Pluralism in the Market of Science?

A citation network analysis of economic research at universities in Vienna.

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DRAFT

1. Introduction

> "We the undersigned are concerned with the threat to economic science posed by intellectual monopoly. Economists today enforce a monopoly of method or core assumptions, often defended on no better ground that it constitutes the 'mainstream'. Economists will advocate free competition, but will not practice it in the marketplace of ideas." (Hodgson, Mäki, & McCloskey, 1992)

This *Plea for Pluralistic and Rigorous Economics* was published in the American Economic Review in 1992, signed by many of the leading economists and Nobel laureates from a variety of schools of economic thought. Famous names such as Franco Modigliani, Robert Axelrod, Richard Goodwin, J. K. Galbraith, Jan Tinbergen, Paul Samuelson, Charles Kindleberger, Kurt Rothschild and Hyman Minsky supported the plea. Over twenty years later the points addressed are as topical as ever. The increasingly narrow core of the discipline has become more dominant, even after the mainstream failed to predict the financial and economic crisis. This 'mainstream' is characterized broadly by a neoclassical framework and a strict orientation towards formal models and econometric empirical approaches. Criticism is on the rise however. Not last also students revolt. The International Student Initiative for Pluralism in Economics (ISIPE), a world-wide platform of local student groups demanding a change in curricula, brought the discussion about the mono-paradigmatic nature of economics back to the floor with an open letter published in May 2014. It is indeed an astonishing fact that economics is the only discipline facing major student revolts against the curricula. Coincidentally, the use of the religious categories of orthodoxy and heterodoxy is unparalleled in science.

Next to students, especially heterodox economists have increasingly pushed for economic pluralism to break open the dominant neoclassical paradigm. Pluralism has been seen as a strategic vehicle to promote their own school of thought, as Paul Davidson's (2004) position could be described, as well as a necessary enhancement of the theoretical understanding of the economy, as proposed by for instance by Dow (2004, 2008) or Garnett (2011). Few authors have tried to identify common theoretical grounds for diverse heterodox schools for instance Lavoie

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(2006). A central debate addresses the question how the mainstream is treated within such a pluralist approach: can and should it be part of the pluralism in economics or are the differences too substantial? Lee (2011) regards heterodoxy to have no theoretical common ground with the mainstream and proposes to understand pluralism as merely mutual tolerance for the two distinct 'broad churches'. Colander (2009) on the other hand argues that heterodox economists largely provoke their exclusion themselves and pleas for building lines of communication between the heterodox schools and the mainstream in order to establish an 'inside-the-mainstream' heterodoxy. Taking up these points Dobusch & Kapeller (2012a, 2012b) call for a pluralist paradigm which also includes the mainstream, but propose 'discursive pluralism' within heterodox economics. They suggest that increased communication between heterodox schools will enhance both their explanatory power and support the heterodox institutionally through a larger number of cross-citations. This will benefit the impact factors of heterodox journals and publications and a unified pluralist heterodox camp could serve as an example for economics as a whole.

Next to these calls for pluralism from the heterodox camp, some attacks against the current conditions of the discipline come from unexpected not necessarily heterodox or pluralistically oriented directions. In his heatedly debated paper (see for instance Buchanan, 2015; DeLong, 2015) on 'mathiness' Paul Romer attacks theory-less formalism in economics and compares modern macroeconomics to a card trick including a sleight of hand. According to him the work of Nobel laureates Robert Lucas and Edward C. Prescott serves as examples of such deplorable science in which "[…] theory is entertainment."(Romer, 2015, p. 93).

Despite this criticism both from without and within the mainstream the face of economics is hardly changing. It remains a fact that heterodox economics is marginalized and non-mainstream economists continue to be pushed out of economics departments (Colander, Holt, & Rosser, 2010). This marginalization by the mainstream is not a new phenomenon (Frederic S. Lee, 2004) and is in part owed to the self-reinforcing mechanisms that have been established within the institutional structure of economics as a science, especially the overarching importance of journal impact factors and rankings. These constitute the institutional vehicles to the exercise dominance neoclassical theory. Not last also tendencies of 'self-marginalization' (Dobusch & Kapeller, 2012a) within heterodoxy further amplify these mechanisms. This is not only the case with regard to the 'right' strategy for opposition as discussed by Colander et al. (2010), but also with respect to citation interactions and the associated self-excluding institutional mechanisms heterodox researchers often (re)produce.

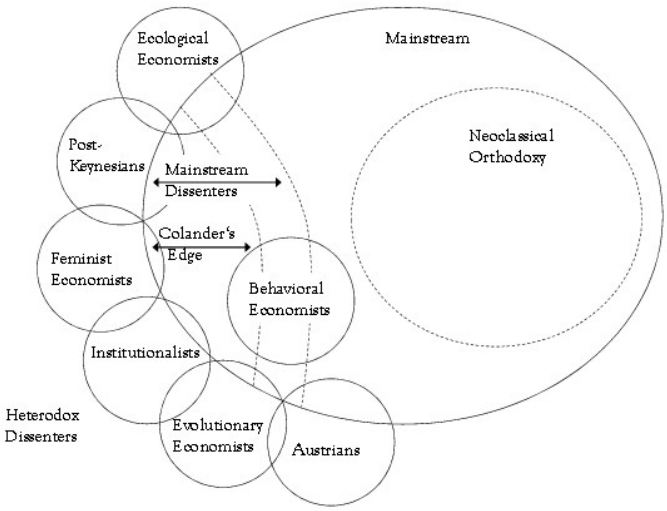
Citations have become a central currency in the institutional setting of economics as a discipline. They are important determinants for the allocation of research funding and positions at economics departments. Analyzing citations also reveals important structures within a discipline and allow to identify patterns of interaction, segregation, clusters and cliques.

In this paper we proceed to investigate these patterns applying bibliometric tools as well as social network analysis and graph theory (see Scott, 2000) on the journal level in the institutional context of the three major university departments engaged in economic research in Vienna. We distinguish between a group of heterodox and a group of mainstream journals as suggested by Lee et al. (2010). The paper is structured as follows. First, we discuss managerialism and the market of

science and the implications of the strict focus on impact factors and rankings. Second, we provide an overview over the institutional specificities of the investigated departments and contrast them to the developments at the University of Notre-Dame, a prominent case of discrimination and displacement of heterodox researchers. Third, we detail the use of social network analysis in bibliometrics and its potential in revealing patterns of interaction and segregation between different economic schools of thought, before turning to the empirical results.

We find that **(1)** Articles in heterodox journals cite more heterodox journals than articles in orthodox or non-categorized journals, but still have negative 'citation export rates', thereby reinforcing the institutional dominance of the mainstream. Orthodox journals completely disregard heterodox journals. **(2)** The Department of Socioeconomics exhibits significantly higher ratios of heterodox to orthodox citations in all three journal categories (heterodox, orthodox, not-categorized) according to the list of Lee et al. (2010). This effect is robust when only comparing journals in which both the DS-WU and an economics department have published. **(3)** There is a marked difference in the network structure between the two Departments for Economics (DEs) at the Vienna University of Economics and Business (WU) and the University of Vienna (UV), and the Department for Socioeconomics (DS-WU). The empirically observed citation interactions of researchers employed at the departments for economics reveal a clear 'mainstream core – heterodox periphery' structure as suggested in the paradigmatic map of the current discourse in the discipline of economics by Dobusch & Kapeller (2012b) as shown in Figure 1. The DS-WU's network is significantly less concentrated and does not display a core-periphery structure **(4)** The ego-centric citation network of the Journal of Economic Behavior and Organization, classified as heterodox by Lee et al. (2010) suggests that the journal is part of the mainstream, as it reveals nearly no connections to other heterodox journals. This finding is also in line with Dobusch & Kapeller's paradigmatic map.

Figure 1: Paradigms in Economic Discourse (Dobusch & Kapeller, 2012b)



2. Managerialism and the Market of Science

Managerialism in science (Harley & Lee, 1997), manifesting in rankings and impact factors have become the currency of academic research. Based on 'naïve' citations, which only take into account quantity, the academic world has been restructured over the last decades. Positions at

universities highly depend on being 'well-published' in terms of number of publications in combination with the respective journal impact factors. Similarly, research funding and allocation of funds between university departments often are dependent on this criterion.

However, assessment based on rankings and impact factors fails to address or rather redefines quality of research. Instead of evaluating whether the work is of high quality and relevant, such assessment is tailored to the question whether it is in demand (Hasselberg, 2012, p. 33). This expresses in its essence the ongoing commodification of science, where content plays a subordinate role. The mechanisms leading to this process of commodification of science can be understood in analogy to the ideas expressed by Polanyi (1944). Polanyi showed that the liberation of the market and the disembedding from its social and historical context in fact necessitated a significant amount of regulation. Similarly, the commodification of science was achieved by thorough regulation, foremost the establishment of rankings and impact factors and their incorporation into institutional rules.

Hasselberg (2012) identifies the consequences of forcing the scientific endeavor into a market framework. The transformation of the text from a means of communication in science into a commodity leads to a shift of focus from quality to quantity which forces the scientist to minimize the amount of information in each publication while maximizing cultural and economic capital as a return. In this context the aim of a publication is not the communication of knowledge but rather maximizing 'profit' from spreading information. The reputation of a researcher in the market of science is constructed on the base of their historical publication records.

Besides these general consequences that follow from the implementation of the market of science, the strict focus on impact factors entails inherent problems. Especially in economics impact factors are a flawed depiction of scientific quality and moreover skew it towards mainstream research for several reasons, some of which we highlight here (for a detailed overview of the flaws of citation metrics see Kapeller, 2010).

(1) It leads to a complete disregard of scientific work not published in journals.

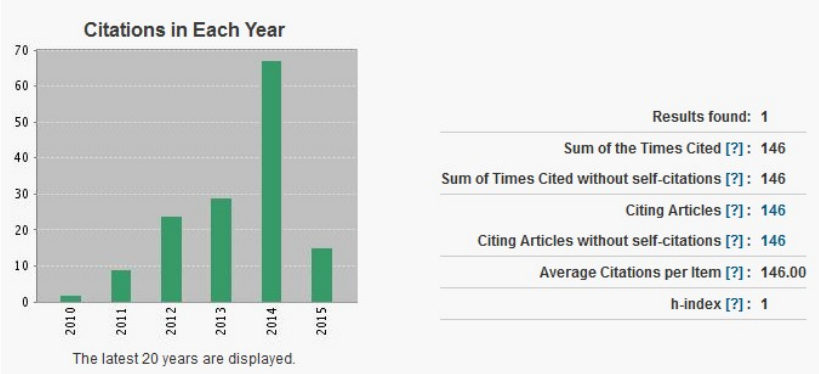
(2) The most important journal impact factor provided by Thomson Scientific has a selection bias, simply due to the fact that many core heterodox journals are not included (Frederic S. Lee & Elsner, 2008) which also harms the overall scores of the non-mainstream journals included. Network effects within the greater group of mainstream researchers further push impact factors in favor of the mainstream. In a system based on citation metrics, these factors further contribute to a displacement of heterodox economists. Lee (2008) therefore proposes alternative methods of calculation impact factors to account for such biases.

(3) Citation metrics ignores important factors influencing the impact factor including article length, language, the number of authors or the accessibility of journals. These disregarded factors also bring about a set of 'perverse incentives' such as the interest in fragmentation of work into smallest publishable units or publication with as many authors as possible.

(4) 'Naïve' counting of citations, does not distinguish between the reasons for which an article was cited. Citation metrics are indifferent to the difference between support and

criticism. In fact, an absurd result of this mere counting exercise is that errors published in scientific journals increase the number of citations and thus also the impact factor. A prominent case for this effect is Reinhart & Rogoff's (2010) *Growth in a Time of Debt* paper, which was shown to be seriously flawed by Herndon, Ash, & Pollin (2014), first published online in December 2013. It is stunning that in the year after the error became public, the article was cited more than in the previous four years together. Also in 2015 it seems highly unlikely that the publication will receive citations anywhere near the 67 in 2014. The absurdity of this mechanism becomes obvious when reflecting that in using this example to illustrate the effect of errors to criticize the 'naïve' logic of journal impact factors we are strengthening it institutionally.

Figure 2: Citations of Reinhart & Rogoff's (2010) Growth in a Time of Debt – Web of Science query 10.6.2015



2010	2011	2012	2013	**2014**	2015	Total
2	9	24	29	**67**	15	146

In this context also 'discursive pluralism' as proposed by Dobusch & Kapeller (2012b) as a single isolated strategy for heterodox economists against their marginalization is prone to a set of fallacies, which are apparent in a comparison of the market of science with the market of goods and the consequences following from the assumtion of sovereign consumers.

According to Hutt (1936, p. 257) "[t]he consumer is sovereign when, in his role of citizen, he has not delegated to political institutions for authoritarian use the power which he can exercise socially through his power to demand (or refrain from demanding)". In discursive pluralism, different heterodox schools of thought consciously interact, discuss and integrate each other's theoretical propositions and empirical results. Considering the institutions scientists are working in, the mentioned discussions, interactions and integrations are limited by the structure of the market of science and the organisations they are working in.

Following the work of Fellner & Spash (2014) on consumer sovereignty, the scope of action i.e. the 'market power' of scientists as sovereign consumers is strongly limited. Measures undertaken to change the market of science from *within* by 'citing sustainably' as suggested in discursive pluralism face the same contradictions as the call of social and environmental movements to cause an overhaul of the dominant way of production by changing consumption behavior. By trying to implement pluralism within the logic of citation metrics, the institutional position of impact factors etc. is strengthened.

Some barriers to the *scientist as a sovereign consumer* include:

(1) Within a market of science, the ability of consumers to 'vote' i.e. to influence the discipline depends the number of successfully published journals and their respective rankings. The minority of heterodox journals overall and particularly in the high ranks determines their academic standing and limits their ability to vote distinctively.
(2) As much as consumer preferences are affected by advertisement, scientists' citation behavior is not independent of the education they received in their career. In fact there exists a self-reinforcing cycle of dominant mainstream ideas in economics education and the dominance of the mainstream in economic research, which constitutes a major barrier to changed citation behavior in the long run.
(3) Consumer sovereignty ignores social pressures concerning positional goods already pointed out by Veblen (1899) as well as mere income barriers following an uneven distribution impeding a sovereign consumption decision. Similary, the career prospects are better for mainstream researchers and also heterodox researchers will often try to be compatible with the mainstream and publish in orthodox journals as their academic career is dependent on their publication record.

In a similar vein, the *scientist as a producer* who wants to sell his product i.e. his school of thought has to act in the interest of his competitors and cite as many other articles, particularly from other schools of thought, in order to promote discursive pluralism. This is still abstracting from the fact that in order for the non-mainstream groups to create a more geared up unified pluralist camp (Sterman & Wittenberg, 1999) in opposition to a theoretical hegemony of the mainstream the smaller number of pluralist researchers would need to cite more articles than their current overall share and in addition learn to master a variety of heterodox theoretical frameworks and discourses. To maintain its position the mainstream in contrast could stay within its neoclassical, new-Keynesian framework, entailing distinctively less theoretical and strategic work

a. Institutional Divides

Managerialism in economics also manifests on the organizational level and often manifests in the displacement of heterodox economists.

> "The reality that underlies our call for change is that heterodox economics are being squeezed out of the U.S. programs and more and more are being squeezed out of European and latin american programs." (Colander, Holt, & Rosser, 2010, p. 407)

The University of Notre Dame is one of the most prominent examples of the squeezing out of heterodox scholars. In January 2003 it became public that the University decided to mirror the theoretical divide in the department with a new structure, not last seeking to improve the department ranking (Monaghan, 2003). The Department of Economics was split. The new Department for Economics and Econometrics (DEE) on the one hand constituted a predominantly mainstream department in terms of the neoclassical theoretical framework, the formal and econometric methodology applied as well as the fields of study, focusing on topics such as growth and industrial organization (McCloskey, 2003). The Department of Economics and Policy Studies (DEPS) on the other hand incorporated the more pluralistic and heterodox approaches to economics, addressing issues of inequality, development, race, and gender, as well as history of economic thought (Schiffman, 2004, p. 1082). These issues, while relevant, cannot

be easily published in high-ranked mainstream journals. By pushing heterodox researchers into a separate department, the administration therefore hoped to be able to increase the ranking of its mainstream department.

Paradoxically, less than ten years after the decision to split the department, the heterodox DEPS was dissolved with the argument that its ranking was too low. The mainstream DEE was renamed Department of Economics again, its faculty was essentially identical to the DEE's. The new department describes itself as "a neoclassical economics department"(Department of Economics, University of Notre Dame, 2015). Heterodoxy at Notre-Dame was effectively eradicated (Steelman, 2014).

Forces to drive out heterodox researchers have also been present at Viennese economics departments. The over the last decades continuously increasing pressure on the Institute for Heterodox Economics at the DE-WU from the side of the mainstream department management is an ideogram for this process. Not last due to the rationale detailed in the case of the University of Notre-Dame, demanding more publications in high-ranking journals, the institute's staff number was reduced steadily. Currently there is no more full professor at the institute.

This development, as well as the circumstance that the curricula of the undergraduate and graduate economics programs both at the Vienna University of Economics and Business and the University of Vienna are oriented strongly towards neoclassical theory, sparked the foundation of the Society for Pluralist Economics Vienna (Gesellschaft Plurale Oekonomik Wien, 2015b), supported by the legal student representations for the respective programs. Trying to raise awareness for the necessity of opening up narrow economics curricula the society participated in the ISIPE Open Letter and organized a Conference on Pluralist Economics in April 2015 with more than 300 participants (Gesellschaft Plurale Oekonomik Wien, 2015a).

Moreover, also the Vienna University of Economics and Business (WU) experienced a splitting of the economics department. Similarly to the University of Notre-Dame's DEPS, the Department for Socioeconomics at the WU was only founded in January 2010, while the economics departments at both universities can look back at a long history[3]. The circumstances of the foundation of this new department are however distinct from those which led to the splitting of the department at the University of Notre-Dame. Rather than a result of trying to shut out heterodoxy, the establishment of this new department was a deliberate step of the WU to strengthen interdisciplinary and holistic approaches to economic research (Lenoble, 2010), including hiring a significant amount of new faculty for the department. Also the introduction of two new Master programs, Socioeconomics[4] (in 2010) and Socio-Ecological Economics and Policy (in 2012) constituted a strengthening of the not uniquely mainstream-oriented camp.

[3] The Department of Economics at the University of Vienna has its origins in 1763, and home to important economists such as Menger, Böhm-Bawerk, Schumpeter and Hayek (Department of Economics, University of Vienna, n.d.), while the Department of Economics at the Vienna University of Economics and Business has its origins in the Imperial Export Academy founded in 1898 (Brusatti, 1998).

[4] As a successor to the old diploma program in Socioeconomics, according to the old Austrian system prior to the Bologna-reforms.

3. Method & Data

a. Bibliometrics and Citation Networks

As discussed above Bibliometrics are used to calculate impact factors for journals and publications. They are however also an interesting tool to determine latent structures of communication within science. While the qualitative character, i.e. the reasons and the content of a citation cannot be captured by bibliometrics, they allow to reveal which authors, journals or groups engage in a dialogue and with whom, be it supportive or critical. Dense citation structures can be the result of similar content areas or similar methodologies (Pieters & Baumgartner, 2002) but also reflect a certain social function of citations: "they are there to show where you belong and which other scholars you like or feel affiliated with" (Hasselberg, 2012, p. 35). Citation analysis has been used to identify individual influential authors and papers (Pasadeos, Phelps, & Kim, 1998), theories (van der Merwe, Berthon, Pitt, & Barnes, 2007) or to investigate the relationships between journals (Cason & Lubotsky, 1936; Doreian, 1988; Eagly, 1975). The analysis of citation flows, specifically cluster analysis also allows to identify related research and to reveal theoretical and disciplinary boundaries. (Arms & Arms, 1978; Gatrell & Smith, 1984; Narin, Carpenter, & Berlt, 1972).

Also in the field of economics citation analysis has been used to uncover patterns of communication. Eagly (1975) shows that there are more systematic citation flows between journals with a theoretical orientation than between theoretical and applied journals. Intra-applied journal citations were found to be insubstantial. Similarly Stigler, Stigler, & Friedland (1995) illustrate the importance of economic theory as intellectual exporter to applied economics using citation-level data. McCain (1990, 1991) uses cluster analysis to identify the emergence of distinct schools of thought.

Less common is the use of network graphs from graph theory to illustrate citation patterns. Cronin (2008) uses such an approach to illustrate the citations between heterodox journals in the period between 1995 and 2007 to show the changing position of journals within the heterodox group over time. Similarly, Dolfsma & Leydesdorff (2008) show the incomparability of impact factors between journals by investigating the citation network of six heterodox economics journals. Dolfsma & Leydesdorff (2008) analyze the citation network of the Journal of Evolutionary Economics.

Levallois, Clithero, Wouters, Smidts, & Huettel (2012) analyse the citation patterns of the growing field of neuroeconomics to reveal it as a link between neural and social sciences, while Fourcarde, Ollion, & Algan (2015) analyze the dominant position of economics within the network of social sciences using bibliometric data. In a similar vein Varga (2011) demonstrates that the citation network of sociology is is significantly more fragmented than the network of economics, in line with the multi-paradigmatic nature of sociology in comparison to the mono-paragadigmatic structure of economics. Combining bibliometric data and publication content with information on authors retrieved with text-mining techniques Jelveh, Kogut, & Naidu (2014) go further to quantitatively evaluate political ideology of economists.

Others have investigated the development of a specific technique or approach within economics. For instance Basturk, Cakmali, Ceyhan, & van Dijk, (2013) shed light on the evolution of

Bayesian econometrics in economics, Panhans & Singelton (2015) show the increase of quasi-experimental techniques in economics over the last decades, and Hoover (2010) the rise of micro foundations as a concept in economics. Guo et al. (2015) analyse the evolution of conceptual diversity in economics paper titles from 1890 to 2012 using social network analysis.

b. Data

To analyze the citation networks present in economics at the major faculties conducting economic research in Vienna we first extracted the employee data of the respective faculties. For reasons of feasibility we chose to investigate the publications of all researchers employed at the Vienna University of Economics and Business in the Department of Economics and the Department of Socio-Economics as well as the University of Vienna in the Department of Economics in February 2015. For the former the BACH database of the Vienna University of Economics and Business was used, which includes the necessary information about employees, including their full name, institute affiliation and academic degree. For the latter, the employee information was extracted from the respective webpage. The alternative, to investigate only publications of researches in the time during their employment at these institutions, would have also involved a bias as many research projects may be completed after the employment has ended even if the majority of the work was done during the time of employment. Moreover, the lack of consistent historical employment data at these institutions did not allow for such an approach.

From the employee data we constructed a search string to retrieve the relevant publications from the Web of Science Core Collection (WOS) and their cited references. To restrict our search string we only searched for researchers at post-doctoral level and professors. Due to the fact that many entries in the database only the first letter of the first name is included we chose to set up our search string respectively, as the possibility to restrict it to publications where the full name of the authors is known was still given with this approach. We searched for the researchers with their last name and the first letter of the first name[5] and restricted the research areas to economics as well as other sciences with potential overlaps with economics, such as other social sciences or psychology. The dataset after this search encompasses 3944 publications. Initial-based name disambiguation however distorts results strongly as the authors' identity cannot unreservedly confirmed (Kim & Diesner, 2015). To ensure that our dataset only includes work of the researchers at the investigated institutions, the list of publications was also extracted from the databases the respective departments use to document their work i.e. the BACH database (for the WU) and the IDEAS: Economics and Finance Research – RePEc database (for the University of Vienna). The list of publication comprises in total 10928 publications of various types (including book-chapters, reports …). After merging the two datasets on the basis of their titles[6], publications not comprised in both extractions were discarded from our analysis. Our final dataset then comprises 551 articles from the authors currently employed at the investigated institutions between 1980 and 2015 with a total of 11344 citations[7]. In the next step we matched

[5] i.e. with a string of the following form: *"(Lastname$_1$, X*) OR (Lastname$_2$, X*) OR … OR (Lastname$_i$, X*)"*. In the case of double names or two first names both variants where included in the search string.

[6] To ensure that all relevant titles are matched, we recoded punctuations, digits & and special characters. Therefor we applied the same routine to both datasets.

[7] All journals which are not included in the Web of Science (except Kurswechsel) and could thus not be found with the help of the journal abbreviations are not included in the network graphs and statistics. The abbreviations were also checked for potential

the publications to the employee data to be able to attribute them to the individual departments and categorized the journals into a heterodox an orthodox and an uncategorized group, both for the publications and the cited references[8], using the list provided by Lee et al. (2010). The list comprises a total of 254 journals[9], of which 62 are categorized as heterodox and 192 as orthodox.

4. Empirical Results

a. Bibliometric results

The investigated sample includes 161 articles of authors currently employed at the DS-WU, 183 articles of authors currently employed at the DE-WU, and 219 articles of authors currently employed at the DE-UV. The composition of articles differs substantially between departments. The share of articles in heterodox and non-categorized journals is significantly higher in the DS-WU (about 90%) than in the DEEs (between 40 and 50%). In total the three departments published in 186 different journals, while only little variation can be observed between the departments (72, 91, 77 journals for DS-WU, DE-WU, DE-UV respectively). Relative to the respective number of publications, the biggest variety of journals published in can be observed in DE-WU (0.5), the lowest in DE-UV (0.35) and DS-WU sits approximately in the middle (0.45).

Table 1: Descriptive statistics:

		Socio-economics (WU)		Economics (WU)		Economics (Univie)		Total	
Publications	O	16	*(9.9%)*	106	*(57.9%)*	144	*(65.8%)*	257	*(46.6%)*
	H	27	*(16.8%)*	14	*(7.7%)*	24	*(11.0%)*	64	*(11.6%)*
	N	118	*(73.3%)*	63	*(34.4%)*	51	*(23.3%)*	230	*(41.7%)*
	T	161	*(100%)*	183	*(100%)*	219	*(100%)*	551	*(100%)*
Citations	O	858	*(5.36Ø)*	3205	*(18.01Ø)*	3012	*(14.01Ø)*	6643	*(12.28Ø)*
	H	425	*(2.66Ø)*	139	*(0.78Ø)*	113	*(0.53Ø)*	671	*(1.24Ø)*
	N	2316	*(14.47Ø)*	1115	*(6.26Ø)*	743	*(3.46Ø)*	4030	*(7.45Ø)*
	T	3599	*(22.49Ø)*	4459	*(25.05Ø)*	3868	*(17.99Ø)*	11344	*(20.97Ø)*
Journals published in	O	12		43		52		72	
	H	7		8		4		14	
	N	53		40		21		100	
	T	72	(0.45Ø)	91	(0.5Ø)	77	(0.35Ø)	186	(0.34Ø)
Journals cited	O	99	*(3.18Ø)*	134	*(8.78Ø)*	114	*(7.42Ø)*	147	*(6.55Ø)*
	H	24	*(0.82Ø)*	18	*(0.35Ø)*	10	*(0.31Ø)*	33	*(0.48Ø)*
	N	491	*(7.79Ø)*	247	*(3.34Ø)*	245	*(2.54Ø)*	751	*(4.33Ø)*
	T	614	*(11.8Ø)*	399	*(12.47Ø)*	369	*(10.27Ø)*	931	*(11.36Ø)*

O – Orthodox, H – Heterodox, N – Not Categorized, T – Total,
Ø – respective values per publication, % respectively in percent of total

The dataset also includes co-authored papers. Publications that have been co-authored across departments are in both department datasets while the total dataset accounts for each publication only once. This is why the Totals are not equal the sum of the three departments. Table 2 shows the co-authorships at the three departments. In total 44 publications have been authored by two employees at the respective institutes. 21 of the co-authored articles have been published in orthodox journals and 3 in heterodox. In 32 publications the co-authors have been employed in the same department and 12 papers have been co-authored across departments. Both

spelling mistakes impeding automatic matching and manually matched for all journals on the Lee et al. (2010) list. The same was done for all abbreviations with more than 5 citations.

[8] As the variable including the cited references only includes an abbreviation of the cited journal name in the next step these abbreviations had to be matched with the list of abbreviations, provided by the Web of Science (Web of Science, n.d.)

[9] As a reference value, the list of economics journals in the SSCI comprises 321 journals.

departments at the WU co-author papers within the departments with 12 and 20 co-authored publications (DS-WU and DE-WU, respectively). With regard to collaborations across departments only the DE-WU has links to the other two departments with 10 papers published together with the DE-UV department and two with the DS-WU. Hence, in terms of co-authorship the link between the DE departments appears to be stronger than the links of DE to the DS-WU departments.

Table 2: Publications co-authored within and between departments

	Socio-economics (WU	**Economics (WU)**	**Economics (Univie)**	**Total**
Socioeconomics (WU)	12 *(1 H, 11 N)*	2 *(1 N)*	0	
Economics (WU)	2 *(1 N)*	20 *(1 H, 7 N)*	10 *(1 H, 1 N)*	
Economics (Univie)	0	10 *(1 H, 1 N)*	0	
Total	14 *(1 H, 12 N)*	32 *(2 H, 9 N)*	10 *(1 H, 1 N)*	44 *(3 H, 20 N)*

Looking at the composition of the citations reveals a phenomenon, which will be further discussed in the following: citations rarely go to heterodox journals and even in the DS-WU where more articles in heterodox journals were published orthodox journals receive drastically more citations. Evidently this is in part due to the biased list used for categorization provided by Lee et al. (2010) which includes around four times as many orthodox journals as heterodox journals. This bias, however represents the factual bases that there is a substantially greater number of orthodox journals than heterodox journals. If heterodox and orthodox journals were cited equally a ratio of 4:1 between citations of orthodox and heterodox journals should thus be expected. In this case the DS-WU cites more than expected heterodox articles with a ratio of 2 (858:425), while DE-WU and DE-VU cite less than expected heterodox journals with ratios of 23.1 and 26.7 (3205:139 and 3012:113, respectively).

The statistics of the journals cited show, next to a larger ratio of heterodox journals, that the network of DS-WU with 614 cited journals is substantially broader than that of the economics departments whose network is only around two-thirds. This, however is only true for the department overall, each article in average cities on average 12 different journals, similar to the economics departments. This suggests that the department structure of the DS-WU incorporates a broader variety of field within economics than in the DE-WU or DE-UV department.

Table 3: Ratio of Heterodox to Orthodox Citations

		Socio-economics (WU)	**Economics (WU)**	**Economics (Univie)**	**Total**
Orthodox Publication	O	176	2025	2014	3893
	H	39	28	70	131
	N	133	566	461	1064
	T	348	2619	2545	5088
	R	*0.222*	*0.014*	*0.035*	*0.034*
Heterodox Publication	O	168	144	292	560
	H	296	86	26	408
	N	460	60	117	629
	T	924	290	435	1597
	R	*1.762*	*0.597*	*0.089*	*0.729*
Not	O	514	1036	706	2190
	H	90	25	17	132

Categorized	N	1723	489	165	2337
	T	2327	1550	888	4659
	R	*0.175*	*0.024*	*0.024*	*0.06*
Total	O	858	3205	3012	6643
	H	425	139	113	671
	N	2316	1115	743	4030
	T	3599	4459	3868	11344
	R	*0.495*	*0.043*	*0.038*	*0.101*

O – Orthodox, H – Heterodox, N – Not Categorized, T – Total, R - Ratio

Table 3 shows the Ratio of Heterodox to Orthodox Citations (*R*) broken down to the three departments and the journal category (heterodox (H), orthodox (O), not categorized (N). This allows to interpret the ratios distinctly for each combination of journal category and department.

Four major observations can be made:

(1) Articles in heterodox journals cite more heterodox journals than articles in orthodox or non-categorized journals. This is true for each department but also for the Total dataset (with the respective ratios 0.034 and 0.729 for publication in heterodox and orthodox journals. Hence, independently of the department employing the researcher it is more likely that he or she cites more articles in heterodox journals if publishing and article in a heterodox journals. This will be called *journal effect* in the following

(2) Overall, the DS-WU has a ratio of *0.461* heterodox to orthodox citations. This is more than ten times the ratio of the DE-WU (*0.036*) and the DE-UV (*0.038*). The Department of Socioeconomics thus strengthens the heterodox community more than the economics departments, even though still around twice as many citations go to orthodox journals.

(3) The ratio is below one for all department – journal category pairs except one. The heterodox camp thus strengthens the orthodox camp by citing its articles over-proportionally. The orthodox camp in contrast hardly cites articles in heterodox journals. Only articles in heterodox journals written by employees of the DS-WU have a ratio of *1.723*. These articles significantly strengthen the heterodox group within the content-blind logic of citation metrics attributing 72 percent more citations to heterodox journals than to orthodox ones.

(4) The substantially higher ratio of the DS-WU shows within each journal category i.e. orthodox articles written in the DS-WU cite more heterodox journals than orthodox articles in the economics departments. The same holds true for heterodox articles and non-categorized articles. This can be due to the *journal effect*, as researcher in DS-WU publish more in heterodox journals or a *department effect*. Under the *department effect* we understand that researchers cite more heterodox literature even when comparing only articles published in the same journals as the economics departments.

Table 4 provides a comparison of the ratios for those journal intersections. The result shows that there is a *department effect* present. The average ratio of heterodox to orthodox citations for articles in journals in which both the DS-WU and the DE-WU or the DE-UV respectively published is around ten times (12.6 & 6.7) times as high for the DS-WU. Researchers of the Department of Socioeconomics thus do not only publish in more heterodox fields of economics, they cite more heterodox publications, independently of the journal they publish in. The combination of the department and the journal effect is evident in the only intersection of department and journal which has a ratio higher than 1.

Table 4: Journal Effect vs. Department Effect – investigation of ratios of heterodox to orthodox citations for journal intersections

	Socio-economics (WU)	Economics (WU)	Economics (Univie)	Intersection of Journals
Socio-economics (WU) & Economics (Univie)	*0.542*	-	*0.043*	8
Socio-economics (WU) & Economics (WU)	*1.721*	*0.256*	-	14
Economics (Univie) & Economics (WU)	-	*0.026*	*0.038*	34
Journals of Department	72	88	76	

To sum up, the analysis of citation metrics suggests that besides the journal researchers publish in, also the department employing them effects their citations. Therefore, only publications in heterodox journals from a researcher employed in departments with a considerable amount of heterodox publications lead to citations ratios that support heterodoxy.

a. Department-level Citation Networks

After analyzing citation metrics, we will now turn to social network analysis and graph theory to investigate the citation patterns of the three departments in more depth. The basic logic of this approach is to treat each journal as one node in the network and each edge between the nodes as a citation directed from the journal published in to the respective citation. The more often a citation directed from one journal to another occurs the higher the weight of the edge. In the graphs this is illustrated through an increased thickness of the edges. The nodes are colored red for heterodox journals, green for orthodox journals and blue for non-categorized journals, unless explicitly specified differently[10]. The node size[11] is ranked according to the Weighted In-Degree. A complete glossary with explanations of all terms used can be found in the annex.

The layout chosen for the network graphs is 'Force Atlas 2'[12], developed by Jacomy, Venturini, Heymann, & Bastian (2014) for Gephi. Force Atlas 2 is a force directed layout, simulating a physical system with charged particles (nodes) repulsing each other while springs (edges) attract connected particles thus leading to the spatialization of the network (see Noack (2009) for a discussion of force directed layout and spatialization). The specific placing of the nodes thus is always dependent on all other nodes and their connections. The algorithm is non-deterministic (i.e. the position of the nodes is dependent on their previous position and will change when the algorithm is applied on the raw data a second time) and cannot be read as a Cartesian projection. The position of a node can therefore not be interpreted on its own but only in comparison to others.

The layout allows for a direct visual interpretation of the network as at the core the algorithm produces a visualization of structural proximities as proximity in the network graph. These proximities can be interpreted as communities in which actors (in our case journals) have more and/or denser relations with each other than with the rest of the network. As a measure for such

[10] Graph Coloring: Green (5,250,0), Red (250,0,0), Blue (10,160,255)

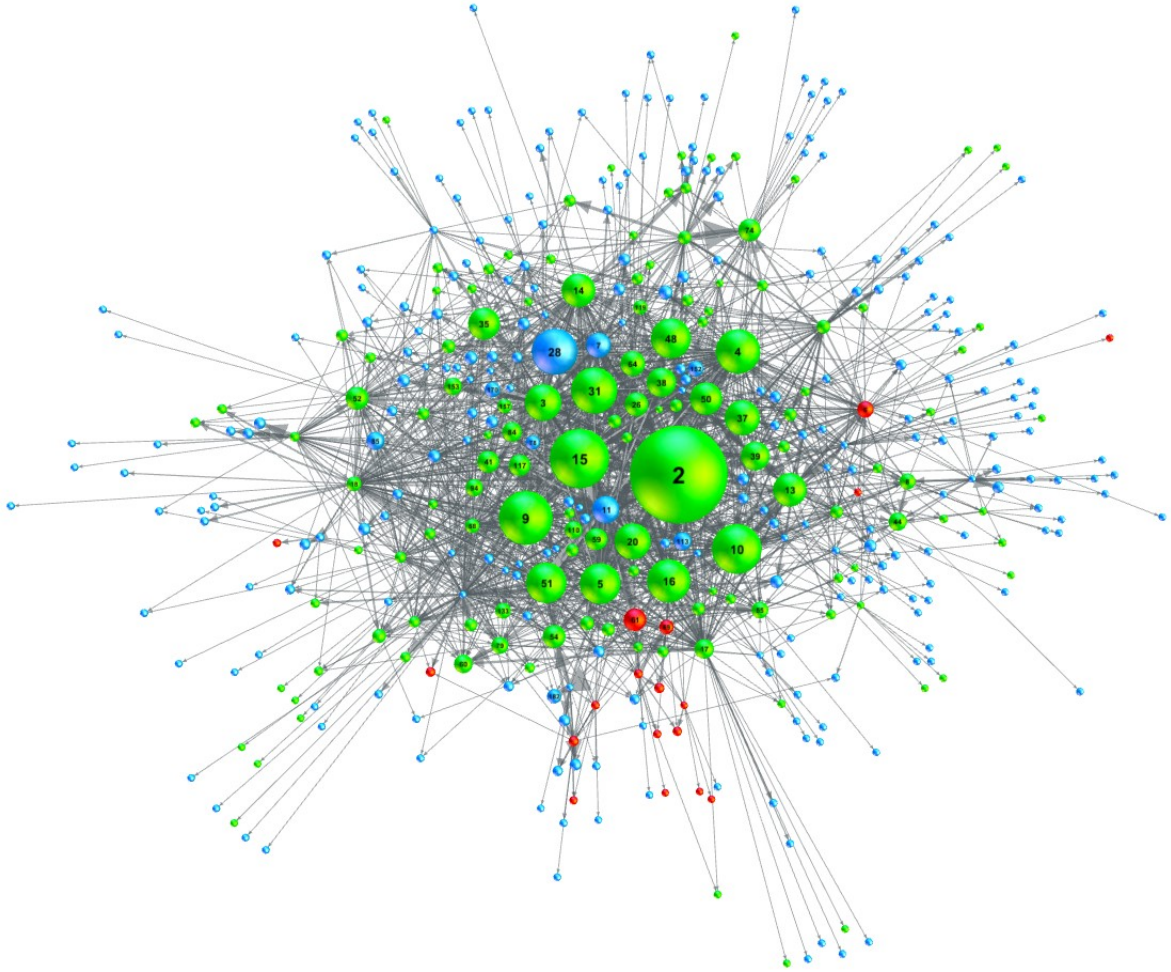
[11] Node size setting: ranked between 2 and 40.

[12] Specific settings: Activated algorithms (Dissuade Hubs, Prevent Overlap, Approximate Repulsion); Edge Weight Influence (1.0); Scaling (2.0); Gravity (1.0); Tolerance [speed] (0.1); Approximation (1.2)

collective proximity Newman (2006) proposes an unbiased measure called 'modularity', which will also feature in our analysis in the following and is optimally depicted in force-directed layouts which generate visual densities that denote structural densities (Noack, 2009).

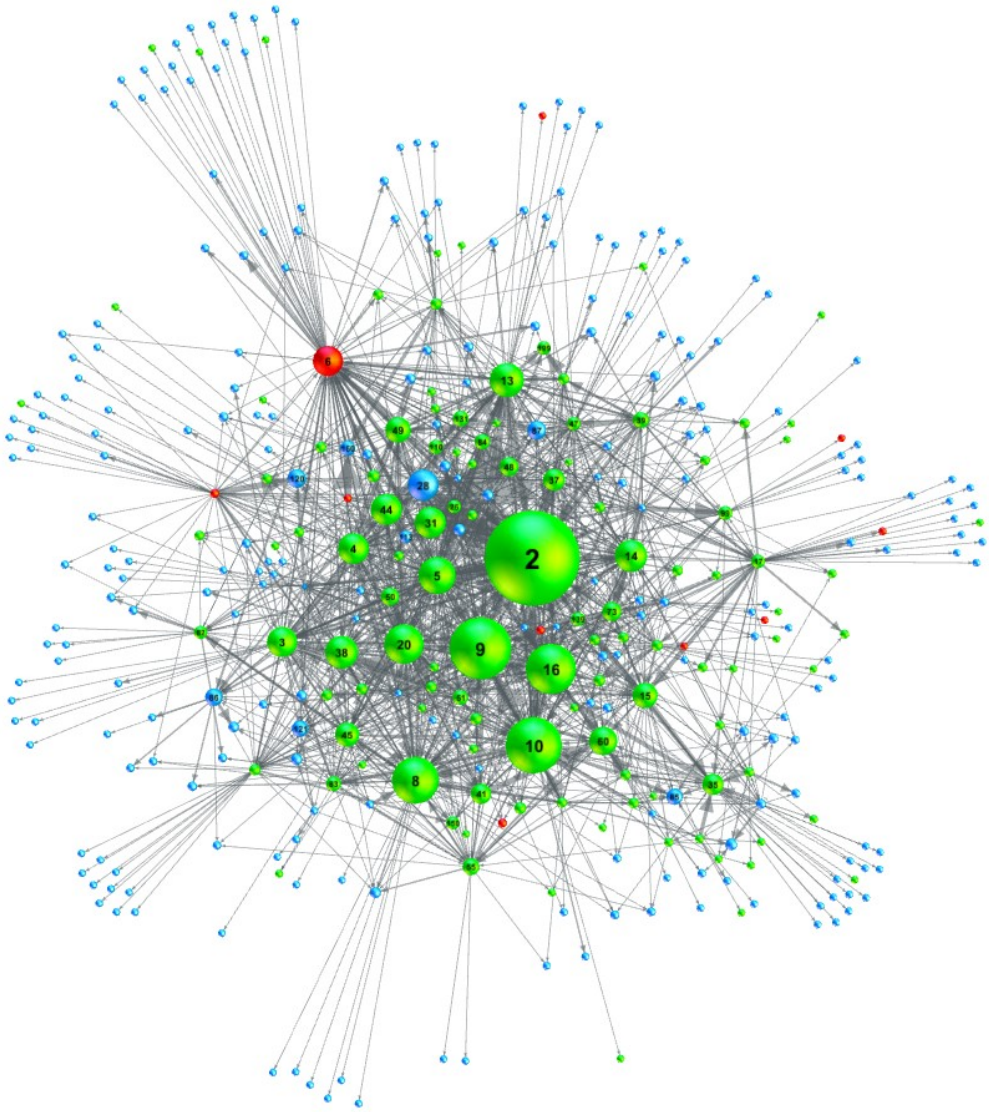
The following figures show the network graphs for the three departments, where node size is ranked by Weighted In-Degree i.e. the number of direct connections (citations) directed to the respective node (journal), considering the weight of the edges (frequency of the citations).

Figure 3: Citation Network Department of Economics WU – Node size ranked by Weighted In-Degree



2	AMERICAN ECONOMIC REVIEW	**20**	REVIEW OF ECONOMIC STUDIES
15	REVIEW OF ECONOMICS AND STATISTICS	**37**	JOURNAL OF ECONOMIC PERSPECTIVES
9	QUARTERLY JOURNAL OF ECONOMICS	**14**	ECONOMICS LETTERS
10	ECONOMETRICA	**13**	JOURNAL OF PUBLIC ECONOMICS
31	JOURNAL OF FINANCIAL ECONOMICS	**50**	JOURNAL OF INDUSTRIAL ECONOMICS
28	JOURNAL OF FINANCE	**35**	JOURNAL OF ECONOMETRICS
4	EUROPEAN ECONOMIC REVIEW	**38**	RAND JOURNAL OF ECONOMICS
16	JOURNAL OF POLITICAL ECONOMY	**39**	PUBLIC CHOICE
5	ECONOMIC JOURNAL	**…**	…
51	JOURNAL OF INTERNATIONAL ECONOMICS	***61***	*CAMBRIDGE JOURNAL OF ECONOMICS*
48	JOURNAL OF ECONOMIC LITERATURE	***6***	*JOURNAL OF ECONOMIC BEHAVIOR AND ORGANIZATION*
3	INTERNATIONAL JOURNAL OF NDUSTRIAL ORGANIZATION	***69***	*METROECONOMICA*

Figure 4: Citation Network Department of Economics Univie – Node size ranked by Weighted In-Degree



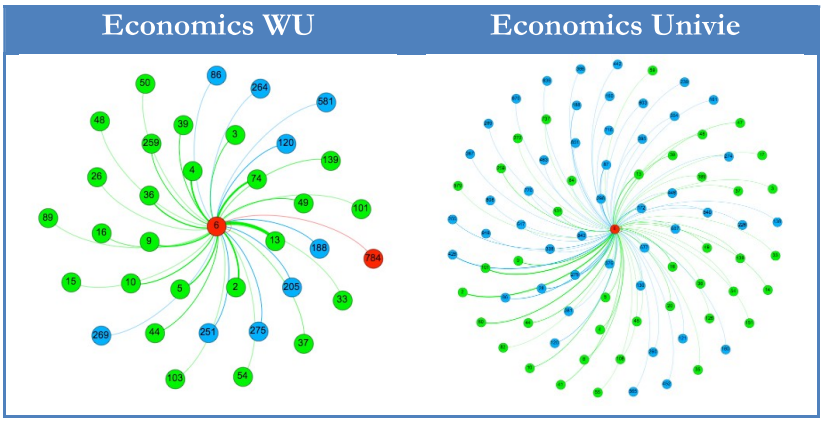
2	AMERICAN ECONOMIC REVIEW	44	GAME AND ECONOMIC BEHAVIOR
9	QUARTERLY JOURNAL OF ECONOMICS	28	JOURNAL OF FINANCE
10	ECONOMETRICA	31	JOURNAL OF FINANCIAL ECONOMICS
16	JOURNAL OF POLITICAL ECONOMY	4	EUROPEAN ECONOMIC REVIEW
8	JOURNAL OF ECONOMIC THEORY	3	INTERNATIONAL JOURNAL OF INDUSTRIAL ORGANIZATION
20	REVIEW OF ECONOMIC STUDIES	6	JOURNAL OF ECONOMIC BEHAVIOR AND ORGANIZATION
5	ECONOMIC JOURNAL	60	JOURNAL OF MONETARY ECONOMICS
13	JOURNAL OF PUBLIC ECONOMICS	49	EXPERIMENTAL ECONOMICS
38	RAND JOURNAL OF ECONOMICS	15	REVIEW OF ECONOMICS AND STATISTICS
14	ECONOMICS LETTERS	45	ECONOMIC THEORY

The network graphs contain several features previously touched upon. Most importantly the citation networks of the two economics departments reveal the same mainstream core, heterodox periphery structure schematically illustrated by Dobusch & Kapeller (2012b). Also non-categorized journals are located rather on the periphery of the networks. The core-periphery structure of economics as a discipline is thus not only to be found at the aggregate level, but also at the meso level of university departments.

The economics departments reveal a network structure with a clear dominant core of heavily cited orthodox journals. For both DEs the American Economic Review is the most important Journal in this respect. Together with the Quarterly Journal of Economics (Place 2 and 3), Metroeconomica (Place 3 and 4) and the Review of Economics and Statistics for the DE-WU and the Journal of Political Eocnomy for the DE-UV they build the centre of the core group. Heterodox and non-categorized journals constitute the periphery of the network. In the DE-WU there is a small heterodox group around the Cambridge Journal of Economics and Metroeconomica.

The only other more important journal in the heterodox group, the Journal of Economic Behavior and Organization (JEBO), is isolated from other heterodox journals. The same holds true for the DE-UV where the JEBO plays a more important role in the network[13], is however barely connected to other heterodox journals. Recalling Figure 1 this is consistent with the notion of Behavioral Economics being closer to the mainstream than other fields and or schools of thought in economics. Indeed when analyzing the network for the JEBO, becomes apparent that the journal only cites orthodox journals. It is thus questionable whether the categorization of Lee et al. (2010) as heterodox is adequate. In fact it rather seems that consistent with the scheme of Dobusch & Kapeller (2012b), Behavioral Economics has indeed been integrated into mainstream. *Figure 5* shows the citations made by JEBO for the two economics departments, no article was published in JEBO by researchers of the DS-WU.

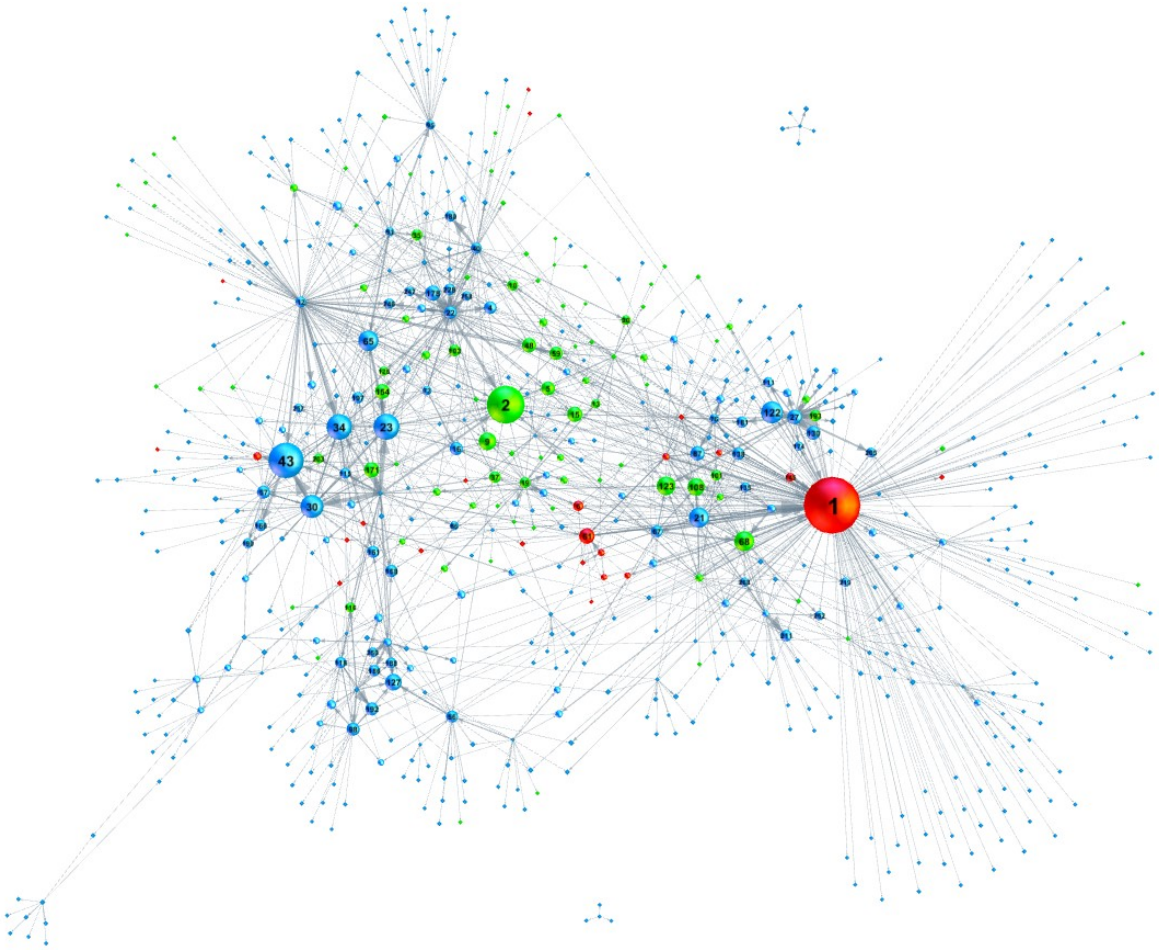
Figure 5: Citations made by the Journal of Economic Behavior and Organization – uniform Node Size, edges colored by target journal



The structure of the DS-WU's citation network differs substantially. It is less dense and does not show a clear core periphery structure. It is rather composed of a number of distinct groups which are strongly connected within but loosely connected to other groups. Non-categorized journals play an important role, while the orthodox group around the American Economic Review is, while present, not dominant as is the case in the economics departments. The greater importance of the heterodox group in the DS-WU is strongly linked to Ecological Economics, which constitutes the most important journal in the network. The Cambridge Journal of Economics is the only other heterodox journal ranked under the Top 20 when considering the Weighted In-Degree.

[13] In both economics departments the JEBO is very important in terms of publications (Out-Degree), is however not cited as reciprocally to the same extent.

Figure 6: Citation Network Department of Socioeconomics WU – Node size ranked by Weighted In-Degree



1	ECOLOGICAL ECONOMICS	123	ENVIRONMENTAL AND RESOURCE ECONOMICS
2	AMERICAN ECONOMIC REVIEW	9	QUARTERLY JOURNAL OF ECONOMICS
43	URBAN STUDIES	108	JOURNAL OF ENVIRONMENTAL ECONOMICS AND MANAGEMENT
23	REGIONAL STUDIES	127	ACADEMY OF MANAGEMENT REVIEW
34	RESEARCH POLICY	61	CAMBRIDGE JOURNAL OF ECONOMICS
30	EUROPEAN PLANNING STUDIES	15	REVIEW OF ECONOMICS AND STATISTICS
122	CLIMATIC CHANGE	171	INDUSTRIAL AND CORPORATE CHANGE
65	ENVIRONMENT AND PLANNING	178	PHOTOGRAMMETRIC ENGINEERING AND REMOTE SENSING
21	ENVIRONMENTAL VALUES	154	JOURNAL OF ECONOMIC GEOGRAPHY
68	LAND ECONOMICS	27	GLOBAL ENVIRONMENTAL CHANGE HUMAN AND POLICY DIMENSIONS

The different structure of the citation network of the DS-WU also shows in the networks statistics in Table 5. Its graph density is substantially lower reflecting the less concentrated network and the modularity value is higher, suggesting that groups of nodes are tightly connected to each other, but loosely connected to nodes outside the module. The measure is based on an algorithm by Blondel, Guillaume, Lambiotte, & Lefebvre (2008). In**Fehler! Verweisquelle onnte nicht gefunden werden.** in the Appendix the citation network is displayed with different coloring of the modules, and a thematic categorization of the modules, which reveals that the different structure of the network is the result of the broad and interdisciplinary research agenda

at the DS-WU, while the distinct modules also suggest that interactions between the different fields are rather limited. The DS-WU can therefore be characterized as a plural rather than as a pluralistic department. Another measure indicating these characteristics is the Average Weighted Degree which is substantially lower in the DS-WU resulting from the fact that the network is more spread out and a larger number of journals are cited in comparison to the economics departments, this is also reflected in a higher number of nodes.

Table 5: Network Statistics

	Socio-economics (WU)	**Economics (WU)**	**Economics (Univie)**
Nodes	623	414	375
Edges	1470	1798	1549
Average Degree	2.36	4.343	4.131
Average Weighted Degree	4.902	11.196	7.139
Network Diameter	7	8	6
Average Path Length	3.13	3.089	2.826
Graph Density	0.004	0.011	0.011
Average Clustering Coefficient	0.147	0.117	0.156
Modularity	0.592	0.383	0.333
Number of communities	13	9	11

5. Conclusions

Several interesting conclusions can be drawn from the bibliometric analysis of journal to journal citations and an analysis of the citation network of the three major departments conducting economic research in Vienna.

(1) Articles in heterodox journals cite heterodox journals more strongly than articles in orthodox or non-categorized journals: the *journal effect*. However, articles in heterodox journals still cite relatively more orthodox journals, with a ratio of heterodox to orthodox citations (*R*) of 0.729, and thereby strengthen the mainstream institutionally in the logic of impact factors. The mainstream ignores heterodox publications with a ratio in articles published in orthodox journals of 0.034. Also articles in journals attributable to the heterodox or the orthodox camp with the help of the list provided by Lee et al. (2010) refer negligibly to heterodox journals (*R=0.06*).

(2) The Department of Socioeconomics exhibits significantly higher ratios of heterodox to orthodox citations, independent of the journal category. This result, the *department effect*, is confirmed when only comparing articles published in the same journals as the economics departments. The combined journal and department effect lead to the only ratio above 1, with a value of *1.723*, being observed for heterodox articles published by researchers of the DS-WU.

(3) The application of social network analysis to citations on the journal level reveals that the "simplified paradigmatic map of economic theorizing" developed by Dobusch & Kapeller (2012b, p. 1037) is consistent with the citation networks of the economics departments. Both departments exhibit a clear 'mainstream core - heterodox periphery' structure. The postulated structure of the economics discourse for the entire discipline can therefore be found at meso-level, the level of economics departments. The Department of Socioeconomics' citation network differs substantially. It does not follow a core-periphery structure, but rather reveals a set of distinct modules, tightly connected within, but only loosely between each other. This is the result of the great variety of research fields and disciplines at the DS-WU as an investigation of the different modules reveals.

(4) The ego-centric citation network of the Journal of Economic Behavior and Organization, classified as heterodox by Lee et al. (2010) suggests that the journal is part of the mainstream, as it reveals nearly no connections to other heterodox journals. This finding is also in line with Dobusch & Kapeller's paradigmatic map.

In light of the perverse mechanisms in the market of science and the resulting self-reinforcing marginalization of heterodox economics and the relatively more promising results for the Department of Socioeconomics, in our view strategies to achieve a paradigmatic change need to go beyond solutions *within* the market, relying solely on the individual researchers and an altered citation behavior. While such efforts may improve the position of heterodoxy in economics within the citation metric, they constitute an uphill battle and are also dialectic in nature, institutionally strengthening at the same time the mechanisms such as impact factors which are cementing the marginalization of heterodox economists. In order to be successful a pluralist movement therefore needs to address the organisations and institutions themselves that impede pluralist research in economics. Evidence that more diversity in terms of research fields within departments has a high explanatory power of individual publication performance (Bosquet & Combes, 2013) is a further reason to expedite change on the organizational level. Developing strategies to undermine the marketization of economics, to influence the evaluation of scientific quality, to change hiring policies at departments and develop alternative career prospects for non-mainstream researchers, will be essential in the future.

Tables

Figures

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Glossary – Social Network Analysis (following Cherven (2015)):

Node-based measures:

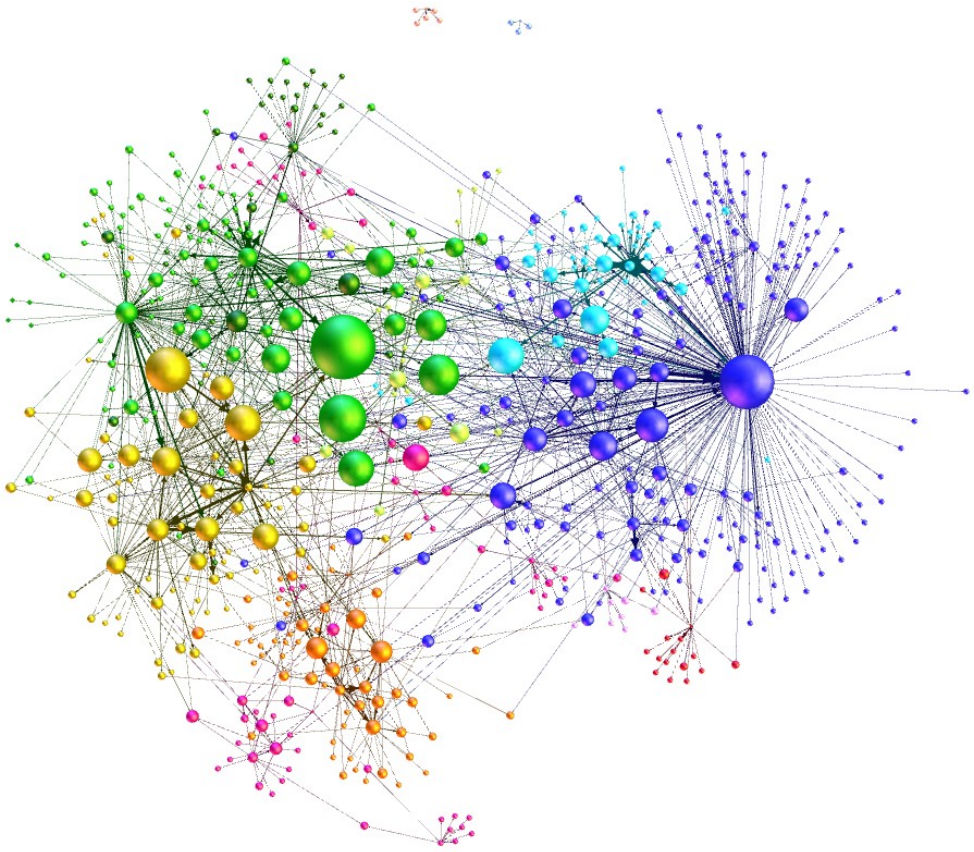
1. **In-Degree:** The number of direct connections directed to the respective node.
2. **Out-Degree:** The number of direct connections directed away from the respective node.
3. **Weighted In-Degree:** The number of direct connections directed to the respective node, considering the weight of the edges.
4. **Weighted Out-Degree:** The number of direct connections directed away from the respective node, considering the weight of the edges.
5. **Betweenness Centrality:** The value expresses on how many shortest paths between every possible pair of nodes in the network the investigated node lies.

Network-based measures:

6. **Nodes**: Number of journals in the network.
7. **Edges:** Number of unique connections between nodes of the network
8. **Average Degree:** The mean amount of connections per node on the graph, ignoring edge weight.
9. **Average Weighted Degree:** The mean amount of connections per node weighted by the weight of the edges.
10. **Network Diameter:** The greatest distance between two nodes in the network.
11. **Average Path Length**: The number of steps needed to reach one node from any other node on average.
12. **Graph Density:** A measure of overall connectedness in the network. It is the number of connections (edges) in the network divided by the total amount of possible connections. A network in which all nodes are directly connected to each other has a density of 1.
13. **Average Clustering Coefficient:** The average clustering coefficient is based on the concept of node triplets. It simply divides the number of closed triplets (triplets where all three nodes are connected to each other) by the overall number of triplets to yield a value between 0 and 1.
14. **Modularity:** Is based on an algorithm by Blondel, Guillaume, Lambiotte, & Lefebvre (2008) and identifies groups of nodes which are tightly connected to each other, but loosely connected to nodes outside the group or module. The value the degree to which the network is modular, or put differently to what degree it is fragmented into distinct groups. The resolution parameter (Lambiotte, Delvenne, & Barahona, 2008) which influences the number of groups the algorithm produces is kept 1, the standard setting.
15. **Number of communities:** The number of groups found by the modularity algorithm (Blondel et al., 2008).

Appendix

Figure 7: Modularity in the citation network of the DS-W



8	(30.66%)
6	(16.21%)
10	(11.24%)
11	(11.08%)
0	(9.95%)
9	(6.9%)
7	(5.14%)
2	(3.37%)
1	(2.57%)
3	(1.28%)
4	(0.96%)
5	(0.64%)

8 = Environment and Ecology

6 = Orthodox Economics (AER, QJE, JPE,…)

10 = Social Policy and Health, Feminist, General

11 = Regional Economics, Economic Geography and Innovation

0 = Entrepreneurship and Management

9 = Climate, Energy and Disasters

7 = Transport

2 = Orthodox Economics and Labor

1 = Hydrology

3 = Physics and Behavior

Figure 8: Citation Networks of the three departments – node size ranked by Weighted In-Degree, Weighted Out-Degree and Betweenness