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What makes a successful scientist in a central bank? Evidence from the RePEc database

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Abstract

This research analyzes factors affecting scientific success of central bankers. We combine data from the RePEc and EDIRC databases, which contain information about economic publications of authors from 182 central banks. We construct a dataset containing information about 3312 authors and almost 80 thousand scientific papers published between 1965 and 2020. Results from Poisson regressions of citation impact measure called h-index, on a number of research features suggest that economists from the US Federal Reserve Banks, international financial institutions, and some eurozone central banks are cited more frequently than economists with similar characteristics from central banks located in emerging markets. Researchers from some big emerging economies like Russia or Indonesia are cited particularly infrequently by the scientific community. Beyond these outcomes, we identify a significant positive relationship between research networking and publication success. Moreover, economists cooperating with highly cited scientists also obtain a high number of citations even after controlling for the size of their research networks.

Keywords: RePEc, Scientific Success, h-index, Big data.

JEL classification codes: E58, D02, I23

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1. Introduction

The aim of this paper is to analyze factors affecting scientific success of economists from international central banks. The scientific success of an economist is measured in terms of the citation impact of her publications. As a measure of citation impact, we use *h*-index, also known as the Hirsch index, proposed by Hirsch (2005). This index is defined for each author as the maximum *h* number of her publications that have been cited at least *h* times. In recent years, this index has been one of the most widely used indicators of publishing productivity and research impact.

The following arguments motivate interest in productivity of central banking scientists. There is a wide consensus among central bankers and economists alike that monetary policy requires credibility in order to be effective (Blinder, 2000; Bordo & Siklos, 2015; Goy et al., 2020). Maintaining credibility requires proven expertise of economic knowledge. Therefore, the institutional setup of research plays an important role in policymaking. Surprisingly, bibliometric analysis of scientific research is rarely used in the context of measuring effectiveness of central bank governance and policy making. This research may help highlight the characteristics of successful scientists which can be used by governing bodies to develop a strong scientific basis for monetary policy making.

Central banks also need to be accountable and transparent (Hetzel, 2012; Buiter, 2014). Central bank scientists with access to confidential data and having interactions with policymakers have a clear research advantage over external academics. Their research may help identify important economic events and reveal factors affecting decisions of policy makers that would be difficult to observe otherwise. In this way, central bank scientists provide a value added to research on monetary issues.

Finally, scientists in central banks are able to follow and understand the latest developments in economic research much more effectively than any other central bank analysts, because scientists interact frequently with academics outside the banking system. These interactions, research networks, and competition with academics often lead to introduction of advanced models and methods as new tools of monetary policy.

In this study, we measure the relationship between the author's affiliation, publishing characteristics, and her citation impact. For example, it is interesting to learn how the variety of publishing outlets affects the likelihood of a high *h*-index. We also investigate how the co-authorship networks are linked to publishing productivity. We obtain results based on the

analysis of 182 central banks, approximately 3300 authors, and around 80000 scientific papers published between the years 1965 and 2020.

Our estimates suggest that central bankers from the US Federal Reserve banks, international institutions such as Bank of International Settlements, European Central Bank BIS and some eurozone national banks are cited more frequently than economists with similar publishing characteristics from banks located in emerging markets. The *h*-indices of economists in these leading banking institutions are approximately by 0.3 to 0.5 higher in comparison to the global median. There is also a group of large emerging countries, including Russia, Indonesia, and Sri Lanka, where publishing authors perform evidently weaker than authors from advanced economies.

We also identify a positive relationship between the value of *h*-index and the number of unique publication outlets and publishing years, but observe no additional statistically significant impact of the variety of publication topics on the publishing productivity measured with *h*-index.

Finally, a strong link between research networking and publishing success is detected. The best researchers are capable of creating networks of co-authors that support their efforts. Interestingly, publishing success is positively correlated with the research network size, the share of papers written with co-authors, and the total number of authors affiliated with the same banking institution.

This document is structured as follows. Section 2 presents literature review on the use *h*-index as a measure of citation impact. Section 3 discusses the impact of scholars on the activities of a central bank. Section 4 presents the RePEc database and its content, as well as basic statistics of constructed variables applied in our analysis. Section 5 describes the model used to measure dependence of *h*-index on a number of authors' features. Section 6 summarizes the model output and the final section concludes.

2. Measurement of scientific success.

This section presents a brief explanation of the Hirsh index (Hirsh, 2005), discusses its advantages and disadvantages, and the need for high quality publications in central banks. *h*-index denotes the largest number of those papers authored by a single scientist that have been cited at least h times each. For example, *h*-index equal 3 indicates that the author published at least 3 articles and each of these articles was cited 3 at least times.

Frequent use of *h*-index in research triggered a debate whether *h*-index describes well publishing productivity of specific authors. Hirsch (2007) highlights that behavior of *h*-index is rather predictable in subsequent years. The index cannot be artificially boosted by publishing a single paper in a co-authorship even if this paper is frequently cited. Opponents note that achieving a high value of this index requires frequent publishing. Ellison (2013) shows examples where distinct scholars, whose papers were cited 1000 times or more, attain relatively low *h*-index values just because they do not have sufficient number of publications to increase the metrics. Jensen et al. (2009) highlight that the index does not consider the number of co-authors of a paper. A big research team may boost the *h*-index value by dishonest practices such as ghostwriting or extensive references to colleagues' publications. Some authors may also strategically cite those papers with the number of citations just below these authors' *h*-index values. Finally, another argument against this citation measure is that the average value of *h*-index differs strongly between fields of economics. Nevertheless, alternative citation indices, e.g. those focusing mainly on the most relevant author's publications, have not gained much recognition (Perry & Reny, 2016; Tol, 2009).

The versatility of *h*-index induced research that tried to determine factors supporting success in scientific career. Acuna et al. (2012) proposed a model describing evolution of metrics based on scholar's characteristics, i.e. the number of published articles, the number of years from the first publication. Bosquet & Combes (2013) focused on the number of publications and the depth of research network. Based on the analysis of g-indices amongst French economists, Bosquet & Combes claim there exist "*increasing returns to scale*" from greater research networks and more frequent publishing. Authors publishing more studies in collaboration with other researchers, achieve higher values of *h*-indices or g-indices. Social ties and publishing in top journals also have a strong influence on scientific career in economics (Colussi, 2018; Heckman & Moktan, 2020). Ayaz et a. (2018) find that such factors as "average citations per paper, number of coauthors, years since publishing first article, number of publications, number of impact factor publications, and number of publications in distinct journals performed better than all other combinations" in predicting future scientific impact in the field of computer science. In our study, we use a similar set of explanatory variables to predict scientific success among economists in central banks.

3. Scholars and the central banking.

This section describes rationale of maintaining economic research in the central bank. The work of researchers is an important part of central bank communication, which significance increased in the last decades. Central banks started to communicate toward households and corporations to shape their expectations, to force saving, borrowing, consumption, investment and other economic behavior. This instrument also helps central banks to increase their credibility (e.g., Born et al. 2014; Cieslak & Schrimpf, 2019; Haldane & McMahon, 2018; Hansen et al., 2019). The research on expertise and the knowledge management in the central bank has been somewhat overlooked in the literature until now, although the role of central banks is inevitable in this area (cf. Trichet, 2008, Claveau & Dion, 2018).

The topics of scientific success and academic integrity have major relevance in central banking. For example, several papers show that metrics of scientific excellency are considered during the employment and salaries negotiations of researchers (Ellison, 2013; Hilmer et al., 2015). Therefore, economists have financial motivation to strategically approach their work.

Central bankers are especially prone to the problem known as confirmation bias (Frey, 2003; Silvia, 2012). Analysts have greater motivation to conformism rather than opposing the wrong ideas of their direct supervisors, because analysts' promotion is purely dependent on the supervisors' opinions. Another frequent but less concerning issue is that authors tend to exaggerate their findings. Some studies showed that researchers too often present parameters whose p-values lie too close to the common thresholds of significance i.e. 5% or 1% (Brodeur et al., 2016; Gorajek et al., 2021).

Individual temptations and potential misconducts can be utilized by the monetary authorities to promote wrong decisions. Rybacki (2020) argues that central bank authorities should maintain diversified and versatile economic research to lower deviations of inflation from the central bank target. Unfortunately, this is not always the case. One example is provided by Fabo et al. (2020) who created a meta-analysis of research papers measuring the macroeconomic effects of quantitative easing. Fabo et al. claim that manuscripts presented by central bankers showed stronger and more positive effects compared to papers written by other academics. The most optimistic papers were authored by a senior central bank staff. These examples further motivate promotion of high-quality research in central banks and highlight the importance of analyzing factors affecting publication success among central bankers. In

this research, we focus on the structural drivers of publishing success. Our study may be treated as a starting point for more advanced analyses of publication biases among central bankers.

4. Database

In this section, we discuss construction of variables used in our research. This research employs information about research papers published by 3312 authors affiliated with one of the 182 international central banks, including international institutions like Bank of International Settlements (BIS) or European Central Bank (ECB). The list of all investigated organizations is presented in Table 1. The publication data are stored in the one of the most widely used databases indexing economic research, namely the RePEc (Research Papers in Economics) database. As stated by the authors, this is a "decentralized bibliographic database of working papers, journal articles, books, books chapters and software components, all maintained by volunteers" (cf. http://repec.org/). One of the main services contributing to RePEc is EDIRC (Economics Departments, Institutes and Research Centers in the World) which contains among others information about instigated central banks. We downloaded available information about authors and their publications using the special RePEc API.[3]

Our retrieved data contain information about papers published between January 1965 and April 2020 (the month when we ran our download scripts). There are 79750 works published either as working papers, articles in peer reviewed journals, book chapters or monographs. From the RePeC database, we were able to derive the following information about central bank researchers:

1. *h*-indices of authors based on the citations available in the CitEc (Citations in Economics) service and using citation information from the RePEc database;
2. authors' career time span, i.e. year of each publication, from the first published paper to the last one;
3. full listing of co-authors of each publication;
4. Information about the number of unique journals where each author published his or her papers;
5. JEL (Journal of Economic Literature) codes corresponding to the author's papers.

[3] The API is discussed in more detail at https://ideas.repec.org/api.html

JEL classification system of the American Economic Association "is a standard method of classifying scholarly literature in the field of economics" and its JEL codes are used to classify this literature into 20 distinct economic categories (cf. https://www.aeaweb.org/econlit/jelCodes.php?view=jel).

Aggregating JEL codes by each author, we were able to identify the most frequently researched economic category for each central banker. In our study, we use these leading categories to predict the topics analyzed by central banking scientists that generate the highest (and the lowest) *h*-index values.

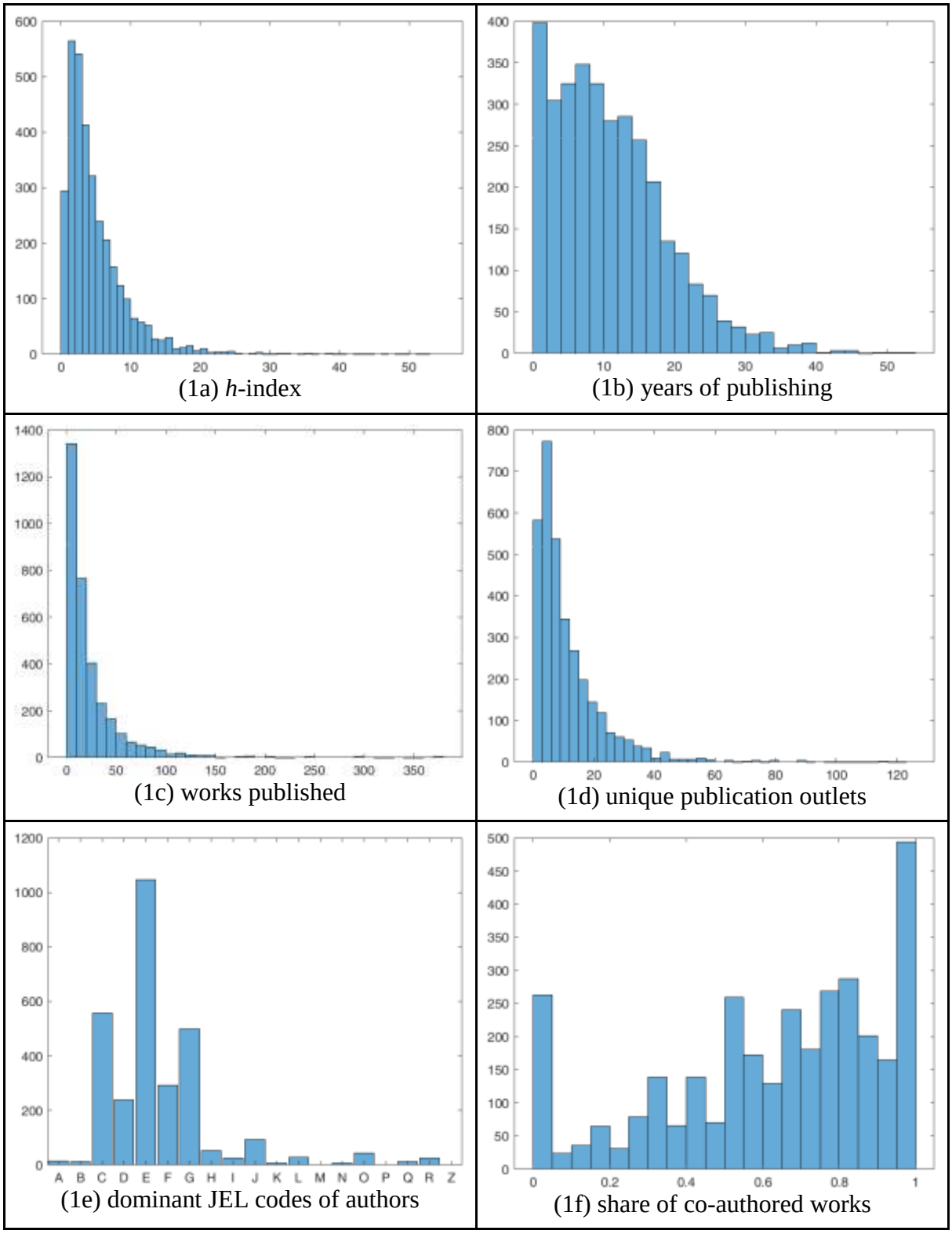
We are interested in measuring the publishing success conditional on the predominant topic of research. One can observe in Figure 1 that studies on monetary policy and inflation (JEL code E) have greater priority in comparison to other research categories. We decided to use only main JEL categories, because the subcategories are too granular and do not allow for meaningful interpretations. We removed authors publishing papers with categories: K (Law and Economics), M (Business Administration and Business Economics; Marketing; Accounting; Personnel Economics), N (Economic History), P (Economic Systems) and Z (Other Special Topics). The number of corresponding researchers in each case does not exceed 10, which means that central bankers are less interested in these specific topics (cf. Figure 1e).

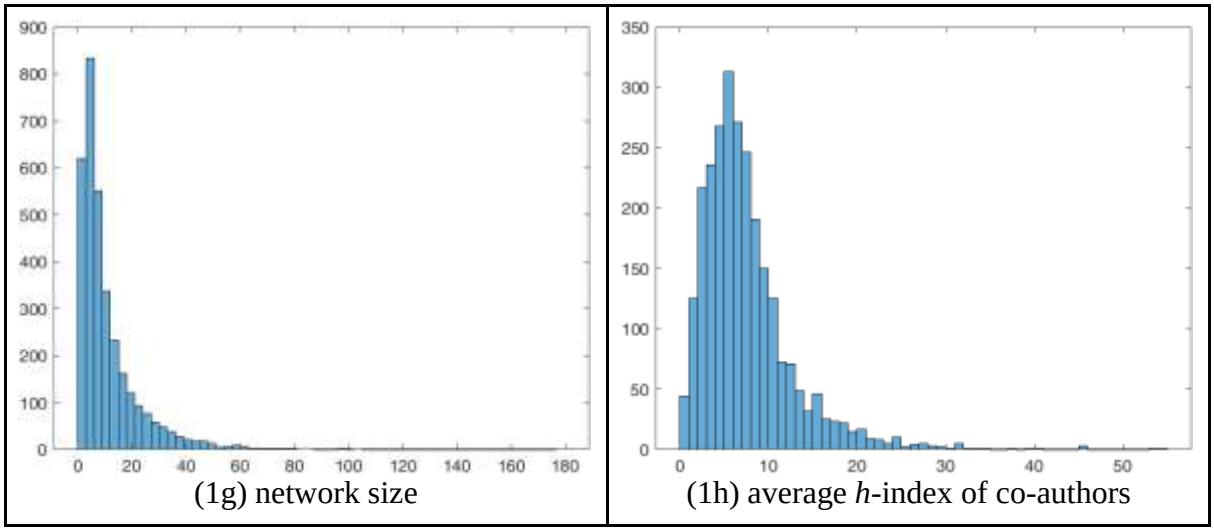
In addition, we analyze the number of works published by each central banker, the number of publishing years (by subtracting the first publication year from the last publication year of a given researcher), and the number of unique publication outlets (e.g. unique journal names) of each researcher. These statistics are used as the basic discriminatory factors explaining the values of *h*-index.

Based on the information about co-authors of each published work, we also calculate the share of works by a researcher written with at least one co-author. This statistic will help predict the effect of productivity gain from writing research papers in groups. Another related important statistic derived from the RePEc database is the number of co-authors linked to every researcher from a central bank. This statistic is complementary to the previous one in that it provides the size of the research network of a central banker and it is not necessarily linked to the number of researchers affiliated within a specific central bank. We expected that the size of a research network will be positively correlated with the publication success due to possible productivity and knowledge gains. Researchers with larger research networks are considered

to be more open to interactions with other scientists, cooperation initiatives, and new research topics.

Figure 1: Histograms of selected variables used in the study





(1g) network size (1h) average *h*-index of co-authors

Note: All variables are aggregated by specific authors.

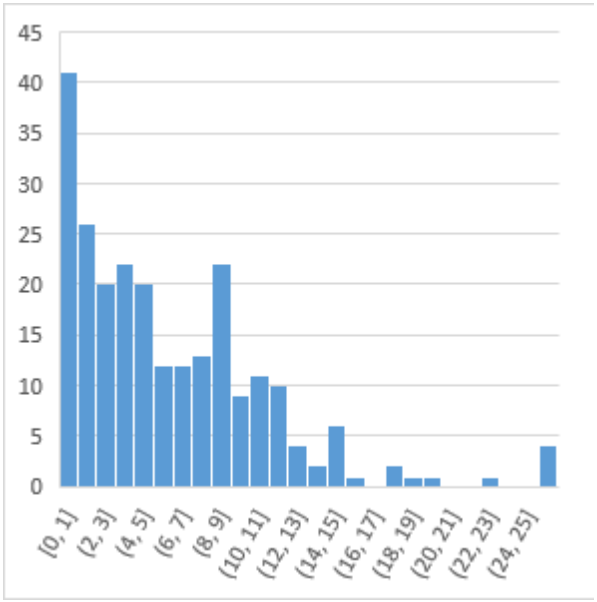
The first look at the dataset reveals that the affiliation of a researcher matters. As an example, median values of *h*-index corresponding to authors affiliated within specific European institutions are presented in Table 2. Based on this metric, Bank of International Settlements seems to be the most influential institution in the field of economics. Moreover, the median *h*-index value for the European Central Bank is higher in comparison to the majority of central banks participating in the Eurosystem. Unfortunately, the RePEc database does not allow to directly track the career progress of central bankers. Therefore, we are unable to analyze whether those institutions recruit people who already possess high *h*-index values or whether it is the specific affiliation that helps authors in being cited more frequently.

The distribution of *h*-index in the majority of institutions is similar to Poisson or lognormal distribution with a fat tail. The histograms of *h*-indices in the ECB, the Bundesbank, the Bank of England, and the Bank of France are presented in Figure 2.

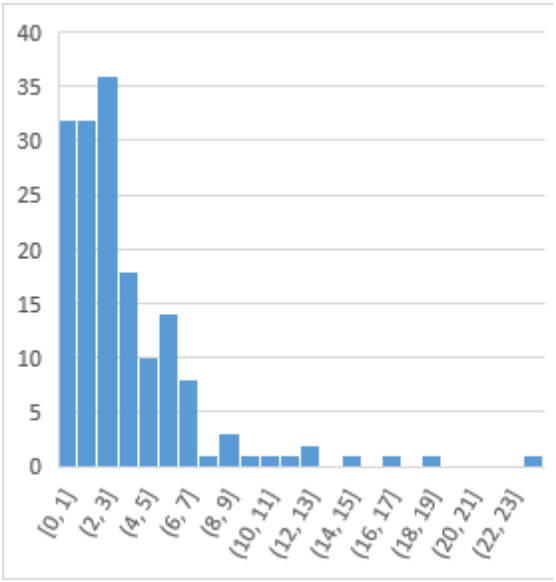
There are several explanations for the fact that we observe a relatively high number of researchers with high *h*-index values. There is a well-known problem of copied citations. Authors automatically cite recognized papers and economists without gaining knowledge about explicit contents of cited manuscripts (Simkin & Roychowdhury, 2007). Bibliometric analyses also show that top researchers often collaborate with the other leading experts in the field (Ding, 2011). In addition, personal relationships of researchers frequently do matter as well. Economists with a greater number of contacts are more likely to succeed in the academic work (Cisneros et al., 2018).

Figure 2: The distribution of *h*-indices in the selected institutions.

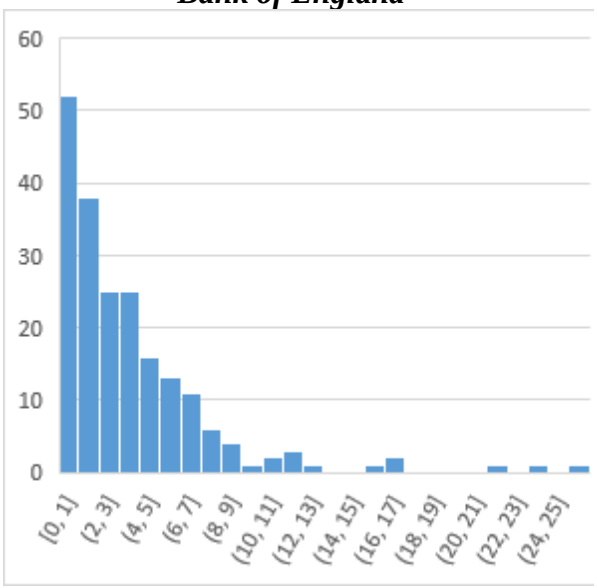
The ECB



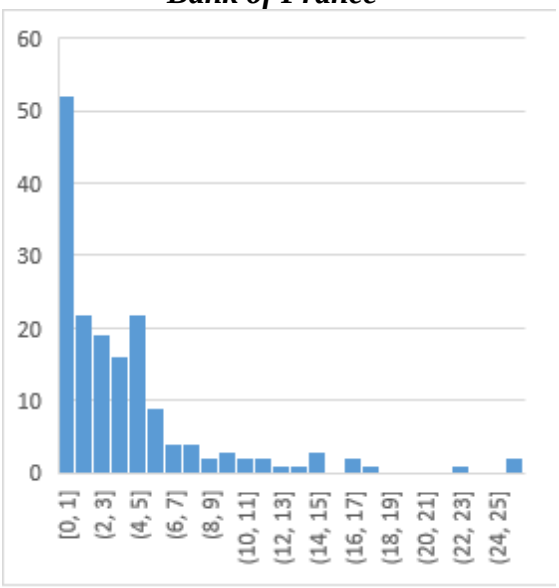
Bundesbank



Bank of England



Bank of France



Source: RePEc database

Note: The presented distributions are similar to Poisson distribution, albeit there exist some fat tails related to high numbers of very frequently quoted researchers.

5. Methodology

This section describes the methodology of our research. We propose a quantitative model predicting *h*-indices of authors conditional on their publication characteristics with a Poisson regression.

The Poisson regression formula explaining the value of *h*-index with a linear combination of explanatory variables takes the following form

$$\log\big(\mathbb{E}(Y_i|\boldsymbol{x}_i)\big) = \alpha_0 + \alpha_1 x_{1i} + \alpha_2 x_{2i} + \ldots + \alpha_k x_{ki}, \quad (1)$$

where Y_i is the value of *h*-index for author i, x_{ji} is the value of j-th control variable for author i, and α_j is the j-th parameter measuring impact of the j-th control variable on Y.

The expected value of the *h*-index for author i, conditional on information contained in control variables can be measured as

$$\mathbb{E}(Y_i|\boldsymbol{x}_i) = \exp(\alpha_0 + \alpha_1 x_{1i} + \alpha_2 x_{2i} + \ldots + \alpha_k x_{ki}) \quad (2)$$

and the Poisson distribution's probability mass function $p(Y_i = y|\boldsymbol{x}_i)$ conditional on independent variables $\boldsymbol{x}_i$ is given by

$$p(Y_i = y|\boldsymbol{x}_i) = \frac{\exp(y \cdot \boldsymbol{x}_i \cdot \boldsymbol{\alpha})}{y!} \exp(-\exp(\boldsymbol{x}_i \cdot \boldsymbol{\alpha})), \quad (3)$$

where $\boldsymbol{x}_i$ is a vector of independent variables including the constant term, $\boldsymbol{\alpha}$ is a vector of regression parameters, and y is the value of the *h*-index. We estimate parameters of the Poisson regression using the maximum likelihood method.

6. Estimation Results

We begin by estimating the impact of a publishing time window ($Years_i$), the number of items published ($Manuscripts_i$), and the number of distinct publication journals ($Journals_i$) for each author on the value of the Hirsh index. The Hirsh index depends by definition on the number of published papers. It is also well known that the *h*-index depends heavily on the number of publishing years (Schreiber, 2015). Therefore, we expect a positive impact of all control variables. The model formula is presented in equation (4)

$$\log\big(\mathbb{E}(Y_i|\boldsymbol{x}_i)\big) = \alpha_0 + \alpha_1 Manuscripts_i + \alpha_2 Journals_i + \alpha_3 Years_i, \quad (4)$$

Table 3 presents estimation results. Each additional year of publishing experience increases the potential to increase the h-index by approximately 4% (ceteris paribus). This result is robust to different model specifications.

Interestingly, the diversity of publication journals plays a more important role than the number of published papers here. This is due to the fact that the number of unique journals and the total number of papers are strongly correlated (e.g., with the Spearman's ρ equal 0.94 and the Pearson correlation of 0.90) and the journal diversity affects the *h*-index slightly stronger than the number of publications. According to the results presented in Table 3, each additional unique publication outlet increases the predicted h-index of an author by about 3%. This value decreases to just above 1% when additional factors are considered.

Next, we account for various economic dimensions covered by publications of analyzed central bankers. We introduce two additional explanatory variables, namely the number of unique JEL codes ($JELs_i$) and the main JEL category identifier ($mainJEL_{j,i}$, where j=A, B, …, Z) taking the value of one when the leading JEL category for a given author is the category j and zero otherwise.

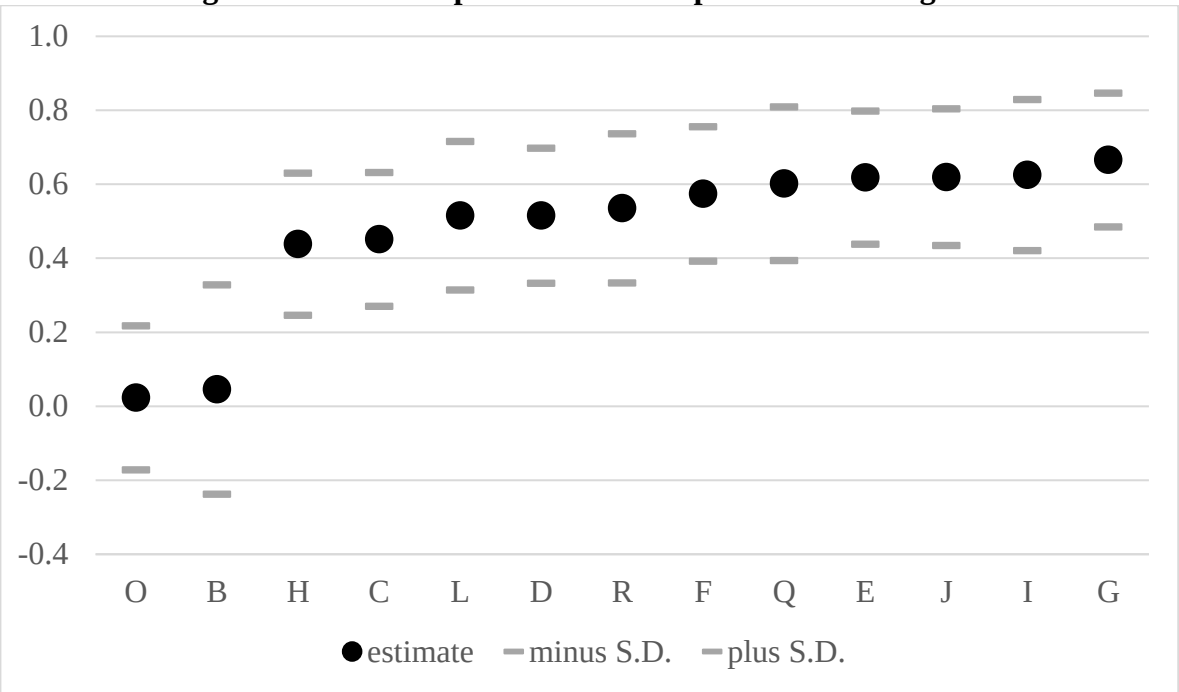
$$\log\left(\mathbb{E}(Y_i|\boldsymbol{x}_i)\right) = \alpha_0 + \alpha_1 Manuscripts_i + \alpha_2 Journals_i + \\ + \alpha_3 Years_i + \alpha_4 JELs_i + \sum_{j=A}^{Z} \alpha_{j,5} mainJEL_{j,i}, \tag{5}$$

The results are presented in Table 4. Again, the number of unique publishing categories covered by one author does not have an additional positive effect on the value of the Hirsh index beyond the number of unique publication outlets. Among the three variables, i.e. published items, unique journals, and unique JEL codes, the latter one is the least correlated with the h-index variable and it is strongly correlated with the two former variables.

Figure 3 presents sorted impact values of respective JEL categories. The highest impact on the *h*-index is observed for authors publishing research in the areas of financial economics (G), health, education, and welfare (I), labor and demographic economics (J), and macroeconomics and monetary economics (E). While effects of categories G and E are clear, because central bankers are simply specialists in these fields of economics, the publication success of authors in categories I and J may result from the specifics of the general numbers of citations in these areas of science. Nonetheless, most of other economic categories assert a similar impact on the *h*-index. Only the categories containing topics like economic development, innovation, technological change, and growth (O), and history of economic

thought, methodology, and heterodox approaches (B) reveal a significantly lower impact than other categories.

Figure 3: Estimated parameters of respective JEL categories



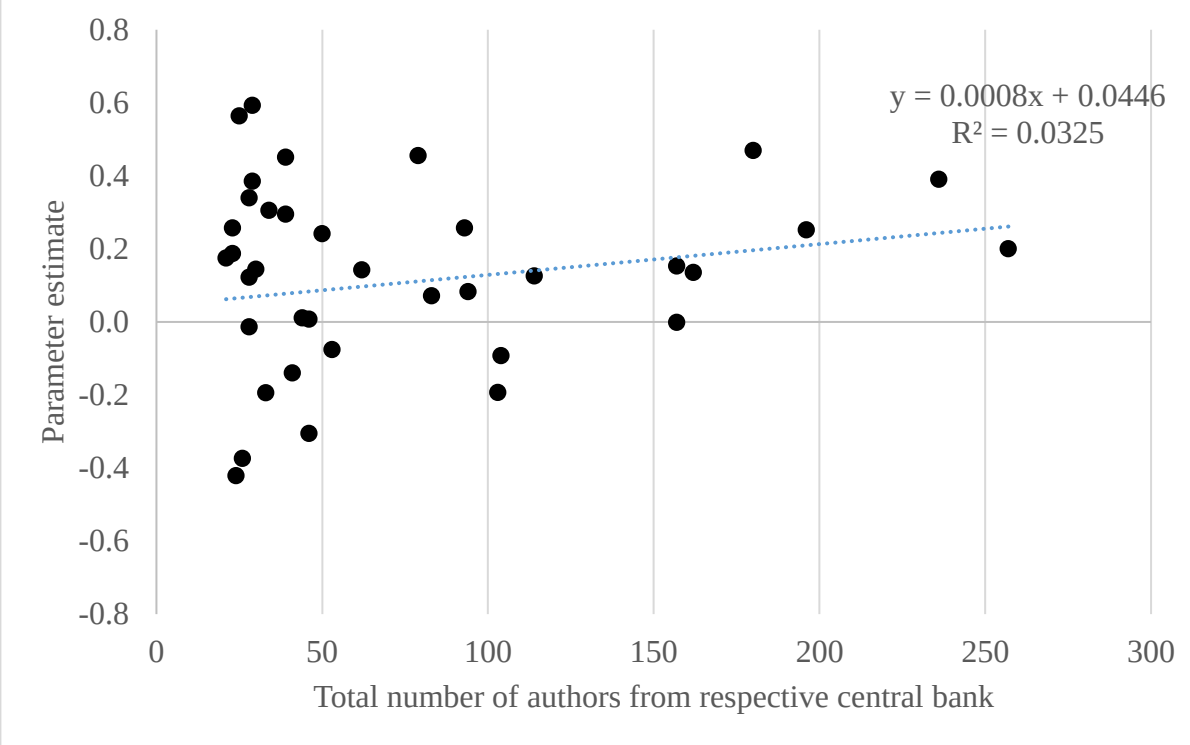
The number of h-index is significantly higher especially in case of financial economists (G), microeconomists analysing health, education, and welfare (I), labor and demographic economists (J), and macro and monetary economists (E)

We also control for the authors' affiliations by using dummy variables ($Bank_{k,i}$, where k is the bank identifier). It is worth noting that several authors have work experience for at least two central banks. There are 300 such researchers. This phenomenon is mostly related to the eurozone region where numerous transfers between national central banks to the European Central Bank take place. For these cases we select ECB as a leading affiliation. There are also a few transfers to neighboring central banks where authors have similar numbers of published papers, e.g. transfers between the Norges Bank and Riksbank in Scandinavia. In these cases, we attribute affiliation lexicographically. In the mentioned example authors are assumed to be affiliated with the Norges Bank. There are approximately 30 such cases. We selected the Polish central bank (Narodowy Bank Polski) as a benchmark because the World median level of *h*-index is close the median value observed in this bank.

We analyze how the value of *h*-index depends on the central bank the author is affiliated with. In this analysis we only analyze the central banks with at least 20 assigned authors and treat the other banks with fewer authors as the 'other banks' group. One disadvantage of this approach is that several central banks with high-quality authors are mixed with central banks

with low-quality authors in the same group, but at least we can compare estimated parameters for those central banks with a larger number of authors. Figure 4 presents the relationship between the estimated parameters of central bank identifiers and the numbers of authors affiliated within the investigated central banks. It shows that that no simple link between the number of authors in a central bank and their publishing success exists.

Figure 4: Relationship between estimated parameters of central bank affiliations and the total numbers of authors from respective central banks



The scatter plot shows weak relationship between the number of authors in a central bank and an estimated parameter corresponding to this institution's dummy in equation (6). Although variable may be statistically significant it has rather weak explanatory power (R-squared equals to 0.03).

This may be discouraging, but affiliation matters. Researchers from the US Federal Reserve Banks, international institutions like BIS, the ECB or some eurozone central banks have *h*-index values greater by 0.3 to 0.5pp than researchers from less developed regions. On the other hand, researchers from emerging economies are less frequently quoted, even despite the fact that large research communities are created in their central banks (e.g., in Russia or in Colombia). Table 6 presents the detailed listing. Quantitative effects of affiliation on the value of h-index are presented in Table 7.

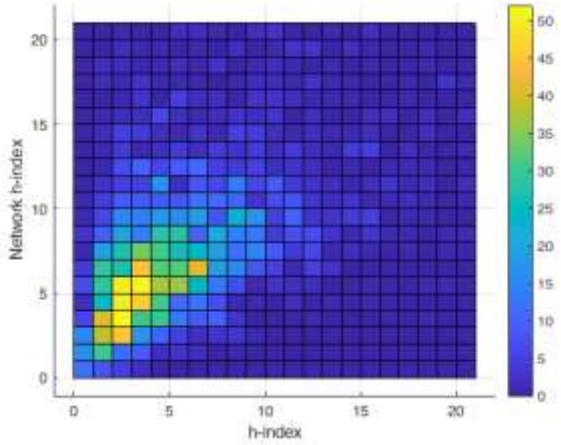
The final stage of our research is the analysis of network effects on publication achievements. We not only investigate the number of authors affiliated within a central bank as a separate explanatory variable in the model ($AuthorsInBank_i$), independent of central

bank identifiers, but we also include two variables describing co-authorship networks. The first variable measures the share of papers written with co-authors ($ShareCoAuthors_i$), as the co-authorship should theoretically increase efficiency of produced research output. The second variable measures the network size of distinct co-authors ($NetworkSize_i$). The high number of co-authors widens the potential area of research, increases the potential to develop publication skills, and helps avoid dead ends, i.e. sticking to research topics uninteresting for readers and other researchers. The final equation is the following:

$$\begin{aligned}\log\big(\mathbb{E}(Y_i|\boldsymbol{x}_i)\big) = \alpha_0 + \alpha_1 Manuscripts_i + \alpha_2 Journals_i + \alpha_3 Years_i + \\ +\alpha_4 JELs_i + \sum_{j=A}^{Z} \alpha_{j,5} mainJEL_{j,i} + \alpha_{k,6} Bank_{k,i} + \\ +\alpha_7 AuthorsInBank_i + \alpha_8 ShareCoAuthors_i + \alpha_9 NetworkSize_i\end{aligned} \quad (6)$$

It is clear that co-authorship networks are not only built within a single bank but may have much greater inter-institutional coverage. Simple correlation analysis confirms this presumption. The correlation of the number of authors within a single institution with the two other network variables is weak, which suggests that successful authors are more prone to building international research networks. What is important, the two other network measures have a strong statistical impact on the value of *h*-index, while the size of a publishing group in a bank has a somewhat weaker but still significant effect. The most important variable seems to be the network size, because it is the most correlated with the Hirsh index, but it is also correlated with the number of articles written and the number of distinct publication journals of the same author. Therefore, the effect of the co-authorship network size is not the most strongly pronounced in the Poisson regression. Nevertheless, *h*-index of the researcher who wrote all the papers with co-authors is almost 100% ($exp(0.684) - 1$) greater than *h*-index of an author who works alone. The results of parameter estimates are presented in Table 5.

Figure 5: Bivariate histogram of the *h*-index and Network *h*-index variables



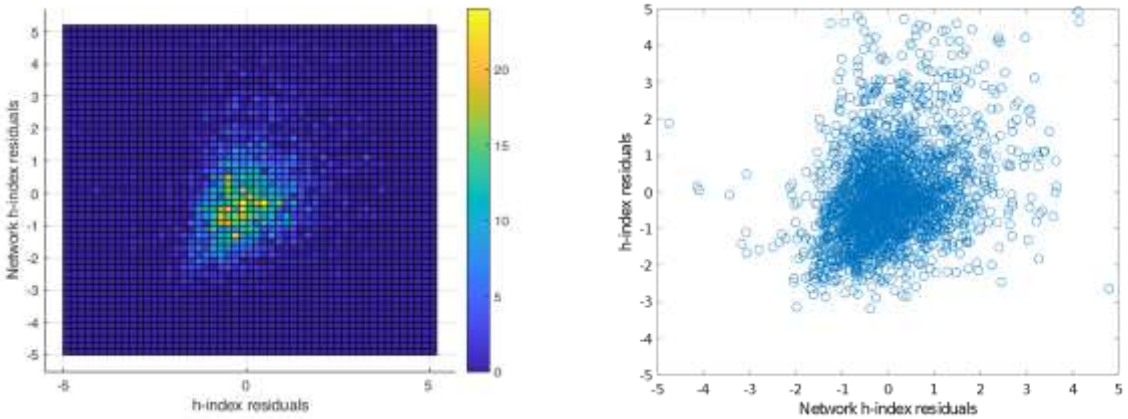
Navy-blue colors denote less frequent cases and orange colors denote more frequent cases in the histogram.

We also analyze the average *h*-index of all co-authors of a given author and call it "Network h-index" ($NetworkHIndex_i$). We expect the dependence between this variable and the original *h*-index to be bidirectional. Highly skilled coauthors have a higher likelihood of cooperating with successful authors. On the other hand, a frequently cited author finds good-quality authors more easily than an unexperienced author finds such coauthors. In order to compare the Network h-index with the original *h*-index of an investigated author, we round Network *h*-index values to integer numbers and run a Poisson regression of the transformed variable on the same set of explanatory variables as we did for the original *h*-index variable. The set of explanatory variables is the same as in equation (6)

$$\begin{aligned}\log\left(\mathbb{E}(NetworkHIndex_i|\boldsymbol{x}_i)\right) = \alpha_0 + \alpha_1 Manuscripts_i + \alpha_2 Journals_i + \\ +\alpha_3 Years_i + \alpha_4 JELs_i + \sum_{j=A}^{Z} \alpha_{j,5} mainJEL_{j,i} + \alpha_{k,6} Bank_{k,i} + \\ +\alpha_7 AuthorsInBank_i + \alpha_8 ShareCoAuthors_i + \alpha_9 NetworkSize_i\end{aligned} \quad (7)$$

Standardized residuals from this regression are then compared with standardized residuals of the *h*-index regression. Figure 6 presents a histogram and a scatter plot of both residuals from the regressions (6) and (7).

Figure 6: Bivariate histogram and scatter plot of the h-index and Network h-index



(a) histogram (b) scatter plot

Navy-blue colors denote less frequent cases and orange colors denote more frequent cases in the histogram.

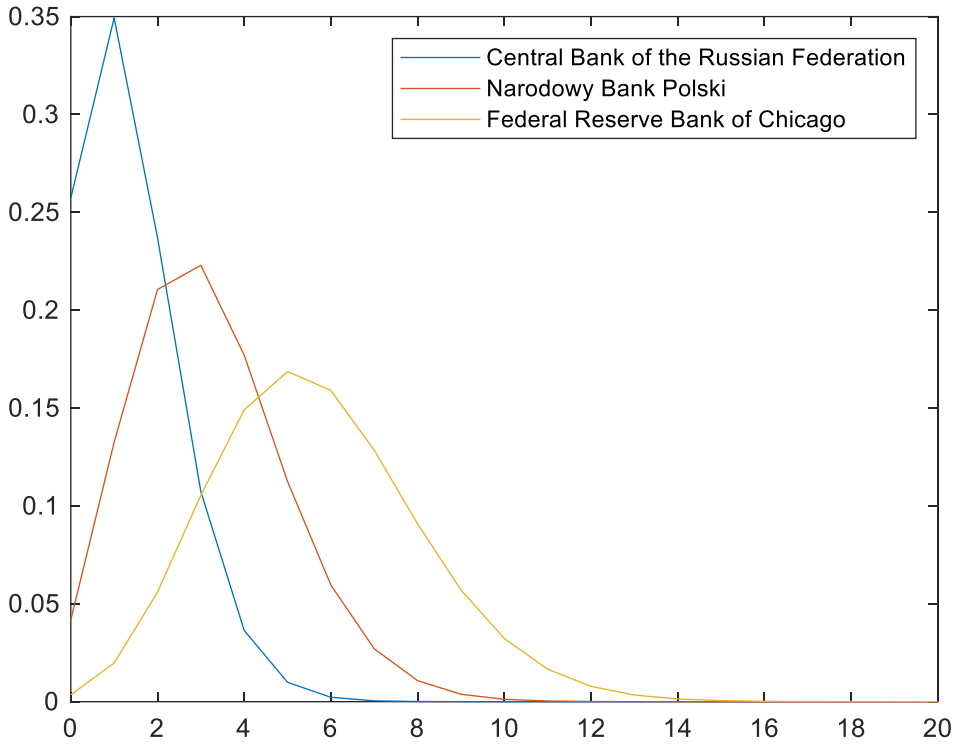
Pearson, Kendall, and Spearman correlations between the h-index and Network h-index residuals are equal 0.196, 0.288, and 0.243, respectively, and they are all statistically significantly different from zero with p-values lower than 0.01. These results indicate that publishing success is positively correlated with the average h-indices of coauthors even after controlling for the impact of control variables like the number of publications, size of the co-authorship network, research area, and a central bank affiliation.

These results suggest that large social networks and cooperation with distinct scholars are important factors supporting publication careers in central banks.

7. Conclusions

This research enables prediction of the h-index for a central banker based on her publication, affiliation, and research topic characteristics. An author with median numbers of published works (15), unique publication outlets (8), publication years (10), unique JEL codes (12), share of coauthors (67%), and network size (7), with the main interest in monetary economics (JEL code equal E) and affiliated with the Polish central bank (together with 46 affiliated authors) has a predicted h-index equal approximately 3 (cf. Figure 7).

Figure 7: Probability distribution functions of h-index values for authors from three selected central banks



The probability distributions are conditional on the number of published works (15), unique publication outlets (8), publication years (10), the number of unique JEL codes (12), share of coauthored papers (67%), network size (7), the main interest in monetary economics (JEL code equal E), and on a central bank affiliation and the number of authors in a given central bank. Calculations are based on formula (3) and estimation equation (6).

An author with the same characteristics has a predicted *h*-index above 5 if she is affiliated with the Federal Reserve Bank of Chicago (25 affiliated authors) and just above 1 if affiliated with the Central Bank of Russian Federation (35 affiliated authors). These predictions suggest that affiliation of a central banker provides a good benchmark to assess potential for the number of citations. At the same time this is a challenge for central banks in emerging economies. The experiences of Federal Reserve Banks may not be appropriate for Asian or South American economies. Therefore, more effort for increasing regional collaboration between researchers should be beneficial.

Our research also confirms that the chosen research dimension has an impact on the number of citations. Among the most cited areas are the topics related to financial and monetary economics. This empirical fact provides a good opportunity for central banks to communicate their policies and establish a solid reputation.

Networking affects publishing success. This result immediately suggests that banks with larger research departments generate more successful publications. In the wake of a prolonged period of missing the inflation target, central banks authorities should investigate whether such an approach does not lead to problems when researchers become overly supportive to their closest collaborators. Interestingly, the network of coauthors does not have to be related to the size of the local central bank community, because the size of the publishing network improves potential for publishing success even after controlling for the number of colleague authors working in the same banking institution. Networks are often developed among foreign partners, e.g. during scientific workshops and conferences, and may be related to other factors like friendships or common research interests of scientists.

Our research finds that the net of highly skilled coauthors is positively associated with the number of cited papers of a given author. The causality may be bidirectional, but it indicates that cooperation with more experienced authors improves chances of publishing success in addition to the number of coauthors in general. This link as well as factors explaining differences among central banks could be further investigated in future analyses.

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Table 1: List of institutions analyzed during the research.

Europe	ECB, Bundesbank, Bank of France, Bank of Italy, Bank of Spain, Bank of Portugal, de Nederlandsche Bank, Oesterreichische Nationalbank, Suomen Pankki, Bank of Greece, Bank of Belgium, Central Bank of Ireland, Eesti Pank, Central Bank of Cyprus, Latvijas Banka, Lietuvos Bankas, Banque Centrale du Luxembourg, Bank Centrali ta' Malta, Banka Slovenije, Národná Banka Slovenska, Bank of England, Danmarks Nationalbank, Sveriges Riksbank, Norges Bank, Magyar Nemzeti Bank (MNB), Narodowy Bank Polski, Česká Národní Banka, Banca Nationala a Romaniei, Bulgarian National Bank, Banka e Shqiperise, Central Bank of Armenia, National Bank of the Republic of Belarus, Centralna Banka Bosne i Hercegovine, Hrvatska Narodna Banka, National Bank of Georgia, Sedlabanki Íslands, Banka Qendror e Republikës së Kosovës, Banca Nationala a Moldovei, Centralna Banka Crne Gore (CBCG), Kuzey Kıbrıs Türk Cumhuriyeti Merkez Bankası, Narodna Banka na Republika Severna Makedonija, Central Bank of the Russian Federation, Banca Centrale della Repubblica di San Marino, Narodna Banka Srbije, Bank for International Settlements (BIS), Schweizerische Nationalbank (SNB), Türkiye Cumhuriyet Merkez Bankası, National Bank of Ukraine
Asia	Da Afghanistan Bank, Central Bank of Bahrain, Bangladesh Bank, National Bank of Cambodia, Zhongguo Renmin Yinhang, Hong Kong Monetary Authority, Reserve Bank of India, Bank Indonesia, Central Bank of the Islamic Republic of Iran, Central Bank of Iraq, Bank of Israel, Bank of Japan, Central Bank of Jordan, National Bank of Kazakhstan, Eurasian Development Bank, Asian Infrastructure Investment Bank, Central Bank of Kuwait, National Bank of Kyrgyz Republic, Bank of the Lao PDR, Banque du Liban, Bank Negara Malaysia, Maldives Monetary Authority, Mongolbank, Central Bank of Myanmar, Nepal Rastra Bank, Central Bank of Oman, State Bank of Pakistan, Palestine Monetary Authority, Bangko Sentral Ng Pilipinas, Qatar Central Bank, Saudi Arabian Monetary Agency (SAMA), Monetary Authority of Singapore, Bank of Korea, Central Bank of Sri Lanka, Central Bank of Syria, Central Bank of the Republic of China, National Bank of the Republic of Tajikistan, Bank of Thailand, Banco Central de Timor-Leste, Türkmenistanyň Merkezi Banky, Central Bank of the United Arab Emirates, Central Bank of the Republic of Uzbekistan, State Bank of Vietnam, Central Bank of Yemen
Oceani	Reserve Bank of Australia, Reserve Bank of Fiji, Reserve Bank of New Zealand, Bank of Papua New Guinea, Central Bank of Samoa
Americas	Banco Central de la República Argentina, Centrale Bank van Aruba, Bahamas Central Bank, Central Bank of Barbados, Central Bank of Belize, Banco Central de Bolivia, Banco Central do Brasil, Bank of Canada, Cayman Islands Monetary Authority, Banco Central de Chile`, Banco de la Republica de Colombia, Banco Central de Costa Rica, Banco Central de Cuba, Centrale Bank van Curaçao en Sint Maarten, Banco Central de la República Dominicana, Banco Central del Ecuador, Banco Central de Reserva de El Salvador, Banco de Guatemala, Bank of Guyana, Banque de la République d'Haïti, Banco Central de Honduras, Bank of Jamaica, Banco de México, Banco Central de Nicaragua, Banco Central del Paraguay, Banco Central de Reserva del Perú, Eastern Caribbean Central Bank, Centrale Bank van Suriname, Central Bank of Trinidad and Tobago, Federal Reserve Bank of San Francisco, Federal Reserve Board (Board of Governors of the Federal Reserve System), Federal Reserve Bank of Atlanta, Federal Reserve Bank of Chicago, Federal Reserve Bank of Boston, Federal Reserve Bank of Minneapolis, Federal Reserve Bank of Kansas City, Federal Reserve Bank of St. Louis, Federal Reserve Bank of New York, Federal Reserve Bank of Cleveland, Federal Reserve Bank of Philadelphia, Federal Reserve Bank of Dallas, Federal Reserve Bank of Richmond, Banco Central de Uruguay, Banco Central de Venezuela
Africa	Banque d'Algérie, Banco Nacional de Angola, Bank of Botswana, Commission de l'Union Économique et Monétaire Ouest Africaine (UEMOA), Banque de la République du Burundi, Central Bank of Cabo Verde, Banque des Etats de l'Afrique Centrale, Banque Centrale des Comores, Banque Centrale du Congo, Banque Centrale du Djibouti, Central Bank of Egypt, Bank of Eritrea, National Bank of Ethiopia, Central Bank of The Gambia, Bank of Ghana, Banque Centrale de la République de Guinée, Central Bank of Kenya, Central Bank of Lesotho, Central Bank of Liberia, Central Bank of Libya, Banque Centrale de Madagascar, Reserve Bank of Malawi, Bank of Mauritius, Banco de Moçambique, Bank Al-Maghrib, Bank of Namibia, Central Bank of Nigeria, Banque National du Rwanda, Banque Centrale des États de l'Afrique de l'Ouest (BCEAO), Central Bank of Seychelles, Bank of Sierra Leone, Central Bank of Somalia, South African Reserve Bank, Bank of South Sudan, Central Bank of Sudan, Central Bank of Swaziland, Bank of Tanzania, Banque Centrale de Tunisie, Bank of Uganda, Bank of Zambia, Reserve Bank of Zimbabwe

Source: EDIRC database

Table 2: Median value of *h*-index in selected European Institutions

No.	Country / Institutions	H-index	No.	Country / Institutions	H-index
1	BIS	9	14	England	3
2	Austria	6	15	France	3
3	Portugal	5	16	Germany	3
4	ECB	5	17	Netherlands	3
5	Sweden	5	18	Poland	3
6	Finland	4.5	19	Slovakia	2.5
7	Belgium	4	20	Czechia	2
8	Greece	4	21	Latvia	2
9	Italy	4	22	Hungary	2
10	Spain	4	23	Switzerland	2
11	Luxembourg	4	24	Turkey	2
12	Ireland	4	25	Russia	0
13	Norway	4	26	Lithuania	0

Source: RePEc database

Table 3. Parameter estimates of the Poisson regression with basic control variables

	estimate	standard error	t-ratio	p-value
Intercept	0.577	0.016	35.747	0.000
Items	-0.002	0.000	-5.880	0.000
Unique journals	0.031	0.001	26.198	0.000
Years of publishing	0.041	0.001	37.537	0.000
Number of observations	3296			
R-squared	0.39	Mean dependent var		4.44
Adjusted R-squared	0.39	S.D. dependent var		4.71
S.E. of regression	3.68	Akaike info criterion		4.28
Sum squared resid	44530.14	Schwarz criterion		4.29
Log likelihood	-7045.63	Hannan-Quinn criter.		4.28
Restr. log likelihood	-11104.43	LR statistic		8118.60

The model is estimated based on equation (4). The positive parameter for unique journals suggests successful authors need to diversify their audience and make effort to cooperate with multiple editorial teams.

Table 4. Parameter estimates of the Poisson regression with basic control variables and JEL codes

	estimate	standard error	t-ratio	p-value
Intercept	0.102	0.180	0.567	0.570
Items	-0.001	0.000	-3.063	0.002
Unique journals	0.029	0.001	23.244	0.000
Years of publishing	0.037	0.001	32.802	0.000
Unique JEL codes	-0.001	0.001	-1.550	0.121
JEL B	0.046	0.283	0.161	0.872
JEL C	0.452	0.181	2.493	0.013
JEL D	0.516	0.183	2.824	0.005
JEL E	0.618	0.180	3.431	0.001
JEL F	0.574	0.182	3.161	0.002
JEL G	0.666	0.181	3.684	0.000
JEL H	0.439	0.192	2.286	0.022
JEL I	0.625	0.204	3.062	0.002
JEL J	0.619	0.185	3.352	0.001
JEL L	0.516	0.201	2.568	0.010
JEL O	0.023	0.195	0.118	0.906
JEL Q	0.602	0.208	2.900	0.004
JEL R	0.535	0.202	2.656	0.008
Number of observations	2926			
R-squared	0.48	Mean dependent var		4.811
Adjusted R-squared	0.48	S.D. dependent var		4.838
S.E. of regression	3.508	Akaike info criterion		4.34
Sum squared resid	35780.44	Schwarz criterion		4.38
Log likelihood	-6330.83	Hannan-Quinn criter.		4.35
Restr. log likelihood	-9913.2	LR statistic		7164.73

The model is estimated based on equation (5)

Table 5. Parameter estimates of the Poisson regression with basic control variables and JEL codes, central bank affiliation and the network effects.

	estimate	standard error	t-ratio	p-value
Intercept	-0.548	0.194	-2.825	0.005
Items	0.001	0.000	2.574	0.010
Unique journals	0.014	0.001	9.707	0.000
Years of publishing	0.039	0.001	31.671	0.000
Unique JEL codes	0.002	0.001	3.047	0.002
Number of authors in a central bank	0.016	0.005	3.244	0.001
Share of works written with co authors	0.684	0.041	16.581	0.000
Network size	0.005	0.001	5.741	0.000
JELs	….	…..	….	….
Affiliations	…..	…..	….	…..
Number of observations	2926			
R-squared	0.69	Mean dependent var		4.811
Adjusted R-squared	0.69	S.D. dependent var		4.838
S.E. of regression	7.316	Akaike info criterion		4.03
Sum squared resid	20974.26	Schwarz criterion		4.15
Log likelihood	-5833.44	Hannan-Quinn criter.		4.07
Restr. log likelihood	-9913.20	LR statistic		8159.52

The model is estimated based on equation (6)

Table 6. Parameter estimates for central bank identifiers

	parameter estimate	standard error	t-ratio	p-value
Banco Central do Brasil	-0.7348	0.2603	-2.8232	0.0048
Bank of England	-2.7907	0.9134	-3.0552	0.0022
Bank of France	-2.5381	0.7448	-3.4075	0.0007
Bank of Portugal	-0.5616	0.1984	-2.8302	0.0047
Central Bank of the Russian Federation	-1.2774	0.2222	-5.7481	0.0000
Federal Reserve Bank of New York	0.2235	0.1056	2.1174	0.0342
Oesterreichische Nationalbank	-0.0886	0.1310	-0.6765	0.4987
Schweizerische Nationalbank (SNB)	-1.3186	0.4114	-3.2051	0,0014
Slovenska Narodna Banka	-1.3827	0.3590	-3.8509	0.0001
Banco Central de Chile	-0.8264	0.2229	-3.7068	0.0002
Banco Central de la República Argentina	-0.6909	0.1558	-4.4352	0.0000
Banco Central de Reserva del Peru	-0.8930	0.2052	-4.3516	0.0000
European Central Bank	-3.3345	1.1117	-2.9996	0.0027
Banco de la Republica de Colombia	-1.7663	0.4547	-3.8841	0.0001
Banco de Mexico	-0.5909	0.1762	-3.3537	0.0008
Bank for International Settlements (BIS)	-0.6999	0.3346	-2.0918	0.0365
Bank of Belgium	-0.2868	0.1238	-2.3168	0.0205
Bank of Canada	-2.2463	0.7204	-3.1181	0.0018
Bank of Greece	-0.5641	0.1725	-3.2711	0.0011
Bank of Italy	-3.9146	1.2154	-3.2208	0.0013
Bank of Japan	-0.1864	0.1163	-1.6027	0.1090
Bank of Spain	-1.6597	0.5072	-3.2722	0.0011
Bundesbank	-2.2619	0.7204	-3.1399	0.0017
Central Bank of Ireland	-0.2297	0.1564	-1.4686	0.1419
de Nederlandsche Bank	-1.1669	0.4052	-2.8798	0.0040
Federal Reserve Bank of Cleveland	0.0247	0.1103	0.2238	0.8229
Federal Reserve Bank of Kansas City	0.0179	0.1302	0.1373	0.8908
Federal Reserve Board	-2.2983	0.8334	-2.7576	0.0058
Magyar Nemzeti Bank (MNB)	-0.5667	0.1562	-3.6285	0.0003
Narodowy Bank Polski	-0.6044	0.1886	-3.2052	0.0013
Norges Bank	-0.0087	0.1201	-0.0725	0.9422

Reserve Bank of Australia	0.1693	0.1241	1.3642	0.1725
Reserve Bank of New Zealand	0.0478	0.1668	0.2866	0.7744
State Bank of Pakistan	-0.3342	0.1506	-2.2182	0.0265
Suomen Pankki	-0.4927	0.1161	-4.2448	0.0000
Sveriges Riksbank	-0.0609	0.1490	-0.4091	0.6825
Central Bank of the Republic of Turkey	-1.6986	0.4610	-3.6843	0.0002
Federal Reserve Bank of Chicago	0.3107	0.0967	3.2140	0.0013

Other model parameter estimates are presented in Table 5. All parameters are estimated based on equation (6). The table suggests that economists from the US Federal Reserve Board and some Euro area central banks are more frequently cited comparing to National Bank of Poland. On the other hand, analysts from big emerging economies like Russia and Turkey receive lower number of citations. However, this is not the full effect of affiliation, because the full effect should also consider the impact of the number of affiliated scientists in a given central bank according to equation (6).

Table 7. Impact of affiliation on publication success

Central bank	Number of affiliated authors	Effect related to the number of authors	Other effects of central bank affiliation	Total effect on log(h-index)
Central Bank of the Russian Federation	35	0.564	-1.277	-0.714
Banco Central de la Republica Argentina	24	0.386	-0.691	-0.304
Banco Central de Reserva del Peru	46	0.741	-0.893	-0.152
Banco de la Republica de Colombia	103	1.659	-1.766	-0.108
Suomen Pankki	26	0.419	-0.493	-0.074
Slovenska Narodna Banka	83	1.337	-1.383	-0.046
Magyar Nemzeti Bank (MNB)	33	0.531	-0.567	-0.035
Central Bank of Turkey	104	1.675	-1.699	-0.024
Banco Central de Chile`	53	0.853	-0.826	0.027
Banco de Mexico	41	0.660	-0.591	0.069
Bank of France	162	2.609	-2.538	0.071
State Bank of Pakistan	28	0.451	-0.334	0.117
Narodowy Bank Polski	46	0.741	-0.604	0.136
Bank of Greece	44	0.709	-0.564	0.144
Bank of Spain	114	1.836	-1.660	0.176
Schweizerische Nationalbank (SNB)	94	1.514	-1.319	0.195
Bank of Belgium	30	0.483	-0.287	0.196
Bank of Italy	257	4.139	-3.915	0.224
Bank of Portugal	50	0.805	-0.562	0.244
Banco Central do Brasil	62	0.998	-0.735	0.264
Bank of Japan	28	0.451	-0.186	0.265
Bundesbank	157	2.528	-2.262	0.266
Bank of Canada	157	2.528	-2.246	0.282
de Nederlandsche Bank	93	1.498	-1.167	0.331
Bank of England	196	3.156	-2.791	0.366
Reserve Bank of New Zealand	21	0.338	0.048	0.386
Federal Reserve Bank of Kansas City	23	0.370	0.018	0.388
Federal Reserve Bank of Cleveland	23	0.370	0.025	0.395
Central Bank of Ireland	39	0.628	-0.230	0.398
Norges Bank	28	0.451	-0.009	0.442
Oesterreichische Nationalbank	34	0.548	-0.089	0.459
ECB	236	3.800	-3.335	0.466
Sveriges Riksbank	39	0.628	-0.061	0.567
Bank for International Settlements (BIS)	79	1.272	-0.700	0.572
Federal Reserve Board	180	2.899	-2.298	0.600
Reserve Bank of Australia	29	0.467	0.169	0.636
Federal Reserve Bank of New York	29	0.467	0.224	0.691
Federal Reserve Bank of Chicago	25	0.403	0.311	0.713