

Brain drain or brain circulation? a study of the academic collaboration network in Uruguay

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Abstract:

The emigration of highly qualified people is a challenge for the development processes of sending countries, particularly in cases such as Uruguay, which has been characterised for several decades as a country that has been an expeller of its qualified population. The literature analysing international migratory movements has broadened the view of "brain drain", which considers the negative effects on sending countries, by also exploring the channels of "brain circulation" and "brain gain", which can be generated through collaboration networks or the return of emigrants to their countries of origin.

This article seeks to make a contribution to the subject from the perspective of networks. In particular, the aim of the article is to analyse how the emigration and return of researchers can determine the formation of academic collaboration networks in Uruguay. As a general hypothesis, we propose that migration trajectories determine the configuration of researcher networks, resulting in a gain for the country from greater cooperation between those who reside abroad and those who reside in Uruguay, while returnees maintain relevant connections with other countries. From a network perspective, this hypothesis implies that both emigrant scientists and returnees tend to occupy gatekeeper positions, connecting local actors with agents abroad. We also expect this gatekeeper position to be determinant in the formation of the collaborative network between academics in Uruguay.

To test these hypotheses, we reconstructed the network of collaboration between academics to produce academic articles. In particular, we use the SCOPUS database, where we identify the authors linked to Uruguay using data from the First Census of People with PhD Degrees in Uruguay and all the public CVs of the Uruguayan national research and innovation agency (ANII). This allows us to extract, from the SCOPUS database, all papers with at least one author linked to Uruguay.

In order to analyse the emigration and return of Uruguayan academics, we used the institutional affiliation data reported in the authorship of each article. This allows us to differentiate between two broad categories: national affiliation (a university or research

centre located in Uruguay) and international affiliation (an institution abroad). From this distinction, we can identify, for each moment in time, those who emigrated, those who returned and those who never left the country. Likewise, the data allow us to include in the analysis those academics who always resided abroad, but who maintained some co-authorship link with academics in Uruguay.

To analyse the collaboration network we consider researchers as nodes and co-authorships as the (non-directed) links. The data includes papers between 1973 and 2021, which allows us to analyse the evolution of the network. To study the propensity of emigrants and returnees to occupy gatekeeper positions, we employ the categories used by Gould and Fernández (1989) as an indicator of this role in the network. In particular, we are interested in studying whether these actors mediate between local and foreign academics, as well as between other emigrants and/or returnees.

The analysis of the network topology shows a significant growth in the number of nodes together with an improvement in the cohesion of the network. Of particular interest is the emergence of a giant component, around the beginning of the 2000s, where about 60% of the network's nodes are connected (Figure 1).

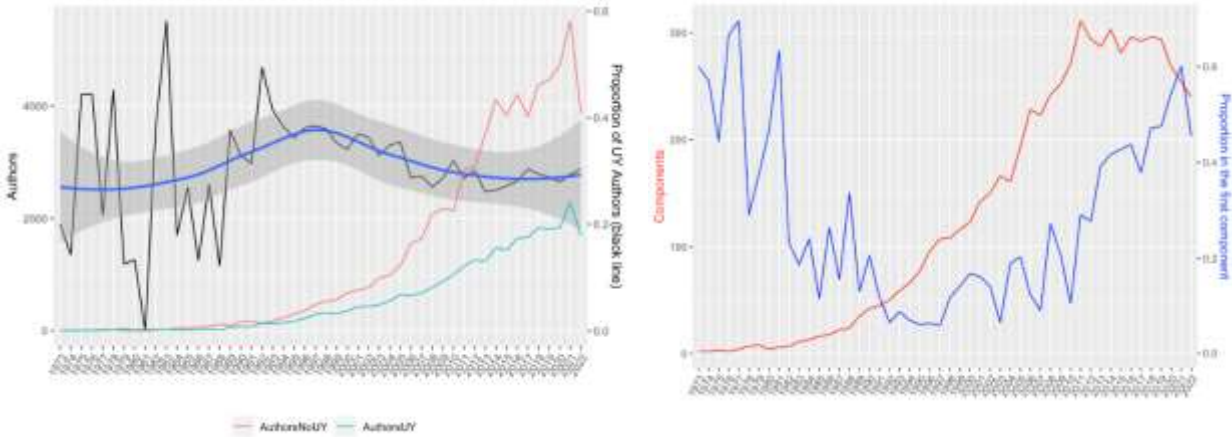


Figure 1. Number of author-nodes (left) and number of components vs. proportion of nodes connected to the largest component (right).

When we focus on the gatekeeper role of emigrants and returnees, the data reveals the propensity of movers (i.e. those who emigrate and those who return after a period abroad) to occupy this position. As shown in Figure 3, these researchers have clearly higher levels of intermediation than the rest of the researchers in the academic networks who are not movers (both national and foreign researchers).

Subsequently, in order to study the determinants of the network, we estimate models of network formation processes, in particular the so-called Exponential Random Graph Models (ERGM) (Robins et al. 2007). In these models we estimate an exponential random process of network formation that maximises the probability of the emergence of a network equal to the observed one. To account for the temporal evolution of the network, time-sliced ERGMs will be used (Kolaczyk and Csárdi 2014), which allow for separate modelling of link length distributions and structural dynamics of link formation.

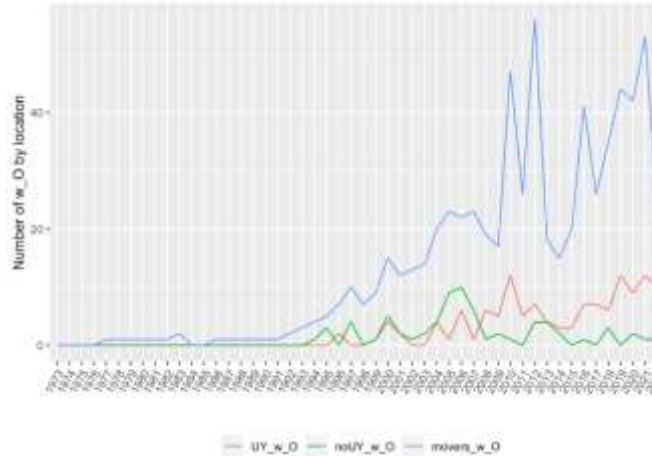


Figure 3. Proportion of researchers of each type occupying an intermediary position.

Note: the intermediary position involves connecting two unconnected researchers to each other, one of them being resident in Uruguay and the other non-resident.

Among the network configurations we estimate in the models, we focus on whether individuals are migrants or returnees. Thus, the ERGM models allow us to estimate whether emigration and return are determinants in the formation of the networks observed in our data. As control variables, we include other characteristics of collaborative structures for research and innovation that have been documented in previous empirical studies (Tomassello et al. 2017, König et al., 2011), such as geographical proximity, team formation or the presence of highly connected actors.

The results show an important role of emigrants and returnees in the shaping of the network. These types of actors seem to have a propensity to occupy gatekeeper positions. On the other hand, the first estimations made with the ERGM models indicate that migration and return are determinant in explaining the structure of the collaboration network between academics. Migrant and returning scientists tend to occupy more central and gatekeeper positions, and these positions play a significant role in determining the structure of collaborative networks among researchers in Uruguay. These results provide empirical evidence of the important contribution made by these actors, through the introduction of knowledge from outside the country and its dissemination at the local level.

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