Modeling and analysis of migration and mobility among scholars using bibliometric data

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Abstract. Bibliometric data give us unprecedented opportunities for understanding patterns of mobility among scholars, testing existing migration theories and developing new ones. In a series of studies, we leverage large-scale bibliometric data to measure and model the migration of scholars in different contexts and answer fundamental questions in the intersection of high-skilled migration and science of science. Our research project series explores three research questions within the scope of migration in academia and analysis of large-scale bibliometric data.

Keywords: high-skilled migration · big data · bibliometric data · scientometrics · science of science.

1 Highly mobile researchers around the world

In order to understand the scholarly migration, determining the extent to which researchers have worked in more than two countries is essential. We focus on the subgroup of highly mobile researchers whom we refer to as "super-movers." More specifically, we track the international movements of researchers who have published in more than two countries through changes in the main affiliation addresses of over 62 million publications indexed in the Web of Science database over the 1956-2016 period. Among other findings, our results point to the emergence of a global system that includes the USA and China as two large hubs, and England and Germany as two smaller hubs for highly mobile researchers [1].

The bibliometric data on super-movers allow us to investigate return migration and compare it across countries. Our results [1, Fig 5] show return migration by country (fraction of super-movers who return to their country of academic origin) for the early-career and the mid-career super-movers. This analysis points to low return migration in Iran, Singapore, Ukraine, and Venezuela. In contrast,

Czech Republic, China, Romania, Russia, South Korea, and Turkey seem to have high return migration. This research contributes to the literature by offering for the first time a snapshot of the key features of highly mobile researchers, including their patterns of migration and return migration by academic age, the relative frequency of their disciplines, and the relative frequency of their countries of origin and destination [1].

2   Internal migration of researchers in Mexico

Our understanding of internal migration among researchers is quite limited partly due to lack of data aggregated at a suitable sub-national level. We re-purpose bibliometric data using a neural network which provides a sub-national level for aggregating affiliation data and tracking changes of affiliations. The neural network takes an affiliation address as input and predicts with a high accuracy the state in Mexico associated with that affiliation address. We analyze internal migration based on over 1.1 million authorship records from the Scopus database to trace the movements of over 250,000 scholars in Mexico and provide measures of internal migration such as net migration rates for all states over the period 1996-2019 [2].

Migration patterns between states in Mexico appear to be heterogeneous in size and direction across regions. However, while many scholars remain in their regions, there seems to be a preference for Mexico City and the surrounding states as a destination. Over the past two decades, we observed a general decreasing trend in the crude migration intensity. The origins and destinations of internal migrants have become more diverse over time, including greater exchange between states along the Gulf of Mexico and the Pacific Coast [2].

3   Academic brain drain and brain gain in Russia

Debates on international migration in academia often consider scientists and the scientific community as one unit which could be either a net loss (brain drain) or a net gain (brain gain) for a given country disregarding the fact that the impact of migration on a national science system could vary for different fields of scholarship. We use data from 2 million publications in Scopus to analyze international migration of researchers in Russia as a commonly debated subject of brain drain. We analyze origins and destinations of migrant researchers with respect to their fields and performance and compute net migration rates. Our analysis shows that Russia has overall suffered a net loss in human capital due to a lack of balance between incoming and outgoing flows of researchers. Also, we observe that the total citations of researchers immigrating to Russia is substantially lower than that of researchers emigrating from Russia except for the case of social sciences in which the difference is negligible. Our results on net migration rates indicate that while Russia has been a donor country in the late 1990s and early 2000s, in more recent years Russia has experienced more balanced flows of incoming and outgoing researchers [3].

We also develop a new methodology to quantify the impact of migration on each field of scholarship and implement it to the case of Russia. Using the subjects associated with the publication venues where migrant researchers have published, we quantify brain drain in Russia for each of the 28 fields of scholarship according to the all science journal classification. Our results [3, Fig 5] suggest that Russia has suffered a loss in almost all disciplines and more notably in neuroscience, decision sciences, dentistry, biochemistry, and mathematics. Our substantive results reveal new aspects of international mobility in academia and its impact on a national science system which speak directly to policy development [3].

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