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**Slow recognition of seminal papers
and fast growth of author connectivity
in economics**

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ABSTRACT: A bird's-eye view of the economics literature and its temporal evolution during the last three decades is provided by analysing titles, abstracts, keywords, reference lists and author affiliations of nearly 204,000 economics papers. Major divisions of the literature are objectively identified through exploring patterns of term co-mention in their titles and abstracts. Temporal research trends are also quantified, and influential references are determined through patterns of co-citation of references in the reference lists of these papers. Analyses show that the literature of economics tends to lag in the adoption of emerging research and is reliant on a traditional knowledge base. Of more than 1,250 references that have had a local burst of citation, the average and maximum gap between their publication year and the onset of recognition has been respectively 10 and 47 years. Influential economics papers typically have to wait for a decade before their recognition comes along, and this phenomenon has intensified over the last three decades. Another observation is the sharp rise in author connectivity and globalisation in economics research. International collaboration in the field of economics shows a distinct acceleration since 2013. If current trend continues, in few years, the number of internationally collaborated economics papers published each year will surpass that of domestically produced papers. Economists may be traditionalists, in that, they are hesitant in giving recognition to new research or creating new research trends, but they cannot be considered insular, as they have become notably well-connected and collaborative.

KEY WORDS: *economics; temporal analysis; scholarly impact; document co-citation; collaboration*

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1. Introduction

Economics as a discipline continues to impact on the narrative used by politicians, bureaucrats, consultants, and others in addressing the many evolving challenges of our society. While it is not the only discipline that matters, many of the developments in engineering, science, psychology etc. all have an underlying set of economic values that are used to define a position in promoting the conversion from research to development and commercialisation of invention and innovation ((Abrardi et al., 2021), (Bickley et al., 2022)). Some of the key underlying economic ideas are associated with value systems, welfare outcomes, equity impacts, structural change in markets such as for labour and energy linked to the big agenda items such as climate change, and macroeconomic consequences as defined by fiscal and monetary policy responses (Khojasteh et al., 2022).

Many of the ideas in the grey literature (Nederhof et al., 2010) and social media often have antecedents in the academic literature as represented by publications in the many top economics journals (Baumann et al., 2020). There is often, however a lag between what is deemed high quality research in these journals, and what we see translated into useful input in decisions made by the political process and industry more generally (Kim et al., 2020). Not all interpretations are wise outcomes, due in large measure to the multifarious nature of what is the ingredients in outcomes observed in real markets and nations. What we are interested in, however, is to see if we can identify some trends in the economics literature over the last 30 years that provide informative evidence on how economics contributes to the layering of ideas and actions (Zhang et al., 2018).

Clearly, this layering phenomenon takes on many dimensions. It varies from fundamental theories on how things work; a good example being the explosion of behavioural economics as a framework in which theories of preference revelation and choice making occurs which has morphed into behavioural changes units in government), through to pragmatic case study evidence on how a specific sector determines its performance and productivity (Thorgeirsson et al., 2013). The full spectrum offers up many ways to formally analyse phenomenon such as causal methods, experimental economics, stated choice methods, group decision making, broad-based econometric tools such as discrete choice methods, count models, machine learning, structural equation model systems, all developed in ways to recognise the richness of data that is increasingly provided though many new technologies, notably real time big data and advance online survey data collection.

To give some structure to this study, we have identified key themes that appear to have dominated the economics literature published in the main journals. These themes are not arbitrarily selected but are the result of a clustering analysis determined by analysing patterns of co-occurrence of terms in titles and abstracts of papers as well as patterns of document co-citation in reference lists of economics articles. More than 204,000 articles of economics published during 1990-2021 are analysed to make this determination. Patterns of co-authorship in economics are also investigated. The main objectives of the analyses were:

- (i) to objectively determine major divisions and dominant topics/streams of economics literature.
- (ii) to objectively determine temporal variations in research activities within these major streams.
- (iii) to objectively determine trending topics in economics research.
- (iv) to objectively determine influential references of economics literature within each major stream.

These analyses additionally produce new findings and novel insight about:

- (v) how seminal work in economics typically take an unusually long time to gain recognition.
- (vi) how the field of economics is rapidly moving away from isolationism and how collaboration and connectivity is rising particularly fast in economics research.

Methods and data

The database used for the analysis consists of the collective content of the top 240 journals (as determined by their Impact Factor) indexed by the Web of Science purely in one of the following three categories: “Economics – SSCI” or “Social Sciences, Mathematical Methods – SSCI AND Economics – SSCI” or “Business, Finance – SSCI AND Economics – SSCI”. To ensure that only mainstream and specialty journals of economics are considered, journals that are indexed in the above categories as well as other categories listed above were excluded. This, for example, excludes contents of journals that are more affiliated with fields such as transportation or environmental science and publish specialty articles in those categories, but are also listed in the economics category as well. The list of the 240 journals that met the inclusion criterion are provided in Appendix A. The full collective content of these journals published between the time period of 1990-2021 were considered as the database of the analysis. This amounts to N=204,000 articles. Full bibliographic data of these articles were exported from the Web of Science in the form of text files. The data includes information such as title, journal name, name and affiliation of authors, year of publication, author keywords, abstracts and reference lists. The data is provided as Supplementary Material.

In addition to statistical analysis on this set of bibliometric data, the structure and composition of the field is analysed using the methodology of Visualisation of Similarities (VOS) proposed by Eck et al. (2007) while the temporal trends are identified using the Document Co-citation Analysis (DCA) methodology of Chen (2004).

The VOS methodology was adopted to identify major divisions of economics research. Assume that there are n objects ($1, \dots, n$). These objects whose similarity are to be determined could be noun phrases and terms in abstracts and titles of economics articles. In such case, their similarity is quantified by the number of times that they have been mentioned in the same article, i.e., patterns of co-occurrence. The objects could, alternatively, economics articles, in which case, measure of similarity will become the number of references that each pair of article has in common (i.e., article bibliographic coupling) (Haghani et al., 2021). $T = (\tau_{ij})$ ($\tau_{ij} \geq 0, \tau_{ii} = 0, \tau_{ij} = \tau_{ji} \forall i, j \in \{1, \dots, n\}$) is the *similarity matrix* with non-negative elements τ_{ij} that represent the similarity of objects i and j . The VOS methodology provides a visualisation in which the distance between each pair of objects represents their similarity τ_{ij} . The *association strength*, also known as *proximity index*, is calculated as Eq. 1, where σ_{ij} is the number of co-occurrences of objects i and j while δ_i and δ_j are their respective number of total occurrences (Van Eck et al., 2007).

$$\tau_{ij} = \frac{\sigma_{ij}}{\delta_i \delta_j} \quad (1)$$

A two-dimensional map is provided in which a weighted sum of the squared Euclidean distances between all pairs of items is minimised (Eq. 2) under the constraint specified by Eq. 3. In this notation, $\mathbf{P}_i = (x_i, y_i)$ is the vector of position for item i in a two-dimensional map and $\|\bullet\|$ is the Euclidean norm.

$$\text{Min } V(\mathbf{P}_1, \dots, \mathbf{P}_n) = \sum_{i < j} \tau_{ij} \|\mathbf{P}_i - \mathbf{P}_j\|^2 \quad (2)$$

$$\text{s. t. } \frac{\sum_{i < j} \tau_{ij} \|\mathbf{P}_i - \mathbf{P}_j\|}{n(n-1)/2} = 1 \quad (3)$$

Dominant topics of the field and their temporal trends of activity as well as their fundamental references are determined using the methodology of *document co-citation* analysis. The method is founded based on the notion that clusters of references that are often jointly cited together (i.e., co-cited) in the reference list of economics papers must represent the knowledge foundation of certain stream of economics research. Hence, by analysing the common theme represented by the citing articles (economics papers) that form each cluster (of co-cited references), one can determine major topics within the field. Variation in the citation patterns of the citing articles over time can also demonstrate variation in the activities of each stream/topic. Figure 1 illustrates the notion of document co-citation analysis in an abstract way. An important distinction here is the one between citing articles (i.e., articles of economics in our dataset of N=204,000 papers) and cited references (i.e., references that have frequently appeared in the reference lists of those N=204,000 articles, be it books or articles themselves, be it mainstream economics papers or papers originated from other fields). A time-slicing of 1 year in duration has been chosen to analyse temporal trends of major streams during 1990-2021. Every instance of citation from the citing articles to the cited references is here referred to as a *local citation*, meaning a citation instance from within the field of economics, as opposed to citations that a reference may have overall accumulated from all fields combined.

A side outcome of the analysis is determination of most locally cited references in economics literature. By analysing temporal variations of such local citations, those that have had a *citation burst* (i.e., a sudden spike in their local citation count from economics) are also identified. Each burst is characterised by its *begin* and *end* year as well as its *strength* (Haghani et al., 2021). This is used as a metric of prominence and the time lapse between the publication year of the reference and the onset of the citation burst is recorded and analysed for such articles. This is used as a proxy for measuring the duration of time taken for a reference (from the time of its birth) to rise to prominence. References with *centrality* are also identified, those that are often co-cited with influential references from outside their own cluster, i.e., those whose influence has been exerted across multiple streams/sub-divisions of economics research.

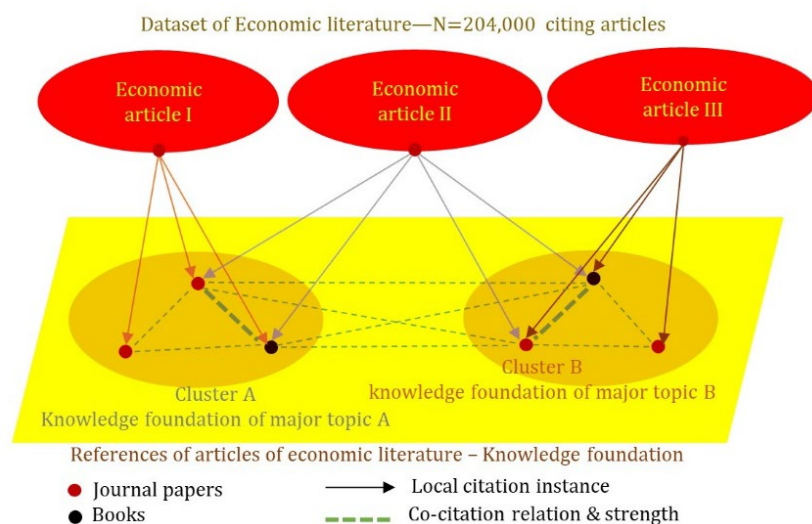


Figure 1 The notion of document co-citation analysis in economics research.

The clusters determined by the term co-occurrence analysis are representative of these research divisions in economics: Cluster 1 (red): *energy, agriculture and economic growth*, Cluster 2 (orange): *monetary policy*, Cluster 3 (yellow): *econometric*, Cluster 4 (green): *game and experimental*, Cluster 5 (blue): *labour economics*, Cluster 6 (grey): *stock market*. By calculating the average of the year of publications of the articles in which these terms have appeared in the titles and abstracts of, newest and oldest prominent terms of titles and abstracts in economics research were determined. The oldest terms are “agriculture”, “cointegration”, “unit root”, “equilibria” and “theorem”. The newest prominent terms of abstracts are “financial crisis”, “great recession”, “oil price”, “field experiment” and “laboratory experiment”.

Similarly, the occurrences of author keywords were analysed across the three time periods (decades) of interest (Figure 3). Top frequently listed keywords during each decade have been identified along with their percentage of occurrence among all recurring keywords during the same time period. An interesting observation is the notable and sudden rise of “China” as a keyword, from absent in the 1990-1999 top ten keywords to the dominant keyword in the subsequent time periods.

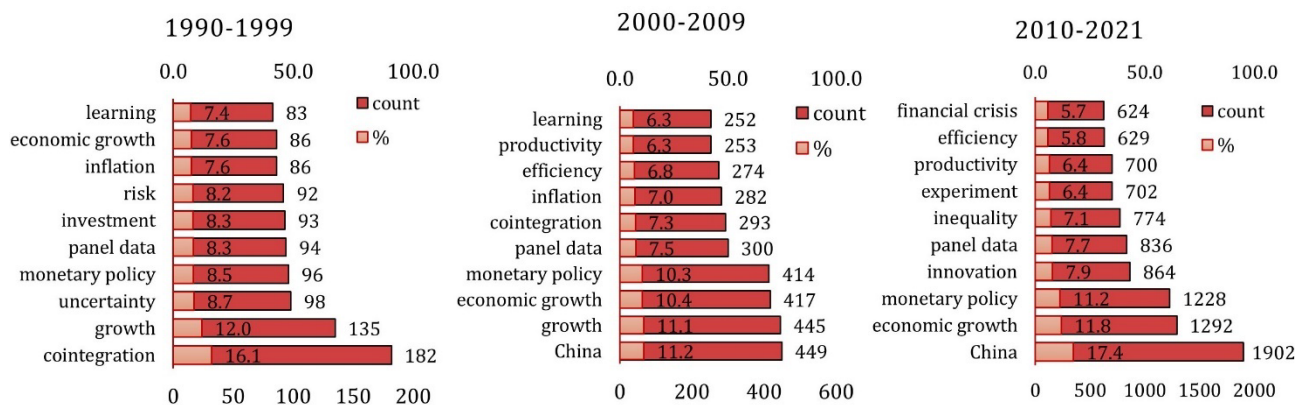


Figure 3 Top ten keywords in economics research over the last three decades.

Connectivity and collaboration patterns in economics literature

Country affiliation of authors listed on the set of N=204,000 economics papers were considered for further analysis. Top five countries whose authors have had the highest number of papers in the dataset during each decade were identified along with the pair of countries whose authors have had the largest number of co-authorship (Figure 4). Consistent with the patterns observed in keywords, the sharp rise of contributions of authors from China in recent times is very noticeable. While China is not identified in the list for the first two decades, in the time period of 2010-2021 Chinese authors appear as the third most contributing to the economics literature. Furthermore, this is also reflected in highest instances of co-authorship between American and Chinese economists over time. While this collaboration link was not so prominent during 1990-1999, currently it constitutes the second strongest link of collaboration between economists across countries.



Figure 4 Relative contributions of top countries to economics literature over the last three decades (left). Strongest country-level collaboration links in economics literature over the last three decades (right).

At a highest level of aggregation, patterns of overall international collaboration between economists were identified in contrast with their domestic research productivity. Any economics paper with at least two authors affiliated with institutions of two different countries is here regarded as an internationally collaborated paper. The number of such economics papers as well as those of domestic papers published during each year have been determined (Figure 5). Results are indicative of a sharp rise in international collaborations between economists, particularly since the early years of the current century. While the ratio of the number of international economics papers to domestic papers in the 1990-1999 period was only .14, this number has now increased to .58. meaning that for every two domestic papers in economics, at least one internationally collaborated has been published during 2010-2021. In fact, this ratio is sharply on the rise, and the last year on the record indicates that the ratio has reached .79. If the trend continues, it is expected that the annual number of internationally collaborated papers will surpass that of domestic publications in only a few years' time. Currently, the body of internationally collaborated research is growing at a noticeably faster pace than that of domestic research. In 2021, while the relative growth of domestic economics papers (compared to the year before) was only 1.18%, international publications kept their momentum and increased nearly 15% compared to 2020.

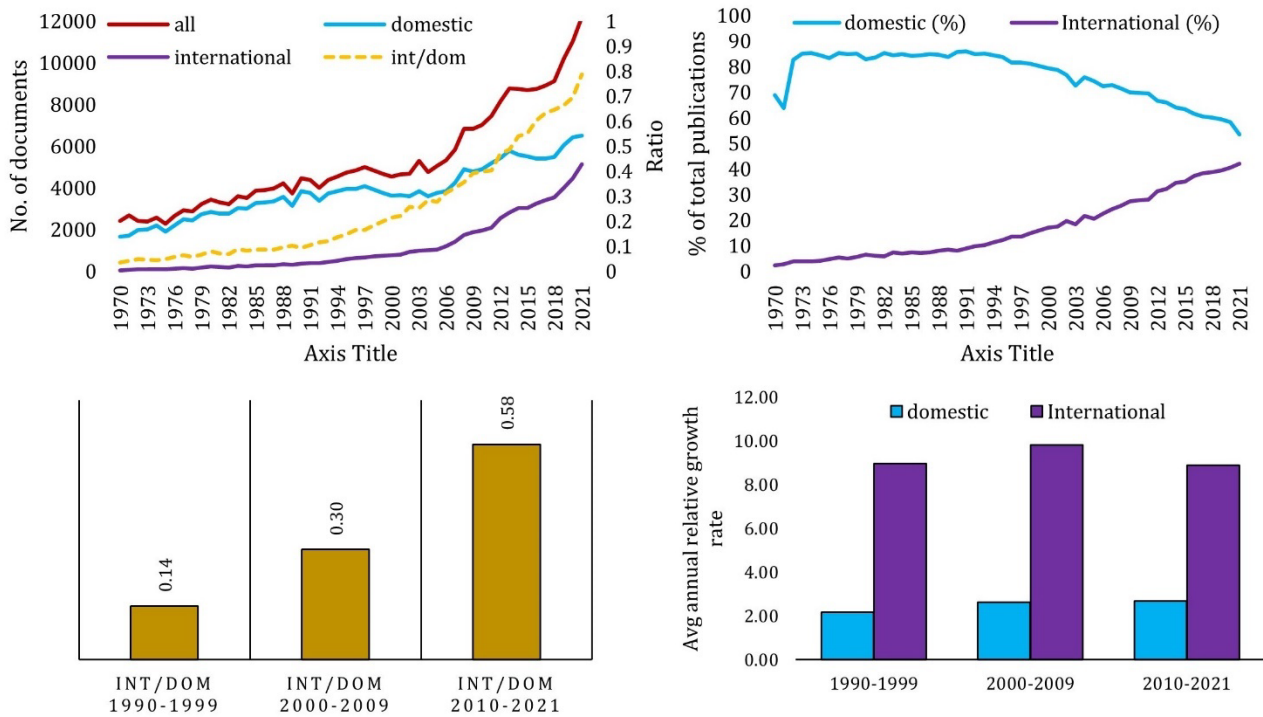


Figure 5 International collaborations versus domestic publications in economics literature and their rate of growth over time.

These patterns of connectivity were also analysed at a lower level of aggregation by considering patterns of collaborations of individual authors. Articles published during each time period (decades) were considered and networks of co-authorship associated with each decade were established (Figure 6). Note that these networks were only formed for *recurring authors* of economics, those that have at least had ten publications during the period of analysis. In each network, nodes represent individual economists/authors and links between them represent co-authorship. Each link is defined by a *link strength* that represents the instances of co-authorships between the pair of authors that it connects. The accumulation of the strengths of all links originating from each node is referred to as *total link strength* (TLS) as a measure of overall instances of collaborations of each author with other major authors on the network. Each node size is proportional to this metric in the presented networks, although in the interactive online networks, readers can change this to the number of publications or citations in the online tool.

The average of TLS across all authors is measured as a proxy for overall connectivity within each network (Figure 7). Results show the percentage of authors that belong to a cluster (i.e., connected authors) have increased in the recent decade. For example, in the period of 1990-1999, only about 73% of authors were found connected to the rest of the body of the network, whereas this number has increased to 97% in the 2010-2021 period. Similarly, when TLS is averaged out across all authors of each network (Figure 7, on the right), results are clearly indicative of increase in connectivity in the most recent decade compared to the previous two decades.

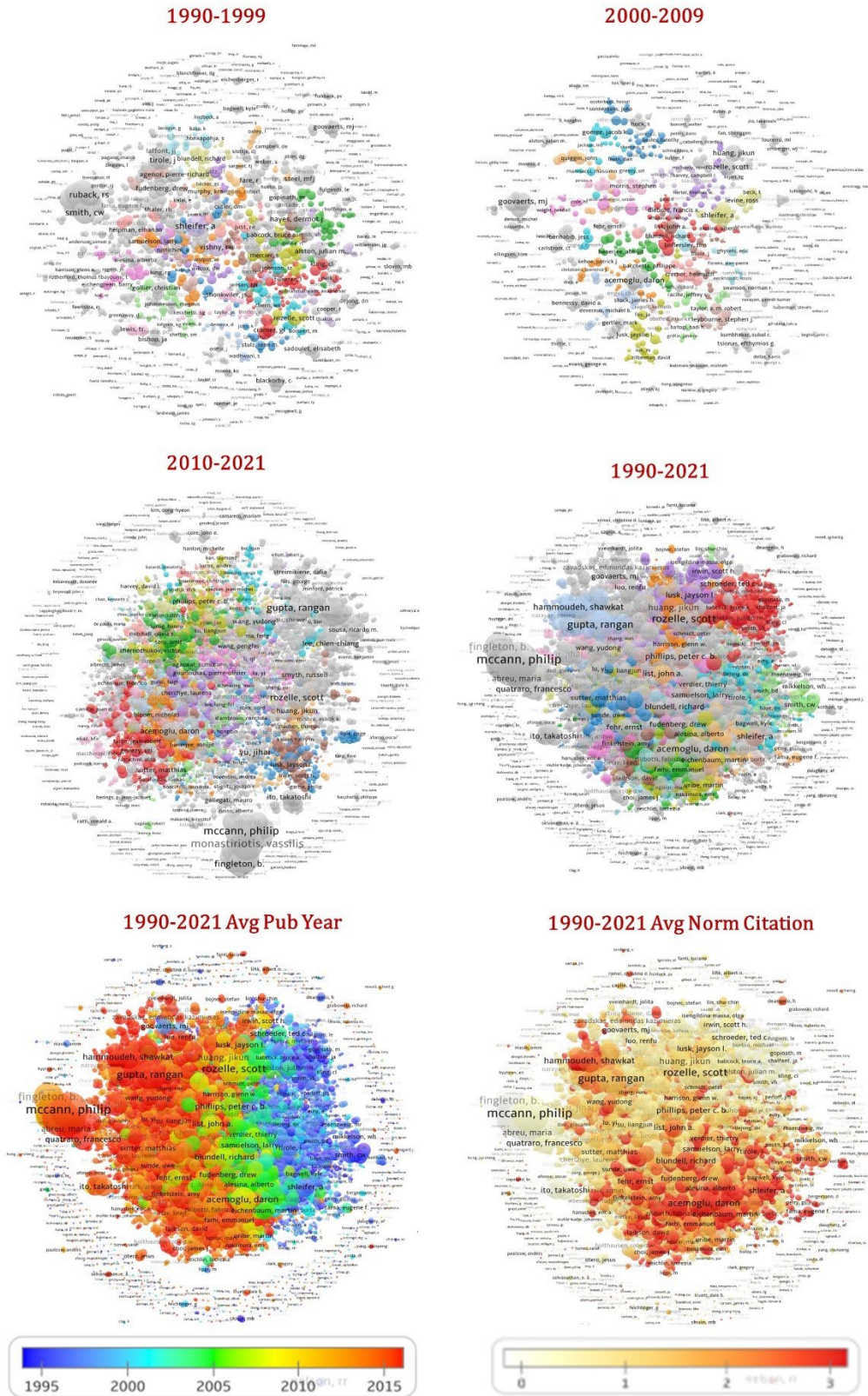


Figure 6 network of authors collaborations in economics literature for the periods of [1990-1999](#), [2000-2009](#), [2010-2021](#) as well as [all years 1990-2021](#), along with an overlay of average publication year of authors and average normalised citations of authors. Node sizes in each network are proportional to the TLS of authors.

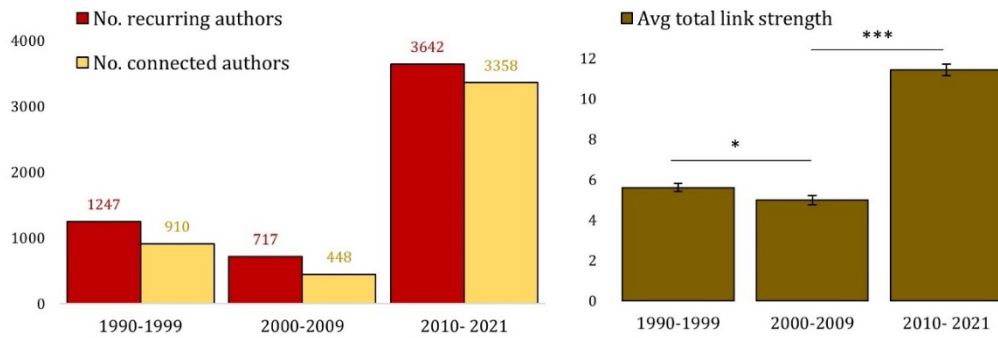


Figure 7 Variation in number of authors and number of connected authors in the field of economics over the last three decades as well as the variation in overall per-author connectivity, measured as average TLS. (*) and (***) indicate statistical significance at 0.05 and 0.0005 respectively.

Temporal trends and influential references of economics research

Patterns of document co-citation in economics literature were analysed to determine major research streams as well as their temporal trends. This is a supplement to the analysis of term co-occurrence through which we determined major divisions and is one that offers a more disaggregate view of the field along with a temporal-analysis component. The method, once applied to the dataset of $N=204,000$ economics papers, produces the network of clusters of co-cited documents shown in Figure 8. Each cluster represents a set of fundamental references (i.e., the core knowledge foundation) of a major research theme/topic of economics. The clusters have been visualised in both network view and timeline view modes. In the network view mode, spatial proximity of clusters is indicative of their thematic similarity, while in the timeline view, this feature has been let go, so that the references of each cluster can be visualised against a timeline based on their year of publication. In both forms of visualisation, each node represents a recurring reference in economics research, while the size of the node is proportional to the number of local citations to that reference (i.e., the number of citations exclusively from within economics, as a measure of local impact). These references may or may not themselves be economics papers. They do not necessarily need to be one of the $N=204,000$ economics papers that exist in the dataset (although many of them are). But these references could also include books, or fundamental economics papers published prior to 1990 or even papers that may not necessarily be classic economics research themselves despite having major influence on economics research. In the timeline view visualisation, references marked by red rings are those for which a burst of citation has been recorded. The thickness of the ring is proportional to the duration of the burst. Purple circles mark references that have high degrees of centrality. The full information of these clusters has been tabulated in Appendix B, including their statistics, influential references (based on three metrics of local citation, citation burst, and centrality) and citing articles with highest degree of coverage of the cluster (i.e., those whose reference lists include the highest number of the references of that cluster). Links in both networks indicate instances of co-referencing (i.e., representative of activities of the citing articles). A dynamic visualisation of the network can be accessed in the Supplementary Material where citation activities (of citing clusters) have been visualised year-by-year during 1990-2021. This essentially determines the state of economics research during every year since 1990 and the shift of activities over the years. To better quantify these temporal variations in activities across the network, the number of citing articles as well as the total coverage (the total number of references cited) of the references of each cluster (i.e., total coverage) have been quantified and visualised in Figure 9, as quantitative measures of cluster activity. This determines trending as well as emerging themes (i.e., those that are beginning to trend) as well

as those whose activities may have flattened out or slowed down in recent years. This also determines the point (i.e., year) of emergence of each trendy topic.

Frequent terms and noun phrases were extracted from the titles of the citing articles of each cluster. A *likelihood ratio* algorithm assigns a weight to each term/phrase based on the frequency of mention in the titles as well as the coverage of the article(s) whose titles have include those terms. The rationale is that those citing articles that have a higher degree of coverage of the references of the cluster are more relevant and therefore, terms that are extracted from them receive higher weights. This determines a set of top terms associated with each cluster. These terms are used as objective (i.e., algorithmically determined) descriptors of the content for each cluster, abstract indicators of the research stream that each cluster represents. In Figure 8, the top term associated with each cluster has been overlaid on the network-view version of the document co-citation map. A list of these top terms associated with each cluster are also listed in the Appendix Table. The authors have also determined an author-specified descriptor (or an alternative label) by studying the content of citing articles of each cluster. Table 1 lists both sets of descriptors for each cluster.

Table 1 Short (algorithmically determined) and long (author-specified) descriptors of clusters of co-cited references in economics literature.

cluster	short descriptor	long descriptor
0	social preference	Preferences, Corporate Governance, Inequality, Trade Agreements
1	economic growth	Economic Growth, Technical Change, Knowledge Transmission and Spillover
2	corporate governance	Corporate Governance, Stock Market, Risk, Banking
3	monetary policy	Macroeconomics and Monetary Policy, International Trade
4	stock return	Modelling Asset Prices, Stochastic Volatility, Financial Markets
5	unit root	Modelling Volatility, Structural Change, Economic Growth, Financial Markets
6	stochastic volatility model	Volatility and Financial Markets
7	risk preference	Individual Decision Making, Risk, Behaviour Over Time
8	international trade	Global Economy, International Trade, Economic Development, Economic Growth
9	regression discontinuity design	Econometric Methods, Empirical Applications, Macroeconomic and Microeconomic Applications
10	economic policy uncertainty	Macroeconomics, Prices, Income, Investment, Growth, Money and Banking
11	precautionary saving	Savings and Investment, Household Consumption, Wealth
12	technical efficiency	Cost and Output, Production, Efficiency, Prices and Information
13	consumer preference	Individual Behaviour, Market Equilibrium, Firm Decisions
14	Covid-19 pandemic	Pandemic, Covid 19, Market Disruption

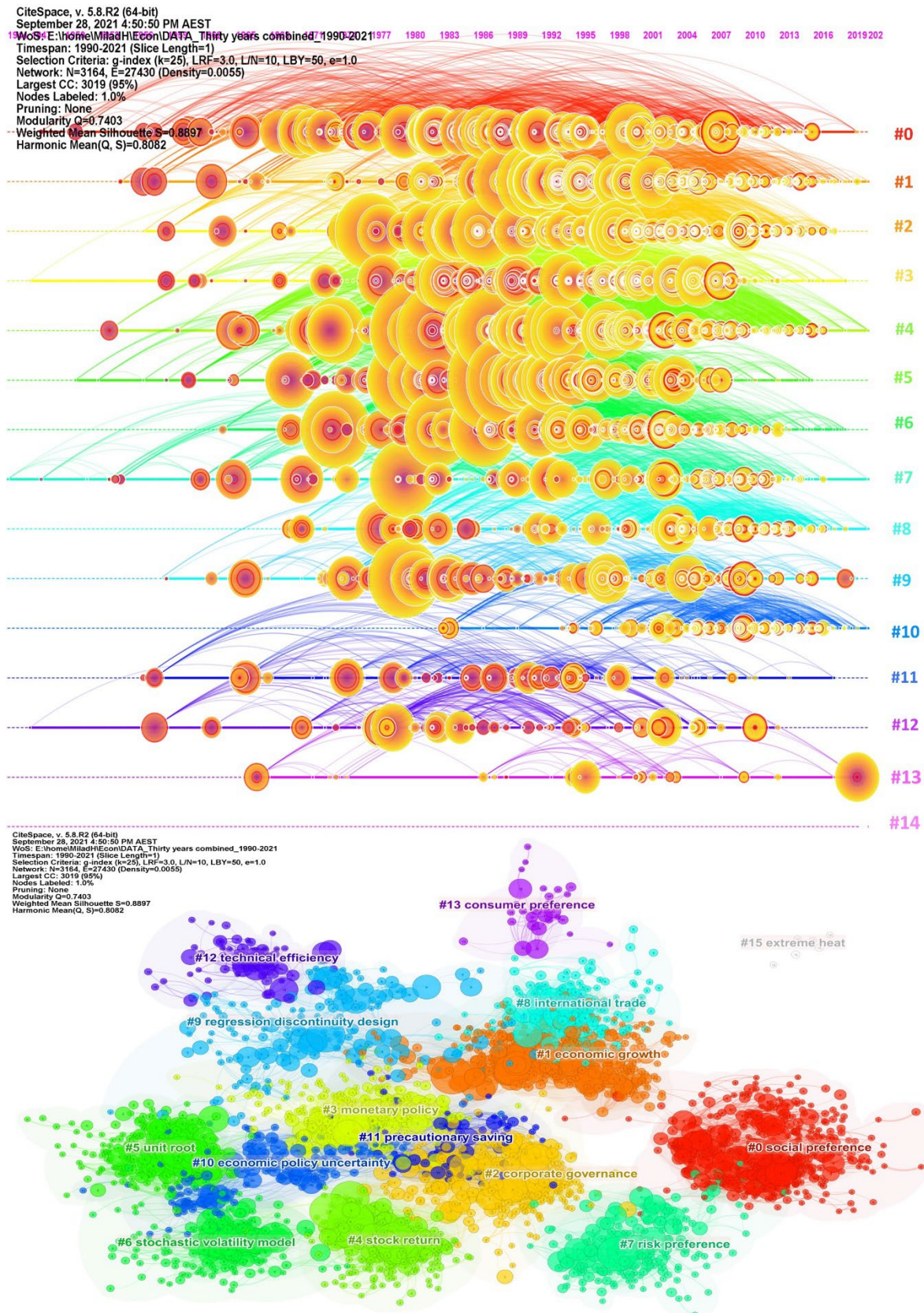


Figure 8 Clusters of co-cited references in economics research in the network view mode (top) and timeline view mode (bottom). A dynamic year-by-year visualisation of activities in the network can be accessed through the Supplementary Material as well as [this link](#).

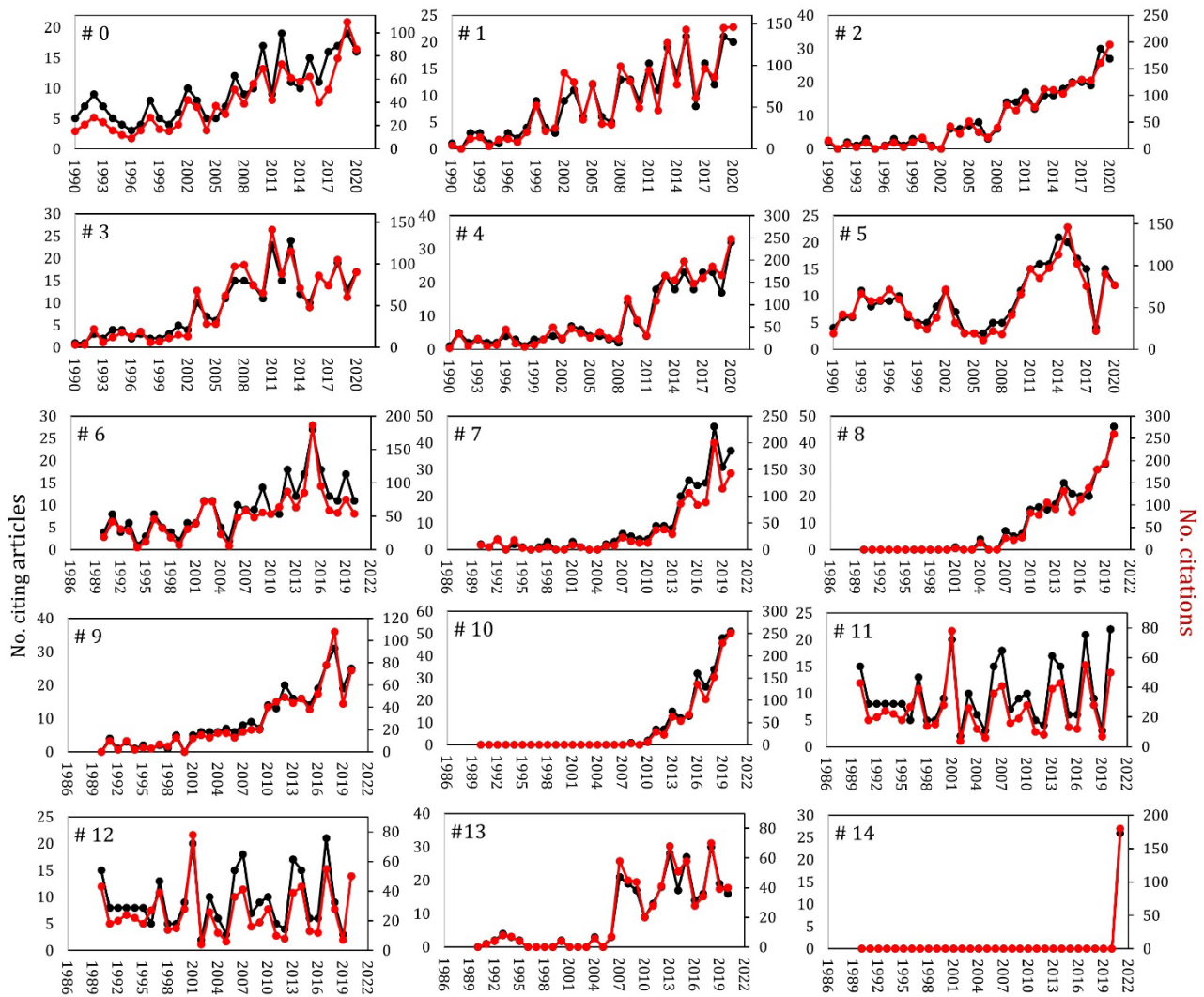


Figure 9 Temporal patterns in development of the clusters of document co-citation network in economics literature based on the number of citing articles of each cluster (black lines, left axes) as well as the total coverage of the references of each cluster (red lines, right axes) during each of 1990-2021 period.

Cluster 0: Preferences, Corporate Governance, Inequality, Trade Agreements. Studies in this cluster relate to decision making by aggregates that influence wealth creation. Trade agreements and corporations are aggregates that take advantage of economies of scale or agglomeration.

Cluster 1: Economic Growth, Technical Change, Knowledge Transmission and Spillover. These are discussions of foundational issues in technology whereby economies use resources to create output and develop new technology.

Cluster 2: Corporate Governance, Stock Market, Risk, Banking. Financial sectors lie behind wealth creation and preservation. The banking sector provides the platform on which wealth and resources are created and distributed. Much of the activity of the banking sector is devoted to distributing and redistributing risk across space and time.

Cluster 3: Macroeconomics and Monetary Policy, International Trade. These are analyses of the processes by which governments conduct aggregate economic policy.

Cluster 4: Modelling Asset Prices, Stochastic Volatility, Financial Markets.

Cluster 5: Modelling Volatility, Structural Change, Economic Growth, Financial Markets.

Cluster 6: Volatility and Financial Markets. Clusters 4, 5 and 6 include microeconomic and market level studies of behaviour in financial settings. The pricing structure is the mechanism by which information about the economy is transmitted to economic agents. This segment focuses on financial prices as different from commodity (goods) prices. The distinction is ambiguous for many commodities such as petroleum, precious metals, crops and currencies.

Cluster 7: Individual Decision Making, Risk, Behaviour Over Time. These analyses are somewhat narrowly focused on descriptions of how individuals make decisions. Risk avoidance and taking behaviour overlaps with clusters 5, 6 and 7.

Cluster 8: Global Economy, International Trade, Economic Development, Economic Growth. These studies consider broader discussions of country level wealth and growth over time. Studies of economic growth and development are focused on the most fundamental questions of wealth and the distribution of wealth within and across economies.

Cluster 9: Econometric Methods, Empirical Applications, Macroeconomic and Microeconomic Applications. Econometric methods have evolved since the 1950s as the set of techniques that social scientists use to aggregate granular observations of economic agents and economic measurements into concise descriptions of how economies work.

Cluster 10: Macroeconomics, Prices, Income, Investment, Growth, Money and Banking. These are similar to studies in cluster 3, but with a closer focus on policy making and the results of policy making.

Cluster 11: Savings and Investment, Household Consumption, Wealth. This cluster joins Cluster 10 in assessing the measurement of economies from the point of view of economic households. Together these two clusters analyse economic measurement from a Keynesian perspective.

Cluster 12: Cost and Output, Production, Efficiency, Prices and Information. Some of the studies in Cluster 12 are a subset of the broader set of methods in Cluster 9, Econometrics. These studies take a microeconomic approach to economic production and resource use by firms and markets.

Cluster 13: Individual Behaviour, Market Equilibrium, Firm Decisions. Cluster 13 relates to Clusters 4, 5, 6 and 7 on market outcomes and decision making by individual agents in those markets.

Cluster 14: Pandemic, Covid 19, Market Disruption. This cluster is a focused group of analyses of the impact of Covid 19 on markets. Since the pandemic is not over (as of this writing), this group of papers represents ongoing observations and as yet to be verified projections.

Further analyses are conducted on the outcome of the document co-citation analysis to determine the number of years that it takes typically for the impact of a seminal paper of economics to be recognised. In doing so, about 1,250 references for which a citation burst (of at least four years long) have been detected and the number of gap years between their time of publication and onset of citation burst were calculated. Figure 10 provides the histogram of frequency of these number of gap years and also compares the average gap years across the three decades of interest in our analysis.

The analysis shows that an average influential papers of economics has a 10.14 years wait time for its impact to begin (i.e., to receive a burst of citation). The median gap is also 7 years. However, this varies in a range. While some studies (in minority) may become impactful almost immediately (here, we refer to them as *fast impactors*), some may take a long time (we refer to them as *laggards*). The

longest gap recorded within our dataset is 47 years long. Tables 1 and 2 provide examples of some of these immediate/fast impactors and laggards for which a strong burst of citation has been recorded.

This delay in receiving recognition and impact has not been stable over time and in fact, has been on the rise over the last three decades. For bursts of citations that have begun during 1990-1999 the average number of gaps years is 8.8. This Figure for the periods of 2000-2009 and 2010-2021 respectively increases to 10.6 and 11.2 years. In other words, as the field of economics progresses over time, it becomes even more hesitant or slow to give recognition to new impactful studies.

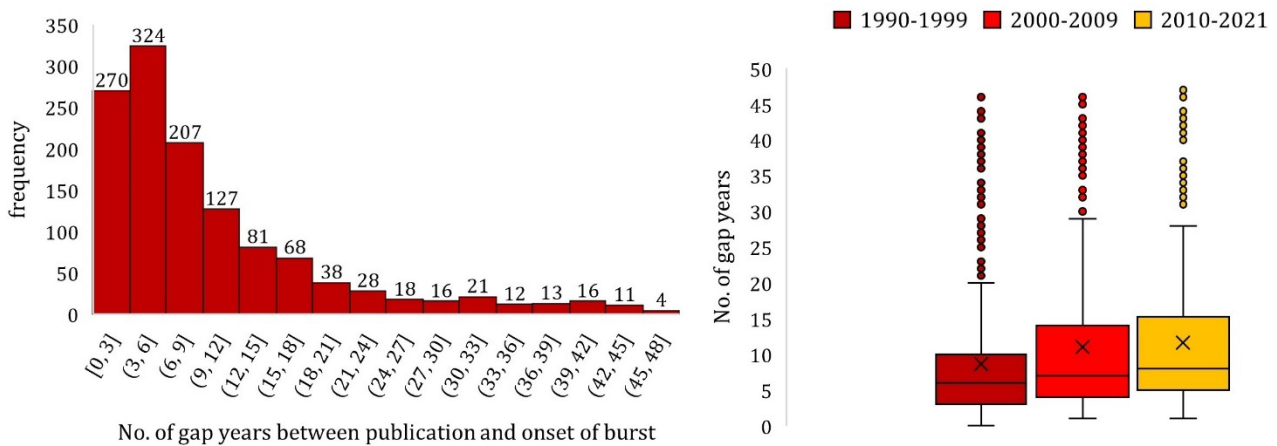


Figure 10 The number of gap years between publication of influential economics papers and their onset of receiving citation burst. The left shows the frequency distribution of the number of gap years and the right shows aggregate comparisons across the last three decades.

Table 1 Examples of fast impactors in economic literature

Author(s) (year)	title	journal	burst strength	begin year	end year
(Summers et al., 1991)	The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950–1988	The Quarterly Journal of Economics	179.79	1992	2007
(Greiner, 2015)	Subject pool recruitment procedures: organizing experiments with ORSEE	Journal of the Economic Science Association	146.92	2016	2021
(Rebelo, 1991)	Long-Run Policy Analysis and Long-Run Growth	Journal of Political Economy	112.07	1992	2003
(Levine et al., 1992)	A sensitivity analysis of cross-country growth regressions	The American Economic Review	110.3	1993	2008
(Zeldes, 1989)	Consumption and Liquidity Constraints: An Empirical Investigation	Journal of Political Economy	83.86	1990	2001
(Phillips, 1991)	Optimal inference in cointegrated systems	Econometrica	76.06	1992	1999
(Wu et al., 2016)	Measuring the macroeconomic impact of monetary policy at the zero lower bound	Journal of Money, Credit and Banking	73.84	2017	2021
(Brunnermeier et al., 2014)	A macroeconomic model with a financial sector	The American Economic Review	72.99	2015	2021
(Christiano et al., 2014)	Risk shocks	The American Economic Review	66.15	2015	2021

Table 2 Examples of laggards in economic literature

Author(s) (year)	title	journal	burst strength	begin year	end year
(Solow, 1956)	A contribution to the theory of economic growth	Quarterly Journal of Economics	51.36	2000	2007
(Altman, 1968)	Financial ratios, discriminant analysis and the prediction of corporate bankruptcy	The Journal of Finance	44.7	2010	2018
(Farrell, 1957)	The Measurement of Productive Efficiency	Journal of the Royal Statistical Society: Series A	156.84	1990	2007
(Solow, 1956)	A Contribution to the Theory of Economic Growth	The Quarterly Journal of Economics	155.18	1990	2006
(Vickrey, 1961)	Counterspeculation, auctions, and competitive sealed tenders	Journal of Finance	97.46	1997	2011
(Aigner et al., 1977)	Formulation and estimation of stochastic frontier production function models	Journal of Econometrics	79.28	2017	2021
(Nash, 1950)	The Bargaining Problem	Econometrica	73.27	1990	2000
(Tiebout, 1956)	A Pure Theory of Local Expenditures	Journal of Political Economy	68.2	1996	2006

Summary and conclusions

A considerable amount of evidence has been documented about the time lag between submission and publication of economics research articles (Conley et al., 2011), showing that in recent years there has been a significant increase in the amount of time necessary to publish a paper in a top economics journal (Ellison, 2002). However, not as much evidence exists about the time lag between publication of seminal economics research and when the research begins to get recognised as being influential. In the largest-scale study of economics literature ever conducted, by analysing clustering patterns of document co-citation in the reference lists of more than N=204,000 papers of economics (collective content of more than 200 economics journals), we demonstrated how hesitant this field is in giving recognition to its seminal research. The results evidenced that a typical influential paper in economics take on average 10.14 years to receive a citation burst from other economics papers. And this phenomenon has become even more tangible over the last three decades, with the gap years rising to 11.2 years in the most recent decade.

In addition to objectively classifying the field using clustering algorithms (Angrist et al., 2017), we also quantified activities of various research divisions in economics. This showed that the majority of the streams that are currently trending in the economics field have been introduced between 2007-2011 and there have not been significant new emergences since, apart from a very new cluster prompted by the onset of the COVID-19 pandemic. The field of economics does not move on from established topics very quickly, and economists are also hesitant in adding new research to their reference lists. It appears that once they form a knowledge foundation (i.e., a set of references that they obtain their knowledge from), they adhere to it for a considerable amount of time and that reflects in their patterns of referencing in their publications.

Despite the old-fashioned style in referencing, however, economists are increasingly becoming connected, and this has reflected in a very sharp increase in the degree of author collaborations in general, as well as international collaborations, especially during the recent decade. The data shows that economists can no longer be considered insular (Angrist et al., 2017). In fact, at the current rate, the annual numbers of international and domestic publications are soon going to match, and the number of internationally collaborated papers will even exceed those of domestic. In 2020, for every five domestic papers there were four international papers, a much higher rate than most other fields.

Conflict of Interest

The authors have no conflict of interest to declare.

Appendix A—Search query

SO=(“Quarterly Journal of Economics” OR “Journal of Economic Perspectives” OR “Brookings Papers on Economic Activity” OR “Journal of Finance” OR “Journal of Economic Literature” OR “Journal of Financial Economics” OR “American Economic Review” OR “Journal of Political Economy” OR “Energy Economics” OR “American Economic Journal-Applied Economics” OR “Review of Economic Studies” OR “Review of financial studies” OR “Journal of Economic Growth” OR “NBER Macroeconomics Annual” OR “Aconomic Policy” OR “Review of Economics and Statistics” OR “Food Policy” OR “Econometrica” OR “American Economic Journal-Economic Policy” OR “Journal of Accounting & Economics” OR “Annual Review of Economics” OR “American Economic Journal-Macroeconomics” OR “Oxford Review Of Economic Policy” OR “Journal of the European Economic Association” OR “Journal of Economic Surveys” OR “Emerging Markets Review” OR “American Journal of Agricultural Economics” OR “Journal of Monetary Economics” OR “Journal of Business & Economic Statistics” OR “Review of Finance” OR “Applied Economic Perspectives and Policy” OR “economic journal” OR “China Economic Review” OR “Journal of Financial and Quantitative Analysis” OR “Journal of Development Economics” OR “Journal of International Financial Markets Institutions & Money” OR “Journal of Agricultural Economics” OR “Journal of Financial Stability” OR “European Review of Agricultural Economics” OR “Economic Systems Research” OR “Journal of Banking and Finance” OR “Agricultural Economics” OR “Journal of International Economics” OR “mathematical finance” OR “Economic Research-Ekonomiska Istrazivanja” OR “Journal of Public Economics” OR “Technological and Economic Development of Economy” OR “Experimental Economics” OR “Econometrics Journal” OR “Oeconomia Copernicana” OR “Journal of Choice Modelling” OR “Annual Review of Financial Economics” OR “Structural Change and Economic Dynamics” OR “Journal of Comparative Economics” OR “Economic Analysis and Policy” OR “Economic Modelling” OR “Journal of Applied Econometrics” OR “China & World Economy” OR “Journal of Institutional Economics” OR “International Review of Economics & Finance” OR “Journal of Asian Economics” OR “China Agricultural Economic Review” OR “Journal of Wine Economics” OR “Journal of Risk and Uncertainty” OR “Economics Letters” OR “European Economic Review” OR “Journal of Cultural Economics” OR “Journal of Forest Economics” OR “Journal of Consumer Affairs” OR “IMF Economic Review” OR “Cambridge Journal of Economics” OR “KYKLOS” OR “Journal of Contemporary Accounting & Economics” OR “Information Economics and Policy” OR “Journal of Business Economics and Management” OR “Theoretical Economics” OR “Spatial Economic Analysis” OR “Transformations in Business & Economics” OR “RAND Journal of Economics” OR “Journal of Financial Econometrics” OR “Journal of Economic Behavior & Organization” OR “Economic Systems” OR “Journal of Econometrics” OR “Journal of Economic Methodology” OR “Journal of Empirical Finance” OR “Journal of Economic Interaction and Coordination” OR “Economics of Innovation and New Technology” OR “International Economic Review” OR “North American Journal of Economics and Finance” OR “Journal of Economic History” OR “Review of Economic Dynamics” OR “Journal of Risk and Insurance” OR “Economic Change and Restructuring” OR “Quantitative Finance” OR “Journal of Policy Modeling” OR “Economica” OR “Scandinavian Journal of Economics” OR “Journal of Evolutionary Economics” OR “Review of Income and Wealth” OR “Australian Journal of Agricultural and Resource Economics” OR “Journal of Productivity Analysis” OR “Journal of Real Estate Research” OR “Journal of Economics” OR “Insurance Mathematics & Economics” OR “Journal of Money Credit and Banking” OR “Labour Economics” OR “American Economic Journal-Microeconomics” OR “Empirical Economics” OR “Asian Economic Policy Review” OR “Annals of Public and Cooperative Economics” OR “Quantitative Economics” OR “Journal of Pension Economics & Finance” OR “Defence and Peace Economics” OR “Games and Economic Behavior” OR “Agribusiness” OR “Journal of Economic Dynamics & Control” OR “Baltic Journal of Economics” OR “Journal of Agricultural and Resource Economics” OR “Economic Inquiry” OR “Review of Economics of the Household” OR “Econometric Theory” OR “Journal of Regulatory Economics” OR “Fiscal Studies” OR “Journal of Behavioral and Experimental Economics” OR “Journal of Economic Theory” OR “Applied Economics” OR “Economic Theory” OR “Journal of Economic Inequality” OR “Open Economies Review” OR “South African Journal Of Economics”)

Appendix B—Clusters of co-cited references in economics literature along with influential references of each cluster.

Table

Cluster ID	Cluster statistics		Influential references								
	- size	- silhouette score	Highest local citation count		Strongest citation burst (strength, duration)		Highest centrality		Highest coverage citing articles		
Top terms	- mean year (ref)	- year range (ref)									
	- mean year (citing)	- year range (citing)									
Cluster #0	- S=377		Fischbacher (2007)	1887	Greiner (2015)	146.92	2016-2021	*Nelson et al. (1982)	0.03	Angrist et al. (2020)	19
	- SS=0.887		Fehr et al. (1999)	1312	*Tirole (1988)	139.38	1990-2006	Shapiro et al. (1984)	0.02	Acemoglu et al. (2005)	15
1. social preference	- MY(ref)=1989		Akerlof (1970)	980	*Laffont et al. (1993)	138.98	1994-2009	Alchian et al. (1972)	0.02	Ahern et al. (2015)	13
2. public good	- YR(ref)=1947-2019		Grossman et al. (1986)	914	*Williamson (1985)	137.46	1990-2007	Grossman et al. (1986)	0.02	Alempaki et al. (2018)	13
3. adverse selection	- MY(citing)=2009		*Fudenberg (1991)	787	*Williamson (1975)	123.28	1990-2010	Becker (1974)	0.02	Andreoni (2018)	12
4. moral hazard	- YR(citing)=1990-2021		Bolton et al. (2000)	783	Fischbacher (2007)	117.11	2014-2021			Abeler et al. (2019)	12
5. incomplete contract			Holmstrom (1979)	744	*Hart (1995)	101.9	1997-2010			Angelova et al. (2013)	12
			*Tirole (1988)	739	*Olson (1965)	99.62	1990-2007			Alm (2019)	12
			*Nelson et al. (1982)	703							
			Rubinstein (1982)	681							
			Rabin (1993)	680							
Cluster #1	- S=350		Arellano et al. (1991)	2440	*Barro et al. (1995)	224.94	1997-2008	Solow (1957)	0.03	Ajide (2019)	21
	- SS=0.874		Blundell et al. (1998)	1842	*Greene (2008)	186.47	1994-2006	Hall et al. (1999)	0.02	Ali et al. (2018)	18
1. economic growth	- MY(ref)=1996		Lucas (1988)	1659	Summers et al. (1991)	179.79	1992-2007	Acemoglu et al. (2001)	0.02	Alesina et al. (2015)	18
2. endogenous growth	- YR(ref)=1954-2020		Romer (1990)	1583	Solow (1956)	155.18	1990-2006	Galor et al. (1993)	0.02	Aghion et al. (2005)	18
3. economic development	- MY(citing)=2011		Romer (1986)	1389	Romer (1986)	135.86	1991-2003	Romer (1990)	0.02	Ahamed et al. (2019)	17
4. human capital	- YR(citing)=1990-2021		Arellano et al. (1995)	1387	Piketty (2014)	118.54	2017-2021	Coe et al. (1995)	0.02	Acemoglu (2002)	16
5. income inequality			Mankiw et al. (1992)	1110	*Hsiao (1986)	117.98	1991-2005	Aghion et al. (1992)	0.02	Acemoglu et al. (2002)	16
			*Grossman et al. (1991)	1069	Lucas (1988)	117.02	1992-2003	Arellano et al. (1991)	0.02	Aghion et al. (1999)	16
			Acemoglu et al. (2001)	1018	Rebelo (1991)	112.07	1992-2003			Ali et al. (2017)	16
			Aghion et al. (1992)	993	Levine et al. (1992)	110.3	1993-2008			Ahmed et al. (2020)	15
			Barro (1991)	983						ahmed et al. (2007)	15
Cluster #2	- S=326		Jensen et al. (1976)	1922	*Dixit (1994)	187.89	1996-2011	La Porta et al. (1998)	0.03	Ai et al. (2020)	22
	- SS=0.857		Jensen (1986)	1365	*Friedman et al. (1963)	98.4	1990-1999	Bernanke et al. (1992)	0.02	Allen et al. (2014)	18
1. corporate governance	- MY(ref)=1997		La Porta et al. (1998)	1328	Fazzari et al. (1988)	75.32	1998-2010	Diamond (1984)	0.02	Ali et al. (2018)	14
2. capital structure	- YR(ref)=1956-2017		Myers et al. (1984)	1156	Brunnermeier et al. (2014)	72.99	2015-2021	Jensen et al. (1990)	0.02	Andreou et al. (2018)	14
3. financial development	- MY(citing)=2013		Kiyotaki et al. (1997)	1058	Schularick et al. (2012)	71.85	2015-2021	Greenwood et al. (1990)	0.02	Airaudo et al. (2013)	13
4. financial constraint	- YR(citing)=1990-2021		Diamond et al. (1983)	1006	Adrian et al. (2016)	71.51	2017-2021	Jensen et al. (1976)	0.02	Alpanda (2013)	13
5. financing constraint			Stiglitz et al. (1981)	975	Jermann et al. (2012)	69.93	2015-2021	Jensen (1986)	0.02	Ahrends et al. (2018)	13
			Rajan et al. (1998)	890	Gertler et al. (2011)	66.66	2015-2021	Diamond et al. (1983)	0.02		
			Petersen (2009)	854	Chodorow-Reich (2014)	63.73	2017-2021	Stiglitz et al. (1981)	0.02		
			Bernanke et al. (1989)	843	Hadlock et al. (2010)	59.93	2016-2021	Rajan et al. (1998)	0.02		
			Merton (1974)	831				Bernanke et al. (1989)	0.02		
Cluster #3	- S=315		Calvo (1983)	1386	*Layard et al. (1991)	126.64	1993-2007	Kydland et al. (1982)	0.03	Angeletos et al. (2021)	26
	- SS=0.851		Christiano et al. (2005)	1205	Hansen (1985)	118.97	1991-2008	Calvo (1983)	0.03	Angeletos (2018)	19
1. monetary policy	- MY(ref)=1993		Taylor (1993)	1104	*Blanchard et al. (1989)	110.13	1996-2007	Diamond (1982)	0.03	Avouyi-Dovi et al. (2007)	15
2. business cycle	- YR(ref)=1946-2018		*Woodford (2003)	1003	*Stokey et al. (1989)	107.45	1992-2007	Hansen (1985)	0.02	Ambler et al. (2012)	15

3. new Keynesian model	- MY(citing)=2011	Smets et al. (2007)	966	Kydland et al. (1982)	105.51	1990-2001	King et al. (1988)	0.02	Ascari et al. (2014)	14
4. sticky price	- YR(citing)=1990-2021	Kydland et al. (1982)	925	*Pissarides (2000)	103.22	2004-2011	Lucas (1972)	0.02	Aoki (2003)	14
5. DSGA model		Clarida et al. (2000)	831	*Woodford (2003)	102.21	2005-2021	Blanchard et al. (1987)	0.02	Angeletos et al. (2020)	13
		Clarida et al. (1999)	768	Rotemberg et al. (1997)	100.87	2002-2011				
		Kydland et al. (1977)	687	Clarida et al. (1999)	96.72	2002-2011				
		Smets et al. (2003)	659							
		Blanchard (1989)	636							
- cluster #4	- S=304	Newey et al. (1987)	2816	White (1980)	267.81	1990-2004	Hansen (1982)	0.06	Atilgan et al. (2020)	26
	- SS=0.879	Fama et al. (1993)	2277	Fama et al. (2015)	136.87	2017-2021	Newey et al. (1987)	0.04	Asness et al. (2018)	23
1. stock return	- MY(ref)=1995	White (1980)	2208	Hansen (1982)	123.7	1990-2003	*Friedman (1953)	0.03	Ahmed et al. (2018)	22
2. asset pricing	- YR(ref)=1953-2020	Hansen (1982)	1944	Hansen et al. (1982)	113.04	1990-2002	Fama et al. (1997)	0.03	Ang et al. (2020)	20
3. cross section	- MY(citing)=2012	Fama et al. (1973)	1373	Hansen et al. (1983)	82.9	1990-2002	De Long et al. (1990)	0.03	Andreou et al. (2001)	19
4. equity return	- YR(citing)=1990-2021	Carhart (1997)	1371	*Friedman (1953)	78.13	1993-2003	Mehra et al. (1985)	0.02	Asness et al. (2013)	18
		Fama et al. (1992)	1252	Fama et al. (1988)	74.11	1990-1998	Constantinides (1990)	0.02	Attanasio et al. (2010)	18
		Kyle (1985)	1234	*Campbell et al. (1997)	71.43	1998-2010	Campbell et al. (1999)	0.02	Adrian et al. (2008)	18
		Mehra et al. (1985)	996				Fama et al. (1993)	0.02	Ang et al. (2013)	17
		Jegadeesh et al. (1993)	907				Fama et al. (1973)	0.02	Aretz et al. (2018)	17
		Campbell et al. (1999)	866				Epstein et al. (1989)	0.02		
		Epstein et al. (1989)	843				Grossman et al. (1980)	0.02		
		Amihud (2002)	843							
Cluster #5	- S=269	Engle et al. (1987)	2831	*Fuller (1976)	259.08	1990-1997	Hamilton (1989)	0.03	Andries et al. (2016)	18
	- SS=0.914	Dickey et al. (1979)	1920	Engle et al. (1987)	252.08	1990-2002	Campbell et al. (1987)	0.02	Ahumada (1992)	16
1. unit root	- MY(ref)=1989	Johansen (1988)	1870	Johansen (1988)	203.3	1992-2005	Sims (1980)	0.02	Agnolucci et al. (2011)	16
2. purchasing power parity	- YR(ref)=1950-2015	Kwiatkowski et al. (1992)	1292	Nelson et al. (1982)	179.87	1990-2005	Granger (1969)	0.02	Abdelradi et al. (2015)	15
3. structural break	- MY(citing)=2008	Hausman (1978)	1249	Dickey et al. (1981)	154.1	1990-2004			Arize (2006)	13
4. energy consumption	- YR(citing)=1990-2021	Hamilton (1989)	1195	*George G. Judge (1985)	151.29	1990-2000			Alguacil et al. (2010)	13
5. cointegration analysis		Johansen (1991)	1188	Phillips (1987)	150.05	1990-2005			Ahmed et al. (1995)	13
		Phillips et al. (1988)	1154	*Hamilton (1994)	148.5	1997-2009				
		Perron (1989)	1120	*Davidson et al. (1993)	135.69	1995-2010				
		Dickey et al. (1981)	1114	Phillips et al. (1988)	130.39	2016-2021				
		Sims (1980)	1113	Johansen et al. (1990)	126.21	1992-2002				
		*Hamilton (1994)	1097							
		Johansen et al. (1990)	1096							
		Im et al. (2003)	1063							
Cluster #6	- S=220	Engle (1982)	1802	Harrison et al. (1979)	105.66	1990-2005	Engle (1982)	0.03	Andersen et al. (2011)	23
	- SS=0.870	Bollerslev (1986)	1679	Diebold et al. (2009)	75.39	2017-2021	Meese et al. (1983)	0.02	Bollerslev et al. (1992)	18
1. stochastic volatility	- MY(ref)=1995	Black et al. (1973)	1582	Corsi (2008)	65.57	2015-2021	Black et al. (1973)	0.02	Aboura et al. (2015)	16
2. volatility forecasting	- YR(ref)=1963-2018	Nelson (1991)	962	Dai et al. (2000)	62.52	2002-2013	Nelson (1991)	0.02	Andersen et al. (2010)	13
3. option pricing	- MY(citing)=2009	Diebold et al. (1995)	915	Peter R. Hansen (2011)	58.29	2017-2021	Baur et al. (2010)	0.02	Amendola et al. (2015)	13
4. Garch model	- YR(citing)=1990-2021	Cox et al. (1985)	843	Clark et al. (2007)	56.47	2017-2021			Alizadeh et al. (2002)	12
		Glosten et al. (1993)	832	Engle (2002)	53.28	2014-2021			Bakshi et al. (2003)	12
		Engle (2002)	752	Vasicek (1977)	52.82	1996-2008			Andersen et al. (2011)	12
		Heston (1993)	712	*Karatzas et al. (1991)	52.53	2003-2009				
		Merton (1973)	608	White (1982)	52.48	1990-1999				
		Andersen et al. (2003)	523	Heath et al. (1992)	51.42	1997-2004				
Cluster #7	- S=189	Kahneman et al. (1979)	2115	Dohmen et al. (2011)	67.07	2015-2021	Kahneman et al. (1979)	0.03	Backes-Gellner et al. (2021)	10
	- SS=0.906	Holt et al. (2002)	844	Frederick (2005)	64.65	2016-2021			Buschena (1994)	10
1. risk preference	- MY(ref)=1997	Tversky et al. (1992)	831	*Kahneman (2011)	62.95	2017-2021			Aliprantis et al. (2018)	9
2. risk attitude	- YR(ref)=1944-2020	Laibson (1997)	745	Rothschild et al. (1970)	62.67	1990-2005				
3. prospect theory	- MY(citing)=2015	Gilboa et al. (1989)	713	SAVAGE (1954)	60.34	1991-1996				
4. loss aversion	- YR(citing)=1990-2021	Manski (1993)	686	Chetty et al. (2009)	60.11	2014-2021				

5. risk aversion		Banerjee (1992)	592	Machina (1982)	58.83	1990-1998				
		Bikhchandani et al. (1992)	584	Malmendier et al. (2011)	56.84	2014-2021				
		Rothschild et al. (1970)	574	Anderson (2012)	56.34	2017-2021				
		Crosos et al. (2009)	506	DellaVigna (2009)	56.29	2011-2017				
		Tversky et al. (1974)	475	Ellsberg (1961)	53.53	2007-2011				
Cluster #8	- S=173	Melitz (2003)	1560	Autor et al. (2013)	105.61	2017-2021	Dixit et al. (1977)	0.03	Alfaro et al. (2018)	18
	- SS=0.913	Dixit et al. (1977)	1070	Hsieh et al. (2009)	77.13	2014-2021			Barrot et al. (2019)	16
1. international trade	- MY(ref)=2003	Anderson et al. (2003)	626	*Helpman et al. (1985)	72.58	1990-2003			Arkolakis (2016)	16
2. heterogeneous firm	- YR(ref)=1969-2020	Olley et al. (1996)	615	Timmer et al. (2015)	63.34	2017-2021			Arkolakis et al. (2012)	15
3. trade liberalization	- MY(citing)=2016	Eaton et al. (2002)	605	Helpman et al. (2008)	60.86	2010-2018			Bastos et al. (2018)	14
4. firm heterogeneity	- YR(citing)=2001-2021	Levinsohn et al. (2003)	581	Brandt et al. (2012)	53.02	2015-2021			Antràs et al. (2017)	14
5. comparative advantage		Hsieh et al. (2009)	572	*Helpman et al. (1985)	52.5	2006-2014			Arkolakis et al. (2018)	14
		Silva et al. (2006)	531	Arkolakis et al. (2012)	51.48	2015-2021			Asturias et al. (2019)	14
		Anderson et al. (2004)	453	Syverson (2011)	50.55	2014-2021			Bao et al. (2018)	14
		Krugman (1980)	444							
		Helpman et al. (2004)	422							
		Krugman (1991)	421							
Cluster #9	- S=169	*Greene (1990)	2375	*Maddala (1983)	204.97	1990-2003	*Silverman (1986)	0.02	Abadie et al. (2018)	18
	- SS=0.920	Heckman (1979)	1921	*Greene (2003)	156.56	2005-2011	*Mincer (1974)	0.02	Abate et al. (2014)	9
1. regression discontinuity	- MY(ref)=1992	*Angrist et al. (2009)	1088	*Amemiya (1985)	140.46	1990-2005			Angrist et al. (2011)	8
2. causal effect	- YR(ref)=1958-2019	Rosenbaum et al. (1983)	968	*Angrist et al. (2009)	138.63	2014-2021			Angeletos et al. (2021)	8
3. treatment effect	- MY(citing)=2012	Staiger et al. (1997)	964	*Deaton et al. (1980)	122.75	1990-1997			Armstrong et al. (2018)	8
4. propensity score	- YR(citing)=1991-2021	Koenker et al. (1978)	847	Cameron et al. (2008)	101.82	2015-2021			Ando et al. (2011)	8
5. instrumental variable		Deaton et al. (1980)	760	Colin Cameron et al. (2015)	99.9	2017-2021				
		*Maddala (1983)	745							
		Cameron et al. (2008)	549							
		*Mincer (1974)	542							
		Imbens et al. (1994)	522							
Cluster #10	- S=145	Bloom (2009)	664	Bloom (2009)	118.02	2015-2021			Bachmann et al. (2020)	13
	- SS=0.914	Bai et al. (2002)	603	*Dixit et al. (1994)	105.11	2012-2016			Berg et al. (2021)	12
1. policy uncertainty	- MY(ref)=2008	Kilian (2009)	562	Jurado et al. (2015)	95.06	2017-2021			Ayyagari et al. (2020)	11
2. oil price shock	- YR(ref)=1983-2020	Baker et al. (2016)	511	*Dixit et al. (1994)	91.95	2016-2021			Aastveit (2014)	11
3. uncertainty shock	- MY(citing)=2018	Hamilton (1983)	410	Jordà (2005)	88.23	2017-2021			Antolin-Díaz et al. (2018)	10
	- YR(citing)=2008-2021	Stock et al. (2002)	377	Wu et al. (2016)	73.84	2017-2021			Andrade et al. (2021)	10
		Blanchard et al. (2002)	358	Kilian (2009)	71.4	2016-2021			Albert et al. (2020)	10
		Stock et al. (2002)	326	Tibshirani (1996)	70.14	2015-2021			Bagirov et al. (2019)	10
		Bernanke et al. (2005)	296						Bai et al. (2016)	10
		Hamilton (2003)	285						Bernardini et al. (2020)	10
		Jurado et al. (2015)	282							
		*Dixit (1994)	273							
Cluster #11	- S=71	Aiyagari (1994)	456	Hall (1978)	117.31	1990-2002	Krusell et al. (1998)	0.02	Angeletos et al. (2001)	15
	- SS=0.935	Barro (1974)	453	Zeldes (1989)	83.86	1990-2001			Browning et al. (1996)	11
1. precautionary saving	- MY(ref)=1989	Krusell et al. (1998)	405	*Friedman et al. (1957)	65.69	1990-2001			Attanasio et al. (2010)	8
2. liquidity constraint	- YR(ref)=1956-2017	Hall (1978)	375	*Judd (1998)	61.74	2000-2008			Campbell et al. (1990)	7
3. permanent income hypothesis	- MY(citing)=2006	Kimball (1990)	331	Yaari (1965)	56.89	2005-2015				
	- YR(citing)=1990-2020	*Judd (1998)	319	Flavin (1981)	44.8	1990-1996				
4. Ricardian equivalence		Diamond (1965)	308	Diamond (1965)	43.88	1998-2008				
5. life-cycle model		Gourinchas et al. (2002)	260	Hall et al. (1982)	42.41	1990-1996				

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