MAPPING THE HIGHER EDUCATION SPACE

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ABSTRACT

Higher Education is often considered as a pathway for economic growth and social mobility. Not surprisingly, since the second half of 20th century the higher education systems have seen growing demand to widen the assess to higher education. Indeed, the increasing massification of the higher education - which was driven in order to match the increasing demand - has been one of the defining features of the late 20th and early 21st centuries higher education systems. The massification process resulted in the magnification of the underlying intricacies of a structure that dates back to the middle ages. Hence, in order to design effective policies/instruments that help avoid undesired/unexpected outcomes, policymakers require novel tools to approach the new higher education paradigm.

Here we present the Higher Education Space, a data-driven approach that maps the similarity structure between degree programs by using the applicants' preferences from Portugal and Chile as a proxy. We use network science methods to analyze the properties of the emerging structure and derive implications to the higher education system.
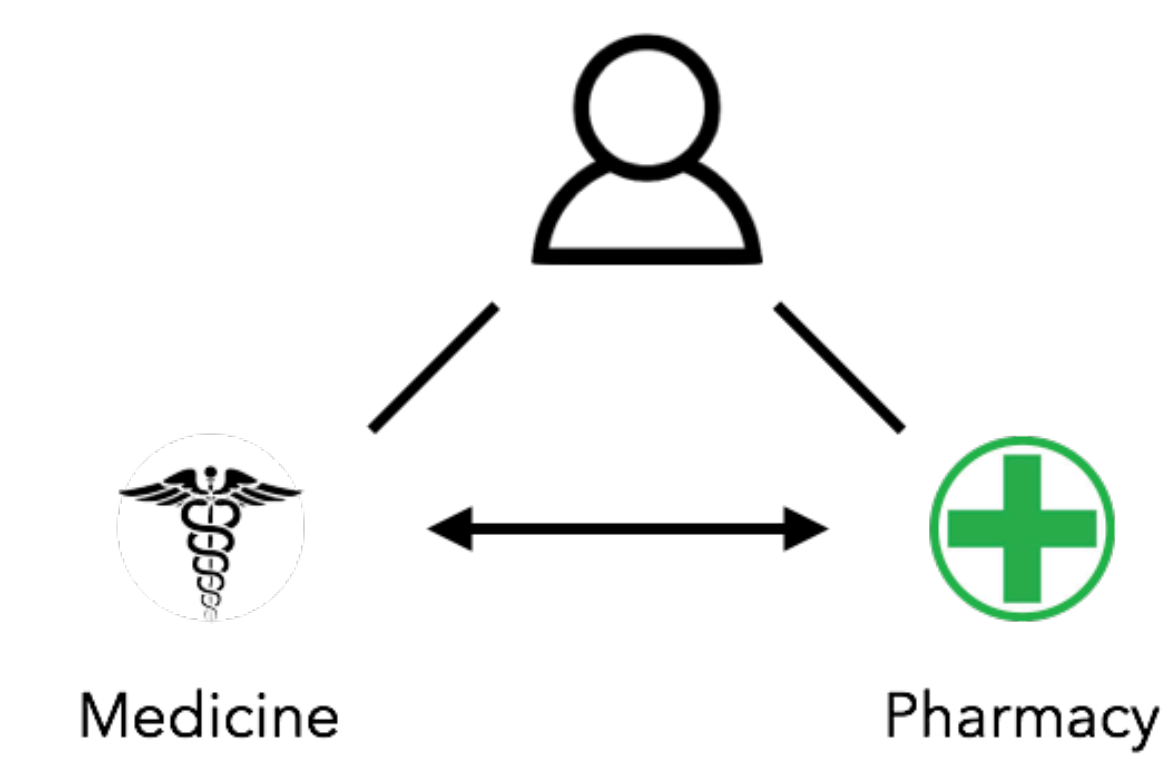
DATA

PORTUGAL

Age, Gender, District of Origin, List of up to 6 preferences, Degree Programs, unemployment Level, Application Scores, open positions.

Application data of the Portuguese Public Higher Education between 2008 to 2015.

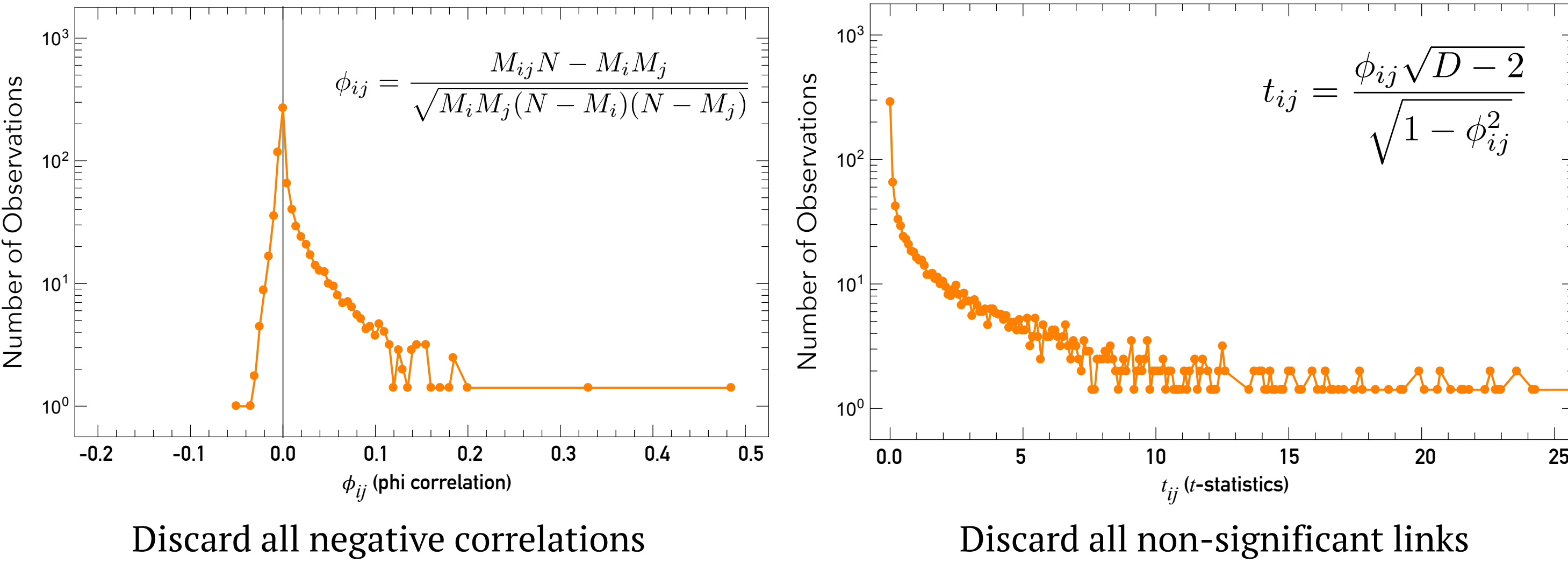Total number of Degree Programs before ~ 740 and after ~ 320 cleaning

CHILE

Age, Gender, City of Origin, List of up to 10 preferences, Degree Programs, Applications Scores, open positions.

Application data of the Chilean Higher Education between 2004 to 2017

total number of Degree Programs before ~ 600 and after ~ 199 cleaning

METHODS

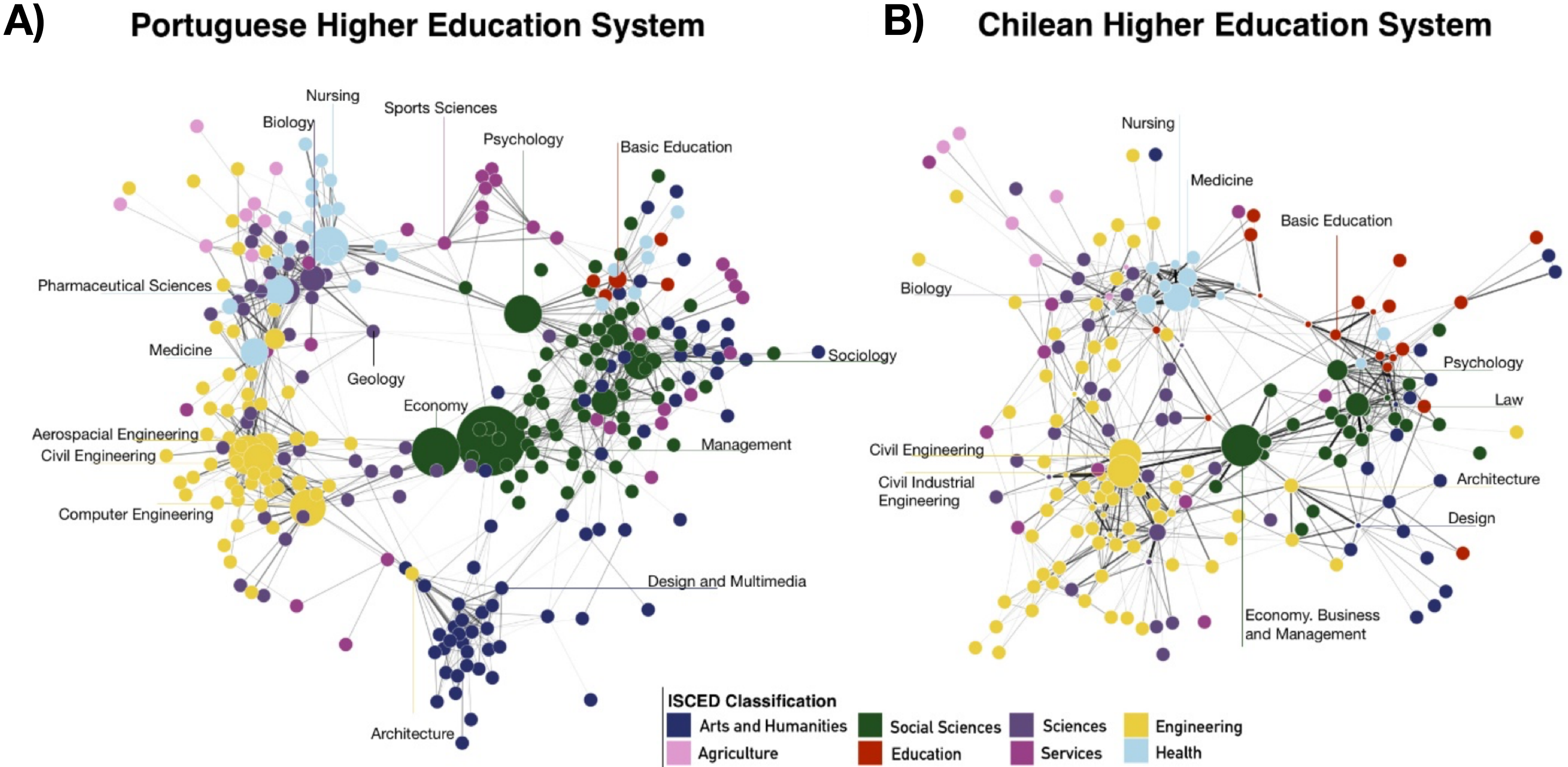### Connecting Degree Programs

Medicine   Pharmacy

The Higher Education Space is a network that connects pairs of degree programs that exhibit a statistically significant relationship. We consider a null model, a scenario in which the propensity for two degree programs to be connected is random, it means, it depends only on the number of candidates applying to each degree programs. We ignore self-connections becuase here they don't provide any useful information.

The unit of observation is the number of times that two degree programs co-occurs in the list of preferences for all candidate. Hence, options that co-occur more often than we would expect from random chance are more likely to be similar, from the applicant's perspective. In that sense, we start by computing the phi correlation index and then assessing the t-statistics.

$$\phi_{ij} = \frac{M_{ij}N - M_i M_j}{\sqrt{M_i M_j (N - M_i)(N - M_j)}}$$

$$t_{ij} = \frac{\phi_{ij}\sqrt{D-2}}{\sqrt{1 - \phi_{ij}^2}}$$

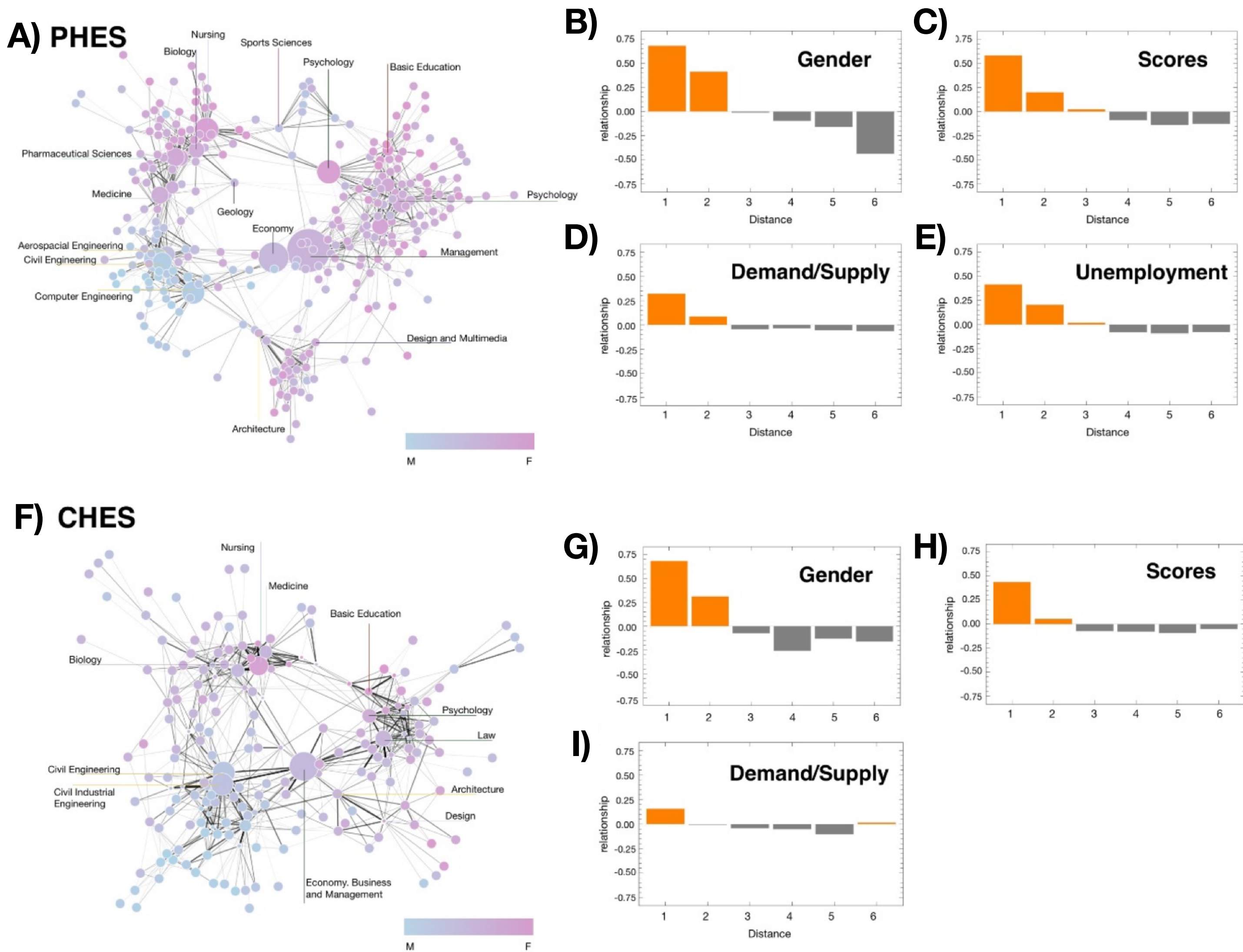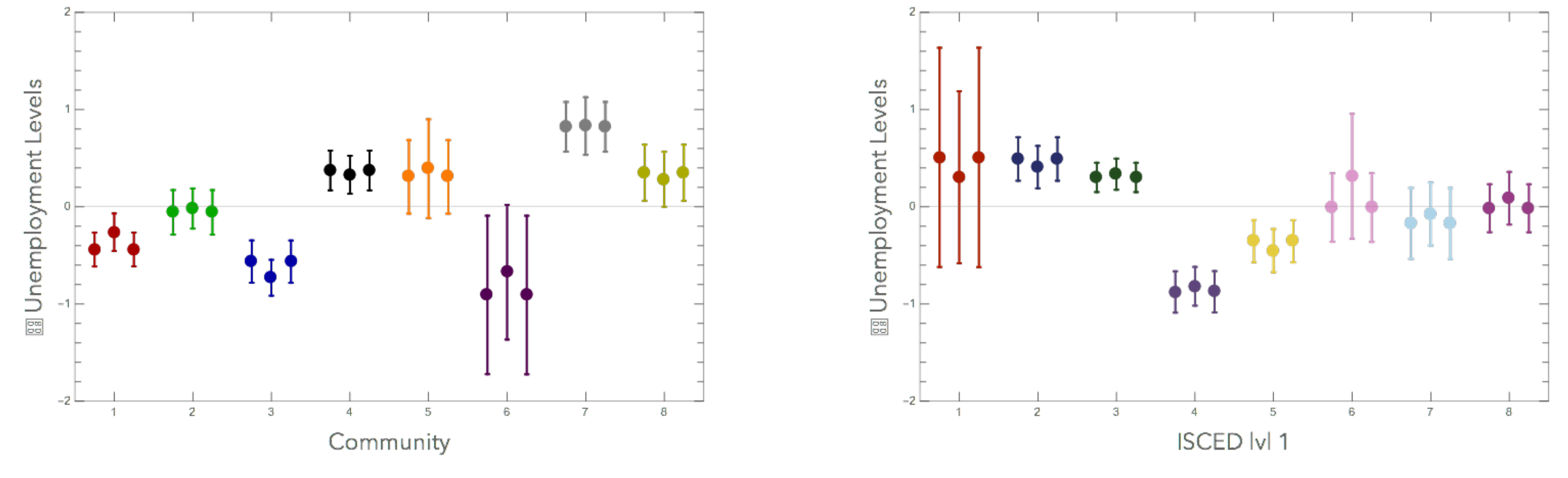Discard all negative correlations   Discard all non-significant links

RESULTS

The Higher Education Space. Panel a) shows the Higher Education Space estimated from the applications to the Portuguese Higher Education System (PHES), Panel b) the Higher Education Space from the applications to the Chilean Higher Education System (CHES).

Graphic depiction of the Higher Education Network. Panel a) shows the gender balance of each degree program on Portuguese Higher Education Space, blue indicates high percentage of boys and pink higher percentage of girls. Panel b) shows the relationship between the gender balance of a focal node and the average levels observed in degree programs at a network distance of n links. Orange bars imply a positive relationship, while gray bars mean a negative or null relationship. Panels c), d) and e) show the spatial relationships for other metrics such as Application Scores, Demand/Supply and Unemployment Levels. the Higher Education Space from the applications to the Chilean Higher Education System (CHES).

When comparing the level of unemployment, in the case of the PHES network, these communities provide predictive power, as we found that the explanatory variance over the expected level of unemployment

DISCUSSION

We provide a novel data-driven approach to better understand higher education system, generating a relational structure of degree programs which is scalable to other countries. The Higher Education Space captures candidates' features and motivations, and market features, behind of a degree program choice. They are reflected in spatial correlations on gender, applicant's scores, demand-supply variations, and unemployment. We confirm that idiosyncrasies exist not only in the way in which people apply to educational programs but also on the way in which the market "judges" specific fields of study. Finally, these findings suggest universalities in the emerging patterns in higher education systems, this mean these patterns could be not country/context specific, but they underlie in a global context.