Supplementary Information

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S1 Data description

S1.1 American Physical Society dataset

The American Physical Society (APS) dataset consists of all papers published by journals of American Physical Society between 1893 and 2009 (Table S1). The dataset contains $463,348$ papers, $4,710,547$ citations, and $248,738$ authors.

S1.2 Web of Science dataset

Web of Science (WOS) dataset contains all papers indexed by Thomson Reuters between 1955 and 2012. The dataset contains $37,553,657$ papers, $672,321,250$ citations, and $8,724,394$ authors. The dataset offers comprehensive information for the study of credit allocation, containing papers from most research fields. This enables us to evaluate the robustness of our method by applying it to papers in different fields.

S1.3 Author name disambiguation

In the two datasets, the same author could be encoded by different forms of their name. For example, the last author of this paper published papers under the names Albert-László Barabási and A. L. Barabási. Moreover, different authors could have the same first and last name. A detailed study of author name disambiguation is beyond the scope of this paper. Here we identify and distinguish authors by combining the last name with initial letters of

Table S1: Basic statistics of dataset.

Journal	#Papers	#Citations	Period
Physical Review (Series I)	1,469	668	1893-1912
Physical Review	47,941	590,665	1913-1969
Physical Review A	53,655	418,196	1970-2009
Physical Review B	137,999	1,191,515	1970-2009
Physical Review C	29,935	202,312	1970-2009
Physical Review D	56,616	526,930	1970-2009
Physical Review E	35,944	154,133	1993-2009
Physical Review Letters	95,516	1,507,974	1958-2009
Review of Modern Physics	2,926	115,697	1929-2009
Physical Review Special Topics - Accelerators and Beams	1,257	2,457	1998-2009
Physical Review Special Topics - Physics Education Research	90	0	2005-2009
Total	463,348	4,710,547	1893-2009

the first and middle names into an identifier of each author. For example, the authors of this paper are denoted as "Shen, HW" and "Barabási, AL" respectively. This simple method behaves well for the credit allocation study since we only need to disambiguate authors in the references of one paper rather than in the whole dataset. Indeed, this disambiguation method is also adopted by both the American Physical Society (publish.aps.org/search) and Web of Science (www.webofknowledge.com) for searching papers with author names as input.

S2 Methods

In the main text, for clarity, we describe our method with one basic credit allocation matrix and the standard co-citation strength. Here we first offer a pseudocode-like description of our algorithm, and then discuss some possible extensions of the credit allocation matrix and the co-citation strength, allowing us to incorporate exogenous information, like authors' positions or their role in the author list. Finally, we discuss the comparison of authors with or without collaboration.

S2.1 Credit allocation algorithm

For clarity, we offer a pseudocode-like description of our algorithm. Given a paper p_0 with m coauthors $\{a_i\}$ $(1 \leq i \leq m)$, we denote with $\mathcal{D} \equiv \{d_1, d_2, \cdots, d_l\}$ all papers that cite p_0, and with $\mathcal{P} \equiv \{p_0, p_2, \cdots, p_n\}$ all co-cited papers, i.e., the set of papers cited by papers in the set $\mathcal{D}$, and with s_j the co-citation strength between p_0 and p_j $(0 \leq j \leq n)$.

Our algorithm consists of the following steps:

1. Collect all papers $\mathcal{D}$ that cite p_0, defining the topic of p_0;

2. Find the co-cited papers $\mathcal{P}$ that are cited together with p_0;

3. Calculate the similarity s_j between each co-cited paper p_j and the target paper p_0 using their co-citation strength, i.e., the number of times they are cited together;

4. Construct a credit allocation matrix A according to the author list of all co-cited papers (see Section 2.2 for details);

5. Obtain the credit share $c = As$ and normalize it.

S2.2 Credit allocation matrix

In theory, any author-list based credit allocation algorithm could be used to offer a prior credit share for our method via altering credit allocation matrix. We describe five priors for constructing the credit allocation matrix $\mathbf{A}$. Considering a paper p_j with n_j authors $\{a_i\}$ $(1 \leq i \leq n_j)$, the details of these priors are:

- *Count prior* [2]: Each author of paper p_j gets one credit. The credit that author a_i gets from paper p_j is

$$A_{ij} = 1. \tag{S1}$$

- *Fractional prior* [3]: All authors of paper p_j equally share one credit, i.e.,

$$A_{ij} = \frac{1}{n_j}. \tag{S2}$$

- *Harmonic prior* [1]: All authors of paper p_j share one credit, where the share of the ith author is proportional to the reciprocal of its rank in the author list. In this case we have

$$A_{ij} = \frac{\frac{1}{i}}{\sum_{k=1}^{n_j} \frac{1}{i}}. \tag{S3}$$

- *Axiomatic prior* [5]: All authors of paper p_j share one credit, when lacking exogenous information, in the following way

$$A_{ij} = \frac{1}{n_j} \sum_{k=i}^{n_j} \frac{1}{k}. \tag{S4}$$

  Axiomatic credit can be extended to incorporate other exogenous information about each author's role. Yet, in this paper the axiomatic prior is used as an alternative way of allocating credit according to author rank like the harmonic prior, hence we do not consider exogenous information in the axiomatic prior.

- *Zhang's prior* [6]: The total credit of all authors is 3. The first author and corresponding author each get one credit. The remaining authors are ranked according to their position in the author list, so that author with rank i $(1 \leq i \leq n_j - 2)$ gets credit

$$A_{ij} = \frac{2(n_j - i)}{(n_j + 1)(n_j - 2)}. \tag{S5}$$

  In this paper we take the last author as corresponding author when no corresponding author information is available.

For example, consider the 2007 Nobel prize-winning paper "D. M. Meekhof, C. Monroe, B. E. King, W. M. Itano, D. J. Wineland. Generation of nonclassical motional states of a trapped atom. Phys Rev Lett 76:1796–1799, 1996", where the last author is viewed as the corresponding author without explicit exogenous information. Hence the corresponding column of the credit allocation matrix is $[1,1,1,1,1]^T$ for the count-based method, $[0.2,0.2,0.2,0.2,0.2]^T$ for the fractional method, $[0.438,0.219,0.146,0.109,0.088]^T$ for the harmonic method, $[0.457,0.257,0.157,0.090,0.040]^T$ for the axiomatic method , and $[1.000,0.444,0.333,0.222,1.000]^T$ for Zhang's method.

Table S2: **Credit Share obtained by our method with different priors.** Credit share is computed according to Eqs. (1) and (2) in the awarding year of each paper. Coauthors are shown according to their position in the author list, with Nobel laureates colored in red. The maximum credit share is highlighted in bold.

Paper	**Authors**	**Credit Share with different priors**				
		Count	Fractional	Harmonic	Axiomatic	Zhang
Science 306, 666 (2004)	K. S. Novoselov	**0.200**	**0.244**	**0.383**	**0.352**	**0.357**
	A. K. Geim	**0.203**	**0.253**	**0.277**	**0.300**	**0.254**
	S. V. Morozov	0.132	0.111	0.115	0.137	0.073
	D. Jiang	0.123	0.102	0.077	0.092	0.048
	Y. Zhang	0.075	0.064	0.051	0.055	0.035
	S. V. Dubonos	0.089	0.075	0.035	0.029	0.019
	I. V. Grigorieva	0.089	0.075	0.033	0.025	0.017
	A. A. Firsov	0.090	0.075	0.028	0.010	0.197
J. Am. Chem. Soc. - Chem. Comm. 16, 578 (1977)	H. Shirakawa	**0.188**	**0.187**	**0.290**	**0.311**	**0.233**
	E. J. Louis	0.124	0.110	0.119	0.145	0.067
	A. G. MacDiarmid	**0.250**	**0.252**	**0.193**	**0.183**	**0.249**
	C. K. Chiang	0.135	0.123	0.170	0.167	0.115
	A. J. Heeger	**0.303**	**0.329**	**0.228**	**0.194**	**0.336**
Nature 362, 318 (1993)	T. Sollner	0.129	0.111	0.284	0.291	0.227
	S. W. Whitehart	0.088	0.067	0.099	0.123	0.047
	M. Brunner	0.114	0.090	0.085	0.105	0.051
	H. Erdjumentbromage	0.090	0.068	0.051	0.060	0.032
	S. Geromanos	0.099	0.074	0.045	0.046	0.027
	P. Tempst	0.106	0.079	0.041	0.032	0.021
	J. E. Rothman	**0.374**	**0.511**	**0.394**	**0.343**	**0.596**

Table S3: **Accuracy of the proposed algorithm with different priors.** The accuracy is based on the results obtained by applying our algorithm with different priors on all multi-author Nobel prize-winning papers for three disciplines. Results are based on the Web of Science dataset.

Disciplines	Priors				
	Count	Fractional	Harmonic	Axiomatic	Zhang
Physics	76%	76%	52%	44%	68%
Chemistry	71%	83%	67%	67%	88%
Medicine	86%	86%	43%	36%	100%
Overall	76%	81%	56%	51%	82%

Next we illustrate the influence of the allocation matrix on the predictive power of our method. As shown in Table S2, for most case, our method correctly identifies the laureates from the author list, no matter which allocation matrix is used. Moreover, we want to clarify that allocation matrix acts as a prior for the credit share of coauthors when no citation arrives, which is then modulated by the collective process of our credit allocation method. For example, the fractional prior evenly assigns credit to all coauthors; the harmonic and the axiomatic priors assign high credit to top-ranked authors.

To systematically compare the five priors, we apply our method with different priors to all multi-author papers in three disciplines. In Table S3 we summarize the results of each prior separately for the three Nobel-awarding disciplines. In this table, Zhang's prior incorporates the corresponding author information, while the harmonic and axiomatic priors prefer the first author, and the count and fractional priors do not depend on the rank of authors. We find that when we incorporate the corresponding author information, usually the last author in Medicine and Chemistry, the accuracy increases. But for many cases such information is not available (in this case, we take the last author as the corresponding author). Overall, for a discipline-independent method for credit allocation, the fractional credit allocation matrix, which does not depend on the order of authors in the author list, offers the highest accuracy. Yet, the improved performance of Zhang's prior for Medicine and Chemistry indicates not only that if more contextual or exogenous information is available, our method can absorb that, but also that such information can improve the predictive power.

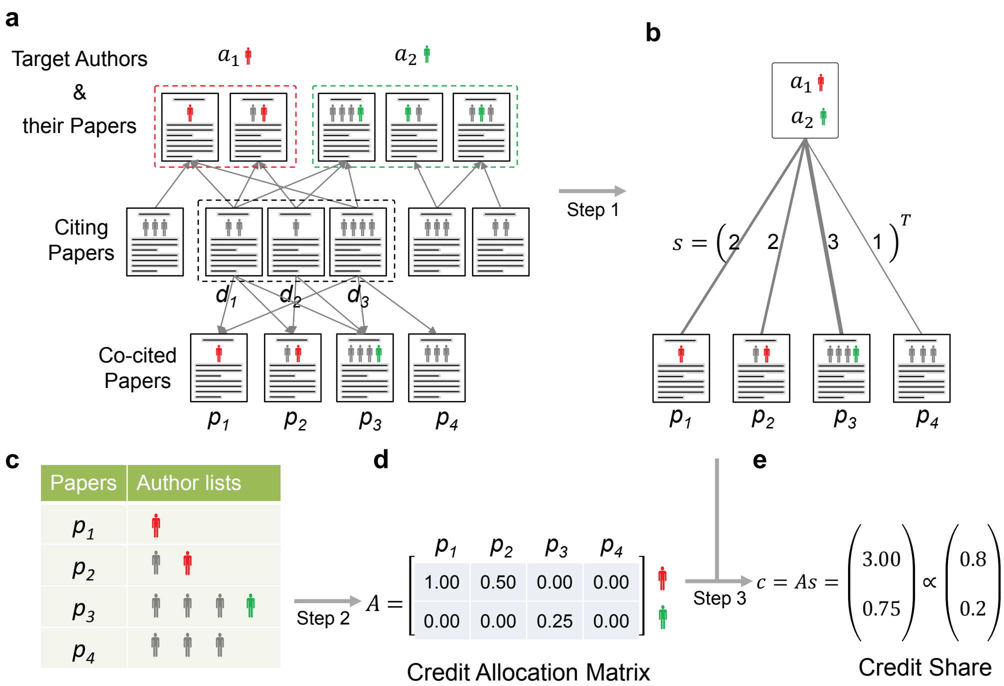

Figure S1: **Comparing independent authors.** **a**, Compared authors a_1 and a_2 colored in red and green respectively and their papers. We denote with $\mathcal{D} \equiv \{d_k : 1 \leq k \leq 3\}$ the set of papers that simultaneously cite at least one paper of each compared author, and denote with $\mathcal{P} \equiv \{p_j : 1 \leq j \leq 4\}$ the co-cited papers that are cited by the citing papers in $\mathcal{D}$. **b**, The co-citation network constructed from **a**, where links connect the set of compared authors and their co-cited papers, with the weights of links denoting the co-citation strength s between the four co-cited papers and the set of compared authors. **c**, The author lists of the co-cited papers. **d**, The credit allocation matrix A obtained from the author lists of co-cited papers in **c**. The matrix A provides for each co-cited paper the authors' share. For example, since p_1 has a_1 as the sole author but it lacks the author a_2, it votes 1.0 for author a_1 and 0.0 for author a_2. **e**, With the matrix A and co-citation strength s, the credit share of the two compared authors is computed according to Eq. (1) with a normalization.

S2.3 Extended co-citation strength

Co-citation strength between two papers is defined as the number of papers that cite these two papers together [4]. This definition assumes that all citing papers are equally important regarding the calculation of co-citation strength. Yet, the definition of co-citation strength can be extended by incorporating exogenous information about citing papers. Specifically, we can assign each citing paper a weight to reflect how important this citing paper is when calculating co-citation strength. For example, if a citing paper is a survey paper that cites many papers together, its weight could be low; if a citing paper is a highly-cited paper, reflecting its high impact in the community, its weight could be high.

The method allows us to incorporate other types of exogenous information.

S2.4 Comparing independent authors

Our algorithm is not limited to determining the collective credit share of coauthors of a joint publication, but can also be used to compare authors that are in the same research field but may not have written research papers together. In this case, the co-citation strength is based on papers which simultaneously cite at least one paper of each compared author (Figure S1). The papers that cite at least one paper of each author of interest automatically identify the common research field of the compared authors. In this way the credit share of the compared authors is based on their common research field, offering a common ground to compare independent authors.

We made an effort to systematically identify cases where Nobel laureates could be compared with those who did not get the prize but had significant contributions to the Nobel-winning topic. However, the Nobel Foundation restricts disclosure of information about the nominations, whether publicly or privately, for 50 years (www.nobelprize.org). We could illustrate the proposed algorithm on the six candidates of the 2013 Nobel prize in Physics because it was well publicized that six scientists contributed to the discovery, offering an excellent case to validate our algorithm.

Next we turn to apply our algorithm to the cases discussed at http://en.wikipedia.org/wiki/Nobel_Prize_controversies, offering information on non-laureates with significant perceived contributions to the prize-winning discovery. Our method offers a natural way to compare the involved researchers, capturing the community's perception of their contribution. We discuss several such cases next:

- **2005 Nobel prize in Physics.** Half of the prize was awarded to R. J. Glauber "for his contribution to the quantum theory of optical coherence" [7], who, however, built on Sudarshan's work [8]. This contribution is widely known as Sudarshan–Glauber representation in the community. Yet Sudarshan was sidelined by the Nobel committee. We apply our method to compare these two researchers (Fig. S2a), finding that Glauber gets two third of the credit share while Sudarshan gets the remaining one third, indicating that the community has assigned the credit to the laureate Glauber, consistent with the Nobel committee's decision.

- **2008 Nobel prize in Chemistry.** The 2008 prize was awarded to O. Shimomura, M. Chalfie and R. Y. Tsien

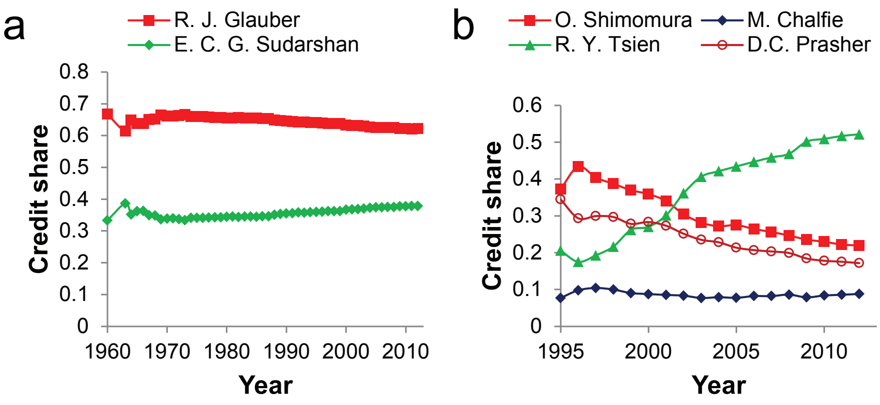

Figure S2: **Comparing laureates with non-laureates.** **a**, The credit share of the laureate R. J. Glauber and a non-laureate researcher E. C. G. Sudarshan who is believed to have significant contribution to the prize-winning discovery by the community. **b**, The credit share when three laureates (O. Shimomura, M. Chalfie, and R. Y. Tsien) and a non-laureate researcher D. C. Prasher who is believed to have significant contribution to the prize-winning work by the community.

for their work on green fluorescent protein or GFP. However, D. Prasher was the first to clone the GFP gene and suggested its use as a biological tracer. Prasher's accomplishments were not recognized and he eventually left science. When the Nobel was awarded in 2008, Prasher was working as a courtesy shuttle bus driver in Huntsville, Alabama. We apply our method to measure the credit share of the four researchers (Fig. S2b). We find that the community assigns credit for the discovery recognized by the 2008 Nobel Chemistry prize to Shimomura, Prasher, and Tsien, in this order, given that the prize could be shared by a maximum of three individuals. M. Chalfie is only the forth based on our prediction. As the third Nobelist, he once stated that "Douglas Prasher's work was critical and essential for the work we did. They could have easily given the prize to Douglas and the other two and left me out." His feeling is fully consistent with the community's assessment of where the credit goes.

In general, it is tricky to answer "what is the appropriate way to compare independent authors". Indeed, there are two ways to define the research field for comparing independent authors: (1) All papers that cite either the papers of A or the papers of B. This method is a simple citation count of the two authors, and is topic-independent. This is what we do when we make statements like "A is better cited than B". (2) All papers that simultaneously cite at least one paper of A and at least one paper of B. This second approach, adopted in this paper, automatically identifies the

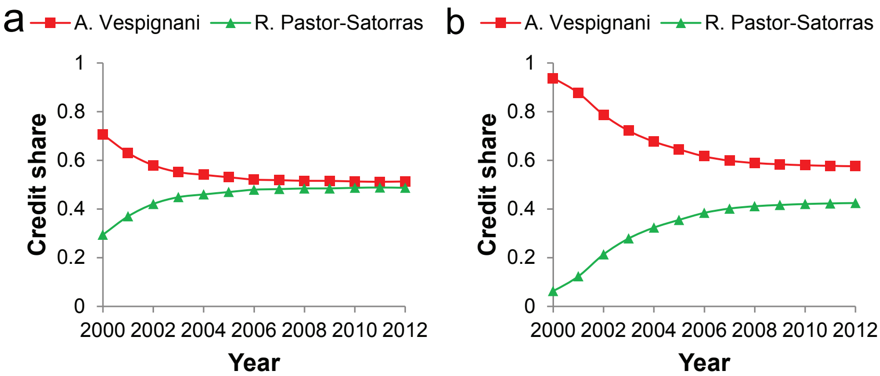

Figure S3: **Comparing two network scientists. a**, The obtained credit share when the co-citation strength is based on the papers that simultaneously cite at least one paper of both authors (i.e., papers that simultaneously cite a paper by Vespignani and a paper by Pastor-Satorras) **b**, The obtained credit share when the co-citation strength is based on the citing papers which cite at least one paper of either author (Hence they do not need to cite Vespignani and Pastor-Satorras in the same paper, a citation to Vespignani or Pastor-Satorras is sufficient).

common research field of authors A and B, hence offering a common ground to compare authors A and B based on their relative contributions to their common research field.

To illustrate the difference between (1) and (2), we selected an area that we are familiar with, choosing two network scientists – A. Vespignani and R. Pastor-Satorras. A. Vespignani is best known for his work on complex networks and epidemic spreading, to which R. Pastor-Satorras also has important contributions. As shown in Fig. S3, A. Vespignani and R. Pastor-Satorras have comparable credit share when the co-citation strength is based on the papers that jointly cite at least one paper of each of them, defining their common research topic — epidemic spreading, i.e., method (2). In contrast, Vespignani gets a higher credit share when the co-citation strength is based on the papers that cite either the paper of each of them, i.e., a pure citation count, or method (1).

S3 Results

S3.1 Comparison with baseline methods

We now compare our method to three existing credit allocation methods, including Harmonic, Axiomatic, and Zhang's method (Table S4). The Harmonic method assigns the highest credit share to the first author, while Axiomatic and Zhang's method assign equal credit share to the first author and corresponding author (if available and is not the first author). These methods always fail for the Nobel prize-winning papers when the laureates are not the first or the corresponding authors. In contrast, our discipline-independent method offers a robust way to assign the highest credit share to laureates no matter where they are in the author list.

Table S4: **Comparison with existing methods.** Existing methods compute credit share of coauthors according to the author list of publications. These methods all allocate the highest credit share to the first author, while axiomatic and Zhang's method give equal credit share to the first author and corresponding author (if available and is not the first author, denoted by '*'). Coauthors are shown according to their position in the author list, with Nobel laureates colored in red. The top credit share is highlighted in bold.

Paper	Authors	Credit Share obtained from different methods			
		Harmonic	Axiomatic	Zhang's method	Our method
Phys. Rev. Lett. 77, 4887 (1996)	M. Brune	**0.368**	**0.340**	**1.000**	0.191
	E. Hagley	0.184	0.215	0.229	0.087
	J. Dreyer	0.123	0.152	0.200	0.077
	X. Maître	0.092	0.111	0.171	0.080
	A. Maali	0.074	0.079	0.143	0.077
	C. Wunderlich	0.061	0.054	0.114	0.081
	J. M. Raimond	0.053	0.033	0.086	0.195
	S. Haroche	0.046	0.016	0.057	**0.212**
Phys. Rev. Lett. 76, 1796 (1996)	D. M. Meekhof	**0.438**	**0.457**	**1.000**	0.180
	C. Monroe	0.219	0.257	0.357	0.225
	B. E. King	0.146	0.157	0.286	0.198
	W. M. Itano	0.109	0.090	0.214	0.170
	D. J. Wineland	0.088	0.040	0.143	**0.227**
Science 306, 666 (2004)	K. S. Novoselov	**0.368**	**0.245**	**1.000**	**0.244**
	A. K. Geim*	**0.184**	**0.245**	**1.000**	**0.253**
	S. V. Morozov	0.123	0.174	0.242	0.111
	D. Jiang	0.092	0.126	0.212	0.102
	Y. Zhang	0.074	0.091	0.182	0.064
	S. V. Dubonos	0.061	0.062	0.121	0.075
	I. V. Grigorieva	0.053	0.038	0.121	0.075
	A. A. Firsov	0.046	0.018	0.091	0.075
Phys. Rev. Lett. 61, 2472 (1988)	M. N. Baibich	**0.353**	**0.314**	**1.000**	0.095
	J. M. Broto	0.177	0.203	0.205	0.093
	A. Fert	0.118	0.148	0.182	**0.224**
	F. Nguyen Van Dau	0.088	0.111	0.159	0.095
	F. Petroff	0.071	0.083	0.136	0.114
	P. Etienne	0.059	0.061	0.114	0.092
	G. Creuzet	0.050	0.042	0.091	0.100
	A. Friederich	0.044	0.026	0.068	0.094
	J. Chazelas	0.039	0.012	0.045	0.093

S3.2 Results on Nobel prize-winning papers

We apply our method to Nobel prize-winning papers to explore whether Nobel Laureates get more credit share than their coauthors. We collected all Nobel prize-winning papers in Physics (1995–2013), Chemistry (1998–2013), Medicine (2006–2013), and Economics (1995–2013), since the Nobel committee started offering a detailed explanation with references for the prize. Tables S5-S8 show the credit share of coauthors for the Nobel prize-winning papers before the year the Nobel prizes were awarded. In most cases, Nobel laureates have the largest credit share in these prize-winning papers, no matter whether they are the first author or ranked in other positions in the author list.

Table S5: Credit share for Nobel prize-winning papers in Physics. Credit share is computed according to Eqs. [1] and [2] with respect to the year (the first column) when the prize was awarded. For each paper, authors are ranked according to their positions in the author list, with their credit share being shown in parenthesis. Nobel laureates are colored in red, and the author with top credit share is highlighted in bold.

Year	Paper	Authors (credit)	
2013	Phys. Rev. Lett. 13, 508 (1964)	P. W. Higgs (**1.000**)	
2013	Phys. Rev. Lett. 13, 321 (1964)	F. Englert (**0.506**)	R. Brout (0.494)
2012	Phys. Rev. Lett. 77, 4887 (1996)	M. Brune (0.204)	E. Hagley (0.074)
		J. Dreyer (0.065)	X. Maître (0.068)
		A. Maali (0.073)	C. Wunderlich (0.069)
		J. M. Raimond (0.212)	S. Haroche (**0.236**)
2012	Phys. Rev. Lett. 76, 1796 (1996)	D. M. Meekhof (0.160)	C. Monroe (0.198)
		B. E. King (0.173)	W. M. Itano (0.200)
		D. J. Wineland (**0.270**)	

Table S5: Credit share for Nobel prize-winning papers in Physics (continued)

Year	Paper	Authors (credit)	
2011	Astrophys. J. 517, 565 (1999)	S. Perlmutter (0.060)	G. Aldering (0.032)
		G. Goldhaber (0.028)	R. A. Knop (0.024)
		P. Nugent (0.038)	P. G. Castro (0.019)
		S. Deustua (0.021)	S. Fabbro (0.027)
		A. Goobar (0.042)	D. E. Groom (0.027)
		I. M. Hook (0.027)	A. G. Kim (0.029)
		M. Y. Kim (0.023)	J. C. Lee (0.021)
		N. J. Nunes (0.033)	R. Pain (0.034)
		C. R. Pennypacker(0.025)	R. Quimby (0.022)
		C. Lidman (0.028)	R. S. Ellis (0.043)
		M. Irwin (0.020)	R. G. McMahon (0.026)
		P. Ruiz-Lapuente (0.031)	N. Walton (0.023)
		B. Schaefer (0.023)	B. J. Boyle (0.024)
		A. V. Filippenko (**0.116**)	T. Matheson (0.032)
		A. S. Fruchter (0.023)	N. Panagia (0.034)
		H. J. M. Newberg (0.021)	W. J. Couch (0.023)

Table S5: Credit share for Nobel prize-winning papers in Physics (continued)

Year	Paper	Authors (credit)	
2011	Astron. J. 116, 1009, 1998	A. G. Riess (**0.084**)	A. V. Filippenko (**0.102**)
		P. Challis (0.047)	A. Clocchiatti (0.037)
		A. Diercks (0.030)	P. M. Garnavich (0.038)
		R. L. Gilliland (0.032)	C. J. Hogan (0.037)
		S. Jha (0.050)	R. P. Kirshner (0.076)
		B. Leibundgut (0.067)	M. M. Phillips (0.073)
		D. Reiss (0.030)	B. P. Schmidt (0.045)
		R. A. Schommer (0.044)	R. C. Smith (0.039)
		J. Spyromilio (0.038)	C. Stubbs (0.033)
		N. B. Suntzeff (0.058)	J. Tonry (0.041)
2010	Science 306, 666 (2004)	K. S. Novoselov (**0.244**)	A. K. Geim (**0.253**)
		S. V. Morozov (0.111)	D. Jiang (0.102)
		Y. Zhang (0.064)	S. V. Dubonos (0.075)
		I. V. Grigorieva (0.075)	A. A. Firsov (0.075)
2009	Proc. Inst. Electr. Eng. 113, 1151 (1966)	K. C. Kao (**0.536**)	G. A. Hockham (0.464)
2009	Bell Syst. Tech. J. 49, 587 (1970)	W. S. Boyle (**0.436**)	G. E. Smith (**0.564**)
2008	Phys. Rev. 122, 345 (1961)	Y. Nambu (**0.544**)	G. Jona-Lasinio (0.456)
2008	Prog. Theor. Phys. 49, 652 (1973)	M. Kobayashi (**0.499**)	T. Maskawa (**0.501**)
2007	Phys. Rev. Lett. 61, 2472 (1988)	M. N. Baibich (0.094)	J. M. Broto (0.090)
		A. Fert (**0.242**)	F. Nguyen Van Dau (0.093)
		F. Petroff (0.114)	P. Etienne (0.089)
		G. Creuzet (0.097)	A. Friederich (0.091)
		J. Chazelas (0.090)	

Table S5: Credit share for Nobel prize-winning papers in Physics (continued)

Year	Paper	Authors (credit)	
2007	Phys. Rev. Lett. 57, 2442 (1986)	P. Grünberg (**0.347**)	R. Schreiber (0.169)
		Y. Pang (0.161)	M. B. Brodsky (0.164)
		H. Sowers (0.159)	
2006	Astrophys. J. 354, L37 (1990)	J. C. Mather (0.078)	E. S. Cheng (0.054)
		R. E. Eplee (0.029)	R. B. Isaacman (0.028)
		S. S. Meyer (0.051)	R. A. Shafer (0.042)
		R. Weiss (0.056)	E. L. Wright (**0.092**)
		C. L. Bennett (0.051)	N. W. Boggess (0.039)
		E. Dwek (0.027)	S. Gulkis (0.039)
		M. G. Hauser (0.041)	M. Janssen (0.033)
		T. Kelsall (0.040)	P. M. Lubin (0.037)
		S. H. Moseley (0.038)	T. L. Murdock (0.033)
		R. F. Silverberg (0.042)	G. F. Smoot (0.065)
		D. T. Wilkinson (0.084)	

Table S5: Credit share for Nobel prize-winning papers in Physics (continued)

Year	Paper	Authors (credit)	
2006	Astrophys. J. 360, 685 (1990)	G. Smoot (0.056)	C. Bennett (0.018)
		R. Weber (0.018)	J. Maruschak (0.018)
		R. Ratliff (0.018)	M. Janssen (0.063)
		J. Chitwood (0.018)	L. Hilliard (0.018)
		M. Lecha (0.018)	R. Mills (0.018)
		R. Patschke (0.018)	C. Richards (0.018)
		C. Backus (0.029)	J. Mather (0.031)
		M. Hauser (0.018)	R. Weiss (**0.109**)
		D. Wilkinson (0.031)	S. Gulkis (0.093)
		N. Boggess (0.020)	E. Cheng (0.037)
		T. Kelsall (0.084)	P. Lubin (0.101)
		S. Meyer (0.049)	H. Moseley (0.018)
		T. Murdock (0.027)	R. Shafer (0.018)
		R. Silverberg (0.018)	E. Wright (0.018)
2005	Phys. Rev. Lett. 10, 84 (1963)	R. J. Glauber(**1.000**)	
2005	Phys. Rev. Lett. 84, 5102 (2000)	S. A. Diddams (0.073)	D. J. Jones (0.053)
		J. Ye (0.099)	S. T. Cundiff (0.021)
		J. L. Hall (**0.147**)	J. K. Ranka (0.096)
		R. S. Windeler (0.117)	R. Holzwarth (0.109)
		T. Udem (0.123)	T. W. Hänsch (**0.162**)
2005	Phys. Rev. Lett. 84, 3232 (2000)	J. Reichert (0.150)	M. Niering (0.054)
		R. Holzwarth (0.185)	M. Weitz (0.081)
		T. Udem (0.209)	T. W. Hänsch (**0.321**)

Table S5: Credit share for Nobel prize-winning papers in Physics (continued)

Year	Paper	Authors (credit)	
2004	Phys. Rev. Lett. 30, 1343 (1973)	D. J. Gross (**0.598**)	F. Wilczek (**0.402**)
2004	Phys. Rev. Lett. 30, 1346 (1973)	H. D. Politzer (**1.000**)	
2003	Sov. Phys. 5, 1174 (1957)	A. A. Abrikosov (**1.000**)	
2003	Phys. Rev. Lett. 29, 1227 (1972)	A. J. Leggett (**1.000**)	
2002	Phys. Rev. Lett. 20, 1205 (1968)	R. Davis (**0.474**)	D. S. Harmer(0.264)
		K. C. Hoffman (0.262)	
2002	Phys. Rev. Lett. 58, 1490 (1987)	K. Hirata (0.033)	T. Kajita (0.047)
		M. Koshiba (0.054)	M. Nakahata (0.044)
		Y. Oyama (0.044)	N. Sato (0.042)
		A. Suzuki (0.045)	M. Takita (0.044)
		Y. Totsuka (**0.060**)	T. Kifune (0.042)
		T. Suda (0.044)	K. Takahashi (0.053)
		T. Tanimori (0.041)	K. Miyano (0.044)
		M. Yamada (0.040)	E. W. Beier (0.041)
		L. R. Feldscher (0.039)	S. B. Kim (0.040)
		A. K. Mann (0.045)	F. M. Newcomer (0.041)
		R. Vanberg (0.040)	W. Zhang (0.041)
		B. G. Cortez (0.036)	
2002	Phys. Rev. Lett. 9, 439 (1962)	R. Giacconi (**0.371**)	H. Cursky (0.296)
		B. B. Rossi (0.160)	F. R. Paolini (0.173)
2001	Science 269, 198 (1995)	D. S. Jin (0.155)	J. R. Ensher (0.194)
		M. R. Matthews (0.186)	C. E. Wieman (**0.229**)
		E. A. Cornell (**0.236**)	

Table S5: Credit share for Nobel prize-winning papers in Physics (continued)

Year	**Paper**	**Authors (credit)**	
2001	Phys. Rev. Lett. 75, 3969 (1995)	K. B. Davis (0.094)	M. O. Mewes (0.137)
		M. R. Andrews (0.082)	N. J. van Druten (0.159)
		D. S. Durfee (0.149)	D. M. Kurn (0.146)
		W. Ketterle (**0.226**)	
2000	IEEE Trans. Electron Devices 23, 648 (1976)	J. S. Kilby (**1.000**)	
2000	Physica Scripta T68, 10 (1996)	H. Kroemer (**1.000**)	
2000	Physica Scripta T68, 32 (1996)	Z. I. Alferov (**1.000**)	
1999	Nucl. Phys. 7, 637 (1968)	M. Veltman (**1.000**)	
1999	Nucl. Phys. 35, 167 (1971)	G. 't Hooft (**1.000**)	
1998	Phys. Rev. Lett. 50, 1395(1983)	R. B. Laughlin (**1.000**)	
1998	Phys. Rev. Lett. 48, 1559 (1982)	D. C. Tsui (**0.369**)	H. L. Stormer (**0.330**)
		A. C. Gossard (0.301)	
1997	Phys. Rev. Lett. 55, 48 (1985)	S. Chu (0.244)	L. Hollberg (0.087)
		J. E. Bjorkholm (0.134)	A. Cable (0.138)
		A. Ashkin (**0.397**)	
1997	Phys. Rev. Lett. 61, 826 (1988)	A. Aspect (0.179)	E. Arimondo (0.213)
		R. Kaiser (0.140)	N. Vansteenkiste (0.137)
		C. Cohen-Tannoudji (**0.331**)	
1997	Phys. Rev. Lett. 61, 169 (1988)	P. D. Lett (0.146)	R. N. Watts (0.149)
		C. I. Westbrook (0.141)	W. D. Phillips (**0.299**)
		P. L. Gould (0.131)	H. J. Metcalf (0.135)

Table S5: Credit share for Nobel prize-winning papers in Physics (continued)

Year	Paper	Authors (credit)	
1996	Phys. Rev. Lett. 28, 885 (1972)	D. D. Osheroff (**0.376**)	R. C. Richardson (**0.306**)
		D. M. Lee (**0.319**)	
1995	Science 124, 103 (1956)	C. L. Cowan (0.229)	F. Reines (**0.389**)
		F. B. Harrison (0.133)	H. W. Kruse (0.124)
		A. D. McGuire (0.125)	
1995	Phys. Rev. Lett. 35, 1489 (1975)	M. L. Perl (**0.065**)	G. S. Abrams (0.032)
		A. M. Boyarski (0.034)	M. Breidenbach (0.030)
		D. D. Briggs (0.013)	F. Bulos (0.026)
		W. Chinowsky (0.030)	J. T. Dakin (0.017)
		G. J. Feldman (0.043)	C. E. Friedberg (0.025)
		D. Fryberger (0.021)	G. Goldhaber (0.030)
		G. Hanson (0.035)	F. B. Heile (0.020)
		B. Jeanmarie (0.017)	J. A. Kadyk (0.032)
		R. R. Larsen (0.031)	A. M. Litke (0.022)
		D. Luke (0.029)	B. A. Lulu (0.018)
		V. Luth (0.033)	D. Lyon (0.017)
		C. C. Morehouse (0.025)	J. M. Paterson (0.031)
		F. M. Pierre (0.024)	T. P. Pun (0.027)
		P. A. Rapidis (0.017)	B. Richter (0.039)
		B. Sadoulet (0.025)	R. F. Schwitters (0.033)
		W. Tanenbaum (0.027)	G. H. Trilling (0.035)
		F. Vannucci (0.029)	J. S. Whitaker (0.028)
		F. C. Winkelmann (0.015)	J. E. Wiss (0.026)

Table S6: **Credit share for Nobel prize-wining papers in Chemistry.** Credit share is computed according to Eqs. [1] and [2] with respect to the year (the first column) when the prize was awarded. For each paper, authors are ranked according to their positions in the author list, with their credit share being shown in parenthesis. Nobel laureates are colored in red, and the author with top credit share is highlighted in bold.

Year	**Paper**	**Authors (credit)**	
2013	J. Am. Chem. Soc. 94, 5612 (1972)	A. Warshel (**0.520**)	M. Karplus (**0.480**)
2013	J. Mol. Biol. 103, 227 (1976)	A. Warshel (**0.764**)	M. Levitt (**0.236**)
2013	Nature 253, 694 (1975)	M. Levitt (**0.565**)	A. Warshel (**0.435**)
2012	Nature 321, 75 (1986)	R. A. F. Dixon (0.058)	B. K. Kobilka (0.075)
		D. J. Strader (0.014)	J. L. Benovic (0.069)
		H. G. Dohlman (0.038)	T. Frielle (0.037)
		M. A. Bolanowski (0.023)	C. D. Bennett (0.015)
		E. Rands (0.032)	R. E. Diehl (0.015)
		R. A. Mumford (0.015)	E. E. Slater (0.015)
		I. S. Sigal (0.055)	M. G. Caron (**0.205**)
		R. J. Lefkowitz (**0.272**)	C. D. Strader (0.064)
2011	Phys. Rev. Lett. 53, 1951 (1984)	D. Shechtman (**0.264**)	I. Blech (0.216)
		D. Gratias (0.267)	J. W. Cahn (0.252)
2010	J. Am. Chem. Soc. 90, 5518 (1968)	R. F. Heck (**1.000**)	
2010	J. Am. Chem. Soc. 98, 6729 (1976)	S. Baba (0.247)	E. Negishi (**0.753**)
2010	Tetrahedron Letters 20, 3437 (1979)	N. Miyaura (0.344)	K. Yamada (0.140)
		A. Suzuki (**0.516**)	

Table S6: Credit share for Nobel prize-winning papers in Chemistry (continued)

Year	Paper	Authors (credit)	
2009	Nature 407, 327 (2000)	B. T. Wimberly (0.124)	D. E. Brodersen (0.127)
		W. M. Clemons (0.134)	R. J. Morgan-Warren (0.099)
		A. P. Carter (0.132)	C. Vonrhein (0.064)
		T. Hartsch (0.075)	V. Ramakrishnan (**0.246**)
2009	Science 289, 905 (2000)	N. Ban (0.161)	P. Nissen (0.167)
		J. Hansen (0.139)	P. B. Moore (**0.280**)
		T. A. Steitz (0.252)	
2009	Cell 102, 615 (2000)	F. Schluenzen (0.079)	A. Tocilj (0.062)
		R. Zarivach (0.093)	J. Harms (0.090)
		M. Gluehmann (0.050)	D. Janell (0.054)
		A. Bashan (0.103)	H. Bartels (0.089)
		I. Agmon (0.080)	F. Franceschi (0.107)
		A. Yonath (**0.192**)	
2008	J. Cell. Comp. Physiol. 59, 223 (1962)	O. Shimomura (**0.417**)	F. H. Johnson (0.406)
		Y. Saiga (0.177)	
2008	Science 263, 802 (1994)	M. Chalfie (0.206)	Y. Tu (0.151)
		G. Euskirchen (0.151)	W. W. Ward (0.229)
		D. C. Prasher (**0.262**)	
2008	Nature 373, 663 (1995)	R. Heim (0.291)	A. B. Cubitt (0.236)
		R. Y. Tsien (**0.473**)	
2007	Surface Science 41, 435 (1974)	H. Conrad (0.227)	G. Ertl (**0.566**)
		E. E. Latta (0.207)	
2006	Science 184, 868 (1974)	R. D. Kornberg (**1.000**)	

Table S6: Credit share for Nobel prize-winning papers in Chemistry (continued)

Year	Paper	Authors (credit)	
2005	J. Am. Chem. Soc. 94, 2538 (1972)	R. H. Grubbs (**0.834**)	T. K. Brunck (0.166)
2005	J. Am. Chem. Soc. 96, 6796 (1974)	R. R. Schrock (**1.000**)	
2004	Proc. Natl. Acad. Sci. 77, 1365 (1980)	A. Ciechanover (**0.245**)	H. Heller (0.155)
		S. Elias (0.079)	A. L. Haas (0.190)
		A. Hershko (**0.331**)	
2004	Proc. Natl. Acad. Sci. 77, 1783 (1980)	A. Hershko (**0.301**)	A. Ciechanover (**0.235**)
		H. Heller (0.137)	A. L. Haas (**0.183**)
		I. A. Rose (0.144)	
2003	Science 256, 385 (1992)	G. M. Preston (0.238)	T. P. Carroll (0.079)
		W. B. Guggino (0.162)	P. Agre (**0.521**)
2003	Science 280, 69 (1998)	D. A. Doyle (0.082)	J. M. Cabral (0.078)
		R. A. Pfuetzner (0.078)	A. L. Kuo (0.089)
		J. M. Gulbis (0.086)	S. L. Cohen (0.094)
		B. T. Chait (0.105)	R. MacKinnon (**0.389**)
2002	Science 246, 64 (1989)	J. B. Fenn (**0.273**)	M. Mann (0.248)
		C. K. Meng (0.179)	S. F. Wong (0.144)
		C. M. Whitehouse (0.156)	
2002	J. Mol. Biol. 182, 295 (1985)	M. P. Williamson (0.097)	T. F. Havel (0.175)
		K. Wüthrich (**0.728**)	
2001	Chem. Comm. 22, 1445 (1968)	W. S. Knowles (**0.506**)	M. J. Sabacky (0.494)

Table S6: Credit share for Nobel prize-winning papers in Chemistry (continued)

Year	Paper	Authors (credit)	
2001	J. Am. Chem. Soc. 102, 7932 (1980)	A. Miyashita (0.084)	A. Yasuda (0.045)
		H. Takaya (0.268)	K. Toriumi (0.052)
		T. Ito (0.057)	T. Souchi (0.078)
		R. Noyori (**0.414**)	
2001	J. Am. Chem. Soc. 102, 5974 (1980)	T. Katsuki (0.398)	K. B. Sharpless (**0.602**)
2000	J. Am. Chem. Soc. - Chem. Comm. 16, 578 (1977)	H. Shirakawa (**0.187**)	E. J. Louis (0.110)
		A. G. MacDiarmid (**0.252**)	C. K. Chiang (0.123)
		A. J. Heeger (**0.329**)	
1999	Science 242, 1645 (1988)	A. H. Zewail (**1.000**)	
1998	Phys. Rev. 140, A1133 (1965)	W. Kohn (**0.566**)	L. J. Sham (0.434)
1998	Theoretica chimica acta 28, 213 (1973)	P. C. Harihara (0.274)	J. A. Pople (**0.726**)

Table S7: **Credit share for Nobel prize-wining papers in Physiology or Medicine.** Credit share is computed according to Eqs. [1] and [2] with respect to the year (the first column) when the prize was awarded. For each paper, authors are ranked according to their positions in the author list, with their credit share being shown in parenthesis. Nobel laureates are colored in red, and the author with top credit share is highlighted in bold.

Year	Paper	Authors (credit)	
2013	Cell 21, 205 (1980)	P. Novick (0.344)	C. Field (0.140)
		R. Schekman (**0.517**)	
2013	Nature 362, 318 (1993)	T. Sollner (0.111)	S. W. Whitehart (0.067)
		M. Brunner (0.090)	H. Erdjumentbromage (0.068)
		S. Geromanos (0.074)	P. Tempst (0.079)
		J. E. Rothman (**0.511**)	
2013	Cell 79, 717 (1994)	M. Geppert (0.068)	Y. Goda (0.067)
		R. E. Hammer (0.046)	C. Li (0.066)
		T. W. Rosahl (0.039)	C. F. Stevens (0.144)
		T. C. Sudhof (**0.569**)	
2012	J. Embryol. Exp. Morph. 10, 622 (1962)	J. B. Gurdon (**1.000**)	
2012	Cell 126, 663 (2006)	K. Takahashi (0.414)	S. Yamanaka (**0.586**)
2011	Science 282, 2085 (1998)	A. Poltorak (0.079)	X. L. He (0.052)
		I. Smirnova (0.056)	M. Y. Liu (0.052)
		C. Van Huffel (0.051)	X. Du (0.072)
		D. Birdwell (0.051)	E. Alejos (0.051)
		M. Silva (0.054)	C. Galanos (0.090)
		M. Freudenberg (0.059)	P. Ricciardi-Castagnoli (0.068)
		B. Layton (0.050)	B. Beutler (**0.214**)

Table S7: Credit share for Nobel prize-winning papers in Physiology or Medicine (continued)

Year	Paper	Authors (credit)	
2011	Cell 86, 973 (1996)	B. Lemaitre (0.219)	E. Nicolas (0.101)
		L. Michaut (0.103)	J. M. Reichhart (0.228)
		J. A. Hoffmann (**0.349**)	
2011	J. Exp. Med. 137, 1142 (1973)	R. M. Steinman (**0.723**)	Z. A. Cohn (0.277)
2010	Nature 227, 1307 (1970)	R. G. Edwards (**0.551**)	P. C. Steptoe (0.298)
		J. M. Purdy (0.150)	
2009	Cell 29, 245 (1982)	J. W. Szostak (**0.376**)	E. H. Blackburn (**0.624**)
2009	Cell 43, 405 (1985)	C. W. Greider (**0.417**)	E. H. Blackburn (**0.583**)
2008	Nature 314, 111 (1985)	E. Schwarz (0.157)	U. K. Freese (0.074)
		L. Gissmann (**0.311**)	W. Mayer (0.072)
		B. Roggenbuck (0.073)	A. Stremlau (0.075)
		H. Z. Hausen (0.239)	
2008	Science 220, 4599 (1983)	F. Barresinoussi (0.100)	J. C. Chermann (**0.109**)
		F. Rey (0.066)	M. T. Nugeyre (0.072)
		S. Chamaret(0.083)	J. Gruest (0.073)
		C. Dauguet (0.076)	C. Axlerblin (0.058)
		F. Vezinetbrun (0.058)	C. Rouzioux (0.081)
		W. Rozenbaum (0.065)	L. Montagnier (**0.159**)
2007	Nature 292, 154 (1981)	M. J. Evans (**0.514**)	M. H. Kaufman (0.486)
2007	Cell 44, 419 (1986)	K. R. Thomas (0.296)	K. R. Folger (0.178)
		M. R. Capecchi (**0.526**)	

Table S7: Credit share for Nobel prize-winning papers in Physiology or Medicine (continued)

Year	Paper	Authors (credit)	
2007	Nature 317, 230 (1985)	O. Smithies (**0.382**)	R. G. Gregg (0.170)
		S. S. Boggs (0.142)	M. A. Koralewski (0.141)
		R. S. Kucherlapati (0.165)	
2006	Nature 391, 806 (1998)	A. Fire (**0.320**)	S. Q. Xu (0.137)
		M. K. Montgomery (0.141)	S. A. Kostas (0.107)
		S. E. Driver (0.106)	C. C. Mello (**0.188**)

Table S8: **Nobel prize-wining papers in Economic sciences.** Prize-winning papers in Economic sciences are either single-author papers, or not contained in the Web of Science dataset. Hence we just list these prize-winning papers.

Year	Paper	Authors (credit)	
2013	International Economic Review 10, 1 (1969)	E. F. Fama M. C. Jensen	L. Fisher R. Roll
2013	Econometrica 50, 1029 (1982)	L. P. Hansen	
2013	American Economic Review 71, 421 (1981)	R. J. Shiller	
2012	Journal of Political Economy 92, 991 (1984)	A. E. Roth	
2012	American Mathematical Monthly 69, 9 (1962)	D. Gale	L. S. Shapley
2011	Journal of Political Economy 84, 207 (1976)	T. J. Sargent	
2011	Econometrica 48, 1 (1980)	C. A. Sims	
2010	Journal of Economic Theory 3, 156 (1971)	P. A. Diamond	
2010	American Economic Review 72, 968 (1982)	D. T. Mortensen	
2010	Journal of Labor Economics 2, 128 (1984)	C. A. Pissarides	
2009	American Economic Review 61, 112 (1971)	O. E. Williamson	
2009	Cambridge University Press, (1990)	E. Ostrom	
2008	American Economic Review 70, 950 (1980)	P. Krugman	

Table S8: Credit share for Nobel prize-winning papers in Economic sciences (continued)

Year	Paper	Authors (credit)	
2007	American Economic Review 63, 1 (1973)	L. Hurwicz	
2007	The Review of Economic Studies 66, 23 (1977)	E. Maskin	
2007	Mathematics of operations research 6, 58 (1981)	R. Myerson	
2006	Economica 34, 254 (1967)	E. S. Phelps	
2005	Annals of Mathematics Study 40, 287 (1959)	R. J. Aumann	
2005	Harvard University Press, (1960)	T. C. Schelling	
2004	Journal of Political Economy 85, 473 (1977)	F. E. Kydland	E. C. Prescott
2003	Econometrica 55, 251 (1987)	R. F. Engle	C. W. J. Granger
2002	Econometrica 47, 263 (1979)	D. Kahneman	A. Tversky
2002	Journal of Political Economy 70, 111 (1972)	V. L. Smith	
2001	Quarterly Journal of Economics 84, 485 (1970)	G. A. Akerlof	
2001	Quarterly Journal of Economics 87, 355 (1973)	A. M. Spence	
2001	Quarterly Journal of Economics (1976)	M. Rothschild	J. Stiglitz
2000	Econometrica 42, 679 (1974)	J. J. Heckman	
2000	Frontiers of Econometrics (1974)	D. L. McFadden	

Table S8: Credit share for Nobel prize-winning papers in Economic sciences (continued)

Year	Paper	Authors (credit)	
1999	Canadian Journal of Economics 29, 475 (1963)	R. A. Mundell	
1998	San Francisco: Holden Day and London (1970)	A. Sen	
1997	Econometrica 41, 867 (1973)	R. C. Merton	
1997	The journal of political economy 81, 637 (1973)	F. Black	M. S. Scholes
1996	The American Economic Review 61, 8 (1971)	P. Diamond	J. A. Mirrlees
1996	Journal of Finance 16, 8 (1961)	W. Vickrey	
1995	Journal of Economic Theory 4, 103 (1972)	R. E. Lucas	

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