Data appendix

to

The public choice of university organization

A stylized story of a constitutional reform

Martin Paldam, Department of Economics and Business, Aarhus University[1]

The main paper claims that the data for Aarhus University are amazingly poor. Since the first version of the paper was published (on the net) people have given me some data, and I have had a meeting with the (new) rector Brian Bech Nielsen and his 'data man' Bo Bjerre Jakobsen. I am grateful for their help, but I still think that the University should make an 'official' set of consistent time series allowing all of us to see what has happened.

I want to state from the start that what I have been able to document is not what I wanted. The key facts of the centralization and bureaucratization of the University are still hidden. Table 1 lists the two main sources used. I concentrate on source (1). The data in source (2) are essentially the same.

The *A-staff* is known as VIP's in Danish. It is the academic staff doing teaching and research. *B-staff* is TAP's in Danish. It is the administrative and technical staff. When an A-staff becomes head of department or something higher, he should move from A- to B-staff.

Table 1. The two main sources

(1)	**The annual data publication from the University, mostly named 'AU i tal'.** URL: http://www.au.dk/om/profil/publikationer/auital/2011/ital2011. These data have few notes. In principle available since 1997 but the links before 2000 are broken. 10-year tables from 2002 to 2006. One set of tables 2000-2004. Another 2005, 2006 and 2007. Then the format completely changes. One major data break discussed below ab D1 and D2
(2)	**Data for all Danish universities** URL: http://www.dkuni.dk/Statistik/Universiteternes-statistiske-beredskab. Starts in 2005. Most series start in 2007. Five separate publications with definitions and notes.

---

1. Street address: Fuglesangs Allé 4, Building 2632 (L), DK-8210 Aarhus V. E-mail: mpaldam@econ.au.dk. URL: http://www.martin.paldam.dk.

1.   Long series

Section 1.1 reports the main series since 1991. Section 1.2 looks at these data, while section 1.3 deals with the main missing link in the data: The A-staff on 'scholarship'. Section 1.4 covers students, and section 1.5 considers productivity.

1.1   The long series 1991-2012: The D1 and D2 definitions and the Dif series

The B-staff seems to be consistently defined, while the A-staff has two definitions: D1 (definition 1) excludes the ***Dif*** series for the staff on 'scholarship', while D2 (definition 2) includes the Dif series. Table 2 reports the series. Column (4) gives the available data for the Dif series and an assessment of the missing values as explained in section 1.3.

Table 2. The staff of Aarhus University 1991-2012. All in full-time equivalents

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Years	A-staff		Dif from	B-staff	Total staff	
	D1	D2	Table (4)		D1	D2
1991	**1302**	1612	*310*	**1038**	**2340**	2650
1992	**1392**	1702	*310*	**1196**	**2588**	2588
1993	**1369**	1688	*319*	**1259**	**2628**	2628
1994	**1408**	1779	*371*	**1253**	**2661**	2661
1995	**1407**	1792	*385*	**1365**	**2772**	2772
1996	**1465**	1801	*336*	**1349**	**2814**	2814
1997	**1519**	1842	*323*	**1410**	**2929**	2929
1998	**1560**	1882	*322*	**1445**	**3005**	3005
1999	**1546**	1869	*323*	**1474**	**3020**	3020
2000	**1498**	**1813**	315	**1493**	**2991**	**2991**
2001	**1442**	**1777**	335	**1528**	**2970**	**2970**
2002	1471	**1810**	*339*	**1550**	3021	**3021**
2003	1489	**1841**	*352*	**1568**	3057	**3057**
2004	1583	**1965**	*382*	**1650**	3233	**3233**
2005	1570	**1985**	*415*	**1678**	3248	**3248**
2006	1566	**2018**	*452*	**1716**	3282	**3282**
			Merger			
2007	2612	**3183**	**571**	**3033**	5645	**5645**
2008	2786	**3474**	**688**	**3095**	5881	**5881**
2009	2807	**3638**	**831**	**3239**	6046	**6046**
2010	2884	**3880**	**996**	**3312**	6196	**6196**
2011	3019	**4115**	**1096**	**3389**	6408	**6408**
2012	3238	**4369**	**1131**	**3623**	6861	**6861**

Note: Bolded numbers are reported in 'AU i Tal', various years. Numbers in italics are my assessment. The definitions D1 and D2 are discussed in the text above and in section 1.3.

1.2   A look at the series in Table 2

The full Table 2 follows if the Dif series of column (4) is accepted. Figure 1 shows the three main series from columns (2), (3) and (5). The vertical axis is logarithmic to deal with a growth process. The three curves look log-linear, except for the level shift in 2007 due to the merger. Table 3 shows that this impression gives a fine explanation of the data.

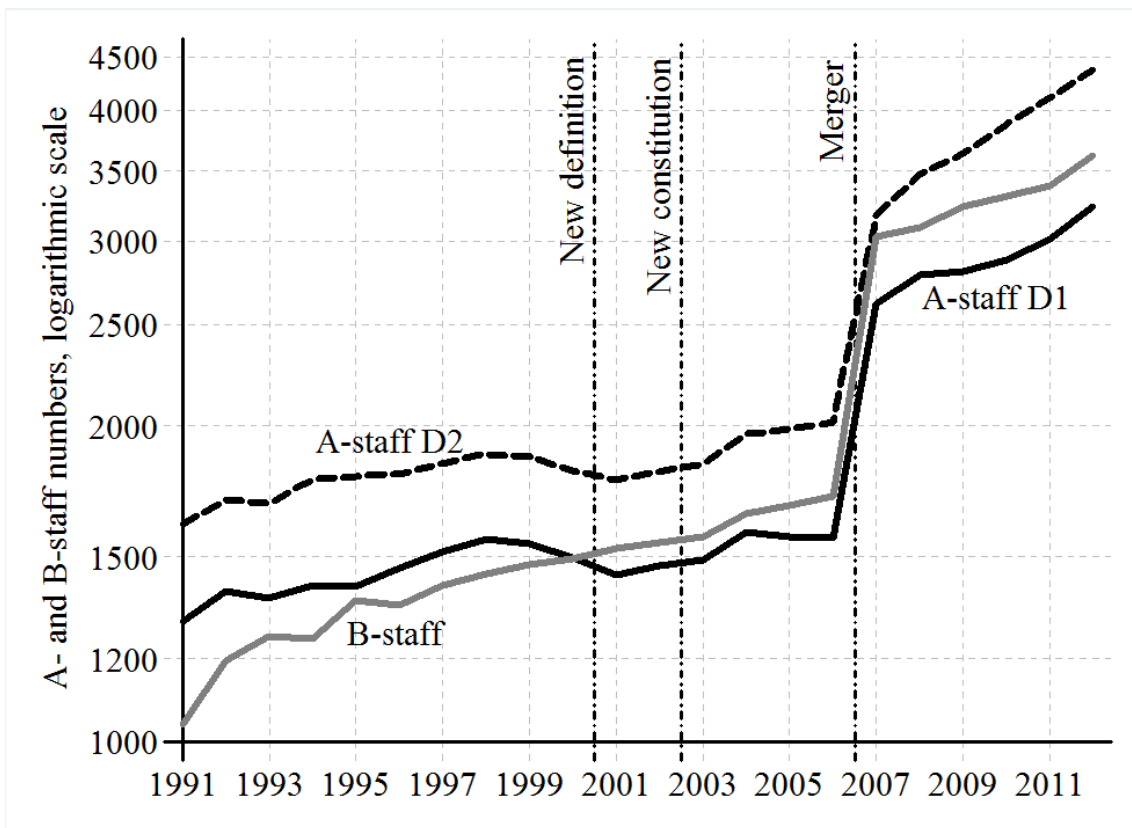Figure 1. The A- and B-staff for the 22 years from 1991 to 2014

Table 3. Explaining the development in the Staff by time trends and a shift after 2006

Row	(1) Ln is natural logarithm	(2) Column Table 2	(2) Time (year) Estimate (t-ratio)	(3) Shift dummy [a)] Estimate (t-ratio)	(4) Constant Estimate (t-ratio)	(5) R^2	(6) Growth $100(e^{estimate}-1)$	(7) Shift
			Explaining the (natural) logs to the numbers					
(1)	ln(A D1)	(2)	**0.011** (5.2)	**0.550** (18.0)	**-14.944** (-3.5)	0.985	1.1	73.4
(2)	ln(A D2)	(3)	**0.013** (4.6)	**0.579** (14.1)	**-18.923** (-3.3)	0.976	1.3	78.4
(3)	ln(B)	(5)	**0.028** (15.7)	**0.528** (21.0)	**-48.147** (-13.6)	0.994	2.8	69.6
			Explaining the A-share. The pattern for the B-share is the reverse					
(4)	A-share D1	(2)/(6)	**-0.0041** (-8.6)	0.0055 (0.8)	**8.786** (9.2)	0.893	0.41	-
(5)	A-share D2	(3)/(7)	**-0.0036** (-5.3)	0.0121 (1.2)	**7.662** (5.7)	0.713	0.36	-

Note: Brackets hold t-ratios. For Df = 20 the 5% and 0.5% significance levels are 2.1 and 3.2, respectively. Bolded estimates are significant. Figure 2 shows regressions (4) and (5), where the calculated growth is in percentage points. (a) The shift dummy is zero till 2006, and 1 from 2007.

3

Figure 2. The A-share: The two long series
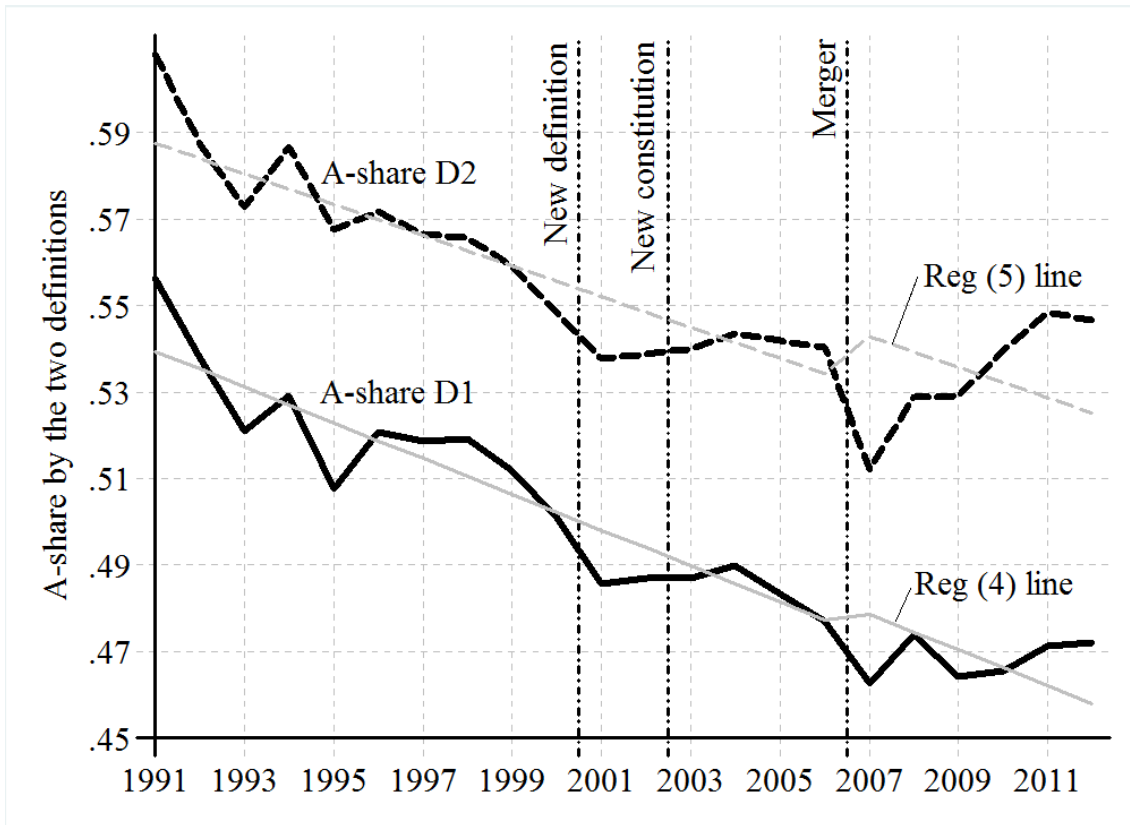
Note: The two regression lines from rows (4) and (5) in Table 3.

Column (6) in rows (1) to (3) of Table 3 shows the growth rate of the staff when the shift due to the merger is controlled for.[2] For the B-staff it is 2.8% p.a., while the growth rate for the A-staff is half of that by *both* definitions

Figure 2 shows the same development in the two shares. The curves for the A- and B-shares add to one for each definition, so they are not shown. The regression results for the B-share are the reverse, so that the numerical values of the estimates are the same while all signs change. For the shares the most linear curve is for D1. It shows a fairly linear fall of about 9 pp (percentage points), or 0.41 pp per year as found in Table 3. The constitutional change is just after the middle, so it appears that the fall is 5 pp before the change and 4 pp after. It looks as if the curves level off at the high end, so maybe the curve will converge to a stable value in the future. For 2013 the development has probably been as usual, but then for 2014 a savings round has occurred where the B-staff has decreased more.[3] Maybe there will even be an increase in the A-share in 2014.

---

2. Note that 100 times the estimate to time equals the growth rate (as it should) in rows (1) to (3) of Table 3.
3. The staff reduction in 2014 is 94 A-staff and 204 B-staff amounting to 308 in total. This is 3.6% of the staff, corresponding to a shift of 1.4 pp. With everything else happening this may not materialize.

Table 4. The estimate of Dif and the students

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years	Scholarship data	All PhD students		Dif Fraction	Dif number	Students	
		Old Uni.	Merged			Old Uni.	Merged
Before merger Dif-fraction is (2)/(3)							
1991		*705*			310	**14531**	
1992		*705*			310	**16124**	
1993		**725**		*0.44*	319	**17303**	
1994		**843**		*0.44*	371	**18506**	
1995		**874**		*0.44*	385	**18852**	
1996		**763**		*0.44*	336	**18772**	
1997		**735**		*0.44*	323	**19247**	
1998		**731**		*0.44*	322	**19841**	
1999		**735**		*0.44*	323	**20582**	
2000	**315**	**709**		0.444	**315**	**20793**	
2001	**334**	**700**		0.477	**334**	**21588**	
2002		**709**		*0.4775*	339	**21888**	
2003		**738**	**877**	*0.4775*	352	**21948**	**30801**
2004		**799**	**964**	*0.4775*	382	**20547**	**29767**
2005		**870**	**1023**	*0.4775*	415	**20176**	**28426**
2006		**947**	**1083**	*0.4775*	452	**19607**	**28447**
Before merger Dif-fraction is (2)/(4)							
2007	**571**		**1194**	0.478	**571**		**29550**
2008	**688**		**1430**	0.481	**688**		**28982**
2009	**831**		**1610**	0.516	**831**		**30414**
2010	**996**		**1822**	0.547	**996**		**32304**
2011	**1096**		**1964**	0.558	**1096**		**34129**
2012	**1131**		**1900**	0.595	**1131**		**37624**

Note: Bolded numbers are from the tables in 'AU i Tal'. The data in italics are my guesses. The students in columns (7) and (8) are discussed in section 1.4.

The merger has been a rather complex operation that is still in the process. It is surprising to see that the coefficients to the share dummy in the share regressions in rows (3) and (4) of Table 3 are insignificant, so it looks as if the A-share in the aggregate of the merged institution was almost the same as in the old university. Also, the University has continued the mergers in 2012; this time with the Engineering College of Aarhus.

1.3   The 'scholarship' adjustment: Dif is about half of the PhD students

Column (4) in Table 2 is repeated as the Dif column (6) in Table 4 that shows how the gaps in the series are filled out. Dif is the share of PhD students included in the A-staff (and some of

the postdocs?). The numbers found in the sources are given in column (2). How they are inter/extrapolated is given by the numbers in italics in column (5).

The statistics distinguish between two types of PhD students: (i) Some are 'students' and receive SU, the general student stipend, though at a higher rate. They are counted as students in the statistics. (ii) Some are 'candidates' (they have a 'master' degree) and receive a scholarship. They are counted as A-staff. Most PhD students change from (i) to (ii) during their PhD period.

The new constitution gives an upward kink in the number of PhD students, and hence a strong rise in the Dif series. In section 2.1 it is shown that half of the rise in Dif is absorbed by the remaining A-staff.

It is difficult to decide if the series should include PhD scholarship holders or not in the A-staff. An argument to do so is that PhDs after a period of coursework become full time researchers. However, they often end up producing a thesis that is only published in the departmental PhD-series, and they do much less teaching than other faculty. Also, they need counseling by their advisers. So, it is problematic to include the PhD students as A-staff.

Figure 3. The share of the included A-staff on scholarship

6
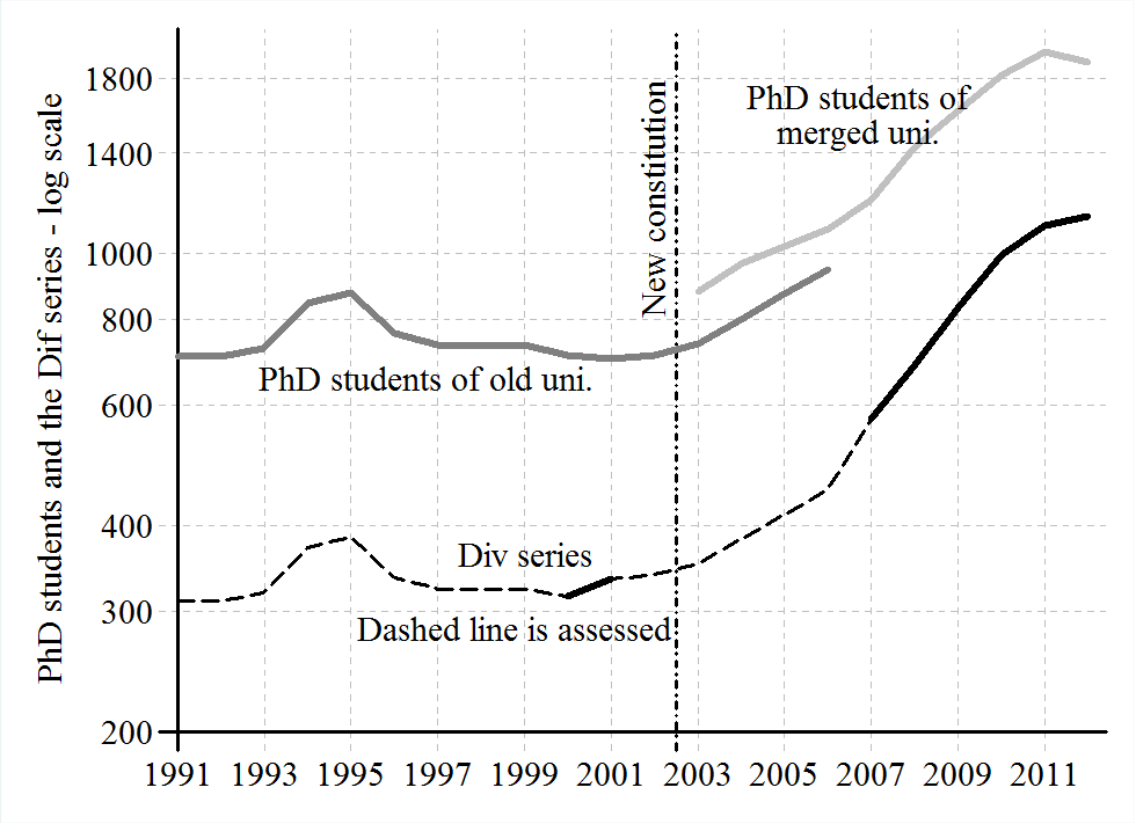
It appears that postdocs should be in the A-staff and are included in all data probably since 2000. Before that most postdocs had other titles and were included. The inconsistent treatment of postdocs is likely to give a small overestimation of A-staff before 2000, so the fall in the A-share D1 is probably a bit too small.

The various categories in Table 4 are shown as the curves on Figure 3. It is difficult to make a reasonable assumption about the inter-/extrapolation that makes the guestimated data in column (6) change by more than $\pm$ 25. Thus, the two key columns (2) and (3) in Table 2 are fairly robust. Section 2.1 interprets the behavior of the staff categories to the growth of the PhD share, i.e., the dif-variable.

1.4   Students

Columns (7) and (8) in Table 4 give the number of students at the University. It appears that they do not include any of the PhD students. Figure 4 shows the number of students. The numbers started to fall after the change of constitution, but it has resumed its growth after 2008. The fall from 2003 to 2008 is hidden in the merger.

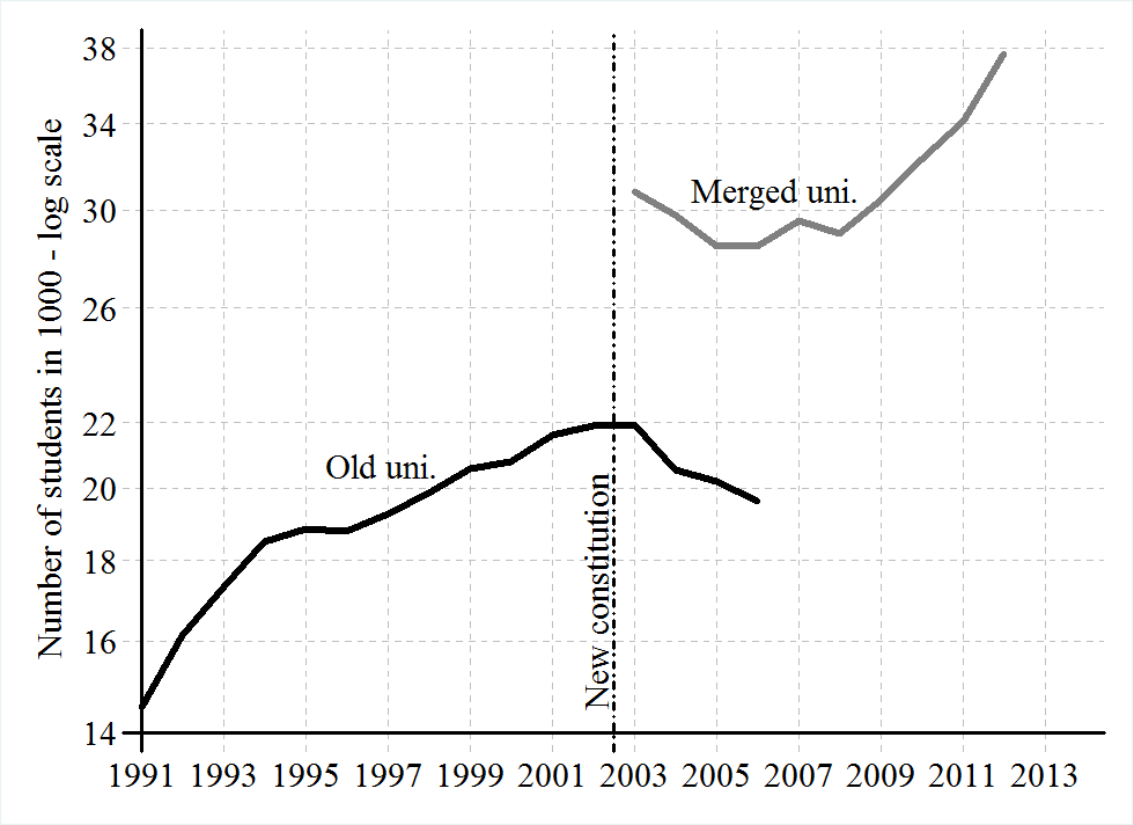Figure 4. The number of students at the old and the merged university

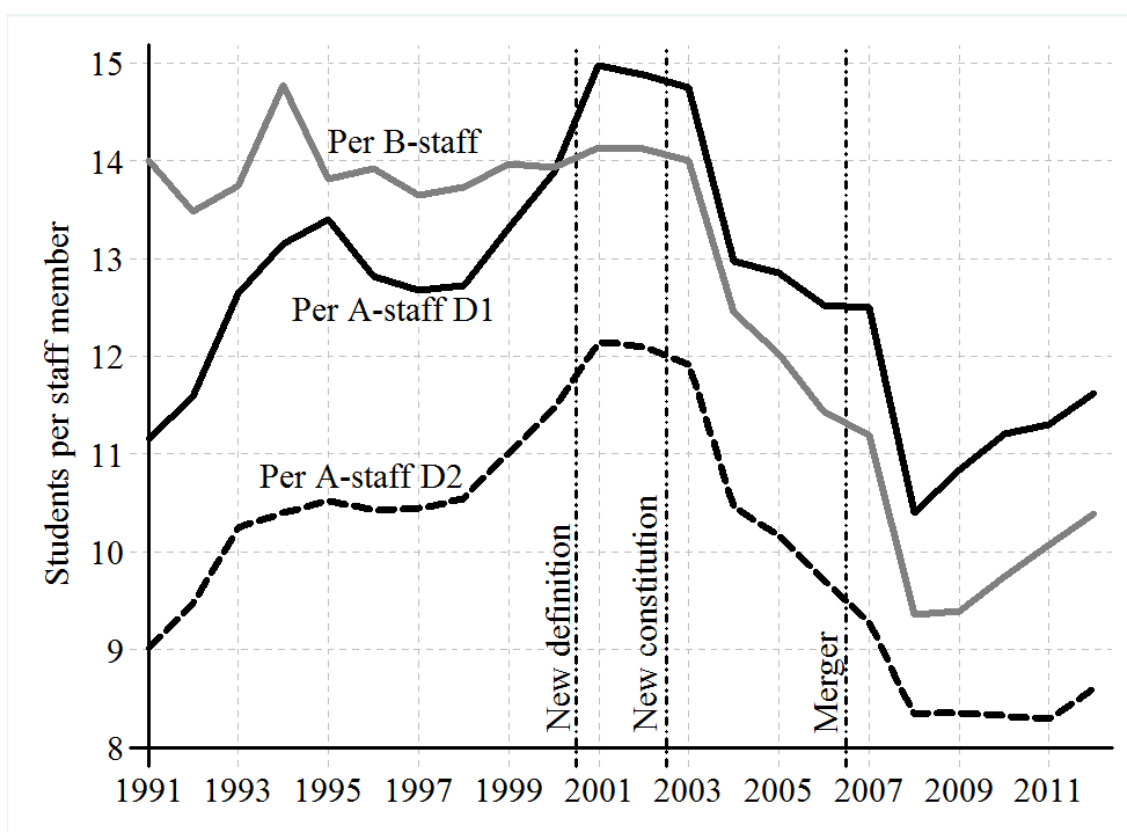Figure 5. The number of students per staff member

Figure 5 looks at the number of students per staff. The shares show how the almost log-linear increase in the staff and the stagnating student population give rather big movements in the shares. But by and large the number of students per staff falls, especially under the new constitution where grants to universities have increased. One reason for the increase since the merger is that it includes some 'pure' research institutes. The largest fall in the number of students per staff is for the B-staff. Here the fall is from a level of 14 to a new level of 8.5. This should give a 60% improvement in the service level.

1.5 Productivity

The production of the A-staff is teaching and research. The number of students per teacher has a fairly constant long-run level, though with large movements around that level. The methods by which research output is measured have changed substantially over time, but irrespective of the measurement the production of research publications has increased considerably more than the staff. Thus the productivity of the A-staff has increased.

It is much easier to measure the productivity of the B-staff as they participate indirectly in the activity of the A-staff and the students. Thus it is some average of the shares (i)

of students per B-staff and (ii) the shares of A-staff per B-staff. As both shares have decreased the productivity has fallen with one caveat. The service level provided by the B-staff to the students and the A-staff may have increased correspondingly.

However, all evidence shows that the students and the A-staff feel that the service they get from the B-staff has decreased substantially, under the new constitution, so the productivity fall is larger than suggested by the numbers given.

2. Three notes of interpretations

Here section 2.1 deals with the changes in the A/B-structure when Dif increases: What gives in when Dif grows. Sections 2.2 and 2.3 consider the externally financed staff. Finally, section 2.4 considers some the shocking alternative data.

Table 5. The effect of increases in the PhDs in the A-staff

	(1)	(2)	(3)	(4)	(5)	(6)
		Explaining the (natural) logs to the numbers				
Row	Log to staff	Ln(Dif)	Time (year)	Shift dummy	Constant	R^2
(1)	Ln(A D1)	**0.127** (2.2)	**0.0085** (3.7)	**0.464** (9.6)	**-10.36** (-2.3)	0.99
(2)	Ln(A D2)	**0.314** (6.5)	**0.0066** (3.5)	**0.367** (9.2)	**-7.61** (-2.1)	0.99
(3)	Ln(B)	0.028 (0.5)	**0.0271** (12.8)	**0.510** (11.5)	**-47.15** (-11.5)	0.99
	Explaining the shares – the shares to the B-staff are precisely the reverse					
	Staff-share	Dif-share [a]	Time (year)	Shift dummy	Constant	R^2
(4)	A-staff D1	0.194 (1.7)	**-0.0042** (-9.2)	0.0019 (0.3)	**8.87** (9.7)	0.909
(5)	A-staff D2	**0.736** (5.7)	**-0.0037** (-9.0)	0.0016 (0.3)	**7.89** (9.6)	0.899

Note: See note to Table 3. (a) when the A-share is by D1, so is the Dif-share, and when the A-share is by D2, so is the Dif-share.

2.1 How is the Dif squeezed in?

Under the new constitution a strong increase has occurred in the stock of PhD students at the University. About half of these students are counted as A-staff by D1 (definition 1). At the same time the A-staff increases less than the B-staff. This is true even by D2 (definition 2) where the part of the A-staff is included in the A-staff.

Table 5 takes the Dif-variable to be exogenous and shows how the staff 'reacts' to the inclusion of extra PhD students. The table is made from Table 3 by adding Dif as an extra regressor in column (2). Row (3) shows that the B-staff does not react to this inclusion. However, the A-staff obviously does. Especially by the D2 definition as it includes Dif.

Table 6. The staff that is externally financed

	All staff			Externally financed		Shares of external finances		
Years	A D1	A D2	B	A	B	Of all D1	Of all D2	Of B
2002	1471	1810	1550	456	228	0.226	0.204	0.147
2003	1489	1841	1568	491	220	0.233	0.209	0.140
2004	1583	1965	1650	495	236	0.226	0.202	0.143
2005	1570	1985	1678	534	243	0.239	0.212	0.145
2006	1566	2018	1716	554	231	0.239	0.210	0.135
2007	2612	3183	3033	1038	447	0.263	0.239	0.147
2008	2786	3474	3095	1251	598	0.314	0.281	0.193
2009	2807	3638	3239	1322	628	0.323	0.284	0.194
2010	2884	3880	3312	1401	634	0.328	0.283	0.191
2011	3019	4115	3389	1350	614	0.306	0.262	0.181

Figure 6. The development in the externally financed staff
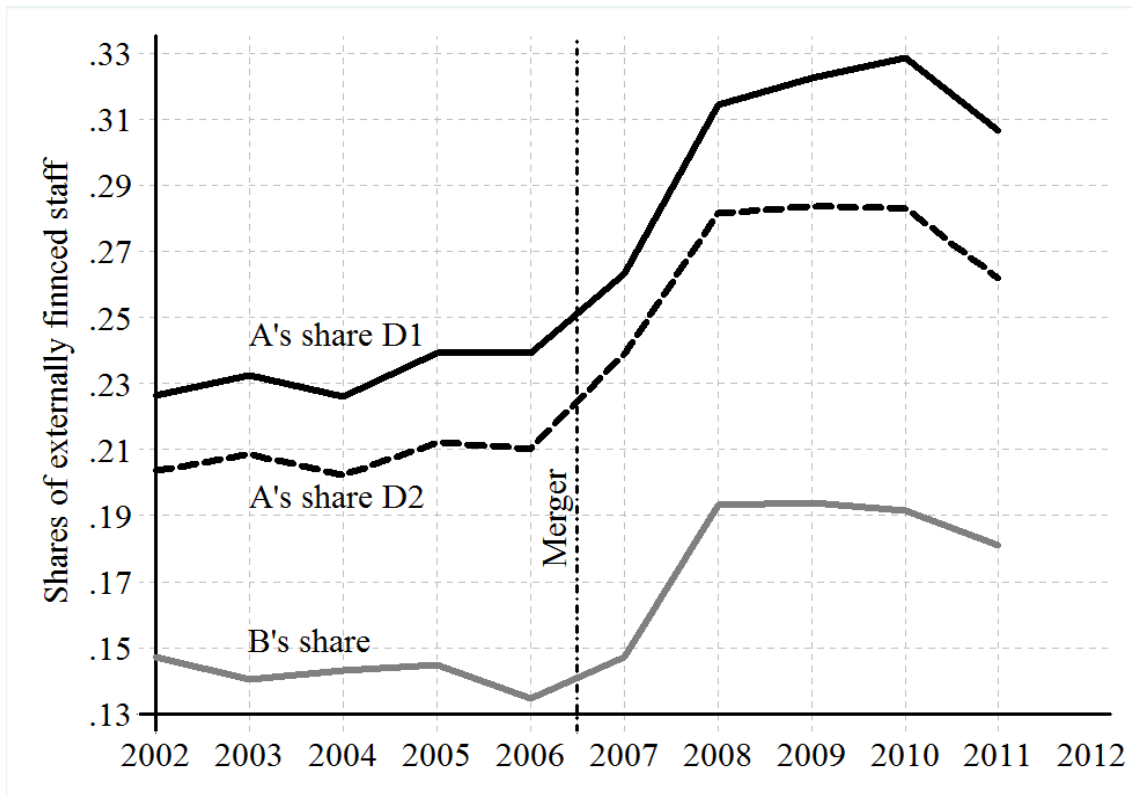
Column (2) in rows (1) to (3) is a log-log relation. Estimates from such relations are elasticities. Thus, if the PhD's in the A-staff increase by 1%, then the rest of the A-staff increases by 0.127 %. The AD1/Dif-ratio is about 4, so app 50% of the increase in Dif is paid for by a drop in the A-staff by D1. The AD2/Dif ratio is about 5, so the elasticity 0.314 means that about 150% of the increase is 'compensated. It is the 100% + 50%, where the 100% is the addition of Dif and the remaining 50% is the same as already found.

2.2 Externally financed staff

In 2010 external sources financed about 28% of the A-staff by D2, and 19% of the B-staff. Table 6 and Figure 6 show the data. They are short series, and they suggest that the share of external finances increases, but this may be due to the merger.

2.3 Long run expenditure data

All data presented till now have been staff data. In order to analyze the changes in the importance of external finances, expenditure shares can also be considered. All available data for the aggregate share are given in Table 7. They are shown in Figure 7.

Here four years of overlapping data for the old and the merged university exists. Notes to these data point to many changes in definitions, but it still appears that they are reasonably comparable. The data are in current prices in the beginning and in fixed prices at the end year later on, but as the data are deflated by the same indices the ratios are rather consistent.

Table 7. The share (times 1000) of external finances in the university expenditures

	Data for old university							Avr	Data for merged university						Avr
	2000	2001	2002	2003	2004	2003	2006		2007	2008	2009	2010	2011	2012	
1991	258							**258**							
1992	268	268						**268**							
1993	283	282	268					**278**							
1994	261	260	261	261				**261**							
1995	245	244	245	245	245			**245**							
1996	236	255	255	255	255	255		**252**							
1997	272	292	292	293	293	293	293	**290**							
1998	245	277	277	277	278	278	275	**272**							
1999	242	274	274	273	273	273	273	**269**							
2000	238	256	256	251	251	252	251	**251**							
2001		238	239	233	233	233	232	**234**							
2002			235	234	235	236	236	**235**							
2003				235	235	235	235	**235**	290	290	290	290	290	290	**290**
2004					227	227	228	**227**	285	285	285	285	285	285	**285**
2005						229	239	**234**	287	287	284	287	287	287	**286**
2006							245	**245**	296	295	292	296	296	296	**295**
2007									297	297	297	297	297	297	**297**
2008										333	333	333	333	333	**333**
2009											322	322	322	322	**322**
2010												282	277	276	**278**
2011													278	278	**278**
2012														299	**299**

Note: The shares are multiplied by 1000 for better visibility. The two bolded averages are the lines shown on Figure 7.
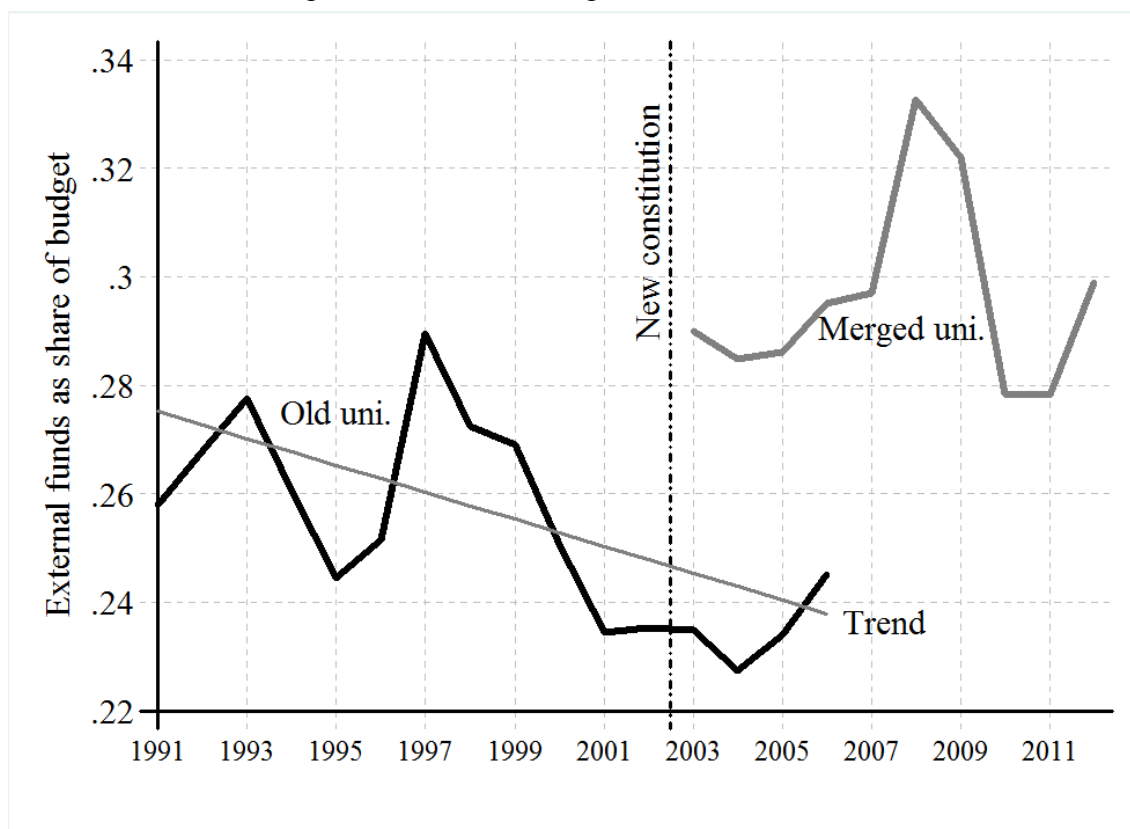
Figure 7. The two average series from Table 7

Table 8. Tests for trends in the share of external financing of the university budget

	Time (years)	Constant	N	R2
Old uni	-0.0025 (-3.2)	5.213 (3.3)	16	0.417
Merged uni	0.0007 (0.3)	-1.075 (-0.3)	10	0.013

Note: See note to Table 3.

The Figure and Table 7 show that the share of external finances in the old university has a significant downward trend. It is included on Figure 7. The only reason for the increase on Figure 6 is that the new parts of the university have a much larger external share than the old. Table 8 also shows that the 10 observations for the merged university have no trend either way. When the share of external finances went down this would have an effect on the A- and the B-share, but the big fluctuations in the external share of finance is poorly reflected in the A- and the B-shares, notably on the B-shares.

2.4   Shocking data to carry in your shirt pocket

In the publication Profil 13/14 the staff for 2011 and 2012 was given as reported in Table 9a. They were given in a special section of the publication, with a perforated line to detach. It was

shown how the note could be folded to be kept in the breast pocket closest to the heart of all staff. And many staff members, including me, certainly took it to heart! I also reported the table in the first issue of my paper, with a note that these numbers did not tally with other statistics on the home page of the University. As far as I know the University has never explained the discrepancy in any of its publications.

The data from Table 2 are different and less shocking, though they are still bad. They are given in Table 9b. The explanation of the difference is that Table 9a counts part-time staff as one person, while Table 9b converts part time staff to full-time equivalents.[4]

Table 9a. All employees from Profil 13/14

| | Total staff | | | Shares of | | |
	2011	2012	Change	A, 2011	B, 2012	Change
A staff	**6,313**	**6,321**	8	56.3%	54.7%	-1.6%
B staff	**4,905**	**5,230**	325	43.7%	45.3%	1.6%
	11,218	**11,551**	333	100.0%	100.0%	0.0%

Note: The bold data are the ones from Profil 13/14. No notes are given to the data

Table 9b. Full time equivalent from Table 2

| | Total staff | | | Shares of | | |
	2011	2012	Change	A, 2011	B, 2012	Change
A staff	4,115	4,369	254	54.8%	54.7%	-0.2%
B staff	3,389	3,623	234	45.2%	45.3%	0.2%
	7,504	7,992	488	100.0%	100.0%	0.0%

Table 9c. First differences between Tables 9 and 10

| | Total staff | | |
	2011	2012	Increase
A staff	2,198	1,952	-246
B staff	1,516	1,607	91
	3,714	3,559	-155

The two tables 9a and b thus show that the increase in A-staff in Table 9b hides a much bigger fall in part time staff, while no such change occurred for the B-staff.

---

4. I am grateful to Bo Bjerre Jakobsen for this information.

3. Conclusions: What has been found and not found?

The above data show a steady increase in the B-staff relative to the A-staff. The increase is about 9% of the staff since 1991, when the merger is controlled for. The change of constitution in 2003 does not change this trend, though it is unclear at the end due to the big process of merger. I conclude that the general relative increase in the B-staff since the constitutional reform is 4%. However, what I really want to know is where the B-staff works. The University has 3 levels:

(i)   The central level – very far from the A-staff. Upward shift

(ii)   The faculty level – far from the A-staff. Upward shift

(iii)   The department level – close to the A-staff. Downward shift

The reform process after the new constitution has essentially reduced the B-staff at level (iii) and increased the B-staff at levels (i) and (ii). ***Here consistent time series data are very difficult to extract from the statistics***.

The two main devices to move staff from (iii) to (i) and (ii) have been to reduce the number of departments and remove the service personnel such as IT, repair, study administration, etc. to a higher level. If the shifts away from the departments are added, the total shift in the location of the B-staff is between 4 and 5%, which should be added to the general increase in the B-staff of 4%. This gives two numbers about the effect of the constitutional reform to explain in the main paper:

(I)   A general shift from A-staff to B-staff of 4 percentage points

(II)   A shift of B-staff from decentralized jobs at the departments to central positions in the faculties and higher levels. It is much less well documented, but likely to be of at least the same magnitude.

Taken together (I) and (II) constitute a major shift in the allocation of the staff. The main paper sets it at 8 %. The excessive centralization and bureaucratization explains why the students and the A-staff feel that the administration works much less well than it used to do under the new constitution.