RESEARCH ARTICLE

Longitudinal Academic Mobility Patterns at Howard University

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Abstract

This paper examines academic mobility patterns at Howard University, one of the leading Historically Black Colleges and Universities (HBCU) in the United States. The work presented is the first investigatory and validation phases of the data analysis portion of a larger NSF supported project working to empirically study academic brain drain from these institutions. The project uses Internet Archive's Wayback Machine and university web pages to collect longitudinal faculty affiliation data at 11 HBCUs from 2005-2021. Preliminary results from Howard University indicate that while most mobile professors moved from the HBCU to primarily White institutions (PWIs) or other non-HBCU institutions, the proportion of faculty moving into HBCUs may be increasing. These patterns vary among disciplines. This analysis will help aid in robust future examination of academic mobility, institutional stratification, and the role of organizational factors in shaping academic mobility.

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Introduction

Historically Black Colleges and Universities have deep cultural, historical, and socio-political significance in the United States as the only institutions prior to the Civil Rights Act in 1964 to offer substantial education for Black citizens. Despite this continued importance, the desegregation of higher education institutions consequently spurred an ongoing academic and legislative debate about the relevance of HBCUs. Today, HBCUs suffer from low funding and high rates of attrition (Bracey, 2017). The attrition of Black faculty to Primarily White Institutions (PWIs) has been occurring for decades (Seymore, 2005) leading to what is known as “brain drain,” or the migration of talented actors from an institution in favor of one with better resources and individual prospects. Social mobility and civil rights movements have accelerated academic mobility (Sugimoto et al., 2017; Van Noorden, 2012); however, there is little research on academic mobility at HBCUs and even fewer that use empirical analysis.

The last large scale study of HBCU brain drain was conducted in the early 90s. In this study, Allen (1991) claimed that most other “available studies are somewhat inconspicuous, dated, noncomparable, limited in scope, and inconsistent in quality” having been primarily conducted using survey and interview methodologies which relied heavily on qualitatively coding anecdata and contemporary technologies. In contrast, this paper fills a methodological gap and explores academic mobility of HBCU faculty with empirical focus through the development of a novel dataset, the presentation of data validation techniques, and the description of early investigations and insights for one university in the dataset; namely, Howard University.

The analysis presented herein is part of a larger ongoing mixed-methods study aimed at mapping the dynamic movements of HBCU faculty in order to understand patterns which may inform progressive policy and advocacy efforts. Data from Howard University produced early insights supporting previously identified patterns of attrition from HBCUs and could enhance our understanding of broader human capital changes at these institutions.

Background

Historically Black Colleges and Universities

Literature on HBCUs ranges widely; however, it is primarily rooted in social science perspectives. HBCUs have been the focus of a number of recent research studies examining student and faculty success and community culture. Ford and Reeves (2020) show that when students are taught by professors of the same race, they perform better across a number

of post-graduation outcomes. This could be in part due to the community-based environment and the unique relationship between these institutions and their faculty and students. Another study looking at job satisfaction at HBCUs found that the drive to help students is a primary motivating factor for faculty (Smith et al., 2023) despite setbacks like institutional politics, time consuming teaching loads, less access to funding, and fewer research opportunities than their colleagues at PWIs (Gasman, 2013). It is evident in the literature that senior Black faculty play a crucial role in supporting and mentoring not only students but more junior faculty as well (Moore, 2020).

Further, HBCUs have demonstrated success in key diversity issues like social mobility (Hardy, et al., 2019), career progression (Smith, et al., 2021), and the intersectional nature of cultural and personal identity formation (Williams et al., 2021, Williams et al., 2022, Patton et al., 2023, Brazile, 2024). At the crux of HBCUs success is the foundational culturally-affirming practices enacted on campus in policies and curriculum (Williams et al., 2021, Williams et al., 2022). Hardy and colleagues' study hypothesized that the supportive environment of HBCUS described would result in better social mobility indicators than PWIs. They compared student success rates at HBCUs and PWIs after controlling for various pre-college factors like socioeconomic status and college preparation. Once these factors were controlled for, HBCUs significantly outperformed PWIs in both first year retention rate of students, and salary post-graduation. The role of HBCUs has a direct and meaningful impact on the national workforce. HBCUs are accountable for educating 27% of Black students who graduated with STEM related Bachelor's degrees making HBCUs a critical player in the STEM workforce pipeline (Ford and Reeves, 2020, Smith, et al., 2021). Ultimately, continued research on similar culturally important institutions and their success outcomes can support these institutions' agendas and missions in government, education policy, and other venues.

As of June, 2024 there have been 84 anti-diversity, equity, and inclusion (DEI) bills introduced and 14 signed into law across 12 states which ban or restrict DEI offices and staff, mandatory DEI training, diversity statements, and identity-based hiring and admissions on college campuses (*Chronicle of Higher Education,* 2024). This disturbing trend may further threaten the continued existence of HBCUs as diverse cultural institutions. This underscores the importance of understanding contemporary patterns in HBCU faculty mobility and supporting the work of institutional and national education policy makers.

Academic Mobility

Broader academic mobility is driven by a variety of reasons that can be academic, job-related, family-related, or personal (Auriol, 2010). There may also be career advantages to academic mobility. Mobile researchers who changed affiliations during their scientific career tend to have slightly higher publication and citation rates than other researchers (Aksnes, Rørstad, Piro, & Sivertsen, 2013). In his dissertation, Allen (1988) was one of the first to address the importance of understanding patterns in the mobility of Black faculty in particular. His work emphasized the interrelation of race, gender, age, education, racial ideology, and academic and career origins. These social factors conceptualized in relation to determinants of mobility identified: salary, job search methods, number of jobs found, type of mobility contacts, retention, job satisfaction, publication rates or working conditions.

For HBCUs, understanding patterns in faculty mobility is paramount in maintaining their precarious social-political position in the United States education system. In particular, issues like brain drain have been cause for concern as Black students and faculty move to non-HBCUs where academic quality (Morris, 1972), access to resources (Broady, et al., 2021), keenness to hire diverse faculty (Barrett & Smith, 2008), and institutional support are perceived as higher (Allen, 1991).

Allen's later study in 1991 was one of the last comprehensive empirical studies on faculty mobility at HBCUs. This project intends to take advantage of modern information technologies like the Internet Archive's (IA) Wayback Machine to collect a large, heterogenous, longitudinal data set of HBCU faculty affiliations and examine mobility patterns. The typical methods used when conducting research on HBCUs varies by each study's goals, but there is a particular focus on qualitative methods like interviews and surveys. Additionally, resulting datasets are often limited to close institutional or author networks. With increased availability to archived web pages and faculty reporting, our systematic approach facilitates better consistency in data collection and makes the data more broadly comparable for analysis than disparate survey responses.

Data and Methods

Data Collection

At the time of analysis, the Carnegie Classification of Institutes of Higher Education indicated that of the 101 HBCUs in the United States, 11 are doctoral-level institutions, 24 are master's-level institutions, and 66 are associate-level or four-year institutions. To appropriately measure the impact of academic moves on research activities, the inclusion criteria of this study requires an institution to have at least moderate research intensity. The 35 master's or doctoral degree granting HBCUs were initially selected due to their potentially higher levels of research intensity.

The Internet Archive's Wayback Machine was used as the primary source of longitudinal faculty affiliation data collected in this study. When investigating the coverage of HBCU webpages in the archive, many universities had very limited or no coverage. Based on availability of data we ultimately limited our data collection and analysis to 11 total HBCUs. It should be noted that this creates limitations on the inferences we may draw from analysis. We acknowledge that by excluding non-research intensive HBCUs, our analysis favors institutions with more access to resources within an already resource deficient environment. Additionally, we are not able to capture the mobility of Black faculty and professionals from low to high intensity universities, and thus the full extent of institutional brain drain from HBCUs

The initial data collection procedure was intended to be fully automated by web scraping the Internet Archive (Zarrillo, et al., 2022). While ultimately the fully automated process was replaced with manual collection, it did produce complete lists of archive URLs for each historical record of all university homepages in our dataset. These time stamped URLs were utilized as starting points in the ultimate data collection protocol. The collection process always begins at the university homepage in order to mitigate gaps in the data which may be due to changes in department name or web page hierarchy

(Kelly, et al. 2022). The protocol, detailed below, was followed to collect longitudinal faculty data from Howard University:

1. Go to the university URI data sheet, choose a capture made in the Fall term (between September and December) of 2021.
2. Locate the web page that contains the list of schools and colleges, typically called “Academics” or “Schools and Colleges” links.
3. From the list of colleges or schools, select each college or school iteratively and document the faculty information until professors’ information from all colleges and schools of that university have been collected.
4. From the school/college page, locate the faculty page or directory from the college level links. If the faculty page is embedded within each department of that college, then go to each department and collect the faculty data.
5. Enter the faculty data in the table format shown in Table 1.
6. Move to the university’s homepage’s capture in the previous year and repeat steps 1-5. Finish collecting this university until the year 2005’s data is collected and documented.

Table 1. Sample data collection worksheet. Names and emails have been anonymized to maintain the privacy of individuals.

Year	Home capture URI	Faculty page URI	School or college name	Department name	Faculty name	Faculty rank	Faculty email
2020	https://web.archive.org/web/2020 1031135530/ http s://home.howard.edu/	https://web.archi ve.org/web/2020 1201173741/ http s://business.howard.edu/about/faculty-staff	School of Business	Accounting	Fred Harris	Professor	fred.harris@howard.edu
2020	https://web.archive.org/web/2020 1031135530/ http s://home.howard.edu/	https://web.archi ve.org/web/2020 1201173741/ http s://business.howard.edu/about/faculty-staff	School of Business	Accounting	John Smith	Associate Professor	john.smith@howard.edu
2020	https://web.archive.org/web/2020 1031135530/ http s://home.howard.edu/	https://web.archi ve.org/web/2020 1201173741/ http s://business.howard.edu/about/faculty-staff	School of Business	Accounting	Jane Garcia	Associate Professor	jane.garcia@howard.edu

Data was collected in order to compare the yearly affiliation change at the institution level and identify incoming and outgoing professors affiliated with the 11 HBCUs. To identify incoming professors’ previous affiliation and outgoing professors’ next affiliation, we used Web of Science to search professors’ names in “Author Search.” The search results contain disambiguated researcher profiles with their affiliations and publication venues. The results also show past and current organization affiliations, including duration of affiliation, based on publication data. Affiliation information was recorded and used to identify types of academic moves.

Despite Web of Science’s efforts in disambiguating authors names, mismatches do occur, and we designed rules to minimize errors: namely, using (1) research areas, (2) publication venues, and (3) publication history to disambiguate authors so that the target author’s publications should fall within the same research areas, the same set of venues, and the same time span. For outgoing professors, if no new affiliation was identified post-move, we recorded the move as an alternative movement type.

After the affiliation and duration data was collected and disambiguated, we cross-referenced institutions with CCIHE to

obtain institution-level data, including HBCU status. The integrated data was used to identify and classify five categories of mobile professors:

1. (S): non-mobile professors (staying within one HBCU since 2006).
2. (M-HBCU-HBCU): mobile professors within HBCUs.
3. (M-PWI-HBCU): mobile professors from non-HBCU or PWI to HBCU.
4. (M-HBCU-PWI): mobile professors from HBCU to non-HBCU or PWI.
5. (M-MIX): other movement types such as academia to industry movement.

Each data point is at the per-move level, which means a professor with an employment history of “HBCU to non-HBCU to HBCU" will be counted as two data points: HBCU to non-HBCU and non-HBCU to HBCU.

Data Validation

While Internet Archive’s coverage is generally consistent for the selected universities based on our sampled URLs in the pilot analysis, there may be cases where URL captures are unavailable. This may be due to a change in the relative URL over time, limited archival capture of pages with large page depths, archived web structure and format, among other reasons. We have designed and implemented the following strategies to address this issue. First, considering that academic moves are a low-volatility event, if the gap between two captures is more than one year but less than two years, we assume no change of affiliation was made between the two captures. For instance, if one capture is in October 2009 and the next is in September 2011, we assume the departmental affiliation in Fall 2010 is the same as the affiliation in October 2009. Second, if the gap between two captures is more than two years, we will check the affiliation of each professor on the webpage through secondary sources including LinkedIn, ORCID, personal websites, and CVs and use the collected information to fill the gaps.[1] The gap threshold of two years was determined arbitrarily but with consideration for the likelihood that a professor would leave and then return to the same institution within that timespan. Third, we perform a validation procedure utilizing data from the Academic Analytics Research Center (AARC) to cross-reference the results of our implemented strategies on the Internet Archive dataset for Howard University. The process and results are described below. The combination of these three methods should fill most of the gaps left by Internet Archive. However, after applying these methods, we will flag the record of any professor whose employment history has remaining gaps of more than two years and exclude these records from the analysis.

We adopted a two-pronged validation procedure. The procedure was tested using Howard University data due to its size and collection coverage in the Internet Archive. The first step focuses on evaluating the accuracy of hand-collected data from IA while the other focuses on evaluating the accuracy of the interpolation of faculty mobility using the collected data. For both evaluations, data from AARC is used as the gold standard reference. Based on our examination of the format, scope, and coverage of data, AARC data is appropriate to be used as the gold standard due to its high data quality. AARC data is made possible by a combination of manual and automated collection and Freedom of Information Act (FOIA) requests. It documents 314,141 tenured or tenure-track faculty across 376 PhD-granting universities and colleges in the U.S., including their names, gender, affiliation, career ranks, publication history via Crossref DOI, grants, PhD

school, and significant awards on an annual basis from 2011 to 2023. AARC data has one capture per year between 2011 and 2023, making it possible to study academic mobility. The scope of the AARC dataset used in this paper is limited to data prior to but inclusive of 2021. While the AARC dataset does not have full departmental coverage for Howard University, it provides sufficient data for validating the accuracy of our hand-collected set.

For step one, hand-collected IA data for Howard University was used to identify the active employment years of each faculty member. For each faculty name + year combination that is located in both IA and AARC data, we used a combination of manual and logical computational methods to validate the accuracy of the following metadata fields:

- Department name: it is a match if the department name in the processed IA dataset matches with the name in AARC (E.g., it is a match if both files record the exact same department name; it is also a match if one set records 'Department of Art' and the other records 'Art'; however, it is not a match if one data set records 'Department of Fine Arts and Music' and the other 'Art').
- Faculty name: it is a match if the first name and last name in both datasets match exactly. Where applicable and easily distinguished as in the case of changes in relationship status, name changes are identified and matched.
- Rank: for each same name + year combination, it is a match if the rank in both datasets is exactly the same. Ranks are defined as tenure-track assistant, associate, or professor, without considering any titles, domains, or endowments. E.g., it is a match if one is Assistant Professor and the other is Lilly Assistant Professor of Management; however, it is not a match if one is Assistant Professor and the other is Teaching Assistant Professor or Clinical Assistant Professor.

Between 2011 and 2021, the hand-collected data contains 12,582 unique name + year combinations. In the same time period the AARC data contains 6,701 unique name + year combinations. A sub-dataset was created with the name + year combination matches found in both original datasets. Within this set of 3,682 matched records, 83.95% had validated matching department names, and 82.40% had validated matching faculty ranks.

Step two involved identifying and creating another data subset of 792 unique faculty names that are recorded in both IA and AARC, independent of their name + year ID. The data were processed to present faculty names and the respective active employment years at Howard University to identify gaps in affiliation data that may require further investigation and impact mobility analysis.

To address employment gaps in the manually collected data and the possibility of faculty being rehired to the same HBCU after some time, we implement three rejoin considerations into our heuristics:

- Rejoin3: a professor is considered as a returning professor if there are more than three years of missing data between the first collected year and last collected year for that professor
- Rejoin5: a professor is considered as a returning professor if there are more than five years of missing data between the first collected year and last collected year for that professor
- RejoinN: we do not consider the possibility of returning regardless of the number of years of missing data

Accordingly, there are three mobility considerations that match with the three rejoin considerations:

- Move3: a professor is considered as a moved professor if there are more than three years of missing data between the first collected year and last collected year for that professor (Rejoin3) or if the last collection year for the whole dataset (2021) is more than the last collected year for the individual professor (E.g., 2021>2015)
- Move5: a professor is considered as a returning professors if there are more than five years of missing data between the first collected year and last collected year for that professor (Rejoin5) or if the last collection year for the whole dataset (2021) is more than the last collected year for the individual professor
- MoveN: only if the last collection year for the whole dataset (2021) is more than the last collected year for the individual professor

For each of the move considerations, a confusion matrix was created comparing the accuracy of the move heuristics made for the hand-collected data to our standard AARC data source (Figure 1). Because the AARC data only goes up to 2021, and our IA data includes records up to 2023, any faculty records after 2021 would inflate the rate of false positives in our matrices and were thus excluded from the validation set. The final validation set included 313 faculty names which were used to evaluate our collection process.

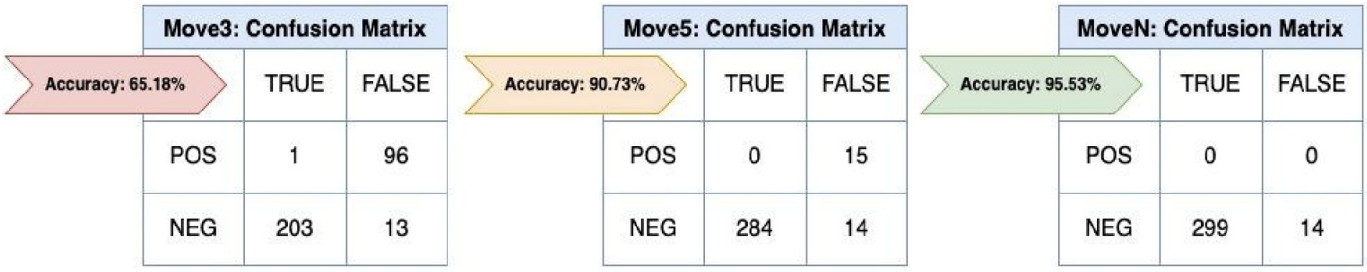

Figure 1. Confusion Matrices showing accuracy of validation procedure to test move assumptions made for IA data. The three matrices correspond to the three move considerations (Move3, Move5, and MoveN). Accuracy rates are listed for true negatives. MoveN has the highest accuracy rate of 95.53% as compared to AARC data

In the confusion matrices, a true positive indicates mobile professors who were accurately identified as mobile from our hand-collected data, a true negative indicates non-mobile professors accurately identified as non-mobile, a false positive indicates non-mobile professors who were inaccurately identified as mobile, and a false negative indicates mobile professors who were inaccurately identified as non-mobile. True positives were rare in our validation set as the processing of the hand-collected data did not account for initial movement into an HBCU. For example, a professor who was identified through other data sources as being mobile from a PWI to an HBCU in 2016, but who stayed at that HBCU from 2016 to 2021, is classified as non-mobile in the hand-collected data because they appear to be non-mobile in the confines of this data. We only consider mobility after a professor was first appointed at an HBCU as only the HBCU IA corpus was collected and we did not back trace a professor's employment prior to one's HBCU appointment. Thus, the rate of true and false negatives is most important for this evaluation.

The assumption that a gap in the longitudinal data of individual professors does not indicate a move (MoveN) proved to have the highest accuracy rate in our validation process. While it is possible that some professors may have left and then

rejoined the same HBCU, our data indicates too rare of an occurrence to significantly affect the analysis. The results of the validation procedure supports our use of the Internet Archive for curating an accurate and reliable dataset for addressing questions of mobility as well as our use of the MoveN assumption.

Analytical Methods

We conducted an initial exploratory and descriptive analysis using the validated longitudinal dataset of faculty affiliations at Howard University from 2005 to 2021. Distributions of various metadata categories are studied over time to identify unique patterns which will inform our preliminary insights for the larger study. Specifically, mobility patterns at the academic college level within Howard University and total mobile professors over time are analyzed.

Results

Using the subset of data from Howard University in our manually collected data, we conducted a preliminary investigation on longitudinal human capital changes.

With the available validated data from Howard University comprising 3,682 matched records, we identify key preliminary statistics. From the hand-collected IA data, the largest proportions of faculty were collected from the College of Arts & Sciences and the College of Medicine making up 32.57% and 32.07%, respectively, of faculty on average during the 2005 to 2021 time period. Of the data that was matched with AARC from 2011 to 2020 (n= 3,682), faculty in the College of Arts & Sciences make up 45.65% of faculty on average, followed by the College of Medicine at 14.91%. Figure 2 depicts this distribution of validated faculty across Howard University's colleges. College and School names have been simplified to allow for standard comparison despite shifts in department structure over time. In addition, this chart helps exemplify the gaps that were identified in the total number of collected faculty from the Internet Archive. Coverage of faculty pages reduced significantly in 2017 and at the time of collection many of Howard University's web pages in 2019 were not accessible. This may be caused by a number of factors related to temporal inconsistency in IA including but not limited to changing privacy policies, IA data collection specifications and policies, institutional data requirements, and changes in the university website's overall infrastructure and page hierarchy or navigation.

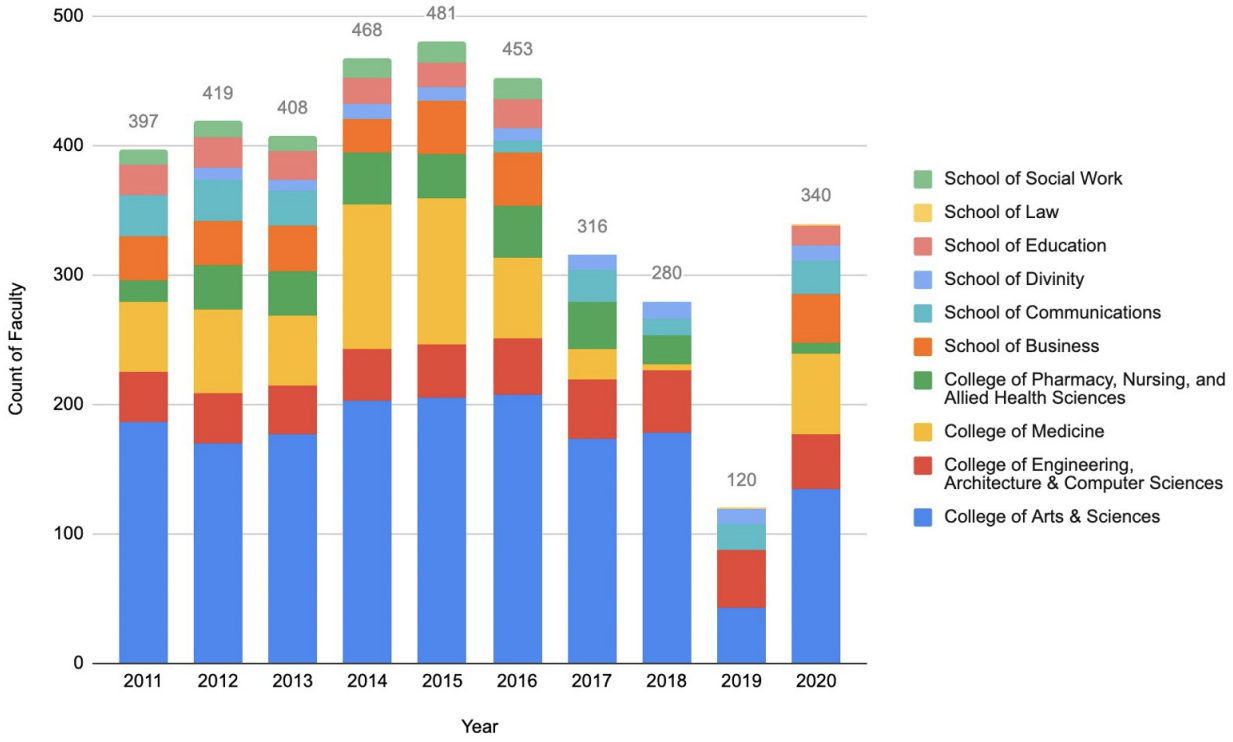

Figure 2. Distribution of faculty in matched data by university colleges over time from 2011 to 2020 with total faculty per year counts included

We also compare proportions of mobile versus non-mobile faculty within Howard's colleges (Table 2). We found that the School of Divinity has the highest relative proportion of mobile professors (6.52%) followed by College of Arts & Sciences (3.70%) and School of Business (3.33%). Coverage for the School of Law was limited in the validated dataset which contained only two identified faculty, neither of which were identified as mobile professors. The proportion of mobile professors in the entire validated dataset is 2.99%, with M-HBCU-PWI making up the most common mobility type, although not by a large margin (Table 3).

Table 2. Total count of faculty, count of mobile faculty, and proportion of professors that were identified as mobile within each of Howard University's colleges

Simplified College	Total faculty	Mobile faculty	% Mobile
College of Arts & Sciences	1680	60	3.70%
College of Engineering, Architecture & Computer Sciences	421	10	2.43%
College of Medicine	549	11	2.04%
College of Pharmacy, Nursing, and Allied Health Sciences	269	7	2.67%
School of Business	248	8	3.33%
School of Communications	183	4	2.23%
School of Divinity	98	6	6.52%
School of Education	145	2	1.40%
School of Law	2	0	0.00%
School of Social Work	87	2	2.35%

Table 3. Count and proportion of mobile professors identified in the validation dataset for each mobility type, all mobile, and total

Mobility type	Validated Mobile Faculty	
	(count)	(%)
M-HBCU-HBCU	9	0.24%
M-HBCU-PWI	43	1.17%
M-MIX	18	0.49%
M-PWI-HBCU	40	1.09%
S	3572	97.01%
All mobile	110	2.99%
Total	3682	100%

Figure 3 further breaks down academic mobility by showing the split between different mobility types of the faculty identified as mobile within each college. Mobile professors in the Schools of Communications, Divinity, and Education at Howard University have equivalent movement between HBCUs and PWIs displaying a similar pattern to the overall dataset. All mobile professors from the School of Social work moved from Howard to a PWI. Interestingly, mobile professors in the School of Business mostly move between HBCUs, while departments in the fields of medicine, pharmacy, and nursing have larger proportions of other mixed movement types, possibly signifying movement between academia and industry or other health related institutions.

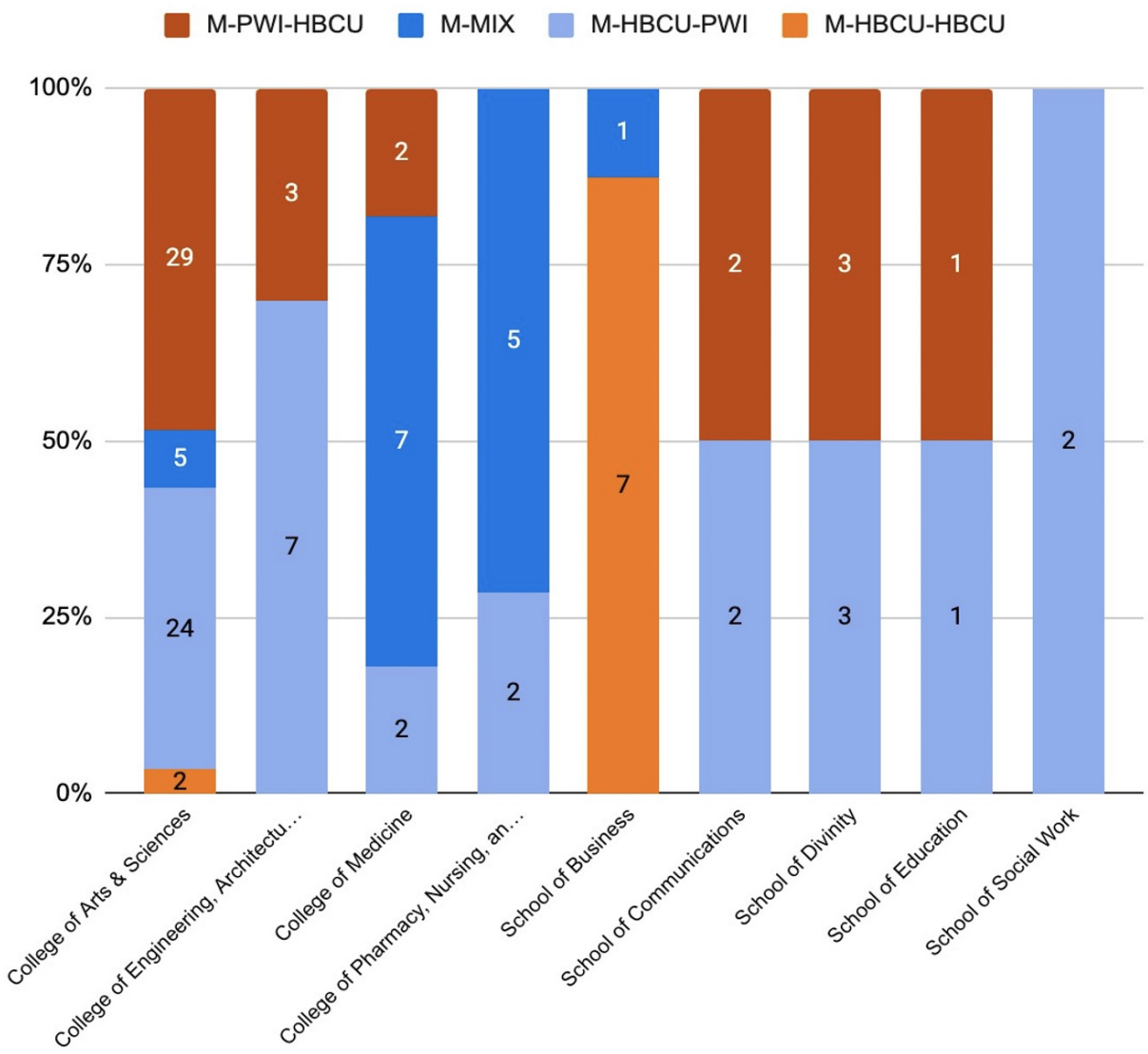

Figure 3. Breakdown of mobility types of faculty identified as mobile from 2011 to 2020 in validated Howard University data. The School of Law had no mobile faculty identified so was excluded from the chart

Finally, initial results could indicate a decline in the number of HBCU faculty moving to PWIs, with a corresponding increase in the number of faculty moving from PWI to HBCU (Figure 4). However, due to the decline in data available in later years, it is not possible to make conclusive insights at this time. Future work with further integrated data including experiential insights from qualitative interviews will be bolstered by additional supplemental data from secondary sources and will look beyond a single institution to identify patterns that emerge across the various dimensions of mobility, productivity, faculty rank, department, and other stratified organizational factors of HBCUs.

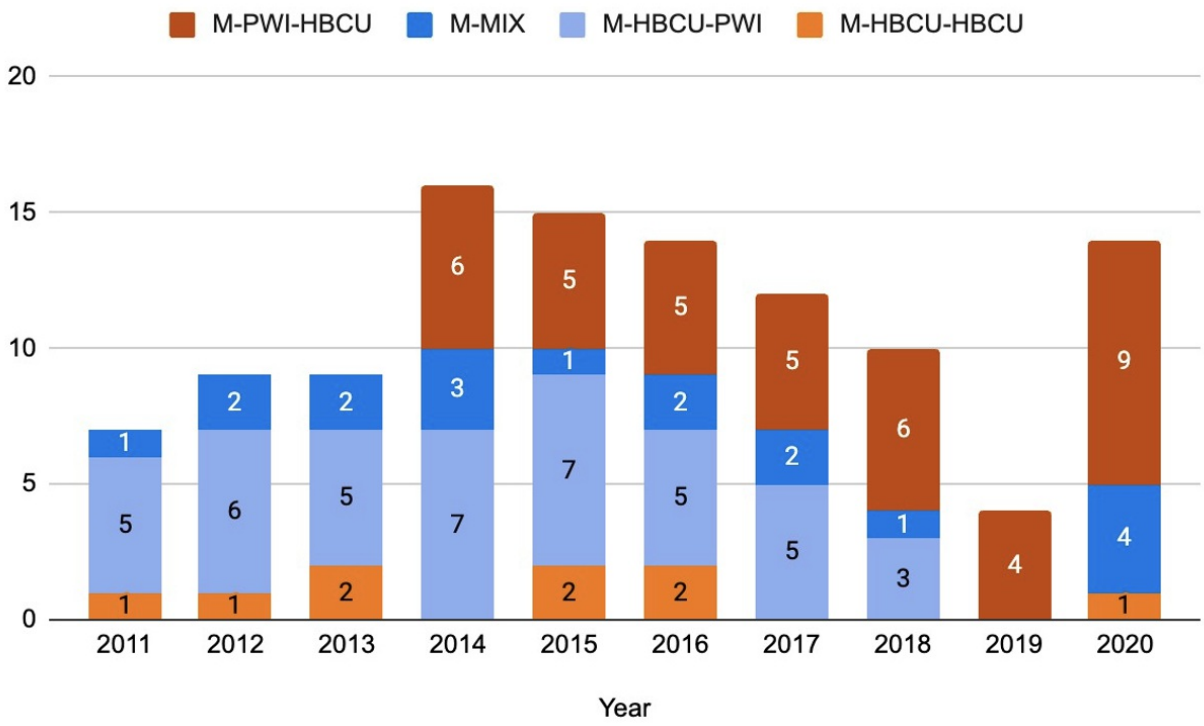

Figure 4. The breakdown of the number and type of mobile faculty at Howard University from 2011 to 2020 in the validated dataset. Faculty data collected for the year 2019 was limited and is an outlier in the current analysis. Non-mobile faculty (n=3,572) are not included in the visualization for purposes of scale

Most mobile professors at Howard University were from the College of Arts & Sciences. Thus this college is the primary driver of the patterns depicted in Figure 4 especially as they relate to movements between HBCUs and PWIs specifically (Figure 5).

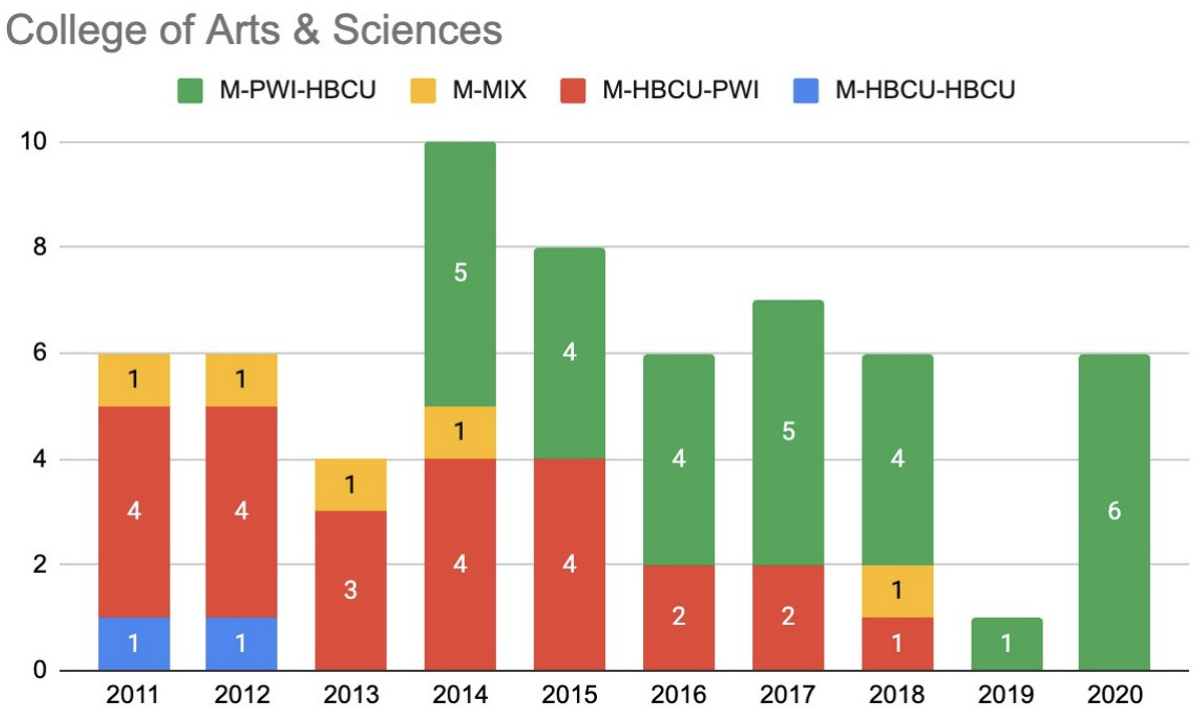

Figure 5. The breakdown of the number and type of mobile faculty in Howard University's College of Arts & Sciences from 2011 to 2020 in the validated dataset. Faculty data collected for the year 2019 was limited and is an outlier in the current analysis. Non-mobile faculty are not included in the visualization for purposes of scale.

By further breaking down the mobility types by individual departments within the interdisciplinary College of Arts & Sciences, we get a more granular view of the field specific mobility patterns in HBCUs (Figure 6).

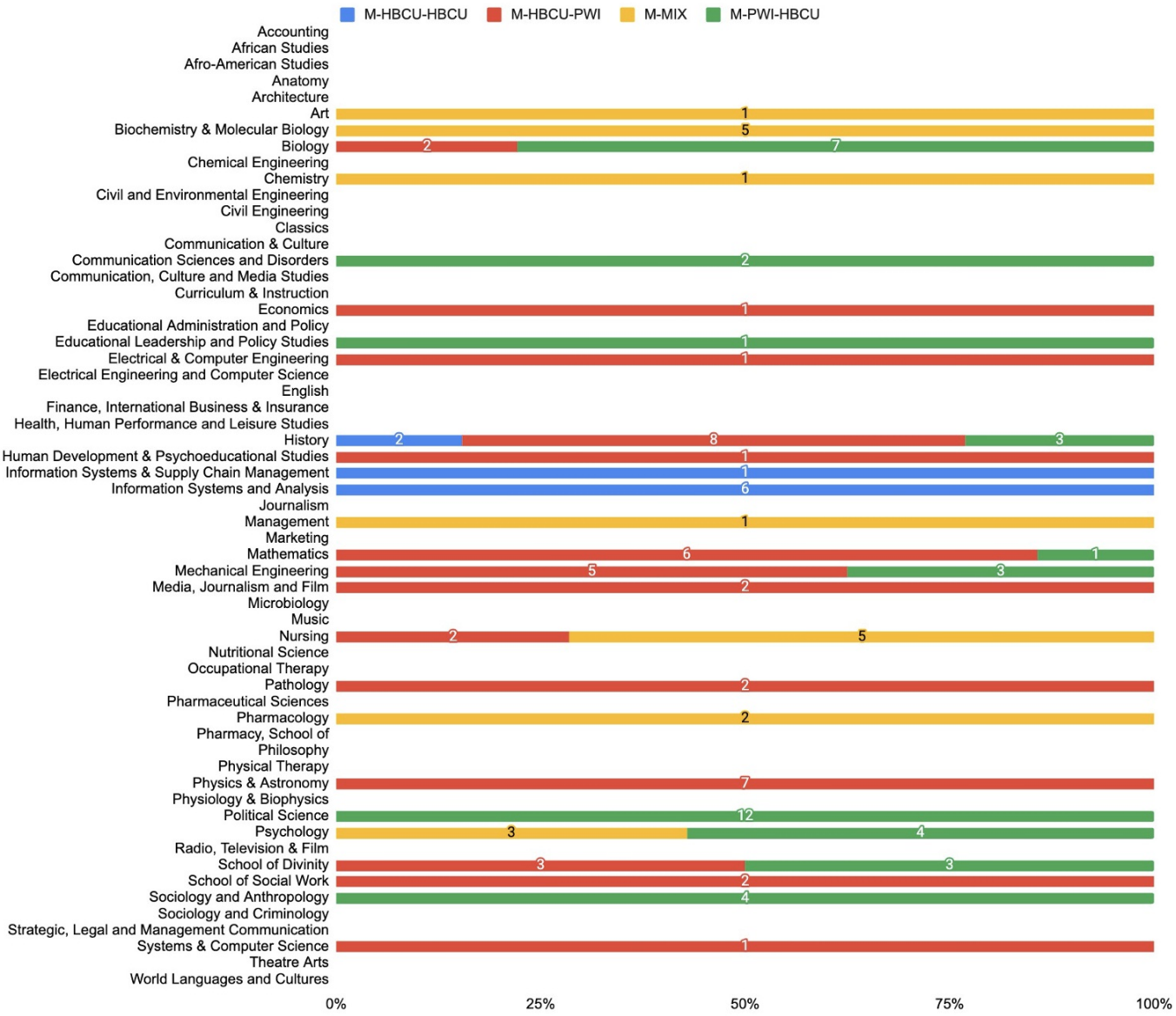

Figure 6. Distribution of mobility types by College of Arts & Sciences department. This list captures a temporal aspect of the department level data as some department names have changed over time. Real value counts are included in the data series, while proportions are represented on the x-axis.

Within this college, faculty movement between Howard and other HBCUs is primarily in the Information Systems departments (n=7). Mixed movements are seen more in the more medical or clinical oriented departments like Psychology (n=3), Pharmacology (n=2), Biochemistry & Molecular Biology (n=5), and Nursing (n=5). The department of history had the most faculty move from HBCU to PWI (n=8). However, natural science departments like Mathematics (n=6), Mechanical Engineering (n=5), and Physics & Astronomy (n=7) are the drivers of this mobility type. The departments with the largest shares of faculty moving from PWIs into HBCUs include departments that can be more social science in orientation: Political Science (n=12), Biology (n=7), Psychology (n=4), and Sociology & Anthropology (n=4).

Discussion

Here we discuss early insights in mobility patterns at Howard University using the results above. The three levels of analysis include: 1) mobility at the larger university level, 2) mobility at the university college level, and 3) mobility at the department level.

Howard University Mobility

Nearly 3% of the validated dataset containing 3,682 faculty members from 2011-2021 affiliated with Howard university were identified as mobile (Table 3). Of these mobile professors, 40% were found to have moved from an HBCU to a PWI while faculty moving from HBCU to HBCU made up the smallest proportion of mobile professors (<1%). Plotting the change in proportion over time (Figure 4) grants us insight into the changing dynamics at HBCUs and allows us to map possible sociopolitical factors within the United States that may have impacted these changes. For instance, while the highest overall proportion of mobile faculty moved from HBCU to PWI, followed very closely by PWI to HBCU, the prominence of these mobility types overtime has flipped. Beginning in 2018, a larger number of mobile professors seemed to move towards HBCUs rather than away from them, overtaking the 'brain drain' of faculty to PWIs for the first time in our dataset's year range. Incoming mobile professor counts have been growing while outgoing professors have been on the decline.

Allen suggests the concept that mobility patterns are stratified across disciplines and informally hypothesizes that more 'professionalized' fields such as Medicine or Social Work may weigh career related determinants of mobility higher than ideological ones, whereas more academic or philosophically focused fields may do the opposite (1981). Additionally, social movements impact academic and professional mobility (Sugimoto et al., 2017). We believe our data may help support and extend these claims. Our 2020 data for Howard University shows a substantial number of faculty that moved from PWI to HBCU (n=9). An increase in coverage and attention of social movements in the same year such as the amplification of Black Lives Matter draws possible links to a surge of academic mobility for HBCU faculty that is inextricably interconnected with sociocultural factors outside of education and career progress. Another interesting data point is the small but noticeable jump in MIX mobile professors in 2020 which aligns with the start of the global COVID19 pandemic. Strained hospital staff and the increase in urgency of vaccine research may serve as a reasonable hypothesis explaining some mobility determinants for certain disciplines. We further explore this stratification in Howard University by analyzing mobility trends in intra-university colleges and schools.

University College Mobility

Within Howard, we found that the largest number of mobile faculty existed in the College of Arts & Sciences (n=60, 3.7% of college faculty). However, the division of Howard with the largest relative proportion of mobile professors when compared to department size is the School of Divinity (7% of college faculty were identified as mobile) (Table 2). Lower mobility rates in a majority of the colleges is expected as the sample of validated faculty is small.

In his study, Allen (1981) identified that the largest proportions of mobile Black faculty were affiliated with social science, humanities, and business disciplines. Despite the small number of mobile faculty in our dataset, our data largely supports

this finding. However, the breakdown and distribution of mobile faculty at Howard by mobility type uncovers patterns which may signify how the structure of HBCUs and determinants of mobility have changed in the last 40 years. Namely, at Howard University the School of Divinity and the two health related colleges (College of Medicine and the College of Pharmacy, Nursing, and Allied Health Sciences) have notable mobility patterns. Within the College of Arts & Sciences (CA&S), we find all mobility types present. The type that makes up the largest proportion of mobile CA&S faculty is PWI-HBCU (48%), followed by HBCU-PWI (40%), MIX (8%), HBCU-HBCU (3%). In the School of Business, mobile faculty are primarily moving between HBCUs, while faculty in the College of Medicine and College of Pharmacy, Nursing, and Allied Health Sciences are more likely to have mixed movements between academia and industry. Academic discipline seems to have a direct impact on the type and determinants of mobility. Allen's hypothesis that more professionalized fields such as medicine weight career related mobility factors higher than other disciplines may also be supported by these results which indicate a deeper industry connection within these colleges.

College of Arts & Sciences Departmental Mobility

The results of this analysis hold interesting early insights into human capital change at HBCUs and highlight how the department level differences may significantly impact faculty mobility. The longitudinal distribution of mobile professors specifically within this highly interdisciplinary college seems to be the primary driver for the flip in PWI to HBCU becoming the most prominent movement type (Figure 5). Interestingly, this flip in proportions caused by a decline in the hard count of faculty moving from HBCU to PWI. This may indicate that brain drain is occurring while talented faculty are not necessarily being replaced. In CA&S, this pattern starts in 2015, a few years earlier in the college than is seen in the aggregated University data.

Because of CA&S's interdisciplinary nature, seeing the distribution of mobility types helped hypothesize and link how fields of study are mobile in different ways. Figure 6 provides this breakdown of mobility types. In the full validated dataset, the departments with the most faculty moving from HBCUs to PWIs included History (n=8), Physics & Astronomy (n=7), Mathematics (n=6), and Mechanical Engineering (n=5). The departments of Political Science (n=12), Biology (n=7), Sociology and Anthropology (n=4), and Psychology (n=4) were the primary PWI-HBCU movers. Finally, Nursing (n=5) and Biochemistry & Molecular Biology (n=5) drive the MIX movement in the college, while the Department of Information Systems and Analysis over represents the HBCU-HBCU movement type (n=6).

Prior research shows that mobility can be driven by career advancement, working conditions, and salary (Auriol, 2010; Allen, 1998). The department level details of HBCU faculty mobility may help quantitatively support this claim, and bring more attention to different patterns in various subsets of faculty like those affiliated with HBCUs, through the stratification of scientific fields and known bias in research and the distribution of funds to various scientific fields (Kozlowski et al., 2022; Hicks & Katz, 2011). Further knowledge and examination of how departmental funds are distributed within a university may help predict movement and underscore the determinants of faculty attrition from HBCUs. Future research for this project involves acquiring qualitative data from interview participants to triangulate experiential data with these early insights to deepen our understanding of these patterns.

Ethical Considerations

The longitudinal nature of this project in combination with the use of Internet Archive's Wayback Machine, various scholarly databases, and future qualitative methods to triangulate and contextualize our analysis bring a number of ethical considerations to the forefront. Web archives are functional sources for large-scale longitudinal data collection; however, their complex social and technical infrastructures create an array of ethical concerns. This is compounded by a notable lack of guidance available for researchers hoping to conduct ethical research of this kind. The larger study containing the analysis presented herein uses the Association of Internet Researchers' Ethical Decision-Making and Internet Research Recommendations developed by Markham & Buchanan (2012) in conjunction with archive based research recommendations developed by Maemura & Ogden (2021) to engage with our data appropriately.

Conclusion

This analysis examines longitudinal HBCU faculty affiliation data collected from Internet Archive and provides early insights into larger mobility patterns to be identified as part of a larger NSF funded project. We explore the dynamics of faculty mobility for professors who were affiliated with Howard University at some point between 2011 and 2020. Mobility was broken down into four types, HBCU to PWI, PWI to HBCU, HBCU to HBCU, and MIX. We found that 3% of faculty in this dataset was mobile. Most mobile professors move between HBCUs and PWIs. The proportion of faculty moving from PWIs to HBCUs has increased in recent years as a result of fewer faculty leaving Howard for a PWI. The primary driver of academic mobility at Howard is the College of Arts & Sciences. In this interdisciplinary college we find that mobility types are stratified across departments and fields of study. Political and social science related departments make the majority of PWI to HBCU moves, while natural sciences like Mathematics, Engineering, and Physics drive movement into PWIs. Additionally, we draw possible connections to socio-political drivers of mobility patterns seen in this study such as Black Lives Matter and the COVID19 pandemic. The emphasis on mobility of HBCU professors is distinct from previous research that largely focused on mobility at major universities and PWIs. Results from this large-scale, longitudinal analysis will provide important evidence regarding the career paths of professors that are or have been affiliated with an HBCU.

The main limitations of the analysis provided here are the relatively small dataset of validated faculty at Howard University (n=3,682 faculty names) and the uneven distribution of available faculty data from 2019 onward. For these reasons, the conclusions of the analysis remain indicative of possible patterns in human capital changes at HBCUs. While patterns that can be identified do align with prior literature, a lack of quantitative work in this area reduces our current ability to generalize and claim statistical significance.

Future work included in the scope of this project involves replicating the data processing and analysis using the data we have collected for other HBCUs. By doing so, we will have the ability to aggregate mobility data for all HBCUs, identify broader patterns, and develop meaningful insights for policy applications. Additionally, we will have access to experiential data collected from surveys and interviews to identify and understand factors associated with mobility and retention

decisions within the HBCU faculty network. Interpretations of this study and of the triangulated data sources will help aid policymakers and institutional administrators in decisions related to hiring, retention, funding, and career trajectory.

Statements and Declarations

Competing Interests

The authors have no competing interests to declare, financial or otherwise, that are relevant to the content of this article.

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Footnotes

[1] LinkedIn (https://www.linkedin.com/) is a social media platform for professional networks. The Open Researcher and Contributor ID (or ORCID) is a persistent digital identifier for researchers. More information can be found at https://orcid.org/

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