Emergent structures in faculty hiring networks, and the effects of mobility on academic performance

Robin Cowan and **Giulia Rossello**

cowan@merit.unu.edu, rossello@merit.unu.edu
Maastricht University, UNU-MERIT —— **STI 2018 Leiden**

UNITED NATIONS UNIVERSITY
UNU-MERIT
STI 2018 Leiden

Abstract

This paper is about the South African job market for PhDs. PhD to first job mobility involves the preferences of both the hiring institution and the candidate. Both want to make the best choice and here institutional prestige plays a crucial role. A university's prestige is an emergent property of hiring interactions, so we use a network perspective to measure it. Using this emergent ordering, we compare the subsequent scientific performance of scholars with different changes in the prestige hierarchy. We ask how movements between universities of different prestige from PhD to first job correlates with academic performance. We use data of South African scholars from 1970 to 2012 and we find that those who make large movements in terms of prestige have lower research ratings than those who do not. Further, looking only those with large prestige movements, those with higher prestige PhDs or first jobs have higher research ratings throughout their careers.

Aim

To link prestige movements at the beginning of scholars' career and their future performance

Background

– University prestige is persistent through time ⇒ **institutional stratification**

– University prestige as an effect of the position within a network of **social exchange**.

– The network of exchange of PhDs:

1. Asymmetric information (unobserved quality)
2. Signals of quality ⇒ Prestige
3. Pairwise assessments of quality
4. Hiring network contains an emergent prestige ordering of universities
5. It encodes the **collective assessment** of each others' quality

Conclusion

1. Comparing people that experience a prestige transitions (up or down) with those who do not (stay) we find a positive **inertia effect**;

2. Comparing people that experience prestige transition (up vs down) we find that university **prestige** is deeply related to performance;

OPEN QUESTIONS - *To investigate the positive role of inertia*:

- Do universities have better judgements on their graduates? Is this related only to job market **imperfect information**? Or

- Is this sustained better performance related to scholars **specializations** and/ or **co-authorship pattern**?

References

[1] Val Burris. The academic caste system: Prestige hierarchies in phd exchange networks. *American sociological review*, 69(2):239–264, 2004.

[2] Aaron Clauset, Samuel Arbesman, and Daniel B Larremore. Systematic inequality and hierarchy in faculty hiring networks. *Science Advances*, 1(1):e1400005, 2015.

[3] Bo Mai, Jiaying Liu, and Sandra González-Bailón. Network effects in the academic market: Mechanisms for hiring and placing phds in communication (2007–2014). *Journal of Communication*, 65(3):558–583, 2015.

Data

South African NRF* data 1970-2012 of scholars in SET with individual characteristics and NRF ratings (scholar research performance) for 1983-2012. (* National Reseach Foundation, www.nrf.ac.za).

Prestige Ranking

As an Emergent order of the faculty hiring network of PhDs. → **Hypotheses :**

1. *Universities want to improve the quality of research and teaching.*
   Corollary: want to hire from "better" universities;
2. *Scholars want to be hired by the "best" universities*

When desires in 1 and 2 are **perfectly satisfied** people only **move down** in prestige hierarchy
⇒ only zeros below the diagonal when rows/columns are ordered according to prestige

The algorithm reorders rows/columns of the adjacency matrix of the faculty hiring network many times to get as close as possible to **zero flows below** the diagonal.
Prestige Ranking is the mean of the orders with the maximum scores.

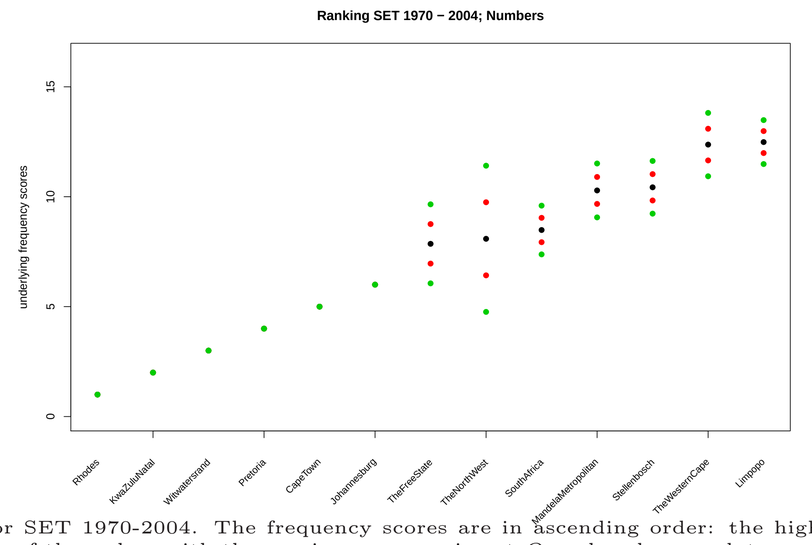

Figure 1: Prestige Ranking for SET 1970-2004. The frequency scores are in ascending order: the highest ranked university has the lowest score. The black dots are the mean of the orders with the maximum scores in set Q, red and green dots are one and two standard deviation from the average. Universities with fewer than 5 PhDs are excluded.

Effects of rank change on future career

We compare scholars' performance with **same** individual **characteristics**, receiving or sending institution but **different prestige transition** from PhD to first job.

In particular: **up vs. stay**; **down vs. stay**; and **up vs. stay**. Looking performance 5, 10, 15, and 20 years after PhD.

Re-sampling technique: matching each time the individuals in the compared groups and storing the proportions of pairs in which one group has higher research rating then the other and vice-versa. This creates two distributions of those proportions (e.g. $F(p|R_{up} > R_{stay})$ and $F(p|R_{stay} > R_{up})$), and we test which distribution **first order stochastic dominates** the other.

Role of inertia —— large transitions vs. stay
→ *stay dominates*, those hired by their PhD institution have higher ratings.

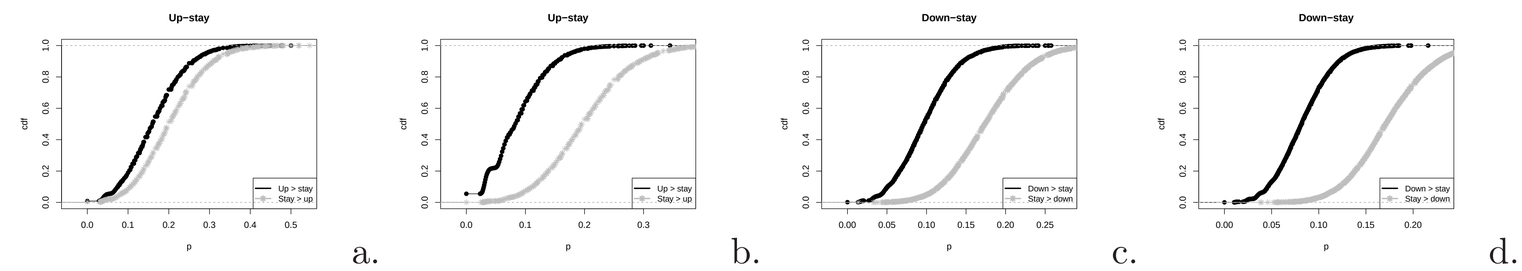

Figure 2: Comparison NRF rating 15 years after PhD up vs. stay (a. b.); down vs. stay (c. d.). Matching on gender, ethnic group, PhD obtained years, and first job institutions (a. c.) or PhD institution (b. d.).

Role of prestige —— large transitions
→ holding job constant: those with "better" PhD (*down dominates*) perform better.
→ holding PhD constant: those with "better" job (*up dominates*) perform better

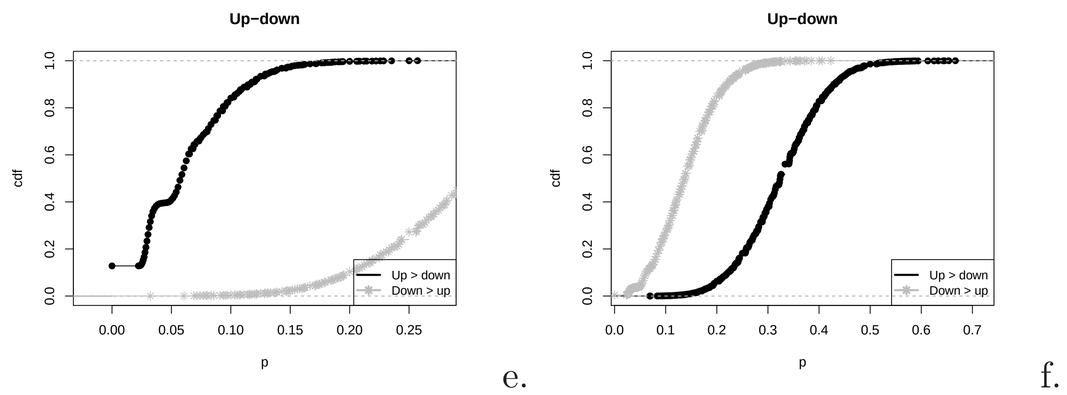

Figure 3: Comparison NRF rating 15 years after PhD up vs. down. Matching on gender, ethnic group, PhD obtained years, and first job institutions (e.) or PhD institution (f.).