Software subcategory of Intellectual Property Products Investment	Private Sector			Public Sector			Household Sector	Rest of World
	Business	Other private nonprofits	Higher education	Higher education	Federal Government and FFRDCs	Non-federal government, ex. Higher Ed.		
Prepackaged								
Custom								
Proprietary								
Open Source (OSS)								
Own-account								
Proprietary								
Open Source (OSS)								

Figure 9. Software Investment Framework, Augmented to Show OSS Producers

To identify the sectors where developers are contributing to OSS, we take a closer look at the manifest data we collected from CRAN for R packages. We obtain 11,886 OSI-approved production-ready packages from CRAN[6] published between 2005-10-29 and 2018-06-18, and collect information about these packages including the license, published data, authors and their roles (creator or maintainer, contributor, copyright holder), and the email address of the maintainers, dependencies (imports, suggests, depends), and URL's to the repositories.

Every package has at least one author and one maintainer listed; they may be the same person. The creator or maintainer is the person to be contacted if there are problems, hence they must provide an email address. We use the email addresses to obtain information about the location and organization of the creators. This approach gives us a lower boundary on university contributions, and a substantial share of email addresses that are insufficient to identify sector.

In our dataset, we obtain 6,697 unique maintainers associated with 6,871 unique email addresses (378 have more than one email addresses). There are 2,261 unique domains (e.g.,

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[6] https://cran.r-project.org/web/packages/available_packages_by_date.html

gmail.com, yahoo.com, outlook.com), and 103 top-level domains (e.g., *.com, .edu, .org, .uk*).

One third (32%) of maintainers have Gmail accounts; these can be from any sector. To get a

sense of geographical distribution, we obtain a complete list of all country top-level domains

maintained by the Internet Assigned Numbers Authority (IANA)[7] Table 11 summarizes the

number of projects and number of creators for the most common top-level domains. The largest

share of package maintainers has *.com* email addresses; these provide little information about

geography or economic sector. However, 17% of both packages and maintainers have *.edu*

email addresses, and more than a third have email addresses that are country specific.

Table 11 Top-level Domains of R Package Maintainers on CRAN

Domain	Packages	Percent	Maintainers	Percent
Total	11,886.0		6,697	
.com	4,964	42%	2,770	40%
.edu	1,981	17%	1,202	17%
.org	481	4%	184	3%
.net	168	1%	89	1%
.gov	69	1%	43	1%
.name	33	0%	3	0%
.info	8	0%	6	0%
.biz	6	0%	3	0%
.(country)	4,124	35%	2,495	36%
Germany (.de)	687	6%	427	6%
United Kingdom (.uk)	434	4%	267	4%
France (.fr)	398	3%	235	3%
Canada (.ca)	335	3%	160	2%
Australia (.au)	198	2%	109	2%
Italy (.it)	198	2%	129	2%
Switzerland (.ch)	172	1%	102	2%
Spain (.es)	166	1%	102	2%
Netherlands (.nl)	151	1%	89	1%
Austria (.at)	123.0	0.0	56.0	1%

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[7] https://www.worldstandards.eu/other/tlds/ IANA is responsible for the global coordination of the DNS Root, IP addressing, and other Internet protocol resources.

A country domain is associated with 35% of contributions (packages) and 36% of the maintainers. Table 11 also shows the top 10 countries (out of 88 countries) that have the highest number of contributions (packages) and the number of maintainers. These exclude projects with an associated .com email addresses (42% of all projects) Finally, we analyze the creators' email domains with .edu., we obtain 1,981 packages (16.7%) created by 1,202 maintainers.

Although we cannot parse the Gmail addresses by sector, we find almost 17% are associated with university domains, and more than one third come from country domains. We view these shares as a lower boundary on the sector's contribution to OSS. We add two columns on the right that show that a full accounting will need to include OSS created outside of work and OSS created internationally.