

Prediction Markets

Theory and applications

Edited by

Leighton Vaughan Williams



Routledge International Studies in Money and Banking

Prediction Markets

Theory and applications

Edited by Leighton Vaughan Williams



First published 2011

by Routledge

2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Simultaneously published in the USA and Canada

by Routledge

711 Third Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

© 2011 Selection and editorial matter; Leighton Vaughan Williams;

individual chapters, the contributors

The right of Leighton Vaughan Williams to be identified as the author of the editorial matter, and of the authors for their individual chapters, has been asserted in accordance with the Copyright, Designs and Patent Act 1988.

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

Trademark notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data

Prediction markets : theory and applications / edited by Leighton Vaughan Williams.

p. cm.

Includes bibliographical references and index.

1. Business forecasting. 2. Economic forecasting. 3. Forecasting.

I. Vaughan Williams, Leighton.

HD30.27.P74 2011

303.49—dc22

2010049035

ISBN: 978-0-415-57286-6 (hbk)

ISBN: 978-0-203-81552-6 (ebk)

Typeset in Times

by Wearset Ltd, Boldon, Tyne and Wear



Printed and bound in Great Britain by
TJI Digital, Padstow, Cornwall

Prediction Markets

How can we effectively aggregate disparate pieces of information that are spread among many different individuals? In other words, how can we best access the ‘wisdom of the crowd’? Prediction markets, which are essentially speculative markets created for the purpose of aggregating information and making predictions, offer the answer to this question. The effective use of these markets has the potential not only to help forecast future events on a national and international level, but also to assist companies in providing, for example, improved estimates of the potential market size for a new product idea or the launch date of new products and services.

The markets have already been used to forecast uncertain outcomes ranging from influenza to the spread of infectious diseases, to the demand for hospital services, to the box office success of movies, climate change, vote shares and election outcomes, to the probability of meeting project deadlines. The insights gained also have many potentially valuable applications for public policy more generally. These markets offer substantial promise as a tool of information aggregation as well as forecasting, whether alone or as a supplement to other mechanisms like surveys, group deliberations and expert opinion. Moreover, they can be applied at a macroeconomic and microeconomic level to yield information that is valuable for government and commercial policy-makers and which can be used for a number of social purposes.

This volume of original readings, contributed by many of the leading experts in the field, marks a significant addition to the base of knowledge about this fascinating subject area. The book should appeal to all those with an interest in economics, forecasting or public policy, and in particular those with an interest in the study of money, investment and risk.

Leighton Vaughan Williams is Professor of Economics and Finance and Director of the Betting Research and the Political Forecasting Unit at Nottingham Business School, Nottingham Trent University, UK.

Routledge international studies in money and banking

- 1 Private Banking in Europe**
Lynn Bicker
- 2 Bank Deregulation and Monetary Order**
George Selgin
- 3 Money in Islam**
A study in Islamic political economy
Masudul Alam Choudhury
- 4 The Future of European Financial Centres**
Kirsten Bindemann
- 5 Payment Systems in Global Perspective**
Maxwell J Fry, Isaak Kilato, Sandra Roger, Krzysztof Senderowicz, David Sheppard, Francisco Solis and John Trundle
- 6 What is Money?**
John Smithin
- 7 Finance**
A characteristics approach
Edited by David Blake
- 8 Organisational Change and Retail Finance**
An ethnographic perspective
Richard Harper, Dave Randall and Mark Rouncefield
- 9 The History of the Bundesbank**
Lessons for the European Central Bank
Jakob de Haan
- 10 The Euro**
A challenge and opportunity for financial markets
Published on behalf of Société Universitaire Européenne de Recherches Financières (SUERF)
Edited by Michael Artis, Axel Weber and Elizabeth Hennessy
- 11 Central Banking in Eastern Europe**
Edited by Nigel Healey and Barry Harrison
- 12 Money, Credit and Prices Stability**
Paul Dalziel

- 13 Monetary Policy, Capital Flows and Exchange Rates**
Essays in memory of Maxwell Fry
Edited by William Allen and David Dickinson
- 14 Adapting to Financial Globalisation**
Published on behalf of Société Universitaire Européenne de Recherches Financières (SUEF)
Edited by Morten Balling, Eduard H. Hochreiter and Elizabeth Hennessy
- 15 Monetary Macroeconomics**
A new approach
Alvaro Cencini
- 16 Monetary Stability in Europe**
Stefan Collignon
- 17 Technology and Finance**
Challenges for financial markets, business strategies and policy makers
Published on behalf of Société Universitaire Européenne de Recherches Financières (SUEF)
Edited by Morten Balling, Frank Lierman, and Andrew Mullineux
- 18 Monetary Unions**
Theory, history, public choice
Edited by Forrest H. Capie and Geoffrey E Wood
- 19 HRM and Occupational Health and Safety**
Carol Boyd
- 20 Central Banking Systems Compared**
The ECB, the pre-euro Bundesbank and the Federal Reserve System
Emmanuel Apel
- 21 A History of Monetary Unions**
John Chown
- 22 Dollarization**
Lessons from Europe and the Americas
Edited by Louis-Philippe Rochon and Mario Seccareccia
- 23 Islamic Economics and Finance: A Glossary, 2nd Edition**
Muhammad Akram Khan
- 24 Financial Market Risk**
Measurement and analysis
Cornelis A. Los
- 25 Financial Geography**
A Banker's view
Risto Laulajainen
- 26 Money Doctors**
The experience of international financial advising 1850–2000
Edited by Marc Flandreau
- 27 Exchange Rate Dynamics**
A new open economy macroeconomics perspective
Edited by Jean-Oliver Hairault and Thepthida Sopraseuth
- 28 Fixing Financial Crises in the 21st Century**
Edited by Andrew G. Haldane

- 29 Monetary Policy and Unemployment**
The U.S., euro-area and Japan
Edited by Willi Semmler
- 30 Exchange Rates, Capital Flows and Policy**
Edited by Peter Sinclair, Rebecca Driver and Christoph Thoenissen
- 31 Great Architects of International Finance**
The Bretton Woods era
Anthony M. Endres
- 32 The Means to Prosperity**
Fiscal policy reconsidered
Edited by Per Gunnar Berglund and Matias Vernengo
- 33 Competition and Profitability in European Financial Services**
Strategic, systemic and policy issues
Edited by Morten Balling, Frank Lierman and Andy Mullineux
- 34 Tax Systems and Tax Reforms in South and East Asia**
Edited by Luigi Bernardi, Angela Frascini and Parthasarathi Shome
- 35 Institutional Change in the Payments System and Monetary Policy**
Edited by Stefan W. Schmitz and Geoffrey E. Wood
- 36 The Lender of Last Resort**
Edited by F.H. Capie and G.E. Wood
- 37 The Structure of Financial Regulation**
Edited by David G. Mayes and Geoffrey E. Wood
- 38 Monetary Policy in Central Europe**
Miroslav Beblavý
- 39 Money and Payments in Theory and Practice**
Sergio Rossi
- 40 Open Market Operations and Financial Markets**
Edited by David G. Mayes and Jan Toporowski
- 41 Banking in Central and Eastern Europe 1980–2006**
A comprehensive analysis of banking sector transformation in the former Soviet Union, Czechoslovakia, East Germany, Yugoslavia, Belarus, Bulgaria, Croatia, the Czech Republic, Hungary, Kazakhstan, Poland, Romania, the Russian Federation, Serbia and Montenegro, Slovakia, Ukraine and Uzbekistan.
Stephan Barisitz
- 42 Debt, Risk and Liquidity in Futures Markets**
Edited by Barry A. Goss
- 43 The Future of Payment Systems**
Edited by Stephen Millard, Andrew G. Haldane and Victoria Saporta
- 44 Credit and Collateral**
Vania Sena

- 45 Tax Systems and Tax Reforms in Latin America**
Edited by Luigi Bernardi, Alberto Barreix, Anna Marenzi and Paola Profeta
- 46 The Dynamics of Organizational Collapse**
The case of Barings Bank
Helga Drummond
- 47 International Financial Co-operation**
Political economics of compliance with the 1988 Basel Accord
Bryce Quillin
- 48 Bank Performance**
A theoretical and empirical framework for the analysis of profitability, competition and efficiency
Jacob Bikker and Jaap W.B. Bos
- 49 Monetary Growth Theory**
Money, interest, prices, capital, knowledge and economic structure over time and space
Wei-Bin Zhang
- 50 Money, Uncertainty and Time**
Giuseppe Fontana
- 51 Central Banking, Asset Prices and Financial Fragility**
Éric Tymoigne
- 52 Financial Markets and the Macroeconomy**
Willi Semmler, Peter Flaschel, Carl Chiarella and Reiner Franke
- 53 Inflation Theory in Economics**
Welfare, velocity, growth and business cycles
Max Gillman
- 54 Monetary Policy Over Fifty Years**
Heinz Herrman
(*Deutsche Bundesbank*)
- 55 Designing Central Banks**
David Mayes and Geoffrey Wood
- 56 Inflation Expectations**
Peter J.N. Sinclair
- 57 The New International Monetary System**
Essays in honour of Alexander Swoboda
Edited by Charles Wyplosz
- 58 Taxation and Gender Equity**
A comparative analysis of direct and indirect taxes in developing and developed countries
Edited by Caren Grown and Imraan Valodia
- 59 Developing Alternative Frameworks for Explaining Tax Compliance**
Edited by James Alm, Jorge Martinez-Vazquez and Benno Torgler
- 60 International Tax Coordination**
An interdisciplinary perspective on virtues and pitfalls
Edited by Martin Zagler
- 61 The Capital Needs of Central Banks**
Edited by Sue Milton and Peter Sinclair
- 62 Monetary and Banking History**
Edited by Geoffrey E. Wood, Terence Mills and Nicholas Crafts

**63 New Approaches to Monetary
Economics and Theory**

Interdisciplinary perspectives

Edited by Heiner Ganßmann

**64 Social Banks and the Future of
Sustainable Finance**

Edited by Olaf Weber and

Sven Remer

65 Policy Makers on Policy

The Mais lectures

Edited by Forrest H. Capie and

Geoffrey E. Wood

66 Prediction Markets

Theory and applications

Edited by

Leighton Vaughan Williams

Contributors

Bin-Tzong Chie is Assistant Professor in the Department of Industrial Economics of the Tamkang University. He received his PhD in Economics at the National Chengchi University in 2007. He is a Research Fellow at AI-Econ Research Center, National Chengchi University. His research interests include agent-based computational economics, experimental economics and decision-making under uncertainty.

Richard Borghesi earned a PhD from the University of Florida in 2004. His research interests include corporate finance, corruption, market efficiency and prediction markets. He has published in *The Journal of Prediction Markets*, *Financial Management*, *Southern Economic Journal*, *Finance Research Letters*, *Journal of Applied Business Research*, *Journal of Economics and Business*, and *Applied Financial Economics*.

Chung-Ching Tai has been Assistant Professor of Economics since 2009 at Tunghai University, Taiwan. He has a PhD from the National Chengchi University, Taiwan. His research focuses on agent-based computational economics and experimental economics. His current research topics include prediction markets, agent-based double-auction markets and cognitive market experiments.

Chen-yuan Tung is Professor at the Graduate Institute of Development Studies and Director of the Center for Prediction Markets, National Chengchi University, Taiwan. He received his PhD majoring in international affairs from the School of Advanced International Studies, Johns Hopkins University. His expertise focuses on international political economy, Chinese economic development, Taiwan–United States–China trilateral relations and prediction markets.

Les Coleman teaches Finance at the University of Melbourne. Les trained originally as an engineer, and his management PhD thesis was published as *Why Managers and Companies Take Risks* (Springer, 2006). His principal research objective is to build two bodies of theory on the bases of financial decisions, and what leads to uncertainty and loss of value by corporations with a preliminary version of the latter in his latest book, *Risk Strategies*:

Dialling up Optimum Firm Risk (Gower, 2009). His papers have been published in numerous journals, he is a regular contributor to the media and delivers executive education programmes in Australia and overseas, and has received research and teaching awards.

Karen Croxson holds a PhD in economics from the University of Oxford. In 2007 she was awarded the Rank-Manning Junior Research Fellowship at New College and began working on market microstructure and prediction markets. In 2008 she joined the Oxford-Man Institute of Quantitative Finance. Some of her recent research has exploited high-frequency data from prediction markets. Other strands have addressed financial regulation, digital piracy, leadership and coordination. Since contributing to this volume, Karen has joined the McKinsey Global Institute.

Andreas Graefe is Research Associate at the Karlsruhe Institute of Technology, where he received his PhD in Economics. His research focus is on the development of forecasting methods that are simple to use, easy to understand, and thus can aid decision-making in the real world. He is also the prediction markets editor of *Foresight – The International Journal of Applied Forecasting*.

Johnnie Johnson is Professor of Decision and Risk Analysis and Director of the Centre for Risk Research in the School of Management at the University of Southampton. He has published widely in the areas of risk taking and decision making under uncertainty, with particular reference to decisions made in speculative markets. Johnnie has a particular interest in developing new approaches for forecasting outcomes in prediction and betting markets.

Iván Marinovic is currently a PhD student at the department of Accounting Information and Management at Kellogg, where he is expected to complete his candidacy shortly. He joined Northwestern after earning an MSc in Economic Theory from the University of Toulouse in France. His current research focuses on financial reporting and disclosure, the efficiency of information systems and the economics of science.

Charles Noussair is Professor of Economics at Tilburg University, and an Adjunct Faculty Member at Emory University and the University of Melbourne. He has a BA from the University of Pennsylvania and an MS and PhD from the California Institute of Technology. His research applies the methods of experimental economics to a variety of topics in micro-and macroeconomics. His research has been published in the *American Economic Review*, the *Journal of Political Economy*, *Econometrica*, the *Journal of Finance*, and the *Economic Journal*.

Anastasios Oikonomidis is undertaking his PhD at the University of Southampton, where he has held the post of Research Assistant in the Centre for Risk Research. His primary current research interest concerns the investigation of information efficiency in football betting markets.

Marco Ottaviani has taught at Northwestern since 2007. He received a PhD in Economics from the Massachusetts Institute of Technology in 1996. His research focuses on information aggregation in markets and organisations. He is currently working on the provision of incentives for information intermediaries, the development of prediction markets to improve corporate and public decision-making, and the rationale for government policies intended at mandating information disclosure and protecting consumers. He is managing editor of the *Review of Economic Studies* and associate editor of the *B.E. Journal in Theoretical Economics* and *The Journal of Prediction Markets*.

Peter Norman Sørensen has been affiliated with the University of Copenhagen since 1998. He received a PhD in Economics from the Massachusetts Institute of Technology in 1996. His research focuses on social learning, strategic communication and information aggregation. He is currently working on the design of prediction markets and on the liquidity effects of central bank interventions. He is editor of *Economica* and associate editor of *Macroeconomic Dynamics*. He is also head of the Finance Research Unit in Copenhagen.

Lionel Page is currently affiliated with the Queensland University of Technology and the University of Cambridge. His research interests include experimental and behavioural economics, applied econometrics, the economics of education and decision making under risk and uncertainty.

Rodney J. Paul is currently Professor of Economics in the Department of Finance at St Bonaventure University. He received his PhD in Applied Economics from Clemson University in 2000. His work in the prediction markets field involves a variety of studies based on prices formed in sports wagering markets. He has studied market efficiency across a wide range of sports, investigated sportsbook behaviour and behavioural biases of bettors through actual sportsbook betting percentages, and has used prices formed in these markets as a way of understanding other sports-related topics. Other research interests include attendance studies and time-series macroeconomics.

John Peirson is Senior Lecturer in Economics at the University of Kent. He has a BA in Mathematics and Economics from the University of Cambridge and a PhD in Economics from Southampton University. He has worked at the Universities of Sheffield, York and Kent, and worked for the UK government. He has published widely in the fields of energy economics, the economics of uncertainty and gambling, transport economics and new economic geography. He has advised the UK, Nigerian and Philippine governments and the European Union on energy and transport economics.

Adi Schnytzer has been an Associate Professor of Economics in the Department of Economics at Bar Ilan University since 1997. He received his BSc and MEc from Monash University and his DPhil from Oxford University. His

research focuses on sportometrics, comparative economics and the economics of prediction and betting markets. He currently serves on the Editorial Board of *The Journal of Gambling Business and Economics*.

Shu G. Wang is Associate Professor in the Department of Economics and also serves as the Associate Director of the AI-ECON Research Center, National Chengchi University. Dr Wang holds a PhD in Economics from Purdue University. His research interests are mainly microeconomics, institutional economics, law and economics and, recently, agent-based computational economics and experimental economics.

Shu-Heng Chen is a Distinguished Professor in the Department of Economics and Director of the AI-ECON Research Center at National Chengchi University. He also serves as Vice Chair of the IEEE Computational Finance & Economics Technical Committee, and as editor-in-chief of the *Journal of New Mathematics and Natural Computation*, associate editor of the *Journal of Economic Behaviour and Organization* and editor of the *Journal of Economic Interaction and Coordination*. Professor Chen holds a PhD in Economics from the University of California at Los Angeles. He has published more than 150 publications in journals and volumes.

Bernd Skiera is a Professor of Electronic Commerce at the University of Frankfurt, Germany, and a member of the board of the E-Finance Lab at the House of Finance in Frankfurt. His research focuses on prediction markets, the impact of information technology on the financial service industry, online marketing, pricing and customer management. His work has been published in *Management Science*, *Marketing Science*, *Journal of Marketing Research*, *Journal of Marketing*, *Economic Letters*, *Journal of Product Innovation Management*, *Journal of Interactive Marketing*, and the *European Journal of Operational Research*.

Michael A. Smith is a Senior Lecturer in Economics at Leeds Business School. His PhD was awarded by Nottingham Trent University, based on an empirical study of information efficiency in a range of betting markets. His current research interests centre on the structure and dynamics of betting exchange and bookmaker markets.

Erik Snowberg is Assistant Professor of Economics and Political Science at the California Institute of Technology. Erik's research is at the intersection of economics and politics, examining how the economy affects elections, and how elections affect the economy. He holds a few undergraduate degrees from the Massachusetts Institute of Technology and a PhD from the Stanford Graduate School of Business.

Martin Spann is a Professor of Electronic Commerce at the School of Management of the Ludwig-Maximilians-University in Munich, Germany. He received his PhD from Goethe University in Frankfurt, Germany. Martin's current research interests are electronic commerce, pricing, auctions, innovation man-

agement, prediction markets and social network analysis. Martin's work has been published in *Marketing Science*, *Management Science*, *Information Systems Research*, *MIS Quarterly*, *Journal of Marketing*, *Journal of Product Innovation Management*, *Journal of Interactive Marketing*, *Journal of Forecasting*, *European Journal of Operational Research* and other journals.

Tzu-Chuan Chou received MS and PhD degrees from the Department of Computer Science and Information Engineering, Tamkang University, Taiwan, in 1998 and 2004, respectively. He was a postdoctoral fellow in the Institute of Information Science, Academia Sinica, Taiwan from 2004 to 2009. He is currently a postdoctoral fellow at the Graduate Institute of Development Studies, National Chengchi University, Taiwan. His research interests include prediction markets, clustering algorithms, information retrieval and image compression.

Leighton Vaughan Williams is Professor of Economics and Finance, Head of Economics Research and Director of the Betting Research Unit and of the Political Forecasting Unit at Nottingham Business School, Nottingham Trent University. He advises the UK government on the taxation and regulation of betting and gaming, and has published extensively in the fields of risk, asymmetric information, financial, betting and prediction markets. He is editor of *Economic Issues*, *The Journal of Gambling Business and Economics* and the *Journal of Prediction Markets*.

Andrew P. Weinbach has been teaching in the Wall College of Business at Coastal Carolina University, where he has held the Colonel Lindsey H. Vereen Endowed Professorship since 2006. His research focuses on the determinants of consumer interest in live sporting events, including forecasting of television viewing, bettor participation and live event attendance. Prior to receiving his PhD from Clemson University, Weinbach worked in the field of information technology as a network engineer, consultant and project manager, specialising in large-scale technology deployment projects for Fortune 500/Global 500 companies.

Justin Wolfers is Associate Professor of Business and Public Policy at the Wharton School of the University of Pennsylvania and a Research Associate of the National Bureau of Economic Research. His research interests include labour economics, macroeconomics, political economy, economics of the family, social policy, law and economics, public economics and behavioural economics.

Yiling Chen is an Assistant Professor of computer science at Harvard University. She has a BS from Renmin University of China, an MS from Tsinghua University, Beijing, China, and a PhD from the Pennsylvania State University. Prior to her appointment at Harvard, she worked at Yahoo! Research, New York. Her research lies at the intersection of computer science and economics. She is interested in designing and analysing social and organisational systems according to both computational and economic objectives.

Eric Zitzewitz is Associate Professor of Economics at Dartmouth College. His research interests include the financial services industry and market-based forecasting and he has a special interest in forensic economics. He received a PhD in economics from MIT and an AB in economics from Harvard College. He has studied stake pricing and late trading in mutual funds, the economic impact of the Iraq War, the effects of fair disclosure regulation and bias and related distortions from equity analysts, financial journalists and Olympic judges.

Contents

<i>Notes on contributors</i>	xv
1 Introduction	1
LEIGHTON VAUGHAN WILLIAMS	
2 Modeling idea markets: between beauty contests and prediction markets	4
IVÁN MARINOVIC, MARCO OTTAVIANI AND PETER NORMAN SØRENSEN	
3 How prediction markets can save event studies	18
ERIK SNOWBERG, JUSTIN WOLFERS AND ERIC ZITZEWITZ	
4 Mechanisms for prediction markets	35
YILING CHEN	
5 Information markets for decision-making: performance and feasibility	52
KAREN CROXSON	
6 Using prediction markets in new product development	75
BERND SKIERA AND MARTIN SPANN	
7 Prediction market accuracy for business forecasting	87
ANDREAS GRAEFE	
8 Price biases and contract design: lessons from Tradesports	96
RICHARD BORGHESI	
9 The predictive ability of financial markets	111
LES COLEMAN	

10	The ability of markets to predict conditional probabilities: evidence from the US presidential campaign	123
	LIONEL PAGE	
11	Prediction markets: a study on the Taiwan experience	137
	SHU-HENG CHEN, CHEN-YUAN TUNG, CHUNG-CHING TAI, BIN-TZONG CHIE, TZU-CHUAN CHOU AND SHU G. WANG	
12	Uses of sports wagering-based prediction markets outside of the world of gambling	157
	RODNEY J. PAUL AND ANDREW P. WEINBACH	
13	Experimental prediction and pari-mutuel betting markets	174
	CHARLES NOUSSAIR	
14	The economic analysis of sports betting by expert gamblers and insiders: a survey	189
	JOHN PEIRSON	
15	Who can beat the odds? The case of football betting reviewed	204
	ANASTASIOS OIKONOMIDIS AND JOHNNIE JOHNSON	
16	The prediction market for the Australian Football League	221
	ADI SCHNYTZER	
17	Do experts know more than the crowd? A case study	235
	MICHAEL A. SMITH	
	<i>Index</i>	256