

Bibliometric Indicators of Portuguese HE Institutions

Faculty Members in FCT Units

Direção-Geral de Estatísticas da Educação e Ciência (DGEEC)

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— RICYT —

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Background Information

- ❑ In 2013 / 2014 **Fundação para a Ciência e Tecnologia** (FCT) conducted a large evaluation exercise of all the research units it funds.
- ❑ As part of that exercise, all researchers were asked by FCT to create an ORCID account and to **list in ORCID their scientific production**, indexed in Scopus, between 2008-2012.
- ❑ About 15.000 researchers did this.
- ❑ **DGEEC also received the list of publications** submitted by each researcher.

Background Information

- ❑ At DGEEC, we linked the **FCT researchers database** with the **REBIDES database** that lists all the teaching staff at Portuguese Higher Education Institutions. In REBIDES, we considered only full time faculty members.
- ❑ About 9.000 researchers in FCT units were identified as full time faculty members of Portuguese HEI.
- ❑ We call these **UID faculty members**. We know to which HE institutions they belong. We confirmed these lists with the institutions themselves.

Background Information

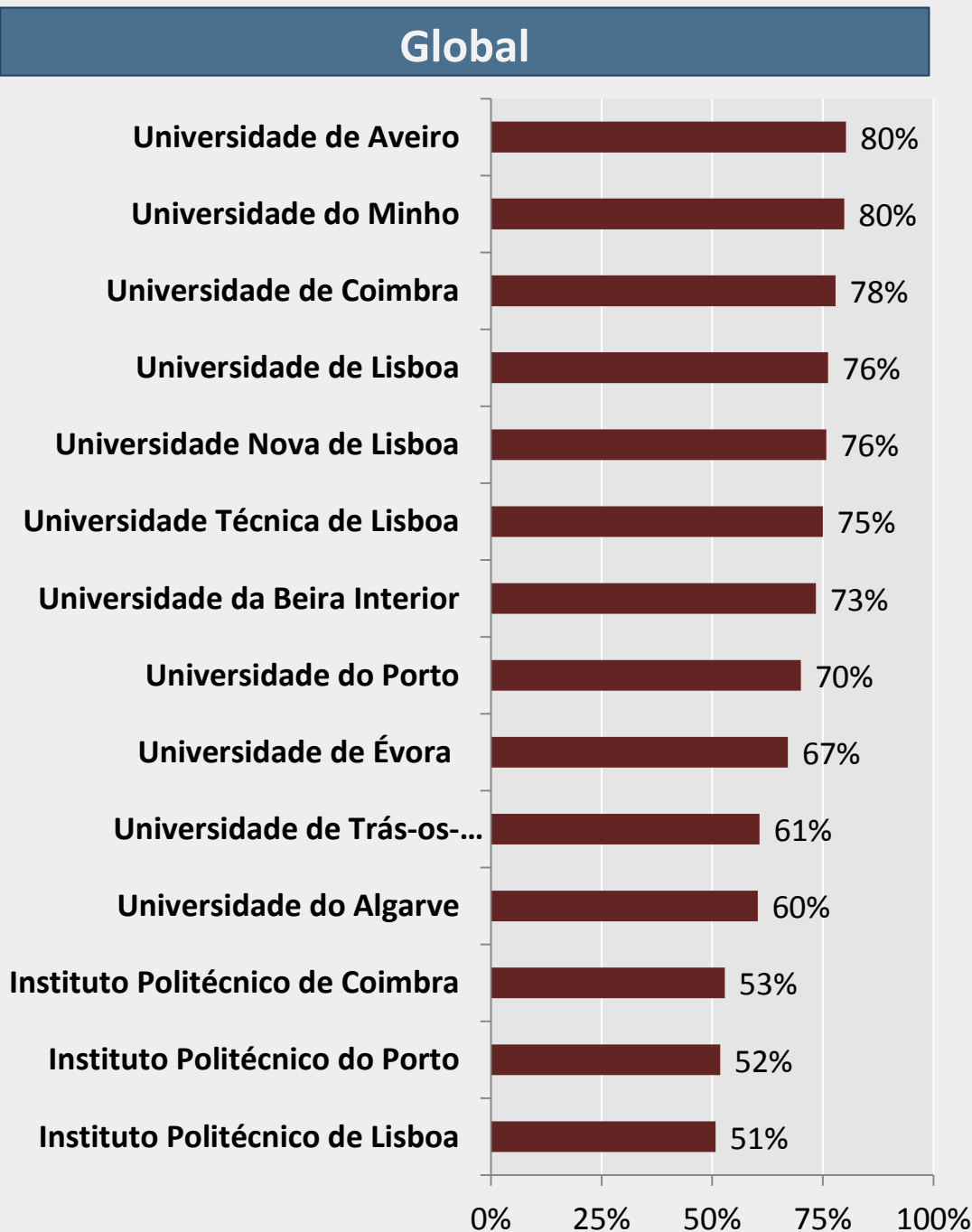
- ☐ We linked the publications list from the FCT evaluation with the **Scopus database** that we purchase every year from Elsevier.
- ☐ This database contains all the publications indexed in Scopus with at least one author with a Portuguese affiliation.
- ☐ Thus, for each UID faculty member, were able to get:
 - a) the **number of citations** of his/her Scopus publications;
 - b) the **scientific discipline** of the journal where each publication appeared (as classified by Scopus);
 - c) the **number of co-authors** of each publication;
 - d) etc.
- ☐ Let's do some bibliometrics!

Bibliometric Indicators of HE Institutions

- ❑ After considerable work, we calculated about **10 global bibliometric indicators** for each Portuguese Higher Education Institution and for each (level 2) scientific discipline in the Scopus (ASJC) Classification.
- ❑ We started publishing these results last week, with a publication for **Mathematics** and another for **Physics**.
- ❑ In these studies, we present results only for the HE institutions with **at least 50 publications** indexed in the subject area in 2008-2012 and with **at least 10 faculty members** active in the area.

Figure 1

**Percentage of faculty members
with PhD that belonged to FCT
Units (all scientific disciplines)**

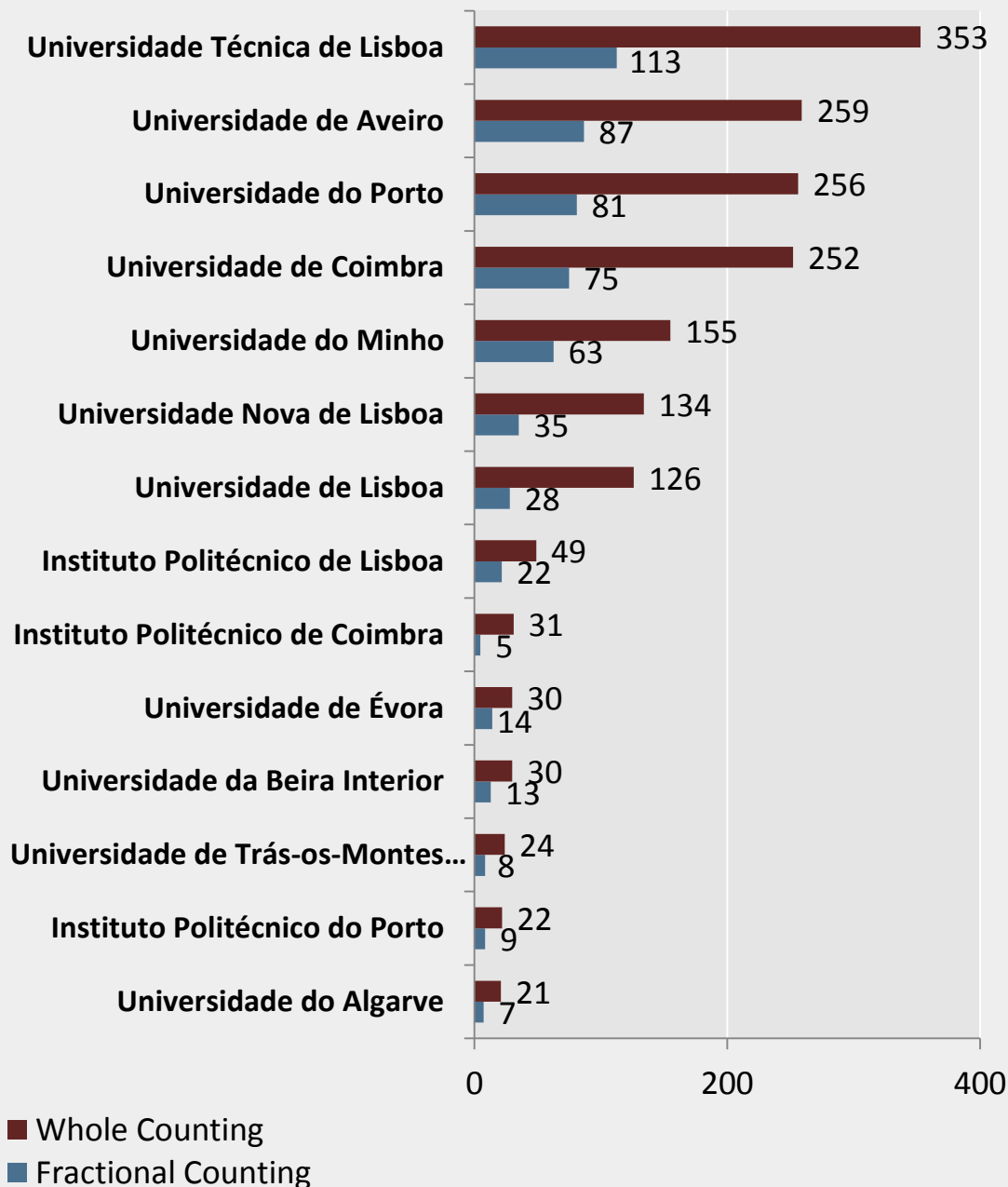


- ❑ The first and simplest indicator is the **number of publications in the discipline** produced by the UID faculty members of each HE institution.
- ❑ The publications may be counted using the **whole counting method** or the **fractional counting method**.
- ❑ Whole counting means that a publication produced by an author of Institution A is **entirely attributed** to Institution A, irrespective of whether the publication has co-authors of other institutions.
- ❑ In fractional counting, a publication with a total of N authors, among which M belong to Institution A, is attributed to Institution A with the **fractional weight M/N** .

Figure 2

**Number of indexed
publications in the discipline,
2008-2012 (annual average)**

Physics and Astronomy



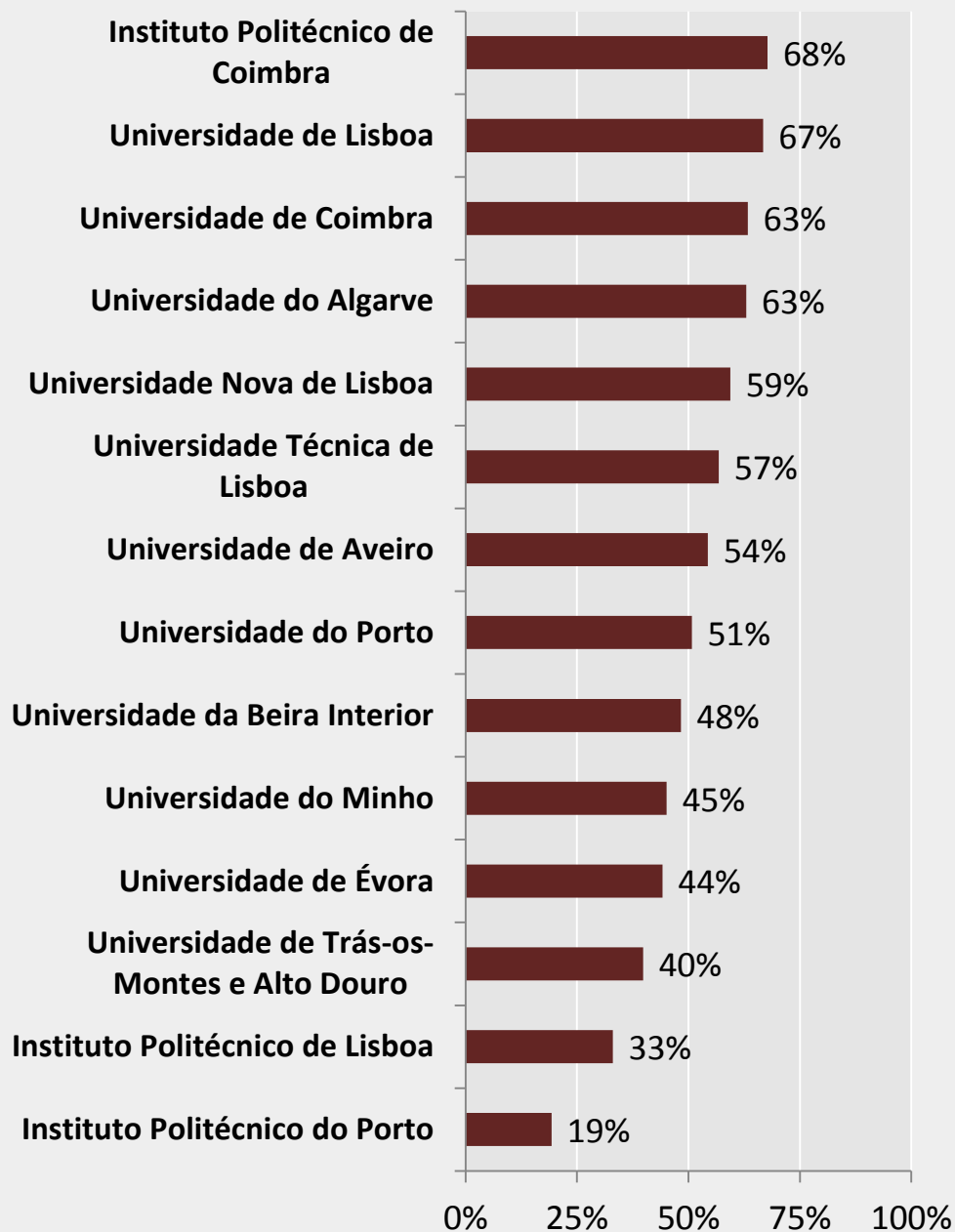
International Collaboration

- ☐ A publication is considered to be an international collaboration if **at least one author has a foreign** (i.e. not Portuguese) **affiliation**.
- ☐ We can calculate the percentage of publications of each HE institution that is produced as an international collaboration.

Figure 3

**Percentage of indexed
publications in the discipline
with international
collaboration, 2008-2012**

Physics and Astronomy



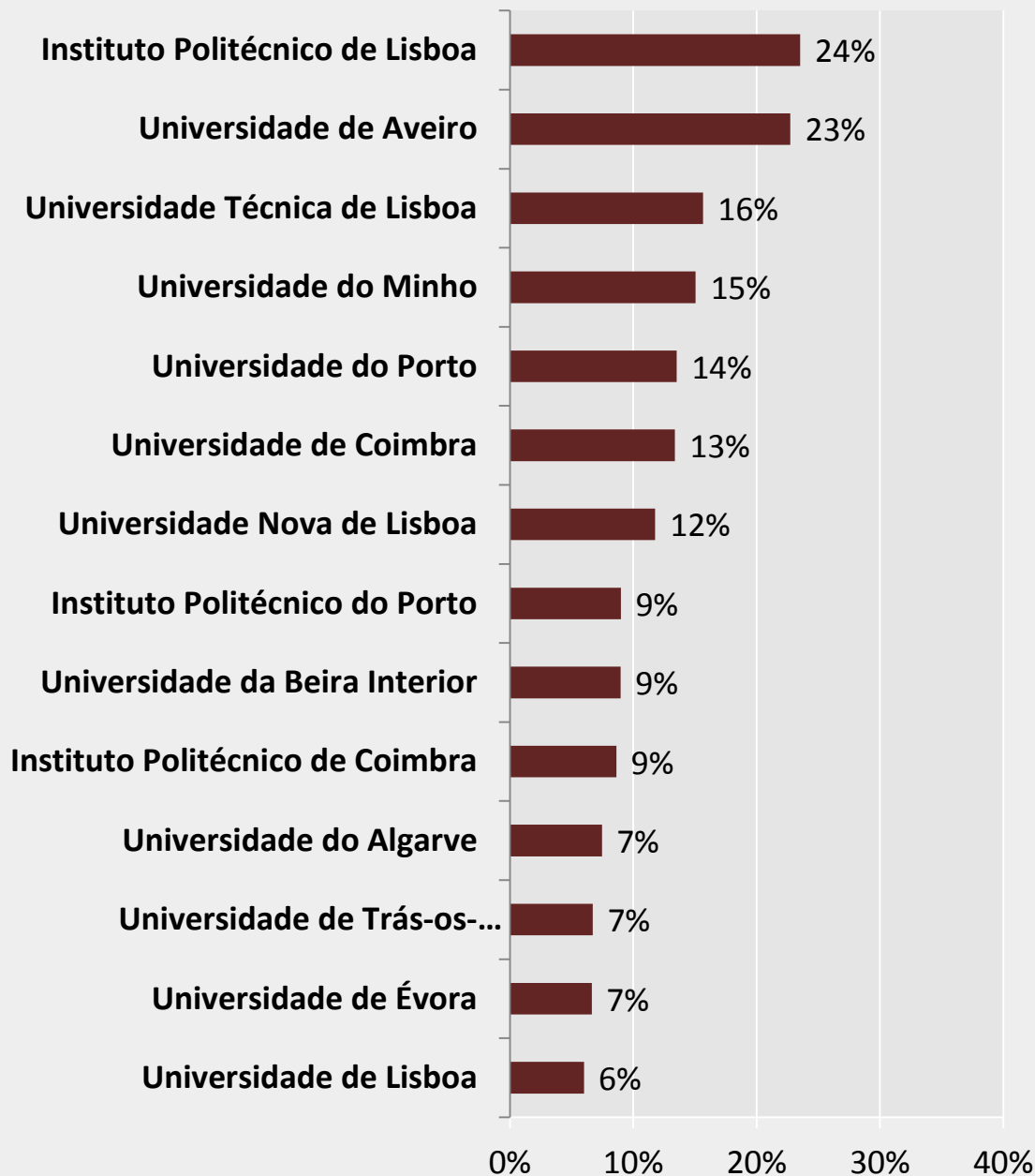
Faculty Members in the Discipline

- ☐ How do we decide the **field of research** of the UID faculty members of each institution?
- ☐ Unfortunately, no self-reported information is available...
- ☐ In our study, we considered that a faculty member is active in Discipline A if he/she has **at least 3 indexed publications classified in Discipline A** by Scopus, produced between 2008-2012.
- ☐ A faculty member may be active in more than one discipline.
- ☐ We can thus calculate the percentage of UID faculty members of each HE institution that are active in Discipline A.

Figure 4

Percentage of UID faculty members with at least 3 indexed publications in the discipline in 2008-2012



Physics and Astronomy

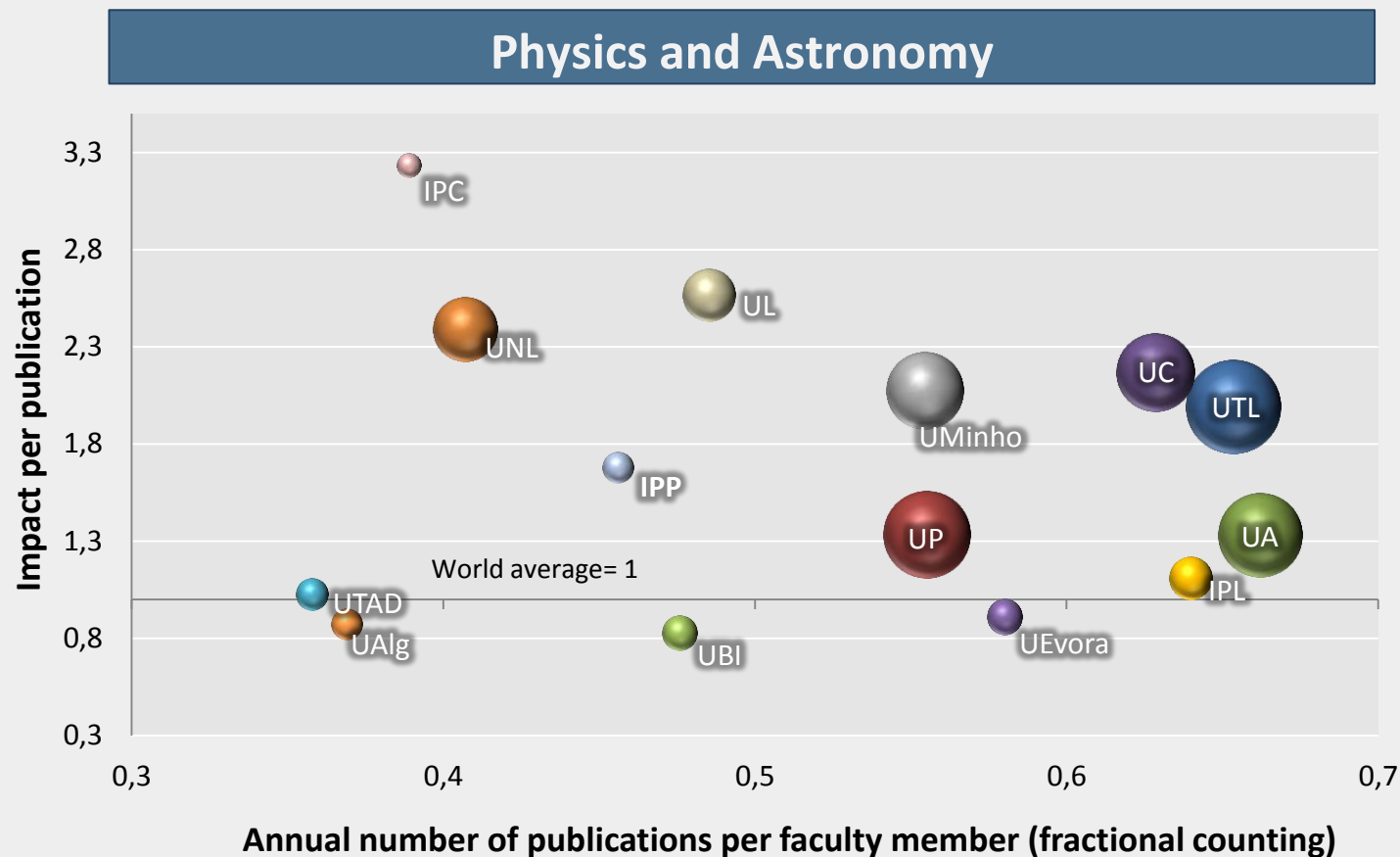


Bibliometric Impact of a Publication

- ❑ The bibliometric impact of a publication is a measure that reflects **how many times the publication was cited** in subsequent (indexed) publications all over the world.
- ❑ **It is not a simple citation count** though... Citation counts are hardly comparable across scientific disciplines and years of publication.
- ❑ The bibliometric impact of a publication is the **ratio between the real number of citations of the publication, and the expected number of citations** given the world averages for publications of the same type, age and scientific discipline.
- ❑ The bibliometric impact is sometimes referred to as the normalized citation count. **It is bigger (resp. smaller) than 1 if the publication has more (resp. less) citations than the world average for similar publications.**
- ❑ For each HE institution, we can calculate the average impact of the publications produced by its UID faculty members.

Figure 5 - Impact per publication vs Number of publications per UID faculty member


 Faculty
members in
scientific
area
Max: 157

 Faculty
members in
scientific
area
Min: 10



Source: DGEEIC; Scopus (2014)

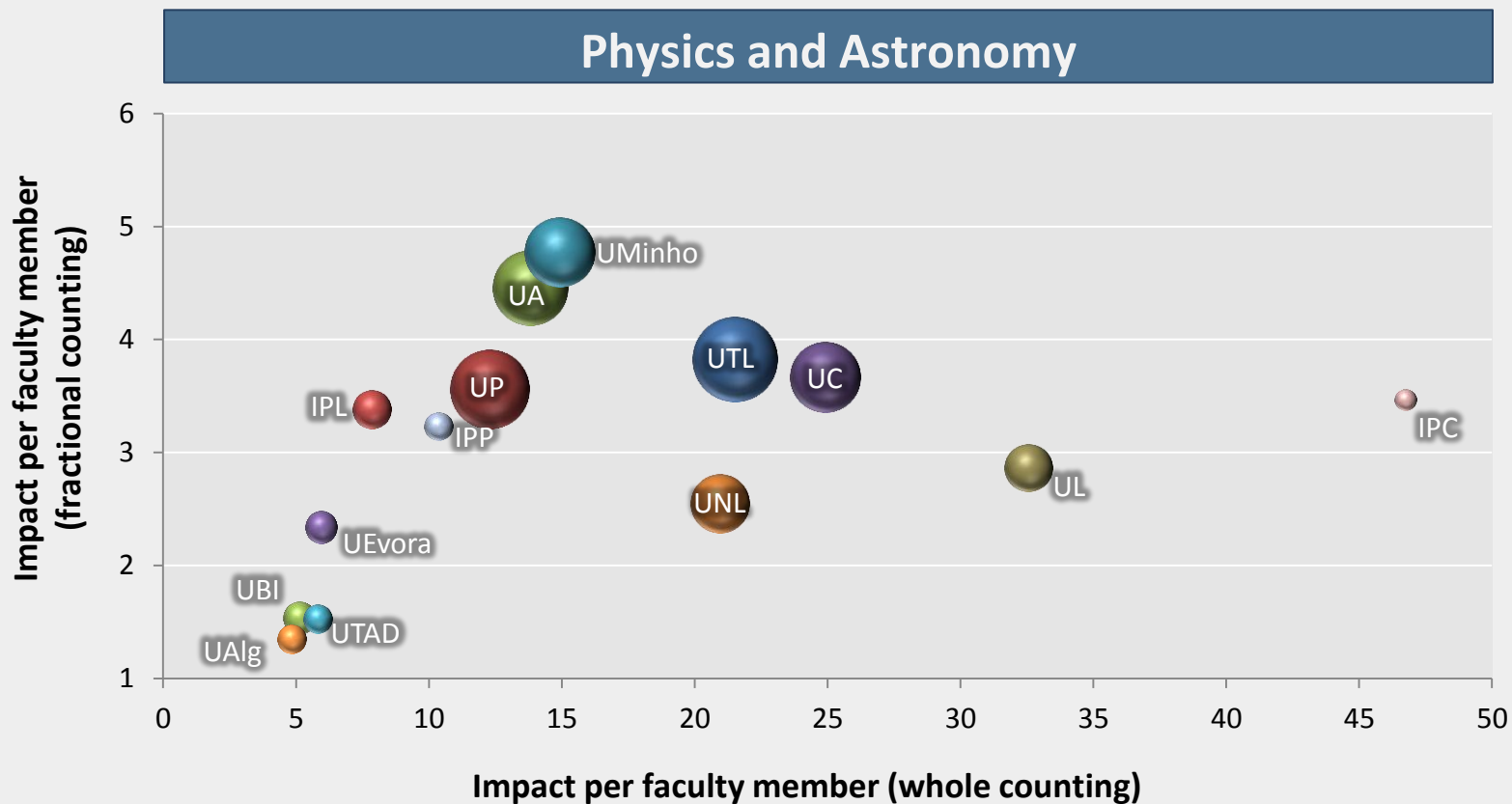
x-axis: Annual average of indexed publications in Physics and Astronomy, 2008-2012 (fractional counting).

y-axis: Average Impact of indexed publications in Physics and Astronomy, 2008-2012.

Aggregate Impact of a Researcher

- ❑ The **aggregate impact of a researcher in a scientific discipline** is a bibliometric measure that depends both on the number of publications produced by the researcher in 2008-2012, and the number of citations received by those publications.
- ❑ It can be regarded as a **weighted count of the researcher's publications**. The weight of each publication will be bigger or smaller than 1, depending on whether the publication received more or less citations, respectively, than the world averages for similar publications.
- ❑ The **weight of each publication is the normalized impact** of the publication.
- ❑ For each HE institution, we can calculate the average aggregate impact of its UID faculty members.

Figure 6 - Impact per UID faculty member: whole counting VS fractional counting



Source: DGEEIC; Scopus (2014)

x-axis: Average Impact of faculty members in Physics and Astronomy, 2008-2012 (Whole Counting).

y-axis: Average Impact of faculty members in Physics and Astronomy, 2008-2012 (Fractional Counting).

Aggregate Impact of an Institution

- ❑ The **aggregate impact of an institution in a scientific discipline** is a weighted count of the institution's publications in the discipline, produced between 2008-2012.
- ❑ The **weight of each publication is the normalized impact of the publication**. It will be bigger or smaller than 1, depending on whether the publication received more or less citations, respectively, than the world averages for similar publications.
- ❑ The aggregate impact is a normalized version of the naive full citation count of the institution.
- ❑ The aggregate impact is an **extensive measure**: bigger institutions (with more researchers) tend to have bigger aggregate impacts.

Figure 7

Aggregate impact of Portuguese higher education institutions in Physics and Astronomy, 2008-2012

Physics and Astronomy



Faculty in the Top National 25% of Impact

- ❑ Using the aggregate impact of a researcher in Discipline A, we can make a ranked list of all the UID faculty members in Portugal active in Discipline A.
- ❑ We can **extract the first quartile (top 25%)** of that list.
- ❑ We can then **count** how many faculty members each HE Institution has on the national top 25%.

Figure 8

**Number of UID faculty members
with high individual impact in
Physics and Astronomy
(national top 25%)**

Physics and Astronomy

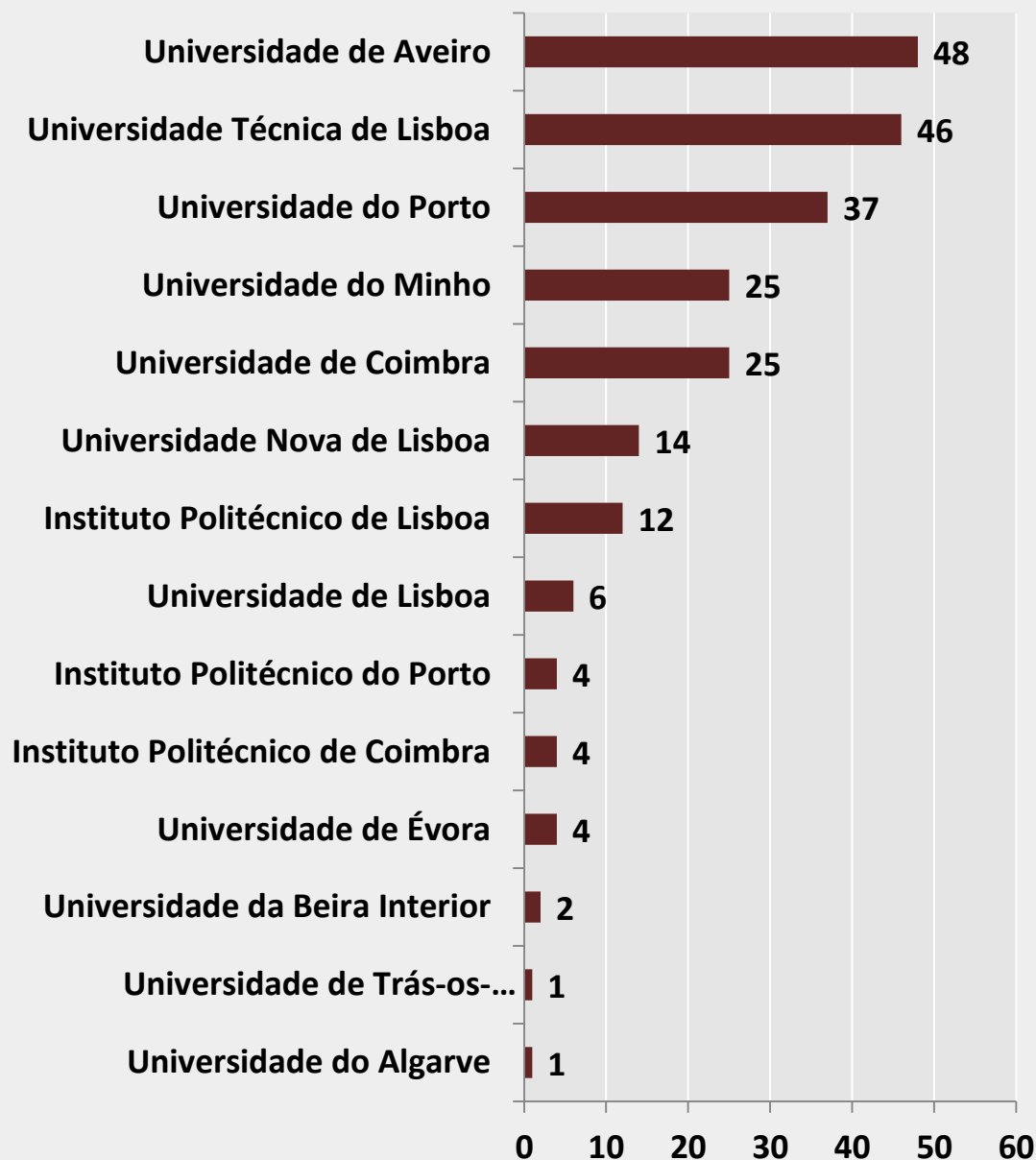
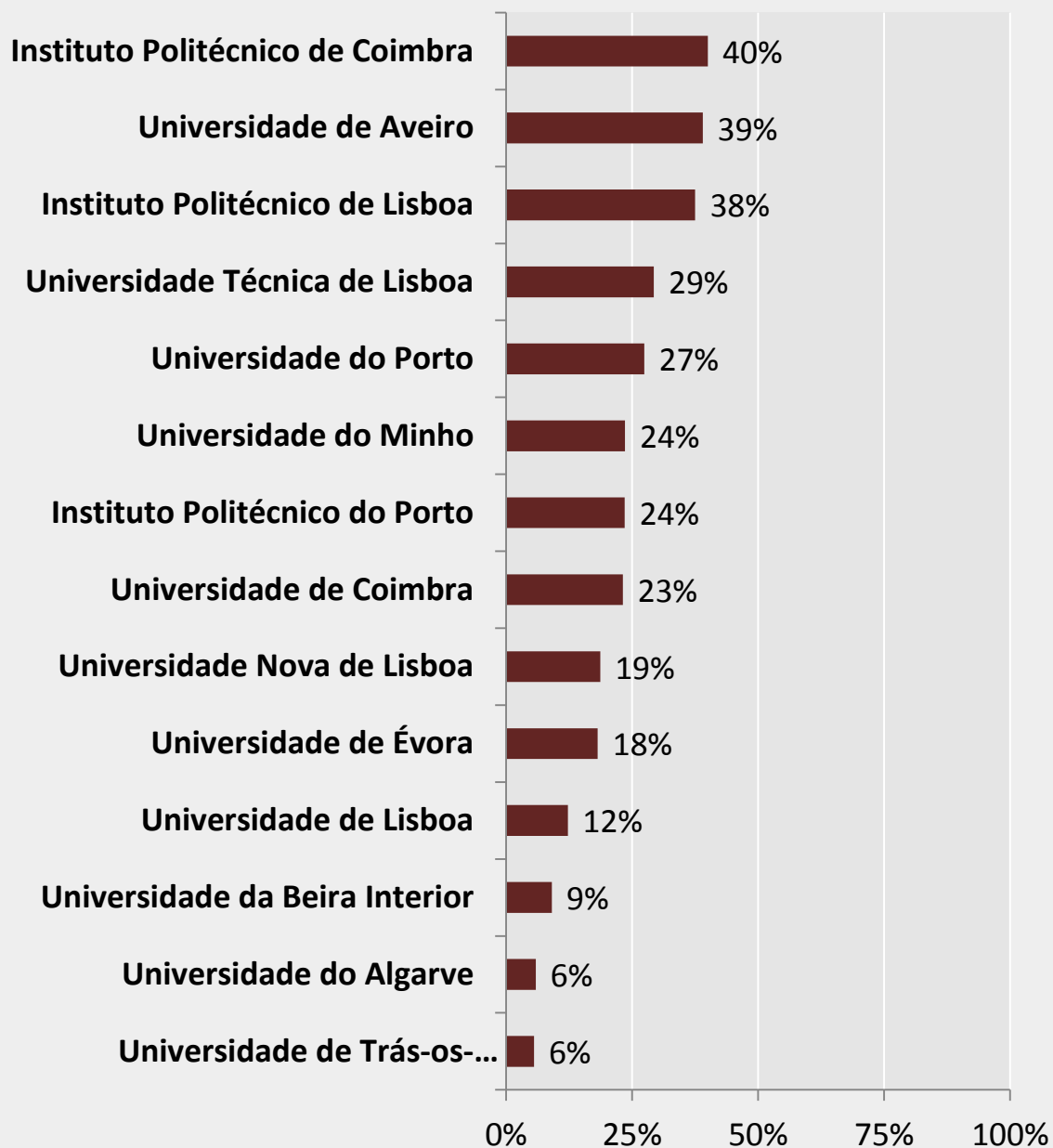


Figure 9

Percentage of UID faculty members in Physics and Astronomy with high individual impact (national top 25%)

Physics and Astronomy



Homogeneity / Heterogeneity of the Faculty

- ❑ After calculating the mean impact of the UID faculty members of an institution, we want to know whether this is a **homogeneous or a heterogeneous group of researchers in terms of impact**.
- ❑ In other words: do the UID faculty members of an institution have all more or less the same impact? Or do some faculty members have much higher impact than the rest?
- ❑ To characterize the degree of inequality of impact among the faculty members of an institution, we have used the **Gini Coefficient**, traditionally used in economic studies.
- ❑ The Gini Coefficient takes values between 0 and 1. The **value 0 corresponds to perfect equality** (everyone has equal impact); the **value 1 corresponds to maximal inequality** (only 1 researcher has non-zero impact).

Figure 10

Concentration/Dispersion of individual impact among UID faculty members in Physics and Astronomy (Gini Index), 2008-2012

Physics and Astronomy

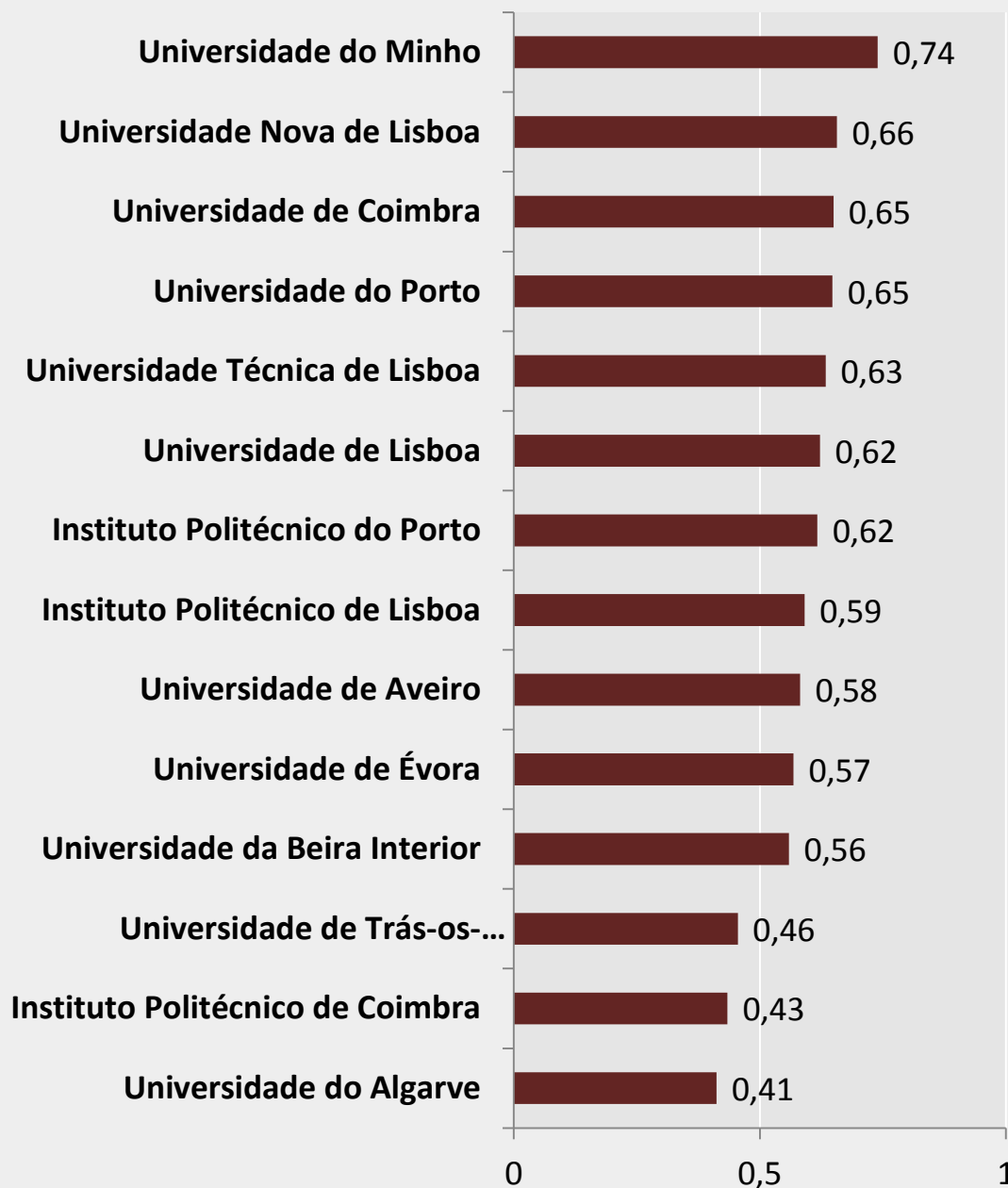
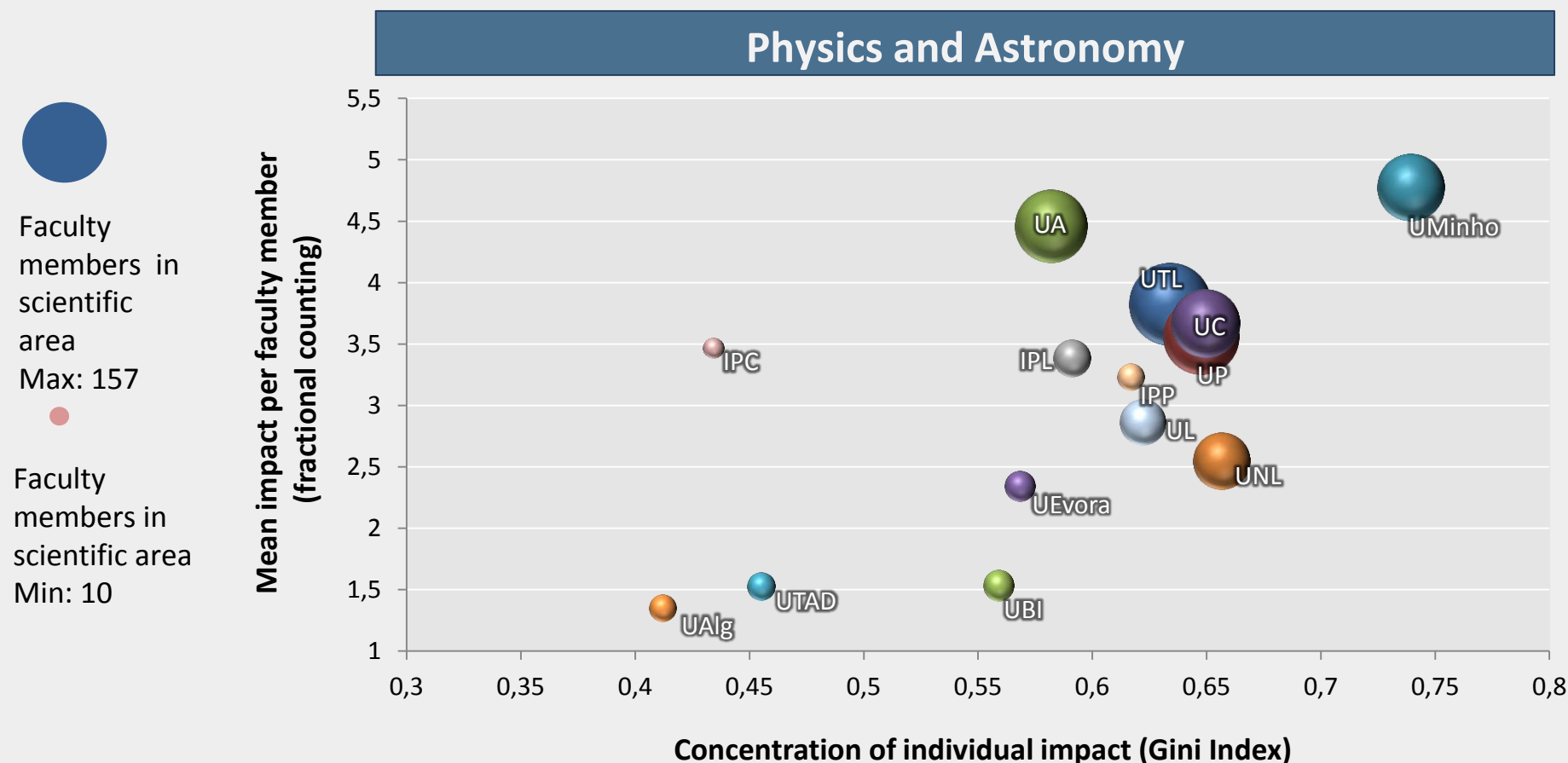


Figure 11 – Mean impact per researcher vs Inequality of individual impact (Gini Index)



Source: DGEEC; Scopus (2014)

x-axis: Concentration of individual impact among UID faculty members in Physics and Astronomy (Gini Index), 2008-2012

y-axis: Mean impact of UID faculty members in Physics and Astronomy, 2008-2012 (Fractional Counting).

Scientific Areas

Scopus Classification (ASJC)

Physics and Astronomy (all)

Physics and Astronomy (all)

Physics and Astronomy (miscellaneous)

Acoustics and Ultrasonics

Astronomy and Astrophysics

Condensed Matter Physics

Instrumentation

Nuclear and High Energy Physics

Atomic and Molecular Physics, and Optics

Radiation

Statistical and Nonlinear Physics

Surfaces and Interfaces

Source: Scopus (2014)

Thank you for the attention!

Portuguese Higher Education Institutions	Acronym
Instituto Politécnico de Coimbra	IPC
Instituto Politécnico de Lisboa	IPL
Instituto Politécnico do Porto	IPP
Universidade da Beira Interior	UBI
Universidade de Aveiro	UA
Universidade de Coimbra	UC
Universidade de Évora	UEvora
Universidade de Lisboa	UL
Universidade de Trás-os-Montes e Alto Douro	UTAD
Universidade do Algarve	UAlg
Universidade do Minho	UMinho
Universidade do Porto	UP
Universidade Nova de Lisboa	UNL
Universidade Técnica de Lisboa	UTL