Pattern Making and Pattern Breaking: Measuring Novelty in Brazilian Economics

Marcos Paulo R. Correia
University of Brasilia
marcospaulocorreia@gmail.com

Bernardo Mueller
University of Brasilia
bmueller@unb.br

July 16, 2021

Abstract

How do new ideas emerge in academic contexts and what forces determine which ideas get selected and which are forgotten? We analyze more than 1,600 papers presented at the ANPEC Brazilian Economics Meetings from 2013 to 2019 using topic modeling and Kullback-Leibler divergence to measure novelty and resonance. In contrast to simply counting citations or reference combinations, these methods explore the (Shannon) information in the actual texts to detect the rise of new patterns and whether these patterns persist once they have been established. We find that novelty is highly correlated with transience so that most new ideas are quickly forgotten. However, of the ideas that persist those that are more novel have a higher impact. We show that our text-based measure of impact is correlated with subsequent citations. Our results provide a metric to compare the nature of research at the level of Brazilian Economics departments as well as for individual researchers. Finally, we analyze how the selection procedures for the ANPEC meetings affect the incentives for economists to pursue more novel or conventional research.

Keyword: innovation, cultural evolution, economic research, emergence of ideas, ANPEC.

JEL codes: O3, Z1 , B41

Resumo

Como surgem novas ideias em contextos acadêmicos e quais forças determinam quais ideias têm impacto e quais são esquecidas? Nós analisamos mais de 1.600 artigos apresentados nos Encontros Nacionais de Economia da ANPEC de 2013 a 2019 usando modelagem de tópicos e divergência de Kullback-Leibler para medir novidade e a ressonância. Em contraste com a simples contagem de citações, esses métodos exploram a informação (no sentido de Shannon) nos textos para detectar o surgimento de novos padrões e se esses padrões persistem depois de estabelecidos. Os resultados mostram que a novidade está correlacionada com transitoriedade, de modo que o que é novo tende a ser rapidamente esquecido. No entanto, das ideias que persistem, aquelas que são mais inovadoras têm um impacto maior. Mostramos que nossa medida de impacto baseada nos texto está correlacionada com citações subsequentes. Nossos resultados fornecem uma métrica para comparar a natureza da pesquisa no nível dos departamentos de Economia do Brasil, bem como para pesquisadores individuais. Por fim, analisamos como os procedimentos de seleção para as reuniões da ANPEC afetam os incentivos para os economistas buscarem pesquisas mais inovadoras ou mais convencionais.

Palavras chave: inovação, evolução cultural, pesquisa em economia, emergência de ideias, ANPEC.

1 Introduction

Science is all about new ideas. Knowledge progresses as new ideas enable new understanding of the world. At the same time, science is profoundly conservative and resistant to ideas that differ from the current understanding (Kuhn, 1996; Merton, 1968; Bourdieu, 2004; Foucault, 1970). The production of new ideas is therefore subject to contradictory forces. This tension leads different individuals, research groups, and even entire disciplines to adopt different strategies for pursuing the advancement of knowledge. While novelty seems to be a necessary component of academic success, it is also the case that most new ideas, precisely because they are unfamiliar, remain obscure.

In this paper we empirically analyze the process of the advancement of science through the creation of novelty in a very specific environment: the annals of the Brazilian National Association of Postgraduate Programs in Economics (ANPEC - *Associação Nacional dos Centros de Pos-graduação em Economia*).[1] This is an interesting context for such inquiry because ANPEC, and Brazilian economists in general, are a large and diverse group that is peripheral yet connected to the major centers of Economic research in the US and in Europe. While most research of this type focuses on the higher echelons of the profession in the major epicenters where research is done, there is less work on how the production of novelty takes place in subsidiary centers.[2] ANPEC was founded in 1973 and today is formed by 28 member centers, with another 24 centers seeking accession, making it the largest association of economists in Brazil. ANPEC manages a large unified exam used by many centers to select Master's students (Petterini, 2020). It also publishes an academic journal, EconomiA,[3] and holds a large diverse conference each year. All of the papers presented in the yearly conference are published and made accessible in the meeting's annals.[4] We use 1676 papers from the ANPEC meetings from 2013 to 2019 to analyze how novel ideas arise in this context and what is their impact.

Qualitative text analysis is often used to measure the emergence of novelty in academic and other types of publications. It is not capable, however, of dealing with more than a small volume of text. Recent advances in machine learning and natural language procession now allow large volumes of text to be processed by computers. While research that seeks to measure novelty in large corpora often resorts to counting words or tracking citations, we use a method that is based on information theory (Shannon, 1948). It seeks, in Bayesian fashion, to identify pattern making and pattern breaking the annals of the ANPEC meetings.[5] We first use topic modeling to identify patterns of word use in the papers at a given point in time. This technique yielded a surprisingly strong fit of the 30 topics that emerged from the data to the actual division of the ANPEC meetings into 13 fields (e.g. labor economics, international economics, political economy, etc.). Each paper is then characterized as a probability distribution over each of the 30 topics. We then use Kullback-Leibler Divergence (KLD) measures to identify when the patterns established up to a point are broken by new, unexpected distributions. Following Barron et al. (2018), we call 'novelty' this measured surprise, when we expect a certain pattern and instead get a different pattern. Similarly, we call 'transience' the KLD of the current text to the patterns that will emerge in the future, that is, when a new pattern that is established by a paper today is not repeated in the following periods. This allows us to then classify papers by 'resonance', which are patterns that are high in novelty and that, once created, continue to be repeated in the future. Resonant papers are how science evolves.

Boianovsky (2021) provides a panorama of the "slow coming to age" of Brazilian economists. Several other studies have analyzed the research strategies and productivity of Brazilian economists, and linked them to the career and reputational incentives they face. (Haddad et al., 2017; Faria et al., 2000; Faria, 2004, 2005; Faria et al., 2007; Issler & Pillar, 2002; Issler & Ferreira, 2004; Guimaraes, 2011; Novaes, 2008, among others). Most of this research, however, is focused on productivity and the choice between quantity versus quality in publishing, using information about citations and

---

[1] http://www.anpec.org.br/novosite/br.

[2] An exception is Pablo Castilla et al. (2020) that analyzes the evolution of research in CEDE, a Colombian economic research center.

[3] https://www.sciencedirect.com/journal/economia.

[4] Available at https://en.anpec.org.br/previous-editions.php

[5] We follow the approach and code used in (Barron et al., 2018) that analyzed over 40,000 speeches in the debates of the National Constituent Assembly that followed the French Revolution.

journal impact factors. Our paper is related to this literature but our interest is in the choice between novelty and conventionality, based on the detection of patterns within the texts.

Our results allow us to classify papers, areas and departments in ANPEC meetings by novelty and by resonance. We validate these results through comparisons with the actual citation pattern of the papers in the ensuing years. Our first result is that more novel papers are generally more transient. This result, that what is new tends to disappear quickly, has been found in a wide variety of contexts (Barron et al., 2018; Boudreau et al., 2016; Wang et al., 2017; Murdock et al., 2017; Jing et al., 2019). The second result is that resonant papers tend to have higher than average novelty. That is, in the context of ANPEC, if a researcher wants to make a mark, it is helpful to break with established patterns and display more novelty, however, thereby also risking obscurity. Of the 1679 papers presented at ANPEC from 2013-2019, 78% were not published in an academic journal by 2021 and 56% had no citations. These numbers suggest that overall, Brazilian economists take a conservative approach to topic choice and development, often eschewing the search for novelty to gain acceptance in the meetings, but at the risk of higher obscurity.

What are the reasons for this conservative academic stance of Brazilian economists? Although it may be due to ideological and cultural factors, it is also affected by the personal and career incentives faced in the Brazilian academic milieu of universities, departments, and scholarly associations, including ANPEC (Checchi et al., 2019). These incentives can be both monetary and reputational. In the second part of this paper we analyze the incentives contained in the selection procedure for participation in the ANPEC meetings. Having a paper accepted for presentation can bring many benefits to Brazilian economists. The acceptance counts points for promotion in most universities, increases the likelihood of obtaining grants, and is favorably considered by the federal agency that ranks departments, which has consequences for how governmental funds are distributed across and within universities. In addition the meetings are a chance see and be seen by other members of the profession, which contributes to prestige. Also, the meetings are often held in agreeable destinations.

The selection procedure starts with a call for papers in mid-July, the chosen papers are announced around two months later, and the meetings are held in early December. The evaluation is done by 13 area committees, composed of two to four names appointed by the ANPEC council each year.[6] The members are chosen based on personal expertise and also to allow all member centers to participate in at least one committee. The volume of submissions typically far outnumbers the available slots, so the process is highly competitive. When submitting, a researcher must choose which area committee will evaluate her/his paper. The committee members are known in advance. The process is thus single blind, as the committee does not see the names of the authors. But, in a world with search engines this restriction may not be binding. The choice of submission area is therefore a strategic decision, since most papers can reasonably be claimed to fit more than one area. A second strategic choice, taken much earlier in the conception stage, is how much the paper breaks with old patterns in the specific literature to introduce new patterns.

To what extent does the committee prize novelty when evaluating the candidate papers and to what extent is novelty a turn-off? We cannot address this question with the data we have. Doing so would require also having the papers that were submitted and rejected. We can, however, examine the selection procedure to get at some aspects of the incentives structure faced by submitting researchers. This incentive structure, together with those faced in other contexts in Brazilian academic life, are partially responsible for patterns of novelty found in the first part of this paper. As noted by Boudreau et al. (2016), "contrary to the popular notions of a 'marketplace for ideas', in which the best ideas simply rise to the top, resource allocation in academic science is shaped in important ways by supporting institutions and processes". These authors held an experiment in which actual grant proposals were appraised by different randomized evaluators. They show that evaluators give systematically lower scores to proposals that are closer to their own area of expertise and also to proposals that exhibit greater levels of novelty. Several other studies have shown that peer-review

---

[6]The thirteen areas are: i-history of economic thought and methodology; ii-political economy; iii- economic history; iv-macroeconomics, monetary economics and finance; v-economic of the public sector; vi-growth, development and institutions; vii-international economics; viii-microeconomics, quantitative methods and finance; ix-industrial economics and technology; x-regional and urban economics; xi-agricultural economics; xii-social and demographic economics; xiii-labor economics.

and other forms of academic evaluation are also frequently subject to considerations besides the true quality of the research (Akerlof, 2020; Colussi, 2018; Heckman & Moktan, 2020; Laband & Piette, 1994; Marsh et al., 2008; Jerrim & Vries, 2020).

Our results show that, like in so many other academic institutions and vehicles, the selection process for the ANPEC meetings also likely suffer from these biases. We analyze the pattern of matches of the affiliations of the evaluating committee members and of the authors of accepted paper to see if that pattern is different from what would be expected from a random distribution of accepted papers. The results indicate that author affiliation does have a statistically significant impact on the pattern of acceptances, suggesting that in practice more information than just the quality of the papers is likely used in that selection process.

The remainder of this paper is organized as follows. In the next section we briefly describe the ANPEC meetings and the paper selection process. Section 3 then describes the concepts of information theory that we use to measure novelty and resonance. Section 4 reviews other papers that have used similar information-theoretic approaches to text analysis. Section 5 describes the data and programs used. In section 6 we describe the topic modeling of the ANPEC meeting annals and in section 7 the results from measuring the novelty, transience and resonance of the papers. Finally, in section 8 we perform a test on the selection procedures of the meetings.

2 ANPEC and the National Economic Meetings

The first Economics departments in Brazilian universities date from 1946 (University of São Paulo and Federal University of Rio de Janeiro). Yet by the mid-1990s there was already the notion that maybe the proliferation of Economics departments had gone beyond the level of efficient resource use for Brazilian academia.[7] The growth of Economics in Brazilian universities took off in the early 1970s together with the foundation of ANPEC, which sought to coordinate teaching and research at the graduate level. Possibly due to this higher degree of coordination and organization, Economics became a priority area for funding by the federal research councils (CAPES and CNPq), which resulted in a large number of Brazilian economists being trained and getting PhDs in American and European universities.

As the teaching of Economics grew in Brazil, ANPEC also expanded to accommodate the new centers that sought to join the association. As a consequence, the yearly meetings also became larger.[8] At some point, however, a constraint for the size of the meetings was reached by the size of venue necessary to house the events. If the conference were to continue to grow, it would be too big for most conference halls or hotels, yet too small for the few really big venues. Once the conference reached this ceiling and the number of submissions continued to grow, the level of competition for acceptance at the conference increased significantly. Submissions come from young researchers to seasoned veterans in every area of economics. Increasingly papers and presentations have been delivered in English, despite enduring resistance in some quarters. Of the 1679 papers presented at ANPEC from 2013 to 2019, 1,101 were in Portuguese, 576 in English and 2 in Spanish. Slowly the conference is attracting the participation of economists from other countries.

This history of ANPEC is important for understanding the context in which the meetings occur and the incentives they provide for the creation of novelty versus conventionality. The high level of competition to get a paper accepted means that researchers must adopt strategies that involve trade-offs in terms of exploration versus exploitation, that is, whether to seek novelty or to stick with what is known and accepted. The nature of ANPEC is also important to make clear what we mean by innovation in this context. Whereas it is a peripheral association of researchers in the global production of economic research - the highest ranked center in Brazil EPGE-FGV is ranked 287 in the Ideas-Repec global in Economics ranking[9] - it is nevertheless well integrated internationally

---

[7]See discussion in Anuatti Neto (1997). On the early days of ANPEC and of the economics profession in Brazil, see Boianovsky (2021); Loureiro (1997); Bianchi (1997); Loureiro & Lima (1994)

[8]The meetings are held in conjunction with the yearly meeting of the Brazilian Econometric Society - SBE. While ANPEC is more diverse and pluralistic in term of themes and approaches, SBE is more focused on quantitative approaches.

[9]https://ideas.repec.org/top/top.inst.all.html

and cannot be considered an isolated system. Innovation in such a context is not so much the creation of absolutely new ideas, but rather the early adoption and diffusion of ideas that flow from the center.[10] This does not diminish the merit of innovating Brazilian economists as the natural resistance to change in academia still makes this type of innovation a risky career strategy.

As an example of the emergence of novelty in the context of Economics, consider how theory and mathematical models got sidelined by empirical research in the last two decades. In the early 2000s mathematical models were the most prestigious type of work in Economics, while empirical papers, though not held in disrepute, were much less valued. In time, however, a series of innovations known as the Credibility Revolution in Econometrics (which mostly revived known but overlooked ideas and methods) emerged and spread among central researchers and journals (Angrist & Pischke, 2010). This is an approach to research that values, above anything else, the extreme statistical and econometric rigor in the use of data and research design so as to allow the uncovering of truly causal relationships. While this revolution's main casualty was the loose set of econometric standards and practices that pervaded the profession up to that point (Leamer, 1983), it also had the effect of displacing theory as the central focus of economic research.

While this shift was taking place at the center of the profession, several researchers in Brazil were taking heed and starting to adopt these new ideas and practices. Our data does not go that far back (we cover 2013-2019), but in principle it would be possible to unveil the pioneering appearance of patterns using words and concepts such as randomization, identification, counterfactual, research strategy, controls, confounding, difference-in difference, regression discontinuity, matching, etc. Doing so would reveal the pattern through which some pioneers were adopting these ideas and probably adapting them to Brazilian contexts and issues, often facing resistance and rejection in those early years. In time, however, these patterns of ideas eventually displaced other themes and approaches to become the dominant style of research today. The very success of these ideas means that they are no longer novel. As this type of inquiry has matured, it has becomes increasingly rare to see truly novel ideas in that domain. The research is solid and relevant, but no longer novel. And it is probably the case that some new ideas that will come to dominate in the ensuing years are already starting to pop up at the center, and even among early Brazilian adopters. Even if you believe that this is true, is very hard to distinguish in advance which among the legion of new ideas that are vying for attention those will be, and which will remain secondary or fade to obscurity.

3   Information theory and the measurement of novelty

The example above reveals the way science evolves. We can understand the competition for scientific prestige through the lens of three variables: innovation, transience and resonance. Breaking previous patterns - high innovation - is a strategy that can only succeed if later research adopts this new trend - low transience. The difference between innovation and transience, which we call resonance, measures the ability of an article to impact scientific production. In this sense, the pioneering work related to the more rigorous statistical analysis were not only innovative but also resonant. Once the research topic became matured, there was a reduction in the novelty of the later works.

Expanding this analysis, we wanted to measure the innovation, transience and resonance in the papers presented at the ANPEC meeting. With these indicators, it would be possible to gain insights into the innovation process and in the frequency in which innovation become obscure. To quantify statistical properties of a set of texts we used methods from Natural Language Processing by means of topic modeling framework.

Our application employs Latent Dirichlet Allocation (LDA; Blei et al. (2003)) as the topic modeling method. LDA is a generative statistical model that treats documents as bags of words generated by a mix of topics. When passing a corpus of texts as input, the algorithm estimates latent topics of the corpus and classifies each document according to the relevance of those topics[11]. LDA topics models have already been used in many domains involving large quantity of documents (Bogdanov

---

[10]This is actually true even of much innovation in the more central universities. On close inspection new ideas are often rediscovery, variations or recombinations of ideas that already existed in some form or other.

[11]See "Data and Programs" section for a detail of the method and requirements.

& Mohr (2013); Griffiths & Steyvers (2004); Barron et al. (2018); Murdock et al. (2017); Milli & Bamman (2016)).

By applying the LDA algorithm in the papers database, we can describe each article as a probability distribution over the k topics. Our goal, then, is to find patterns and differences in the way co-authors choose their topic combination. We did this through Kullback-Leiber Divergence (KL), a measure of how one probability function diverges from another. To interpret the meaning of KL a brief explanation of the field to which it belongs, Information Theory, is necessary.

Introduced by Shannon (1948), Information Theory is a mathematical formulation designed to characterize the limits and possibilities of communication. The vast growth of the field, however, surpassed the analysis of communication and has made fundamental contributions to statistics, econometrics, physics, computer science and many other domains (Cover & Thomas (1991); Maasoumi (1993)).

The most important concept in information theory is entropy. Entropy measures the amount of uncertainty or, equivalently, the randomness in a given context. The entropy, H, of a random variable, X, is defined as:

$$H(X) = -\sum_{i=1}^{n} p(x_i) log_2 p(x_i) \tag{1}$$

where the sum is over all values x that X can take, and $p(x)$ is the probability of the value x occurring. Measured in bits, $H(x)$ corresponds to the expected amount of information that the occurrence of an event in X produces, that is, the surprise of observing what happened in X. The more random the distribution, the more information resides in X.

Two points should be highlighted here. First, the concept of uncertainty used in Information Theory does not make a distinction, as in the economic literature, between uncertainty and risk (Keynes (2018); Knight Frank (1921)). Algorithm Information Theory, an advanced approach in the area, allows the measurement of the informative quantity for computable contexts whose probability distributions are not accessible, so that this distinction can, in theory, be overcome[12].

Second, information is defined in an unusual way, as equivalent to uncertainty, which is different from its definition in Economics (Garrouste (2001)). Specifically, Information Theory is related to Informational Economics, but they are quite separate fields. Arrow (1984), for example, defined information as an economic commodity whose payoff and cost functions could be modeled based on Information Theory. However, while Informational Economics studies economic behavior under conditions of incomplete information, Information Theory is a theoretical formulation designed to understand the transmission, encoding and compression of information, a very distinct analysis.

The concept of Kullback-Leiber Divergance (KL), on which our analysis relies, measures the gain in information when, given a probability distribution, $p(x)$, we use instead an alternative distribution $q(x)$:

$$KL(p \mid q) = \sum_{i=1}^{n} p(x_i) log_2 \frac{p(x_i)}{q(x_i)} \tag{2}$$

Due to Jensen's Inequality, $KL(p \mid q) \geq 0$ and $KL(p \mid q) = 0$ when $p(x) = q(x)$ (Maasoumi (1993)). Kullback-Leiber Divergence is asymmetrical in relation to the distributions since it does not obey the triangle inequality. KL is also known as relative entropy.

In econometrics, KL has many applications. We can think about the Kullback-Leiber Divergence as the information - uncertainty - gain when we approximate the true distribution of data, $p(x)$ by $q(x)$, say, the normal distribution. Trying to approximate by other distributions would then give a selection criterion in which the best approximate distribution is the one with the lowest KL value. It can be shown that General information criterion (GIC), Akaike's information criterion (AIC) and Bayesian information criterion (BIC) are all derived from this measure (Evren & Tuna (2012)).

From the perspective of Bayesian reasoning, the information gain from KL corresponds to the surprise that an agent has when expecting $q(x)$ and realizing that $p(x)$ has occurred (Barto et al.

---

[12]See Cover & Thomas (1991) for a complete description of these formulation.

(2013)). The measure of innovation, transience and resonance are developed from this interpretation. Replacing $p(x)$ with $s^{(j)}$ and $q(x)$ with $s^{(j-1)}$, the probability distribution of, respectively, the (j)th and $(j-1)$th papers in the data, we have:

$$KL(s^{(j)} \mid s^{(j-1)}) = \sum_{i=1}^{k} s_i^{(j)} log_2 \frac{s^{(j)}}{s^{(j-1)}} \tag{3}$$

where we sum over all the k topics. Equation (3) represents the surprise of a text given the topics combination of its predecessor. Innovative papers generate more surprise as they break the pattern of their previous ones. We define novelty, $\mathcal{N}_w(j)$, of the (j)th paper by averaging the KL of all the w previous texts:

$$\mathcal{N}_w(j) = \frac{1}{w} \sum_{d=1}^{w} KL(s^j \mid s^{j-d}) \tag{4}$$

Thus, novelty represents the Bayesian surprise of an article when all previous papers are known. The higher the value, the greater the evidence that a given paper has introduced a new way of dealing with the research question or a novel research subject. Similarly, we define transience, $\mathcal{T}_z(j)$, of the (j)th paper by averaging the KL of all the z later texts:

$$\mathcal{T}_z(j) = \frac{1}{w} \sum_{d=1}^{z} KL(s^j \mid s^{j+d}) \tag{5}$$

Transience is also the Bayesian surprise, but in relation to all future texts. $\mathcal{T}$ determines the degree in which the pattern of an article is overlooked by future research. High values of transience represent a loss of interest in the way that a certain article combined the research topics.

While coauthors can decide on advance the novelty that their researches have, much less control can be said about the transience of their work. Even so, due to the parsimonious nature of scientific production (Kuhn, 1996), we can expect a strong relationship between novelty and transience, so that novelty is punished by the high probability of being forget. In order to find an paper's ability to break previous patterns and influence future research, we define resonance, $\mathcal{R}(j)$ of the (j)th paper as:

$$\mathcal{R}(j) = \mathcal{N}_w(j) - \mathcal{T}_z(j) \tag{6}$$

Resonance, therefore, estimates the frequency in which innovation can overcome obscurity. With novelty, transience and resonance, we were able to quantity the contradictory forces involved in the scientific progress.

4 Literature review

In this section we briefly describe the previous literature which uses topic modeling and Kullback-Leibler divergence on different types of text to analyze issues related to cultural evolution. In this paper we rely directly on the ideas and techniques developed by Barron et al. (2018). These authors use reconstructed transcripts of debates that took place during the first National Constituent Assembly of the French Revolution, involving thousands of speakers and over 40,000 speeches, to track the creation, transmission and destruction of new ideas, many of which would set the patterns to be followed by subsequent democracies. They found a strong relationship between novelty and transience, so that very innovative speeches, on average, tend to be quickly forgotten. The variance in the results, however, exposes different strategies between political groups.

Left-wing political representatives had more innovative speech patterns, while conservatives were responsible for keeping the debate consistent with the patterns already established - low transience. In this sense, the authors noted that both political spectra were important for the development of ideas concerning modern states, each one with different roles.

Besides analyzing patterns of collective speech, the authors also examined the role of individual speakers. Some stood out for systematically breaking established patterns with a high resonance value. Robespierre, a famous Jacobin, produced speeches of high innovation and low transience, which means that his speeches had the effect of determining the subject of debate. Conservative representatives such as Jean-Sifrein Maury and Jacques de Cazalès had speeches of low innovation, but even less transience, so that these politicians were able to stabilize the debate on the same issues (Barron et al., 2018).

The measures uncovered the impact of newly created organizational functions such as the NCA's president and the work committees. For example, the NCA presidents marked the discussions due to the high transience of speeches. This is because these individuals repeatedly summarized the debates held throughout the day, without necessarily participating in the formulation of the arguments.

A very similar method was used to analyze the readings that influenced Charles Darwin to create his theory of evolution (Murdock et al. (2017)). Due to the dense reading journals that he annotated throughout his life, it was possible to evaluate Darwin's responses to the trade-off between exploration and exploitation. Exploitation refers to the deepening of knowledge in the same area and exploration refers to the search for different knowledge.

Murdock et al. (2017) used LDA to create a probabilistic structure of topics on the books cited in Darwin's journals, and then applied the Kullback-Leiver divergence to them. Exploration, here, was proposed as the KL values above the average, both between two close texts and between one text and all the previous ones. Conversely, exploitation refers to the KL values below the average, in the same context. The main technical difference between this paper and the previous one is the fact that the analysis of Darwin's readings did not assess transience.

The authors found that Darwin changed his strategy between exploration and exploration throughout his career, first engaging in exploitation and later exploring new topics. Remarkably, they show that these changes were related to important events in his career.

A related study by Jing et al. (2019) applied similar techniques to fanfiction, which is a genre of fiction where fans take existing characters and stories, such as Harry Potter or Sherlock Holmes, and write new stories that are linked to the original but posit new situations and contexts, for example making Watson an alien or crossing over with characters from other stories. They use a corpus of more that 500 thousand pieces of fanfiction and measure success as the number of kudos (similar to 'likes' in most social media) that each piece receives from other readers. Using topic modeling and KL-divergence, they classify each piece by novelty and then analyze how novelty relates to performance. This genre of text is particularly appropriate for this test because fanfiction often invites transgressions where the original stories and characters are wildly modified and refitted. Their results show an inverted U relationship between novelty and popularity. The fans of fanfiction overwhelmingly prefer conventional approaches. As novelty increases the number of kudos decreases monotonically. But at the extreme level of novelty a few pieces manage to reach very high levels of popularity.[13]

Degaetano-Ortlieb & Teich (2018) use KL-divergence on the corpus of the Royal Society of London to analyze linguistic change over time, with periods of change followed by periods of consolidation. Chang & DeDeo (2020) provide some discussion of the different ways to conceptualize novelty in the quantitative analysis of text, and argue in favor of divergence (KL) as preferable to other distance measures. Finally, there is a large literature that analyzes text, music, patents, and other forms of cultural expression with the focus on measuring novelty and uncovering the relationship between novelty and success or performance, but these use other methods, such as tracking patterns of citations or using complex networks (Askin & Mauskapf, 2017; Foster et al., 2015; Mueller, 2021; Uzzi et al., 2013; Youn et al., 2015, among others).

---

[13]Thus the title, "Sameness attracts, novelty disturbs, but outliers flourish in fanfiction online".

5 Data and programs

Our analysis was implemented in Natural Language Processing using initial code made available by Barron et al. (2018).[14] Initially, the urls containing the downloaded hyperlinks, authors' names and area of the paper in ANPEC's meeting were scraped and the results were saved as a structured database. Of the 1679 articles published between 2013 and 2019, only one had issues for downloading and was not used in the application.

The downloaded documents were converted to text files. Subsequently, a textual language detection algorithm was performed. Identifying the language of the text is essential since the conventional LDA libraries were produced for uni-language corpus. Among the remaining 1678 articles, two of them were written in Spanish, which is too few for topic modeling so they were then removed from the database, leaving 1100 articles in Portuguese and 576 in English. The corpus was divided by language into two corpora and the procedures were performed separately in each set.

We then performed the lemmatization of the texts, which is a process to find the root of the words. This is essential if we want the LDA to recognize terms like 'municipality' and 'municipalities' as coming from the same canonical word[15]. Lemmatizing is an optional procedure, but was applied do to its capacity to enhance topic modeling predictions in our corpora.

The next stage of implementation consists of pre-processing the texts. Bibliographic references, badly coded characters, special characters, digits, e-mails, references to websites, punctuation (with the exception of accents) and words with less than three letters were removed. The remaining words have been converted to lowercase. We also created a stopwords[16] list of about 1900 terms and only used words that were presented in more than 3 papers.

We did the LDA topic modeling with a computationally efficient method for optimizing the words in the topics, the Online Variational Bayes (OVB). Based on stochastic optimization, OVB converges more quickly to an equilibrium compared to other versions of Bayesian calculations (Hoffman et al., 2010). Following the best practices for LDA implementations (Asuncion et al. (2012); Wallach et al. (2009)), we applied an optimized asymmetric Dirichlet prior over the document–topic distributions and an symmetric prior over the topic–word distributions.

To determine the number of topics, k, we compared the Perplexity and Topic Coherence Score, which are the conventionally selection criteria used in LDA applications, for a wide variety of numbers. We find that 30 topics was a good fit to our data both for English and Portuguese corpora, although values close to 30 would also be accepted.

Finally, with the probability distribution over the 30 topics, we calculate novelty (4), transience (5) and resonance (6) in relation to papers of the same area and of the same corpus. We control by publication area so that the measures used do not suffer from noise effects, in the sense that papers from different research areas may have high KLDs between them due to the different topics studied and not by the presence of novelty or transience.

A limitation of the database used lies in the fact that it is not possible to know the order in which papers published in the same year were created. To overcome the limitation, we randomly sorted articles of the same year and area 100 times and took the median of all simulations as the final value. This solution is very similar to the one presented by Murdock et al (2017) to deal with the same problem. After all the calculations, the corpora are again integrated into the same database.

6 Topic modeling of ANPEC Meeting annals

In this and the next section we present the analysis of the 1,679 papers accepted to the ANPEC meetings from 2013 to 2019. Here we describe the results from the first step of this process, which

---

[14]See their supplementary material and the example at https://github.com/CogentMentat/NTRexample$_F$RevNCA. Our code is available at https://github.com/correia-marcos/Innovation-on-brazilian-economic-research.

[15]We implemented lemmatization through the Stanza library, a powerful neural network for Natural Language Processing. Specifically for lemmatization, is one of the best available currently (see https://universaldependencies.org/conll18/results-lemmas.html).

[16]words that don't add information for topic modeling so that they are ignored by the LDA algorithm, such as 'the', 'a', 'an'.

involves using latent Dirichlet allocation to extract from the entire corpus 30 topics which are subsequently used in the next section to characterize each paper as a weighted combination of these topics. We opted for having 30 topics, after some experimentation, to get enough but not too much granularity. The program then selected the content of each topic with no further information from us, simply by identifying co-occurring patterns.

Figure 1 shows a mapping of the topics on two dimensions by using multidimensional scaling. The topics cluster in groups as one would expect in any academic discipline, where some topics are related in object of study and/or methods, and others are more distant. The 15 most relevant words for 10 topics are listed in Table 1.[17] The overall most salient terms in the full corpus are shown in figure 2. The program receives as inputs only the texts and no information about the structure of the Economics literature or the ANPEC meetings. Yet for any economist the nature of each topic is instantly recognizable. And anyone who has participated in an ANPEC meeting will easily surmise to which of the 13 ANPEC areas each topic corresponds. In the last row of each column we indicated our guess of the ANPEC area for each topic.

Once we know the topics, sense can be made of the clusters in figure 1. The most salient words for topic 1, for example, can be seen in figure 3. The topic is clearly related to international economics. By examining the topic mix in each area of the map in figure 1 we can locate each of the ANPEC areas. The cluster in the top-left quadrant includes economic history (topics 9 [politician, Furtado, history ...] and topic 19 [coffee, slave, paulista ...]), history of economic thought (topic 12 [science, economist, institution ...]) and political economy (topic 13 [Marx, capitalist, money ...])[18]. A cluster of international economics is located in the lower-left quadrant, including topic 17 [elasticity, export, import ...], topic 26 [exchange, exchange rate, volatility ...] and 27 [opening, crisis, flux ...]. These are close to some macroeconomic topics, topic 5 [shock, inflation, regime ...], topic 18 [fiscal, expenditure, corruption ...], and topic 7 [interest, credit, monetary, ...]. The crowded cluster in the lower-right quadrant is composed mostly of applied microeconomics topics, such as labor, urban & regional, social & demographic. Interestingly, the topic modeling procedure is so discerning that it distinguishes between the macroeconomic analysis of labor and employment (topic 25 [unemployment, salary, inflation, worker, pay cut, wage ...]) and the microeconomic analysis (topic 3 [worker, wage, woman, occupation, man, age, earnings, ...]). Several other examples of the uncanny precision of the topic modeling classification can be found by examining the map and topics. Based on these patterns we can speculate that the horizontal dimension is capturing the distinction between micro and macro economics, and the vertical dimension the greater or lesser use of mathematics in the texts.

7   Novelty, transience and resonance

Once we have the list of topics which pervade Brazilian economic research, we can then decompose each paper into a set of patterns expressed as a probability distribution across topics. Novelty can then be measured as the divergence of a given paper, or set of papers, to the patterns established by previous papers. We use Kullback-Leibler Divergence (KLD) measures to do this, as described in section 3. Divergence is a measure of surprise, which can be interpreted as novelty. Given that you are used to a certain set of patterns from past ANPEC meetings, how surprised are you when you read a new paper from the latest meeting and find new patterns?

Note that this approach has some similarities with the standard approach of conceiving of novelty as the recombination of existing ideas (Askin & Mauskapf, 2017; Youn et al., 2015; Uzzi et al., 2013; Mueller, 2021). But it is also different because it does not think in terms of atomistic recombination of lone ideas, but rather of whole distributions of ideas and their interactions, which gives it a Bayesian nature that provides a better representation of the pattern-making and pattern-breaking dynamic that is the evolution of culture.

Besides measuring the surprise for the patterns in a paper given the patterns in past papers (novelty), we also measure the surprise compared to future papers, which we take as a measure

---

[17]We only show 15 words and 10 topics because of space considerations. The full output is available upon request.
[18]In Brazil and especially in ANPEC, the term 'political economy' is often use to mean leftist economics.

Table 1: Topics in the ANPEC annals.

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
Trade	Innovation	Worker	Space	Shock
Export	Technological	Salary	City	Inflation
Industry	Firm	Women	Regional	Regime
Commercial	Growth	Occupation	Municipality	Cycle
Import	Technology	Man	Urban	Forecasting
Industrial	Patent	Age	Distance	Expectation
China	Industrial	Income	Center	Monetary
Exporter	Interaction	Time	Industry	IPCA
Input	Industry	Working	Worker	Hiatus
'Trade'	Innovative	Home	Density	Curve
Household	Intensity	Wages	Mobility	Structural
Export	Network	Differential	Concentration	Matrix
Sectoral	Innovation	White	Agglomeration	Breakage
Matrix	Effort	Boss	Location	Phillips
Worldwide	Innovative	Benefit	Transport	Meta
Area 7	Area 9	Area 13	Area 10	Area 4
International	Industrial	Labor	Regional &	Macro., Mon.
Economics	and Tecnology	Economics	Urban	& Finance

Topic 6	Topic 11	Topic 12	Topic 13	Topic 14
Currency	Emissions	Science	Marxs	Inequality
Active	Energy	Economist	Capitalist	Poverty
Crisis	Scenario	Institution	Money	Regional
Risk	Family	Knowledge	Merchandise	Poor
Monetary	Environmental	Concept	Profit	Northeast
Portfolio	Ethanol	Scientific	Capitalist	Regional
Return	Simulation	Veblen	Accumulation	Decomposition
Liquidity	Energy	Human	Strength	Rural
Flow	Transport	World	Category	Education
Global	Shock	Vision	Wealth	Income
Action	Fuel	Thought	Class	Southeast
Interest	Balance	Hayek	Expansion	North
Credit	Oil	Critical	Trading	Family
Title	Climate	Practice	World	Urban
Exchange	Input	Action	Infrastructure	Gini
Area 4	Area 11	Area 1	Area 2	Area 12
Macro., Mon.	Agricultural &	Hist Thought	Political	Social &
& Finance	Environment	Methodology	Economy	Demog. Econ.

Source: Authors' elaboration. Papers in Portuguese and table translated by the authors. Original table in appendix. Data from ANPEC Meeting annals - http://www.anpec.org.br/novosite/br

Figure 1: Map of topics at ANPEC Meetings.
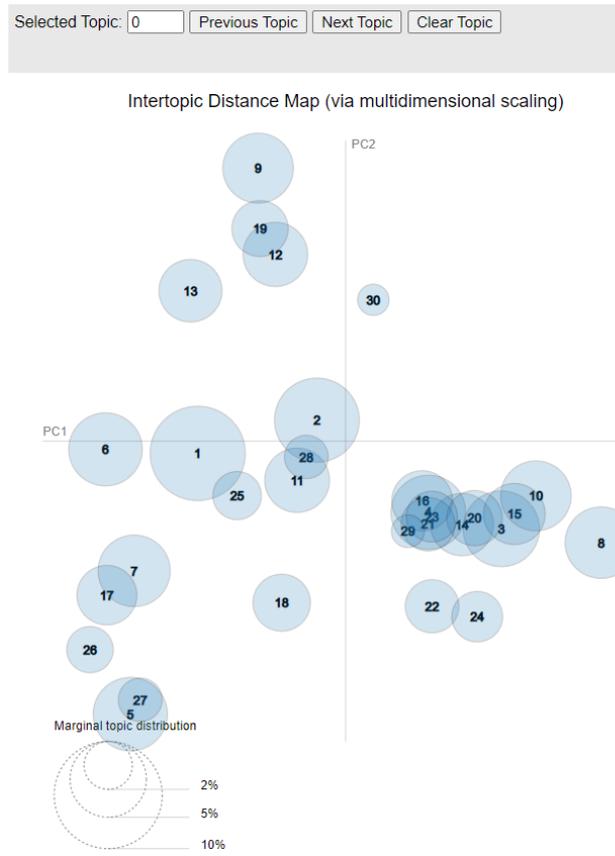

Figure 2: Overall most salient terms.
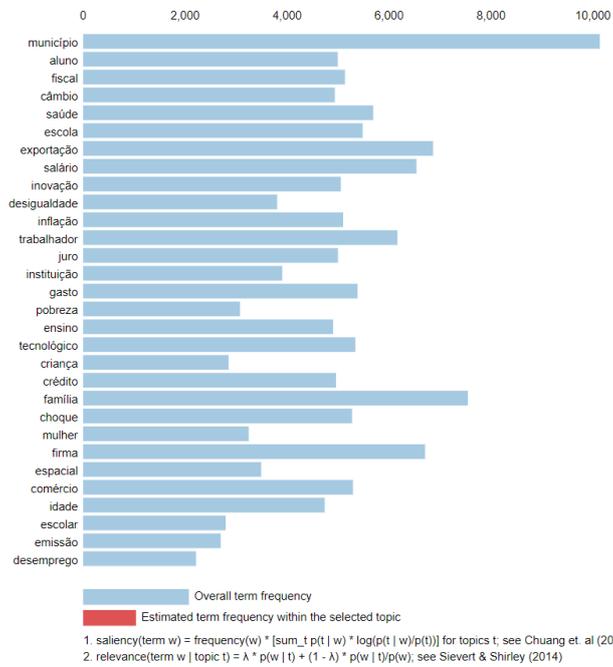
Figure 3: Overall most salient terms Topic 1.
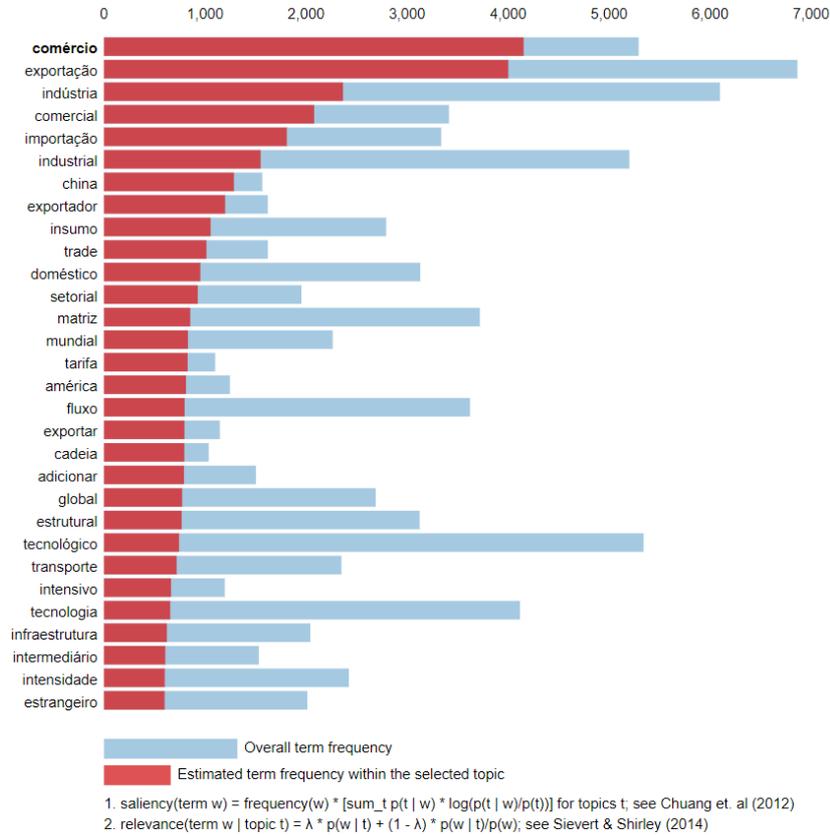
of transience. If a new pattern appears at a given ANPEC meeting, but then does not appear in subsequent meetings, this means that the pattern did not catch on or diffuse. If, on the contrary, the new pattern subsists in subsequent meetings, then we can think of it as having, in a sense, changed the conversation. Following Barron et al. (2018), we call the difference between novelty and transience, resonance.

In figure 4 we show the results for the set of ANPEC papers in Portuguese. The figure plots each paper by novelty on the horizontal and transience on the vertical axis. It is clear that there is a tight fit along the 45 degree line. This indicates that papers that are high in novelty tend to also be high in transience. Most novel ideas tend to be ephemeral. This may be because many new ideas are simply uninteresting, but it can also be due to the natural conservatism of scientific inquiry. In many cases this is how it should be. Researchers should only embrace new ideas once these ideas prove themselves to be valid and valued, and it is not always obvious whether any given new idea is one or the other. But this resistance is often misplaced and good ideas can be wrongly dismissed. There is no guarantee that all good ideas will eventually prevail.

Close examination of the graph reveals that although the fit is tight, there are several papers that are significantly below the 45 degree line. This means that they have considerably less transience than would be expected given their level of novelty. Figure 5 explores these relations by plotting novelty against resonance. Although it may be difficult to visualize, there is a positive correlation of 0.19 between novelty and resonance (statistically significant at 1%). A regression line reveals a positive slope of 0.78 for the papers in Portuguese and a slope of 0.98 for English, also statistically significant at 1%. This result means that in the ANPEC meetings the papers that contribute most to changing the conversation in the economics profession, tend to be papers that contain novel patterns. Though positive and statistically significant, the correlation is not that high, so other characteristics besides novelty are probably also honored by the profession. Nevertheless, novelty is also valued.

These results provide some assistance to Brazilian economists contemplating the trade-off between exploration and exploitation. Exploration (seeking new areas) is a risky endeavor that often ends badly. The guardians of the profession, including editors, peer reviewers, grant proposal evaluators, dissertation committees and others, value traditional concepts, well-established topics and familiar methods and do not easily engage with the new. On the other hand, there is a cost to exploitation (sticking to what already works), as having a greater impact seems to require at least some novelty.

Figure 4: Novelty vs. Transience at ANPEC meetings
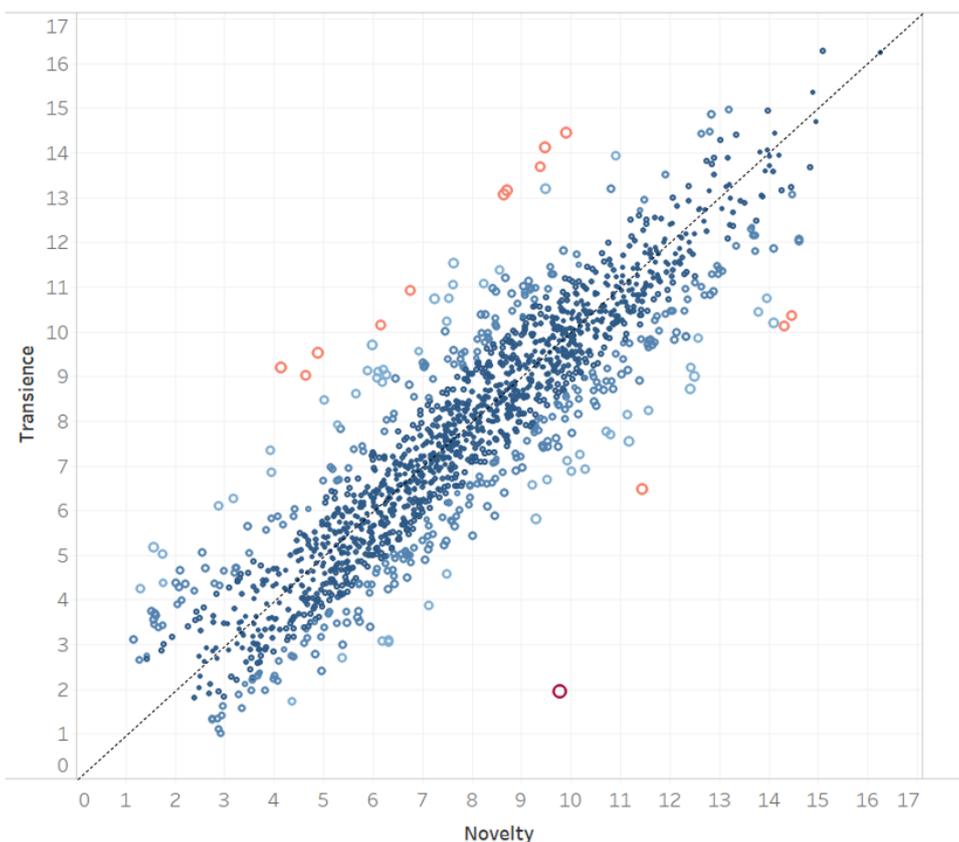
Source: Authors' elaboration using data from ANPEC http://www.anpec.org.br/ and code from Barron et al. (2018). The size and color of the points changes as they become further from the 45 degree line.

The results above were all derived passing the corpus of ANPEC papers through topic modeling and KL divergence procedures. One might wonder if our measurements of novelty, transience and resonance actually capture what we claim they measure. In order to validate our interpretations of the results we compare these measurements with the number of citations each of these papers has received since the meeting. This information is available in Google Scholar, which also identifies when the paper has been subsequently published in a journal or whether it has been published only in the ANPEC meetings annals. Because citations are an external measurement of the papers' content, it would not be tainted by any bias or misinterpretation in our procedures, so it is a good counterpoint to compare our results and evaluate our claims.

We do not expect resonance and citations to be the same thing. Resonance is an information theoretic measure based solely on the papers' content. Citations are subject to subsequent choices of the authors after writing the paper (submission, presentation, networking, etc.). They are also subject to the sociology of science that involves the reaction of the network to the paper, based on many other criteria besides the actual content of the paper (friendships, rivalries, the vagaries of

Figure 5: Novelty vs. Resonance at ANPEC meetings
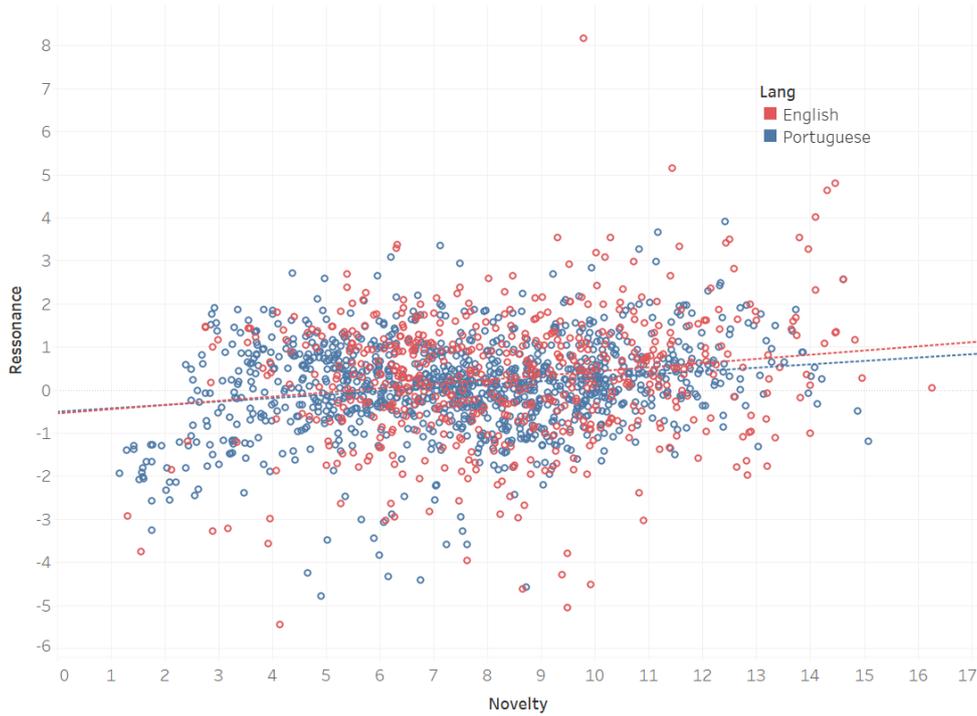
Source: Authors' elaboration using data from ANPEC http://www.anpec.org.br/ and code from Barron et al. (2018). The slope for English is 0.98 and for Portuguese 0.78, both statistically significant at 1%

peer review, institutional policies, etc.). Nevertheless, if our interpretations of novelty, transience and resonance are to make sense, we expect that there should be some relation between them and citations.

One way to make this comparison is to divide the full set of papers in two groups according to the number of citations and check if those with more than the median number of citations have a different level of novelty, transience and resonance than those below the median. Doing this, however, does not show any difference in these measures (see figure A1 in the appendix for a histogram for resonance). The problem with doing the comparison in this way is that the year of the meeting makes a big difference in terms of citations, as papers presented closer to 2013 have had more time to garner citations than those presented closer to 2019. Therefore, in table 2, we regress the number of citations against each of our three measures (separately), while controlling for each paper's meeting year. In addition, we control for whether the paper was eventually published in a Brazilian or a foreign journal (base category: published only in the ANPEC annals), whether the paper was written in English or Portuguese, and the number of co-authors. We also add ANPEC area dummies and dummies for all departments that had more than 10 papers presented in the full 2013-2019 period.

The results show our measures of novelty, transience and resonance are associated with citations in accordance to our interpretations above. Column I shows that the novelty is negatively but not statistically related to citations. As we expected, novelty tends to be quickly forgotten. Yet transience, in column II, is significantly negatively associated with citations. Papers that do not endure in our information theoretic measure also do not make a subsequent impact through citations. Most importantly, resonance in column III is positively associated with citations. Resonant papers are those that introduce novel patterns and these patterns do not immediately fade but rather have some endurance in subsequent meetings (all else constant). The coefficient magnitude implies that a one unit increase in resonance is associated with 0.4 more citations. Given that 56% of the papers

Table 2: Citations and papers' characteristics

Dep. variable	I Citations	II Citations	III Citations
Novelty	-0.011		
	(-0.20)		
Transience		−0.114*	
		(1.76)	
Resonance			0.421*
			(1.73)
Brazilian journal	4.496***	4.485***	4.558***
	(8.02)	(7.99)	(8.13)
Foreign journal	8.954***	8.920***	8.949***
	(5.21)	(5.24)	(5.26)
English	0.576**	0.652**	0.509**
	(2.23)	(2.42)	(2.03)
Number of authors	0.294*	0.295*	0307*
	(1.84)	(1.85)	(1.95)
2014	-0.836	-0.846	-0.928
	(-0.90)	(-0.91)	(-1.02)
2015	−2.234***	−2.248***	−2.361***
	(-3.01)	(-3.03)	(-3.10)
2016	−3.666***	−3.647***	−3.836***
	(-5.31)	(-5.35)	(-5.27)
2017	−4.296***	−4.314***	−4.578***
	(-6.15)	(-6.20)	(-5.92)
2018	−4.501***	−4.544***	−4.759***
	(-7.20)	(-7.22)	(-6.92)
2019	−4.836***	−4.934***	−5.134***
	(-7.85)	(-7.84)	(-7.39)
Constant	3.149***	3.818***	3.122***
	(3.27)	(3.74)	(3.39)
Observations	1,676	1,675	1,675
R-squared	0.23	0.23	0.23

Notes: Ordinary least squares, robust errors. * 10%, ** 5%, *** 1%. Base year is 2013. Foreign and Brazilian publications compared to papers only published in the ANPEC annals.

in our data have zero citations, this is a sizable payoff for resonance.

The control variables provide interesting information on which kinds of papers in the ANPEC meetings receive most citations. As expected, the year dummies are more negative the closer to 2019. It takes time for papers to be known and to be cited. Papers published in Brazilian journals have on average 4.5 more citations than those that never progress further than the meetings' annals, and for papers published in foreign journals that number is doubled. For this same reason papers published in English are more cited than those in Portuguese. In addition, papers with more coauthors are more highly cited. This is a trend that has been observed more generally in science (Wuchty et al., 2007). We cannot, however, distinguish if this is because the content is better or if more coauthors are better able to promote the paper, through more presentations and networking.

The results in table 2 are evidence that our measures of novelty, transience and resonance capture characteristics of the papers that, at least in part, explain their subsequent performance in terms of citations. These characteristics are by no means the sole or even the main determinant of greater or lesser success in cultural markets. As shown by Salganik et al. (2006), in cultural markets, of which academic publications are a part, "hit songs, books, and movies are many times more successful than average, suggesting that 'the best' alternatives are qualitatively different from 'the rest'; yet experts routinely fail to predict which products will succeed." Similarly, Barabási (2018) surveys research in a wide variety of fields, including art, sports, wine tasting, universities, academic productivity, Nobel prizes, Kickstarter campaigns, and others, and shows that "success, as it turns out, is not a direct result of our achievements, but instead an indirect reaction to how those achievements are perceived and valued by those around us." It is not that performance is irrelevant for success, but that where performance is difficult to measure, it is networks that drive success. In academic markets the networks include the whole hierarchies of universities, departments, societies, research groups, journals, Whatsapp groups, etc. In the next section we examine a small part of how this networks deals with the fact that for economics papers, as in any other area, performance is difficult to measure.

Before closing this section we use our data to explore the variation of novelty and resonance across departments and across ANPEC areas. The objective is to see if some departments or some areas are more prone to introduce novelty and/or to have greater resonance than others. We can imagine classifying departments and areas in a novelty-resonance space that can be divided into quadrants. Research that has higher than average novelty and higher than average resonance would fall in the top right quadrant. This is work that introduces new patterns in the meetings and these patterns persist. In the high-novelty, low-resonance quadrant new patterns are introduced but they fail to change the conversation. In the low-novelty, high resonance quadrant the research is not novel, that is, it uses the same patterns as before, but those are solid patterns that are maintained in the future. And in the low novelty, low resonance quadrant, few new patterns are introduced and those do not tend to persist.

Figure 6 shows the plots in novelty-resonance space by departments and figure 7 for ANPEC areas. It is important to take into account several caveats when analyzing the results. The first is that the comparison is limited to the context of the ANPEC meetings. It says nothing about how those papers compare to papers in other meetings, journals or to papers in general. The results should not be understood as an evaluation of the work done in any department, only of the work that each department presented at ANPEC. The number of researchers in a given department that consider ANPEC as an outlet for their work varies greatly. And those that do, may not be representative of the whole. Some departments are fully engaged with ANPEC meetings and others might focus instead in other conferences, such as the SBE (*Sociedade Brasileira de Econometria*) meetings that are held in conjunction with ANPEC. It is possible that some researcher might choose to send their best work to foreign meetings instead. Furthermore, it may not even make much sense to think of a department as a unit, since in Economics at least, research is often done individually or with colleagues from other institutions. Another important caveat is that for these plots, we classify each paper as belonging to the department of the first author. Many papers, however, have multiple authors and authors form different universities. Also, we considered only departments that had more than 10 observations in our sample, so many departments are excluded.

At first glance figures 6 and 7 seem to suggest interesting patterns in the average novelty and

resonance of research done across Brazilian economics departments and across ANPEC areas. But if we take into consideration the variation around the averages it turns out that the difference is not that large. Figures A2 and A3 in the appendix show the values one-standard deviation above and below the mean. In practically all cases the department and area averages are within this interval for other departments and areas. This is not due to a lack of variation across papers. Figures 4 and 5 shows much heterogeneity at the level of individual papers.[19] What these results show is that there are no systematic differences across departments or areas. In the same department or area there is high and low novelty/transience. This is probably due to the nature of research in economics, which is, more so than in many other areas, an individual pursuit or one in which the collaborations are done across universities. Brazilian federal research agencies (CNPq and CAPES) often try to arrange their programs and grants around the concept of research groups. Our results suggest that research in economics is not structured in this way. Therefore, it does not make much sense to say that a given department or area has a certain characteristic, at least in terms of novelty and resonance.

Figure 6: Economics departments by novelty and resonance
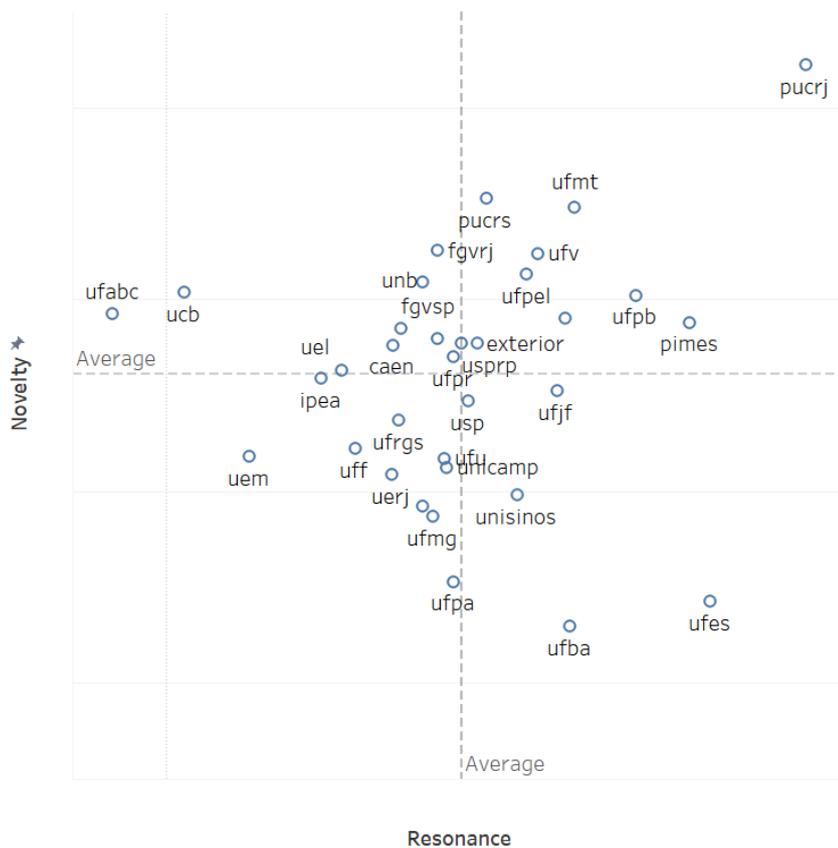
Notes: Departments set according to the first author. Only departments with more that 10 papers at the meetings from 2013 to 2019 were included.

---

[19]In the appendix we list the 15 papers with highest resonance values (table A2) and highest novelty values (table A3).

Figure 7: ANPEC areas by novelty and resonance
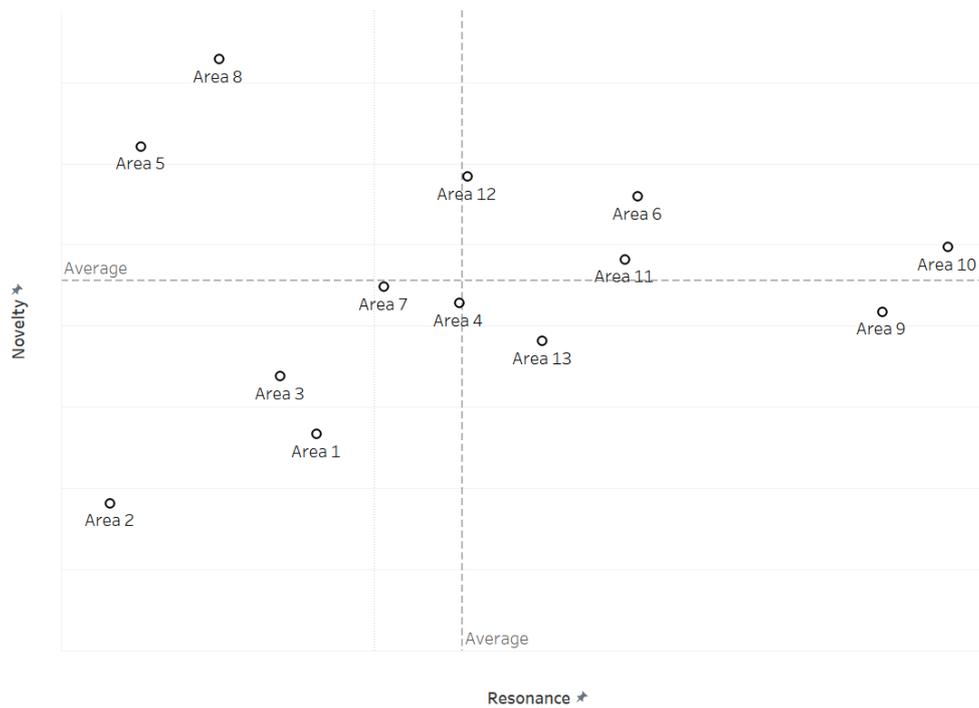
Notes: Area 1 - History of economic thought; Area 2 - Political economy; Area 3 - Economic history; Area 4 - Macro, monetary, finance; Area 5 - Public sector econ.; Area 6 - Growth, develop., institutions; Area 7 - International econ.; Area 8 - Micro. Quant. methods, finance; Area 9 - Industrial econ. & technology; Area 10 - Regional and urban; Area 11 - Agricultural & Environmental; Area 12 - Social & demographic; Area 13 - Labor economics.

8   Paper selection at ANPEC meetings

The metaphor of a science as a 'market for ideas' gives the impression that the mechanisms that evaluate new ideas and replace those that are found to no longer explain observed reality, are efficient. But much research has shown that in academia a wide variety of market failures often mean that this process does not work so well (Kuhn, 1996; Merton, 1968; Bourdieu, 2004; Foucault, 1970). Azoulay et al. (2019), in a paper called "Does Science Advance One Funeral at a Time? ", show empirically that new ideas often have to await the death of dominant figures in a field before they are allowed to flourish. They show, for the field of life science, that it is not the competitors from within a sub-field, who assume the mantle of leadership, but rather entrants from other fields who step in to fill the void created by a star's absence (and) importantly, this surge in contributions from outsiders draws upon a different scientific corpus and is disproportionately likely to be highly cited." This suggests that the mechanisms for selecting new ideas is not impartial and purely meritocratic.

Boudreau et al. (2016) performed an experiment where they randomized the assignment of real grant proposals at a large research university so as to have many combinations of evaluators and proposals. They find that "evaluators systematically give lower scores to research proposals that are closer to their own areas of expertise and to those that are highly novel." Their results highlight how difficult it is to design efficient and fair mechanisms for selecting across ideas given the increasingly specialized nature of science. Wang et al. (2017) use all the papers published in the Web of Science in 2001 to develop a measure of novelty based on the number of first time ever combinations of journals in a paper's reference list. They find, as do we, that more novel papers are more likely to have greater impact, but are more risky to the researcher as they have greater citation variance. Importantly, they find that the high-impact novel papers are significantly more likely to be cited in foreign fields instead of its own home field. Once again, this indicates that the mechanisms for

selecting ideas are often convoluted.

Heckman & Moktan (2020) note that in Economics there is a "tyranny of the Top Five" journal in tenure decisions, even though "the T5 are not the journals with the top five impact factors in Economics" (pg. 46).[20] They echo the critique by Akerlof (2020) that the counting of Top Five publications is more often the means to judge a researcher's body or work than a close and careful reading of that work. A large number of papers have tested for a variety of forms of discrimination in academic settings, where concerns other than an idea's inherent worth are used as selecting criteria (Smart & Waldfogel, 1996; Card & DellaVigna, 2017; Fisman et al., 2018; Hofmeister & Krapf, 2011; Laband & Piette, 1994; Medoff, 2003, 2006; Mason et al., 2005; Hengel, 2020; Sarsons et al., 2021, among many others).

Given that the "market for ideas" fails so frequently in so many academic settings, it possibly does so as well in the context of the ANPEC meetings. To what extent does the selection of papers for at these meetings select the 'best' papers? To answer this question we would ideally like to have not only the papers that were accepted, but also those that were submitted but did not make the cut. Then we could compare accepted papers with those that were rejected using the four criteria we used above; novelty, transience, resonance, and citations. The ANPEC meetings attract way more submissions than they are able to accept, so a very large cut is made in the selection process, probably revealing any potential difference between those that make it and those that are refused.

Unfortunately, our sample suffers from survivor bias, as we do not have the submitted-yet-rejected papers. There is, however, a way to get at some aspects of the selection procedure by focusing on the affiliation of the selection committees' members. In the ANPEC meetings, authors must indicate to which of the 13 ANPEC areas they are submitting. Their paper will then be evaluated by the area committee, which is composed of two to four evaluators indicated by the ANPEC member economics departments (currently there are 28 member centers plus 24 aspiring centers). ANPEC strives to reach broad representation across centers in the committees and to give opportunity to young and promising economists. The submitters therefore know the composition of the committees and can use that knowledge to choose an ANPEC area where they perceive their chances are higher. Most papers are sufficiently nuanced that they can credibly be submitted to more than one area. The choice of area can thus be based on a wide variety of perceptions, which are affected by the names of the committee members, their affiliations, the nature of their paper, and other information. The committee members are blind to the identity of the authors, as they receive anonymous copies of the papers. However, should a committee member wish to do so, there are easy ways to figure out who are the authors in many cases.

In order to evaluate the process of evaluation at ANPEC we set up a test that compares the number of times that there is a match between the affiliation of a committee member and the affiliation of the co-authors of the selected papers. We compare the number of matches to that which would arise at random if the committee were making draws of author-affiliations from a distribution proportional to the size of the centers' graduate program.[21] That is, we create 1000 random sets of placebo accepted papers, each equal to the number of actual accepted papers and determine how many matches there are in each set of author affiliation to committee member affiliation. These 1000 number of matches are then used to create a distribution against which we can compare the actual number of matches and infer if the process is random or appears to follow some other generation process. Table 3 gives an example of how the distributions are calculated supposing a committee of 3 members, 20 centers (A to T) and 15 presentation slots to be filled from a large number of papers submitted to this area committee. In the first draw there were four matches (B, A, C and B), in the second two (A, C), and so on.

Figures 8 and 9 show the results for all 13 ANPEC areas. The histograms show the frequency of placebo matches (sum for all years from 2013 to 2019) and a vertical line shows the actual number of matches. The results vary by area, but for several of the areas the actual number of matches lies

---

[20]Their measure of impact is:"For any given journal, an x -year impact factor as of 2017 is defined as the sum of cita-tions received in 2017 by all articles published in the journal during the time period 2016 x to 2016 divided by the journal's total volume of publications during the same time period".

[21]We compute that size through the number of permanent professors in each department's graduate program as declared to CAPES (the bureau of the Ministry of Education in charge of evaluating Brazilian Universities).

Table 3: Distribution of placebo accepted papers

Commitee	Centers	Slots	Draw 1	Draw 2	Draw 3	...	Draw 1000
Center A	A	1	K	G	J	...	E
Center B	B	2	M	F	K	...	**C**
Center C	C	3	S	**A**	S	...	M
	D	4	**B**	S	F	...	D
	E	5	F	J	R	...	E
	F	6	**A**	O	K	...	L
	G	7	D	M	I	...	T
	.	8	G	S	D	...	P
	.	9	L	P	L	...	G
	.	10	**C**	Q	Q	...	M
	N	11	T	T	R	...	D
	O	12	R	**C**	E	...	**A**
	P	13	**B**	K	T	...	I
	Q	14	F	D	D	...	K
	R	15	I	E	O	...	Q
	S						
	T						
		N. of matches	4	2	0		2

Notes: In this example the committee is made up of three members, from centers A, B and C. They must choose 15 papers from $N >> 15$ submitted papers. We make 1000 draws from a distribution that contains all 20 centers (A to T in this example), weighted by the size of the programs. This gives us the number of matches per draw and we can build a distribution of matches. Then compare the actual number of matches to the distribution.

in the upper tail, signifying that with a high degree of confidence those number of matches did not occur by chance. In particular, areas 1, 2, 4, 5, 6, 8, 10, 11 and 12 have a configuration of matches that suggest that author affiliation might have been a factor in the selection procedure.

How can these results be interpreted? Given the literature cited above showing evidence of the ubiquity of failures in evaluation in science, including Economics, favoritism or discrimination may be the first explanation that comes to mind. And while this may be the case in the ANPEC meetings, there are also other plausible hypotheses that can explain these results.

These other explanations are largely due to the fact that the committee has a very short time to select among a large number of papers so that a careful reading and reflection is generally not practical. The first alternative explanation is related to our first result, that novel ideas tend to be quickly rejected. When sifting through a large number of papers subject to a tight deadline, it is common for the evaluator to look for markers that she/he thinks distinguishes better research. That is, the evaluator can't take the time to internalize each paper fully, so she/he looks for patterns that single out the best papers. Because novel patterns are hard to internalize, they won't be latched on in such a procedure. If, as one would expect, the patterns that the evaluator is most familiar with are those that prevail among her/his department colleagues, this could lead to a non-random number of matches.

Another explanation can arise even if the evaluation diligently goes through all the papers and eliminates the large majority that are clearly below par. The number of submission is often so high that more papers still make the cut than there are slots. So a second criteria has to be lexicographically used to sort among the set of clearly suitable paper. One such criteria could be choosing authors you know. But even in the absence of this second-order favoritism, the criteria might be, once again, to go for patterns you recognize from your colleagues work, maybe unconsciously, instead of novel and disturbing patterns. A third variant on these explanation is that the evaluator is more likely to already know the research by his departamental colleagues, perhaps in seminars or other interactions. When considering between that paper and another, even if the evaluator is committed to being perfectly impartial, the fact that she/he has a deeper knowledge of a paper might make it seem sincerely better than the other which was only quickly gleaned through.

Clearly, many other explanations or attenuating circumstances can potentially help make sense of the results in Figures 8 and 9. It is likely that selection for ANPEC meetings, like selection processes in general, are afflicted with a mixture of the incentives and behaviors cited above. One would expect that economists, more so than any other profession, would be able to design a selection mechanism that efficiently allocates slots to submitted papers. Yet, once one factors in the real world contexts in which these procedures take place, subject to scarce time and resources, and involving collective decision-making across 28 heterogeneous member centers, the ways to fix the problem may not be so obvious. Not only does the impossibility of aggregating individual preferences into a minimally acceptable collective choice constrain what can be done (Arrow, 1951), but Goodhart's law suggests that whatever you try, people will find ways to game the system (Goodhart, 1984). Nevertheless, a rather obvious recommendation in the light of our results, would be to proscribe members of any department from submitting to the ANPEC areas in which there is a committee member from their department. This might impose a cost on some authors, but most papers can be pitched as belonging to more than one area. Also, greater attention to the problem by the profession and tighter supervision by ANPEC might surely ameliorate the incentives and ensure fairer outcomes, but if experience from wherever science is done is taken as a guide, the market for ideas will likely continue to fail.

9 Conclusion

Most studies that seek to identify and evaluate the impact of new ideas, use citations or some other measure external to the actual papers' content. In this paper we used a technique based on Barron et al. (2018) that uses the actual corpus of text in which the ideas were formulated. We used topic modeling and Kullback-Leibler divergence to create measures of novelty, transience and resonance for all the paper accepted to the ANPEC meetings of the Brazilian Association for Graduate Economics

**Figure 8:** Actual versus random number of matches
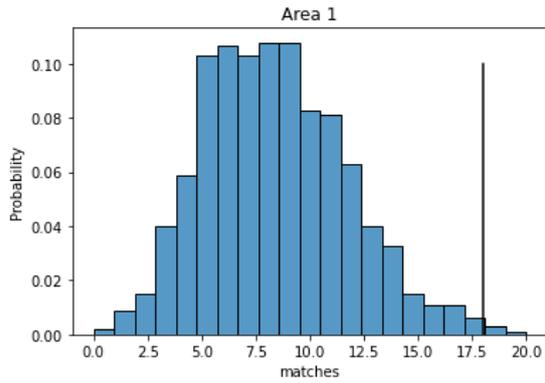
(a) History economic thought
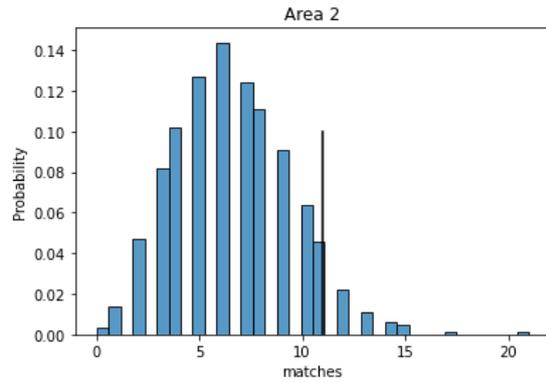
(b) Political economy
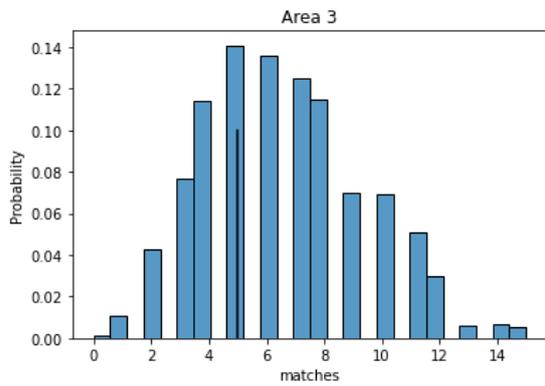
(c) Economic history
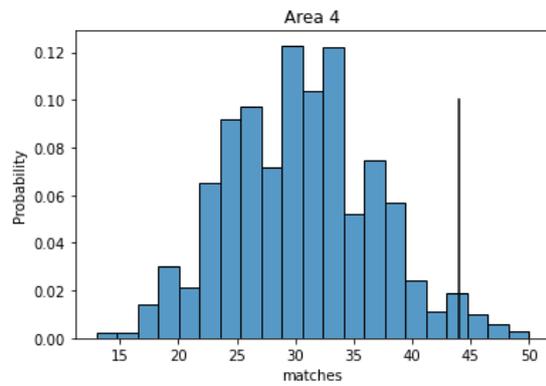
(d) Macro, monetary, finance
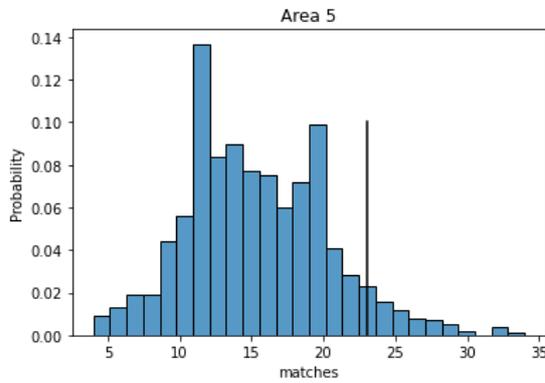
(e) Public sector
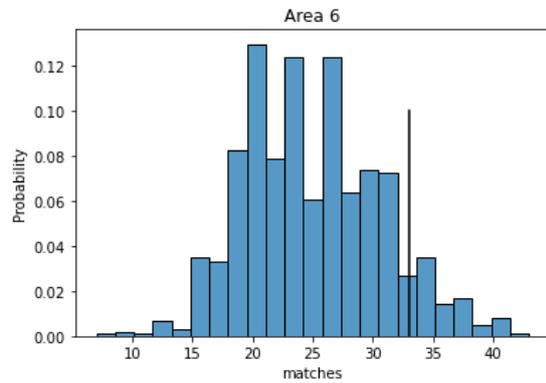
(f) Growth, develop., institutions
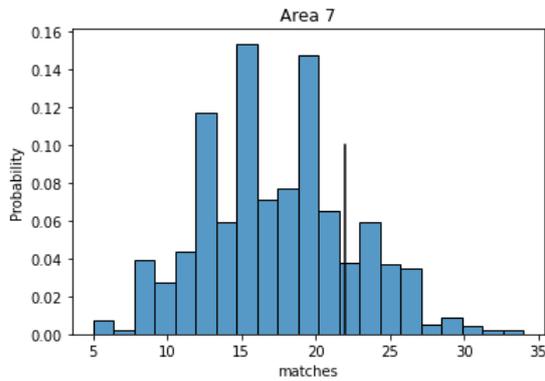
(g) International economics
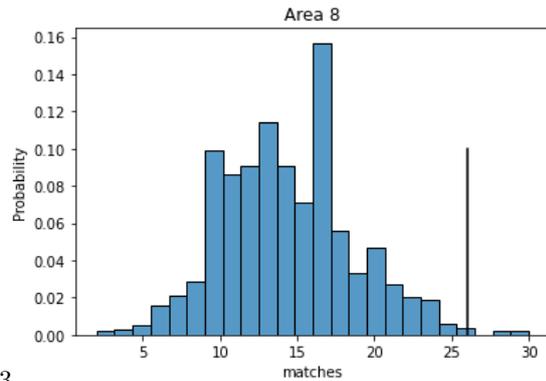
(h) Micro, quant., finance

23

Figure 9: Actual versus random number of matches (cont.)
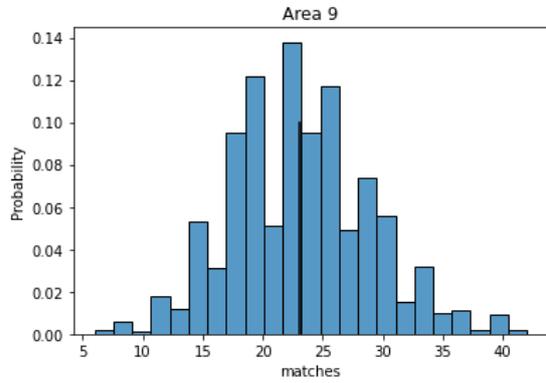
(a) Industrial org., technology
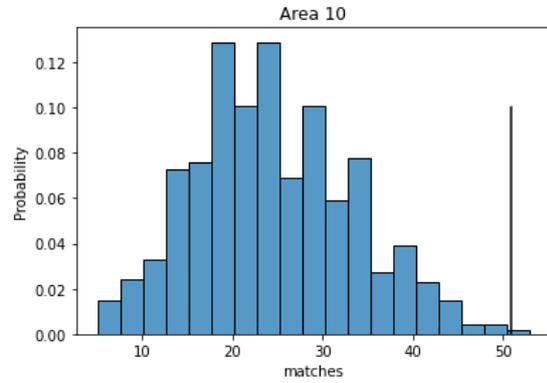
(b) Regional, urban economics
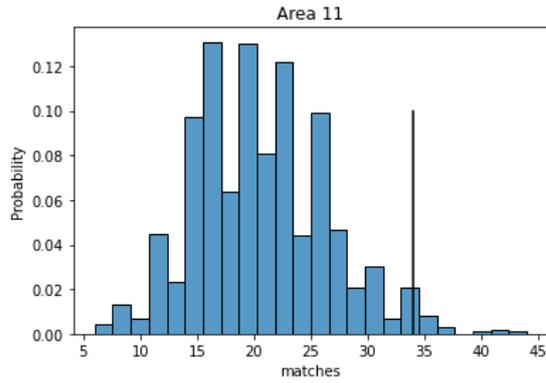
(c) Agricultural, environmental
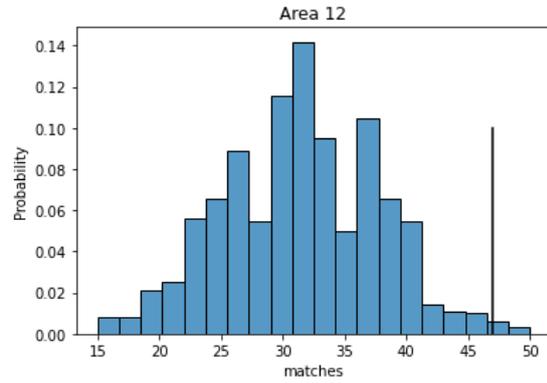
(d) Social, demographic econ.
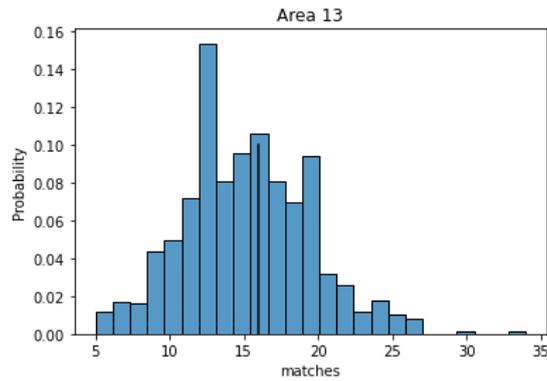
(e) Labor economics

from 2013 to 2019. Our results confirm the "law" that most novel ideas are quickly forgotten. We showed, however, that novelty tends to be a precondition for ideas that do turn out to be more impactful. We also showed that there is a positive correlation between our measure of resonance and the papers' subsequent citation record, so that at least in part they seem to be measuring related aspects of impact.

In a sense, our measure can be thought of as a different form of citation. When a paper introduces a new set of patterns, subsequent research can cite that paper in the conventional way, which is picked up in citation statistics such as those in Google Scholar. However, novel ideas can also be "cited" when the new patterns are repeated in subsequent literature, sometimes even unconsciously and without standard citation procedures. One might argue that this is actually a more sincere form of citation as it shapes the new paper more profoundly than a conventional citation, which is often perfunctory.

In the second part of the paper we showed that the procedures for paper selection at the ANPEC meetings display patterns that suggest that familiarity to the submitted papers' patterns or authors may be a determinant of the observed outcomes. This is compatible with our findings that novelty generally creates aversion. These dynamics are by no means exclusive to ANPEC, rather a large literature has shown them to be quite general. They arise naturally from self-interest and the incentives that pervade academic life together with constraints on time, resources and attention. It is beyond the scope of this paper to suggest how these incentives and constraints could be changed so as to produce processes of selection and evaluation that would lead to more and better ideas, but we suspect the task is much harder than one might suppose.

References

Akerlof, G. A. (2020). Sins of omission and the practice of economics. *Journal of Economic Literature*, *58*(2), 405–18.

Angrist, J. D., & Pischke, J.-S. (2010). The credibility revolution in empirical economics: How better research design is taking the con out of econometrics. *Journal of economic perspectives*, *24*(2), 3–30.

Anuatti Neto, F. (1997). Competição e complementaridade dos centros de pós-graduação em economia. *LOUREIRO, MR (Org.)*, *50*, 1946–1996.

Arrow, K. J. (1951). *Social choice and individual values*. Yale university press.

Arrow, K. J. (1984). *The economics of information* (Vol. 4). Harvard University Press.

Askin, N., & Mauskapf, M. (2017). What makes popular culture popular? product features and optimal differentiation in music. *American Sociological Review*, *82*(5), 910–944.

Asuncion, A., Welling, M., Smyth, P., & Teh, Y. W. (2012). On smoothing and inference for topic models. *arXiv preprint arXiv:1205.2662*.

Azoulay, P., Fons-Rosen, C., & Graff Zivin, J. S. (2019). Does science advance one funeral at a time? *American Economic Review*, *109*(8), 2889–2920.

Barabási, A.-L. (2018). *The formula: The five laws behind why people succeed*. Pan Macmillan.

Barron, A. T., Huang, J., Spang, R. L., & DeDeo, S. (2018). Individuals, institutions, and innovation in the debates of the french revolution. *Proceedings of the National Academy of Sciences*, *115*(18), 4607–4612.

Barto, A., Mirolli, M., & Baldassarre, G. (2013). Novelty or surprise? *Frontiers in psychology*, *4*, 907.

Bianchi, A. M. (1997). Do encontro de itaipava ao encontro da usp: comentários à margem da história da anpec. *LOUREIRO, Maria Rita Garcia*, *50*.

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *the Journal of machine Learning research*, *3*, 993–1022.

Bogdanov, P., & Mohr, J. W. (2013). Topic models. what they are and why they matter. *Poetics*, *31*, 545–569.

Boianovsky, M. (2021). Economists, scientific communities, and pandemics: An exploratory study of brazil (1918–2020). *EconomiA*.

Boudreau, K. J., Guinan, E. C., Lakhani, K. R., & Riedl, C. (2016). Looking across and looking beyond the knowledge frontier: Intellectual distance, novelty, and resource allocation in science. *Management Science*, *62*(10), 2765–2783.

Bourdieu, P. (2004). *Science of science and reflexivity*. Polity.

Card, D., & DellaVigna, S. (2017). *What do editors maximize? evidence from four leading economics journals* (Tech. Rep.). National Bureau of Economic Research.

Chang, K. K., & DeDeo, S. (2020). Divergence and the complexity of difference in text and culture. *Journal of Cultural Analytics*, *4*, 1–36.

Checchi, D., De Fraja, G., & Verzillo, S. (2019). Incentives and careers in academia: Theory and empirical analysis. *Review of Economics and Statistics*, 1–46.

Colussi, T. (2018). Social ties in academia: A friend is a treasure. *Review of Economics and Statistics*, *100*(1), 45–50.

Cover, T. M., & Thomas, J. A. (1991). *Elements of information theory*. USA: Wiley-Interscience.

Degaetano-Ortlieb, S., & Teich, E. (2018). Using relative entropy for detection and analysis of periods of diachronic linguistic change. In *Proceedings of the second joint sighum workshop on computational linguistics for cultural heritage, social sciences, humanities and literature* (pp. 22–33).

Evren, A., & Tuna, E. (2012). On some properties of goodness of fit measures based on statistical entropy. *International Journal of Research and Reviews in Applied Sciences*, *13*, 192–205.

Faria, J. R. (2004). Some reflections on incentives for publication: The case of the capes'list of economic journals. *Economia aplicada*, *8*(4), 791–816.

Faria, J. R. (2005). Is there a trade-off between domestic and international publications? *The Journal of Socio-Economics*, *34*(2), 269–280.

Faria, J. R., Araujo Jr, A. F. d., & Shikida, C. D. (2007). The international research of academic economists in brazil: 1999-2006. *Economia Aplicada*, *11*(3), 387–406.

Faria, J. R., et al. (2000). *The research output of academic economists in brazil*. School of Finance and Economics.

Fisman, R., Shi, J., Wang, Y., & Xu, R. (2018). Social ties and favoritism in chinese science. *Journal of Political Economy*, *126*(3), 1134–1171.

Foster, J. G., Rzhetsky, A., & Evans, J. A. (2015). Tradition and innovation in scientists' research strategies. *American Sociological Review*, *80*(5), 875–908.

Foucault, M. (1970). The archaeology of knowledge. *Social science information*, *9*(1), 175–185.

Garrouste, P. (2001). *What economics borrows from the statistical theory of information?* Springer.

Goodhart, C. A. (1984). Problems of monetary management: the uk experience. In *Monetary theory and practice* (pp. 91–121). Springer.

Griffiths, T. L., & Steyvers, M. (2004). Finding scientific topics. *Proceedings of the National academy of Sciences*, *101*(suppl 1), 5228–5235.

Guimaraes, B. (2011). Qualis as a measuring stick for research output in economics. *Brazilian Review of Econometrics*, *31*(1), 03–18.

Haddad, E. A., Mena-Chalco, J. P., & Sidone, O. (2017). Produção científica e redes de colaboração dos docentes vinculados aos programas de pós-graduação em economia no brasil. *Estudos Econômicos (São Paulo)*, *47*(4), 617–679.

Heckman, J. J., & Moktan, S. (2020). Publishing and promotion in economics: the tyranny of the top five. *Journal of Economic Literature*, *58*(2), 419–70.

Hengel, E. (2020). Publishing while female (summary).

Hoffman, M., Bach, F. R., & Blei, D. M. (2010). Online learning for latent dirichlet allocation. In *advances in neural information processing systems* (pp. 856–864).

Hofmeister, R., & Krapf, M. (2011). How do editors select papers, and how good are they at doing it? *The BE Journal of Economic Analysis & Policy*, *11*(1).

Issler, J. V., & Ferreira, R. C. (2004). Avaliando pesquisadores e departamentos de economia no brasil a partir de citações internacionais.

Issler, J. V., & Pillar, T. (2002). Mensurando a produção científica em economia de pesquisadores e departamentos brasileiros. *Ensaios Econômicos Da Epge*, *450*.

Jerrim, J., & Vries, R. d. (2020). Are peer-reviews of grant proposals reliable? an analysis of economic and social research council (esrc) funding applications. *The Social Science Journal*, 1–19.

Jing, E., DeDeo, S., & Ahn, Y.-Y. (2019). Sameness attracts, novelty disturbs, but outliers flourish in fanfiction online. *arXiv preprint arXiv:1904.07741*.

Keynes, J. M. (2018). *The general theory of employment, interest, and money.* Springer.

Knight Frank, H. (1921). Risk, uncertainty and profit. .

Kuhn, T. S. (1996). *The structure of scientific revolutions 3rd ed chicago.* IL: University of Chicago Press.

Laband, D. N., & Piette, M. J. (1994). Favoritism versus search for good papers: Empirical evidence regarding the behavior of journal editors. *Journal of Political Economy*, *102*(1), 194–203.

Leamer, E. E. (1983). Let's take the con out of econometrics. *The American Economic Review*, *73*(1), 31–43.

Loureiro, M. R. (1997). *anos de ciência econômica no brasil (1946-1996): pensamento, instituições, depoimentos.* Petrópolis: Vozes.

Loureiro, M. R., & Lima, G. T. (1994). A internacionalização da ciência econômica no brasil. *Brazilian Journal of Political Economy*, *14*(3).

Maasoumi, E. (1993). A compendium to information theory in economics and econometrics. *Econometric Reviews*, *12*(2), 137-181. Retrieved from https://www.tandfonline.com/doi/abs/10.1080/07474939308800260 doi: 10.1080/07474939308800260

Marsh, H. W., Jayasinghe, U. W., & Bond, N. W. (2008). Improving the peer-review process for grant applications: reliability, validity, bias, and generalizability. *American psychologist*, *63*(3), 160.

Mason, P. L., Myers Jr, S. L., & Darity Jr, W. A. (2005). Is there racism in economic research? *European Journal of Political Economy*, *21*(3), 755–761.

Medoff, M. H. (2003). Editorial favoritism in economics? *Southern Economic Journal*, 425–434.

Medoff, M. H. (2006). Evidence of a harvard and chicago matthew effect. *Journal of Economic Methodology*, *13*(4), 485–506.

Merton, R. K. (1968). The matthew effect in science: The reward and communication systems of science are considered. *Science*, *159*(3810), 56–63.

Milli, S., & Bamman, D. (2016). Beyond canonical texts: A computational analysis of fanfiction. In *Proceedings of the 2016 conference on empirical methods in natural language processing* (pp. 2048–2053).

Mueller, B. (2021). Where'd you get that idea? determinants of creativity and impact in popular music. *EconomiA*, *22*(1), 38-52.

Murdock, J., Allen, C., & DeDeo, S. (2017). Exploration and exploitation of victorian science in darwin's reading notebooks. *Cognition*, *159*, 117–126.

Novaes, W. (2008). A pesquisa em economia no brasil: uma avaliação empírica dos conflitos entre quantidade e qualidade. *Revista Brasileira de Economia*, *62*(4), 467–495.

Pablo Castilla, J., et al. (2020). To kill a black swan: The credibility revolution at cede, 2000-2018.

Petterini, F. C. (2020). Brazilian academic economics: A picture from the anpec exam microdata. *EconomiA*, *21*(3), 325–339.

Salganik, M. J., Dodds, P. S., & Watts, D. J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *science*, *311*(5762), 854–856.

Sarsons, H., Gërxhani, K., Reuben, E., & Schram, A. (2021). Gender differences in recognition for group work. *Journal of Political Economy*, *129*(1), 000–000.

Shannon, C. E. (1948). A mathematical theory of communication. *The Bell system technical journal*, *27*(3), 379–423.

Smart, S., & Waldfogel, J. (1996). *A citation-based test for discrimination at economics and finance journals* (Tech. Rep.). National Bureau of Economic Research.

Uzzi, B., Mukherjee, S., Stringer, M., & Jones, B. (2013). Atypical combinations and scientific impact. *Science*, *342*(6157), 468–472.

Wallach, H. M., Mimno, D. M., & McCallum, A. (2009). Rethinking lda: Why priors matter. In *Advances in neural information processing systems* (pp. 1973–1981).

Wang, J., Veugelers, R., & Stephan, P. (2017). Bias against novelty in science: A cautionary tale for users of bibliometric indicators. *Research Policy*, *46*(8), 1416–1436.

Wuchty, S., Jones, B. F., & Uzzi, B. (2007). The increasing dominance of teams in production of knowledge. *Science*, *316*(5827), 1036–1039.

Youn, H., Strumsky, D., Bettencourt, L. M., & Lobo, J. (2015). Invention as a combinatorial process: evidence from us patents. *Journal of the Royal Society interface*, *12*(106), 20150272.

A Appendix

Figure A1: Histogram of resonance above and below median citations

Resonance: grey - above median citations, red - below median citations
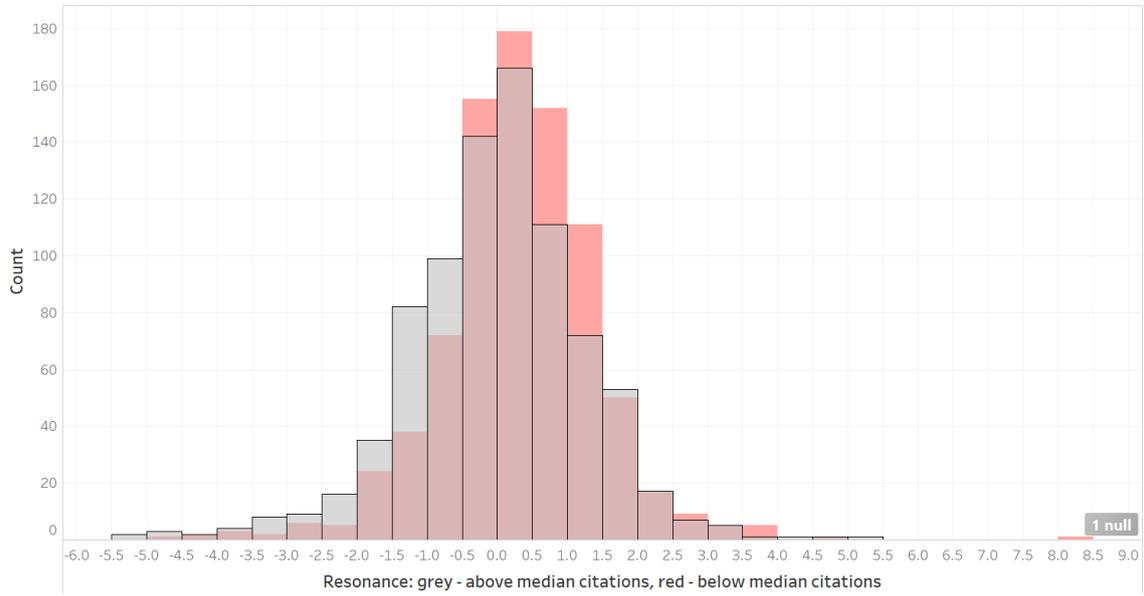
Table A1: Topics in the ANPEC annals.

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
Comércio	Inovação	Trabalhador	Espacial	Choque
Exportação	Tecnológico	Salário	Cidade	Inflação
Indústria	Firma	Mulher	Regional	Regime
Comercial	Crescimento	Ocupação	Município	Ciclo
Importação	Tecnologia	Homem	Urbano	Previsão
Industrial	Patente	Idade	Distância	Expectativa
China	Industrial	Rendimento	Centro	Monetário
Exportador	Interação	Hora	Indústria	IPCA
Insumo	Indústria	Trabalhar	Trabalhador	Hiato
Trade	Inovativo	Domicílio	Densidade	Curva
Doméstico	Intensidade	Salarial	Mobilidade	Estrutural
Exportação	Rede	Diferencial	Concentração	Matriz
Setorial	Innovation	Branco	Aglomeração	Quebra
Matriz	Esforço	Chefe	Localização	Phillips
Mundial	Inovador	Benefício	Transporte	Meta
Area 7	Area 9	Area 13	Area 10	Area 4
International	Industrial	Labor	Regional	Macro., Mon.
Economics	and Tec.	Economics	& Urban	& Finance

Topic 6	Topic 11	Topic 12	Topic 13	Topic 14
Moeda	Emissão	Ciência	Marx	Desigualdade
Ativo	Energia	Economista	Capitalista	Pobreza
Crise	Cenário	Instituição	Dinheiro	Regional
Risco	Família	Conhecimento	Mercadoria	Pobre
Monetária	Ambiental	Conceito	Lucro	Nordeste
Carteira	Etanol	Científico	Capitalista	Regional
Retorno	Simulação	Veblen	Acumulação	Decomposição
Liquidez	Energético	Humano	Força	Rural
Fluxo	Transporte	Mundo	Categoria	Educação
Global	Choque	Visão	Riqueza	Rendimento
Ação	Combustível	Pensamento	Classe	Sudeste
Juro	Equilíbrio	Hayek	Expansão	Norte
Crédito	Petróleo	Crítico	Troca	Família
Título	Climático	Prática	Mundial	Urbano
Câmbio	Insumo	Ação	Infeaestrutura	Gini
Area 4	Area 11	Area 1	Area 2	Area 12
Macro., Mon.	Agrícola &	HPE	Political	Social &
& Finance	Meio Ambiente	Methodology	Economy	Demog. Econ.

Source: Authors' elaboration using data from ANPEC Meeting annals - http://www.anpec.org.br/novosite/br

Figure A2: Novelty and resonance variation by departments
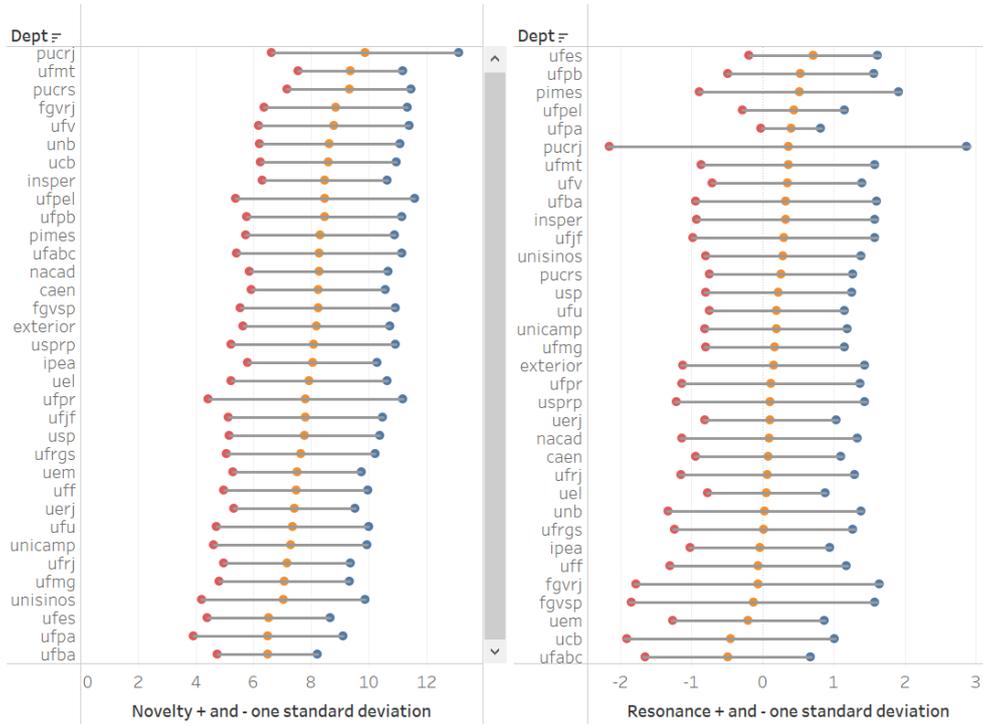

Figure A3: Novelty and resonance variation by Anpec area
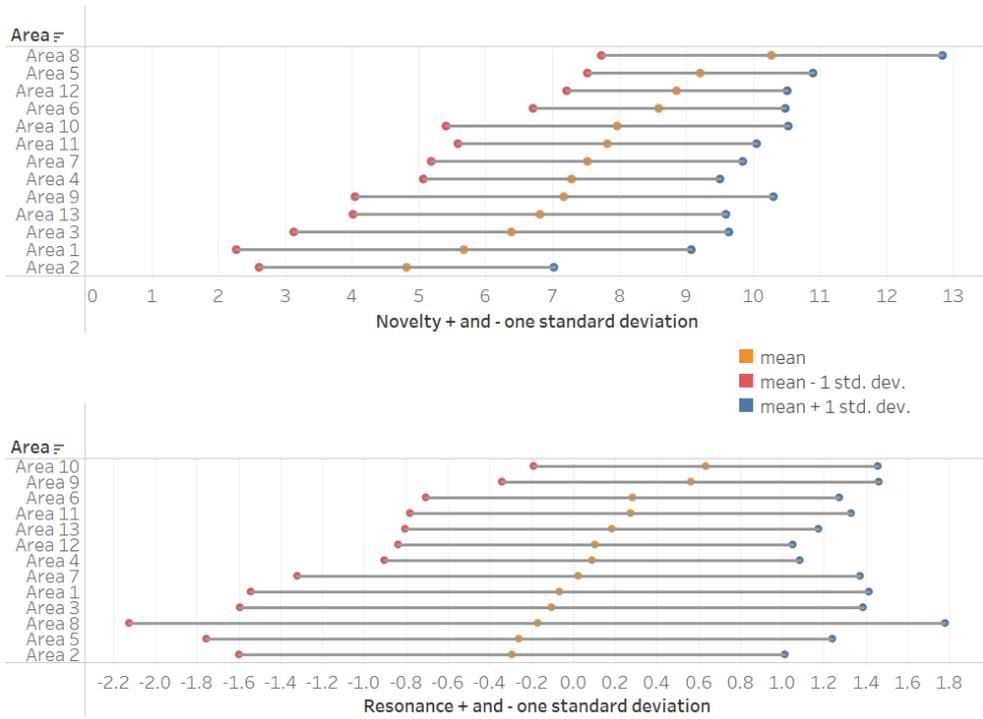
Table A2: Fifteen papers with highest resonance values

Num	Resonance	Citations	Area	Year	Title
1	8.16	0	Area 5	2019	DO PROTESTS REACH THE BALLOTS. THE ELECTORAL DIVIDEND OF THE BRAZILIAN SPRING Holanda, C. and Lima, R.C.
2	5.15	1	Area 10	2013	URBAN SPRAWL AND SPATIAL SEGREGATION IN SÃO PAULO METROPOLITAN REGION Ramos, F.R. and Biderman, C.
3	4.80	1	Area 3	2013	HISTORICAL ORIGINS OF BRAZILIAN RELATIVE BACKWARDNESS Barros, A.R.
4	4.63	0	Area 7	2018	IMPACTO DAS MEDIDAS NÃO-TARIFÁRIAS SOBRE O COMÉRCIO DE VALOR ADICIONADO Araújo Jr, I.F, Perobelli, F.S. and Faria, W.R.
5	4.01	2	Area 11	2013	AMAZON MONITORING AND DEFORESTATION SLOWDOWN: THE PRIORITY MUNICIPALITIES Rocha, R., Assunção, J. and Gandou, C.
6	3.90	0	Area 8	2019	ROTATIVIDADE DE TREINADORES E O DESEMPENHO DAS EQUIPES DE FUTEBOL NO BRASIL Azevedo, C.O., Almeida, A.T.C. and Ramalho, H.M.B.
7	3.67	0	Area 6	2017	CARACTERÍSTICAS QUE INFLUENCIAM A PERCEPÇÃO DE CONFIANÇA NAS INSTITUIÇÕES E CORRUPÇÃO NO BRASIL. Monteiro, V.S., Justo, W.R., Rocha, R.M. and Castanheira, L.F.
8	3.54	0	Area 8	2019	LONG MEMORY AND TERM STRUCTURE OF INTEREST RATES Valente, F. and Laurini, M.
9	3.54	0	Area 11	2014	CLIMATE CHANGE POLICY IN BRAZIL AND MEXICO: HOW SIMILAR ARE THE IMPACTS AND SOLUTIONS? Gurgel, A.C., Octaviano, C. and Paltsev, S.
10	3.53	0	Area 13	2014	DOES MONEY MOVE TEACHERS? Silva Filho, G.A., Pinto, G.C.X., and Vieira, M.T.
11	3.51	2	Area 6	2013	ENDOGENOUS LABOR EFFORT AND WAGE DIFFERENTIALS IN A DYNAMIC MODEL OF CAPACITY ... Silveira, J.J. and Lima, G.T.
12	3.41	0	Area 1	2019	PATTERNS OF INTERDISCIPLINARY CITATIONS AND ASYMMETRY BETWEEN ECONOMICS ... Silva, V.C. and Cavalieri, M.
13	3.38	0	Area 11	2019	IRRIGATION, TECHNICAL EFFICIENCY AND FARM SIZE IN BRAZIL Morais, G.A.S., Silva, F.F., Freitas, C.O. and Braga, M.J.
14	3.34	0	Area 7	2019	VANTAGENS COMPARATIVAS AO NÍVEL DE FIRMAS: EVIDÊNCIAS INICIAIS PARA A INDÚSTRIA ... Hidalgo, A.B., Casagrande, D.L. and Feistel, P.R
15	3.34	110	Area 5	2014	TERM LIMITS AND POLITICAL BUDGET CYCLES AT THE LOCAL LEVEL: EVIDENCE FROM A YOUNG DEMOCRACY Klein, F.A. and Sakurai, S.N.

Table A3: Fifteen papers with highest novelty values

Num	Novelty	Citations	Area	Year	Title
1	16.27	0	Area 9	2017	LENIENCY AND DAMAGE LIABILITY IN BRAZIL: THE EFFECTS ON COLLUSIVE BEHAVIOR Pinha, L.C. and Braga, M.J.
2	15.09	0	Area 9	2017	O USO DE FILTROS DE CARTÉIS: UMA APLICAÇÃO PARA O CASO DO VAREJO ... Silva, A.S., Vasconcelos, S. and Vasconcelos, C.
3	14.97	0	Area 9	2015	LOST IN TIME AND SPACE: THE DETERRENCE EFFECT OF CARTEL BUSTS ON THE RETAIL ... Grezzana, S.
4	14.88	0	Area 9	2015	DINÂMICA DE PRECIFICAÇÃO EM MERCADOS CARTELIZADOS: O CASO DA GASOLINA A ... Silva, A.S., Vasconcelos, S. and Vasconcelos, C.
5	14.83	10	Area 8	2014	THE 2D:4D RATIO AND MYOPIC LOSS AVERSION (MLA): AN EXPERIMENTAL INVESTIGATION Teixiera, A.M., Tabak, B.M. and Cajueiro, D.O.
6	14.62	2	Area 3	2013	FOREIGN ELECTRICITY COMPANIES IN ARGENTINA & BRAZIL: THE CASE OF AMERICAN... Saes, A.M. and Lanciotti, N.
7	14.61	0	Area 8	2014	THIN SUBSIDIES NO BRASIL: UMA INVESTIGAÇÃO DOS SEUS EFEITOS SOBRE A DEMANDA DE FRUTAS ... Silva, M.M.C. and Coelho, A.B.
8	14.48	3	Area 13	2014	LABOR MARKET EQUILIBRIUM EFFECTS OF CASH TRANSFERS - EVIDENCE FROM A STRUCTURAL MODEL ... Lehmann, M.C.
9	14.46	3	Area 1	2013	LUCAS'S EARLY RESEARCH IN THE 1960'S Silva, D.F.R.
10	14.46	1	Area 3	2013	HISTORICAL ORIGINS OF BRAZILIAN RELATIVE BACKWARDNESS Barros, A.R.
11	14.31	0	Area 7	2018	IMPACTO DAS MEDIDAS NÃO-TARIFÁRIAS SOBRE O COMÉRCIO DE VALOR ADICIONADO Araujo Jr., I.F.A., Perobelli, F.S. and Faria, W.R.
12	14.27	3	Area 8	2014	PROPAGATION OF SYSTEMIC RISK IN INTERBANK NETWORKS Quadros, V.H., Gonzalez-Avell, J.C. and Iglesias, J.R.
13	14.21	4	Area 9	2015	IMPACTO DE FUSÕES E AQUISIÇÕES SOBRE A QUALIDADE DO ENSINO SUPERIOR Garcia, C.P. and Azevedo, P.F.
14	14.13	0	Area 12	2018	RELAÇÃO ENTRE EXPOSIÇÃO À VIOLÊNCIA E HABILIDADES SOCIOEMOCIONAIS: O CASO DOS ... Silva, W.P., Scorzave, L.G., Sarmento, C.M. and Santos, D.
15	14.11	2	Area 11	2013	AMAZON MONITORING AND DEFORESTATION SLOWDOWN: THE PRIORITY MUNICIPALITIES Rocha, R., Assunção, J.C., and Gandour, C.