

# HELENA



Higher Education Global  
Efficiency Analysis

## *Economies of Scale at Faculties*

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**1. Introduction**

**2. Historical View: 5 Years Back**

**3. Today's View: Research Results 2012/13**

**4. Implications**

**5. Discussion**

# 1. Introduction

## Research Interest

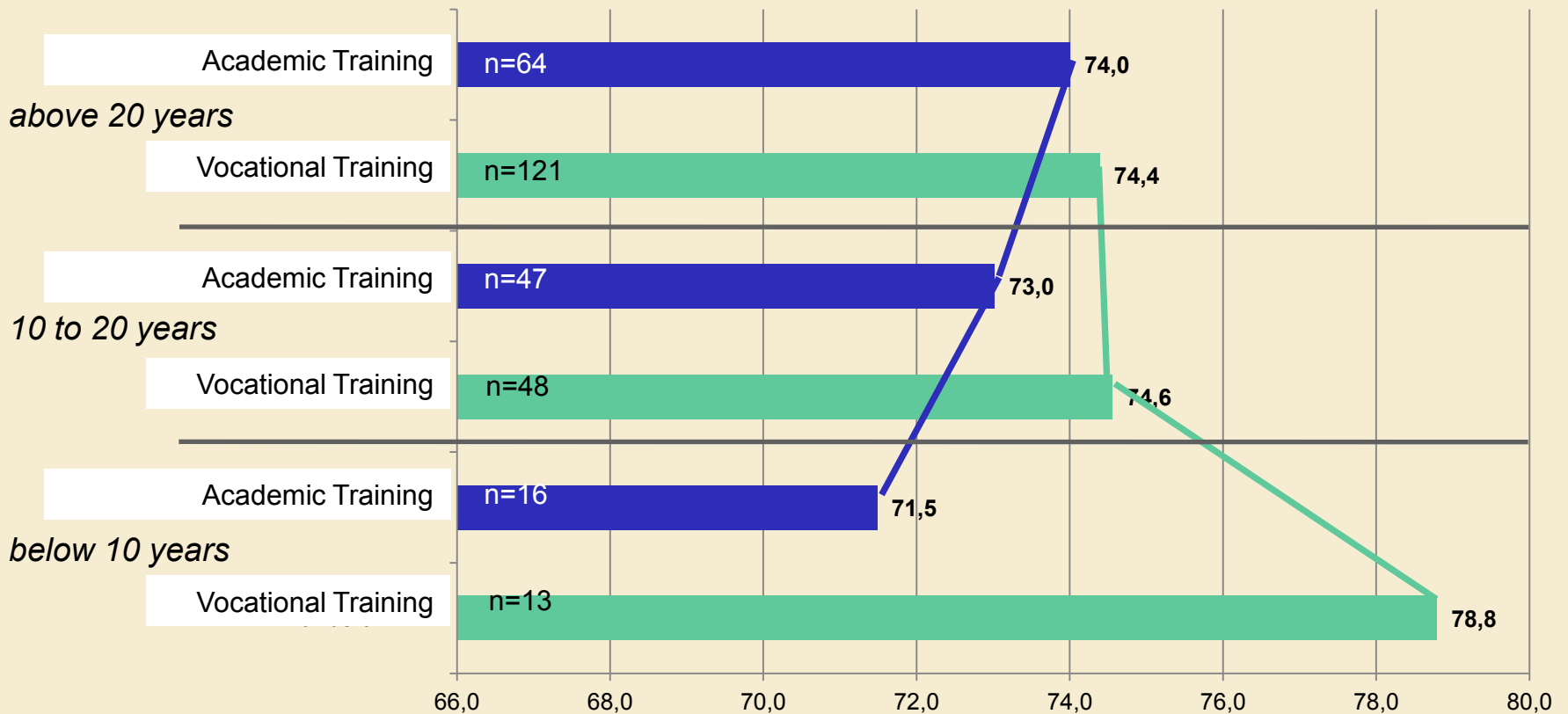
- Management Question of University and Faculty Steering / Sizing
  - Multi-Level Problem (University – Faculty – Institute – Chair – Researcher ...)
  - Increase of Competition and Societal – Stakeholder – Expectations
  - Lack or Relative Decrease of Government Resources
- Allocation of “Optimal” Budget and Resources

## Research Questions

- Is there a connection between faculties' efficiency and their size, i.e. are there **economies of scale for faculties**?
- What can we learn from this for faculty and research management?

## 2. Historical View: 5 Years Back I

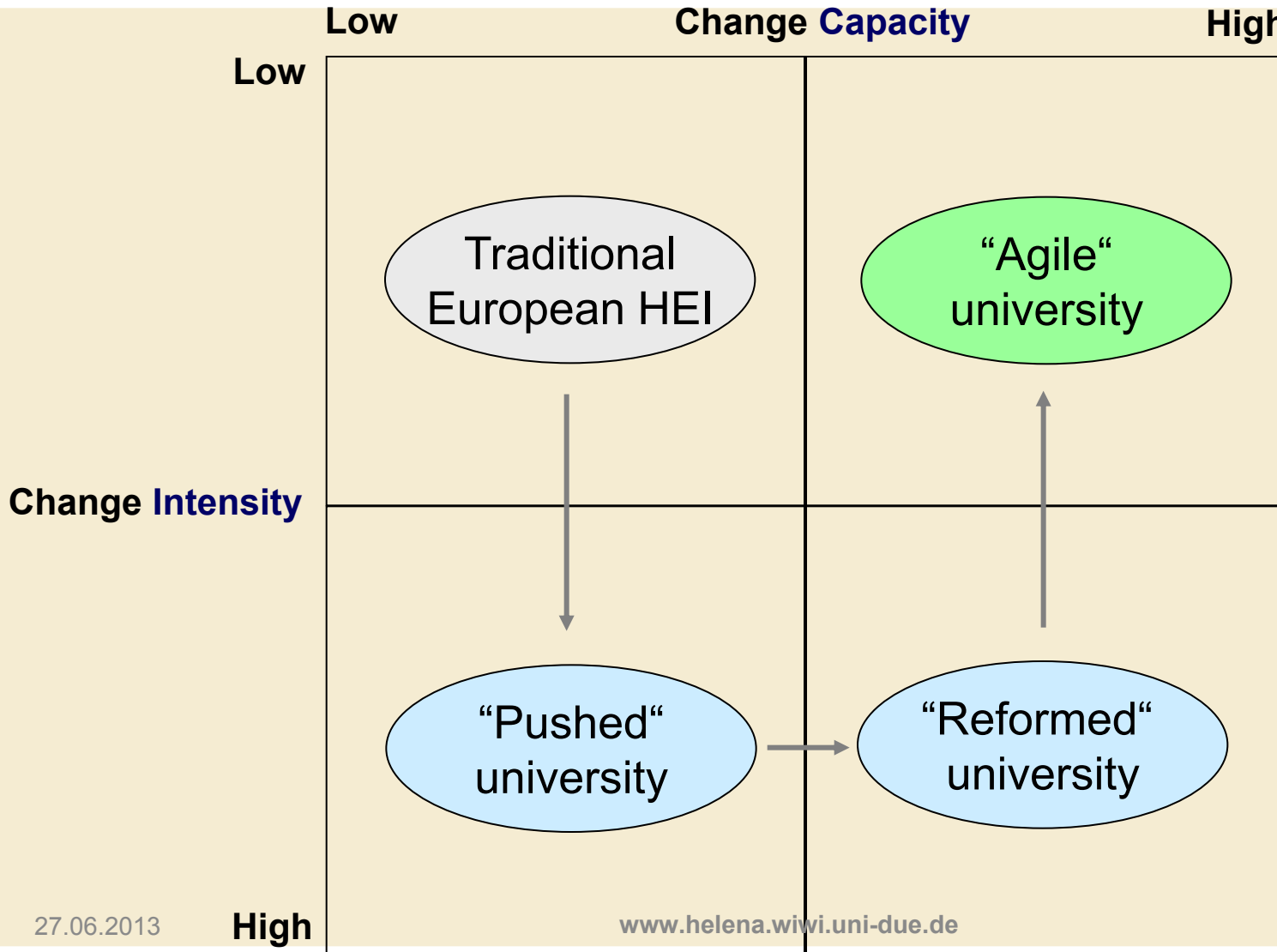
### Research Findings: Task of LLL getting more important



**Ageing Competence: Berufswertigkeit level by age / work experience (left side)**

Klump, M.: Citizenship and Employability, 35th EUCEN Conference, University of Edinburgh 2008

## 2. Historical View: 5 Years Back II



## 2. Historical View III

- **Output Ranking**
- **Scores for Ranking Positions and GEI Awards**

Klumpp, M./Zelewski, S. (2008): Higher Education Production Analysis, in: Conference Proceedings 15<sup>th</sup> International Working Seminar on Production Economics, Innsbruck, Vol. 2, p. 341-352.  
 27.06.2013

No	University (DMU) Name	A. Budget 2001-03, Mio €	B. DFG Ranking			C. SJTU World Universities Ranking				D. R- Meta B.+C.	E. Excellence Initiative Ranking				F. Meta B.+C.+ E.
			DFG Fund	EU Fund	S	World Rank	Region Rank	National Rank	S		Area 1 GS	Area 2 CL	Area 3 FU	S	
1	Univ Munich	3082,6	1	2	99	51	10	1	100	199,0	1	3	1	100	299,0
2	Tech Univ Munich	1917,6	9	3	90	52	11	2	99,5	189,5	1	2	1	80	269,5
3	Univ Heidelberg	2136,5	3	5	94	71	21	3	94,5	188,5	3	2	1	100	288,5
4	RWTH Aachen	2313,3	2	4	96	203-300	80-123	17-23	65	161,0	1	3	1	100	261,0
5	Univ Karlsruhe	708,9	6	7	89	203-300	80-123	17-23	65	154,0	1	1	1	60	214,0
6	Univ Bonn	2222,1	13	12	77	101-152	36-56	6-11	87	164,0	2	1		40	204,0
7	Univ Goettingen	1996,4	12	9	81	84	26	4	92	173,0	1	1	1	60	233,0
8	Univ Freiburg	1861,7	11	10	81	90	29	5	90,5	171,5	1	1	1	60	231,5
9	Univ Frankfurt	1646,9	20	8	74	101-152	36-56	6-11	87	161,0		2		40	201,0
10	Univ Wuerzburg	1396,7	4	27	71	101-152	36-56	6-11	87	158,0	1			10	168,0
11	Univ Tuebingen	1880,7	8	6	88	101-152	36-56	6-11	87	175,0		1		20	195,0
12	Univ Bochum	964,7	16	13	73	203-300	80-123	17-23	65	138,0	1			10	148,0
13	Univ Erl-Nuernberg	1727,7	7	26	69	203-300	80-123	17-23	65	134,0	1	1		30	164,0
14	Univ Hamburg	1952,9	17	19	66	101-152	36-56	6-11	87	153,0		1		20	173,0
15	Univ Stuttgart	904,7	14	1	87	203-300	80-123	17-23	65	152,0	1	1		30	182,0
16	Tech Univ Dresden	1607,6	21	14	67	301-400	124-168	24-33	43	110,0	1	1		30	140,0
17	Tech Univ Berlin	943,5	22	15	65	203-300	80-123	17-23	65	130,0	1	1		30	160,0
18	Univ Muenster	2159,9	15	25	62	101-152	36-56	6-11	87	149,0		1		20	169,0
19	Univ Mainz	1779,3	19	11	72	153-202	57-79	12-16	76,5	148,5	1			10	158,5
20	Univ Koeln	1871,2	18	20	64	153-202	57-79	12-16	76,5	140,5		1		20	160,5
21	Univ Kiel	1464,9	36	37	29	153-202	57-79	12-16	76,5	105,5	1	2		50	155,5
22	Univ Marburg	1197,1	27	31	44	153-202	57-79	12-16	76,5	120,5				0	120,5
23	Univ Giessen	1408,0	26	24	52	401-500	169-205	34-40	20,5	72,5	1	1		30	102,5
24	Univ Leipzig	1435,8	40	33	29	153-202	57-79	12-16	76,5	105,5	1			10	115,5
25	TU Darmstadt	633,7	25	17	60	301-400	124-168	24-33	43	103,0	1	1		30	133,0
26	HU Berlin	2985,3	5	18	79				0	79,0	3	1		50	129,0
27	Univ Bremen	575,7	23	23	56	401-500	169-205	34-40	20,5	76,5	2	1		40	116,5
28	FU Berlin	1724,7	10	16	76				0	76,0	3	2	1	100	176,0
29	Univ Konstanz	297,8	34	35	33	301-400	124-168	24-33	43	76,0	1	1	1	60	136,0
30	Univ Halle - Wit	1225,3	35	40	27	203-300	80-123	17-23	65	92,0				0	92,0

## 2. Historical View III

- Efficiency Ranking
- Relation Ranking Points per Budget (€)
- „Changing Picture“

No	University (DMU)	A. Budget	B. DFG Rank*	C. SJTU Rank*	D. Res Rank*	E. Exc Rank*	F. Total Rank	G. Research Productivity**	H. Excellence Productivity**	I. META Productivity**
29	Univ Konstanz	297,8	33,0	43,0	76,0	60,0	136,0	0,255	0,201	0,457
5	Univ Karlsruhe	708,9	89,0	65,0	154,0	60,0	214,0	0,217	0,085	0,302
33	Univ Bielefeld	471,1	34,0	43,0	77,0	30,0	107,0	0,163	0,064	0,227
25	Tech Univ Darmstadt	633,7	60,0	43,0	103,0	30,0	133,0	0,163	0,047	0,210
27	Univ Bremen	575,7	56,0	20,5	76,5	40,0	116,5	0,133	0,069	0,202
15	Univ Stuttgart	904,7	87,0	65,0	152,0	30,0	182,0	0,168	0,033	0,201
41	Univ Bayreuth	291,8	0,0	43,0	43,0	10,0	53,0	0,147	0,034	0,182
17	Tech Univ Berlin	943,5	65,0	65,0	130,0	30,0	160,0	0,138	0,032	0,170
12	Univ Bochum	964,7	73,0	65,0	138,0	10,0	148,0	0,143	0,010	0,153
2	Tech Univ Munich	1917,6	90,0	99,5	189,5	80,0	269,5	0,099	0,042	0,141
3	Univ Heidelberg	2136,5	94,0	94,5	188,5	100,0	288,5	0,088	0,047	0,135
34	Tech Univ Braunschweig	566,7	33,0	43,0	76,0	0,0	76,0	0,134	0,000	0,134
8	Univ Freiburg	1861,7	81,0	90,5	171,5	60,0	231,5	0,092	0,032	0,124
9	Univ Frankfurt	1646,9	74,0	87,0	161,0	40,0	201,0	0,098	0,024	0,122
10	Univ Wuerzburg	1396,7	71,0	87,0	158,0	10,0	168,0	0,113	0,007	0,120
7	Univ Goettingen	1996,4	81,0	92,0	173,0	60,0	233,0	0,087	0,030	0,117
4	RWTH Aachen	2313,3	96,0	65,0	161,0	100,0	261,0	0,070	0,043	0,113
21	Univ Kiel	1464,9	29,0	76,5	105,5	50,0	155,5	0,072	0,034	0,106
11	Univ Tuebingen	1880,7	88,0	87,0	175,0	20,0	195,0	0,093	0,011	0,104
28	FU Berlin	1724,7	76,0	0,0	76,0	100,0	176,0	0,044	0,058	0,102
22	Univ Marburg	1197,1	44,0	76,5	120,5	0,0	120,5	0,101	0,000	0,101
39	Univ Hannover	765,3	57,0	0,0	57,0	20,0	77,0	0,074	0,026	0,101
1	Univ Munich	3082,6	99,0	100,0	199,0	100,0	299,0	0,065	0,032	0,097
13	Univ Erlangen-Nuernberg	1727,7	69,0	65,0	134,0	30,0	164,0	0,078	0,017	0,095
6	Univ Bonn	2222,1	77,0	87,0	164,0	40,0	204,0	0,074	0,018	0,092
19	Univ Mainz	1779,3	72,0	76,5	148,5	10,0	158,5	0,083	0,006	0,089
14	Univ Hamburg	1952,9	66,0	87,0	153,0	20,0	173,0	0,078	0,010	0,089
16	Tech Univ Dresden	1607,6	67,0	43,0	110,0	30,0	140,0	0,068	0,019	0,087
20	Univ Koeln	1871,2	64,0	76,5	140,5	20,0	160,5	0,075	0,011	0,086
32	Univ Ulm	1111,4	41,0	43,0	84,0	10,0	94,0	0,076	0,009	0,085

### 3. Today's View: Research Results 2012/13

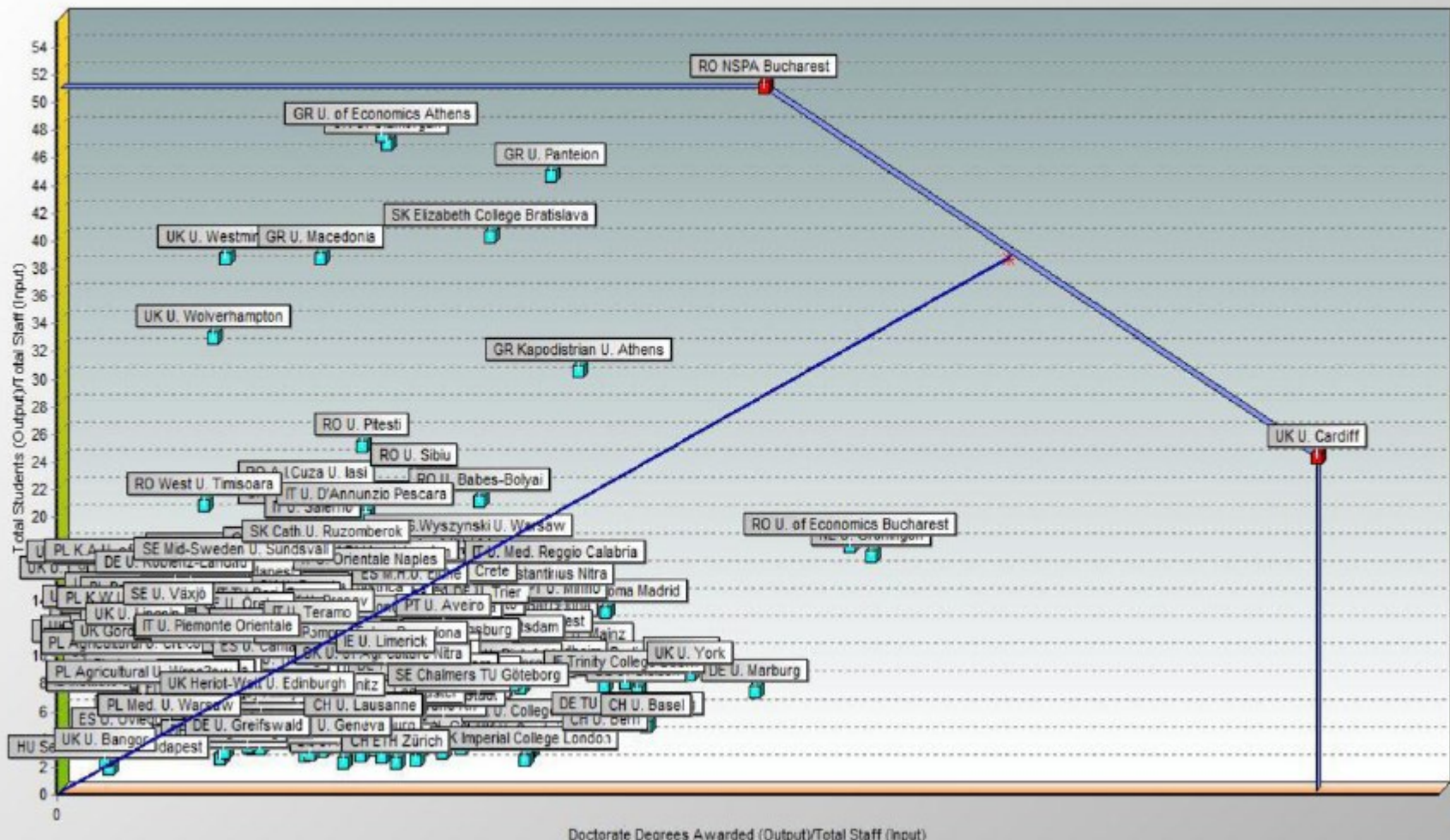
## Research Setups

- **(I)** University Level Efficiency Analysis (DEA, 2012) / Teaching
  - EUMIDA Dataset (EU), 370 Universities in Europe
- **(II)** Comparative Faculty Efficiency Analysis 4 Universities (DEA, 2012)
  - Two German and two Swiss Universities with Budget Allocation on Faculty Level
- **(III)** Economic Faculty Efficiency Comparison (DEA, 2013) / Research
  - Data Sources “Handelsblatt Ranking Economics” and “DFG Funding Ranking”
  - Input: Number of Professors, Outputs: Publication Points (Journals) and DFG Funding
  - Altogether 25 Universities, 5 thereof Private Universities (no DFG Funding)



### 3. Today's View: Research Results 2012/13

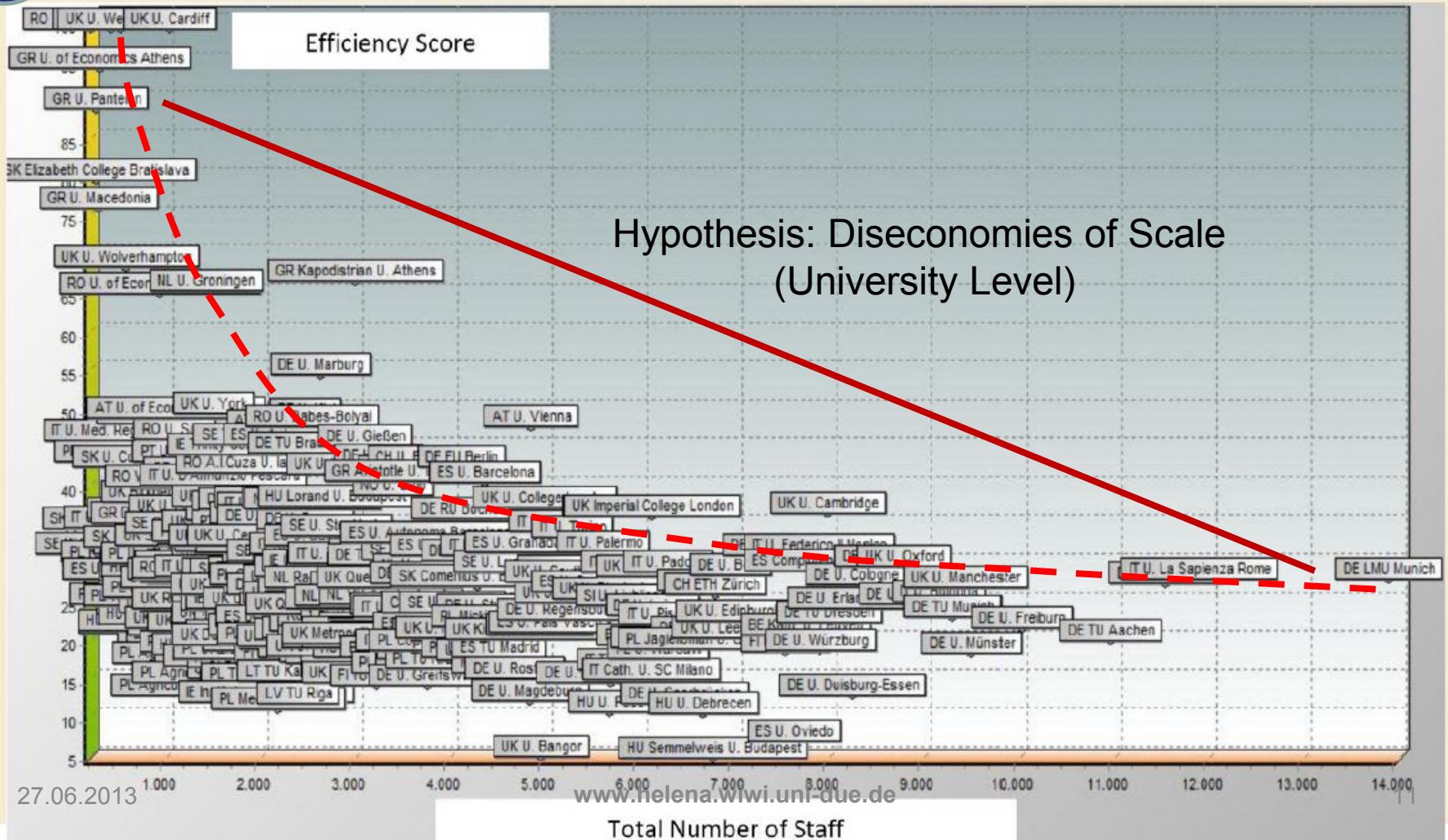
## I. CASE A: Input Staff, Outcome Students and Doctorates





### 3. Today's View: Research Results 2012/13

## I. CASE C: Input Staff, Outcome Int. Students, Students & Doctorates



## 3. Today's View: Research Results 2012/13

I.

EUMI-DA ID	University Name	Found. Year	Univ. Hospital	Staff (Input)	Doctorate Degrees Awarded (Output)	Total Students (Output)	Total Int. Students (Output)	Efficiency (Case A without Int. Students)	Efficiency (Case B without Total Stud.)	Efficiency (Case C - all Output Indic.)	Efficiency (Case D - Restricted Weights 25%)
RO052	RO NSPA Bucharest	1991	No	282	50	14319	110	100.0%	56.0%	<b>100.0%</b>	18.4%
UK135	UK U. Cardiff	1883	Yes	1105	350	26587	4143	100.0%	100.0%	<b>100.0%</b>	88.4%
UK137	UK U. Glamorgan	1913	No	487	40	22710	3777	91.8%	95.1%	<b>100.0%</b>	100.0%
UK126	UK U. Westminster	1838	No	604	25	23224	5446	75.7%	100.0%	<b>100.0%</b>	70.3%
GR016	GR U. Patras	1964	Yes	1324	127	22089	1123	93.2%	36.2%	<b>95.0%</b>	58.4%
GR013	GR U. of Economics Athens	1920	No	371	30	17557	744	87.4%	48.6%	<b>89.7%</b>	71.3%
SK011	SK Elizabeth Coll. Bratislava	2003	Yes	333	36	13304	619	78.7%	40.0%	<b>80.4%</b>	58.3%
GR010	GR U. Macedonia	1948	No	367	24	14086	500	75.6%	26.6%	<b>76.8%</b>	42.7%
UK128	UK U. Wolverhampton	1932	No	653	25	21305	3044	64.3%	55.0%	<b>69.1%</b>	58.6%
GR020	GR Kapodistrian U. Athens	1837	Yes	3070	401	93004	3931	65.3%	41.2%	<b>67.3%</b>	44.7%
NL006	NL U. Groningen	1614	Yes	1498	306	25322	1321	66.1%	64.5%	<b>66.1%</b>	31.0%
RO034	RO U. Sibiu	1844	No	1166	104	26415	157	65.7%	62.8%	<b>65.7%</b>	8.4%
DE052	DE U. Marburg	1527	No	2704	473	19142	1956	55.2%	55.2%	<b>55.2%</b>	21.9%
UK132	UK U. York	1963	No	1576	250	13184	2725	50.1%	50.1%	<b>50.1%</b>	36.1%
AT001	AT U. Vienna	1365	No	4924	594	67457	11962	36.5%	49.2%	<b>49.5%</b>	53.4%

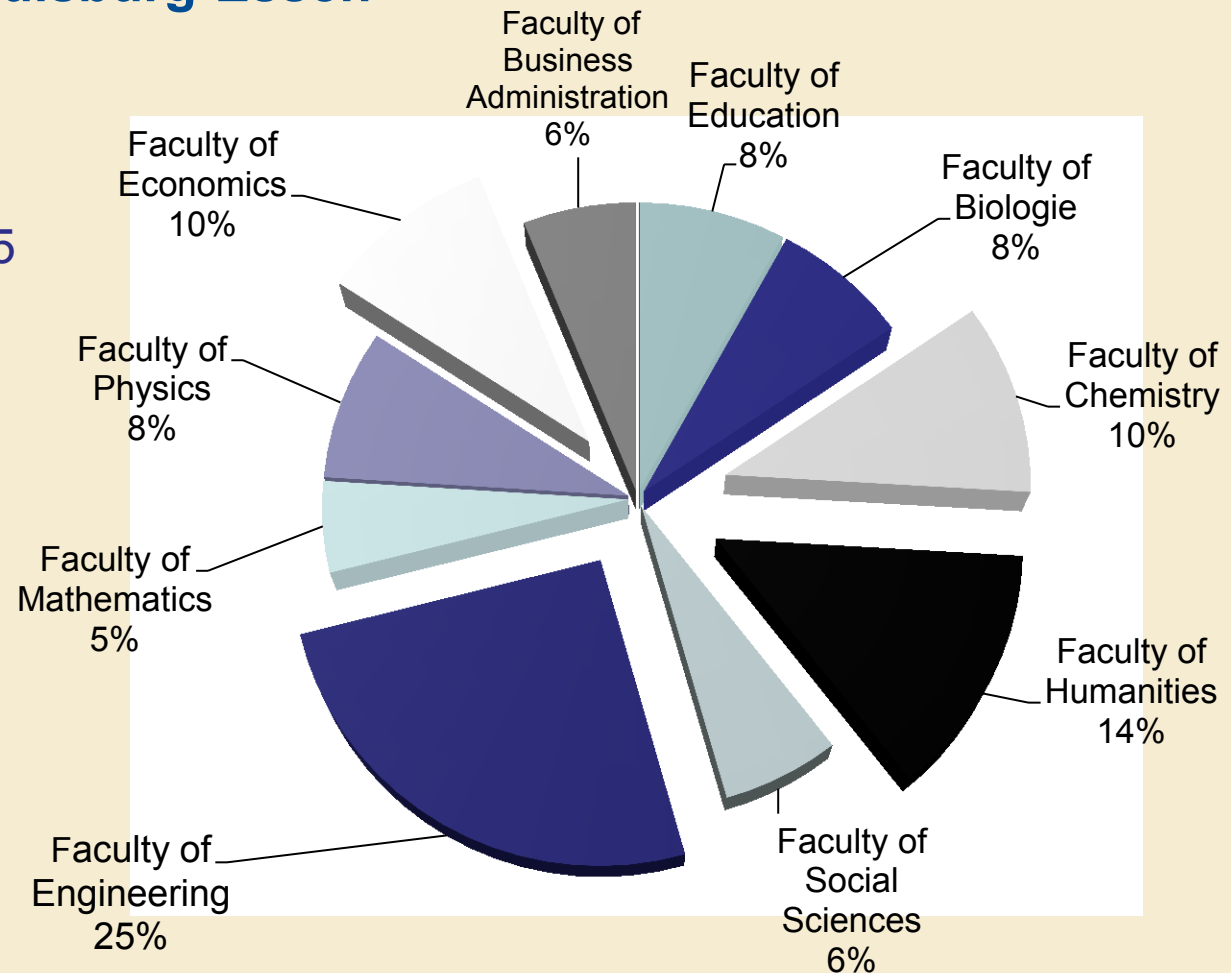
### 3. Today's View: Research Results 2012/13

#### II. a) University of Duisburg-Essen

Number of faculties: 10

Number of students: 37,085

Total budget: 337,994,193



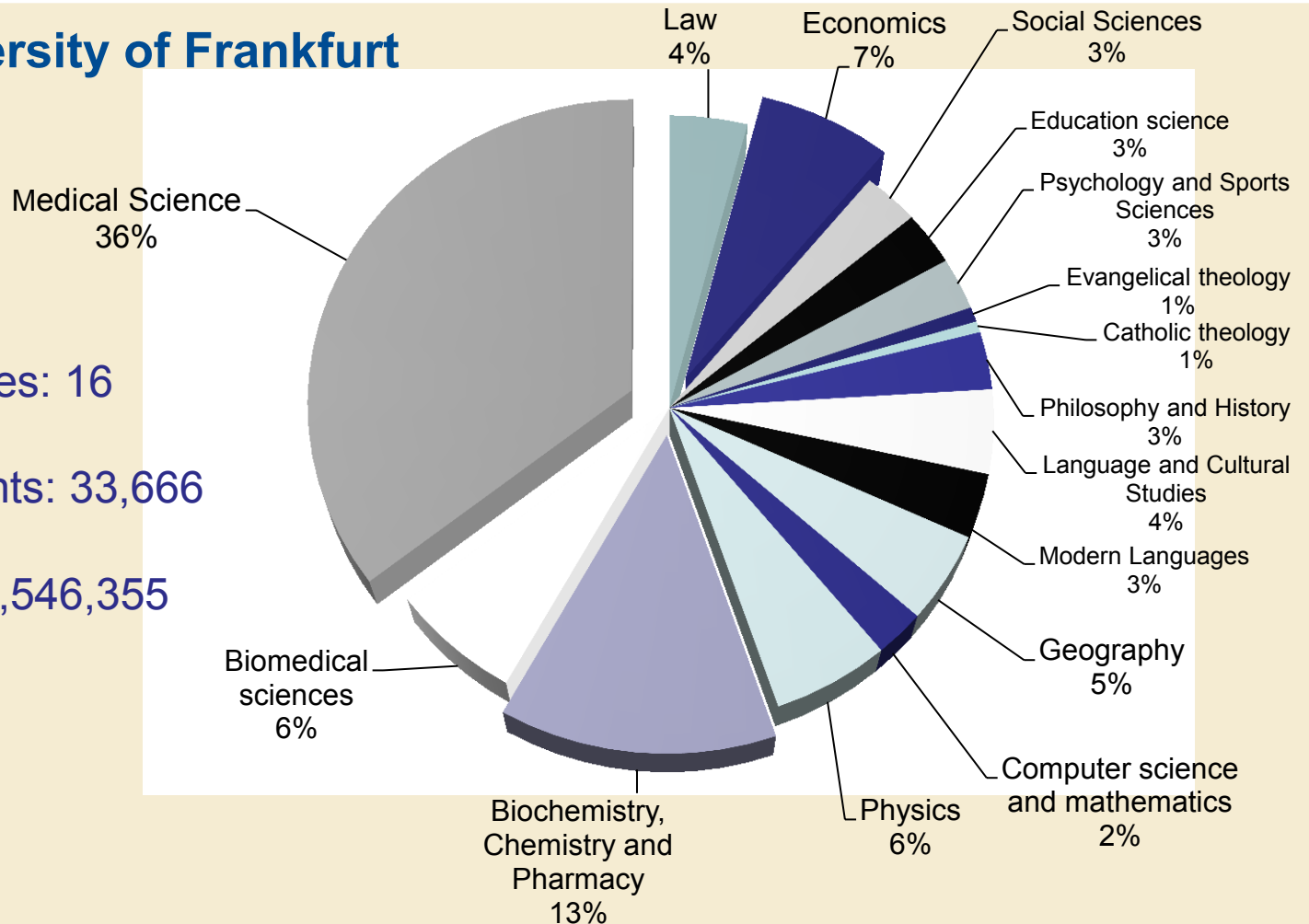
### 3. Today's View: Research Results 2012/13

#### II. b) University of Frankfurt

Number of faculties: 16

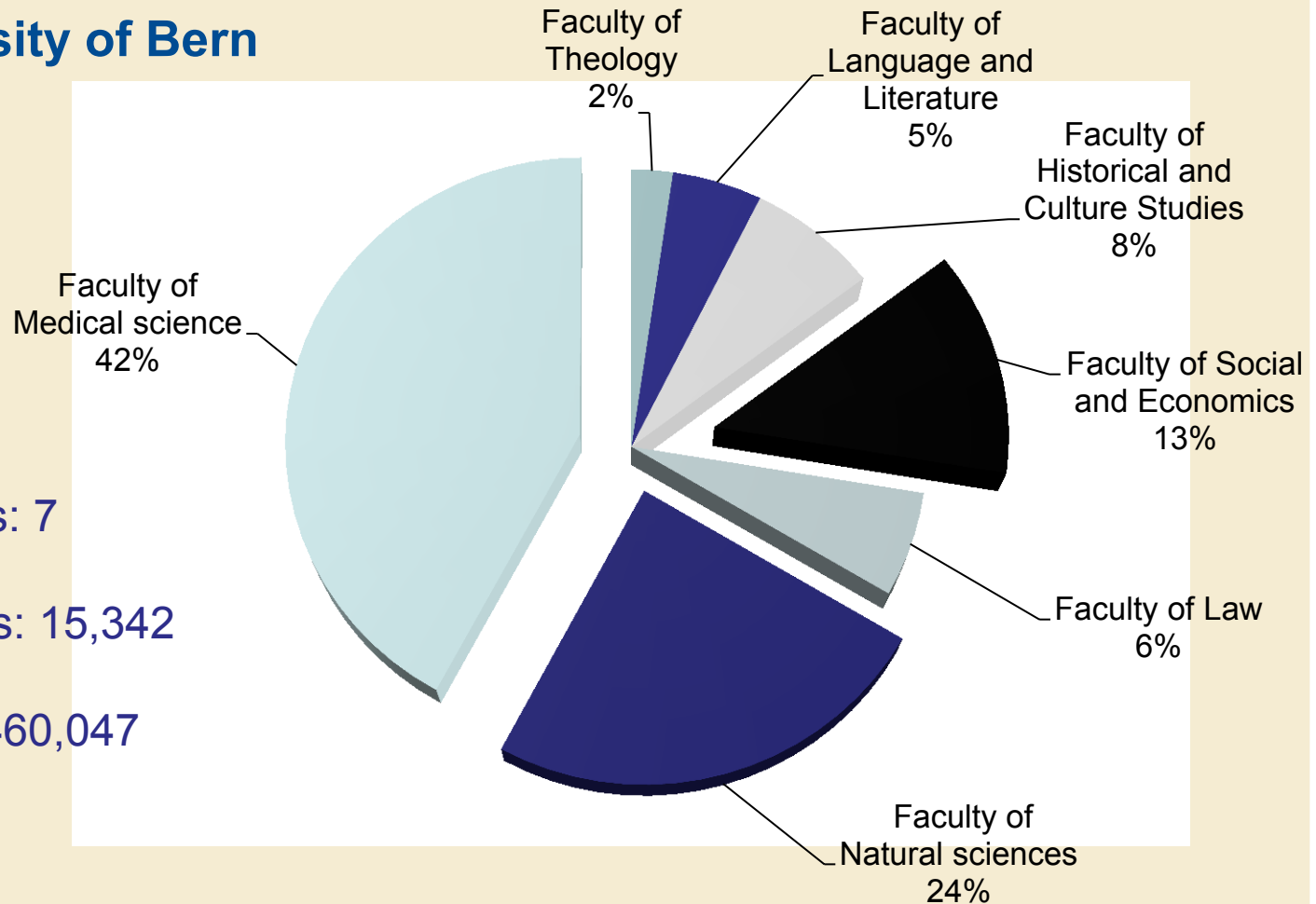
Number of students: 33,666

Total budget: 466,546,355



## 3. Today's View: Research Results 2012/13

## II. c) University of Bern



Number of faculties: 7

Number of students: 15,342

Total budget: 429,460,047

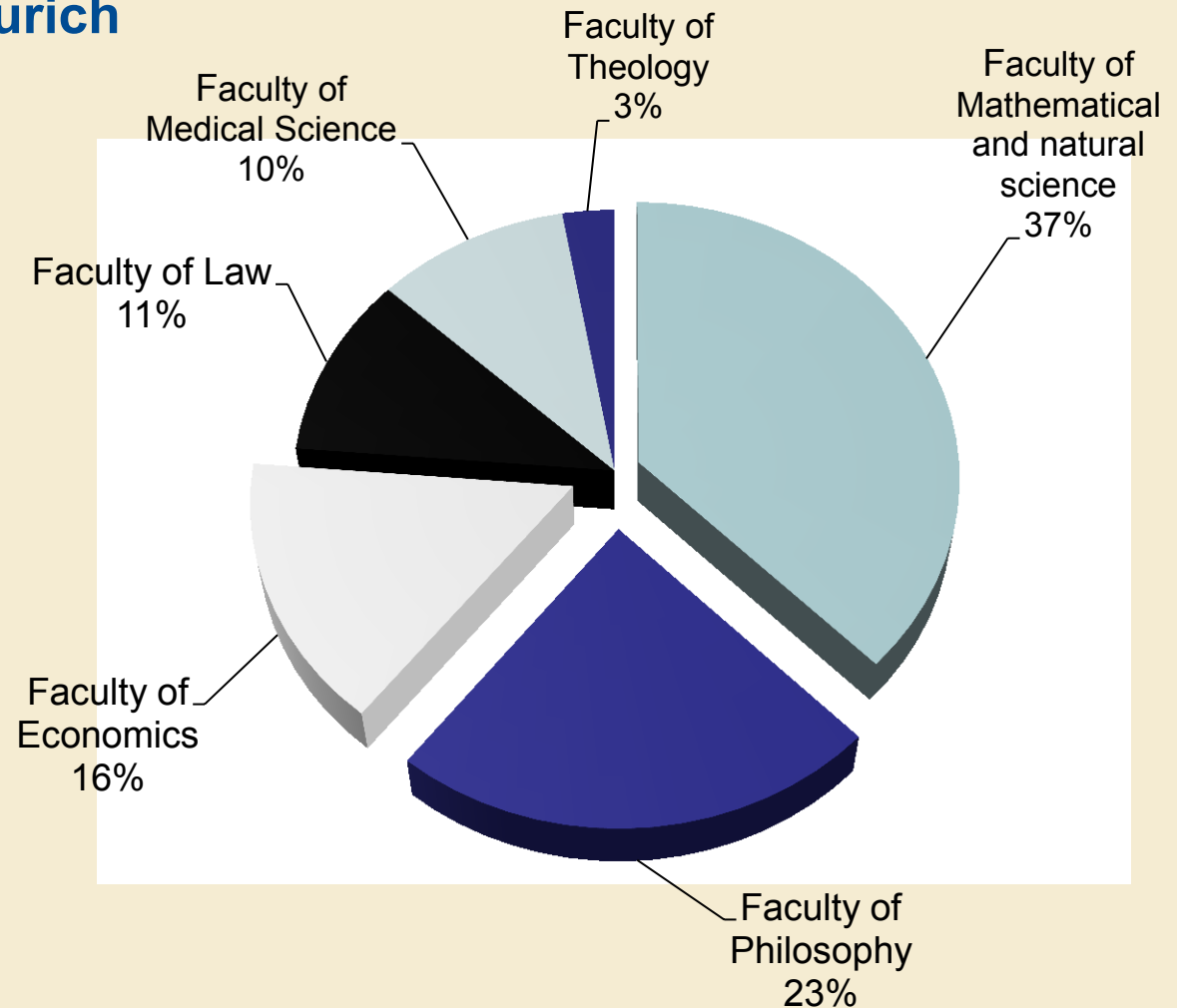
### 3. Today's View: Research Results 2012/13

#### II. d) University of Zurich

Number of faculties: 6

Number of students: 20,404

Total budget: 441,729,395





### 3. Today's View: Research Results 2012/13

#### II.

- In general, the internal budget allocation is very diverse and different to each university (“fingerprint”).
- All universities allocated halves of their budget shares to two or three faculties.
- Medical faculties in two universities (Frankfurt and Bern) received more than one third of budget share which is the highest share. Whereas, that of Zurich university’s was only 10%.
- Mathematics faculty in Zurich university received the highest budget share whereas the lowest budget share of 2% was allocated to this faculty compared to university of Duisburg-Essen and Frankfurt.

### 3. Today's View: Research Results 2012/13

#### II. a) University of Duisburg-Essen

≤50=0%

≥90=36.14%

Unit name	Share of total Budget	Score of efficiency	Potential improvements		
			Percent Total budget	Percent Third-party funds	Percent Count Graduates
Faculty of Education	7.95%	100	0%	0%	0%
Faculty of Economics	9.63%	100	0%	0%	0%
Faculty of Mathematics	4.98%	100	0%	0%	0%
Faculty of Social Sciences	6.08%	94.92	-5.08%	0%	53.69%
Faculty of Biology	7.49%	93.10	-6.90%	0%	0%
Faculty of Engineering	25.40%	89.56	-10.44%	0%	62.18%
Faculty of Humanities	13.62%	87.54	-12.46%	55.60%	0%
Faculty of Physics	8.26%	87.05	-12.95%	0%	267.16%
Faculty of Business Administration	6.11%	73.58	-26.42%	124.15%	0%
Faculty of Chemistry	10.48%	51.54	-48.46%	0%	0%

## 3. Today's View: Research Results 2012/13

II. b) Frankfurt Unit name	Share of total Budget	Score	Potential improvements		
			Percent Total budget	Percent Third-party funds	Percent Count Graduates
Faculty of Law	4.03%	100	0%	0%	0%
Faculty of Modern Languages	3.40%	100	0%	0%	0%
Faculty of Economics	6.95%	86.13	-13.87%	0%	0%
Faculty of Physics	5.69%	85.73	-14.27%	0%	612.03%
Faculty of Social Sciences	2.91%	72.30	-27.70%	0%	0%
Faculty of Psychology and Sports	2.78%	69.70	-30.30%	0%	0%
Faculty of Computer science and	2.44%	68.74	-31.26%	0%	0%
Faculty of Science of education	2.89%	67.16	-32.84%	0%	0%
Faculty of Natural science	6.36%	54.95	-45.05%	0%	2.55%
Faculty of Medicine	35.57%	54.26	-45.74%	0%	209.15%
Faculty of Language and Cultural	4.46%	51.26	-48.74%	0%	0%
Faculty of Geography	4.75%	50.08	-49.92%	0%	37.59%
Faculty of Philosophy and History	3.07%	44.75	-55.25%	0%	0%
Faculty of Biochemistry, Chemistry	13.31%	40.28	-59.72%	0%	49.44%
Faculty of Evangelical theology	0.79%	25.78	-74.22%	0%	0%
Faculty of Catholic theology	0,59%	24,52	-75,48%	0%	0%

≥90=7%

≤50=18%

## 3. Today's View: Research Results 2012/13

## II. c) University of Bern

 $\leq 50 = 42.16\%$ 
 $\geq 90 = 44.55\%$ 

Unit name	Share of total budget	Score	Potential improvements		
			Percent total budget	Percent third-party funds	Percent count graduates
Faculty of Social and Economics	12,86%	100	0%	0%	0%
Faculty of natural sciences	24,32%	100	0%	0%	0%
Faculty of Historical and Culture	7,37%	94,87	-5,13%	0%	0%
Faculty of Law	5,92%	75,37	-24,63%	0%	0%
Faculty of Language and Literature	5,05%	63,18	-36,82%	0%	0%
Faculty of Theology	2,32%	54,71	-45,29%	0%	0%
Faculty of Medicine	42,16%	32,81	-67,19%	0%	0%

## 3. Today's View: Research Results 2012/13

## II. d) University of Zurich

 $\leq 50 = 0\%$ 
 $\geq 90 = 76\%$ 

Unit name	Share of total budget	Score	Potential improvements		
			Percent total budget	Percent third-party funds	Percent count graduates
Faculty of Economics	15,62%	100	0%	0%	0%
Faculty of Philosophy	23,21%	100	0%	0%	0%
Faculty of Mathematical and natural Science	37,47%	91,70	-8,30%	0%	70,66%
Faculty of Medicine	10,30%	88,34	-11,66%	279,37%	0%
Faculty of Theology	2,76%	84,09	-15,91%	0%	173,00%
Faculty of Law	10,65%	74,21	-25,79%	119,02%	0%

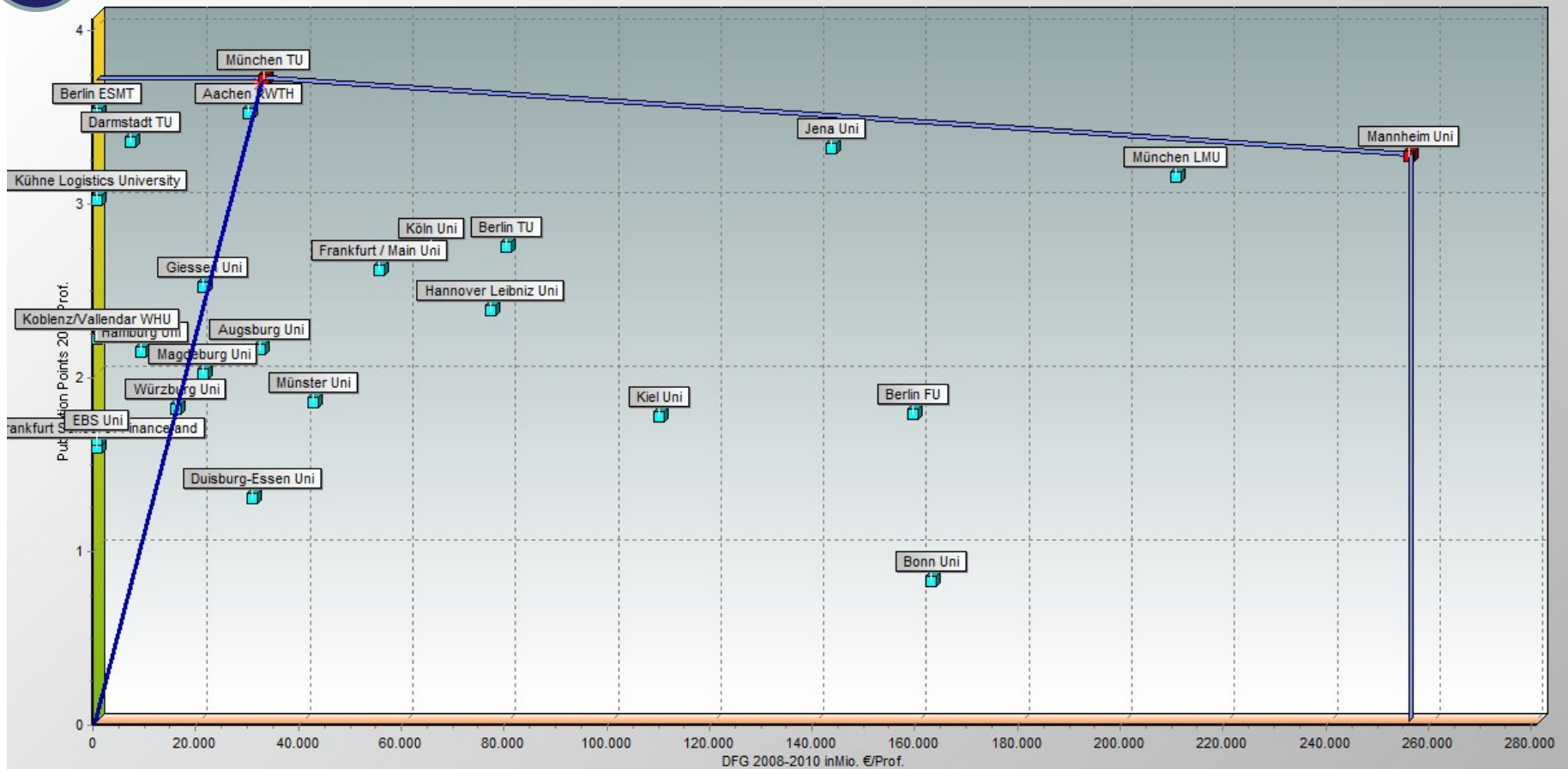
## 3. Today's View: Research Results 2012/13

III

University	Prof.	DFG 2008-2010 in Mio. €	Publication Points 2012	Rang Rang 2012	Rang 2009	Publication Points A+ Journals	Publication Points A+ & A Journals
<i>St.Gallen Uni</i>	44	- €	118	1	2	5,30	30,10
<i>Wien Uni</i>	16	- €	91	2	1	2,00	22,80
<i>Zürich Uni</i>	27	- €	89	3	4	16,80	35,70
<i>Wien WU</i>	45	- €	87	4	5	6,60	24,30
München TU	23	746.163,98 €	85	5	12	6,10	32,10
Mannheim Uni	24	6.129.920,61 €	78	6	3	17,30	36,60
Frankfurt / Main Uni	27	1.486.697,92 €	70	7	6	10,00	25,90
München LMU	22	4.622.675,13 €	69	8	11	5,30	20,70
Hamburg Uni	32	278.261,45 €	68	9	10	3,90	18,10
Köln Uni	25	1.625.446,88 €	68	9	7	11,00	29,40
<i>Zürich ETH</i>	12	- €	63	11	9	2,00	14,40

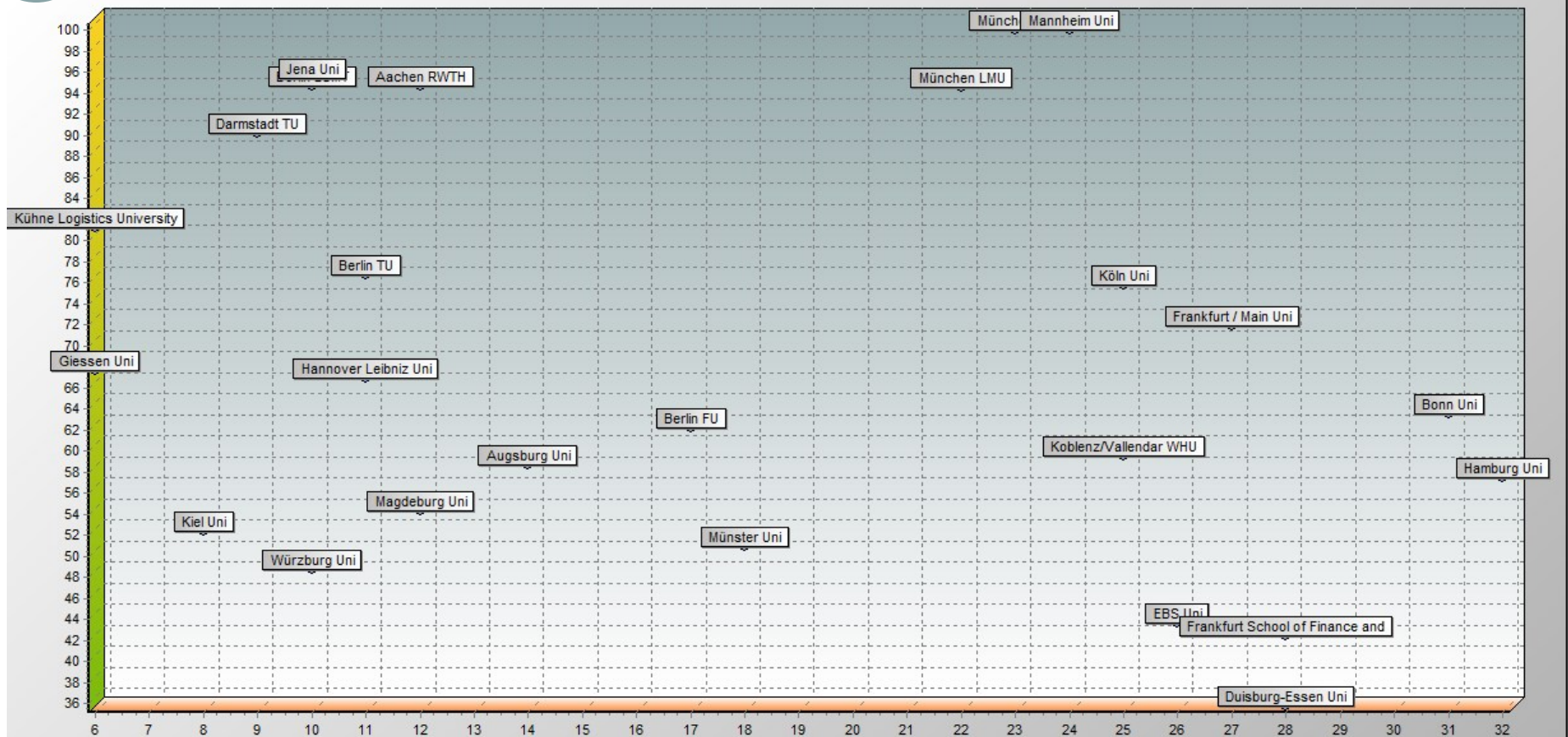
### 3. Today's View: Research Results 2012/13

#### III a) Input Orientation, CCR (Constant RTS)



### 3. Today's View: Research Results 2012/13

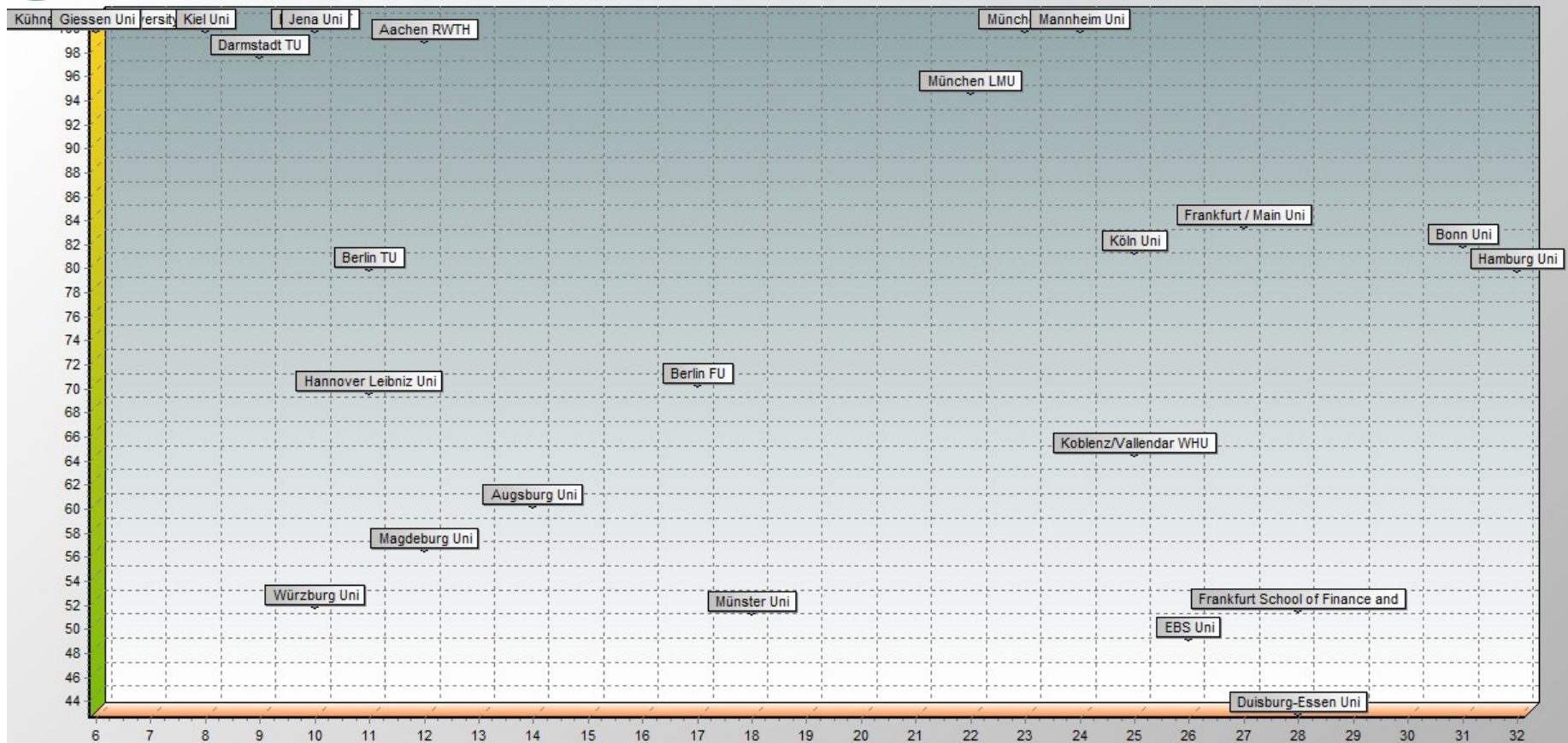
#### III a) Input Orientation, CCR (Constant RTS), Correlation -0,26





### 3. Today's View: Research Results 2012/13

## III b) Output Orientation, BCC (Variable RTS), Correlation $-0,34$



## 3. Today's View: Research Results 2012/13

## III b) Output Orientation, BCC (Variable RTS)

Unit name	Score
Giessen Uni	100,00%
Kühne Logistics University	100,00%
Berlin ESMT	100,00%
Jena Uni	100,00%
Kiel Uni	100,00%
Mannheim Uni	100,00%
München TU	100,00%
Aachen RWTH	99,20%
Darmstadt TU	97,80%
München LMU	94,80%
Frankfurt / Main Uni	83,70%
Bonn Uni	82,10%
Köln Uni	81,60%
Berlin TU	80,20%
Hamburg Uni	80,00%
Berlin FU	70,50%
Hannover Leibniz Uni	69,80%
Koblenz/Vallendar WHU	64,70%
Augsburg Uni	60,40%
Magdeburg Uni	56,80%
Würzburg Uni	52,00%
Frankfurt School of Finance and Münster Uni	51,80%
EBS Uni	51,50%
Duisburg-Essen Uni	49,40%
	43,20%

**Leading Group of Econ./Man.  
Faculties**

**Middle Group of Econ./Man.  
Faculties**

**Improvement Group of  
Econ./Man. Faculties**

## 4. Implications

### Interesting Results:

- **No empirical evidence for economies of scale can be found (hypothesis not falsified but increasing probability for a diseconomies of scale hypothesis)**
- **Possible reasons and influences: Coordination efforts, increasing „mission diversity“ and „mission creep“ with institutional size**
- **Positive view: Benchmarking reveals efficiency potential in most settings and analyses – for all subgroups (large/small, private/public)**
- **Efficiency view may be a complementary and necessary perspective**

## 4. Implications

### **“Management Approach”:**

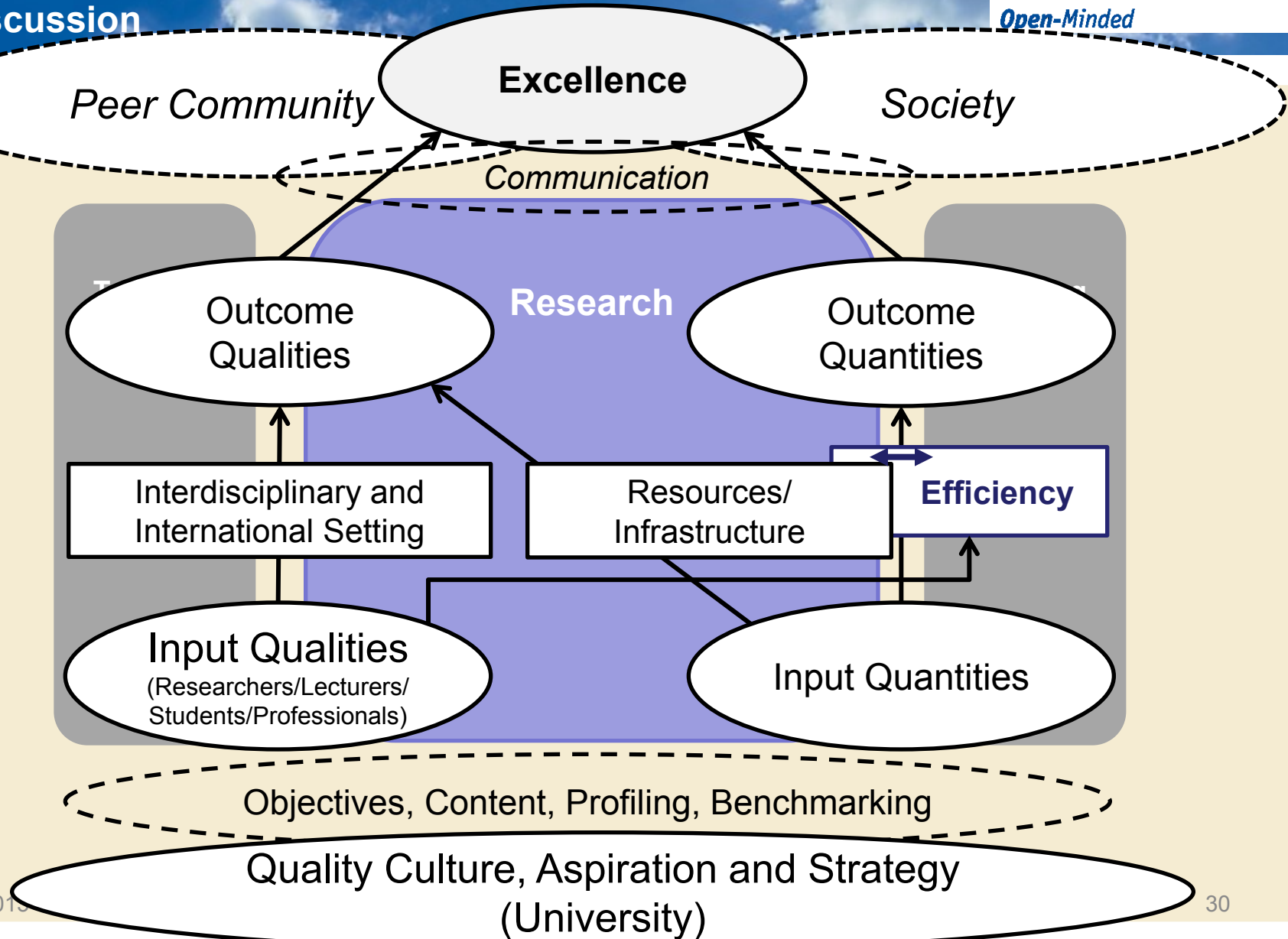
- **Aust “size matters” strategies – very cautious application, only with “checks and balances”**
- **Rethink objectives, strategies and excellence concepts – in combination with „quality profiling“**
- **Make “excess cost of excellence and size” visible in institutions (and also provide “fair” cost allocation)**
- **Make efficiency view a standard KPI / management question in major decisions (e.g. research results for efficiency costs of mergers)**

## 5. Discussion

### Suggestions for Further Research:

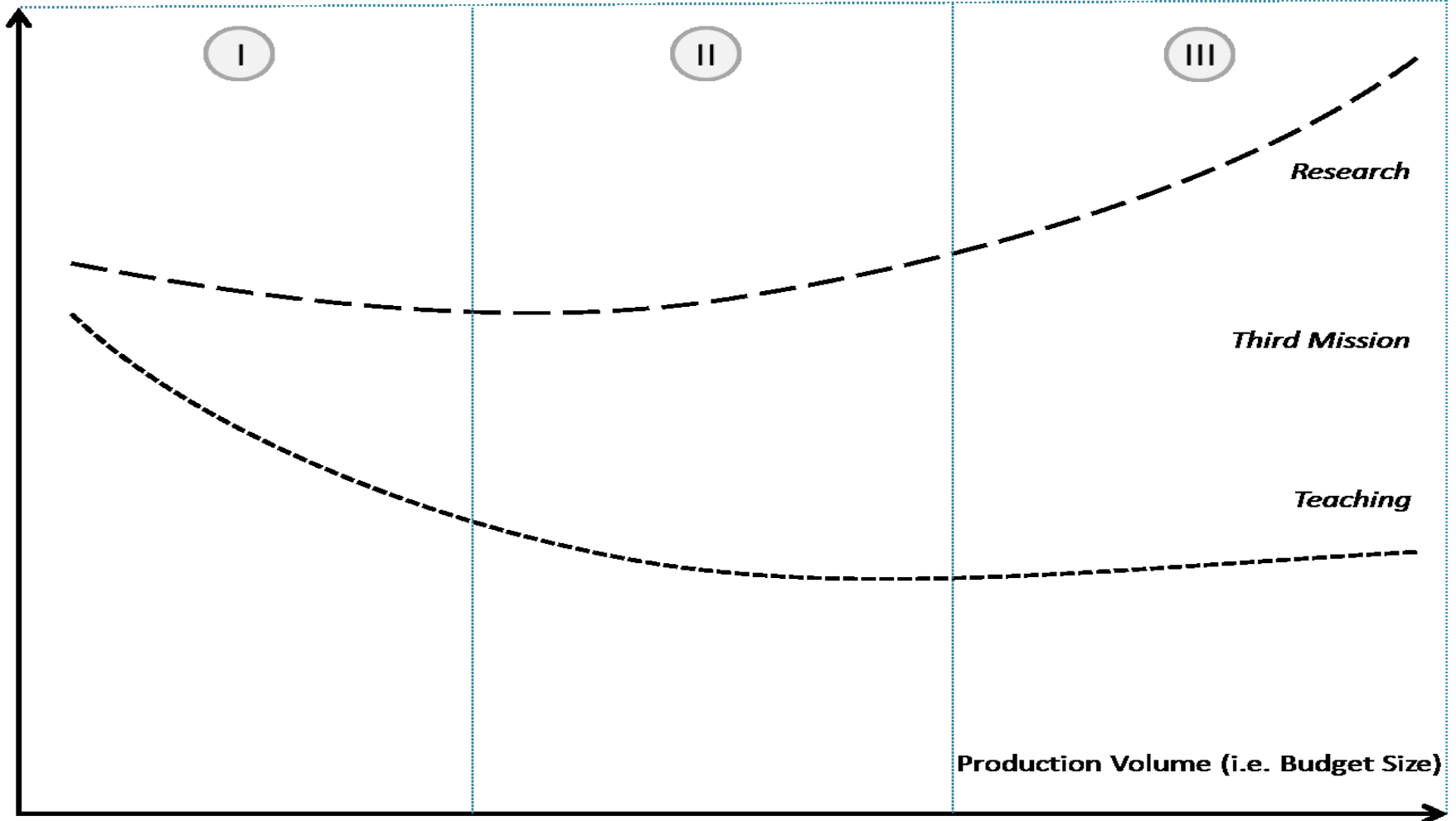
- **Intensive and increasing rigor regarding data quality necessary (examples EUMIDA, Handelsblatt Ranking, THE Ranking etc.)**
- **Larger datasets needed (comparative view) – also indicator for dataset size and quality (DEA)**
- **Discussion about legitimate objectives and output indicators still necessary**
- **“Drilling down” into individual institute and researcher settings in order to quantify efficiency influences (“production function”)**
- **Increase awareness of “production diversity” in universities / faculties further (researchers, HE managers – deans, politicians)**

## 5. Discussion



## 5. Discussion

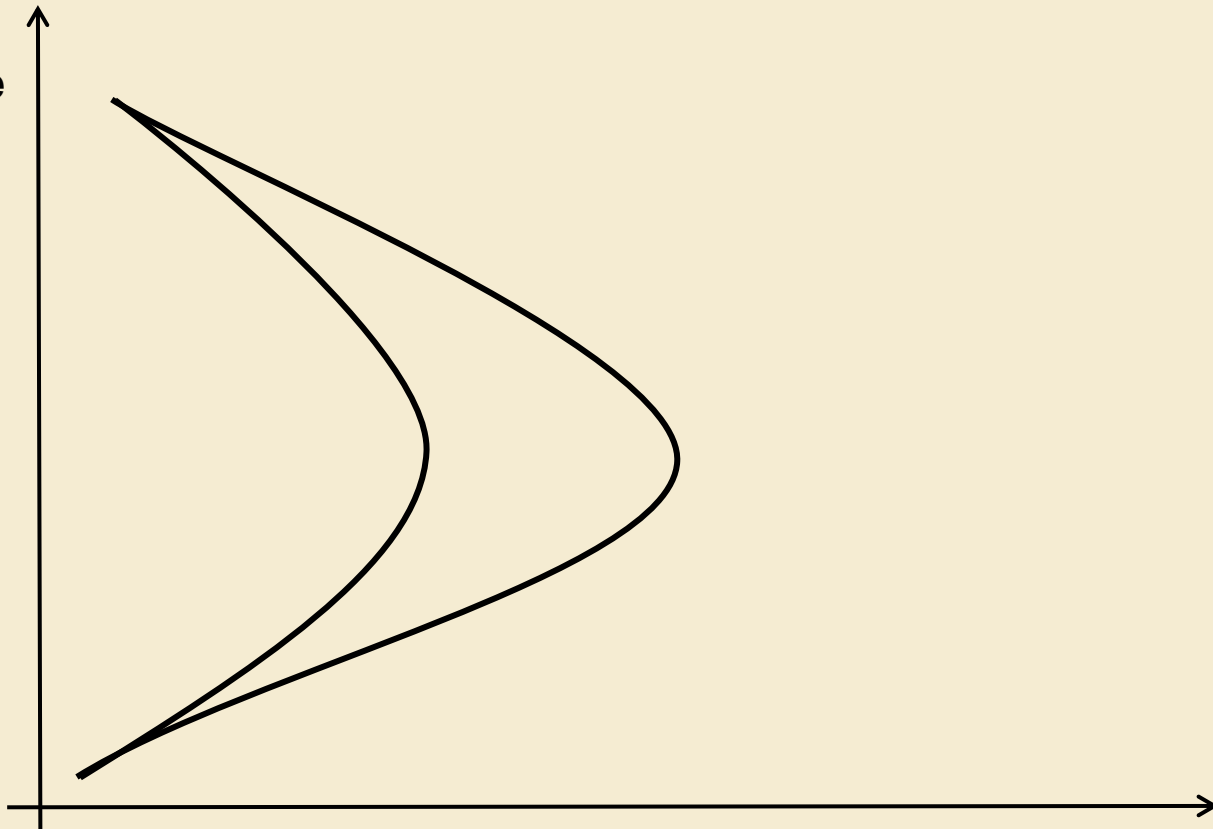
Average Cost per Production Unit



## 5. Discussion

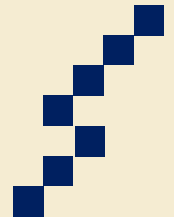
Is there an “efficiency banana” in pursuing excellence?

Level of  
excellence  
(high)



Level of efficiency (high)





**Thank you for  
your attention!**

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