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Research Article

Thematic Networks in the Argentine Economics Main Annual Meetings

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ABSTRACT
This contribution presents information on mainstream research topics in Argentina deduced from the analysis of paper research codes published in the proceedings of main national meetings. We gather data from the Asociación Argentina de Economía Política Annual Meetings from 1964 to 2014. By using network analysis, we create thematic networks given that all paper must be tagged with at least two JEL codes. We estimate network metrics and find main themes and clusters. Thematic networks show clusters of codes and the analysis shows the preeminence of fields related to international trade, macroeconomics, labor market, distribution/poverty, and econometric topics. These categories are potential indicators of the research agenda of the profession in the country.
Keywords: Economic profession, Proceedings, Social network analysis, Community detection, Thematic network, Argentina.

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INTRODUCTION

A widely used way to diffuse academic production is by presenting it at a congress. It is often less demanding in terms of being subject of a softer reviewing process and formal requirements comparing to a journal article. This institutional form has been diminishing its importance as a source of scientific knowledge generation and citation and each country has developed its large meeting for each branch of the science.[1-4] For instance, for Economics, the American Economic Association Annual Meeting in the USA and the Encontro Nacional de Economia Política in Brazil are clear examples of congresses that reunite mostly national professionals. In Argentina, the main congress where recent graduates submit their production for releasing publicly and discuss their results is the traditional Annual Meetings of the Asociación Argentina de Economía Política (AAEP). The meetings unite recently graduated to old school researchers and professors yearly for presenting highly diverse contributions.[5] The congress is the first step for recent graduates and the profession in general to submit their contributions and, on many occasions, these become their first publications in an actual proceeding. The event represents the gate of entrance to the profession for many economists in Argentina. At the same time, contributions also represent the state-of-the-art of economic knowledge in the country.

As professors update their curricula and create research teams and explore new avenues, they spread new techniques and topics in their students and colleagues and the output may come up in a congress, among other ways. Since the 1980s, these topics have been codified in the JEL classification system sponsored by the American Economic Association.[6] Codes represent the avenues of research that professionals follow in the academic system. What key themes can be observed from the JEL codes of the proceedings of this meeting? Is there a recognizable pattern between topics and research centers? How topics have evolved during the period? What might explain the importance (centrality) of such themes in the literature? Is topic composition and evolution a portrait of what a national academic system is producing? Based upon these insights there is a worth-studying research gap.

We follow precedent contributions pointing to JEL codes tagged in papers representing the research profiles of their authors and affiliations. We collected codes for each contribution and by using SNA tools we construct a topical network of code co-occurrence that reflects the evolution and composition of the topics exposed in the congress. Specifically, the goal is to present a dimension of the evolution of the economic academic production and prevalent economic topics in Argentina in a 40-year time span. We will focus in providing information on the changes that the economic research has shown through the presentations in this congress, as a way of showing how the academic economic thought has changed in the period. It is valid to remark that most departments of Economics in Argentina participate so the contributions express the main topics and lines of thought

and syllabus present in the local academia. Methodologically this work is in the fashion of Benckendorff[7] in terms of the analysis of research themes and studies such as Serenko *et al*.[8] in terms of the scope of the investigation. This contribution attempts to shed light on some bibliometrics aspects of this proceedings by using SNA tools.[9] This way we observe the topical evolution of the economic research in Argentina. The main themes identified are international trade, prices, business fluctuations, and wages, among others.

The paper follows with section 2 where we present introductory concepts and review recent literature. Section 3 presents and analyzes the network of JEL codes and structural metrics. Section 4 presents clusters of *k*-cores and section 5 present the building of themes from the JEL code network. Section 6 ends with conclusions.

Literature review

The importance of proceedings versus published articles has been a subject since the seventies. Garvey *et al*.[10] Garvey *et al*.,[11] and Garvey and Tomita[12] track scientific work from its earliest oral presentation at meetings and conferences through successive avenues of dissemination ending up in publications. These contributions find that nearly half of all conference papers in their case study were finally published as journal articles in the short-run (with the exception perhaps of information science where that seems less likely according to Drott, 1995).[13] However, in computer research conference proceedings is regarded a substitute of journal article.[14] This not seems the case of Economics but for most of the period under analysis Argentinian economists regarded (as far as late 80s) proceedings as important as a journal article in their curriculums. When considering all fields of sciences proceedings are a valuable supplement to journal publications.[15] In any case, conference proceedings seem to be focused on innovation or new ideas in software engineering (Montesi and Mackenzie Owen, 2008).[16] In terms of citation, proceedings have lower citation-impact than proper articles.[17] In an ordered fashion, computer scientists tend to cite the most from books and book chapters, followed by journal articles, and then conference proceedings.[14] However, computer scientists cite mostly journal publications, but these highly cited items receive more than 40% of their citations from proceedings papers.[3] Finally, Lisee, Lariviere, and Archambault[1] found that the relative importance of conference proceedings was diminishing over time.

On the other hand, defining knowledge sets as topics and themes by clustering documents has being a proper academic avenue in the past 30 years. When researchers construct their contribution, they must take into account all the precedents on the topic. Papers are building on references of colleagues adding a new future reference as outcome. Topics then emerge when third parties analyze the common grounds in these contributions by searching patterns in words, documents, co-citation, co-occurrence, authors' features, and many more variables. For instance, scientific paradigms may be constructed by reconstructing co-citation structures.[18] A simple approach rely on SNA. For instance, thematic networks for chemistry academic research are created by analyzing research areas in articles published in specialized journals.[19] A fairly similar analysis has been applied to health studies.[20] Collaborative research networks are promoted to enhance the quality and share knowledge. European networks show small-world properties and scale-free distributions.[21] These large hubs have been identified as universities and research centers that played an increasing role in this matter. A global centrality metric in a network is betweenness centrality that represents the importance of a node as a bridge between distant nodes. Nodes with high score are pivotal points in scientific citation as a way to detect trails of evolution of the academic knowledge[22] or to detect crossing borders between academic borders: When a topic relates non-previously connected topics it expands knowledge and often in a multidisciplinary fashion.[23]

Network approach has also been a way of understanding how Economics has evolved. For instance, it has been applied for grasping on the importance of collaboration in Economics articles published in the German Wikipedia.[24] Epidemiological models have been used for understanding diffusion of economic knowledge.[25] The contribution follows authors considering them *infected/inspired* if they publish a paper displaying a *virus* (represented by a specific three-digit JEL code) either in a given year, or both before and after a given year. This publication is analyzed as if authors may have adopted a framework inspired by the virus. There are also *recovered* scholars (recovered as from an infection) who do not publish within a particular JEL code in the current or any subsequent years, but previously published within that particular JEL code. The contribution finds that some economic sub-fields (a little more than four hundred) have higher endogenous growth rates than others and this is sustained by the increasing entrance of new apprentices that in the case of the present work are represented by graduate and postgraduate students. On the other hand, 'diversity premia' emerges when co-authors tend to write with colleagues of the same ethnicity but that does not imply to access new information and by accessing to more a diverse class of coauthors then new information may be obtained for the team.[26] The work tests their hypothesis on the data from Repec repository. Another study on diversity using SNA tools but in scientific disciplines in Spain finds weak links for multidisciplinarity.[27] A study on how different author features studies affect co-authorship in economics detects, as Gurley and Johnson (2017),[25] a slow decline of the economic theory papers and a dynamic uprising on author-gathered data applied papers, while a preeminence of older

authors in academic production.[28] Works more closely related to the present contribution investigates JEL code trends in American academia and remarks the winning side of applied vs. theoretical papers.[29] On the other hand, one study concentrates in the top five economics journal.[30] It uses some SNA tools for depicting most used keywords and the list of most repeated words are 'labor economics', 'macroeconomics', 'health economics', 'public economics' and 'game theory' as the most common research fields for multiple productive authors. An analysis of citation in economic papers in the American Economic Association for finding the more influential ones is made in Durden and Ellis (1993).[31] The work ranks papers according their influence through citation analysis. It detects 127 highly quoted papers, and a core of 11 so-called *classic* papers, the more cited papers among the sample. The contribution of Kim *et al*.[32] also works on finding influential economic papers analyzing a more recent sample from top 20 American journals. Interestingly for the present paper, it follows JEL code from the list of more influential works identifying eleven fields are Econometrics (C except game theory), Microeconomics (D), Game theory (C7), Macroeconomics (E), International economics (F), Finance (G), Public finance (H and I), Labor (J), Industrial organization (L), Growth and development (O and P), and others. Econometrics, macroeconomics, international economics and growth are the more used JEL codes in the Argentinian proceedings. In the specific case of Argentina, local social scientists' production on a wide basis looking for explaining the productivity of the country as whole.[33] Economists do not show a particular international performance in academic research.

METHODOLOGY

Descriptive analysis metrics

The relation of JEL categories and affiliations is initially presented in two-entry tables in a fairly standard fashion. This would present information on the intensity of topic-affiliation participation. We also use compositional data in a dynamic approach for observing evolution of the main topic categories.

SNA and communities

The concept of social network analysis (SNA) was first proposed by Mitchell (1969). To date, SNA has been used to study the relationship between different ethnic group and business, as well as dynamics, sentiment analysis and activities that other circles of networks being involved (Akuma *et al*., 2016; Karyotis *et al*., 2018). These actors can be people, as well as institutions or countries. SNA is frequently used by several disciplines such as sociology, anthropology, social psychology, communications and economics.[9,34] Relationships among entities can be represented by networks, i.e., nodes or points associated through edges or lines. Relations may include many definitions under many contexts. It usually represents individuals and some type of human interaction: friendship, kinship, marriage, etc. However, this could be extended for any well-defined node or link. For instance, words present in a text, authors collaborating in a paper, among others. Once a network is formed, a natural mathematical way of representing is through graphs and its adjacency matrices. This way structural metrics provide more information on the nature of the relationships.

Visualization plays an important and introductory role in observing grouping patterns but for the sake of precision metrics have to be estimated. We use network analysis tools like graphs and metric estimations.

Clusters and k-cores in SNA

A key concept in SNA is centrality: how important is a node according to different criteria. For instance, a node might be important given that it is connected to a large number of other nodes; in that case, degree centrality accounts for the number of links a topic shares with other topics. The presence of self-loops in the network (codes that link to themselves) prevents from using the classical definitions of betweenness. To overcome this, we calculate random walk and random walk betweenness centralities the exploits with probabilities a wider spectrum of connections.[35] Actually, both centralities are highly correlated (correlation coefficient of .98). Consider a generic node i for which we want to compute the random walk betweenness centrality and an impulse generated from a different node h, which works its way through the network in order to get to target node k. Let $f(h, k)$ be the source of vector N × 1, such that $f_i(h, k) = 1$ if $i = h$, $f_i(h, k) = -1$ if $i = k$ and 0 otherwise. Newman (2005)[35] shows that law of Kirchoff of current conservation implies that

$$v(h,k) = [D - W]^{-1} f(h,k) \quad (1)$$

where $v(h, k)$ denotes the $N \times 1$ vector of node voltages, $D = diag(s)$, where s is the node-strength vector, and $[D - W]^{-1}$ is computed using the Moore-Penrose pseudoinverse. This implies that the intensity of the interaction flowing through node i originated from node h and getting to target node k, is determined by

$$I_i(h,k) = W \cdot \left| v(h,k) - 1v_i(h,k) \right| \quad (2)$$

where $I_h(h,k) = I_k(h,k) = 1$ and 1 is the conformable unit vector. Then it can be computed random walk betweenness centrality (RWBC) for node i as:

$$RWBC_i = \frac{\Sigma_h \Sigma_{k \neq h} I_i(h,k)}{N(N-1)} \quad (3)$$

RWBC is a measure of node centrality that captures the effects of the magnitude of the relationships that a node has with other nodes within the network as well as the degree/strength of the node in question. Finally, eigenvector centrality and PageRank, a variant of the former, are also used for detecting highly influencing and highly demanded topics respectively.

We then identify clusters of JEL codes by using cluster algorithms and *k*-cores. A *k*-core in an undirected network is a connected maximal induced subgraph which has minimum degree greater than or equal to *k*. Moreover, in our case, a *k*-core is a maximal group of JEL codes, all of whom are connected to some number (*k*) of other codes of the group. The coreness score is the maximum value of *k* for which it is in a *k*-core.

We rely on three software packages for visualizing information. Firstly, NodeXL[36] is used for presenting clusters in Figure 1. Secondly, Gephi[37] is used for Figure 2, and thirdly, VOS-viewer[38] is used for the heat maps and VOS algorithm cluster presentation in Figures 3 and 7. Finally, we use Pajek (Batagelj and Mrvar, 1998) for estimating VOS clustering (single refinement) in the topical network and VOSViewer for visualization.

RESULTS

Descriptive analysis

Affiliation plays a role in deciding what topic of research chooses to investigate.[20] A priori, we identify 7 types of affiliation: *Central/private bank*, *Foreign university*, *Private* or *Public university* (both national), *Research center* (national) and *State organization* (mainly composed with contributors from ministries and government dependencies) and *SD* (without denoting a specific affiliation). Table 1 presents as a heat map the cumulative number of papers that associate a code (to a letter aperture) and the type of institution or affiliation that originate the paper. Public universities represent the major component of institutions sending papers to the meeting. They are leading in Mathematical and Quantitative Methods (A), Labor and Demographic Economics (J), Microeconomics (D) and Health, Education, and Welfare (I). Private universities are second with main topics being Microeconomics (D) and Macroeconomics and Monetary Economics (E). Thirdly, bank research divisions contribute with a logical preeminence of Mathematical and Quantitative Methods (C) and Macroeconomics and Monetary Economics (E).

The evolution of the JEL codes over time is an indication on how the local economic thought has changed. Figure 1 shows the change in composition of JEL codes by decade. The category *Other JEL Codes* groups codes that have less than 50 papers. It is clear that C (Mathematical and Quantitative Methods), H (Public economics) and I (Health, education, and welfare) have increased their share of contributions across decades. E (Macroeconomics and monetary economics) during the 80s was a predominant topic in an Argentina in middle of the recurrent macroeconomic crises in the country. Q (Agricultural economics) has slowly increased its participation in the last decade given that dedicated research groups have grown across national departments. D (Microeconomics) decreased its share since the 2000's when it was the third more important topic. L (Industrial organization) has also sadly decreased its participation in the following decades.

Table 1: JEL Code Distribution by Category and Affiliation (1964-2014).

JEL	Central/Private Bank	Foreign University	Private University	Public University	Research Center	SD	State Organization
A				1	1	1	
B			3	5			
C	16	11	18	76	6	9	1
D	1	4	23	48	4	8	1
E	14	2	20	37	9	11	
F	4	4	12	28	9	11	1
G	7	2	15	13	1	5	
H		4	15	35	7	6	2
I		3	12	39	4	5	
J		2	7	50	7	6	1
K		3	7	7	4		
L		4	12	31	7	5	
M				2		1	
N			3	12	2	1	
O		3	9	34	8	8	
P			1	3		1	
Q	2	1	15	29	5	2	
R		3	6	19		4	
Z				1			

A – General Economics, Handbooks and Teaching; B – History of Economic Thought, Methodology, and Heterodox Approaches; C – Mathematical and Quantitative Methods; D – Microeconomics; E – Macroeconomics and Monetary Economics; F – International Economics; G – Financial Economics; H – Public Economics; I – Health, Education, and Welfare; J – Labor and Demographic Economics; K – Law and Economics; L – Industrial Organization; M – Business Administration and Business Economics; Marketing; Accounting; N – Economic History; O – Economic Development, Technological Change, and Growth; P – Economic Systems; Q – Agricultural and Natural Resource Economics; Environmental and Ecological Economics; R – Urban, Rural, and Regional Economics; Z – Other Special Topics. Source: The Author

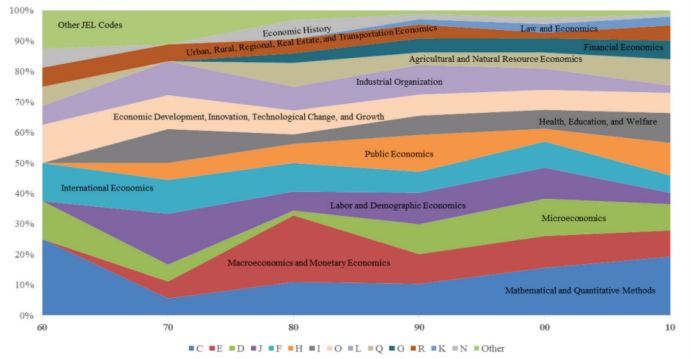

Figure 1: Topic composition of JEL codes (letter) in proceedings grouped by decades
* Implies that decades are not complete.
Source: The Author

In Table 2 a similar information that in Figure 4 but adding one digit to the JEL code. Codes are sorted by total average importance. I3 and C2 share the top position following in second by E3, F1, I1 and Q1. Main contributions presented single equation regression applied to poverty and welfare issues, following by topics in inflation and cycles, trade, health and agriculture.

Network of JEL Codes

We use conference papers published in the AAEP site (http://www.aaep.org.ar) during the period 1964-2014 given that reflects a 50-year time span enough for observing a long-term pattern. The organizer requires that each paper presented has to be categorized with at least two JEL codes[1]. The JEL network has 109 nodes and 451 unique links and 34 self-loop links. The density of the graph is .071 and exhibit one connected component. The diameter of the network is 6 with an average geodesic distance of 2.6.

Analyzing key topics clusters in thematic networks could represent an important tool for researchers. This co-occurrence network is developed by groups of repeated topics represent the more important lines of research of the database.[39] We are going to use network analysis tools applied to thematic representation.

To quantify the topic similarity between papers, a variation of the Author-Conference-Topic (ACT) model (Tang *et al.*, 2008) was used. The underlying idea of the ACT model is that if two articles share multiple JEL codes, they have a higher probability of being on the same research topic. This facilitates analyzing what topics are co-presents in the economic community at the AAEP events. We link each paper by the

1 For papers older than 1990 this requisite was not mandatory so we must read each paper and ascribe it two JEL codes according to the topics analyzed in each contribution.

Table 2: Top 10 of 1-digit JEL Category Percentage Contribution.

JEL 1 digit\Decade	60*	70*	80	90	00	10*	Total
I3– Welfare, Well-Being, and Poverty	0%	0%	0%	11%	12%	12%	11%
C2– Single Equation Models • Single Variables	0%	0%	8%	6%	11%	14%	11%
E3– Prices, Business Fluctuations, and Cycles	0%	0%	25%	8%	11%	6%	10%
F1– Trade	0%	0%	8%	11%	11%	8%	10%
I1– Health	0%	0%	0%	11%	7%	15%	10%
Q1– Agriculture	0%	0%	17%	11%	10%	8%	10%
C4– Econometric and Statistical Methods: Special Topics	0%	0%	0%	8%	11%	8%	9%
C1– Econometric and Statistical Methods and Methodology: General	0%	0%	8%	3%	12%	6%	8%
C6– Mathematical Methods • Programming Models • Mathematical and Simulation Modeling	46%	0%	25%	8%	4%	8%	8%
E2– Consumption, Saving, Production, Investment, Labor Markets, and Informal Economy	0%	0%	8%	6%	9%	6%	7%
H7– State and Local Government • Intergovernmental Relations	0%	0%	0%	17%	4%	9%	7%

* Implies that decades are not complete. There are 11 categories listed because the last one share 16 repetitions. Source: The author

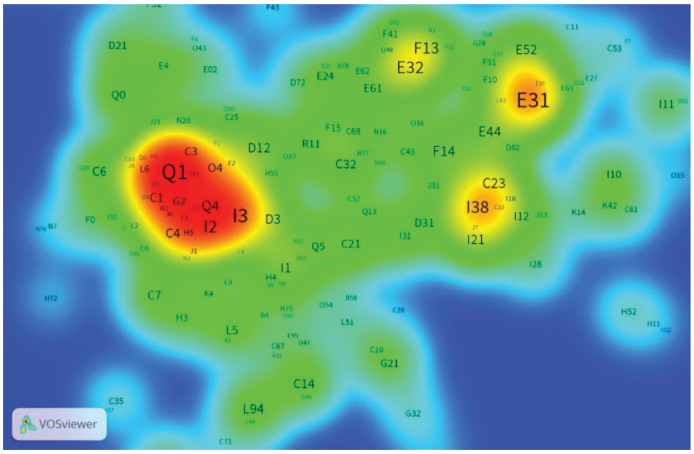

Figure 2: Density Map (close up) of the Thematic Network (1-digit JEL)
Note: Close up on main component and size of nodes corresponds to betweenness centrality value (kernel = .8)
Source: The author

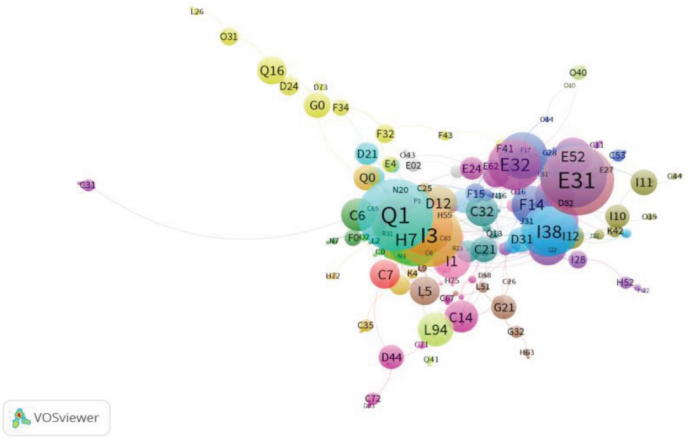

Figure 3: VOS clustering in the topical network (2-digit JEL).

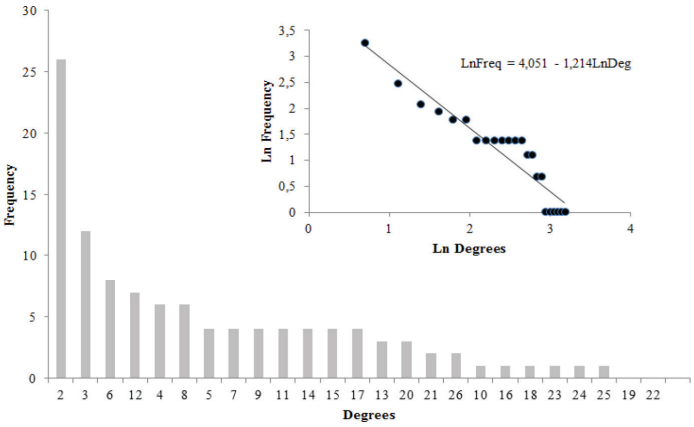

Figure 4: Frequency of degrees and log-log representation of the JEL network.
Source: The Author
Note: Tag size proportional to Pagerank centrality, link color according to modularity class

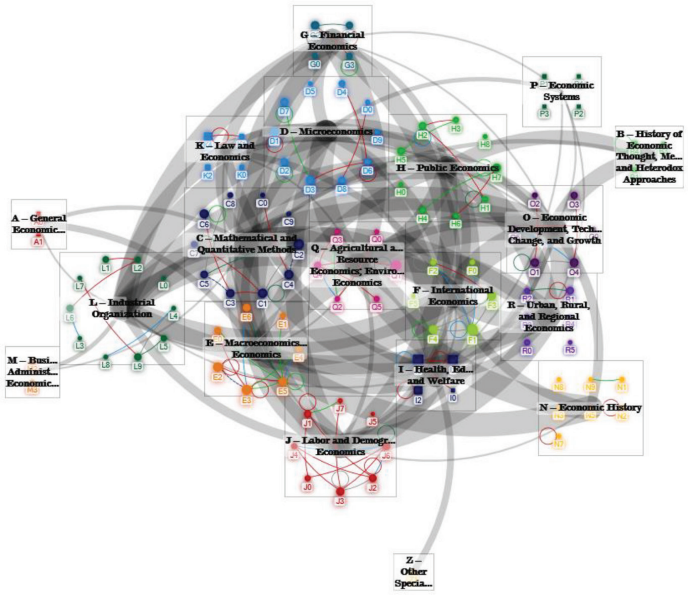

Figure 5: Clustering by JEL category in all contributions.

coincidence of its two JEL codes this way providing a picture of the topics that are shared by the contributions.

Figure 5 shows the JEL code network. Clusters were ma de by grouping contributions within each general category (only first letter). In a similar fashion of our paper, network tools for analyzing contributions published in the proceedings a congress on e-government.[40] It detects main actors and metrics of evolution of the conference. Clusters are displayed in circular network. Slimmer links represent intra-cluster links and broader links represent extra-cluster links.

Again, as in the previous section a descriptive metric about the diffusion property of the network is presented in the composite Figure 4. The main Figure shows the distribution frequency of the degree among JEL codes while the inserted Figure represents the same information but in log-log scale. As observed, it appears to have a long-tailed distribution of degrees. This is too an indication of the presence of a structure of diffusion of information congregated in hubs, or codes repeatedly connected with farther nodes. A network with fat-tail distribution of degree of nodes has good properties for dissemination of information. In our case, there are a few JEL codes that are central to many other codes and there are many codes that have little connections to the rest.

Table 3 shows centralities of the topics. *Trade* (F1) and *Welfare and Poverty* (I3) are jointly the most chosen JEL codes (higher degree). However, *Economic Development* (O1) shows the highest score in random walk centrality and given the presence of self-loops is a most important indicator of the importance of this topic.

O1 is followed by the highest score of BWBC that is *Trade* (F1). That grants it the role of pivotal topic that joins more distant topics in the network.[22] As another way of understanding the results of Leydesdorff *et al.*,[23] betweenness centrality in this context is analyzed as the codes that are present jointly with other codes the most. RWBC— measured as the relative number of times that a node is part of the shortest distance between other nodes in a network of topics—is an obvious candidate for the measurement of *interdisciplinarity*. RWBC measures the relation among categories inside the JEL code classification system. In this matter, trade, development, and econometrics act as 'inter-categorical' bridges in the papers presented in the meeting, i.e., the topics that related other more diverse topics.

The most prominent code in eigenvector centrality is *Econometric Methods* (C2), followed by *Prices, Business Fluctuations, and Cycles* (E1). That represents C2 and E1 as being co-referred by other more important topics. That is a logical research background by a country that has had recurrent macroeconomic crises dealing with high inflation and a volatile GDP.

Table 3: Centralities the JEL Codes of Coauthored Papers (sorted by degree).

Code-Area	Degree	RW Centrality	RWBC	Eigenvector	PageRank
F1 – Trade	**26**	**24.701**	**4.01**	3.0	**2.895**
I3 – Welfare and Poverty	**26**	9.814	1.3	3.0	**2.889**
C2 – Econometric methods: Single equation models; Single variables	25	8.87	1.27	**3.4**	2.608
Q1 – Agriculture	24	7.362	0.97	2.4	2.749
E3 – Prices, Business Fluctuations, and Cycles	23	12.068	1.87	**3.1**	2.37
C1 – Econometric and Statistical Methods: General	21	14.708	2.31	2.5	2.226
I1 – Health	21	9.999	1.63	2.0	2.421
C4 – Econometric and Statistical Methods: Special Topics	20	15.084	2.21	2.3	2.23
C6 – Mathematical Methods; Programming Models; Mathematical and Simulation Modeling	20	12.829	2.01	2.2	2.164
E2 – Macroeconomics: Consumption, Saving, Production, Employment, and Investment	20	12.072	1.83	2.6	2.013
O4 – Economic Growth and Aggregate Productivity	18	8.114	1.3	2.1	2.113
C3 – Econometric Methods: Multiple or Simultaneous Equation Models	17	23.75	**2.84**	2.3	1.81
G2 – Financial institutions and Services	17	6.797	1.12	2.2	1.747
H7 – State and Local Government; Intergovernmental Relations	17	0.956	0.16	1.6	2.019
O1 – Economic development	17	**26.196**	**2.87**	2.0	1.782
F4 – Macroeconomic Aspects of International Trade and Finance	16	3.778	0.58	2.2	1.634
E5 – Monetary Policy, Central Banking, and the Supply of Money and Credit	15	0.391	0.07	2.1	1.485
I2 – Education	15	14.515	2.05	1.8	1.563

Bold Figures represent first two maximum values in each variable. RW Centrality means random walk centrality and RWBC means random walk betweenness. Eigenvector centrality values are original metric values multiplied by 100. (Source: The Author)

Figure 6: Thematic Network According to 17-coreness (2-digit JEL).

Dynamically the first three decades (60s to 80s) show lower activity compared to the 90s through the 2010s. From the 90s on, participation grew exponentially in almost all fields of the economic categories in contributions presented at the meeting given the increase in university enrollment and the incorporation of overseas postgraduate into university staffs.

Clusters and k-cores of thematic communities

We work with the total topical network (that includes both single-authored and coauthored contributions). We calculate the k-core for the network of one-digit JEL codes (it means one letter and one digit) and find a 17-core where 17 is the maximal group of JEL codes mutually interconnected. We depict the network in Figure 6 where the size of the tag is proportional to the Pagerank centrality of each code. This measure of centrality highlights more demanded codes. Code E3 (Prices, Business Fluctuations, and Cycles) is the largest, following by O1 (Economic development), N1 (Macroeconomics and Monetary Economics, Industrial Structure, Growth and Fluctuations), L1 (Market Structure, Firm Strategy, and Market Performance), O4 (Economic Growth and Aggregate Productivity) and F1 (Trade).

This code group is markedly focus on contributions that use topics referred to macroeconomics, fluctuations, prices, economic growth, and international trade. It is fair to remark that during the period, the country has been subject to regular and highly variable macroeconomic shocks (there were

Table 4: JEL codes description.

Code and description	
C1 – Econometric and Statistical Methods: General	G1 – General Financial Markets
C2 – Econometric methods: Single equation models; Single variables	G2 – Financial institutions and Services
C3 – Econometric Methods: Multiple or Simultaneous Equation Models	H5 – National Government Expenditures and Related Policies
C4 – Econometric and Statistical Methods: Special Topics	H7 – State and Local Government; Intergovernmental Relations
C6 – Mathematical Methods; Programming Models; Mathematical and Simulation Modeling	I1 – Health
D3 – Distribution	I3 – Welfare and Poverty
E2 – Macroeconomics: Consumption, Saving, Production, Employment, and Investment	J2 – Time Allocation, Work Behavior, and Employment Determination and Creation; Human capital
E3 – Prices, Business Fluctuations, and Cycles	J6 – Mobility, Unemployment, and Vacancies
E4 – Money and Interest Rates	L1- Market Structure, Firm Strategy, and Market Performance
E5 – Monetary Policy, Central Banking, and the Supply of Money and Credit	N1- Macroeconomics and Monetary Economics • Industrial Structure • Growth • Fluctuations
F1 – Trade	O1 – Economic development
F3 - International Finance	O3 – Technological Change; Research and Development
F4 – Macroeconomic Aspects of International Trade and Finance	O4 – Economic Growth and Aggregate Productivity
	Q1 – Agriculture

Source: The author

remarkably economic crisis back in 1974, 1981, 1989, 1998, and 2002, being this last as the worst national crisis since 1930). This way, naturally macroeconomic crisis has influenced the contributions presented at the meeting.

Table 4 in the Appendix shows the description of the codes for understanding the relatedness of the connections. Another way of observing groups in the topics of the contributions is through a density graph,[41] where regions with more links are depicted in hotter color (redder) than regions with fewer links (more green). Precisely, Figure 2 depicts the density network where hotter colors (red) indicate more dense connections between pairs of nodes. The reddish section (at the center to the left of the Figure) broadly (and expectedly) coincides with the *k*-core of the network.

Building Themes

Themes in the bibliometrics references are clusters of the topic according to co-occurrence or co-citations of papers.[42] A theme is usually named after the more important topic (according to some network metric) in a cluster. A highly used approach to cluster topics is by the VOS algorithm.[43] VOS algorithm minimizes a weighted sum of the squared distances between the association strength of all pairs of items in the network. The association strength depends on the actual co-occurrences of a pair items as ratio of the expected co-occurrences between both. To avoid trivial solutions in which all items have the same location, the constraint is imposed that the average distance between two items must be equal to one. We detect 33 clusters and Figure 3 shows the giant component of the topical network where clusters are shown in different color. Node sizes are determined by random walk betweenness centrality values.

Once identified, the top ten clusters are described in Table 5. Each cluster is denominated Theme and the main JEL code determines the name of the theme. JEL codes are sorted by degree and top codes are remarked in bold characters. As observed, findings in topic identification overlap with the *k*-core of the previous section but we have now a more detailed description of the particular crossings of topics in the literature production of the event.

More diverse topics refer to international macroeconomics, cycles, and economic growth (themes 1 and 2), following by labor market, applied mathematics, public policy (themes 3 to 5). These have been historical topics in conferences and workshops inside the event. It also emerges recent topics such as trade policy, poverty, and economic development (themes 6 to 7 that began to been presented by the mid-90s in the AAEP mostly by graduates from foreign postgraduate programs returning home) and finally applied econometrics and agriculture (themes 8 and 10) that are both historical since the beginning of the 60s. Agriculture has always a sensitive place in the event given the productive structure of the economy associated to farm production and agribusiness and econometrics is also associated to the return of *prodigal sons*.[41-44]

CONCLUSION

The purpose of this paper is to analyze relational information extracted from a national meeting proceeding as a way of understanding how researcher choices mold the construction of knowledge on a specific field. Each branch of science has its journals and specialized congresses, meetings, or seminaries. These are channels of diffusion and discussion of new outcomes that expand the frontier of knowledge at each specific field inside a country. Each time these outcomes are summarized by codes that tag the specific field investigated it can be traced back to conform groups of codes that are used conjointly defining themes. We infer that this is a way of detecting what research is carried out in this specific field. For that to be done, social network analysis tools show to be an invaluable tool for grasping the relationship and structural importance of each field.

Table 5: Top 10 main themes in the topic network.

Theme	JEL Codes	Name
Theme 1	**F41**, Q2, E62, Q16, D24, E4, F32, F34, G0, O31, D73, F43, L26, Q0, C41, D70, D92, L60, Q10, Q15	Open Economy Macroeconomics
Theme 2	**E3, O4,** C3, F1, F4, E2, E5, E6, F3, E0, O5, G3, E1, A1, H6, O0, C65, D9, H1	Prices, Business Fluctuations, and Cycles - Economic Growth and Aggregate Productivity
Theme 3	**J3**, L5, O3, Q4, F15, C68, L9, E51, L51, Q3, E17, F2, D58, E41, L7, L95, H0, I20, K2	Wages, Compensation, and Labor Costs
Theme 4	**C6,** C14, C7, D44, D8, F0, C72, C71, N7, C73, C91, D46, D83, G23, G26, N76	Mathematical Methods • Programming Models • Mathematical and Simulation Modeling
Theme 5	**I38**, I12, K42, I10, C61, I14, J13, J22, K14, O15, Q12, F50, J33, O11	Public Policy
Theme 6	**F13,** F10, O40, G28, F12, L83, O10, O14, E20, F17, G18, O55, R41	Trade Policy • International Trade Organizations
Theme 7	**I32**, D31, I31, C67, I18, O47, O54, J60, C33, C38, D74, P36, R15	Measurement and Analysis of Poverty
Theme 8	**O1**, E32, E44, E22, D82, H55, O16, O17, N26, E38, H20, N1, N2	Economic Development
Theme 9	**C1**, **H7**, J6, C2, H5, J0, H2, B41, H72, R5, H71, R31	Econometric and Statistical Methods and Methodology: General - State and Local Government • Intergovernmental Relations
Theme 10	**Q1**, E24, R3, J23, D21, D23, J21, C46, C69, E25, Q17	Agriculture

Note: JEL Codes inside each theme are sorted by degree. Source: The Author

We have presented data and analysis of a topical network using the JEL codes of each contribution in the main congress of Economics in Argentina. We find a cluster of tagged codes up to the second digit. It shows the importance of international macroeconomics, business cycles, and growth as main (and historical) themes following by more recent themes such as poverty and econometrics studies. These findings may show the topics of research present in academic units along with the country. The composition of such themes seems to be supported by the economic evolution of the Argentine economy at the time, prone to inflation and growth crisis as well as the increase in poverty rates. We also observe that diverse topics emerge as changes in university enrollment and staff composition. While conclusions may appear ambitious, they actually add new information on how Economics has been unfolding in the past half-century in Argentina.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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