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Abstract

This article addresses the relationship between international research collaboration and the performance of researchers through the focus on a specific discipline -Economics- in a small developing country -Uruguay-. We map the collaboration between Uruguayan economists and non-local researchers and analyze the correlation between these collaborations and scholars' achievements, as reflected by the quality of the publications included in Scopus-Elsevier. Our results confirm the positive and significant association between research collaboration and research output. Researchers from a developing country involved in international collaborations get a higher impact or quality of their research, but this result holds only when international collaborations involve researchers located in northern countries.

Resumen

Este artículo aborda la relación entre la colaboración internacional en investigación y el rendimiento de los investigadores con el foco en una disciplina específica -Economía- en un pequeño país en desarrollo -Uruguay-. Mapeamos la colaboración entre economistas uruguayos e investigadores no locales y analizamos la correlación entre estas colaboraciones y los logros de los académicos, reflejados por la calidad de las publicaciones incluidas en Scopus-Elsevier. Nuestros resultados confirman la asociación positiva y significativa entre la colaboración en la investigación y los resultados de la misma. Los investigadores de un país en desarrollo que participan en colaboraciones internacionales obtienen un mayor impacto o calidad de sus investigaciones, pero este resultado se mantiene sólo cuando en las colaboraciones internacionales participan investigadores localizados en países del Norte.

Keywords: research networks, research output, bibliometrics

Palabras clave: redes de investigación, resultados de investigación, bibliometría

JEL: A14; I23

Introduction

Collaboration between researchers is a relevant aspect of understanding academic performance. Co-authorship of scientific publications can be considered research collaboration or network formation. So the patterns of co-authorship provide helpful information to understand the links between research collaboration and the impact or quality of scientific research.

The literature has widely discussed the importance of research collaboration for research performance and addressed the distinction between domestic and international collaboration. International collaboration has been hypothesized to be more positively related to research output than domestic or within-university collaboration because distant partners are more likely to bring different experiences and diverse ideas (among others He et al., 2009; Abramo et al., 2017). This relationship involves complex causal links, and it may depend on national contexts. The potential relationship may be differential depending on the researcher's location and the involved discipline. For developing contexts, the nature of this relationship may be even more relevant and remains mainly unexplored.

The objective of this paper is to illustrate the relationship between international research collaboration and the performance of researchers, focusing on a specific discipline -Economics- in a small developing country -Uruguay-. Using a bibliometric approach based on the Scopus database and taking articles written by Uruguayan economists as the unit of analysis, we map the collaboration between Uruguayan economists and non-local researchers and analyze the correlation between these collaborations and scholars' achievements, as reflected by widespread measures of quality of journals.

We hypothesize that in a small academic community with relatively low publications like the one we are studying, knowledge sharing becomes crucial for attaining higher visibility in terms of publications and their impact. Therefore, our first hypothesis is that collaboration with researchers from abroad increases the impact or quality of research for Uruguayan economists.

We also explore if different international networks are related to the different impact or quality of Uruguayan economists' publications, given that different strategies of international openness may yield differential results. Our second hypothesis is that collaboration with northern-based researchers is associated with a higher impact or quality of the research for Uruguayan

economists. To test it, we classify all non-local coauthors as northern or southern researchers, depending on the location of their first institution of affiliation.

Although we are not able to claim causality as we cannot perfectly control for cofounding abilities, our research is illustrative about the importance of international research collaboration for small research communities in developing countries. Our results confirm the positive and significant association between research collaboration and research output measured by several indicators of the impact of publications. We also find that research networks with other researchers from the South do not yield the same results. The underlying explanation for these differential results may lie in research competencies, professionalization in the publication process, or other factors; these aspects deserve further research.

1. Research performance and collaboration

The link between the performance of a researcher and her or his research networks is complex. The first complexity derives from how to measure research performance. At present, the mainstream form of evaluation of academic research trusts the process of peer review and considers bibliometric methods to proxy the quality of research. Academics' achievements are judged by the number of publications, emphasizing publications in journals that are considered more prestigious. The quality of publications is usually assessed based on where an article gets published, referring to a classification of the journal, or the article's impact in the academic community, as reflected by the number of citations it receives. The limitations and distortions that these metrics may create in a hypercompetitive environment are being discussed at present for all sciences (see for example Fire & Guestrin, 2019; Paulus et al, 2015; 2018), and to some extent, also concerning Economics (Heckman & Moktan, 2020; Hammermesh, 2021). However, most studies, including ours, rely on the abovementioned metrics to proxy research quality, probably because of the current state of the art and the mainstream practices.

A second complexity derives from the unclear causal link between research collaboration and research performance. On the one hand, we may argue that collaboration is the result of a process that depends on the ability of researchers, leading to assortative matching (Fafchamps et al., 2010). Institutions affect this process because they differ in characteristics such as resources and academic environment. In developing countries, most academic institutions are weak. So we

may expect that ability gaps between researchers gain importance in the matching process. In other words, being a higher-performance researcher in a developing country may enhance the likelihood of entering international collaboration, particularly with researchers in the North.

Another reason for a sorting ability matching comes from costs of research collaboration, especially when it involves international networks. Mainly because collaboration is time-consuming in terms of coordination, we may expect that costs reduce research performance, though it is reasonable to assume that technological advances have lowered them. In any case, they may induce a selection of international coauthors oriented towards maximization of productivity, implying that best performance researchers would have a higher probability of engaging in research collaborations.

On the other hand, we expect that research collaboration improves outcomes for several reasons. It allows better knowledge creation through the combination of different academic profiles and expertise. Besides, it gives access to critical knowledge and practices that are tacit and derive from collective experience. It also permits access to more resources or richer data and allows a convenient division of labor among collaborators, leading to more efficient use of time. Finally, by overcoming intellectual isolation, it acts as a motivation to researchers in their work which is reinforced by shared responsibility. In developing countries with small academic

reputation by increasing the diffusion and visibility of her work. The reputation of a communities, these reasons may be more critical because of the weakness of local environments.

Besides, at least two issues make more complex measuring the effect of international collaboration in the research performance of developing countries performance. As long as partnership has a positive effect on the research performance, it may also favor researcher's researcher influences her possibilities of publication and increases the propensity of citations. Thus, the reputation channels reinforce the link between collaboration and measures of research performance (Abramo, 2017). This phenomenon could be significant in developing countries if international networks facilitate the entrance to the North's academic audiences.

Secondly, researchers expect benefits from entering international collaboration. In the case of the social sciences, specific scientific and contextual knowledge and access to rich and novel data could be attractive features for researchers from developed countries. In turn, researchers

in developing countries may be searching to learn about the academic publishing process and other relevant research outputs. Besides, researchers may enter international collaboration in the search of budget provided by grant programs that encourage or favor international networks.

Many studies document that scientific collaboration exerts a positive influence on researchers' performance. For the case of American universities, collaboration among scientists influences scientific productivity in terms of publications (Lee & Bozeman, 2005; Adams et al., 2005), probably due to a greater division of labor within larger research teams. The distinction between domestic and international collaboration appears in more recent work. For example, He et al. (2009), based on a panel of 65 biomedical scientists over 14 years, distinguish between international collaboration, domestic collaboration, and within university collaboration. At the article level, their results indicate that within-university and international collaboration are positively related to articles' quality (proxied by the impact factor of the journal or citations). International collaboration is also more positively related to future research output than domestic or within-university collaboration at the scientist's level. Their results also suggest that the causal relationship goes from international collaboration to research output. Evidence about the positive link between academic collaboration and research output is also reported in Abramo et al (2009), Chung et al (2009), among others.

Some studies address collaboration and the quality of research in Economics. For Italy, Aldieri et al. (2019) show that international collaborations have a high impact on research quality, and the effect is stronger than that of national (external to the institution) collaborations. The authors use the number of grants as instruments for the endogeneity of the collaboration variable. For French economists, Besacento et al. (2017) confirm a positive and robust relationship between individual productivity and the quality of academic networks. They consider that the best quality paper published alone by an academic is a good measure of individual skills, and use this variable as an instrument to control for endogeneity between collaboration and productivity. Their findings also indicate that the quality of coauthor networks is a function of individual productivity. Moreover, individual productivity is an important determinant of the quality of coauthor networks, but not the quantity.

Some studies find no significant or negative effects from collaboration on research output. Medoff (2003) empirically tests if collaboration by economists produces higher quality research

than sole-authored research. The study does not distinguish domestic or international collaboration. Results indicate that -controlling for article length, journal, and author quality, and subject area-, collaboration does not result in significantly higher quality research (as measured by the number of citations an article receives) in economics. In their study for Italian researchers in all disciplines excluding social science and humanities, Abramo et al. (2017) find that the propensities to collaborate at the intra-university or domestic levels have a positive and significant impact on research productivity, while the propensity to collaborate at the international level has no significant impact at the overall level, although positive effects of international collaborations are found in specific fields (Biology, Mathematics and Computer Science). This is consistent with Hamermesh and Oster's (2002) argument about the lower productivity, in terms of subsequent citations, of distant coauthors as compared to close coauthors. They argue that scientific collaborations may not only respond to strategic behavior, but to a willingness to keep an academic relationship, being welfare increasing without increasing productivity.

The arguments developed in the literature to consider international collaborations do not, in general, address the issue of collaborations between scholars with different backgrounds, meaning different reputations or experiences, or different academic environments. An exception is Bhattacharya et al (2015), who find that international collaboration, through international co-authorship, has been an important contribution to the increase in academic publications from India. Bidault and Hildebrand (2014) explore the distribution of returns between coauthors endowed with asymmetric resources, measured in terms of scientific experience. They observe differences between junior and senior researchers but do not analyze geographical differences. In our case, we consider that the characteristics of the networks are important in terms of potential impacts on research productivity. Research competencies and access to resources are differentials between regions, and so the potential synergies of network collaboration may also depend on the conformation of the network.

The role of international research networks has been scarcely analyzed in the region and Uruguay. For the social sciences in general, Aguado-López & Becerril-García (2016) show the increase in the academic collaboration as a publishing strategy in Latin America, but the role of national and international networks is scarcely considered. In their bibliometric study of

academic production in Iberoamerican countries (Argentina, Brazil, Chile, Mexico, Venezuela, Spain, and Portugal), Cardoza and Fornes (2009) find that academic collaboration and participation in international co-operation networks allow researchers based in Ibero-American countries to research advanced topics and also to reach the degree of excellence. Likewise, for Brazil, the study of patterns of academic collaboration has shown that international cooperation increases the impact of publications by Brazilian researchers (Leta and Chaimovich, 2002). In a recent study of the case of Colombia, Ordoñez et al. (2020) found that collaborating with partners from the South yields the greatest impact on team productive capacity, in terms of bibliographic products, and the relationship in the case of collaboration with Northern researchers is not significant.[1]

In the case of Uruguay, the research performance of economists has been analyzed by Amarante et al. (2021) who show that there is a gender gap in academic production, and suggest that non-local partnership may explain part of this gap, as a partnership with non-local authors is more likely among men.

2. Data and method

2.1 Data

Our database covers the academic production of Uruguayan economists. The departure point was the elaboration of a list of academic researchers in Economics in Uruguay. This list includes all economists in a bibliographical database conceived by the Department of Economics, Faculty of Social Sciences, Universidad de la República in 2004.[2] It also includes all current active researchers from the main academic institutions in Uruguay (data collected in 2019). For this group of researchers in Economics, we identified all their journal publications in a

[1] With a different perspective, other strand of literature has pointed out that collaboration between researchers in the North and in the South may entail the reorientation of research to comply with Northern agendas, whereas South-South collaboration may increase focus on local affairs, leading to a relatively small number of scientific international publications in high quality journals (Ordoñez et al., 2020).

[2] At that time, online bibliographical repositories were unusual, so existing research from Uruguayan economists was scattered in different libraries. This database was conceived to solve that problem. It mainly contains working papers and technical documents (see Amarante et al., 2021).

bibliographical portal that allows access to publications included in Jstor, Scopus, EBSCO, Springer, Scielo, Directory of Open Access Journals, among others. This portal is named Timbo and is provided by the *Agencia Nacional de Investigación e Innovación* (ANII) in Uruguay.[3] After we found the production of each one of these Uruguayan researchers, we identified their coauthors and looked for their production when they were Uruguayan residents. We repeated the process until we could not find any more researchers in Economics with their primary affiliation corresponding to an Uruguayan institution. . We have information about the title of each article, the journal where it was published, the year of the publication, the names of the authors, and the JEL classification. This database comprises publications from 1980 to march 2021. For our present analysis, we consider publications since 1996 because the indexes used to rank journals are not available before. Our database then comprises 689 articles, 597 authors (342 of them reporting an Uruguayan institution as their main affiliation), and 340 journals.

We manually gendered-coded all authors included in the database. We also manually classified them as local researchers or not. The concept of local or non-local researcher reflects if the researcher's main institution at the moment of publication is located in Uruguay or not. So being a local researcher does not coincide with being Uruguayan. If at the date of publication, the Uruguayan researcher is located outside Uruguay (as reflected by the geographical location of her main institution), he will be considered a non-local researcher. In turn, a non-Uruguayan residing in Uruguay is regarded as a local researcher. In the case of non-local researchers, we manually codified if their institution is located in the global South or the North. For each article that involves international collaboration, we calculate the ratio between non-local authors and total authors.

For each journal, we add the region, ISSN and EISSN, extracting this information from the Scimago database and the ISSN Portal. In search of measuring the impact or quality of publications, we included ranking classifications of journals according to SJR, the SNIP, and

[3] https://foco.timbo.org.uy/home

the CiteScore (percentile).[4] As these three indicators correspond to the journal, so they do not characterize the specific article.

The SJR is provided by Scopus and expresses the average number of weighted citations received by the documents published in the selected journal in the three previous years. In addition, the metric considers the prestige of the citing journal, determined by the number of its citations (iterative process). The calculation excludes self-citations, assigns a higher value to citations from more prestigious journals, and is normalized to account for differences between disciplines (Guerrero-Bote & Moya-Anegón, 2012).[5] We attribute to each article of our database the SJR of the journal in March 2018.

The SNIP reflects the ratio of a journal´s average citation count and 'citation potential'. Citation potential is measured as the number of citations that a journal would be expected to receive for its subject field. The longer the reference list of a citing publication, the lower the value of a citation originating from that publication. This implies that the SNIP also allows for direct comparison between fields of research with different publication and citation practices.

The CiteScore is based on the number of citations received by a journal to documents published in the latest four years (including the calculation year), divided by the number of documents published in the same period. It is relevant to notice that CiteScore is a metric without field formalization, so the comparison between different subject fields is not advisable as citation practices across disciplines affect the values of the metrics. For example, in biomedical fields, the lists of references then to be longer, with more than 50 items being a common practice, whereas in social sciences and economics, the standard practice implies fewer references. The major part of the journals that we are considering correspond to Economics or Social Sciences. But there are some publications in our database by local researchers who published in journals belonging to other subject areas (mainly Mathematics, Business, and Medicine). For this reason,

[4] SJR and SNIP were downloaded from Scimago database avaliable in: https://www.scimagojr.com. CiteScore ranking is available in Scopus: https://www.scopus.com/sources.

[5] The SJR addresses the problem of comparisons between disciplines, whereas the extended Impact Factor does not take into account that different research fields have different citations rates, with lower citations in Engineering, Social Sciences and Humanities (Guerrero-Bote& Moya-Anegón, 2012).

we opted for the CiteScore percentile, which indicates the relative standing of a journal in its subject field. We choose the CiteScore percentile corresponding to the first subject area in which the journal is indexed in Scopus. It has been shown that this metric is suitable for comparing the citation impact of titles in different fields (Colledge et al., 2017).

We also consider as a dependent variable the number of citations of the article, which was manually obtained, for all articles in our database, from the Dimensions portal.[6] This measure reflects the true impact of the publication, unlike the previous three that hide the heterogeneity of publications of the same journal (see Hammermesh, 2021).

Finally, we included each researcher's H-index reported by REPEC portal to measure individuals' productivity.[7] This is collected at a certain point and so is an imperfect approximation to the scientist's ability or productivity.

It is worth noting that a relatively important percentage of articles in our database are published in journals that are not included in SJR or Scopus, or in the Dimensions database. In fact, around 30% of articles included in our database are not classified according to SJR or individual citations, whereas for Scopus database almost half of the articles are not classified (table A.1 in the Appendix). As expected, exclusion from rankings is especially important for articles published in Latin American journals. The underrepresentation of Latin American journals in the mainstream databases has already been noticed in the literature and constitutes a constraint as it leads to a limited vision concerning total scientific production (Collazo Reyes et al., 2008).[8] The reasons why these journals are not indexed in Scopus probably include but are not restricted to quality issues; other factors such as willingness from regional editorial boards to promote indexation or the low value of indexation at the local or regional level may also operate. In the Latinamerican case, publication in quality journals is still not extended as a requirement for

[6] See https://www.dimensions.ai/

[7] This information was collected in April 2021 from CitEc: http://citec.repec.org/p/index.html. For authors that did not have a profile in REPEC, we consider the H index as cero

[8] These authors also report, considering all disciplines, very little inter-citation between Latin American scientists: regional researchers were not aware of, or chose not to cite papers from neighboring countries.

tenure or work stability, so the incentive for these publications is still not widespread as in other regions. Finally, it is important to notice that we are aware that good quality national or regional publications not covered by Scopus (including books and chapters) may be influential for economic policy discussions at the country level, so their exclusion constitutes a limitation of our analysis.

2.2 Method

We estimate the link between the impact of publications and the integration of international networks for Uruguayan economists using the following model (articles are the unit of analysis):

$$Y_{\mathrm{i}} = \beta_0 + \beta_1 Net_{it} +_{\mathrm{i}} \beta_2\ Gc_{\mathrm{it}} +\ \beta_2 Pr_{\mathrm{i}} + \beta_3 Nr_{\mathrm{it}} + \mu_i + \gamma_t + e_{\mathrm{it}}$$

The variable *Y* is the impact of publication *i* measured alternatively by the Scimago Journal Rank (SJR), the Source Normalized Impact per Publication (SNIP), the CiteScore percentile, and the number of citations of the article.

The variable *Net* reflects the characteristics of the international research network. Thus, the estimated coefficient β_1 is our parameter of interest. We consider two definitions of research networks. First, we build a binary variable that takes the value 1 if the publication was written by local authors in collaboration with non-local authors, indicating the presence of an international network.

In the second definition we distinguish between articles written only by local authors, those written by local authors and at least one author located in northern countries, and finally those articles written by local authors and researchers in southern locations. By including this set of dummies, we attempt to explore the potential differential nature and impacts of international networks.

These categorical classifications may be problematic because an article classified as internationally coauthored may be written by a team of almost all non-local researchers, or the opposite, it may well have more local collaborators than international ones. For this reason, we also estimated the equation considering the composition of the team as proportions, instead of

binary variables. Based on of the first definition of research networks, we calculated the proportion of non-local authors among total authors. For the second definition of research networks, we consider two variables. One reflects the proportion of northern authors in total authors and the other, the proportion of southern authors.

Our estimations include controls that reflect the gender composition of the team (*Gc)*, measured as the proportion of women in authors; the mean productivity of local researchers (*Pr*), based on the H Index of each author, and the number of authors (*Nr*) captured in dummy variables (single author articles, articles written by 2 to 4 authors, and articles written by 5 or more authors). We also include controls for JEL codes and five-year-periods dummies for the year of publication.

We run OLS regressions. When the dependent variable reflects the article's citations, we follow Card and DellaVigna (2013) and consider the logarithm of citations plus 1 as a dependent variable to not drop publications with no citations, which represent 14,8% in our database. For citations (which only take zero or positive values), we also estimate a negative binomial model (presented in the Appendix), given the over-dispersed nature of the variable (the variance is larger than the mean).

As robustness checks, we re-estimate the regressions imputing zero to the observations with missing in the dependent variable using a Tobit model (presented in the Appendix) and we also re-estimate our regressions excluding articles written by single Uruguayan economists.

3. Results

3.1 Publications from Uruguayan economists: descriptive analysis

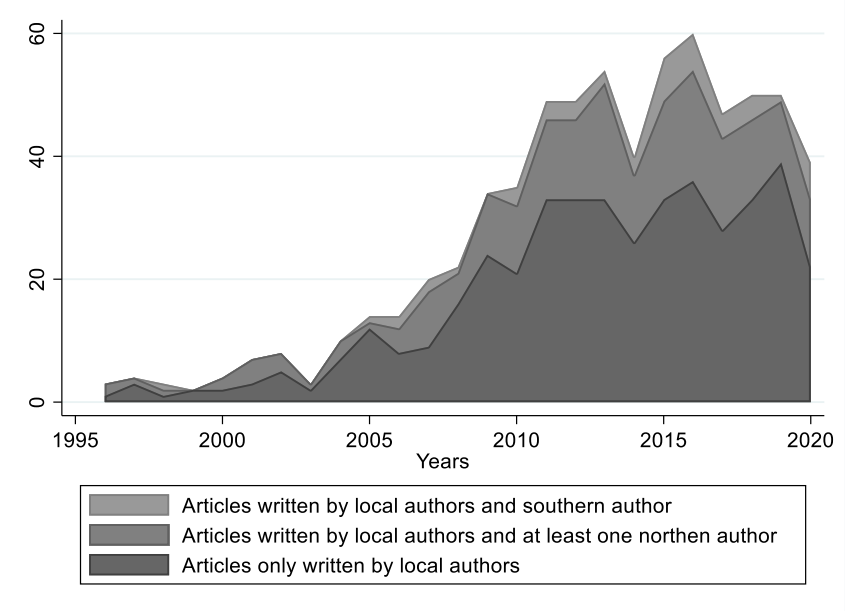
Some basic statistics illustrate the characteristics of publications in Economics from Uruguayan researchers. These publications have increased in time, adding to 16 between 1996 and 2000, 167 between 2001 and 2010, and 506 between 2011 and 2021.[9] This implies an average of 3 per year in the first period, 17 in the second, and 46 in the third. The bulk of the publications in our analysis correspond to the last decade (73%). This evolution reflects the relevant transformation undergone by the Uruguayan economics academia in the period, as the system has introduced

[9] Articles published during 2021 are not included in the figures, as we do not have the complete year.

bibliometric standards to evaluate an individual's performance. A similar increasing path in publications in Economics from researchers with Latin American affiliation is detected by Bonilla et al. (2015), who underline the relatively good regional results of Uruguay (jointly with Costa Rica) in per capita terms.

The importance of collaborations with northern researchers has increased in absolute terms, although it decreased in relative terms, going from 37.5% in the first period, 30.6% in the second, and 28.3% after 2010. For collaborations with southern researchers, the corresponding relative participation is 6.3%, 5.4%, and 8.1% in each period. A year-by-year analysis displays this pattern more clearly, suggesting a relative constant distribution of types of authorship during the last decade (Figure 1).

Figure 1. Publications from Uruguayan economists by network type. 1996-2020



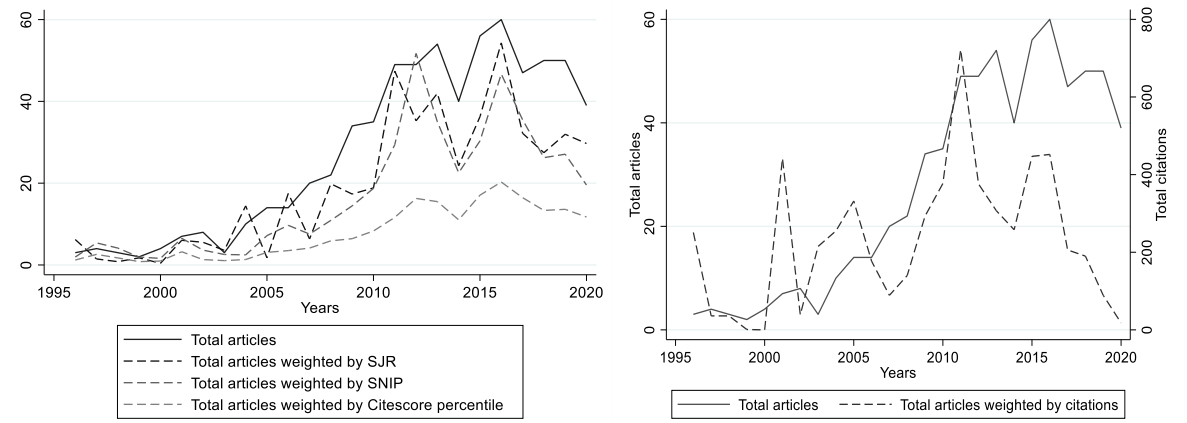
Source: own elaboration based

In terms of the impact or quality of the publications, the evolution has been similar to the total number of articles when analyzed through SJR or SNIP, with a maximum around 2015 and a decreasing trend in the last years (Figure 2). Movements are smoother when the Citecore Percentile is used as a weight. Again, it is important to notice that when weighting by SJR or SNIP we are losing a significant proportion of articles in our database, which are published in journals not included in these rankings (mainly Latin American Journals, see table A.1). When

weighted by article citations, the inverse U-shaped pattern of the citation counts reflects lower citations for more recent articles, which have had less time to be cited by others.

Figure 2. Publications from Uruguayan economists by network type. 1980-2020

a. Weighted by journal rankings b. Weighted by individual citations



Source: own elaboration

The most frequent destinations of the research production of Uruguayan economists are European and Latin American journals (46% and 39% respectively), followed by journals from the USA (14%) and other areas (see Table 1). But the importance of destination varies depending on whether there is a non-local researcher among coauthors. Latin American journals take account of 51% of articles when written only by local authors; this share declines to 39% for Europe and is only 10% for the USA. In the case of non-local partnerships, Latin American journals' share falls to 19%, whereas the share of European and American journals increases to 58% and 22%, respectively. The association of local authors with non-local researchers located in northern or southern institutions depicts different patterns: collaborating with northern authors has a bigger impact on the share of publication in Europe and EUA than the association with southern authors.

Table 1. Distribution of articles by journal location

	Latin America	EUA	Europe	Other areas	All
Unit of analysis: articles					
All	39,3	14,2	45,7	0,7	100,0
By only local authors	50,9	9,6	38,8	0,7	100,0
By at least 1 non-local author	19,1	22,3	57,8	0,8	100,0
By at least 1 non-local author (northern)	16,0	23,0	60,0	1,0	100,0
By at least 1 non-local author (southern)	31,4	19,6	49,0	0,0	100,0

Source: own estimations

3.2 The role of networks

To explore the role of international collaborations on the impact of publications from Uruguayan researchers, we first estimate equation (1) by Ordinary Least Squares (OLS), considering different metrics to reflect the impact of the publications (table 2). Our dependent variables are the value of the journal's article in SJR rank (column 1), its value in SNIP (column 2), the Citescore percentile of the journal's article (column 3), and the logarithm of the number of citations of the article plus one (column 4). The first three measures reflect the journal's impact whereas the fourth one is a direct proxy of the article's impact.

Our estimations indicate that those articles written by international research networks have a better result in the four measures of impact or productivity considered, with a 99% level of significance. International collaboration is associated with publication in higher-ranked journals, according to SJR, SNIP, and CiteScore percentile, and it is also associated with a higher number of citations for the article. In Table A2 in the Appendix, we run the same regressions but international collaboration is reflected by the ratio of non-local to total authors (instead of a binary variable). Results regarding the positive and significant association between international collaboration, in this case, reflected by a higher proportion of non-local researchers among authors, remain unchanged. In general terms, these results confirm our first hypothesis about the positive correlation between collaboration with researchers living abroad and the impact or quality of research for researchers in a developing country.

Concerning the control variables, the proportion of women in authors is not related to the impact of the publications. Besides, the mean productivity of the local authors (measured at one point in time) is positively correlated with the SJR ranking and the CiteScore percentile of the journal of publication and with the number of citations of the article. In addition, the number of authors has no effects. So, the common result about coauthored articles receiving more citations and the "teamwork advantage" of co-authorship (Wuchty et al, 2007; Hagan and Kuld, 2020; among others) does not hold for our database.

Table 2. OLS regression. Dependent variable: impact of the publication (SJR, SNIP, Citescore percentile, citations).

	(1)	(2)	(3)	(4)
VARIABLES	SJR	SNIP	CiteScore percentile	ln(citations+1)
International network	**0.813*** **	**0.500*** **	**13.35*** **	**0.749*** **
	(0.194)	**(0.140)**	**(3.694)**	**(0.123)**
Proportion of women	-0.157	-0.0996	-4.408	-0.0310
	(0.250)	(0.150)	(4.489)	(0.146)
Productivity of local authors	0.0807**	0.0296	1.616***	0.0426**
	(0.0345)	(0.0198)	(0.503)	(0.0178)
Number of co-authors:				
Between two to four authors	-0.443	-0.0540	1.180	0.225
	(0.276)	(0.131)	(4.301)	(0.139)
Five or more authors	0.379	2.075	-10.02	-0.0142
	(1.367)	(2.425)	(12.04)	(0.382)
Constant	0.828	1.197***	54.98***	1.256**
	(0.605)	(0.342)	(10.19)	(0.487)
Observations	477	354	360	485
R-squared	0.098	0.118	0.203	0.294

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations

To explore the potential role of different international collaborations, we distinguish two types of networks: those involving collaboration with at least one researcher based on a northern institution and those involving collaborations with researchers based on southern institutions. As table 3 depicts, the positive association found above, with all measures, is only present in the case of networks involving northern researchers. Indeed, the association with southern-based

researchers is not statistically different from having no international collaboration (omitted variable). When the estimations include the proportion of coauthors from northern or southern institutions, this result remains: only the proportion of northern coauthors is significantly associated with the impact of publications (Table A3 in the Appendix). Results regarding the control variables remain unchanged except that the productivity of local authors is positively correlated to the impact of publications (except in the case of SNIP ranking).

Table 3. OLS regression. Dependent variable: impact of the publication (SJR, SNIP, CiteScore percentile, citations). Role of northern and southern networks

	(1)	(2)	(3)	(4)
VARIABLES	SJR	SNIP	CiteScore percentile	ln(citations+1)
Northern network	**0.869*** **	**0.590*** **	**17.23*** **	**0.921*** **
	(0.208)	**(0.149)**	**(3.707)**	**(0.129)**
Southern network	**0.583**	**0.122**	**-2.828**	**0.0685**
	(0.443)	**(0.275)**	**(6.558)**	**(0.191)**
Proportion of women	-0.172	-0.143	-6.260	-0.0843
	(0.248)	(0.152)	(4.475)	(0.144)
Productivity of local authors	0.0815**	0.0306	1.670***	0.0455***
	(0.0348)	(0.0199)	(0.501)	(0.0176)
Number of co-authors:				
Between two to four authors	-0.448	-0.0650	0.690	0.204
	(0.277)	(0.132)	(4.296)	(0.138)
Five or more authors	0.374	2.048	-9.815	-0.0255
	(1.364)	(2.420)	(11.85)	(0.366)
Constant	0.838	1.218***	55.78***	1.262***
	(0.603)	(0.333)	(9.446)	(0.481)
Observations	477	354	360	485
R-squared	0.099	0.125	0.230	0.323

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations

In the case of article citations, we also estimated our model using a Negative Binomial Model, with the number of citations as the dependent variable.[10] In the same way as in the OLS's estimations, we added controls for JEL codes and period of publication. The results are shown in Table A.4 in the Appendix, for the two definitions of networks, and considering alternatively binary variables and the proportion of non-local authors. These results confirm the positive and significant association of the impact of publications with the presence of northern researchers.

As robustness checks, we re-estimate the regressions imputing zero to the observations with missing in the dependent variable using a Tobit model (tables A.5 and A.6 in the Annex). We also re-estimate our regressions excluding articles written by single Uruguayan economists, as they may generate fewer citations and maybe drive our results (tables A.7 and A.8 in the Annex). Our main results and conclusions remain unchanged.

Final remarks

Our findings indicate that researchers living in a developing country get a higher impact or quality of their research when involved in international collaborations involving researchers located in northern countries. Indeed, knowledge sharing with northern researchers has allowed Uruguayan economists to gain greater visibility or impact of their work, at least in terms of the quality of citations of their publications. Our findings do not necessarily and only respond to the fact that collaboration with northern researchers implies an advancement of the academic capacity of local researchers. As northern researchers have experience in the publication process, local researchers may improve local researchers' access to well-ranked journals. Besides, local researchers may benefit from extending their audience, especially to other northern researchers.

Our results suggest that policies that strengthen the capacity to collaborate at the international level may help local economists to achieve a higher impact on their publications and build a stronger academic career according to international standards. Support for the creation of international networks for sharing knowledge and openness from local universities towards other international academics may help researchers in developing countries to gain visibility of their research and improve the quality of their publications, and hopefully improve research

[10] We tested a Poisson Model also, but the Negative Binomial fits better owing to overdispersion.

quality at the national level. National researchers' collaboration with colleagues living in other countries can be set as a desired outcome of national research policies. A question to focus on in future research is how much migration of researchers from developing countries increases the likelihood of international collaboration.

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Appendix

Table A1. Distribution of articles published in ranked or non-ranked journals

	SJR		Scopus database		Citations	
	Freq.	%	Freq.	%	Freq.	%
Publicaations in Latin America jorunals						
Articles with information	115	42,4%	95	35,1%	128	47,2%
Articles without information	156	57,6%	176	64,9%	143	52,8%
Total	271	100,0%	271	100,0%	271	100,0%
UEA journals						
Articles with information	86	88%	58	59%	86	88%
Articles without information	12	12%	40	41%	12	12%
Total	98	100%	98	100%	98	100%
European journals						
Articles with information	275	87,3%	206	65,4%	272	86,3%
Articles without information	40	12,7%	109	34,6%	43	13,7%
Total	315	100,0%	315	100,0%	315	100,0%
Journal from other areas						
Articles with information	5	100,0%	3	60,0%	3	60,0%
Articles without information	0	0,0%	2	40,0%	2	40,0%
Total	5	100,0%	5	100,0%	5	100,0%
All publications						
Articles with information	481	69,8%	362	52,5%	489	71,0%
Articles without information	208	30,2%	327	47,5%	200	29,0%
Total	689	100,0%	689	100,0%	689	100,0%

Source: own estimations

Table A2. OLS regression. Dependent variable: impact of the publication (SJR, SNIP, CiteScore percentile, citations). Role of international networks.

VARIABLES	(1) SJR	(2) SNIP	(3) CiteScore percentile	(4) ln(citations+1)
% of non local authors	**1.318*** **	**0.569***	**22.01*** **	**1.386*** **
	(0.396)	**(0.321)**	**(6.366)**	**(0.221)**
Proportion of women	-0.199	-0.154	-5.074	-0.0454
	(0.251)	(0.158)	(4.459)	(0.144)
Productivity of local authors	0.0842**	0.0337*	1.662***	0.0445**
	(0.0348)	(0.0194)	(0.501)	(0.0176)
Number of co-authors:				
Between two to four authors	-0.399	0.0428	1.700	0.221
	(0.286)	(0.129)	(4.272)	(0.139)
Five or more authors	0.442	2.243	-10.20	-0.0287
	(1.503)	(2.610)	(13.30)	(0.401)
Constant	0.873	1.262***	56.00***	1.286***
	(0.601)	(0.340)	(10.17)	(0.487)
Observations	477	354	360	485
R-squared	0.094	0.106	0.201	0.302

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations

Table A3. OLS regression. Dependent variable: impact of the publication (SJR, SNIP, CiteScore percentile, citations). Role of northern and southern networks.

VARIABLES	(1) SJR	(2) SNIP	(3) CiteScore percentile	(4) ln(citations+1)
% of northen authors	**1.487*** **	**0.842*** **	**31.20*** **	**1.764*** **
	(0.420)	**(0.287)**	**(6.376)**	**(0.235)**
% of southern authors	**0.719**	**-0.395**	**-9.173**	**0.0742**
	(0.953)	**(0.733)**	**(12.63)**	**(0.374)**
Proportion of women	-0.219	-0.210	-6.915	-0.105
	(0.249)	(0.161)	(4.467)	(0.142)
Productivity of local authors	0.0846**	0.0335*	1.668***	0.0445**
	(0.0350)	(0.0194)	(0.499)	(0.0177)
Number of co-authors:				
Between two to four authors	-0.401	0.0397	1.491	0.211
	(0.286)	(0.128)	(4.256)	(0.137)
Five or more authors	0.602	2.489	-0.631	0.291
	(1.541)	(2.654)	(13.77)	(0.381)
Constant	0.883	1.289***	56.76***	1.280***
	(0.599)	(0.329)	(9.413)	(0.480)
Observations	477	354	360	485
R-squared	0.097	0.120	0.231	0.332

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations

Table A.4. Dependent variable: number of citations. Negative binomial

	Article's citations			
VARIABLES	(1)	(2)	(3)	(4)
Net 1:				
International network	**1.157*** **			
	(0.156)			
% of non local authors		**2.019*** **		
		(0.273)		
Net 2:				
Northern network			**1.291*** **	
			(0.158)	
Southern network			**0.315**	
			(0.271)	
% of northern authors				**2.322*** **
				(0.283)
% of southern authors				**0.406**
				(0.518)
Proportion of women	0.0391	0.0145	-0.00163	-0.0477
	(0.202)	(0.199)	(0.200)	(0.199)
Productivity of local authors	0.0210	0.0300	0.0285	0.0329
	(0.0232)	(0.0239)	(0.0233)	(0.0239)
Number of co-authors:				
Between two to four authors	0.127	0.158	0.0996	0.138
	(0.212)	(0.209)	(0.213)	(0.211)
Fiveor more authors	-0.00497	0.312	-0.133	0.449
	(0.510)	(0.511)	(0.483)	(0.496)
Constant	2.329***	2.348***	2.254***	2.310***
	(0.598)	(0.611)	(0.578)	(0.598)
ln(alpha)	0.471***	0.466***	0.436***	0.429***
	(0.0673)	(0.0671)	(0.0689)	(0.0686)
Observations	485	485	485	485

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations

Table A5. Tobit model. Dependent variable: impact of the publication (SJR, SNIP, CiteScore percentile, citations). Role of international networks.

	SJR		SNIP		CiteScore percentile		ln(citations+1)	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
International network	**0.753*** **		**0.480*** **		**15.26*** **		**0.887*** **	
	(0.149)		**(0.107)**		**(3.130)**		**(0.106)**	
% of non local authors		**1.292*** **		**0.751*** **		**29.63*** **		**1.601*** **
		(0.262)		**(0.189)**		**(5.465)**		**(0.186)**
Proportion of women	-0.0320	-0.0513	0.116	0.0949	3.626	3.668	-0.158	-0.171
	(0.178)	(0.177)	(0.128)	(0.128)	(3.727)	(3.700)	(0.127)	(0.126)
Productivity of local authors	0.0876***	0.0898***	0.0379**	0.0401**	2.030***	2.035***	0.0625***	0.0641***
	(0.0220)	(0.0220)	(0.0158)	(0.0158)	(0.461)	(0.458)	(0.0157)	(0.0156)
Number of co-authors:								
Between two to four authors	-0.215	-0.192	-0.0121	0.0219	2.239	1.850	0.269**	0.277**
	(0.161)	(0.160)	(0.116)	(0.115)	(3.379)	(3.336)	(0.115)	(0.113)
Five or more authors	-0.232	-0.186	0.215	0.277	-15.91**	-16.48**	-0.239	-0.219
	(0.351)	(0.349)	(0.253)	(0.252)	(7.362)	(7.285)	(0.250)	(0.248)
Constant	0.459	0.488	0.948***	0.973***	41.43***	41.71***	0.992***	1.019***
	(0.489)	(0.489)	(0.351)	(0.352)	(10.24)	(10.19)	(0.347)	(0.346)
var(e.sjr0)	2.395***	2.399***						
	(0.130)	(0.130)						
var(e.cs_snip0)			1.238***	1.245***				
			(0.0669)	(0.0673)				
var(e.cs_percentile0)					1,051***	1,042***		
					(56.82)	(56.37)		
var(e.ln_citations1_0)							1.211***	1.203***
							(0.0655)	(0.0651)
Observations	684	684	684	684	684	684	684	684

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations

Table A6. Tobit model. Dependent variable: impact of the publication (SJR, SNIP, CiteScore percentile, citations). Role of northern and southern networks.

	SJR		SNIP		CiteScore percentile		ln(citations+1)	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Northen network	**0.820*** **		**0.555*** **		**18.24*** **		**1.033*** **	
	(0.158)		**(0.114)**		**(3.300)**		**(0.111)**	
Southern network	**0.495** **		**0.193**		**3.758**		**0.325***	
	(0.252)		**(0.181)**		**(5.246)**		**(0.177)**	
% of northen authors		**1.468*** **		**0.920*** **		**35.48*** **		**1.989*** **
		(0.289)		**(0.208)**		**(6.006)**		**(0.202)**
% southern authors		**0.758***		**0.236**		**11.82**		**0.423**
		(0.454)		**(0.327)**		**(9.443)**		**(0.317)**
Proportion of women	-0.0482	-0.0710	0.0984	0.0759	2.903	3.012	-0.193	-0.214*
	(0.178)	(0.178)	(0.128)	(0.128)	(3.717)	(3.697)	(0.125)	(0.124)
Productivity of local authors	0.0879***	0.0892***	0.0383**	0.0396**	2.043***	2.018***	0.0631***	0.0630***
	(0.0220)	(0.0220)	(0.0158)	(0.0158)	(0.459)	(0.457)	(0.0155)	(0.0153)
Number of co-authors:								
Two to four authors	-0.220	-0.195	-0.0175	0.0188	2.021	1.744	0.258**	0.270**
	(0.161)	(0.160)	(0.116)	(0.115)	(3.362)	(3.324)	(0.113)	(0.112)
Five or more authors	-0.247	-0.0973	0.198	0.362	-16.60**	-13.53*	-0.273	-0.0244
	(0.351)	(0.354)	(0.252)	(0.255)	(7.327)	(7.368)	(0.247)	(0.248)
Constant	0.470	0.495	0.960***	0.980***	41.89***	41.96***	1.015***	1.036***
	(0.488)	(0.488)	(0.350)	(0.351)	(10.18)	(10.15)	(0.344)	(0.341)
var(e.sjr0)	2.389***	2.392***						
	(0.129)	(0.129)						
var(e.cs_snip0)			1.231***	1.238***				
			(0.0666)	(0.0670)				
var(e.cs_percentile0)					1,039***	1,034***		
					(56.21)	(55.93)		
var(e.ln_citations1_0)							1.184***	1.168***
							(0.0640)	(0.0632)
Observations	684	684	684	684	684	684	684	684

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Note: estimations include controls for JEL and period of publication

Source: own estimations

Table A7. OLS regression. Dependent variable: impact of the publication (SJR, SNIP, CiteScore percentile, citations). Role of international networks (excluding single author articles).

VARIABLES	(1) SJR	(2) SNIP	(3) CiteScore Percentile	(4) ln(citations+1)
International network	**0.816*** **	**0.526*** **	**14.03*** **	**0.771*** **
	(0.203)	**(0.156)**	**(3.843)**	**(0.127)**
Proportion of women	0.0539	0.0457	-4.291	0.0146
	(0.287)	(0.231)	(6.072)	(0.194)
Productivity of local authors	0.0801*	0.0281	1.260**	0.0236
	(0.0436)	(0.0266)	(0.586)	(0.0203)
Number of co-authors:				
Five or more authors	0.843	2.187	-12.53	-0.223
	(1.360)	(2.497)	(11.49)	(0.339)
Constant	0.0309	0.741**	44.79***	1.671**
	(0.460)	(0.374)	(11.76)	(0.746)
Observations	381	278	280	384
R-squared	0.126	0.125	0.194	0.305

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations

Table A8. OLS regression. Dependent variable: impact of the publication (SJR, SNIP, CiteScore percentile, citations). Role of northern and southern networks without articles written by only one author.

	(1)	(2)	(3)	(4)
VARIABLES	SJR	SNIP	CiteScore Percentile	ln(citations+1)
Northen network	**0.862*** **	**0.600*** **	**17.69*** **	**0.937*** **
	(0.219)	**(0.162)**	**(3.839)**	**(0.132)**
Southern network	**0.615**	**0.164**	**-3.338**	**0.0736**
	(0.434)	**(0.279)**	**(6.623)**	**(0.198)**
Proportion of women	0.0269	-0.0404	-8.524	-0.0932
	(0.279)	(0.236)	(5.985)	(0.193)
Productivity of local authors	0.0813*	0.0307	1.395**	0.0273
	(0.0441)	(0.0266)	(0.579)	(0.0199)
Number of co-authors:				
Five or more authors	0.844	2.181	-11.29	-0.214
	(1.360)	(2.501)	(11.50)	(0.319)
Constant	0.0456	0.774**	46.18***	1.701**
	(0.442)	(0.358)	(10.48)	(0.730)
Observations	381	278	280	384
R-squared	0.127	0.131	0.231	0.342

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: estimations include controls for JEL and period of publication

Source: own estimations