Efficiency in Mexican universities: DEA and MDS

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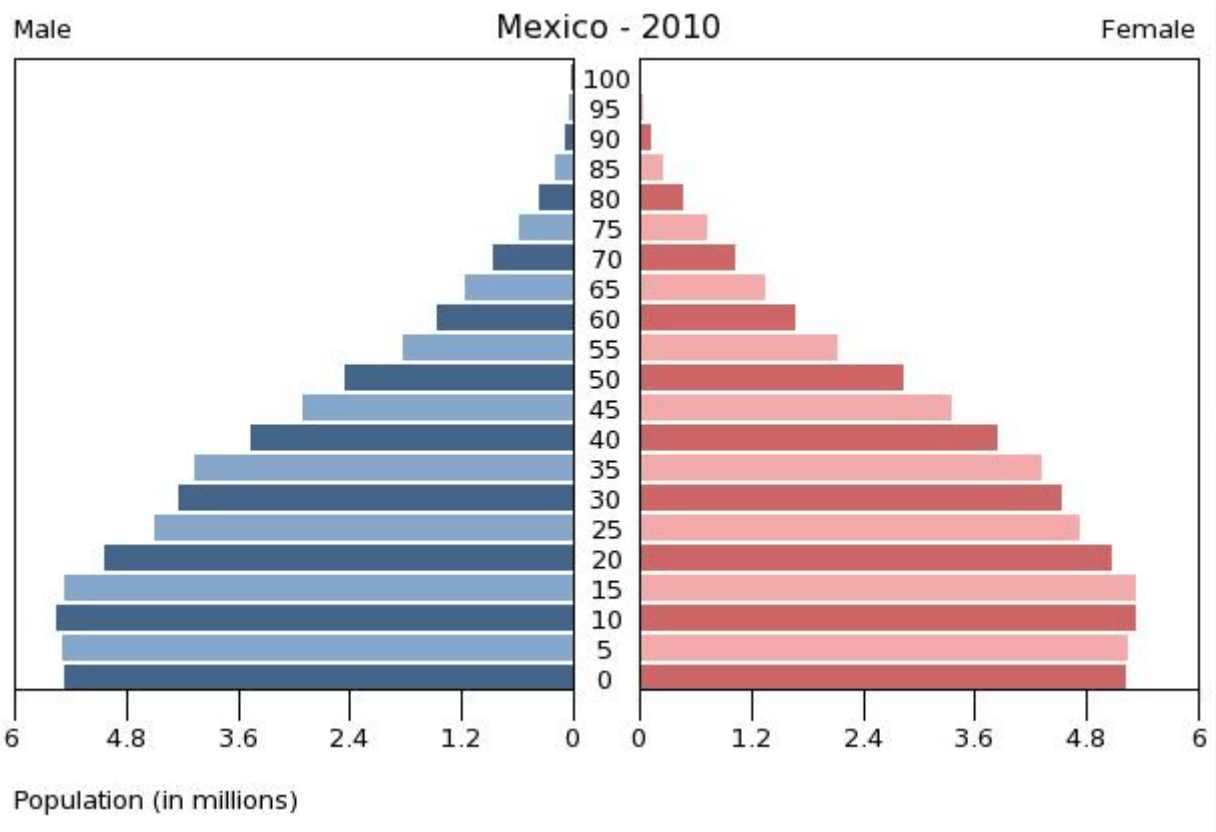
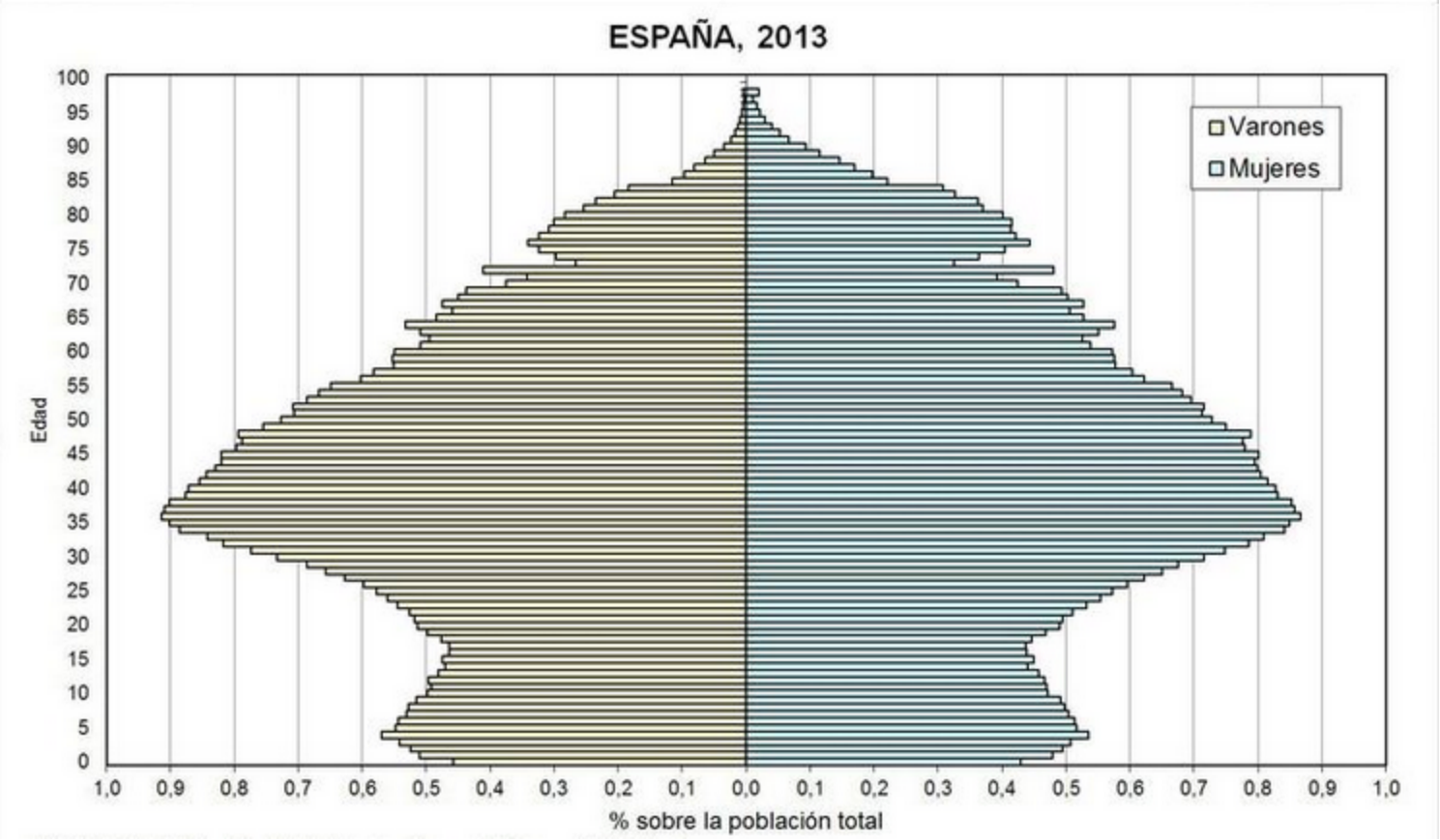
Population pyramid Mexico 2010



Population pyramid Spain 2013



Mexico's education modernisation programme

- Started in 1989
- Large increase in public expenditure in HE
- National planning of degree provision in state universities
- National Researchers System
- Budget split into ordinary and extraordinary components
- Universities bid for extraordinary component (30% of total)

55 universities in the study

- 6 Federal universities
- 34 local state universities
- 15 private universities
- Six years data 2007 to 2012

- We know that universities have improved but have they become more efficient?
- We need to look at individual universities within a Mexican global context

12 Ratios data

Ratio	***Ratio description***
FTEFTot	Full time equivalent faculty / total faculty
ScopusF	Scopus papers / full time equivalent faculty
ScopusEn	Scopus papers / total enrolment
EnrolLi	Enrolment (Licentiate) / total enrolment
EnrolMa	Enrolment (Master) / total enrolment
HealthG	Graduates (Health) / total graduates
SocialG	Graduates (Social Sciences) / total graduates
ScienceG	Graduates (Sciences) / total graduates
HumanG	Graduates (Humanities & Education) / total graduates
SuccessGFj	Success ratio: total graduates / first joining students
SuccessGEn	Success ratio: total graduates / total enrolment
TotalEnrol	Size: total enrolment

DEA inputs and outputs

Inputs		Outputs	
A	Full time equivalent faculty	1	Scopus papers
B	Total enrolment	2	Graduates
C	First joining graduates		

21DEA specifications

Specification	*Inputs*	*Outputs*
A1	A	1
AB1	A,B	1
ABC1	A,B,C	1
AC1	A,C	1
BC1	B,C	1
B1	B	1
C1	C	1
A2	A	2
AB2	A,B	2
ABC2	A,B,C	2
AC2	A,C	2
BC2	B,C	2
B2	B	2
C2	C	2
A12	A	1,2
AB12	A,B	1,2
ABC12	A,B,C	1,2
AC12	A,C	1,2
BC12	B,C	1,2
B12	B	1,2
C12	C	1,2

Three way data set

- For each year and each university we have values for 33 variables (12 ratios and 21 DEA specifications)
- DEA scores calculated using input-oriented VRS model
- This is 3-way data
- Analysed using the metric version of the INDSCAL model of Carroll and Chang (1970)

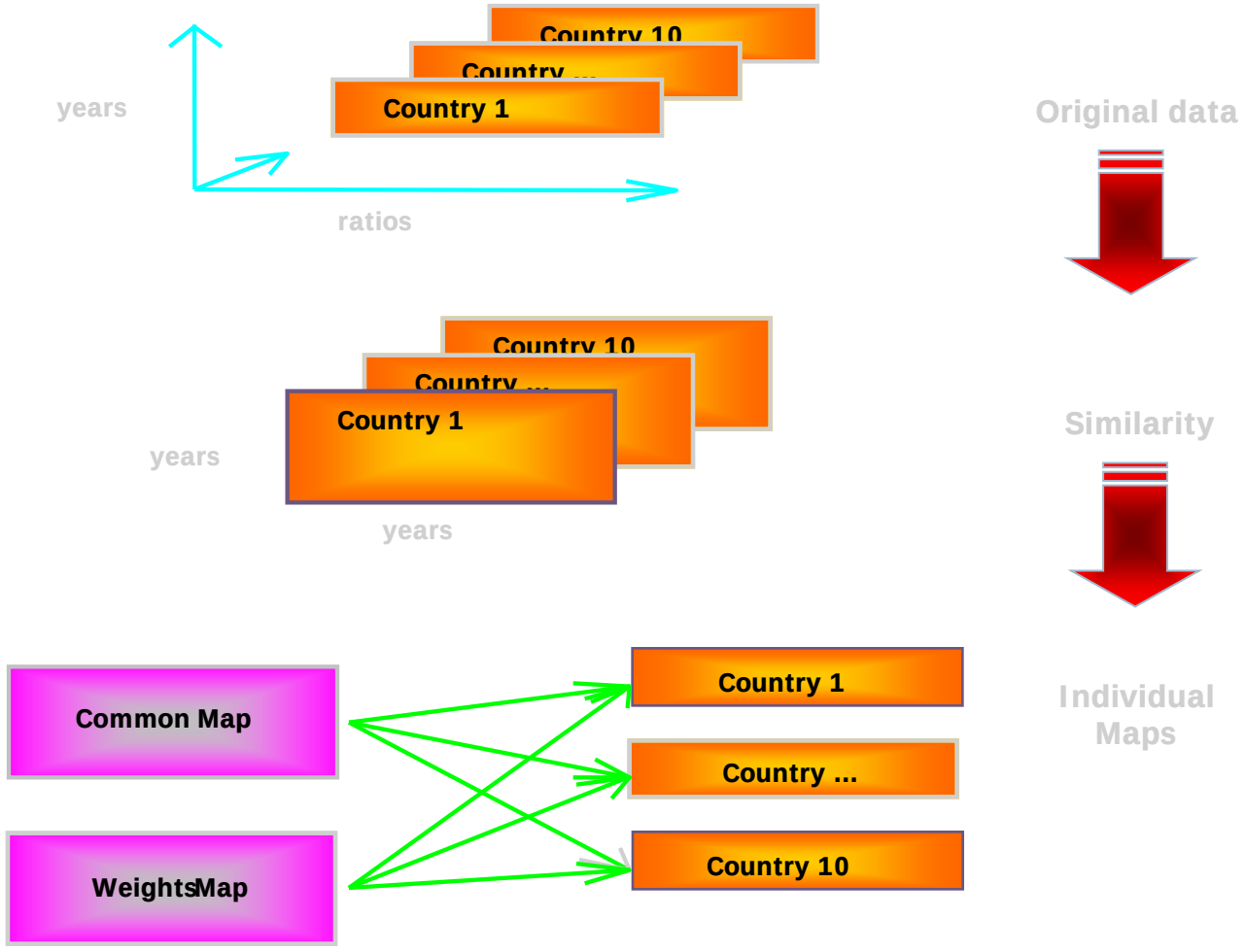
Preliminary analysis

- Each individual year matrix was analysed separately using the Principal Components approach to Factor Analysis
- Six or seven components found using Kaiser's criterium (accounting for about 60% of variation)
- First two components always associated with efficiency
- Other components associated with: discipline, degree vs master orientation, drop-out rates…
- Results were very stable across matrices

INDSCAL analysis

- ALSCAL routine in IBM SPSS package version 20

The WMDS model



Steps in the implementation of the WMDS model

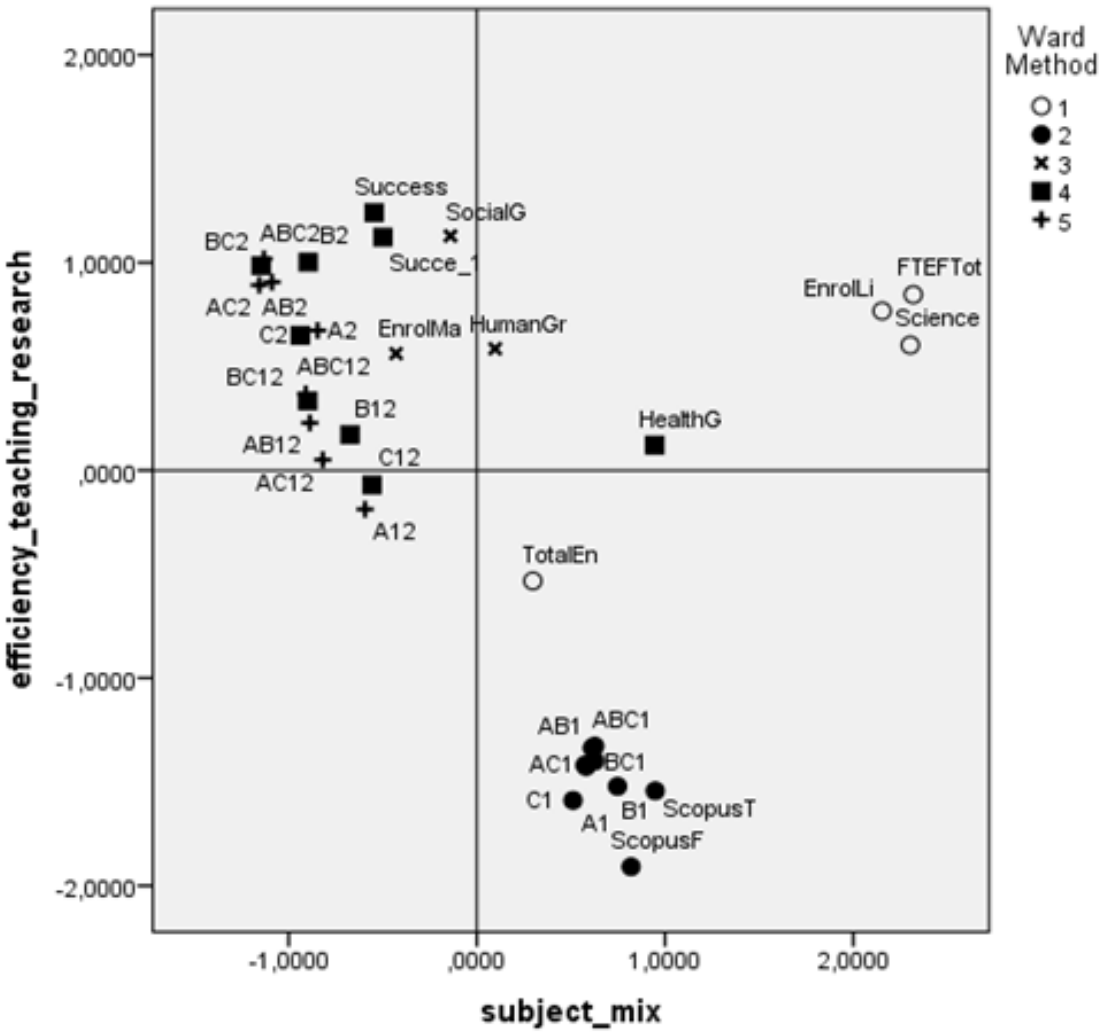
INDSCAL results: goodness of fit

Year	Stress	R^2
2007	0.084	0.933
2008	0.083	0.931
2009	0.076	0.940
2010	0.073	0.949
2011	0.083	0.948
2012	0.097	0.912
All data	0.083	0.935

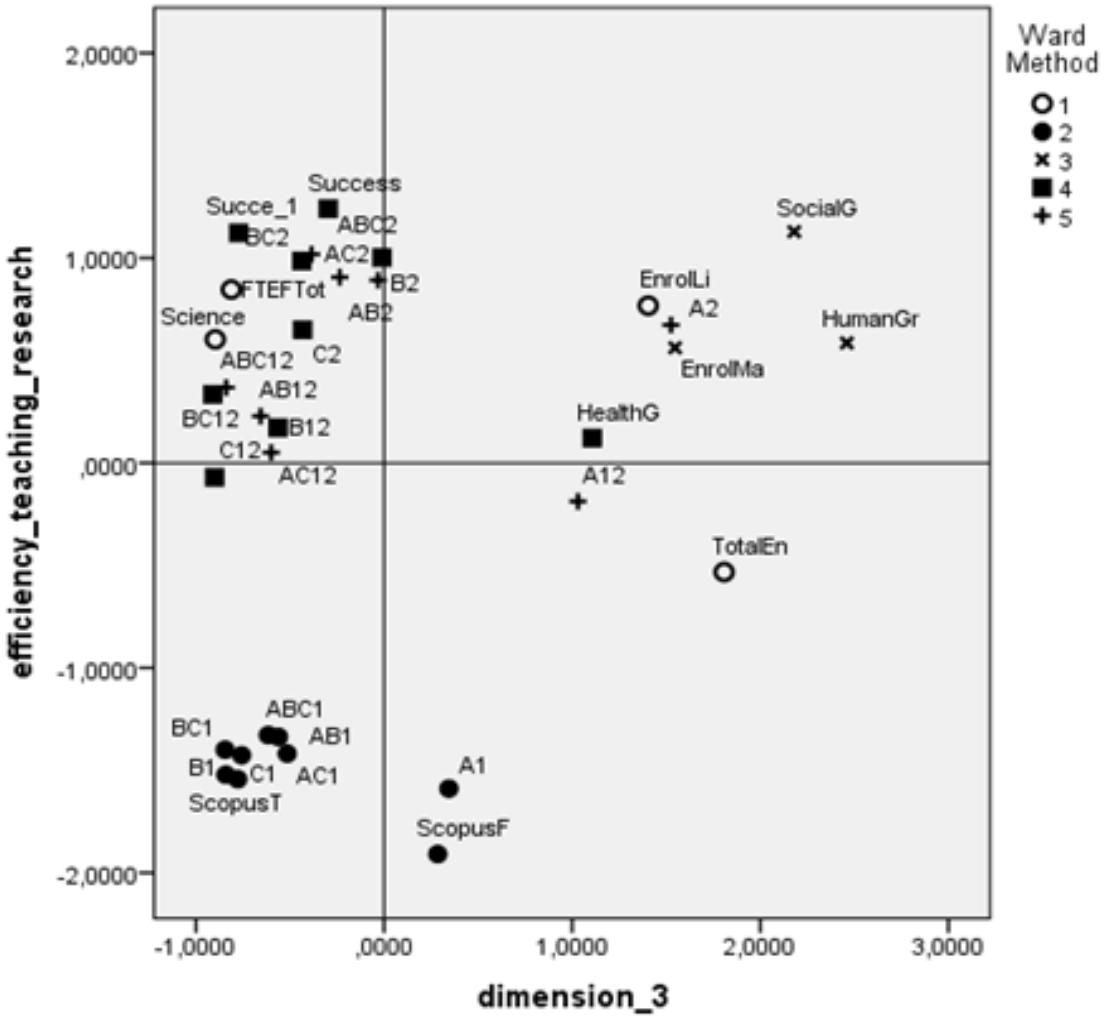
INDSCAL results: subject weights

Year	*Weirdness*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Dim5*	*Dim6*
2007	0,115	0,521	0,420	0,420	0,323	0,316	0,323
2008	0,050	0,516	0,476	0,401	0,338	0,329	0,234
2009	0,079	0,545	0,481	0,372	0,318	0,360	0,209
2010	0,102	0,611	0,493	0,389	0,279	0,251	0,200
2011	0,062	0,570	0,459	0,358	0,315	0,325	0,283
2012	0,074	0,620	0,433	0,366	0,297	0,275	0,203
Overall importance of each dimension		0,320	0,213	0,148	0,098	0,097	0,061

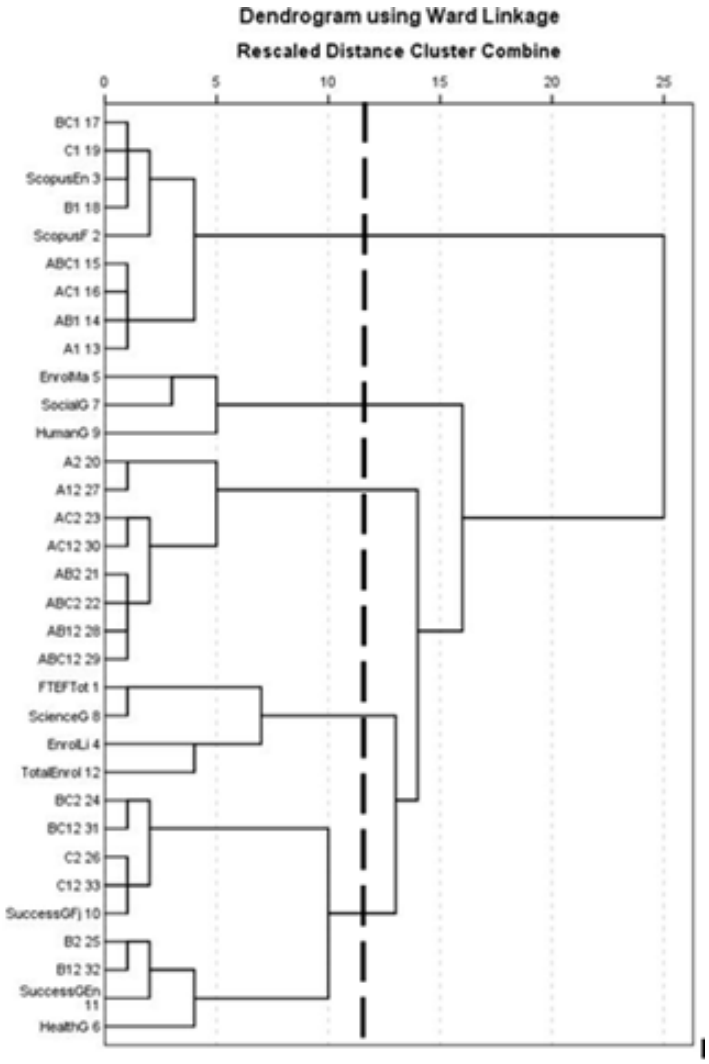
Configuration (dimension 1 and dimension 2)



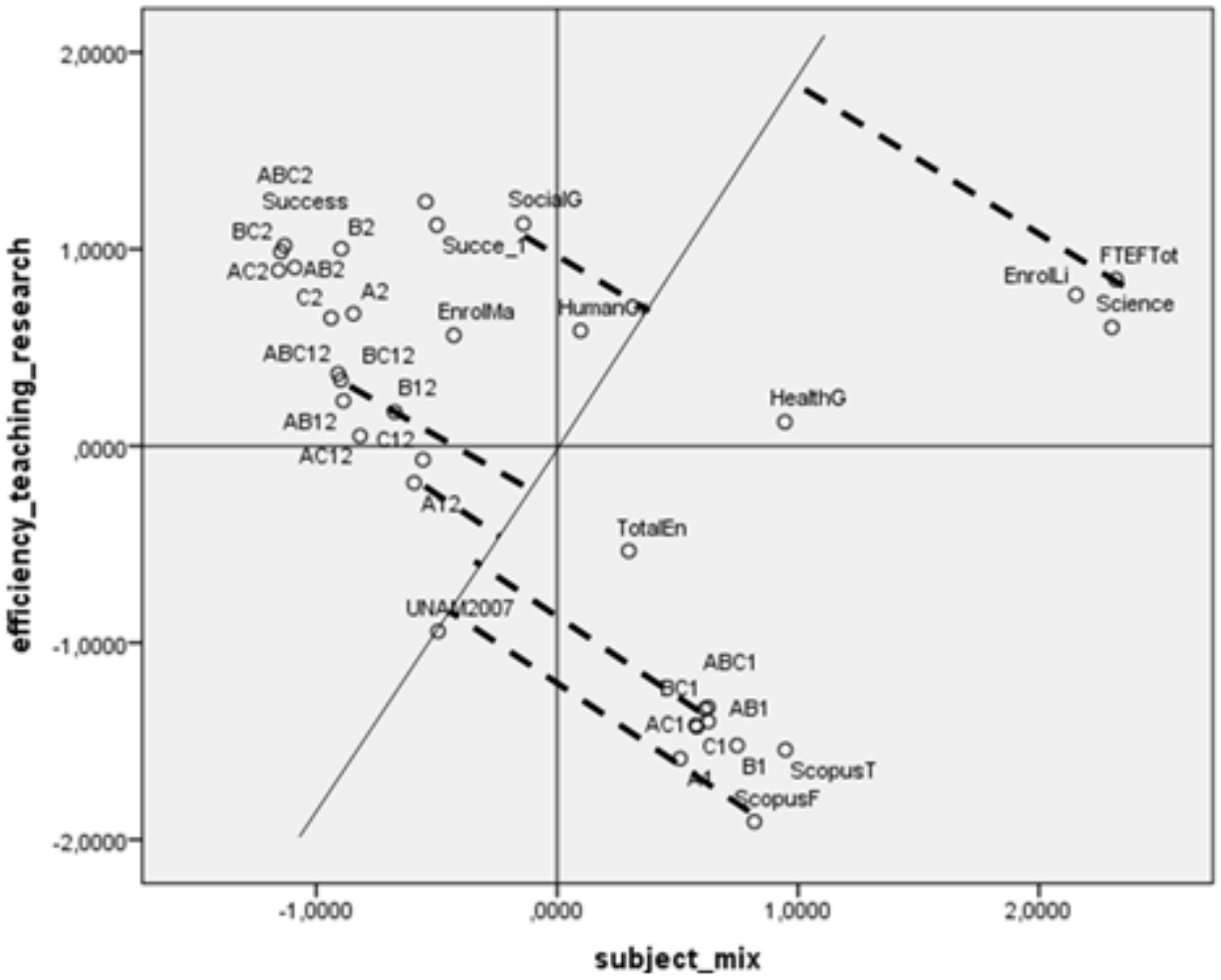
Configuration (dimension 1 and dimension 3)



Cluster analysis (Ward method)



Method for projecting universities



3 (federal, state, private) universities over time