
Some insights on the development of economic sciences through the lens of the Nobel Prize

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Abstract

The paper discusses the key developments in the area of economic sciences. The insights are derived from the analysis of the achievements of the laureates of the prize in economic sciences in memory of Alfred Nobel.

Keywords: economic sciences, technology, economic growth, Nobel Prize

1. Evolution in economic sciences – some directions

An insight into the changes in economic sciences can be gained from an analysis of article citations from various sub-disciplines in economics. A study by Kim, Morse, and Zingales (2006), *What mattered to economics since 1970*, which analysed the number of citations from specific areas of economics in 41 of the most well-known economic journals, based on 209 articles published between 1970 and 2005 (i.e. before the great financial crisis), highlighted several facts:

- the three areas with articles receiving the highest number of citations were:
 - in 1970-1974 – Microeconomics (26.7%), Finance (20%), Econometrics (10%);
 - in 1994-1999 – Finance (31.4%), Econometrics (22.9%), Growth/Development (17.1%);
- the share of the three key types of articles was as follows:
 - in 1970-1974 – Theoretical (76.7%), Empirical (13.3%), Methodological (6.7%);
 - in 1994-1999 – Empirical (60.0%), Methodological (22.9%), Theoretical (11.4%).

This indicates a clear increase in frequently cited articles containing research in finance and econometrics, as well as the growing importance of empirical articles.

There is a significant role of research in finance, econometrics, and macroeconomics. Additionally, there is increasing recognition of research that is not necessarily *mainstream*, which reflects the growing interdisciplinarity of research, which includes such areas as behavioural economics, experimental economics, and economic sociology.

The author would like to draw attention to two disciplines within the field of economics that have gained significant importance compared to other disciplines, namely econometrics (or rather quantitative methods, including statistics, mathematics, etc.) and finance.

It is worth pointing out the basic features that favour the development of these disciplines. In the case of econometrics and other quantitative sub-disciplines, the following regularities can be observed:

- the increase in application possibilities (due to the development of IT tools and databases, including big data);
- the establishment of a standard for the use of mathematical tools in empirical economic research;
- the increasing diversity of methods applied indirectly due to the adaptation of methods originating from sciences other than economics;
- the relative increase in methods in the field of data exploration (data mining);
- the increase in the risk of a mathematical model as its complexity grows.

In the field of finance, the following patterns can be observed:

- the increase in the possibilities for applying developed theories, as well as in the ability to test their effectiveness;
- the creation of new theories to address practical issues;
- the dependence of research development on technology (information technology, telecommunications, media);
- the impact of innovation and increasing risk (including systemic risk) on the development of research in finance.

There are two key trends that are taking form, and will continue to shape the nature of research in economic sciences, as well as in some disciplines classified under social sciences. The first trend arises from the observation that the main stream of economic sciences, particularly classical economics and classical finance, has proved to be insufficiently effective in explaining and predicting economic and financial processes, especially in situations of rapid changes in the economy, in the financial market, as well as in the behaviour of economic agents. Criticism of classical economic and financial theories based on the assumption of human rationality (*homo economicus*) began to intensify, especially following the experiences of the 2007-2008 crisis.

In the author's opinion (Jajuga, 2021), there are at least three features of the transformations in contemporary economic research that already have and will have a key impact on the shape of research on economic and social phenomena, naturally including those studies in which quantitative methods are applied, namely:

- The growing importance of positive (descriptive) research on economic phenomena.

Due to the fact that research based on normative economic theories may not reflect reality (reliance on counterfactual assumptions, lack of methodological resilience to dynamic changes in the economic and social environment, paying less attention to solving real economic problems), the importance of descriptive research, in particular empirical studies attempting to explain the actions of economic agents, is increasing.

- The degree of formalisation in economic sciences.

This feature is particularly important when it comes to the significance of research conducted using quantitative methods. The history of achievements in economic sciences, for example those awarded with the Nobel Memorial Prize, indicates a high degree of formalisation in research using mathematical models. There is no doubt that a significant level of mathematical formalisation in

research is necessary to prevent the lack of in-depth analysis in some studies, which are justifiably referred to as qualitative, yet excessive formalisation can lead to an increased model risk, i.e. the model's inapplicability in the real world.

- Interdisciplinarity of economic research.

Research on economic processes increasingly utilises the achievements of other disciplines, due to the following reasons:

1. A number of scientific disciplines allow for a more in-depth analysis of the behaviour of economic agents, in such disciplines as psychology, neurophysiology (the influence of the brain's functioning on human behaviour), sociology (the influence of interactions in social networks on human behaviour), anthropology (the influence of culture on human behaviour).
2. Changes occurring in the global economy impose methodological requirements, necessitating recourse to other areas of knowledge.

In addition, attention should be paid to the methods of theory testing and data exploration, crucial in economic research based on the data analysis, which is now the prevailing stream of research. Here quantitative methods are applied.

These methods (statistical, econometric) can be divided into two general groups, a distinction that has been known for a long time:

- confirmatory methods, in which existing theories are tested using available data;
- exploratory methods, in which patterns are sought in data that may form the basis of a new theory.

The first group of methods has been developed over many years within the field of classical statistics (as well as econometrics). Historically, the main driving force stimulating the development of successive testing methods (usually well-known statistical inference methods) was the assumption of normality (and multivariate normality) of the statistical distribution. The exploratory data analysis methods have been developed on a larger scale for at least sixty years. In this area, the most important pioneering studies were by Tukey, especially his *Exploratory Data Analysis* (1977), where exploratory data analysis methods were extensively described. Furthermore, this author noted that the study placed too much emphasis on statistical inference, and too little on using data to identify a hypothesis that would then be tested with classical statistical inference methods.

The increasing importance of exploratory methods results from three reasons:

- new economic and social processes are (still) not reflected in theory, and therefore do not justify the use of confirmatory methods;
- the huge increase in available data, primarily big data, i.e. large, variable, and varying datasets, whose analysis can lead to the discovery of new knowledge;
- technological progress has made it increasingly easier to efficiently (quickly and accurately) analyse data.

Thus one can state here (synthetically and simplistically) that testing methods are methods of mathematical statistics, derived from a stochastic approach, whereas exploratory methods are methods of universally understood descriptive statistics, not relying on assumptions about the stochastic nature of the analysed variables.

The second trend that has shaped and will continue to shape research in the economic sciences arises from technological changes. In this context, three driving forces should be highlighted:

- increased computer speed;
- growth in the amount of available data;
- increased connections between entities in social networks.

These three characteristics have led, in a sense, to a confrontation and competition of approaches in the study of economic and social processes, where quantitative methods are applied. These approaches are:

- the use of classical statistical (or econometric) methods;
- the use of machine learning methods, simplistically, but not always correctly, referred to as artificial intelligence methods.

2. The Nobel Memorial Prize in Economic Sciences – different areas

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel (also called the Nobel Memorial Prize in Economic Sciences or the Nobel Prize in Economics) was established in 1968 and funded by the Central Bank of Sweden (Riksbank). The first prize was awarded in 1969, and up to 13 October 2025, with fifty-seven prizes awarded to ninety-nine scientists, including three women.

The analysis of the scientific achievements for which the prize has been awarded led to the recognition of the principal areas within the widely understood economic sciences. However, one must remember that the prize is awarded for life achievements, often published even several dozen years earlier, therefore it is more retrospective analysis.

This analysis was based on the classification proposed by A. Lindbeck (2008), who conducted an analysis of the prizes awarded until 2007. The author has extended this analysis to 2025.

The list of areas and the names of Nobel Memorial Prize laureates includes:

- Econometrics: Frisch, Tinbergen, Haavelmo, Heckman, McFadden, Engle, Granger, Angrist, Imbens;
- Macroeconometrics: Klein, Sargent, Sims;
- Macroeconomics: Tobin, Modigliani, Lucas, Friedman, Phelps, Kydland, Prescott;
- Macroeconomics and Institutional Economics: Myrdal, von Hayek;
- Microeconomics and Economic Sociology: Becker;
- Microeconomics: Hurwicz, Maskin, Myerson;
- International Economics: Ohlin, Meade;
- International Macroeconomics: Mundell;
- International and Regional Economics: Krugman;
- Development Economics: Schultz, Lewis;
- Labour Economics: Diamond, Pissarides, Mortensen, Card, Goldin;
- Welfare Economics: Sen, Deaton, Banerjee, Duflo, Kremer;
- Financial Economics: Markowitz, Sharpe, Miller, Merton, Scholes, Fama, Shiller, Hansen;
- Economic History: Fogel, North;
- Administrative (Management) Science: Simon;
- Economic Psychology and Experimental Economics: Kahneman, Smith, Thaler;
- Economics of Information: Mirrlees, Vickrey, Akerlof, Stiglitz, Spence;
- Public Finance: Buchanan;
- Industrial Organization: Stigler, Tirole;
- Game Theory: Harsanyi, Nash, Selten, Aumann, Schelling, Roth, Shapley;
- Auction Theory: Milgrom, Wilson;
- National Income Accounts: Stone;
- General Equilibrium Theory: Hicks, Arrow, Debreu;
- Partial and General Equilibrium Theory: Samuelson, Allais;
- Economic Growth Theory: Solow, Nordhaus, Romer, Mokyr, Aghion, Howitt;
- Economic Growth and Economic History: Kuznets, Acemoglu, Johnson, Robinson;
- Input-Output Analysis: Leontief;
- Theory of Optimal Allocation of Resources: Koopmans, Kantorowicz;
- Theory of Institutions: Coase;
- Economic Governance: Ostrom, Williamson;
- Contract Theory: Hart, Holmstrom;
- Banking: Bernanke, Diamond, Dybvig.

It should be also mentioned that some prizes can be classified as related to more than one area.

The following conclusions can be drawn from this systematisation:

- The areas in which the most prizes were awarded are: Macroeconomics, Econometrics and Finance.
- There are some non-mainstream areas, recognised as worthy of awards, for example: Economics of Information, Auction Theory, Contract Theory.
- Apart from purely theoretical achievements, some prizes (especially in the last 15 years) were awarded for the widely applied achievements (or even those practice-driven), for example: Game Theory, Auction Theory, Welfare Economics, with the arguments for awarding those supported by their practical usefulness.
- Some achievements were of interdisciplinary character, for example: Economic Psychology, Economic Governance.

Additional conclusions can be drawn from the list of laureates.

Firstly, the list shows a dominance of professors employed at American universities. Below the author presents a ranking of the number of laureates coming from leading universities (at least four laureates from a given institution at the time when the prize was awarded are listed):

- University of Chicago – 15;
- Massachusetts Institute of Technology – 10;
- Harvard University – 9;
- Princeton University – 7;
- University of California Berkeley – 6;
- Stanford University – 5;
- Yale University, New York University, Columbia University, University of Cambridge – 4.

To sum up, out of ninety-nine laureates, eighty-three were from US universities, fifteen from European universities, and one from Israel.

One of the laureates, Professor Reinhard Selten, born in 1930 in Wrocław (Doctor honoris causa of Wrocław University in Economics and Business), received the Nobel Memorial Prize in 1994 (together with John Nash and John Harsanyi) for “their pioneering analysis of equilibria in the theory of non-cooperative games”.

It is worth mentioning that as a rule, a long period of time (sometimes more than a quarter of a century) passes between the time of key publications by Nobel laureates and the year the prize is awarded. The same occurred this year, as the main publications of this year’s laureates were released in the first half of the 1990s.

Since the start of this century, an increasing number of awarded achievements have pertained to practical issues, and these achievements have had a direct impact on the functioning of the economy and society. On the one hand, these achievements are supported by empirical research, whilst on the other, they are classified as descriptive economics (rather than normative economics).

The achievements of recent years contain many indications for policymakers regarding decisions in areas such as economic and social policy. One of the best examples is the 2019 Prize, awarded to Abhijit Banerjee, Esther Duflo and Michael Kremer, for “their experimental approach to alleviating global poverty”. It is only appropriate to express regret that in some countries, policymakers (especially politicians) do not want to follow the guidance of science.

The prizes awarded in this century indicate that economic sciences (which is the name of the prize) are becoming increasingly interdisciplinary and include references to other disciplines (psychology, sociology, etc.).

3. The Nobel Memorial Prize in Economic Sciences in 2025 – technology and economic growth

This year, the announcement of the awarding of the next, already the fifty-seventh, Alfred Nobel Memorial Prize in Economic Sciences (the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel), commonly referred to as the Nobel Prize in Economics, took place on 13 October 2025. It was awarded to:

- Joel Mokyr (Northwestern University, Evanston, and Tel Aviv University) – half of the prize;
- Philippe Aghion (Collège de France, Paris, INSEAD, Paris, and London School of Economics and Political Science) – quarter of the prize;
- Peter Howitt (Brown University, Providence) – quarter of the prize.

The official statement contains the overall justification for the prize as “having explained innovation-driven economic growth”.

The detailed justifications were as follows:

- regarding Joel Mokyr: “identifying the conditions necessary for sustained growth through technological progress”;
- regarding Philippe Aghion and Peter Howitt: “the theory of sustained growth through creative destruction”.

Joel Mokyr was born in 1946 in Leiden (the Netherlands), and received his PhD degree from Yale University in 1974. Philippe Aghion was born in 1956 in Paris, with his PhD from the Sorbonne in 1983 and from Harvard in 1987. Peter Howitt was born in 1946 in Canada, and was granted his PhD in Northwestern University in 1973.

The fact that this year’s award was given for the connection between economic growth and innovation is not accidental – it is, in a sense, a classic issue. It is worth remembering that one of the laureates of the 2018 award (the 50th one) was Paul Romer, whose key achievement is the theory of endogenous growth. This demonstrates how knowledge can serve as a driving factor for long-term economic growth, whilst the earlier macroeconomic research emphasised technological innovations as the main factor of economic growth. Romer showed how economic forces stimulate the willingness of firms to create innovative ideas and innovations. His research analysed how technological changes occur in a market economy over the long term, and he is the author of the theory of endogenous growth, which examines knowledge as a factor that stimulates economic growth. The theory was formulated in 1990 in the article *Endogenous technological change* (Romer, 1990), which studied two criteria for classifying different assets. The first was the rivalry criterion – referring to the use of a particular asset by one entity which excludes its use by another entity; examples included machinery and labour. In contrast, ideas which create technological innovations can be used by multiple entities simultaneously and therefore do not compete, hence the second criterion was the possibility of excluding the use of assets. This means that the use of an idea can be reserved for a specific entity; examples included patents and copyrights.

Romer pointed out the market conditions necessary for the creation of ideas to be possible, captured in the five characteristics of the introduced endogenous growth model:

- the accumulation of ideas is a source of long-term economic growth;
- ideas are non-rival goods (many entities can use them);
- a larger stock of ideas facilitates the discovery of new ideas;
- generating ideas is costly but purposeful;
- the owner of an idea can sell the right to apply the idea in practice at the market price.

Romer’s introduction of the endogenous growth model allows for the explanation of differences in the economic growth rates of various countries, which implies that the convergence theory does not fully

operate. Differences in the level of economic development can be reduced through the positive effect of technology diffusion.

There is also the second argument in favour of choosing the area of research from which achievements were awarded. We are now in a period of the most dynamic technological development, particularly in the field of artificial intelligence, which gives rise to the belief that this will promote faster economic growth. The achievements of this year's Nobel laureates may provide answers to this question, in particular whether these innovations do indeed drive economic growth, as stated in the justification for the award. Moreover, these achievements will allow us to answer two questions that also appeared in the award's rationale, namely:

1. What are the conditions necessary for sustainable growth through technological progress?
2. Which theory can explain the occurrence of sustainable growth?

The answer to the first question was found in the research of Joel Mokyr. His two most important books are: *The Lever of Riches: Technological Creativity and Economic Progress* (Mokyr, 1990) and *The Gifts of Athena: Historical Origins of the Knowledge Economy* (Mokyr, 2002). He used historical sources to indicate the causes of sustained (and thus long-lasting) economic growth. His research showed that maintaining the innovation process requires not only knowledge of how an innovation works (referred to as prescriptive knowledge), but also knowledge of why it works that way (referred to as propositional knowledge), and justified the importance of society that must be open to innovative ideas and allow for change.

Mokyr's idea, which states that one must understand why an innovative solution works, clearly also applies to artificial intelligence, especially generative artificial intelligence (Gen AI), such as large language models. Everyone is fascinated by the fact that this tool works, yet very few – if anyone at all – can explain why this tool works (see the search for explainable artificial intelligence – Explainable AI).

The answer to the second question can be found in the research of Philippe Aghion and Peter Howitt. The key publication was the article by the two Nobel laureates entitled "A model of growth through creative destruction" (Aghion, & Howitt, 1992), published in the journal *Econometrica*, where they presented a mathematical model for the so-called creative destruction: when a new and better product enters the market, companies selling older products lose out. Innovation represents something new, and therefore it is creative. It is also destructive because the company producing outdated products may disappear from the market. It is important that these outdated entities do not block innovation that is disadvantageous to them, and for this to happen, an open society is needed.

One example of blocking innovation is protectionism, the introduction of tariffs, and limiting competition (unfortunately quite common in the world today), which makes it difficult to disseminate innovations that promote economic growth and, consequently, an increase in prosperity.

It is worth noting that the concept of creative destruction already appeared with Schumpeter in his work *Capitalism, Socialism and Democracy* (Schumpeter, 1942).

At the end of the justification presented during the broadcast of the award announcement, three pillars of sustainable growth were formulated: innovations based on scientific research, creative destruction, and a society open to change.

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