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The United States is at a critical juncture in its ability to remain internationally competitive in science, technology, engineering, and mathematics (STEM). At present, too few people from diverse populations, including women, participate in the STEM academic and workforce communities. This series of issue briefs is produced by American Institutes for Research (AIR) to promote research, policy, and practice related to broadening the participation of traditionally underrepresented groups in STEM doctoral education and the workforce.

AIR supports the national effort to prepare more students for educational and career success in STEM by improving teaching and providing all students with 21st century skills needed to thrive in the global economy; meeting the diverse needs of all students—especially those from underrepresented groups; and using technology, evidence, and innovative practice to support continuous improvement and accountability.

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Who Pays for the Doctorate?

A Tale of Two PhDs

The extreme levels of debt accrued by students pursuing postsecondary degrees has been identified as one of the nation's most worrisome educational issues and one of the greatest challenges in meeting President Barack Obama's goal of increasing postsecondary degree completion rates in the United States. U.S. residents currently owe more than $1 trillion in student debt (FinAid, n.d.), generally from undergraduate tuition. It also has been observed that debt incurred in graduate school has been increasing. A 2014 report indicated that about 40 percent of all student debt financed graduate education, yet only about 16 percent of all students in the United States are graduate students (Delisle, 2014). The prevalence and magnitude of debt that students are accruing are especially troubling because of the simultaneous desire among employers for college-educated employees and the tighter job market. College graduates are having a harder time finding jobs than ever before.

An earlier American Institutes for Research (AIR) issue brief examined student debt for STEM (science, technology, engineering, and mathematics) and SBE (social, behavioral, and economic)[1] doctorates and compared debt levels of underrepresented minorities (URMs)[2] with those of white and Asian students in general (non-URMs; Zeiser, Kirshstein, & Tanenbaum, 2013). Although a majority of PhD recipients in STEM fields did not accrue debt during graduate school, this was not the case for SBE doctorates. There also were substantial racial and ethnic disparities in debt accrual in that African American and Hispanic PhD recipients in both STEM and SBE fields were disproportionately likely to accrue more than $30,000 in graduate school debt.

In this brief, we deepen and expand our first exploration of graduate student debt levels to examine how STEM and SBE PhD recipients funded their doctorate education and how debt is tied to funding patterns. Specifically, we use data from the *Survey of Earned Doctorates* (SED)[3] for the 2010–11 academic year to examine and compare student debt levels by STEM and SBE PhD recipients' primary source of graduate school funding and whether students received tuition waivers.

[1] For example psychology, anthropology, sociology, geography, demography, political science, and economics are classified as SBE fields.

[2] URMs include African Americans, Hispanics, and Native Americans.

[3] http://www.nsf.gov/statistics/srvydoctorates/

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For the purposes of this brief, we identified the following sources of funding:

- *Institutional funding:* funding from research assistantships, teaching assistantships, fellowships, grants, and other types of assistantships or traineeships[4]
- *External funding:* all other sources of funding (including savings, earnings, loans, and employer reimbursement)

In addition, we examine whether students primarily relying on institutional sources of funding and students primarily relying on external sources of funding also received partial or full tuition waivers.

Finally, because there are documented differences in debt accrual by race and ethnicity, we examine the relationship between financial assistance during graduate school and debt separately for URMs and non-URMs. All PhD recipients considered in this report were either U.S. citizens or legal permanent residents at the time of receiving their doctoral degrees.

The differences in graduate school funding and debt levels between STEM and SBE students are striking. Our key findings were the following:

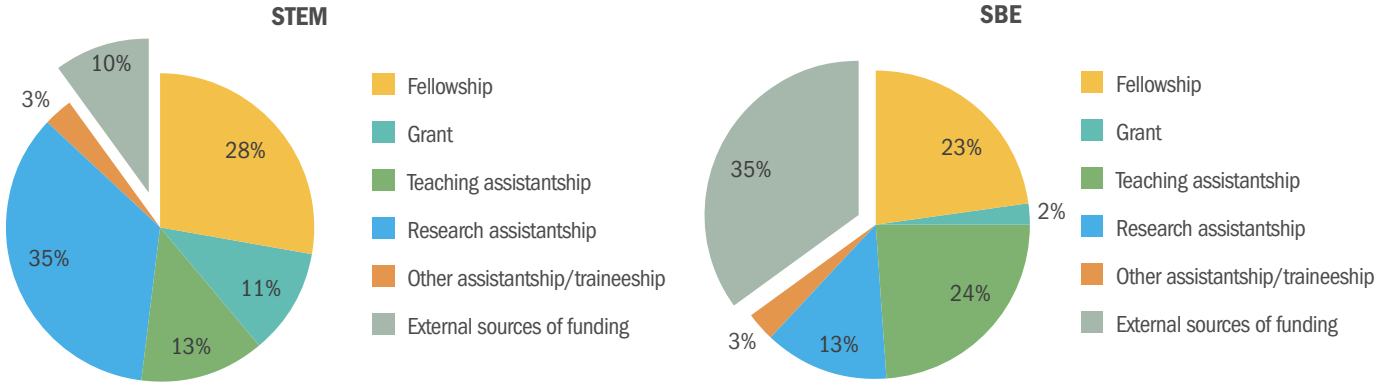
- *STEM PhD recipients were more likely than SBE PhD recipients to receive funding from their institutions to support their graduate education.* About 90 percent of STEM doctoral recipients primarily funded their graduate education through institutional sources, in contrast with 65 percent of SBE PhD recipients.
- *The percentages of students receiving institutional funds were similar for URM and non-URM recipients in both STEM and SBE disciplines, and within public and private institutions.* Non-URM students with institutional funding were more likely, however, than URMs with institutional funding to receive full tuition waivers.
- *Students who primarily relied on external funding during graduate school and who did not receive any tuition assistance accrued much higher levels of debt than students who received both institutional funding and full tuition waivers.* Even among SBE PhD recipients who received institutional funding and full tuition waivers, however, 21 percent of URM recipients in public institutions and 15 percent of URM recipients in private institutions accrued more than $70,000 in graduate school debt (in comparison with 9 and 5 percent of non-URM recipients, respectively).

Graduate Education Funding Sources

STEM and SBE graduate students fund their doctorates differently. Whereas 35 percent of PhD recipients in SBE fields reported an external source of funding as their primary source of funding, only 10 percent of PhD recipients in STEM fields relied primarily upon external funding. By comparison, 35 percent of PhD recipients in STEM fields listed research assistantships as their primary source of funding, in comparison with 13 percent of recipients in SBE fields. Assuming that fellowships, grants, and research assistantships are all research-related sources of funding, a total of 74 percent of STEM PhD recipients and only 38 percent of SBE PhD recipients were primarily funded through research-related activities. The SED data do not allow us to determine the reason for these disparities in funding between STEM PhD recipients and SBE PhD recipients, but one hypothesis may be that, although research opportunities exist in both STEM and SBE, there may be a greater availability of research funding (e.g., federally funded research) in STEM fields than in SBE fields that can be used to support graduate student research.

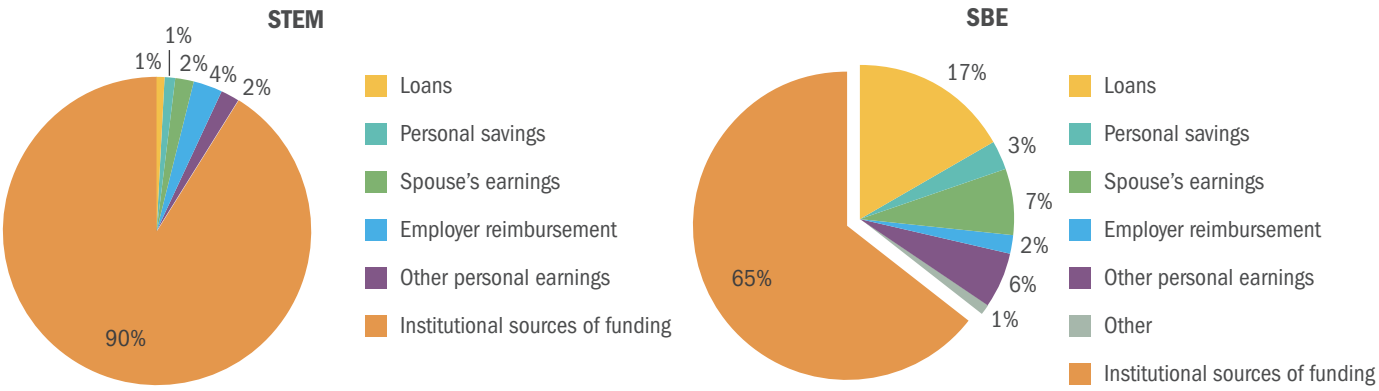
[4] We acknowledge that many fellowships and grants are awarded to graduate students from foundations and government agencies, and therefore the source of funding is technically external to the institution. We classify these sources of funding as institutional funds because fellowship and grant money is often awarded through the institution itself.

Figure 1. Primary Sources of Institutional Funding Among PhD Recipients in STEM and SBE Fields, 2010–11



Although only 10 percent of STEM PhD recipients listed an external source as their primary source of graduate school funding, a third of them (approximately 4 percent of all STEM PhD recipients) received funding or reimbursement from their employers. SBE students, in comparison, relied heavily on loans. Approximately 17 percent of recipients in SBE fields reported loans as their primary source of funding, making loans the third most commonly reported primary source of funding among PhD recipients in SBE fields, after teaching assistantships and fellowships. Notably, only about 1 percent of PhD recipients in STEM fields reported loans as their primary source of funding.

Figure 2. Primary Sources of External Funding Among PhD Recipients in STEM and SBE Fields, 2010–11[5]



Secondary Funding Sources

When secondary funding sources are considered, almost a third of SBE PhD recipients indicated loans as either their primary or secondary source of graduate school funding, in comparison with only 9 percent of STEM PhD recipients. Of recipients who reported both a primary and a secondary source of funding,[6] 70 percent of STEM PhD recipients listed institutional sources of funding for both their primary and secondary sources of funding, in comparison with 38 percent of PhD recipients in SBE fields.

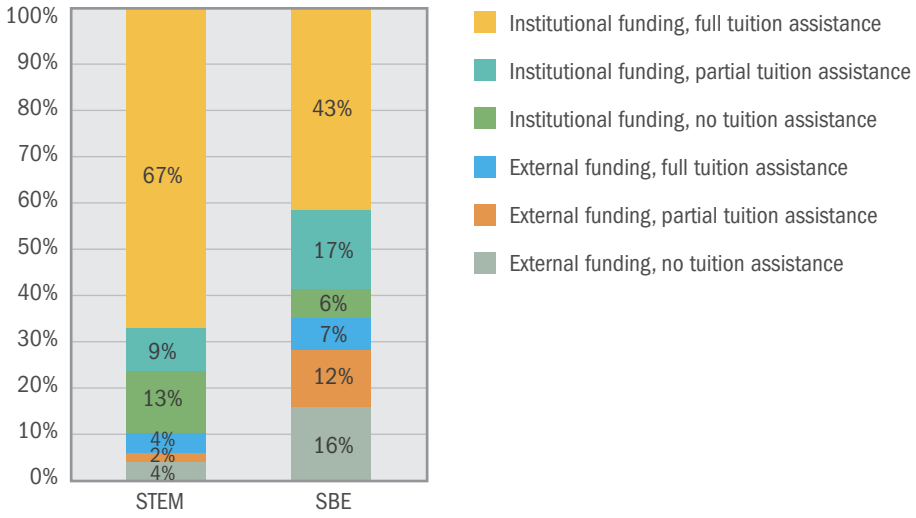
Primary Funding and Tuition Assistance

Graduate students may receive fellowships and assistantships, but these forms of financial assistance do not automatically come with tuition remission. Indeed, STEM PhD recipients were far more likely than their SBE counterparts to receive institutional funding coupled with full tuition assistance. Whereas 67 percent of STEM PhD recipients received institutional funding with full tuition assistance, only 43 percent of SBE recipients benefitted from this level of support (see Figure 3). At the other extreme, 16 percent of SBE PhD recipients, but only 4 percent of STEM PhD recipients, funded their doctorates with external funding and no tuition assistance.

[5] Note that the "other" category includes internships, foreign sources of funding, and other unspecified external sources of funding. This category was omitted from the figure for STEM PhD recipients because the percentage of STEM PhDs with "other" forms of external funding rounded to zero percent.

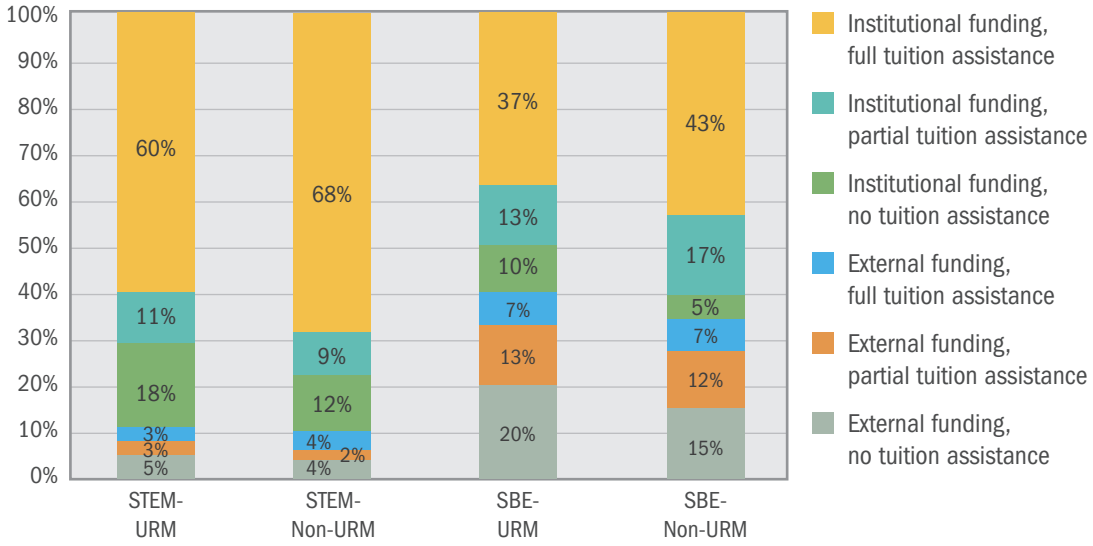
[6] Of PhD recipients who reported a primary source of funding, 4.7 percent of PhD recipients in SBE fields and 9.8 percent of PhD recipients in STEM fields did not report a secondary source of funding.

Figure 3. Type of Financial Help Provided to STEM and SBE PhD Recipients, 2010–11



Are there differences by race or ethnicity in these graduate education funding patterns? Overall, the proportions of URM and non-URM STEM PhD recipients with institutional funding were similar. Non-URMs, however, were more likely than URMs to receive institutional funding with full tuition waivers (68 percent, in comparison with 60 percent), and URMs were slightly more likely than non-URMs to receive institutional funding without tuition assistance (18 percent, in comparison with 12 percent). In the SBE fields, a somewhat higher percentage of non-URMs than URMs (65 percent, in comparison with 60 percent) reported an institutional source of funding as their primary source of support.

Figure 4. Type of Financial Help Provided to STEM and SBE PhD Recipients by URM Status, 2010–11



STEM PhD Recipients

Because of differences in funding structures and the price of tuition, it also is important to consider differences in graduate student funding in public versus private institutions. In both public and private institutions, close to 90 percent of URM and non-URM STEM PhD recipients received some type of institutional funding (see Figure 5). However, non-URMs were more likely than URMs to receive full tuition waivers.

Among STEM PhD recipients in both private and public institutions, non-URMs were less likely than URMs to accrue debt during graduate school (see Figure 6). In private universities, two thirds of URMs and 82 percent of non-URMs left graduate school without any debt. In the meantime, 15 percent of URMs and 7 percent of non-URMs in private institutions accrued more than $30,000 in graduate school debt. Patterns were similar in public institutions, where 21 percent of URMs and 11 percent of non-URMs accrued more than $30,000 in debt during graduate school.

Figure 5. Type of Financial Help by URM Status and Private Versus Public institution Type Among STEM PhD Recipients, 2010–11

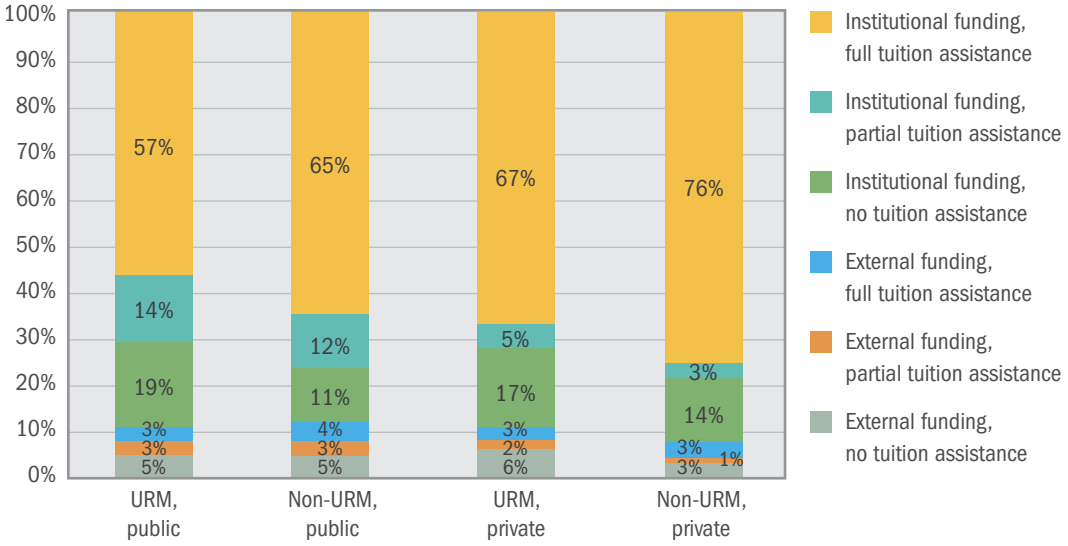
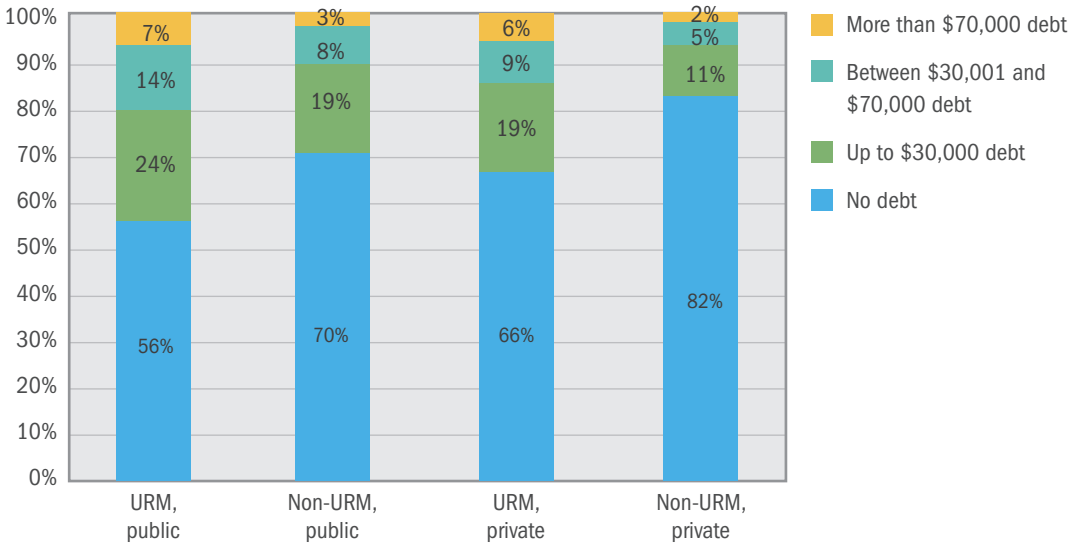


Figure 6. Graduate Debt by URM Status and Private Versus Public Institution Type Among STEM PhD Recipients, 2010–11



SBE PhD Recipients

The types of financial assistance that supported SBE PhD recipients' graduate education varied across public and private institutions and between URMs and non-URMs (see Figure 7). Racial and ethnic disparities in financial assistance were smaller in public institutions than in private institutions. Although roughly two thirds of URMs and non-URMs received institutional funding in public institutions, non-URMs were somewhat more likely to receive both institutional funding and full tuition waivers than URMs (44 percent, in comparison with 39 percent). In private

institutions, one third of URM SBE PhD recipients and almost one fourth of non-URM SBE PhD recipients reported external sources as their primary source of funding and no tuition assistance. This type of financial support has implications for the accrual of debt during graduate school because private institutions typically have higher tuitions than public institutions. In contrast, non-URMs were more likely than URMs in private institutions to receive both institutional funding and full or partial tuition assistance (54 percent, in comparison with 44 percent).

Within the SBE fields, URM PhD recipients were more likely to accrue debt during graduate school than their non-URM peers in both public and private institutions (see Figure 8). In addition, URM students were more likely to accrue extreme levels of debt than non-URMs, particularly among those who earned their degrees from private institutions, where 25 percent of non-URM PhD recipients and 41 percent of URM PhD recipients accrued more than $70,000 in debt during graduate school. Racial and ethnic differences in debt accrual also were large in public institutions, where 23 percent of URMs and 14 percent of non-URMs accrued more than $70,000 in debt during graduate school.

Figure 7. Type of Financial Help by URM Status and Private Versus Public Institution Type Among SBE PhD Recipients, 2010–11

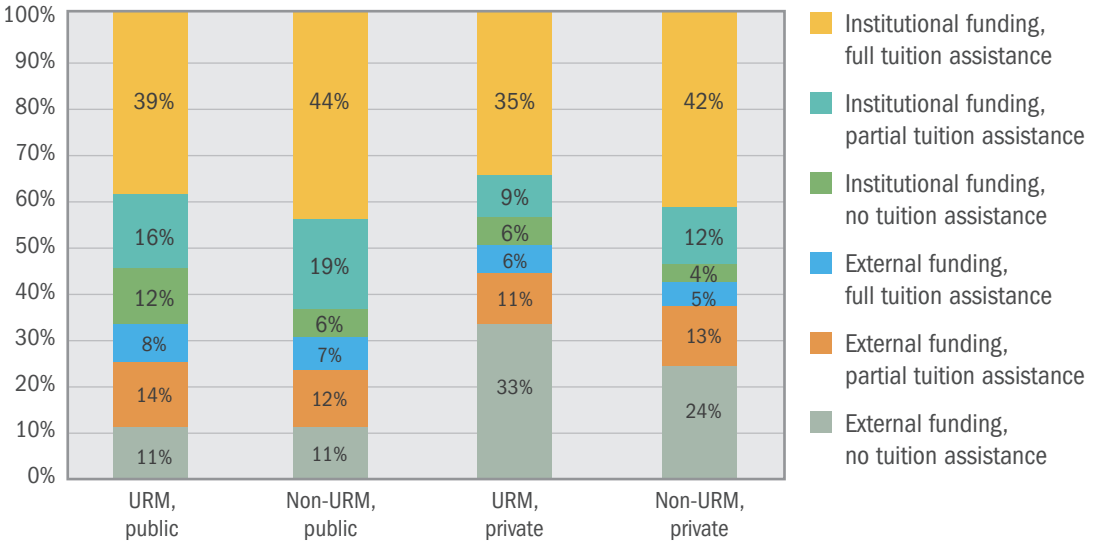
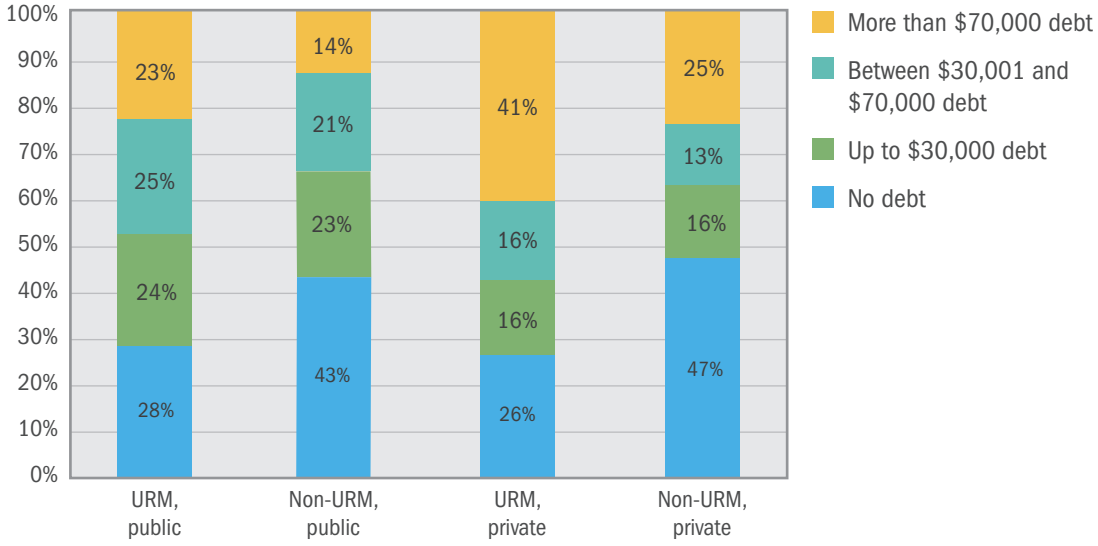


Figure 8. Graduate Debt by URM Status and Private Versus Public Institution Type Among SBE PhD Recipients, 2010–11

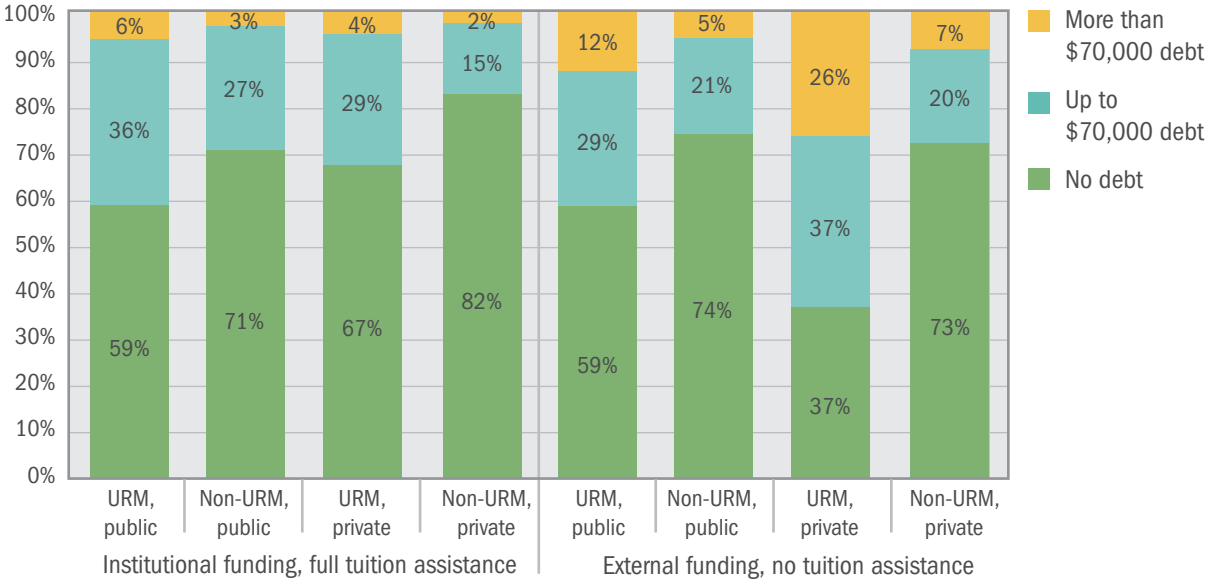


Financial Assistance During Graduate School and Debt Accumulation

To better understand the relationship between financial assistance during graduate school and debt accumulation, we further examine the levels of debt among URMs and non-URMs in public and private institutions with different combinations of primary funding sources and levels of tuition assistance. First, among recipients whose primary source of funding came from the institution and who received full tuition waivers, the majority of URM and non-URM PhD recipients in STEM fields did not accrue any debt during graduate school (see Figure 9). However, racial and ethnic differences in debt accumulation were apparent in both public and private institutions, with a smaller percentage of non-URM PhD recipients in STEM accruing debt during graduate school.

Among SBE PhD recipients with full tuition waivers and institutional funding, 72 percent of URM recipients and 53 percent of non-URM recipients in public institutions accumulated debt during graduate school (see Figure 10). Racial and ethnic disparities in debt accumulation also occurred in private institutions, where 55 percent of URMs and 36 percent of non-URMs accrued debt during graduate school. These disparities also were observed at the extreme levels of debt: among URM PhD recipients in SBE fields with institutional funding and full tuition waivers, 21 percent whose degrees were earned in public institutions and 15 percent of recipients in private institutions accumulated more than $70,000 in debt during graduate school, in comparison with 9 percent and 5 percent of non-URM recipients, respectively. These findings suggest that the amount of institutional funding received by PhD recipients in SBE fields did not cover all the expenses associated with graduate school, particularly for URM recipients. Our data do not allow us to determine, however, whether this is primarily due to differences in funding levels, differences in access to personal savings or family support, or differences in students' expenses during graduate school.

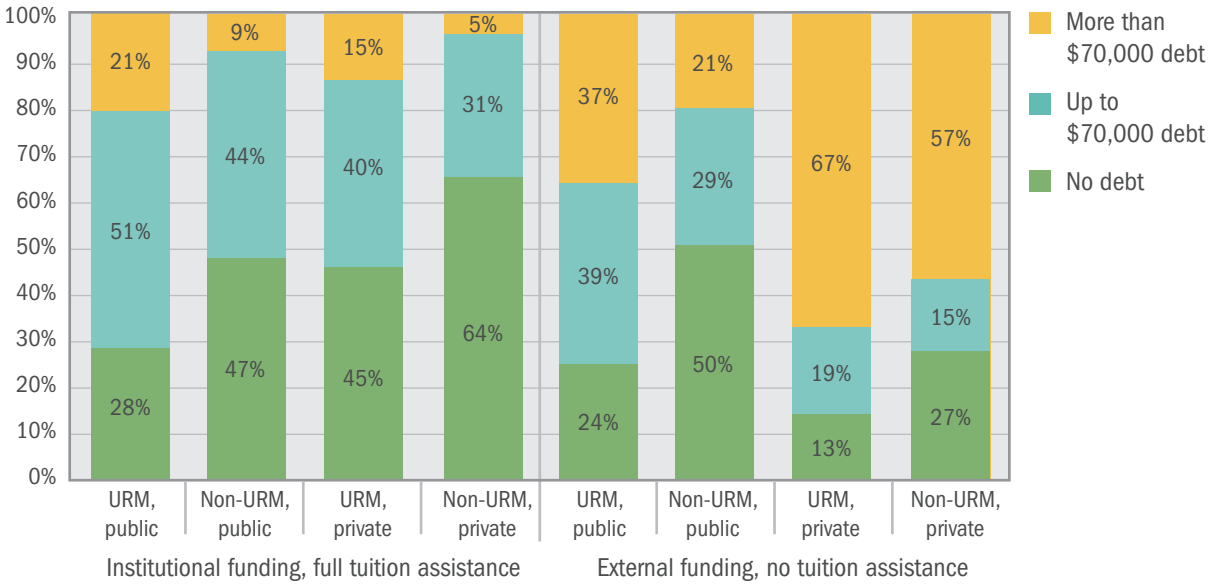
Figure 9. Graduate Debt by URM Status, Private Versus Public Institution Type, and Type of Financial Assistance Among PhD Recipients in STEM Fields, 2010–11



As one would expect, recipients whose primary source of funding was external and who did not receive any tuition assistance accumulated more debt, though debt accumulation varied by race and ethnicity and whether the degree was earned in a STEM or an SBE field. Almost three quarters of non-URM PhD recipients in STEM fields did not accumulate debt during graduate school in both public and private institutions (Figure 9). In comparison, among URM recipients in STEM fields, 59 percent of recipients in public institutions and 37 percent of recipients in private institutions did not accumulate debt. Among STEM PhD recipients, debt accumulation was most severe for URMs in private institutions, where 26 percent of recipients accumulated more than $70,000 in debt (in comparison with 7 percent of non-URMs in private institutions). Only a small percentage of STEM PhDs (less than 10 percent), however, relied on external funding and did not receive tuition waivers, and so these percentages are based on a relatively small group of STEM PhDs recipients.[7]

Debt accumulation was particularly high among PhD recipients in SBE fields who received their degrees from private institutions without financial support. Among recipients who primary relied upon external funding without tuition assistance, 67 percent of URMs and 57 percent of non-URMs who earned degrees from private institutions accumulated more than $70,000 in graduate school debt (see Figure 10). Extreme levels of debt were less common in public institutions, likely because of the lower cost of tuition, though 37 percent of URM and 21 percent of non-URM PhD recipients in SBE fields accrued more than $70,000 in debt.

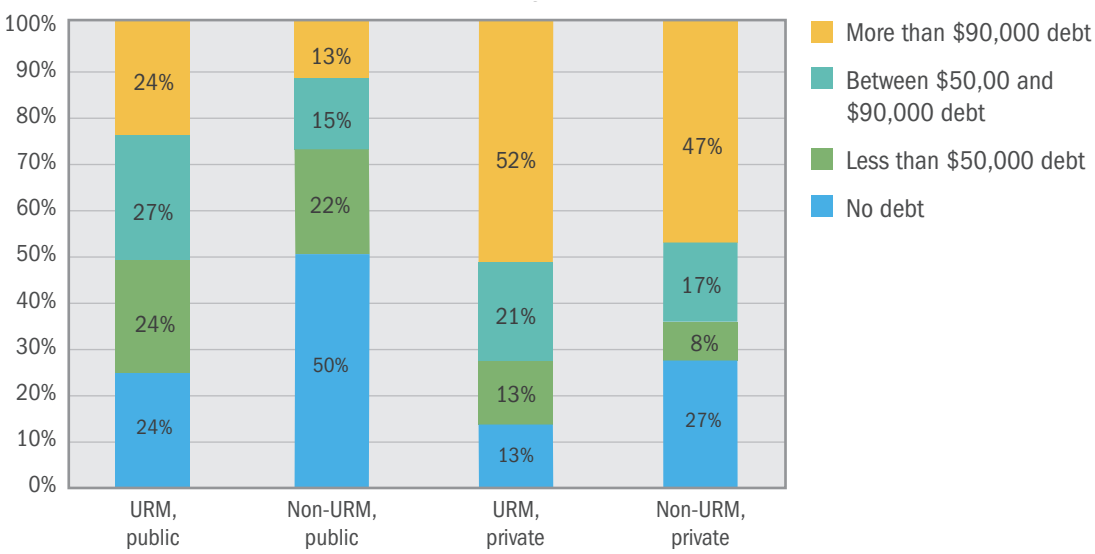
Figure 10. Graduate Debt by URM Status, Private Versus Public Institution Type, and Type of Financial Assistance Among PhD Recipients in SBE Fields, 2010–11



[7] In the SED, 6 percent of all URMs who obtained STEM PhDs from private institutions accrued more than $70,000 in graduate school debt. The percentages in Figure 9 are based on the subsamples of students who (1) primarily relied on institutional funding and received full tuition waivers and (2) primarily relied on external funding and did not receive tuition waivers.

The highest level of graduate school debt that recipients could report in the 2010–11 academic year was "$90,001 or more," and a substantial number of PhD recipients in SBE reached this extreme debt level. Approximately half of SBE PhD recipients at private institutions with external sources of funding and without tuition assistance accrued this extreme level of debt—52 percent of URM recipients and 47 percent of non-URM recipients (Figure 11).[8] This extreme level of debt was less common among PhD recipients in public institutions, where 24 percent of URM and 13 percent of non-URM PhD recipients in SBE fields who did not receive either institutional funding as a primary source of funding or tuition waivers accrued more than $90,000 in graduate school debt. Similar information could not be reported for STEM PhD recipients because of the small number of them who did not receive institutional funding or tuition waivers and accrued more than $90,000 in graduate school debt.[9]

Figure 11. Graduate Debt by URM Status in Private and Public Institutions Among PhD Recipients in SBE Fields Whose Primary Source of Funding Was External and Who Did Not Receive Tuition Assistance, 2010–11



Conclusion

The American workforce is in need of workers with graduate degrees, but the process of obtaining these degrees often comes at a substantial cost. In particular, despite the call to increase the representation of underrepresented minorities in graduate education, they are the students who accrue the most debt during graduate school. In addition to initiatives to recruit and retain URM students in graduate programs, policies need to consider how to fund graduate education so that earning a PhD, particularly in an SBE field, is not synonymous with accruing crippling debt.

It is important to note that a majority of PhD recipients—90 percent of recipients in STEM fields and 65 percent of recipients in SBE fields—reported institutional funding as their primary source of support. A large percentage also reported receiving full tuition waivers during graduate school. Despite these efforts, students are still accruing large amounts of debt during graduate school, indicating that the amount of funding is not sufficient and that URMs may be particularly at risk of not having their graduate education adequately supported. Although graduate programs may consider their stipends and tuition waivers to be more than generous, graduate students often have to balance

[8] In the SED, 29 percent of all URM and 17 percent of all non-URM students who received their SBE PhDs from private institutions accrued more than $90,000 in graduate school debt. The percentages in Figure 11 are based on the subsample of students who primarily relied on external funding and did not receive tuition waivers.

[9] For reports that utilize restricted-use data, the National Science Foundation prohibits the reporting of any finding for subsamples of respondents that contain fewer than five PhD recipients.

their educational costs with the additional financial burdens of rent, living expenses, and perhaps even child care—and do so while forgoing the wages they could be earning in the workforce. The amount of institutional funding that students receive is particularly important for students who do not have the savings or familial resources to buttress expenses while pursuing a PhD.

It is important to note that the data in this brief covers only students who obtained their PhDs. More than half of all graduate students fail to complete the doctorate (Cassuto, 2013), and those who leave tend to have higher debt than those who complete their degrees (Lovitts, 2001). In addition, this brief focused only on debt accrued during graduate school; many of these PhD recipients also accrued debt during their undergraduate educations, thus making the levels of debt reported in this brief conservative estimates of the total amount of debt that new PhD recipients face.

The job market for new PhD recipients also is of concern, particularly for SBE graduates. Although there are many reports noting the need for more STEM degrees, including individuals with doctoral degrees in STEM fields, there is not a national cry for more PhD recipients in most of the SBE fields. Furthermore, the well-documented growth in part-time faculty (Desrochers & Kirshstein, 2014) has made it more difficult for both STEM and SBE PhD recipients to obtain tenure-track academic positions. How does a prospective graduate student decide whether pursuing a doctorate in his or her field of study is worth it? Perhaps more to the point, is it the responsibility of academe to limit the number of students pursuing advanced degrees in fields with limited funding for graduate education and job opportunities once the degree is obtained? Further research on how funding and potential for debt factor into students' decisions to pursue graduate education may be needed, as well as exploration into the possible advantages, disadvantages, and consequences that could result from placing limits on advanced degree pursuits among students in particular fields.

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