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Fostering National Research Networks: The Case of Turkish Coauthorship Patterns in the Social Sciences

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The case of Turkish coauthorship patterns in the social sciences

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Abstract

We analyse the coauthorship networks of researchers affiliated at universities in Turkey by using two databases: the international SSCI database and the Turkish ULAKBIM database. We find that coauthorship networks are composed largely of isolated groups, permitting little knowledge diffusion. Moreover, there seems to be two disparate populations of researchers. While some scholars publish mostly in the international journals, others target the national audience, and there is very little intersection between the two populations. The same observation is valid for universities, among which there is very little collaboration. Our results point out that while Turkish social sciences and humanities publications have been growing impressively in the last decade, domestic networks to ensure the dissemination of knowledge and of research output are very weak and should be supported by domestic policies.

Keywords

Research collaboration, coauthorship, networks, research policy.

1. Introduction

This paper investigates the collaboration patterns of Turkish social sciences and humanities (SSH) researchers, as evidenced by coauthored papers published in an international and in a Turkish database of academic journals. National policies, specific features of SSH research, as well as cultural and institutional factors play an important role in explaining the patterns of scientific collaboration in a nation. This EU candidate country exhibits particularly interesting features to carry out such an analysis. Firstly, the growth of Turkish publications has been the highest in Europe in the last 10 years, partly because of an increase in the number of English teaching private universities, partly because of policies seeking to increase the number of publications of Turkish researchers in international journals. Secondly, as compared to other countries, Turkey seems to be a collaboration-intensive nation, which can be measured by the percentage of publications written by at least two coauthors. For sure, collaboration among national researchers is crucial for the diffusion of SSH knowledge in a large, complex, and developing society like Turkey, mainly to diffuse research output carried out dispersedly in the country. To examine the extent to which channels exist to diffuse knowledge among distant and diverse researchers, one can analyse the structure of coauthorship networks. Despite recent growth in SSH publications and a high collaboration propensity, Turkey seems to be in the lower end of the spectrum in terms of the productivity of its researchers.

Our network analysis of coauthorship patterns in Turkey allows us to bring to the fore unexpected structures of national and international coauthorship networks formed by Turkish SSH researchers, namely the ones affiliated to a Turkish academic institution. Our evidence for Turkey points out that national linkages among researchers remain strikingly low, and that there is a fragmentation between internationally-oriented researchers, who mostly publish in SSCI journals, and nationally-oriented ones, who mostly publish in ULAKBIM journals. This suggests that Turkish SSH knowledge is fragmented and that there is little knowledge transfer between and among groups of Turkish SSH researchers.

Although Turkey has a great potential for research collaboration, results from our coauthorship network analyses lead us to question the extent to which this potential has received appropriate policy support. We argue that despite some positive effects, Turkish scientific policies have not been successful in establishing and maintaining a strongly connected domestic network of SSH researchers. Therefore, we argue that it is vital to strengthen domestic SSH networks, in order to foster knowledge diffusion and the creation of new knowledge. Dense research networks facilitate the diffusion of knowledge, and in the perspective of the European integration of Turkey, the existence of a critical mass of connected SSH researchers would allow them to fully participate in the European Research

Area (ERA). Based on these results, policy recommendations for Turkey and new member states to improve knowledge diffusion and to make up for their low intensity of publications are formulated.

2. Background

2.1. European and Turkish SSH research

The patterns of SSH research in European countries reveal important differences in publication intensities and in the propensity of countries' researchers to collaborate with national and international colleagues. Figures 1 and 2 show the number of publications per capita between 2000 and 2007. In terms of publications in the SSCI database, most of the new European member states and Turkey seem to be in the lower end of the spectrum. Despite the lower output of Turkish SSH researchers compared to their European partners (ranked 22/28), the Turkish SSCI output has been growing significantly during the last decade. Indeed, Turkey has the highest average annual growth rate of publications compared to all EU_{27} countries.

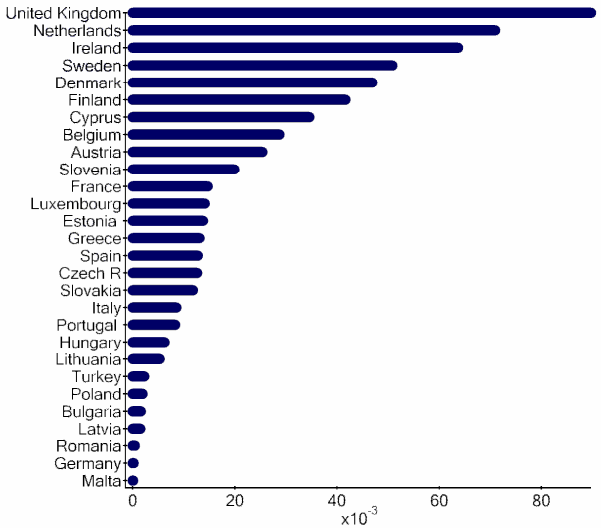

Figure 1. SSCI publications per capita ('000)

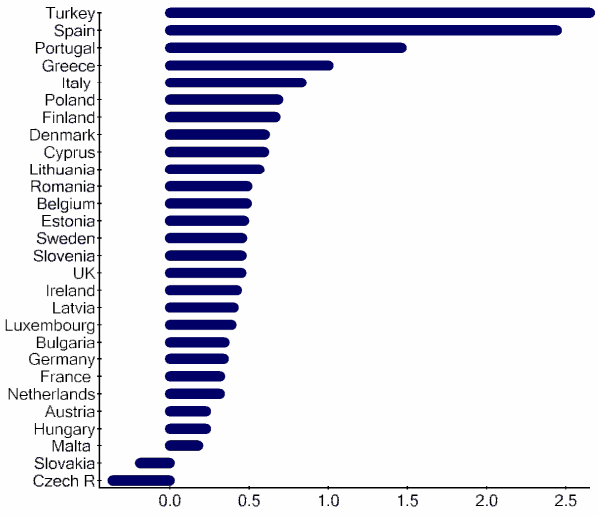

Figure 2. Average annual growth rate of these publications (%), 2000-2007 [1]

Several factors can explain such an impressive growth in the SSCI publications of Turkish researchers. At first, research incentive schemes as well as carrier promotion rules have undergone changes, giving a strong importance to international publications. Second, new private universities, many of which teach in English, were created during the 1990s.[2] Advantageous employment schemes used by some of these universities to attract high profile researchers requested outstanding publication records, which drove potential candidates to increase their SSCI output to be able to compete with international candidates. A third factor relates to the fact that since the Helsinki European Council of

[1] Because annual growth is inconsistent in most countries, this average is normalized with respect to standard deviation.

[2] E.g. Bilkent was founded in 1984, Koç in 1992, and Bilgi and Sabancı in 1994.

December 1999, Turkey was officially recognised as a candidate country that could gradually participate in European research programmes. In June 2006, the negotiation chapter dealing with "Science and Research" was concluded between Turkey and the EU, suggesting that sufficient structures were in place in Turkey to foster research collaboration. These recent events raised awareness among Turkish researchers about the internationalisation of research, and allowed them to increase their participation to international research projects that had the potential to generate international publications. Nevertheless, we argue in this paper that internationalisation of research and the increase in the number of publications are not sufficient to develop the research potential of Turkey. To do so, the existence of channels through which this research output can be diffused among domestic researchers is vital.

2.2 Research collaborations and internationalisation of research in Europe and in Turkey

According to Katz and Martin (1997), collaboration in research can be defined as "the working together of researchers to achieve the common goal of producing new scientific knowledge". At individual level, scientists collaborate for a variety of reasons summarised by Sonnenwald (2007). For example, new collaborations allow scientists to discover new knowledge and to build trust among them, to increase understanding between countries, to promote political unity, to support innovation and sustainable development, and to facilitate the transfer and diffusion of both codified and tacit knowledge. At national level, one of the main reasons for supporting scientific collaboration is that it fosters knowledge creation and diffusion. Research by Crane (1972) on "invisible colleges", and more recently by Lee and Bozeman (2005), underline the positive effect of scientific collaboration on the diffusion and advancement of knowledge.

In the past few years, many studies have shown that that the rates of international collaboration measured by coauthorship have soared, which is usually accompanied by an internationalisation of research.[3] This led to a slow process of homogenisation and convergence of countries' research profiles reinforced by the process of European integration of Eastern European countries (Glänzel and Schlemmer, 2007). In the case of natural sciences, the density of the network of researchers from EU and accession countries between 1990 and 2000 has increased significantly (Wagner and Leydesdorff, 2005a). International scientific collaboration has also been made easier by the substantial fall in the costs of travel and communication, which tends to have a positive effect on international coauthorship. Adams et al. (2005) explain this rise in coauthorship by factors such as financial earnings from international publishing, an argument which seems to be valid in the case of Turkey since private universities give substantial financial rewards to authors publishing in SSCI journals.

[3] See e.g. Melin (2000), Sonnenwald (2007), and Adams et al. (2005).

For Turkey, the participation to European research programmes coincides with an increase in the international publications of Turkish researchers in the SSH.[4] The rising internationalisation of Turkish SSH research suggests that its output increasingly diffuses throughout the international scientific community. This internationalisation is due to intentional efforts, since a number of national and supranational policies have been developed to generate positive externalities from international research collaboration. These include the European Research Area, the Human Frontier Science Programme, and European Science Foundation programmes, to name but a few. Indeed, one of the priorities of the Scientific and Technological Research Council of Turkey (TUBITAK) and of the Turkish Academy of Sciences (TUBA) is to support authors publishing in international journals, which also happens through increased international collaborations. Besides, they promote bilateral cooperation with 16 countries and with regional and international institutions.[5] Given the impressive growth of SSCI publications per capita in Turkey (Figure 2), these policies seem to have succeeded in fostering international SSH research collaboration in this European candidate country.

Figure 3 shows researchers' propensity to collaborate, measured by the percentage of a countries' publications having at least two coauthors, versus their international collaboration rates, measured by the percentage of publications with at least one foreign author.[6] As expected, there is a positive relation between the two. Still, one can also observe that countries are largely dispersed. For example, one group of countries has a large international collaboration propensity. These countries are mostly small ones, and exhibit international collaboration percentages higher than 0.4 (Belgium, Bulgaria, Cyprus, Luxembourg, Portugal, Romania). This supports what Luukkonen et al. (1992) find in their study of institutional collaborations in 97 countries based on the Science Citation Index database, namely that small countries tend to have the highest number of collaborations. Along the lines of Hicks' (1999) argument, this might be due to the fact that when a research topic becomes fashionable, it can be easily applied to small countries and lead to new coauthored papers. Focusing on Latin American countries, Gomez et al. (1999) support this finding. They show that although bigger countries tend to be more involved in multinational networks, the rates of collaboration between scientists are much higher in small countries. A second group is composed of Mediterranean countries having a high collaboration potential (Cyprus, Greece, Italy, Portugal, Spain, Turkey). However, most of these countries have relatively less international collaborations compared to the small country group, which underlines their relative isolation from international scientific networks. Finally, a third

[4] Cf. Gülgöz et al. (2002), Yurtseven and Gülgöz (1999), Uzun (1998).

[5] For example, the SSH committee of TÜBITAK participates to three COST actions and to three EUROCORES programmes of the European Science Foundation.

[6] Collaborative propensity is measured by the percentage of coauthored papers and published in the SSCI database between 2000 and 2007. International collaborations are the percentage of papers written with foreign colleagues.

group exhibits high collaboration rates is composed of Estonia, Denmark, Finland, Lithuania, and Sweden. The case of the two latter groups (Mediterranean and Scandinavian-Baltic countries) tends to support the argument of Callon (1991) on "archipelagos" of science and the one of Zitt et al. (2000) on the role of political and cultural factors in shaping scientific networks.

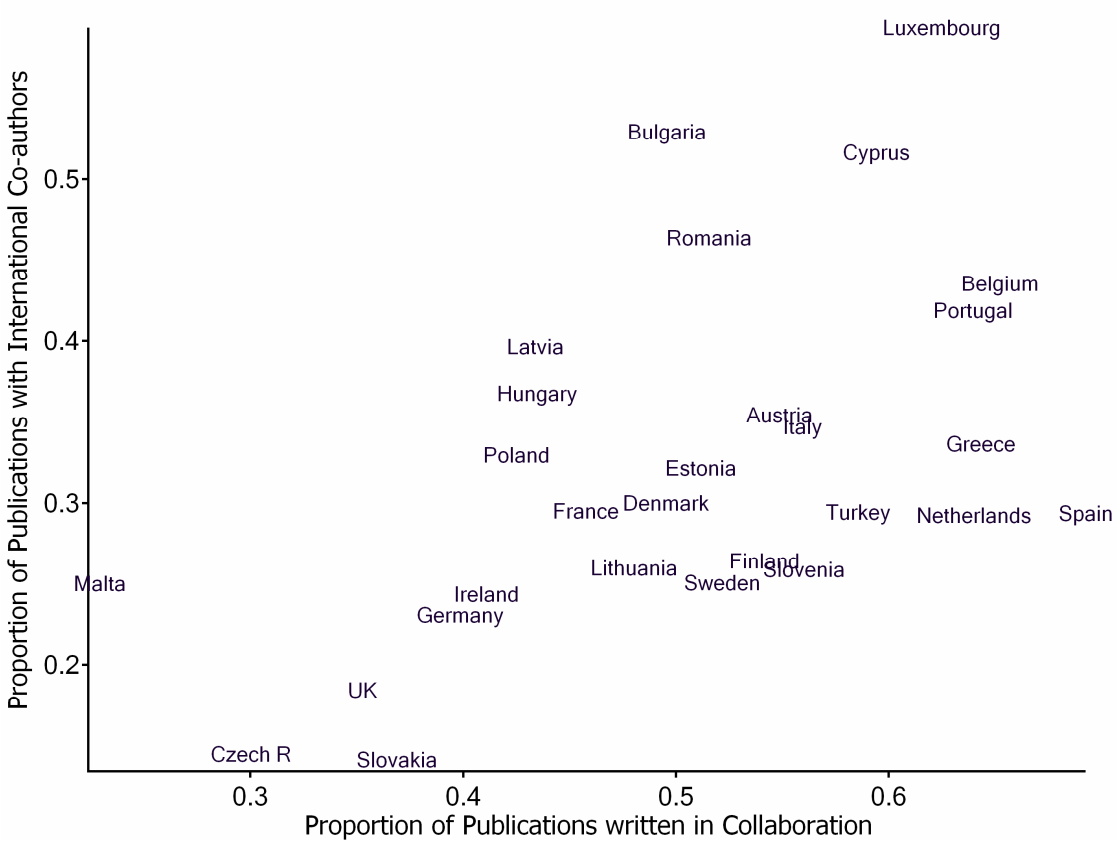

Figure 3. Researchers' propensity to collaborate

Policies to foster international research collaboration have contributed to the restructuring of international networks of researchers. However, some scholars have also pointed out possible negative effects of such policies. For example, in a study of the publication performance of Australian academics, Butler (2003) finds that a culture of evaluation has increased research productivity at the expense of publication quality. Besides, as argued in the following section, even if such policies increase the international visibility of domestic research, policies supporting internationally-oriented research collaboration should not be carried out at the expense of nationally-oriented ones.

2.3. The importance of research collaboration for developing countries

Collaboration among national researchers is crucial for the diffusion of SSH knowledge in a large, complex, and fast changing society like Turkey. In the more general case of developing countries, Wagner (2006) shows that the density of the network of African researchers has increased

during the 1990s, which has allowed African countries to access knowledge more easily and to make up for underdeveloped research infrastructures. But not only can it foster economic growth, it also contributes to a better understanding of social, cultural, and environmental dimensions of development. Sonnenwald (2007) argues that scientific collaboration strengthens national unity and improves research infrastructures by diffusing knowledge through domestic networks of researchers. To develop national research networks, Wagner (2006) underlines the importance of institutional capacities, because:

> "Local links also increase the likelihood that knowledge creation focuses on issues relevant to the developing countries rather than on issues that concern only scientists in advanced countries. [Therefore] the question for developing countries is not how to get into collaborations with Germany, the UK or the US, but how to take applicable knowledge from the network (no matter where it is located), make it relevant to local needs and problems, and tie it down".

Thus, if national policies supporting internationally-oriented researchers increase the international visibility of Turkish SSH research, on the other hand they may also deter national researchers to publish in domestic journals, which focus on research addressing domestic issues. Among the publications written by Turkish academics in SSCI journals between 2000 and 2007, only 28% of them deal with Turkish issues. This finding supports the argument that policies to increase the international visibility of Turkish SSH research is implemented at the expense of the development of research on the Turkish economic and society. Although the growth of internationally-oriented research in Turkey is impressive (Figure 2) and its collaboration potential is quite high (Figure 3), findings presented in the next section suggest that domestic networks of researchers are not strong. Common language and culture increase the efficiency with which tacit knowledge flows within a country, such as knowledge about national and local financial sources and about on-going research projects. Therefore, collaborations among domestic researchers should yield higher benefits than the ones carried out with international colleagues. In our view, national and international collaborations are complementary to each other, and policies supporting one should not be implemented at the expense of the other.

In order to examine the extent of research collaboration in Turkey, we analyse national and international coauthorship networks formed by Turkish SSH researchers. Few studies have been carried out on the patterns of academic collaboration in Turkey. In the case of chemistry, Yurtsever and Gülgöz (1999) find evidence that a few authors publish many and high quality papers, but they do not study coauthorship networks. In an attempt to establish a scientometric profile of social sciences in Turkey, Uzun (1998) witnesses a decrease in the number of single-authored papers between 1987 and

1996. A key question that remains to be answered is whether the recent intensification of international research in Turkey has had any positive impact on nationally-oriented researchers. This paper addresses this question, and examines the extent of domestic knowledge diffusion.

By mapping domestic and international networks of Turkish SSH researchers, we shed light on the efficiency of European and Turkish initiatives to foster the local and international diffusion of the knowledge produced by these scientists. We also examine whether the connectedness among Turkish SSH researchers is solid enough to advance research on Turkish economic and societal issues. Besides, we draw lessons for the design of research policies in Turkey and in new member states having similar low research intensity. To address these issues, analysing researchers' networks by using coauthorship data is a promising avenue. We construct two types of networks: a coauthorship network, where nodes are individual authors, and an institutional network, where nodes are institutions. For one thing, high rates of coauthored publications in a country do not necessarily mean that there is an effective diffusion of knowledge. To examine the diffusion of knowledge, one should look at the structure of the network of coauthors. A network analysis can reveal isolated clusters of authors, how the ties among authors are distributed, and whether the networks permit a decentralised diffusion of knowledge. A network analysis of Turkish academic institutions also permits to see whether knowledge is localised and whether international visibility is exclusive to certain locations. If it is the case, are there networks between these locations and others? Are there paths through which knowledge flows among researchers in different institutions?

3. Method and Data

Various indicators can be used to account for collaboration in scientific research, such as the participation to research projects and conferences or the joint registration of patents. In this paper, scholarly coauthored papers are used as an indicator of scientific collaboration because they reveal coauthorship networks, through which scientific knowledge diffuses within a country and beyond its borders. As Melin (2000) points out, pioneering works about coauthorship analyses started more than four decades ago with Solla Price and Beaver (1966) and Merton (1973). Because they provide relatively reliable data on scientific output, coauthorship networks are the object of an increasing number of papers, most of which focus on the publication patterns of natural sciences in Western countries (Sonnenwald, 2007). In a social network analysis, as opposed to many bibliometric studies, we are more interested in ties than in people's characteristics (Otte and Rousseau, 2002). Provided that collaboration is not confused with coauthorship, using coauthorship networks to study knowledge diffusion presents several advantages. Argue Katz and Martin (1997: 3), they are invariant and

verifiable, relatively inexpensive and practical, and like other bibliometric studies measuring them they are neutral to the collaboration process.

One of the most commonly used databases to analyse coauthorship patterns is the SSCI database, which raises several problems when analysing publications by SSH researchers. At first, according to Hicks (1999) the main bias stemming from the use of this database is that "The proportion of a nation's output in indicators will depend not only on the number of nation's journals indexed in the SSCI; it will also depend on how often researchers publish in English language, international journals". Besides, because of competing paradigms, the SSH literature tends to be more fragmented than the natural sciences literature, and to generate more publications in books.[7] Moreover, since SSH researchers investigate society, they tend to focus on national issues and to publish in domestic journals that are not included in the SSCI database, which can only cover the national literatures of a few countries.[8] However, Hicks (1999) argues that recent changes, such as the development of supranational research programmes, have contributed to homogenise SSH internationally.

These suggest that papers published by Turkish authors in SSCI journals can be used as an indicator of internationally-oriented SSH research in Turkey. Nevertheless, considering the aforementioned problems, an analysis of the domestic collaboration patterns of Turkish SSH researchers would be much better served by using a Turkish journals database. This explains why we use two databases in this paper: the SSCI and the ULAKBIM databases. Founded by TUBITAK in 1996, ULAKBIM used free Turk Telekom services to establish a National Academic Network (ULAKNET) connecting all universities, research centres and other knowledge institutions. ULAKNET is used by 80 000 researchers and by some 1 700 000 students in Turkey. Updated weekly, the ULAKBIM SSH database includes 72 national referred journals and is the biggest of its kind in Turkey. Between 2002 and 2005, a total of 931 papers were published in the SSCI database by 1 290 researchers affiliated to Turkish universities. In the same period, 2 355 researchers published 2 143 papers appearing in the ULAKBIM database.

The definition of a coauthorship network used in this paper is as follows. We assume that there is a link between two authors if they have at least coauthored one paper together. We construct two separate coauthorship networks, one of them based on the SSCI database and the other based on the ULAKBIM database. We used the same subject categories in the ULAKBIM database and in the SSCI

[7] The development of competing paradigms reduces the chances of reaching theoretical consensus, which is associated with higher shares of book publications as opposed to journal publications. The ULAKBIM database does not allow to retrieve book references, which could not be included in this study.

[8] According to Hicks (1999: 204, Table 6), the share of countries' journals in the SSCI database is as follows: USA 60%, UK 18%, Germany 3%, France 2%, Rest of the world 17%.

database. We then compare the structure of the two coauthorship networks, and analyse the extent to which they overlap in terms of researchers having published in journals pertaining to both databases. We also construct an institutional network, in which a link between two institutions or universities exists if at least two scholars from two different institutions have published a joint paper during the reference period (2002-2005). Construction of the networks is done by using the Pajek software. Analytical tools used to carry out the social network analysis are explained in Wasserman and Faust (1994).

4. Research networks in Turkey

4.1. Coauthorship networks

Figures 4 and 5 respectively show the coauthorship networks obtained from the ULAKBIM and SSCI databases. The two structures exhibit an interesting common feature, which is that both networks contain groups of researchers isolated from each other.

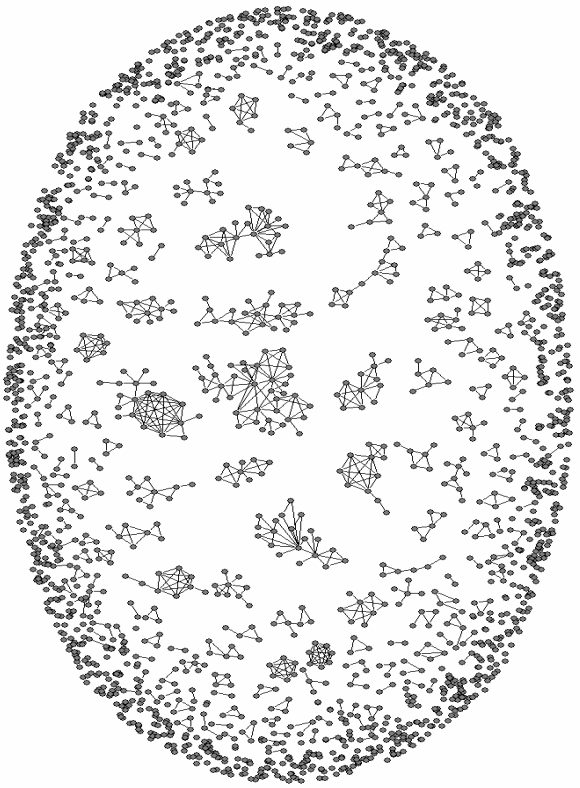

Figure 4. ULAKBIM coauthorship network

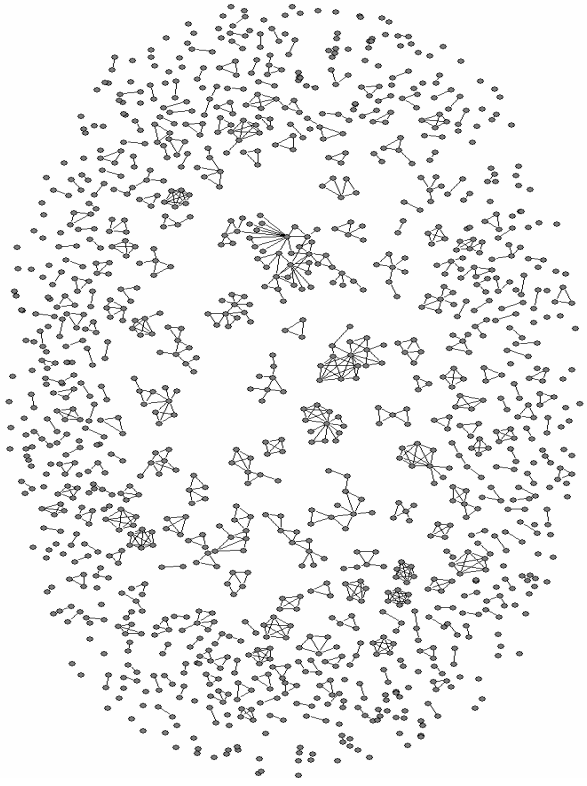

Figure 5. SSCI coauthorship network

We compare the intensity of connections of both networks by using a network density indicator computed as follows:

$$D = \frac{\sum_{i}^{N}\sum_{j}^{N} x_{ij}}{N(N-1)}$$

where x_{ij}=1 if a tie exists between *i* and *j*, and N is the total number of nodes. ULAKBIM density was found to be 0.0006, and SSCI density was found to be 0.0013. This difference partly reflects differences in networks size, because bigger networks usually have smaller densities. It also reflects the fact that collaborations are more intensive in the SSCI network, which means that to publish in international journals a higher degree of collaboration is necessary. These results support the findings of Adams et al. (2005), who emphasise the positive link between research collaboration and international research activities. This observation might be due to what Luukkonen et al. (1992) call "Increasing pressures to publish or perish [which] provide additional incentives to augment collaboration in all fields".

When we look at the structure of the clusters, it is possible to see that some researchers act as "brokers" connecting otherwise disconnected groups. The same structure appears in both networks where there is at least one big cluster of researchers, in which there are a few star scientists. In most coauthorship networks, a preferential attachment mechanism results in the emergence of star scientists as in this case, who are highly productive and visible researchers (Wagner and Leydesdorff, 2005b). Around these star scientists are a group of researchers connected to each other via the stars. Nevertheless, the implications of the network structure for the diffusion of knowledge will obviously depend on the general connectedness of the network, which is measured by reachability among network members. In both networks, reachability among pairs is very low. In the ULAKBIM network, only 99.8 percent of the pairs in the network are unreachable, and in the SSCI network, this figure is 99.6 percent.

Several reasons can explain such a structure of coauthorship networks in Turkey. At first, this structure may not be specific to Turkey but to all SSH networks. Indeed, authors like Moody (2004) in the case of sociology and Hicks (1999) underline how the nature of SSH influences research collaboration patterns in these fields. For example, the lack of theoretical consensus contributes to the fragmentation of SSH research.

Second, the structure of such a network composed of isolated groups can be related to the size of the country. In bigger countries, for one thing there tend to be higher administrative, transportation and communication costs to carry out research collaboration activities. Although the effect of geographical dispersion can be overcome by the use of ICTs, in the case of Turkey there is no sound evidence in the literature suggesting that ICTs are efficiently used to foster research collaboration.

Third, the structure of networks is also likely to be shaped by culture and policy. Testing the argument of Callon (1991) about the existence of "archipelagos" of science, Zitt et al. (2000) emphasize the role of political and cultural factors in shaping scientific networks. Although cultural factors are out of the scope of this study, culture can be an important determinant of the structure of

research networks in Turkey. Several recent cross-cultural studies including Turkey find that there is a wide gap between in-group collectivism and institutional collectivism in this country (Kabasakal and Bodur, 2006). This means that Turkish people tend to form close relationships with others in their own group, but that much less interaction occurs with people outside their group. This cultural effect can well influence the way networks among academics are shaped. In other words, a strong in-group collectivism and a low out-group collectivism are likely to generate networks which are structurally cohesive and composed of clusters, as in the case of Turkey.

Finally, scientific policies carried out by TUBITAK, TUBA, and by individual universities also influence the structure of the Turkish network of SSH researchers. Few programmes have sought to foster and to establish domestic SSH networks in Turkey.[9] Turkish scientific priorities seek to support international collaborations and publications, mainly to increase the international visibility of Turkish SSH research. The risk of such an international focus is that it may widen the gap between internationally-oriented researchers and their nationally-oriented colleagues. This gap would widen if there were discrepancies in the quality of research infrastructures of different Turkish universities.[10] As a consequence, research can become largely fragmented, giving rise to a group of researchers who are more visible in the international arena and others who carry out research within the domestic confines. Fragmentation of research can hinder the diffusion of ideas and knowledge, especially in this case when reachability among nodes of the networks is quite low (Figures 4 and 5). To examine whether this is the case, one may look at the intersection between the two aforementioned networks, which contains academics appearing in both networks. The fragmentation of Turkish researchers is further explored in the next section.

4.2. Fragmentation among Turkish SSH researchers: International versus domestic scholars

In order to examine the extent to which there are two different publishing agendas among Turkish SSH researchers, we count the number of Turkish authors who publish in both databases. We find that out of 2 300 authors publishing in ULAKBIM journals, only 250 also publish in SSCI journals during the same period (11%). This separation between internationally-oriented authors and nationally-oriented ones strongly limits the cross-fertilisation of ideas. Besides, it reinforces the compartmentalisation of knowledge and deters the undertaking of interdisciplinary studies. The centrality measures of the intersection group of authors allow us to examine whether central actors can act as brokers in the creation and diffusion of knowledge. In other words, if authors appearing in both

[9] E.g. the OYP program targets graduate level mobility, and ULAKBIM is maintaining a nationwide publications database, which has been used in this study.

[10] In Turkey such an inequality is likely to exist because private universities have more funds, and have in general more opportunities to build a stronger research infrastructure.

databases are the more central ones in the domestic network, this might imply that their research is better disseminated to the national audience.

The betweenness centrality of a node measures the extent to which an author is on the shortest path between other pairs of authors. Our analysis shows that only 19% of the authors with a positive centrality in the ULAKBIM network are the ones who appear in the SSCI network. This means that knowledge diffusion between internationally-oriented authors and nationally-oriented ones is poor, because 81% of the authors who act as brokers in the local network do not appear in the international network. Moreover, within the intersection group, only 13% have positive betweenness centrality measures.

One may argue that the language of publication is an important factor to explain the divide in the population of SSH researchers in Turkey. Indeed, since no Turkish journal appears in the SSCI database, English teaching universities have a certain advantage over Turkish teaching ones when it comes to publishing in English SSCI journals. However, ULAKBIM journals publish papers written in both English and Turkish. Moreover, one of the preconditions to have a university position in any Turkish university is the proven ability to write in at least one foreign language in addition to Turkish. Therefore, as argued above although the language issue can be a source of research fragmentation, other factors play a strong role in this process. According to Norgaard (2004), the increasing specialisation of science, and thus the corresponding risk of knowledge fragmentation, has a strong negative effect on our capacity to understand systemic issues. With the example of the community of climate change scientists, the author shows how such a fragmentation can be overcome by setting up collective learning mechanisms, since "collective understanding comes largely through shared learning and assessment processes". Networks of researchers play a key role in fostering this understanding.

It is important to know whether the divide between Turkish SSH networks results from a fragmentation among universities and research centres. To address this question, one needs to look at institutions networks. Because the main concern of this paper is the diffusion of knowledge, we are particularly interested in the geographical and inter-university dimension of collaborations. Are we going to witness the same fragmentation among universities? To what extent do people from distant universities collaborate with each other?

4.3. Inter-university networks

At first, to answer the two aforementioned questions, we examine whether research fragmentation at author level is caused by the fact that researchers in some universities mostly publish in international journals and others in ULAKBIM journals. Figure 6 corroborates this assumption.

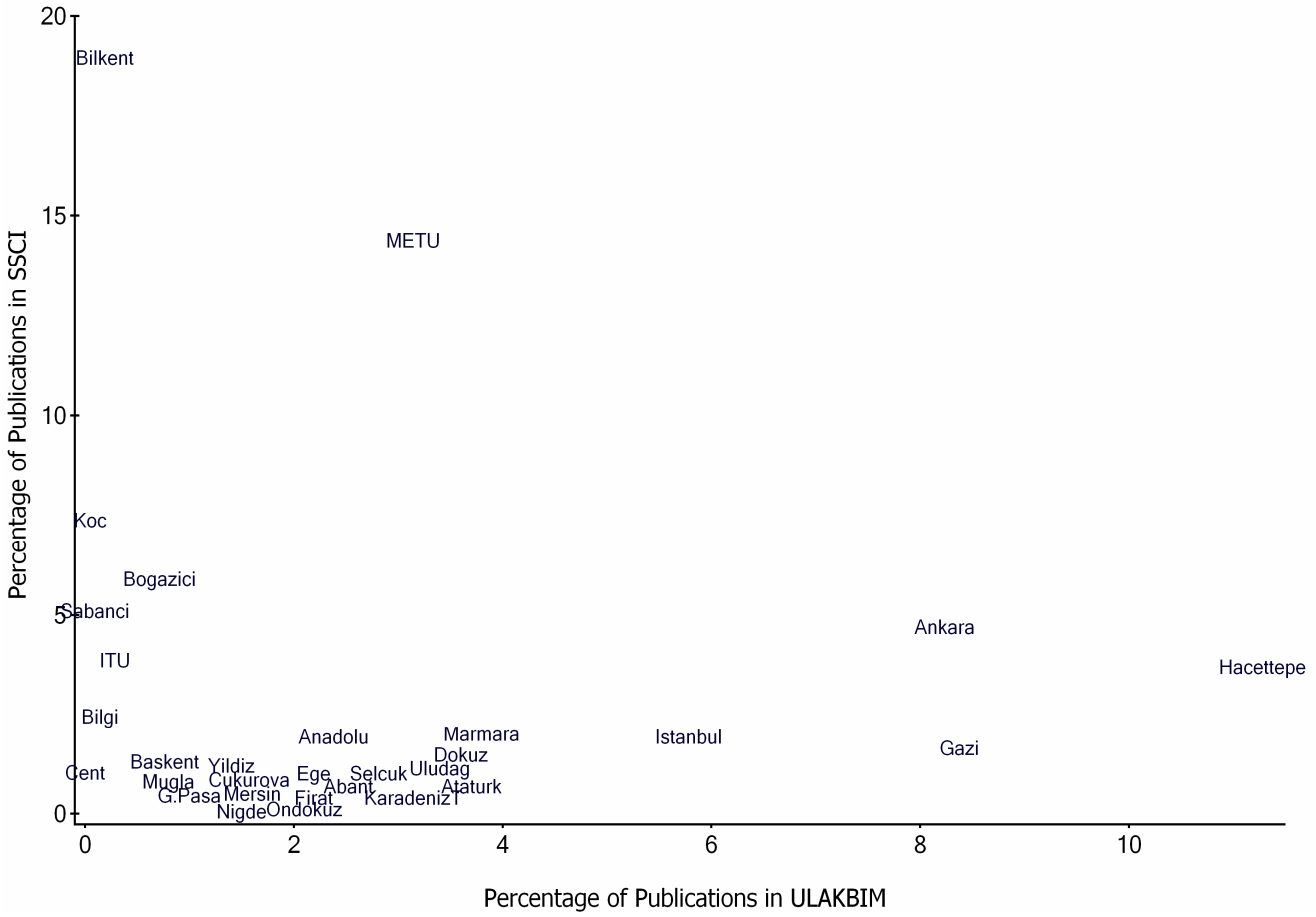

Figure 6. Propensity of Turkish universities to publish in SSCI and ULAKBIM journals

There are several implications of this pattern. Firstly, universities that publish the most in both databases are the ones located in the two biggest cities, Istanbul and Ankara.[11] The contribution of universities located in other cities is relatively small. A striking observation from this figure confirms that Turkish universities are divided into two groups, which either publish mostly in SSCI journals or in ULAKBIM journals. The notable exception is METU, a public university whose researchers publish in journals included in both databases. In accordance with the above findings, authors affiliated to internationally-oriented universities are hardly present in the national research arena. Thus, there seems to be a deliberate strategy of some universities to drive their researchers to publish in SSCI journals. In this respect, Bilkent university stands out as having the highest share in Turkey's SSCI output, and one of the lowest share of publications in national journals. This result is also a consequence of the internal rewarding mechanisms of some universities. Because their publication

[11] These universities are Ankara, Bilgi, Bilkent, Gazi, Hacettepe, Istanbul Technical University (ITU), Koç, Marmara, METU, Sabancı.

incentives prioritize “where to publish”, such policies can have deterrent effects on the diffusion of knowledge to domestic researchers and on the choice of Turkish issues as a research topic for papers to be published in SSCI journals.

In a study of scientific collaboration in Nordic universities, Persson et al. (1997) underline that universities within the same country do not have the same collaboration contacts because of the differences in the specialisation of university research institutes. This suggests that the Turkish university divide could be explained by differences in the nature of the research carried out by each group, and that internationally-oriented universities do not seek to benefit from knowledge produced by their nationally-oriented colleagues.

Given such a big diversification in the publication profiles of Turkish SSH researchers, a final question addressed here is whether there are linkages among these two distinct groups of universities to permit the diffusion of research output. To what extent are these universities linked to each other? Is there knowledge dissemination among these disparate research centres?

On the basis of data extracted from the Turkish ULAKBIM database, we construct an institution-based network to examine the extent to which authors from different Turkish universities collaborate with each other. This is given in Figure 7, in which a link exists between two institutions if there at least one joint publication has been published by their researchers. The strength of linkages is given by the numbers beside each link, which show how many joint papers have been published.

Studying such a network allows us to shed light on the diffusion of the knowledge produced by individual Turkish universities. This diffusion can for example lead to the formation of new ideas, to the development of scientific paradigms, and can help to avoid research redundancies by pooling together intellectual resources. Moreover, when different cities are involved in scientific networks, remote cities can access the knowledge located in research-intensive cities. One way to strengthen these domestic knowledge spillovers is to promote the use of ICTs to make up for a lack of spatial proximity. Indeed, the hypothesis that coauthorship decreases with geographical distance has been challenged by studies on the impact of ICTs on research collaboration. For example, Wulf (1993) underlines the role of both hardware and software in enabling the use of remote libraries and databases and the remote collaboration and interaction via email, visio-conference, or Web-based instruments. In a study of scientific teams and institutional collaborations in US universities, Adams et al. (2005) also argue that the increased geographical dispersion of collaborators might be enabled by lower communication costs.

An important observation of Turkish university networks evidenced in Figure 7 is that there is hardly any networking between them. The central city seems to be Ankara, because its universities act

as brokers to connect many universities in Turkey. Quite surprisingly, Istanbul has the highest number of universities, but the least networking ones.

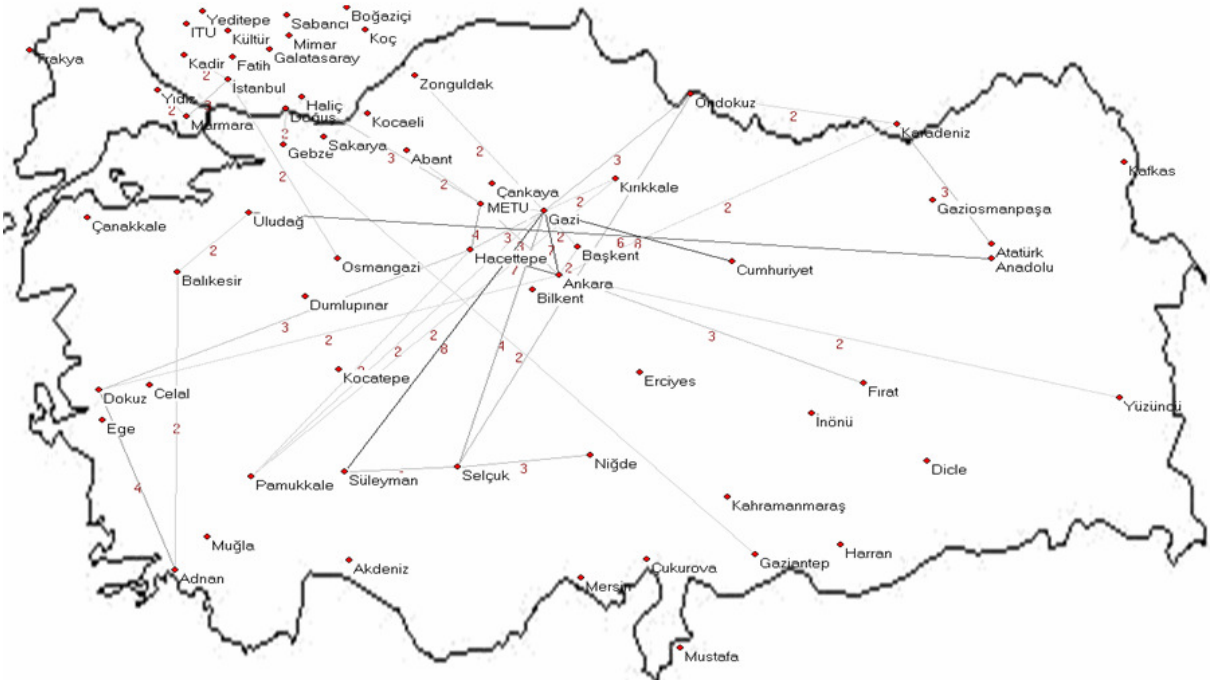

Figure 7. Network of Turkish academic institutions

Another important observation is that during the reference period (2002-2005), universities with the highest international output (Figure 6) have no research collaborations with researchers from other universities in Turkey (Figure 7).[12] In this sense METU is the only exception. These results and their implications for knowledge diffusion lead us to formulate some policy recommendations for Turkey and other countries in which the dissemination of research output is poor, such as new European member states.

5. Policy recommendations

In general, our results underline the need to strengthen domestic networks of SSH researchers. Nowadays, publishing in international journals has become a paramount criterion to evaluate academic research output in many countries. Such a strategy has side-effects and can deter authors to publish in national journals, which tend to deal more with local issues, to reach a wider domestic audience, and thus to better diffuse domestic knowledge. Besides, as evidenced by Butler (2002) in the case of Australia, such policies tend to have a negative effect on the quality of publications and to contribute to publication inflation, which limits the promotion of high-quality science at national level.

[12] These universities are Bilgi, Bilkent, Bogazici, ITU, Koc, and Sabanci.

Many Western countries with high publication rates have well-established research networks that provide funding opportunities to connect universities to each other. These networks are also endowed with more established mechanisms through which academic research can be distributed, such as a better ICT infrastructure and institutions supporting knowledge diffusion. However, in countries where research intensity is lower, these mechanisms and institutions for knowledge diffusion are, as expected, weaker. Knowledge creation is more localised, there is a relatively lower use of ICTs, which is partly due to SSCI subscription costs, but also to the fact that researchers may not be accustomed to using these tools. Moreover, funding to organise conferences or short term schools or seminars is relatively low. All these obstacles restrict the domestic diffusion of knowledge, and result in the creation of localised knowledge systems that reinforce knowledge fragmentation. Therefore, developing and maintaining knowledge diffusion mechanisms is vital to strengthen the research base of countries that face such challenges. Currently in Turkey, most of the policies carried out by TUBITAK and TUBA favour internationally-oriented authors and do not provide enough support to the diffusion of knowledge at national level. However, as argued in Section 2.3, if links with international networks are important for developing countries to get in touch with foreign sources of knowledge, local links increase the likelihood that this knowledge will benefit to the country. It is thus essential to develop policies that foster the tying down of international knowledge at national level. TUBA acknowledges this statement when it says that "no institution in the world can survive in isolation from the environment in which it has flourished".[13]

By strengthening incentives to publish in national journals as well as the channels to promote the diffusion of research output, governments of countries facing similar challenges as Turkey would ensure that SSH disciplines achieve their societal goals by diffusing their knowledge beyond the sole English-speaking academic community. Moreover, following Wagner (2006), successful research policies could seek to strengthen the links between government and research institutions, and to promote bottom-up approaches involving individual researchers in the decision-making process. Indeed, as Melin (2000) puts it:

> "The scientists themselves should choose with whom they would like to cooperate, and under which forms. Initiatives and directives from politicians and funding agencies are not welcomed by the scientific community and can lead to the establishment of contacts with people other than the scientifically most interesting ones".

In order to shape an inspiring research environment, ways to support ideas building on collaboration and arenas for interaction should also be supported, such as conferences and research

[13] Source: http://www.tuba.gov.tr/eng/index.php, accessed on 12/02/2007.

infrastructures, including electronic ones. The propensity of researchers to collaborate differs across countries. Factors explaining those differences range from culture, geographical closeness, ICT infrastructures, country size, or language. Despite its size, poor infrastructure, and a lack of policies to foster cooperation between distant scholars, Turkey has a high research potential given its fast growing publication intensity. As evidenced in Figure 2, to a lesser extent it is also the case of several new European member states like Poland, Cyprus, or Lithuania.

At first, remote universities would benefit from national and international knowledge spillovers, which would in turn stimulate their research productivity. Then, an increased collaboration between internationally-oriented and nationally-oriented universities would ease the popularisation of Turkish issues among internationally-oriented researchers. Finally, increasing the density of the domestic network of Turkish SSH researchers would foster the emergence of robust national science networks able to fully participate in the ERA.

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