

## ZHEN LEI

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### RESEARCH INTEREST

Applied Economics, Energy and Environmental Economics, Health Economics, Big Data Science, Science and Technology Policy, Economics of Innovation and Intellectual Property Right, Industrial Organization, Development Economics

### EDUCATION

Ph.D., 2009, Agricultural and Resource Economics  
University of California, Berkeley

Ph.D., 2000, Pharmaceutical Sciences  
Peking University Health Science Center, China

M.S., 1997, Chemistry  
Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, China

B.S., 1993, Chemistry  
Wuhan University, China

### PROFESSIONAL EXPERIENCE

Professor of energy and environmental economics, 2024-  
Department of Energy and Mineral Engineering, Penn State University

Associate professor of energy and environmental economics (with tenure), 2015-2024  
Department of Energy and Mineral Engineering, Penn State University

Assistant professor of energy and environmental economics, 2009-2015  
Department of Energy and Mineral Engineering, Penn State University

Postdoctoral Researcher, 2000-2003  
Department of Nutritional Science and Toxicology, UC Berkeley

## **PROFESSIONAL ACTIVITIES**

Board Member, Asia Pacific Innovation Network, 2022-  
Board of Directors, Chinese Economist Society, 2019-2020  
Editorial Board, National Accounting Review, 2019-  
Editorial Board, SPOUDAI – Journal of Economics and Business, 2022-  
Chair of Scientific Committee, Asia Pacific Innovation Conference, 2019

## **RESEARCH GRANTS AND AWARDS**

National Science Foundation Grant (CIVIC, Civic Innovation Challenge), “CIVIC-FA Track A: Leveraging Existing Fiber-Optic Cables to Identify and Manage Urban Environmental Hazards”, Co-Principle Investigator, 10/01/2023-09/30/2024, \$937,211.

USDA/NIFA, “Opioid and Drug Misuse and Overdose in Rural Coal Communities in the Post-COVID Era of Energy Transition,” Principle Investigator, 07/01/2023-06/30/2026, \$642,936.

National Science Foundation Grant (CIVIC, Civic Innovation Challenge), “CIVIC-PG Track A: Leveraging Existing Fiber-Optic Cables to Identify and Manage Urban Environmental Hazards”, Co-Principle Investigator, 10/01/2022-03/31/2023, \$50,000.

CDC/NCHS, “Characterize and Identify Risk Factors for Opioid overdose Deaths of Concomitant Drugs for Patients With Hospital and ED Visits,” Principle Investigator, 02/01/2022, primarily getting access to restricted data via the RDC (Research Data Center), plus \$17,000.

National Science Foundation Grant (CBET, Chemical, Biological, Environmental, and Transport Systems), “Collaborative Research: Conservation Tillage for Sustainable Food, Energy and Water Systems: Linked Econometric and Process-based Models”, Principle Investigator at Penn State, 01/01/2021-12/31/2024, \$500,000.

HHS Centers for Medicare & Medicaid Services Grant, “Pennsylvania Rural Health Model,” Co-Principal Investigator, 04/17/2019-10/20/2019, \$4,426,440 (Lei’s share: \$80,000).

National Science Foundation Grant (III, Information Integration and Informatics), “Learning Latent Representation of Heterogeneous Information Networks”, Co-Principle Investigator, 8/1/2017-7/31/2020, \$499,635.

National Science Foundation Grant (SciSIP, Science of Science and Innovation Policy), “Impacts of Greater Public Accessibility to Federally Funded Research

Publications: Evidence from the NIH Public Access Policy”, Principle Investigator, 6/1/2014-5/30/2017, \$619,768.

National Science Foundation Grant (SciSIP, Science of Science and Innovation Policy), “Collaborative Research: The Impacts of University Research and Funding Sources in Chemical Sciences: Publishing, Patenting, Commercialization”, Principal Investigator at Penn State, 5/1/2011-4/30/2014, \$646,543.

National Institute of Health Grant (subcontract from University of Minnesota), “International Assessments of Patenting in Genetics,” Principal Investigator, 07/01/2011-06/30/2012, \$39,421.

DOE Hub “Greater Philadelphia Innovation Center for Energy Efficient Building (GPIC)”, Subtask on “GPIC EEB Hub History and Assessment”, Co-Principal Investigator, 07/01/2011-01/31/2014, \$580,160.

Penn State Sustainability Seed Grant, “China’s Monopoly on Rare Earth Elements and the Sustainability of Green Technology”, Co-Principal Investigator, 6/1/2010-5/31/2011, \$40,000.

Pennsylvania State Electricity Markets Initiative, Consortium of Electric Utilities, Co-Principal Investigator, 1/1/10 – 12/31/11, \$250,000.

Center for Rural Pennsylvania Grant, “Assessing and Mitigating Rising Electricity Prices in Rural Pennsylvania,” Co-Principal Investigator, 1/1/08-5/31/10, \$100,000.

## **PUBLICATIONS**

### **Publications in Peer-reviewed Journals:**

1. Fan Xia, Ximeng Cheng, Zhen Lei, Jintao Xu, Yu Liu, Yingxin Zhang, Qinghong Zhang, (2023). “Heterogeneous Impacts of Local Traffic Congestion on Local Air Pollution Within a City: Utilizing Taxi Trajectory Data,” *Journal of Environmental Economics and Management*, 122, 102896.
2. Travis Young, Jennifer Baka, Zhongyang He, Sekhar Bhattacharyya, Zhen Lei, (2023). “Mining, Loss, and Despair: Exploring Energy Transitions and Opioid Use in an Appalachian Coal Community,” *Energy Research & Social Science*, 2023, 99, 103046.

3. Maoyong Fan, Jing Cao, Kuangyuan Zhang and Zhen Lei, (2022). “Command vs. Market in China’s Energy Intensity Reduction Strategies; Firm-level Evidence,” *PLOS ONE*, 17(2): e0263325.
4. Yingbo Li, Yigang Wei, Yan Li, Zhen Lei and Alessandra Ceriani, (2022). “Connecting Emerging Industry and Regional Innovation System: Linkages, Effect and Paradigm in China,” *Technovation*, 111, 102388.
5. Zhen Sun, Zhen Lei, Brian D. Wright, Mark Cohen and Taoxiong Liu, (2021). “Government Targets, End-of-year Patenting Rush and Innovative Performance in China,” *Nature Biotechnology*, 39, 1068-1076.
6. Zhihua Chen, Andrew N. Kleit, Zhen Lei, Haizhong An, Luis F. Ayala & Antoine J.C.J. Pruvot, (2020). “The linear-analog Method: A More Efficient and Effective Linearization Method for Natural Gas Transportation Optimization,” *Journal of Natural Gas Science and Engineering*, 80, 103305.
7. Zhen Lei and Chen-Hao Tsai, (2019). “Market Deregulation and Nuclear Safety,” *Energy Economics*, 82, 62-67.
8. Siwei Cao, Zhen Lei and Junbyoung Oh, (2019). “How Do Firms Utilize the Deferred Patent Examination System? Evidence from Korea,” *European Journal of Innovation Management*, 22(2), 234-256.
9. Zhongyang He, Zhen Lei and Dashun Wang, (2018). “Modeling Citation Dynamics of ‘Atypical’ Papers,” *Journal of the Association for Information Science and Technology*, 69(9), 1148-1160.
10. Huanguang Qiu, Jianbiao Yan, Zhen Lei and Dingqiang Sun, (2018). “Rising Wages and Energy Consumption Transition in Rural China,” *Energy Policy*, 119, 545-553.
11. Zhen Sun, Zhen Lei and Zhifeng Yin, (2018). “Innovation Policy in China: Nationally Promulgated But Locally Implemented,” *Applied Economics Letters*, 25:21, 1481-1486.
12. Kyriakos Drivas, Zhen Lei and Brian Wright, (2018). “Application Publication or Confirmation of Grant: Which Matters More for Academic Technology Transfer?” *International Journal of Industrial Organization*, 56, 204-228.

13. Yingbo Li, Yan Li, Zhen Lei, Qiuya Liu. (2018) “Are innovation output and economic output strongly related in emerging industrial clusters? Evidence from China.” *European Scientific Journal*, Vol.14, No.22, 255-275.
14. Kyriakos Drivas, Zhen Lei and Brian Wright, (2017). “Academic Patent Licenses: Roadblocks or Signposts for Nonlicensee Cumulative Innovation?” *Journal of Economic Behavior & Organization*, 137, 282-303.
15. Zhen Lei and Brian D. Wright, (2017). “Why Weak Patents? Testing the Examiner Ignorance Hypothesis,” *Journal of Public Economics*, 148, 43-56.
16. Daniel R. Cahoy, Zhen Lei, Yuxi Meng and Seth Blumsack, (2017). “Global Patent Chokepoints,” *Stanford Technology Law Review*, 20, 213-244.
17. Zhen Lei, Chen-Hao Tsai and Andrew N. Kleit, (2017). “Deregulation and Firm Investment Incentives: Evidence from Nuclear Power Uprates,” *Energy Journal*, 38(3), 113-139.
18. Maoyong Fan, Zhen Lei and Gordon Liu, (2016). “Discounting of Medical Saving Accounts,” *American Journal of Health Economics*, 2(2), 161-183.
19. Lei Cheng and Zhen Lei, (2015). “Does the Expansion of Chinese State-owned Enterprises Affect the Innovative Behavior of Private Enterprises?” *Asian-Pacific Journal of Accounting & Economics*, 22(1), 24-54.
20. Mingwei Fu, Jingyi Ye, Yuxi Meng and Zhen Lei, (2015). “The Impacts of Domestic Content Protection on Indigenous Innovation,” (in Chinese) *Economic Research Journal*, 50(2), 118-131.
21. Zhen Lei and Anastasia V. Shcherbakova, (2015). “Revealing Climate Change Opinions through Investment Behavior: Evidence from Fukushima,” *Journal of Environmental Economics and Management*, 70, 92-108.
22. Mier Zhang, Wei Guo, and Zhen Lei, (2014). “Patent Analysis of Shale Gas Technology in China and Implications for the Exploitation,” *Energy Technology*, 2(12), 1040-1045.
23. Kyriakos Davis, Zhen Lei, Steve Merrill and Brian D. Wright, (2014). “Technology Transfer: Industry-funded Academic Inventions Boost Innovation,” *Nature*, 507, 297-299.

24. Gregory D. Graff, Devon Phillips, Zhen Lei, Sooyoung Oh, Carol Nottenburg, and Philip G. Pardey. (2013). "Not Quite a Myriad of Gene Patents: Assessing the Potential Impact of the U.S. Supreme Court on the Changing Landscape of U.S. Patents that Claim Nucleic Acids," *Nature Biotechnology*, 31(5), 404-410.
25. Daniel R. Cahoy, Joel Gehman and Zhen Lei, (2013). "Fracking Patents: The Emergence of Patents as Information Containment Tools in Shale Drilling," *Michigan Telecommunications and Technology Law Review*, 19(2), 279-330.
26. Weisheng Tian, Kai Ding, Yun-Shan Sun, Ling Chen and Zhen Lei, (2013). "Total Synthesis and Establishment of the Stereochemistry of Spiniferin-1, a Rare Planar Chiral Marine Natural Product with a 1,6-Methano[10]annulene Skeleton", *Synthesis*, 45(4), 438-447.
27. Jingyi Ye, Chenle Li, Zhen Lei and Heping Cao, (2012). "Early Application Publication, Patent Quality and Knowledge Dissemination," (in Chinese) *Journal of World Economy*, 8, 115-133.
28. Zhen Lei, Rakhi Juneja and Brian Wright, (2009). "Patents vs. Patenting: Implications of Intellectual Property Protection for Biological Research", *Nature Biotechnology*, 27(1), 36-40.
29. Steven E. Sexton, Zhen Lei and David Zilberman, (2007). "The Economics of Pesticides and Pest Control", *International Review of Environmental and Resource Economics*, 1(3), 271-326.
30. Zhen Lei, Weiguo Chen, Min Zhang and Joseph L. Napoli, (2003). "Reduction of all-trans-retinal in the mouse liver peroxisome fraction by the short-chain dehydrogenase/reductase RRD: induction by the PPAR $\alpha$ -ligand clofibrate", *Biochemistry*, 42, 4190-4196.
31. Zhen Lei, Ling Zhang, Liang Ren Zhang, Jun Chen, Jimei Min and Lihe Zhang, (2001). "Hybrid Characteristics of oligonucleotides consisting of isonucleoside 2',5'-anhydro-3'-deoxy- 3'-(thymine-1-yl)-D-mannitol with different linkage modes", *Nucleic Acids Research*, 29(7), 1470-1475.
32. Zhen Lei, Jimei Min, Lihe Zhang, (2000). "Synthesis of 3-deoxy-3-nucleobase -2,5-anhydro-D -mannitol: a novel class of hydromethyl-branched isonucleosides", *Tetrahedron Asymmetry*, 11, 2899-2906.

33. Weisheng Tian, Zhen Lei, Ling Chen, Ying Huang, (2000). "Some new reactions of per(poly)alkyl sulfonyl fluoride with steriodic molecules", *Journal of fluorine chemistry*, 101, 305-308.

**Publications in Peer-reviewed Conference Proceeding in Computer and Data Science:**

1. Hui-Ju Hung, Wang-Chien Lee, Chih-Ya Shen, Fang He, Zhen Lei. (2024). "Leveraging Transfer Learning for Enhancing Graph Optimization Problem Solving," *The 28<sup>th</sup> Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD 2024)*, 339-351, Tainan, Taiwan, May 7-10, 2024.
2. Hui-Ju Hung, Wang-Chien Lee, Tao-Yang Fu, Chih-Ya Shen, Zhen Lei, (2024). "Learning to Solve Combinatorial Optimization Problems on Graphs with State-Aware Multi-Relation Aggregation," *The 39<sup>th</sup> ACM/SIGAPP Symposium on Applied Computing (SAC 2024)*, 490-491. Avila, Spain, April 8-12, 2024.
3. Fang He, Wang-Chien Lee, Tao-Yang Fu, Zhen Lei, (2021). "CINES: Explore Citation Network and Event Sequences for Citation Forecasting," *The 44<sup>th</sup> International ACM SIGIR Conference on Research and Development in Information (SIGIR '21)*, 798-807, Virtual Event, Canada, July 11-15, 2021.
4. Hui-Ju Hung, Wang-Chien Lee, De-Nian Yang, Chih-Ya Shen, Zhen Lei, and Sy-Miin Chow, (2020). "Efficient Algorithms towards Network Intervention," *The Web Conference 2020 (WWW '20)*, 2021-2031, Taipei, Taiwan. April 2020.
5. Tao-Yang Fu, Wang-Chien Lee, and Zhen Lei, (2017). "HIN2Vec: Explore Metapaths in Heterogeneous Information Networks for Representation Learning," *ACM International Conference on Information and Knowledge Management (CIKM 2017)*, 1797-1806, Singapore, November 2017.
6. Tao-Yang Fu, Zhen Lei, and Wang-Chien Lee, (2016). "Modeling Knowledge Diffusion with Time Lags in Citation Networks." *IEEE International Conference on Data Mining, (ICDM 2016)*, 865-870, Barcelona, Spain, December 2016.
7. Tao-Yang Fu, Zhen Lei, and Wang-Chien Lee, (2015). "Patent Citation Recommendation for Examiners." *IEEE International Conference on Data Mining, (ICDM 2015)*, 751-756, Atlantic City, NJ, November 2015.
8. Shuting Wang, Zhen Lei and Wang-Chien Lee, (2014). "Exploring Legal Patent Citations for Patent Valuation," *The ACM International Conference on Information*

- and Knowledge Management (CIKM 2014)*, 1379-1388, Shanghai, China, November 2014.
9. Sooyoung Oh, Zhen Lei, Wang-Chien Lee, and John Yen, (2014). “Recommending Missing Citations for Newly Granted Patents,” *The 2014 International Conference on Data Science and Advanced Analytics (DSAA 2014)*, 442-448, Shanghai, China, October 2014.
  10. Shuting Wang, Wang-Chien Lee, Zhen Lei, Xianliang Zhang and Yu-Hsuan Kuo, (2014). “Exploring Technological Trends for Patent Evaluation,” *The 2014 International Conference on Data Science and Advanced Analytics (DSAA 2014)*, 277-283, Shanghai, China, October 2014.
  11. Sooyoung Oh, Zhen Lei, Wang-Chien Lee, and John Yen. (2014). “Patent Evaluation Based on Technological Trajectory Revealed in Relevant Prior Patents,” *The 18<sup>th</sup> Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD 2014)*, 545-556, Tainan, Taiwan, May 13-16, 2014.
  12. Sooyoung Oh, Zhen Lei, Wang-Chien Lee, Prasenjit Mitra and John Yen. (2013). “CV-PCR: A Context-Guided Value-Driven Framework for Patent Citation Recommendation,” *The ACM International Conference on Information and Knowledge Management (CIKM 2013)*, 2291-2296, San Francisco, CA, U.S.A., Oct. 2013.
  13. Sooyoung Oh, Zhen Lei, Prasenjit Mitra and John Yen, (2012). “Evaluating and Ranking Patents Using Weighted Citations,” *The ACM/IEEE-CS Joint Conference on Digital Libraries (JCDL 2012)*, 281-284, Washington D.C., U.S.A., 2012.

### **Book Chapters and Reports**

1. Daniel R. Cahoy, Joel Gehman and Zhen Lei, “The transformation of patents into information containment Tools”, in “The Changing Face of US Patent Law and its Impact on Business Strategy,” Edited by Daniel R. Cahoy and Lynda J. Oswald, *The New Horizons in International Business*, Edward Elgar, 2013.
2. Kyriakos Drivas, Zhen Lei and Brian Wright, “A Preliminary View of University of California Data on Disclosures, Licensing and Patenting,” Prepared for *The Committee on Management of University Intellectual Property: Lessons from a Generation of Experience, Research, and Dialogue*, National Research Council, The National Academies.



## **Patents**

1. Weisheng Tian and Zhen Lei, 6,10-methylene-19-nor-4-ene-3-one steriodic compounds and their synthesis, *Chinese Patent, CN 97106575.6*

## **OTHERS**

### **Reviewer for Refereed Journals**

Over 35 scientific journals

### **Panelist and Peer Reviewer for Grants**

1. National Science Foundation, Chemical, Bioengineering, and Transport Systems (CBET) Division.
2. National Science Foundation Science of Science and Innovation Policy (SciSIP) Program

### **Membership**

American Economic Association

U.S./International Association for Energy Economics (USAEE/IAEE)

Agricultural and Applied Economics Association

The Society for Empirical Legal Studies

Chinese Economists Society