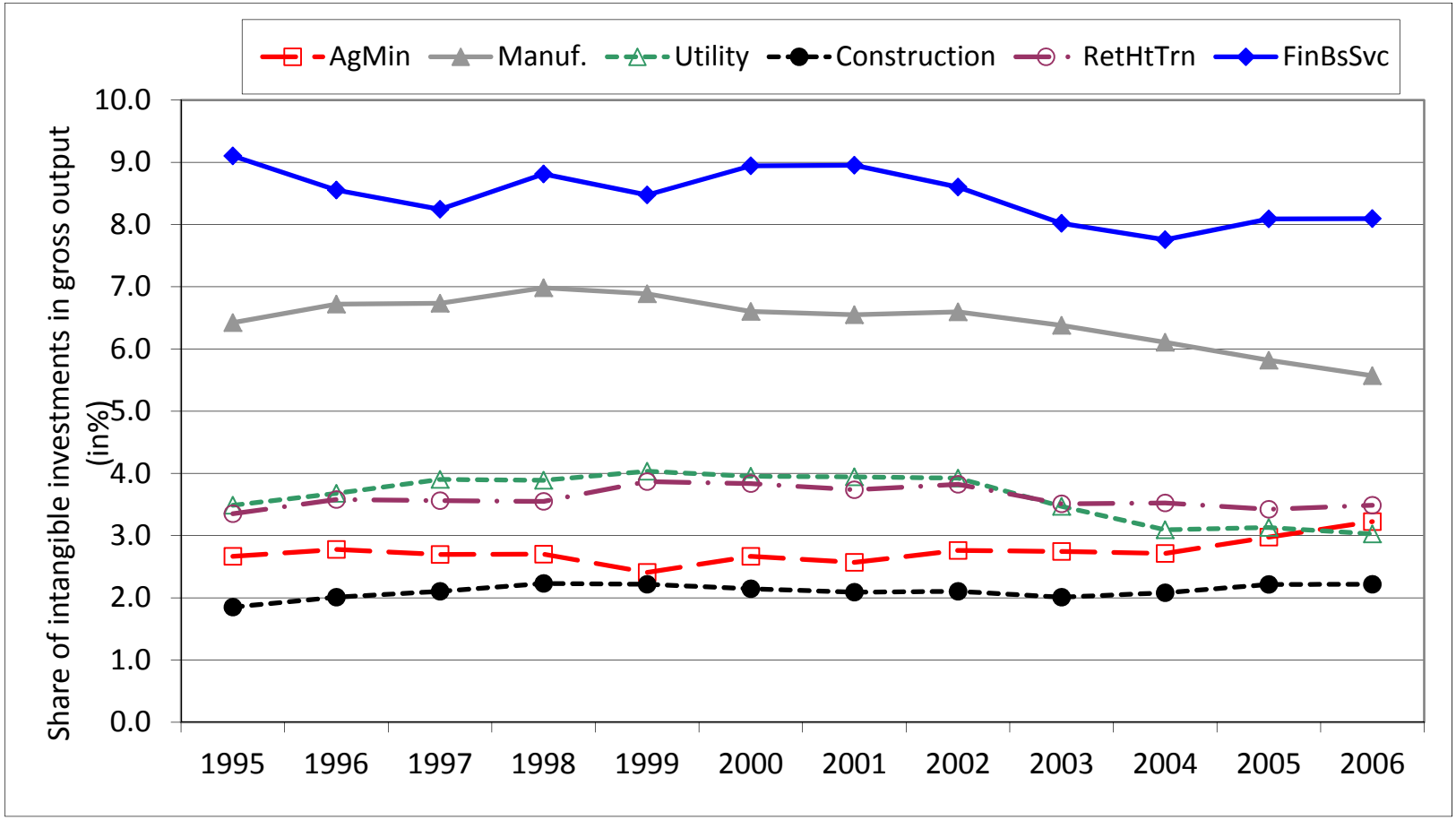
Intangible Investment as Share of Industry Gross Output



Benchmarking these figures with UK:
German firms from all sectors invest a higher proportion of gross output in R&D.
Same holds for advertising (ex Trade & Transport).
For all other categories and sectors proportion is higher in UK than in DE.

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Contributions to Labour Productivity at the Sector Level

	AgMin	Mfr.	Utility	Cons.	RetHtTm	FinBsSvs
Labour Productivity	**2.545**	**4.554**	**6.410**	**-0.284**	**2.362**	**-0.458**
Capital deepening	0.162	0.832	1.863	0.131	0.585	0.867
ICT capital	0.023	0.040	0.094	0.017	0.117	0.390
Non-ICT capital	-0.061	0.200	1.388	-0.051	0.234	0.059
Intangible capital	**0.199**	**0.592**	**0.380**	**0.165**	**0.234**	**0.417**
Computerized Information	**0.012**	**0.039**	**0.086**	**0.014**	**0.048**	**0.065**
Software	0.012	0.038	0.085	0.014	0.047	0.063
Databases	0.000	0.001	0.001	0.000	0.001	0.003
Innovative property	**0.065**	**0.386**	**0.068**	**0.041**	**0.040**	**0.204**
Scientific R&D	0.015	0.289	0.013	0.003	0.008	0.045
Mineral exploration	0.013	0.000	0.000	0.000	0.000	0.000
Copyright licenses	0.000	0.039	0.000	0.000	0.000	0.000
Financial services innovation	0.000	0.000	0.000	0.000	0.000	0.068
Architectural & engineering design	0.037	0.057	0.055	0.038	0.032	0.091
Economic competencies	**0.122**	**0.167**	**0.226**	**0.110**	**0.146**	**0.148**
Advertising	0.031	0.025	0.032	0.008	0.015	0.003
Market research	0.002	0.001	0.002	0.000	0.001	-0.002
Firm-specific human capital	0.018	0.062	0.111	0.059	0.082	0.045
Organizational structure (p)	0.032	0.034	0.037	0.017	0.021	0.036
Organizational structure (oa)	0.040	0.045	0.046	0.025	0.028	0.066
Labour quality	-0.217	0.073	0.038	0.078	-0.011	-0.031
Intermediate input deepening	1.035	3.093	3.889	0.076	1.131	-0.032
TFP	1.565	0.556	0.620	-0.570	0.657	-1.262

Contribution of IntCap > ICT and non ICT separate-ly, except for utility

Ranking of CI, IP and EC varies across industries

EC are relatively less growth-enhancing.

In manuf.:
EC account for 39% of int. inv., but only for 28% of the contribution of IntCap.

FinBsSvs:
62% vs. 35%

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Contributions to Labour Productivity at the Sector Level

	Including Intangibles											
	AgMin		Mfr.		Utility		Cons.		RetHtTm		FinBsSvs	
	97-00	00-06	97-00	00-06	97-00	00-06	97-00	00-06	97-00	00-06	97-00	00-06
Gross output	-0.89	-0.16	4.01	2.17	0.98	3.88	-1.37	-3.51	3.87	1.33	4.76	2.17
Hours worked	-2.20	-3.53	-1.99	-1.42	-3.79	-3.62	0.34	-4.17	0.28	-0.22	4.47	3.13
Labour Productivity	**1.31**	**3.37**	**6.01**	**3.59**	**4.78**	**7.50**	**-1.71**	**0.67**	**3.58**	**1.55**	**0.29**	**-0.96**
Capital deepening	0.11	0.20	1.38	0.47	2.56	1.40	0.21	0.08	0.83	0.42	1.92	0.17
ICT capital	0.02	0.02	0.06	0.03	0.13	0.07	0.02	0.01	0.16	0.09	0.62	0.24
Non-ICT capital	-0.13	-0.01	0.30	0.13	1.79	1.12	-0.14	0.01	0.23	0.24	0.23	-0.06
Intangible capital	**0.22**	**0.19**	**1.01**	**0.31**	**0.64**	**0.21**	**0.32**	**0.06**	**0.44**	**0.10**	**1.07**	**-0.02**
Labour quality	-0.35	-0.12	0.02	0.11	0.04	0.04	0.05	0.09	-0.08	0.03	-0.06	-0.01
Intermed. input deep.	-0.08	1.78	4.08	2.44	2.01	5.14	-0.69	0.59	1.80	0.68	0.37	-0.30
TFP	1.64	1.51	0.53	0.57	0.17	0.92	-1.28	-0.10	1.03	0.41	-1.94	-0.81

Structure

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3. **Impact of Intangibles on Productivity Growth at the Micro Level**

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Approach & Main Findings From Micro Work

- Analysis based on panel data (Mannheim Innovation Panel) for German companies from 2006-2010 (6345 firms, 11129 observations).
- We estimate the productivity effect of different kinds of intangible assets at the firm level (OLS, FE, OP).
- We confirm strong positive productivity effects for R&D, marketing and training.
- Effects of marketing are highest, even higher than those of R&D (in the short term).
- Only weak evidence for positive productivity effects of innovative knowledge capital that is not related to own R&D like design, licenses and product preparation.
- Mixed productivity effects of firms increasing their organizational capital by introducing organisational innovations: positive effect for business practices but not for workplace organisation.

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Thank you for your kind attention!

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Intangible Assets: Data Sources

- Computerized information
  - Computer software: EU KLEMS Nov2009 Release
  - Computerized databases: Turnover tax statistics (72.4)
- Innovative property
  - R&D, including social sciences and humanities: ANBERD (Eurostat)
  - Mineral exploration: Turnover tax statistics (45.12)
  - Copyright and license costs: Turnover tax statistics (92.11)
  - New product development costs in the financial industry: Mannheim Innovation Panel (MIP)
  - New architectural and engineering designs: Turnover tax statistics (74.2)
- Economic competencies
  - Brand equity: Central Association of the German Advertising Industry (ZAW), MIP, Turnover tax statistics (74.13)
  - Firm-specific human capital: MIP, IW
  - Organizational structure: Turnover tax statistics (74.14.1), Structure of earnings survey, EU KLEMS Nov2009

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Econometric results

	OLS (1)		OLS (2a)		OLS (2b)		OLS (3)	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Labour	-0.006	(0.117)	-0.001	(0.752)	-0.001	(0.806)	-0.001	(0.783)
Capital	0.072***	(0.000)	0.056***	(0.000)	0.056***	(0.000)	0.056***	(0.000)
Material	0.416***	(0.000)	0.389***	(0.000)	0.389***	(0.000)	0.389***	(0.000)
R&D	-		0.042***	(0.000)	0.042***	(0.000)	0.046***	(0.000)
Non-R&D Innovation	-		0.004***	(0.007)	0.004**	(0.010)	0.008***	(0.001)
Training	-		0.051***	(0.000)	0.051***	(0.000)	0.051***	(0.000)
Marketing	-		0.057***	(0.000)	0.057***	(0.000)	0.057***	(0.000)
R&D*NonR&D-Inno.	-		-		-		0.001**	(0.022)
East Germany	-0.157***	(0.000)	-0.143***	(0.000)	-0.143***	(0.000)	-0.143***	(0.000)
Belonging to a group	0.144***	(0.000)	0.122***	(0.000)	0.122***	(0.000)	0.122***	(0.000)
Export intensity	0.131***	(0.000)	0.068***	(0.001)	0.068***	(0.003)	0.068***	(0.001)
Time D	yes		yes		yes		yes	
Industry D	yes		yes		yes		yes	
W_Time	(0.0013)		(0.0000)		(0.0000)		(0.0004)	
W_Industry	(0.0000)		(0.0000)		(0.0000)		(0.0000)	
R2	0.673		0.700		0.700		0.700	
# Obs.	11,129		11,129		11,129		11,129	

Regression additionally includes four dummies indicating R&D, Non-R&D innovation, training, and marketing is zero.
Robust p-values in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Econometric results

	OLS (1)		OP (1)		OLS (2)		OP (2)	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Labour	-0.006	(0.117)	-0.012*	(0.096)	-0.001	(0.752)	-0.001	(0.911)
Capital	0.072***	(0.000)	0.060***	(0.000)	0.056***	(0.000)	0.041***	(0.002)
Material	0.416***	(0.000)	0.418***	(0.000)	0.389***	(0.000)	0.391***	(0.000)
R&D	-		-		0.042***	(0.000)	0.040***	(0.000)
Non-R&D Innovation	-		-		0.004***	(0.007)	0.003***	(0.001)
Training	-		-		0.051***	(0.000)	0.051***	(0.000)
Marketing	-		-		0.057***	(0.000)	0.057***	(0.000)
East Germany	-0.157***	(0.000)	-0.156***	(0.000)	-0.143***	(0.000)	-0.142***	(0.000)
Belonging to a group	0.144***	(0.000)	0.143***	(0.000)	0.122***	(0.000)	0.120***	(0.000)
Export intensity	0.131***	(0.000)	0.128***	(0.000)	0.068***	(0.001)	0.068***	(0.002)
Industry D	yes		yes		yes		yes	
W_Industry	(0.000)		(0.000)		(0.000)		(0.000)	
# Obs.	11,129		10,682		11,129		10,682	

Regression additionally includes four dummies indicating R&D, Non-R&D innovation, training, and marketing is zero. Robust p-values in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

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Econometric results

	OLS (5)		OLS (6)		OLS (7)		OLS (8)		OLS (9)	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Labour	-0.005	(0.198)	-0.025***	(0.000)	-0.017***	(0.002)	-0.017***	(0.003)	-0.001	(0.806)
Capital	0.064***	(0.000)	0.065***	(0.000)	0.056***	(0.000)	0.059***	(0.000)	0.056***	(0.000)
Material	0.407***	(0.000)	0.424***	(0.000)	0.410***	(0.000)	0.405***	(0.000)	0.389***	(0.000)
R&D	0.062***	(0.000)	-		-		-		0.042***	(0.000)
Non-R&D Innovation	-		0.005***	(0.002)	-		-		0.004**	(0.010)
Training	-		-		0.096***	(0.000)	-		0.051***	(0.000)
Marketing	-		-		-		0.083***	(0.000)	0.057***	(0.000)
East Germany	-0.168***	(0.000)	-0.154***	(0.000)	-0.143***	(0.000)	-0.134***	(0.000)	-0.143***	(0.000)
Belonging to a group	0.137***	(0.000)	0.180***	(0.000)	0.166***	(0.000)	0.169***	(0.000)	0.122***	(0.000)
Export intensity	0.075***	(0.000)	0.101***	(0.000)	0.093***	(0.001)	0.073***	(0.007)	0.068***	(0.003)
Time D	yes		yes		yes		yes		yes	
Industry D	yes		yes		yes		yes		yes	
W_Time	(0.0163)		(0.0212)		(0.0000)		(0.0001)		(0.0000)	
W_Industry	(0.0000)		(0.0000)		(0.0000)		(0.0000)		(0.0000)	
R2	0.682		0.694		0.705		0.705		0.700	
# Obs.	11,129		8,227		8,227		8,227		11,129	

Regression additionally includes four dummies indicating R&D, Non-R&D innovation, training, and marketing is zero. Robust p-values in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1