Student Economic Review 2018

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Prize-Winning Essays of the Student Economics Review 2017/2018

Best Overall Essay: Dermot McAleese Medal

A New Theory of Health and Consumption

Ryan Cleary

Best Applied Economics Essay: Donagh Lynch Medal

Winning the Middle Ground: The Strategic Behaviour of Campaigners and Politicians on the Eighth Amendment Referendum

Mide ni Ghriofa

Best Freshman Essay Prize:

The War on Drugs: Worst Come Down Ever?

Ali Crighton

Editors and General Managers of the Student Economic Review, 1987-2018

Year	Editor	General Manager
1987 (Vol. I)	John Fingleton	Paddy Waldron
1988 (Vol. II)	Kevin Carey	Finbar McDonnell
1989 (Vol. III)	Johnathan Wright	Joe Denehy
1990 (Vol. IV)	Philip Lane	C. J. O'Neill
1991 (Vol. V)	Paul O'Connell	Billy Stamp
1992 (Vol. VI)	Alan White	Addo C. Barrows III
1993 (Vol. VII)	Gareth Davis	David Butler
1994 (Vol. VIII)	Alan Dunne	Donagh Lynch
1995 (Vol. IX)	Fergal Shortall	Myles H. Clarke
1996 (Vol. X)	Geoffrey Gill	Suzanne O'Neill
1997 (Vol. XI)	Sarah Rowell	Carol Newman
1998 (Vol. XII)	Richard Doyle	Charlotte Hess
1999 (Vol. XIII)	Michael Mc Mahon	Niamh McDonagh
2000 (Vol. XIV)	Ana Carrie	Collette Murphy
2001 (Vol. XV)	Ronan Lyons	Charles Larkin
2002 (Vol. XVI)	Ivan McAdam	Janine Boyd O'Carroll
2003 (Vol. XVII)	Rowena Gray	Elaine Doyle
2004 (Vol. XVIII)	Denis Tkatchenko	Tara McInhoe
2005 (Vol. XIX)	Cormac O'Dea	Paul Sammon
2006 (Vol. XX)	Deirdre Reilly	Melinda Simonffy
2007 (Vol. XXI)	Niamh Crilly	Charlie Nolan
2008 (Vol. XXII)	Nathalie Ennis	Kieran Curtis
2009 (Vol. XXIII)	Jean Acheson	James Walsh
2010 (Vol. XXIV)	Jason Somerville	Amandine Lobelle
2011 (Vol. XXV)	Robert Farhat	Áine Ni Shúilleabháin

Year	Editor	General Manager
2012 (Vol. XXVI)	Tony O'Connor	Debbie Blair
2013 (Vol. XXVII)	Brian Higgins	Marielle Grigsby-Rocca
2014 (Vol. XXVIII)	Féidhlim Mc Gowan	Ciá**n** Mc Leod
2015 (Vol. XXIX)	Gearóid Gibbs	Michael Mahony
2016 (Vol. XXX)	Gillian O'Connell	Kate Hayes
2017 (Vol. XXXI)	Míde Ní Ghríof**a**	Alexandru Radu Puiu
2018 (Vol. XXXII)	Keelan Beirne	Aditya Garg

GUEST SPEAKERS AT THE LAUNCH OF THE STUDENT ECONOMIC REVIEW, 1990-2017

Year	Speaker	Organisation
1990 (Vol. IV)	Richard Lipsey	Simon Fraser University
1991 (Vol. V)	Charles Goodhart	London School of Economics
1992 (Vol. VI)	Peter Sinclair	Brasenose College, Oxford
1993 (Vol. VII)	David Greenway	Nottingham University
1994 (Vol. VIII)	Hamish Mc Rae	The Iindependent, London
1995 (Vol. IX)	John Sutton	London School of Economics
1996 (Vol. X)	John Martin	OECD
1997 (Vol. XI)	Alan Tait	IMF
1998 (Vol. XII)	David O'Sullivan	European Commission
1999 (Vol. XIII)	Paula Donovan	World Bank
2000 (Vol. XIV)	Dermot McCarthy	Department of an Taoiseach
2001 (Vol. XV)	Donal Donovan	IMF
2002 (Vol. XVI)	Margaret Doyle	The Economist
2003 (Vol. XVII)	Tomy Healy	Irish Stock Exchange
2004 (Vol. XVIII)	Gerry Foley	ITV PLC.
2005 (Vol. XIX)	John Fingleton	Competition Authority
2006 (Vol. XX)	Marius Brülhart	HEC University of Lausanne
2007 (Vol. XXI)	Cliff Taylor	Sunday Business Post
2008 (Vol. XXII)	Alan Barrett	ESRI
2009 (Vol. XXIII)	Patricia Callan	Small Firms Association
2010 (Vol. XXIV)	Jane Williams	Forfás

2011 (Vol. XXV)	Tom O'Mahony	Department of Transport
2012 (Vol. XXVI)	Kyran Mc Stay	Key Capital Limited
2013 (Vol. XXVII)	Alan Gray	Indecon Economic Group
2014 (Vol. XXVIII)	Anke Heydenreich	Attestor Capital LLP
2015 (Vol. XXIX)	Declan Sheehan	JP Morgan
2016 (Vol. XXX)	Various Speakers	Past Committee Members
2017 (Vol. XXXI)	Kevin O'Rourke	All Souls College, Oxford
2018 (Vol. XXXII)	Liam Delaney	U.C.D.

Student Economics Review Debates, 1996-2018

Year	Opposition	Topic	Victor
1996	U.C.D.	Third Level Fees	Trinity
1998	U.C.D.	EMU Without Britain	Trinity
1999	Oxford	The Euro: The Way Forward	Oxford
2002	Oxford	Boston or Berlin?	Trinity
2003	Cambridge	The Euro is a Success	Cambridge
2004	U.C.D.	Free Trade and Development	U.C.D.
2005	Oxford	Third World Debt	Trinity
2006	Cambridge	Common Agricultural Policy	Trinity
2007	Oxford	Environmental Resposibility	Trinity
2007	Yale	Boston or Berlin?	Trinity
2008	Harvard	Mass Emigration and Labour	Trinity
2008	Cambridge	Britain's Place in Europe	Cambridge
2009	Yale	Boston or Berlin?	Yale
2009	Oxford	Bank Nationalisation	Trinity
2010	Cambridge	Should Ireland have Joined the Euro?	Trinity
2010	Harvard	The Decline of US Economic Dominance	Harvard
2011	Oxford	Ireland Owes a Debt of Gratitude to Britain	Oxford
2011	Yale	It's all America's Fault	Trinity
2012	Cambridge	Ireland Should Rejoin the Sterling	Trinity
2012	Harvard	The US State Does Not Care for its Sick	Harvard
2013	Oxford	Deserting the Euro	Trinity

2013	Yale	Tax is Theft	Trinity
2014	Cambridge	United States of Europe?	Cambridge
2014	Harvard	US Education System	Trinity
2015	Oxford	100% Inheritance Tax	Trinity
2015	Yale	Opening the Mexican Border	Yale
2016	Cambridge	Will the EU Benefit from Brexit?	Cambridge
2016	Harvard	Should we be Afraid of Cheap Oil?	Harvard
2017	Oxford	The EU is Unsustainable	Oxford
2017	Yale	Globalisation is Doomed	Yale
2018	Cambridge	Britain Should Pay Reparation to Former Colonies	Cambridge
2018	Harvard	The American Dream is Dead	Trinity

ENDORSEMENTS

"The Student Economic Review gives many students their first opportunity to publish a piece of academic written work. it thus supports and promotes the rigorous analysis, excellence in learning and persuasion that are essential building blocks for future careers and broader intellectual contribution. The collected contributions, now reaching into a third decade, constitute an elegant contribution to scholarship and erudition of which Trinity College can be proud."

John Fingleton
DPhil Oxford and former Chief Executive Officer of Fair Trading
London
Editor, Ser 1987

"My involvement in the SER was an important defining point in my undergraduate experience atTrinity. It introduced me to the world of academia, the role and importance of academic publishingand the range of questions and depth of research possibilities in the discipline of economics. It has stood the test of time and grows stronger every year attracting the highest calibre of students."

Carol Newman
PhD TCD, Associate Professor TCD
General Manager, 1997 SER

"Ever since leafing through a copy of the SER in my JF year, my ambition to become involved in this prestigious student society could not be curbed. Leading the committee through the year from the first workshop to the launch was an experience dotted along the way with enduring memories. From a three-day discussion about which tablecloth should be used for the workshop, to finally holding a copy of the review at the launch evening. I'm sure our friendships will last as long as the memory of my scrupulous organisation!"

Cián McLeod
Strategic Operations Specialist, Google Ireland
General Manager, SER 2014

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STUDENT ECONOMIC REVIEW WELCOMES

Welcome from the General Manager

On behalf of the committee of the 32nd edition, it is my honour and privilege to welcome you to the 2017 Student Economic Review.

The Student Economic Review is the oldest academic journal published by students in the world. Every year since 1987 we have published the work of the brightest Economic students in Trinity College Dublin, in order to support and showcase the talent of our peers.

Indeed, the essays you will have the opportunity to read in this journal are among the finest economic thought pieces written this year. Each year, the SER, in conjunction with the College Historical Society and the University Philosophical Society, hosts debates on the most pressing economic issues.

This year, we were privileged to host teams from Oxford and Harvard to debate on the feasibility of reparations to former colonies of the British Empire and the death of the American dream.

The rhetorical skill of the debaters impressed audiences, who were exposed to thought-provoking and innovative arguments. Overall, we are extremely proud to continue the tradition of organising inspiring debates which will surely leave a lasting impression on attendees.

The success of these debates is due to the hard work of our Debates Convener, Mark Finn, whom we thank for his dedication towards the SER. Mark not only single handedly organised both the debates, but also ensured that the Trinity team emerged triumphant over the Harvard team after X years.

The SER also organises various talks and workshops with the aim of enriching our fellow students' college life. This year, we invited our sponsors, Frontier Economics, who presented an insightful case study on how consulting firms use Economic concept to aid policymakers.

In addition, we hosted a workshop to assist Junior Freshman students in studying for their scholarship examination.

In 2018, we have had an extremely high quality of submissions for our journal. We are grateful to all the people who have taken their time to submit essays for publication.

The Editorial Board has had the immensely challenging, yet rewarding task of se-

lecting the articles to be published in the journal. The work of our Editorial team, comprised of Keelan Beirne, Dinnaga Padmaperuma and Luke Hosford ensured the highest standard of this year's edition.

The 32nd edition of the SER would not be complete without the contribution of Katie Duffy and Mark Henessey who lead the production and launch of the journal respectively. Daniel Ferreira rounded up the team by helping us manage our accounts. The journal you hold in your hands today is a product of the combined efforts of what can only be described as one of the best Student Economic Review Committees.

We want to thank our patrons, Dr Tara Mitchell, Dr Ronan Lyons and Dr Michael Wycherley for providing us with all the advice one could need when producing a journal of this calibre Our extended thanks goes out to John O'Hagan, without whom this journal would not exist and who continues to support economic students in appreciating their contributions to economics even now.

Their guidance was essential for ensuring that all our events went as smoothly as possible.

Furthermore, we want to extend our gratitude to all the other staff of the Economics Department and the Alumni Office who have offered their support. We would like to thank our sponsors for their generous support, without which this journal would not have existed. I would like to thank our chief sponsor, Harry Hartford, for the immense support he has provided over the past ten years.

The debates xix Welcome to the Review we organised this year were made possible by the generosity of Conor Killeen and Kyran McStay, of Key Capital, and Vinay Nair. As past Economics students of our college, your continuous support for academic endeavours is truly inspirational.

Lastly, yet most importantly, I would like to thank my fellow committee members. While I have praise for each and every individual, I would like to particularly commend the team effort that enabled us to achieve our goals for this year. I have a deep appreciation for the talent and commitment of everyone on our team.

Our hope is that the 32nd edition of the Student Economic Review will meet your high expectations. What I can assure you is that our committee has aimed for excellence and, as a result, we think that you will consider this journal an insightful and exciting read.

Aditya Garg,
General Manager, SER Vol. XXXII

Welcome from the Editor

I am delighted to have the privilege to welcome you to the 2018 Student Economic Review. In the 32nd edition of the Review, we hope we have provided all undergraduate students at Trinity College Dublin the opportunity to display their creativity, knowledge and engagement in economics, and to receive recognition for the high standard of work they have displayed, to the high standard our predecessor have set in the past.

As in past years, the volume and diversity in submissions reflects students' interest and understanding of economics, alongside their ability to apply original and creative thinking to give novel perspectives and a wealth of topics. We sincerely hope the Review itself reflects the high level of diversity and engagement in the submissions which we have received. The standard of submissions we received made the selection process an extremely difficult task, and unfortunately only a small proportion of essays submitted can be included. I would like to thank all those who submitted an essay for their interest in the review, and congratulate them on the quality of their work. I would also like to congratulate those who have had essays selected on their achievement given the quality of essays submitted.

This year's Review is compiled of seven sections which I will briefly describe. The first section is Economic History, which displays student's ability to learn lessons from the past and see their relevance for today's world. This year's first essay is Rebecca Fryer's insightful analysis of the links between grain price fluctuations and Italian emigration at the turn of the twentieth century, and is followed by an essay which gives an original view on the causes of the great depression, by senior fresher Melissa Barrett.

The Economic policy section highlights student's engagement in policy issues and their ability to apply economic logic to these issues in an original and intelligent manner. The section opens with an essay investigating the issues and providing suggestions for reform in the Irish ticket touting market, by Eoin Cambay. Next, a comprehensive description of the failures of the war on drugs, and potential improved strategies are provided by Ali Crighton, for which she was awarded the best Fresher essay prize. Arthaud Mesnard outlines the potential of modern crowdsourcing to solve difficult issues in society. The section concludes with an informative essay which details the way in which high switching costs prevent competition in the Irish Mortgage market, by Sibeal Wheatley.

Our third section this year is development economics, which is opened by Eimear

Flynn's comprehensive analysis of the role of cocoa production in Ghana's economy, and recommends the role which would be desirable going forward. Mide Ni Ghriofa outlines the importance of human capital investment in development, and gives a comprehensive policy guide to maximising its returns, while Eilis O'Brien discusses the complex ways inequality can effect growth and the implications for development policy.

For the first time in the history of the review, a behavioural economics section has been included, which highlights the increasing prominence the field has received in recent times. An essay by Tamsin Greene Barker, Natali Gordo and Áine O'Gorman, describes how they applied behavioural theory to create a policy nudge which attempted to prevent students monopolising scarce seats in the library. Juliette Weyand and Sophie Donnelly give their respective critiques of the classical assumption of perfectly rational actors made in the field of economics to conclude the section.

The year's European economics section consists of just one essay, but that does not take away from the section's quality. An interesting and comprehensive description of the existential challenges the Eurozone faces today are provided by Conor Judge, who also outlines three possible directions for reform in order for the Eurozone to prosper as an economic zone.

This year's Applied economics section consists of four essays which apply game theory and economic logic to analyse decision making in a political or international relations context. The section is opened by Doireann O'Brien's use of economic logic and reasoning to analyse and describe the effects low voter turnout has on demand for redistributive policies among voters. Winner of this year's Dermot McAleese medal for best applied economics essay is Mide Ni Ghriofa, who uses game theory to provide an in depth analysis of the strategic interactions between vote seeking politicians and reform seeking campaigners in the 8th Amendment referendum campaign. Next, Protectionist measures and trade disputes have come firmly back into the economic agenda recently, and India Healy O'Connor provides a comprehensive game theoretic analysis of trade disputes, in the context of the recent Bombardier dispute between the USA and the UK. In the concluding essay of the section, Marcel Jaensch utilises a game theory analysis to show the possible perfectly rational nature of the North Korean regime's unpredictable and erratic behaviour.

The final section in this year's Review is Economic Research, showing student's ability to conduct quality independent research. The section opens with Michael Howard's econometric analysis of the relationship between marijuana excise duties

and government education grants in Colorado, following the allocation of 10% of excise receipts to education as a political aid to legalisation. This year's recipient of the Dermot McAleese medal, Ryan Clearly, impressively builds an original model to theoretically analyse individual's decisions regarding money spent on healthcare. In the Review's concluding essay, Mark Frahill uses econometric techniques to highlights the interesting impact military spending has on countries' Olympic medal haul.

I would like to take this opportunity to extend a special word of thanks to my fellow members of the editorial team, Luke and Dinnaga, for their endless work in selecting and editing the essays. They were a pleasure for me to work with, through what was a challenging but thoroughly rewarding and enjoyable process. I hope the Review reflects not only the quality of work we were presented with, but also the enjoyment we gained from working on it.

I would also like to thank our editorial team for their constant support. Aditya, our general manager, was always at hand to allow the process run smoothly and provide us with everything we need. Our production manager Katie worked tirelessly to ensure the Review attained the high standards which had been set for us by past committees. Mark, our launch manager has put in countless hours to make our launch as successful as possible. A special word of thanks to Mark and Daniel, who along with their own duties as fiancé and debates manager, provided the editorial team with much valued support during the selection process. I would also like to thank the 2017 committee for all the help and support they provided to the committee as we adjusted to the challenge of our new roles.

Finally, I would like to take this opportunity to thank the Economics Department for their endless support of this publication. I would particularly like to thank Dr Mitchell, Dr Wycherley and Dr Lyons, firstly for giving me the privilege to be involved in producing this year's Review, and equally for their invaluable advice and help throughout the year. We very much appreciate how they have facilitated us to produce this year's Review.

I now invite you to turn the page and begin reading the diverse selection of essays in this edition of the Student Economic Review, I hope you gain as many insights and enjoyment from reading these essays as I have.

Keelan Beirne
Editor, SER Vol. XXXII

SER Debates 2017/18

Each year, the SER hosts two inter-varsity debates, one against either Oxford or Cambridge and oneagainst either Harvard orYale. This year's debates, against Cambridge and Harvard, were both held in conjunction with the University Philosophical Society (The Phil), who compete each year with the College Historical Society (The Hist) to host.

The debates offer an excellent way to for student to showcase competing economic ideas, articulatetheir viewpoint and defend it from opposing ideas, in particular ones of strong contemporaryrelevance. For those in attendance, the debates act as a fantastic way for people to see both debateand oratory at its highest level.

Trinity v Cambridge - November 23rd 2016

This House Believes The UK Should Pay Reparations To Former Colonies.

On Thursday the 16th of November the Student Economic Review (SER) began another year withits first of two annual inter-varsity debates co-hosted by the DU Philosophical Society (The Phil).

This term's debate was against the University of Cambridge on the motion This House Believes the UK Should Pay Reparations to Former Colonies - a weaving of developmental economics and moral principles, leading to a packed Chamber of audience members eager to see the debate.

The Trinity team was captained by Sophie Donnelly a Senior Sophister of Economics and Political Science with Ronan Mac Giolla Rua (a Senior Sophister of Mathematics) and Ryan Cleary (aSenior Sophister of Economics) also representing Trinity.

From the University of Cambridge was Alasdair Donovan, a Finalist of History, Jessica Van Meir, a M-Phil Candidate of Development Studies and Matt Hazell, a recent Graduate of Veterinary Medicine. Trinity were speaking on proposition and Cambridge on opposition.

The debate was chaired by Professor Francis O'Toole, the Head of the Trinity Economics Department and judged by Prof John O'Hagan chairing, the former President of the SER who was vital in the set up of the debates and has worked in Trinity since 1970 now being a Professor Emeritus. Joining him were Dr Sean Barrett, a former Senior Lecturer in the Economics Department and Senator for Trinity College and Hannah Beresford of the Class of 2017 who was awarded best speaker at the SER debate againstYale in 2015 and was a finalist of the Irish Times Debating

Competition.

The GMB Debating Chamber was packed for the debate and raucous cheers rang out for the speakers. Trinity made the case that the UK had a principled obligation to pay reparations to the former colonies due to the harms of colonisation and that reparations could go a long way in the long run economic development of these countries. Cambridge argued that the money used would not necessarily go towards the development sought by Trinity and would be of detriment to the foreign aid currently paid by the UK. In the end, the judges decided the opposition had won although declared it incredibly close, with Matt Hazell being awarded the medal for Best Speaker in the debate. Following the debate, there were floor speeches from Navika Mehta and Mark Fortune on Proposition and Liam Lysaght and Clare Elwell on opposition before remarks were made by the

Chair and results were delivered.

Trinity v Harvard - 22nd of February 2018

This House Believes the American Dream is Dead

Whilst students finished their submissions and the editorial team began to think about how many articles their would be to read in the coming weeks, the SER hosted its second inter-varsity debate this one on the motion This House Believes the American Dream is Dead; aptly, Harvard were opposing and Trinity proposing. This was a debate of particular contemporary importance given the rise of Trump and constant debates concerning his economic policy and state many Americans find themselves living in.

The Trinity Team was captained by Christopher Costigan, a Senior Sophistor in History and Political Science last year's Best Speaker in the Trinity vYale debate. Joining him was Clare Elwell, a Senior Freshman Business, Economics and Social Science student and Harry Higgins, a Junior Sophistor Law and Political Science student. Representing Harvard was Romina Lilollari, a Freshman of Economics; Benazir Neree, a Freshman of Linguistics and finally, Clíodhna Ní Chéileachair, pursuing a Masters in Law (following completing her Undergraduate degree in University College Dublin).

The debate began with Harry Higgins opening to define the American Dream and discuss how "'the facts of your birth" should by no means determine "the facts of your life"' is not the case due to income inequality, a lack of social mobility, a lack of government funding and welfare schemes. Romina Lilollari, responded to the argument by discussing how the American Dream was not immediate but rather

came about through incremental change, something demonstrated by the increased standard of living evidenced in the US for the last fifty years.

Clare Elwell contested this, demonstrating how low social mobility meant that the incremental change could not exist as well as bringing the new ideas that more money increased one's political capital in the US and that portraying American as a land of dreamers was harmful because people give everything to a dream that is unlikely to come true. Benazir Neree contested this, arguing that the election of Donald Trump caused by working class voters in Rustbelt States demonstrated that influence could be had by any as well as contesting that people realise they won't make it instantly, but once again know that incremental change is what would occur. Rounding off the proposition was Christopher Costigan, who contested the key point on incremental change being the American Dream ('Ronald Reagan never spoke about incremental change') and demonstrated how systematic factor within the US (such as school funding coming from Property Tax) mean the American Dream was dead and that if it existed it was a nightmare. Finally, Clíodhna Ní Chéileachair argued that the nature of capitalist system that the US has chosen for itself necessarily would result in some inequality.

The Judging Panel was Chaired by Prof Martina Lawless of the Economic and Social Research Institute and she was joined by Dr Sean Barrett and Cormac Henehan, a Graduate of Trinity who spoke in the SER debates in the past as well as being in the 5th ranked team at the European University Debating Championships in 2016. Whilst they deliberated, four students (Amelia Melanson, Alec Bickerstaff, Nicole O'Sullivan and Harry Hogan) added their own contributions by means of floor speeches before the Chair gave his remarks. The Chair was Prof Patrick Honohan, a former Governor of the Irish Central Bank, an Honorary Professor of Trinity's Economics Department and member of the Royal Irish Academy.

In the end, Trinity were declared the victors and Christopher Costigan, once again, won the award for Best Speaker. The two debates, provided an excellent platform for some of the best debaters from Trinity, Cambridge and Harvard to discuss contemporary social and economic issues. On each night the Chamber was full of students ready to hear a variety of perspectives, to learn more about these issues and to be entertained. The organisation of them began in May of 2017 and it was a pleasure to sit back and watch them unfold on each night in question as well as to see a Trinity victory for the first time in a number of years.

Mark Finn
Debates Manager, SER Vol. XXXII

SER Workshops 2017/18

The Student Economic Review organizes workshops throughout the academic year to not only provide academic guidance to the younger cohorts with regard to examinations but further the wider applications of economics outside of the standard lecture setting. During the academic year of 2017 – 2018, the Student Economic Review organized two workshops. The first took place in the latter half of the Michaelmas Term and focused upon providing Senior Freshman students an adequate guide to prepare for their upcoming Foundation Scholarship examinations. The second workshop was done in conjunction with Frontier Economics, an economics-oriented consultancy firm where we were pleased to welcome consultants Saoirse Gahan and Louis Turner. The workshop consisted of a general introduction of economic consulting to the audience and subsequently a discussion into the client projects that Frontier Economics is involved in.

Foundation Scholarship Workshop – 22nd November 2016

This Foundation Scholarship workshop hosted annually by the Student Economic Review remains a long standing tradition which has become an essentially component of the preparation process of Senior Freshman students. To date the most effective tool to prepare for these exams continues to be allowing prospective students to speak with their peers who have previously sat and excelled in the exams.

For this workshop we were fortunate to host Scholars from all manner of disciplines including Economics, Business, Political Science, Sociology and Philosophy, providing students a fantastic insight into the variety of ways one may approach not only the preparation process but additionally how they may tackle specific elements of the papers. Following the assortment of speeches given by the past scholars, the floor was opened up for questions allowing students to address any doubts they may be encountering.

Although this workshop is targeted towards students hoping to sit the Foundation Scholarship exam, it is often the case that students who are still considering this decision will attend simple as it provides a platform for successful students to share their study habits which are applicable universally. This workshop in essence functions very much like the final Review itself, as it aims to encourage students to engage with their degree in a critical manner that often forces you to go beyond the standard lecture material.

Frontier Economics Workshop – 30th of January February 2018

On the 30th of January, the Student Economic Review was privileged to welcome two consultants, Saoirse Gahan and Louis Turner, from the Frontier Economics office in Dublin. Frontier Economic remains an economic consultancy focused on aiding clients to analyze respective markets and base their strategies on sound economic theory. Established in 1999, the consultancy presents a strong commitment to the theories of microeconomics in order to evaluate competitive dynamics, market structures, pricing, and consumer behavior so as to provide concise policy/business advice to both private and public clients. The added complexity presented by this grounding in theory and often difficult tools such as game theory or behavioral economics constantly encourages Frontier Economics to provide their recommendations in a distilled and succinct manner.

The first speaker, Saoirse Gahan, provided a general introduction to Frontier Economics as a company and how it functions on a day to day process. An interesting insight was looking into the variety of client sectors that it is involved, ranging from energy to media and transport. Building upon this, a insight provided was the manner in which Frontier Economics retains many of its clients, and that is by aiding them understand why business behavior changes through time and going beyond this to identify and solve the root causes. The discussion closed with a comprehensive understanding at what Frontier Economics expects from prospective economic consultants through a run-down of their rigorous application process for graduates and penultimate students. Considering Frontier Economics' lookout for talent, they announced an exclusive extension of their internship program for TCD students which the Student Economic Review was involved in securing.

The second speaker, Louis Turner, provided a firsthand application of economic consulting through an interactive case study of a 'imperfectly' competitive fish market. Of course, this was an extremely simplified version of what one may face in actuality. Yet, it did provide a key insight to the method that Frontier Economics would apply in their day-to-day but also a rough framework they would expect from potential interviewing candidates. This framework essentially aims to disaggregate each individual problem to the bare economic essentials in this case to supply and demand from EC1010, then subsequently adding layers of complexity depending upon the individual problem. This framework is very intriguing as it seeks to find structural causes as opposed to standard consulting practices wherein past/similar case studies are analyzed to detect possible solutions and then applied as if the solution is transferable.

The event concluded with an extensive Q&A session wherein students offered their opinions on the case study but also wider questions they had on economic consulting in general. The event proved an excellent introduction to a very niche field that engages many practical economic problems in an innovative and adaptive manner.

I'd like to extend my personal thanks to Saoirse Gahan and Louis Turner for their intriguing presentation and help in building the Review's relationship with Frontier Economics; and to all of the past Scholars who attended the event to share your advice with this year's Senior Freshman cohort. I would also like to express my gratitude to Keelan, Luke, Daniel and Katie for making the editorial process extremely rewarding; and Aditya as well as the SER committee for their constant assistance in organizing these workshops.

An additional thank you to Dr. Ronan Lyons, Dr. Tara Mitchell and Dr. Michael Wycherley for their guidance and support throughout the year.

Dinnaga Padmaperuma
Assistant Editor &Workshops Convenor, SER Vol. XXXII

Economic History

The Failure of International Multilateralism and the Great Depression

Melissa Barrett, Senior Freshman

Almost 90 years after its beginning, the causes of the great depression remain contested and uncertain. In this paper Melissa Barrett attempts to decipher the chain of effects which caused the initial deflationary episode to propagate into a deep depression. She explains how the gold standard monetary became a catalyst of the deflationary crisis. This was a symptom of an inadequacy in policymakers' toolkit of response, due to a lack of understanding and acknowledgement of the business cycle, and international coordination. She concludes that these key failures which were the root of policymakers' miserable failure to mitigate the crisis.

Introduction

This essay will argue that the primary causes of the Great Depression were the deflationary conditions of the mid 1920s, caused mainly by incompetency in monetary policy. By extension, it is my contention that the international resentment caused by deflation was a reason behind the deep severity of the Great Depression. Furthermore, any limited response was muted by the lack of coordination between the world's economy, and the prevailing attitude of narrow national interest, rather than acknowledgement of the interdependent nature of the global economy.

Deflation was incredibly problematic during the 1920s as it caused a rise in the real value of debts, which brought already strained creditors to breaking point. Deflation made paying back intergovernmental debts even more unfeasible, and this exacerbated the existing strain between countries in the post war period. This strain was further worsened by debtor nations' unrealistic expecta-

tions and so it is the case that by 1923, the French still believed that the Germans would make their reparation payments (Kemp, 1972).This was despite the fact that the German mark was not stabilised until 1924, after a period of hyperinflation (Zacchia, 1976). Hjalmar Schacht, President of the Reichsbank from 1923 to 1930, wrote in 1931 that 'the French attack upon German currency … was the seed of that ever-growing lack of confidence which today hangs over the entire world' (Kindleberger, 1973).

Origin of deflation

A pertinent question to pose at this point is where did these deflationary conditions come from? I will discuss two main causes of deflation, the housing sector in the U.S and the Gold Standard. Both causes will be related back to a European context. A single example which illustrates the immense importance of the U.S to the international economy is seen in the fall of U.S exports when the Federal Reserve raised interest rates in 1927. The fall in U.S exports was due to other countries raising their own interest rates to keep in line with the dominant currency of the world, the U.S dollar(Eichengreen, 2004).This was not an advisable move for European countries. Their interest rates were now threatening to exceed their sluggish economic growth rates, making paying back debts even less feasible.

The geographical origins of deflation in the housing sector lie in the U.S. In 1928, the American demographer P.K Whelpton published a projection of the U.S population which 'showed 16.3 per cent growth of the 1920s, falling to under 12 per cent in the 1930s and in succeeding decades to 9.7 per cent, 7.3 per cent and 5.4 per cent.' (Barbar, 1978). In reality, the percentage increase was 16.1 per cent for 1920-1930, and in the succeeding decades the increases were 7.2 per cent, 14.5 per cent and 19 per cent, respectively(US Census Bureau, 2000). While Whelpton's projection is obviously erroneous in hindsight, it contributes to an understanding of the outlook of economic planners of the time. The idea that investment should occur in areas with rapidly growing populations can be inferred from the writings of the economist John Hicks of the LSE (1926-1935). Hicks argued in his book Value and Capital that 'one cannot repress the thought that perhaps the whole industrial revolution of the last two hundred years has been nothing else but a vast secular boom, largely induced by the unparalleled rise in population' (Barber, 1978). The increase in housing supply and prices, driven by the roaring economy of the 1920's and the anticipated endless demand, caused a crash in prices in 1929 when these expectations failed to materialise.

The Gold Standard, with its ideals of a fixed exchange rate and free flowing

capital, transferred this deflationary shock to European economies faster than otherwise would have been the case. The return to the Gold Standard, starting with Germany in 1925, after the war, precipitated a pushing down of prices so that currencies would be able to return to their pre-war value on the Gold Standard (Feinstein et al., 2008). The Gold Standard encouraged a balance of trade surplus. This was because goods would be exported in order to buy foreign currency and gold which could then be used to back up a domestic currency. The irrational attachment to a balance of trade surplus in the European psyche is summarised in a quote from the German Chancellor Leo von Caprivi. Caprivi is reported as saying 'we must export. Either we export goods or we export people' (James, 2009). Restrictive U.S immigration laws passed in 1921 and 1924 meant that European countries no longer had emigration to act as a pressure valve for its unskilled labour during times of economic hardship (Steiner, 2005). These laws worsened the impact of unemployment in Europe in the period from 1929 to 1932.

Agricultural prices fell due to a reduction in the rate of population growth, and hence a reduction in demand. This reduction in demand coincided with a glut in supply. Temin argues that this glut in supply was caused by non-European agricultural sources (which had expanded during the war period) continuing to supply food in the post-war period (Temin, 1976). The idea that France became an independent source of deflation is justified in the high percentage of the active population employed in agriculture in 1920 in France at 42 per cent, versus Germany at 31 per cent and Britain at a meagre 8 per cent .

Policy failure

Another cause of deflation was mismanagement in monetary policies and fatal flaws in the structure of central banks. The Bank of France was vulnerable because it was highly sensitive to the whims of public confidence due its dependence on short term borrowing (Kemp, 1972). There were also significant differences between the pre-war global economy and its successor. Prior to the war, global monetary power had been concentrated in London. The pre-war structure of the Bank of England was a profit-making institution (Kemp, 1976). This meant that the BoE had an incentive to sell gold and not hoard it, a feature which was lacking in both the post-war Banque de France and the Federal Reserve. By 1932, France had 32% of the gold used in monetary transactions (James et al. 1991). To understand the economic crisis in Europe, a detour must be taken into U.S economic policy. Maddison puts forward the point that 'the severity of the crisis was probably mainly attributable to the fact that the USA was trying to run a major capitalist economy with the financial institutions of a rural frontier economy'

(Maddison, 1976). This point is supported by the saving of the U.S financial system by two private financiers in the late 1890s. J.P Morgan and the Rothschilds provided gold to a near bankrupt New York Federal Reserve. The U.S did not even have a centralised central banking system until 1913, with the creation of the U.S Federal Reserve System. E.H Carr argued that 'in 1918, world leadership was offered, by almost universal consent to the United States… and was declined' (Kindleberger, 1973). The inability of American leaders to see the links between a healthy American economy and therefore a robust world economy is seen in the first inaugural speech of President Franklin D. Roosevelt. Roosevelt stressed that 'our international trade relations even though vastly important, are in a point of time and necessity secondary to the establishment of a sound national economy' (Kindleberger, 1973).

Among European leaders there was such caution towards implementing inflationary measures that they maimed their own economies in their own inaction. Brüning, (Chancellor 1930-1932), was so affected by the hyperinflation of the early 1920s that he failed to inflate prices a decade later, even when the Institut fur Konjunkturforschung's index of world industrial production fell by 10% between 1929 and 1930 (Eichengreen, 2004).

Inadequacy of International Institutions

The increased strain between countries led to a deficit of belief in the capabilities of international organisations. The Treaty of Versailles had set a negative precedent for inter-war international relations due to its exclusion of Germany from participation in the talks. Clavin argues that the League of Nation's implementation of effective policies came too late when she writes that 'only by the mid- 1920s did the League's Economic and Financial Organisation have sufficient resources to make a genuine contribution to the prosperity of the region (Europe)' (Clavin et al., 2009). The growing scepticism towards international organisations came from both the ever increasingly more powerful far right and far left. In the election campaign of July 1932, Hitler characterised international co-operation as against the German national interest. He said publicly that there were 'so many international contracts, there's the League of Nations, the Disarmament Conference, Moscow, the Second International, the Third International - and what did all that produce for Germany?' (James, 2009) There were also grumblings from the centre ground. Benjamin Strong, the Governor of the Federal Reserve Bank of New York warned Montagu Norman that 'no surrender of sovereignty' could be tolerated and that 'anything in the nature of a league or alliance, with world conditions as they are, is necessarily filled with peril'. This lack of belief in the capabilities of international organisations led to the Great

Depression because governments acting on a national level attempting to solve a globalized and international problem, such as deflation, were ineffective.

Even when positive action was taken, such as the Tripartite agreement between the U.K, U.S.A and France, other major countries such as Germany were not brought into the fold and the action often came too late to be effective. The Tripartite agreement (1936) had promised to 'relax quotas and exchange controls and to avoid competitive devaluations' between the three countries (Feinstein et al., 2008). Another example of the failure of inter war international organisations to execute co-operation is seen in the failure of the so-called 'prohibition conferences', which were organised by the Economic Committee of the League of Nations. These conferences took place from 1927 to 1929 in Geneva (Zacchia, 1976). The effort to abolish restrictions on imports and exports was abandoned when one of the eighteen countries involved in the agreement failed to ratify it by January 1930. The agreement subsequently fell apart. This lack of resolute action by international authorities meant that trust in co-operation resulted in little.

Denial of crisis

International relations policy was not unique in its inadequacy. Fiscal policy directed by governments was also found to be seriously lacking. President Hoover wrote in his memoirs that his U.S Treasury Secretary Andrew Mellon 'had only one formula- "liquidate labour, liquidate stocks, liquidate the farmers, liquidate real estate"' (White, 2008). The prevailing economic orthodoxies of the time insisted that the state should not consistently intervene in an economy. In 1913, German government expenditure represented 12.1 per cent of GDP at factor cost, in 1970 that figure was 36.7 per cent (Maddison, 1976). According to White, 'Hayek's theory viewed the recession as an unavoidable period of allocative corrections' (White, 2008). It is my view that this policy gave an excuse to central bankers not to take positive action and allowed a sense of resignation and laziness to prevail, worsening the impact of the Great Depression. Hoover tried to keep the federal budget balanced in 1930-31 'because they (the Hoover administration) adhered to the Hayekian theory of the business cycle' (White, 2008). There is a sense in Hoover's writings of the Great Depression being a purifying process. Hoover reports Mellon as saying 'it will purge the rottenness out of the system… People will work harder, live a moral life. Values will be adjusted, and enterprising people will pick up the wrecks from less competent people' (White, 2008). This excessively conservative moralistic view of economics helped to deepen the Great Depression by creating a reluctance to participate in public investment. If public investment had been carried out earlier, employment would have risen and inflation would subsequently have risen also.

Imperialist International relations

International tension was also present in monetary policy. A flaw in the ideology of European central bankers was the amalgam of imperialism and monetary policy. The French central banker Moreau wrote in his diary - 'would it not be useful to have a serious conversation with M. Norman (Chancellor of the Bank of England), with a view to dividing Europe into two zones of financial influence which would be attributed respectively to France and Britain' (Kindleberger, 1973). This imperialistic view was designed to antagonise Germany. The European desire to maintain an empire is echoed by Jack Eloranta and Mark Harrison who note that 'the old colonial powers had failed to give way to the aspirations of the new imperialists' (Eloranta, 2010). The importance of colonies in the post-war period is seen in the superior performance of the U.K in maintaining its foreign assets in comparison to France or Germany. France suffered losses of about two thirds of its pre-war foreign assets and Germany lost most of its £1.2 billion foreign investments which were seized as reparation. The U.K however, received 'substantial war gifts from Canada and India' (Maddison, 1976). The competition that had existed between imperialist European economies could no longer be maintained due to the increased integration of European markets. In short, a broader attachment to the economic orthodoxies of antebellum years was a cause of the Great Depression. As Lundberg summarises 'in the 1920s … there were various policy aims that today would largely be considered as intermediate, secondary, irrelevant or irrational targets' (Maddison, 1976). The fact that responses were therefore fragmented, ill targeted or mostly non-existent allowed the crisis to develop into deep depression. The poorly informed, contradictory and rivalrous policies implemented in the wake of the crash in 1929 did not serve to lessen the crisis, but rather these policies allowed the recession deepen and in fact accelerated its decline to depression.

Conclusion

The great tragedy of the Great Depression was that the desire for stability ironically caused instability on a scale that was dissimilar to any economic downturn that preceded it. The Gold Standard, previously a sign of good economic housekeeping, became a reason for the near collapse of European economies. The value of goods and services in America fell by almost 50 per cent in the early 1930s (Temin, 1976). It is true that internationalism was operating in difficult circumstances. Steiner writes that 'ethnic nationalism, whether in victorious or defeated countries, above all in Eastern Europe, was heightened in the scramble for territory' in the early post-war period (Steiner, 2005). However, this does not excuse the error of Western leaders in their calculation that a return to normality

needed to be a return to the past. The lack of acknowledgement of the crisis, the ignorance in its causes and the failure to coordinate and cooperate in a response were failures which mostly laid at the feet of western leaders.

References List:

1. Barber, Clarence L., 'On the Origins of the Great Depression', Southern Economic Association, Vol.44, No.3, (January 1978), 432-456
2. Bernanke, Benjamin and James, Harold, 'The Gold Standard and financial crises in the Great Depression: An International Comparison', in R. Glenn Hubbard (ed.) Financial Markets and Financial Crises (Chicago, 1991)
3. Briggs, Isaac and Clavin, Patricia, Modern Europe 1789-present (New York, 2005) Eloranta, Jack and Harrison, Mark, 'War and Disintegration' in Stephen Broadberry and Kevin O'Rourke (eds), The Cambridge Economic History of Modern Europe; Volume 2: 1870 to the Present (Cambridge, 2010)
4. Eichengreen, Barry, 'Understanding the Great Depression', The Canadian Journal of Economics/Revue Canadienne d'Economique, Vol. 37, No.1 (Feb 2004) 1-27 Feinstein, Charles, Peter Temin, Gianni Toniolo, The World Economy Between the World Wars (Oxford, 2008)
5. James, Harold, The End of Globalisation: Lessons from the Great Depression (Cambridge MA, 2009)
6. Kemp, Tom, The French Economy 1913-39; The History of a Decline (London, 1972)
7. Kindleberger, Charles, The World in Depression 1929-1939 (London, 1973) Maddison, Angus, 'Economic Policy and Performance in Europe 1913-1970', in , (ed. Carlo M. Cipolla), The Fontana Economic History of Europe: the Twentieth Century Part 2, (Glasgow, 1976)
8. Steiner, Zara, the Lights that Failed: European History 1919-1933, (Oxford, 2005)
9. Temin, Peter, Did Monetary Forces Cause the Great Depression? (New York, 1976)
10. White, Lawrence, Did Hayek and Robbins Deepen the Great Depression? Journal of Money, Credit and Banking, Vol 40, No.4, (June 2008) 751-768
11. Zacchia, Carlo, 'International Trade and Capital Movements 1920-1970' in Carlos M.Cipolla (ed.), The Fontana Economic History of Europe: The Twentieth Century; Part 2 (Glasgow, 1976).

A Recipe for Emigration: Grain price fluctuations and Italian emigration from 1870-1913

Rebecca Fryer, Senior Sophister

The episode of mass migration from Italy between 1870 and 1913 is perhaps one of the most recognisable in modern times. In this essay Rebecca Fryer investigates the relationship between grain prices and Italian emigration in this period. She first outlines the significance of grain as the staple food of the agrarian Italian economy at the time. Next, Rebecca draws on an extensive body of evidence from previous research to display the large role grain prices have played in this migration, through their effect on wages, prices and employment. She concludes by highlighting the relevance of these kinds of relationships to policymakers in the present day, citing the potential of climate change and population pressures to increase pressure on the supply of staple foods and employment in Africa, and the subsequent migration patterns which could follow as a consequence.

Introduction

Volatility in the price of foodstuffs has always been a major concern of economists. A key facet of this is the two competing desires of major stakeholders. While farmers want to secure fair and sustainable prices for their produce, consumers want to secure cheap unrestricted access to food staples. This creates a precarious dynamic in regards to the regulation of the price of food stuffs which has captured the attention of both governments and their people. There is a need to protect the producer but also a countervailing force of a need to protect the consumer. This trade-off is an exceptionally tricky one and if significant numbers of the population are involved in agricultural production this adds another prob-

lematic dimension. Thus it is essential for economists to examine the impacts of changes in the prices of essential food stuffs. This paper argues that the dynamic change of the price of grain, the staple food in the Italian diet was fundamental in explaining migration flows from 1870 to 1913 in Italy. As Italy became increasingly integrated as a nation in the 1870s and with the European system so too did its grain prices (Cohen and Federico, 2001). This integration led to fall after fall in the price of grain before protectionism was embraced and with it grain prices rose again. With so much of their economy dedicated to agricultural work and the production of grain it is important to recognize the catastrophic instability that changes in the price of grain had on the Italian economy and its role in promoting widespread migration.

Significance of Grain Italy and grain have a particularly fascinating history. From trade with the Mongols to the reign of Mussolini the price of grain has been a major source of conflict in Italy. Many important shifts in the Italian economy can be charted by changes in their price of grain (Toniolo, 2013). With the fall of the maritime states importance in the European trade Italian nobles looked inwards moving into agriculture and away from trade and maritime ports in a movement known as the terra ferma.

Indeed, The Crisis of Tana in 1343 whereby the Khan of the Golden Horde decided to revenge Italian conquest by imposing a blanket ban of all exports of grain from all the Italian city states highlights the Khan s understanding of Italian reliance on grain and thus how best to hurt the Italian economy (Luzzatto, 1969). The Napoleonic conquest of Italy led to massive grain shortages, sharp price increases as well as famine and strife (Cohen and Federico, 2001). With the late development of industry Italy was very much still an agrarian society focused on the growing of grain by its unification. When the world s markets integrated and economies opened up to a significantly less expensive bountiful supply of grain from the New World, Italy was not prepared. See figure 1 below from Gray, Narciso, and Tortorici (2017) using data from Annuario Statistico Italiano showing Italy s changing trade position from a net exporter of wheat to a net importer. At this point the government sought to protect the Italian grain producers from cheap foreign grain. In order to protect their economy Italy raised protectionist tariffs on most agricultural products (O Rourke, 1997). As a result, the timing of rapidly falling grain prices and unprecedented Italian migration can be seen to be instinctively tied. It was not till World War I that Italy would begin to buffer these shocks to their economy and thus differentiate its exports through industrialization (Cohen and Federico, 2001). In the meantime, from unification up until World War I Italy experienced major emigration flows. It s estimated that in 20

years 3.2 million Italians emigrated to the US alone (Cohen and Federico, 2001). Given the Italian economy s focus on agriculture and their dependence on grain it is evident that changes in grain prices and their resulting effects on income, wages and employment significantly contributed to the factors encouraging Italians to emigrate.

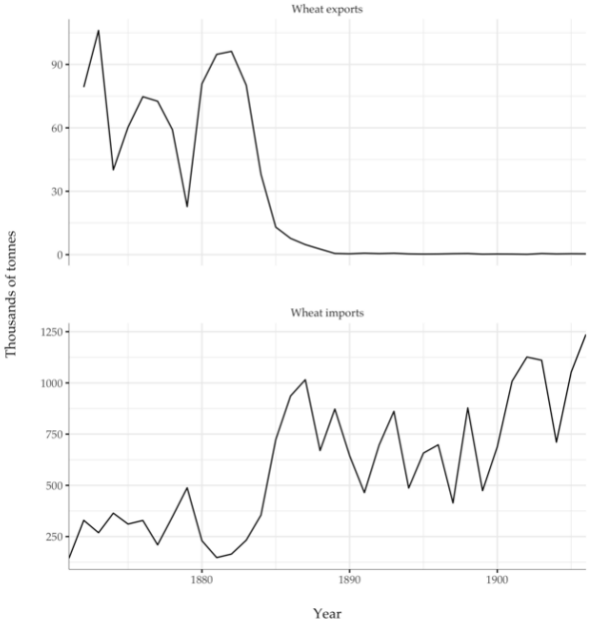


Figure 1

Factors determining migration Neoclassical literature on explaining migration flows generally posits that migration can be explained when the potential for an increase in income as a result of migrating, or the wage differential weighted by the cost of transport and the likelihood of finding employment is positive (Todaro, 1969). However Moretti (1999) finds these explanatory variables weak in determining migration timing from Italy and quite often he finds actually the opposite result. He posits that the presence of existing social networks in potential host countries also contributed as a strong determinant in migratory patterns from Italy. Based on Moretti s research he offers that the fact that a poor villager in Southern Italy decided to migrate to the United States or Brazil in 1912 has as much to do with 1912 wage differentials as it does with the migration decisions of those who left the year before him.

That is, he believes that Italian migration is tied to the flow of previous

migrants and their beliefs in expected earnings and outlook on finding success abroad. This implicitly fits into this essay s thesis that migration was majorly impacted by the insecurity in grain prices from falling grain prices and then rising grain prices as a result of protectionism. The rapidly changing prices and their effects on food prices and wages seriously affected the average Italian agricultural worker at first weakening their income and with the imposition of protectionism in turn financing their move.

Faini and Venturini (1994) use data from southern European countries in the period of 1962-1988 to investigate the effect of positive income shocks on relatively poorer and relatively richer countries propensity to migrate. In their model they include a wide variety of regressors including wage differential, origin country per capita income as well as the income of the lowest quintile of the origin population doing this in order to inform the potential for understanding the financial constraints of migration. They find in the case of a relatively poorer country like Italy at the time, that a positive income shock, which Italy experienced from protecting grain prices, will increase the likelihood of migration. They find that income shocks for the very poorest gave them just enough capital in order to cover the transport and regulatory costs of moving. This explains why even as the wealth gap between Italy and the destination countries began to close as a result of protecting grain why emigration still increased.

Spitzer (2016) also finds strength in the role of agriculture as a proxy for determining income shocks and thus migration flows. He finds that it is a statistically significant factor in determining Jewish migration from Russia along with the existence of immigration networks was also a major factor in explaining migration. He conducts a variety of regressions beginning with a difference regression which compares migration between regions with pogroms and pogrom absent regions. As a result, the common belief that the 1881-1914 wave of Jewish immigration from Russia was driven solely by the Pogroms is refuted, and instead finds a much more complex explanation for the pattern of migration driven by instability in the price of the staple food.

Role of Stable Food Prices

In O Rourke s (1997) paper the European Grain Invasion he takes an in depth look at the effect of significantly less expensive grain imports entering the European market and particularly the effectiveness of protectionist policies on this grain. He draws attention to the level of protectionism that was employed across Europe but particularly in Italy where the government felt extreme measures were necessary. See figure 2 below which demonstrates the growth of Ital-

ian agricultural tariffs when compared across Europe overtime (Lehmann and O Rourke, 2010). While O Rourke does not explicitly test this in his model he suggests that the key economic events of the next forty years and particularly the unprecedented levels of autonomous European mass migrations were a direct result of this grain invasion. Using a sector specific model of trade O Rourke analyses the effects of new world grain entering the European market. He finds that when the quantity of labour demand in food production falls, that the wages of these workers fall and so labour moves from food production to industry. But the implications of this for Italy is important, due to the late development of industry there was no industry for them to move into. The lack of alternative means of employment is essential in considering the fluctuating price of grain as a major push factor for the average Italian worker in increasing their propensity to migrate.

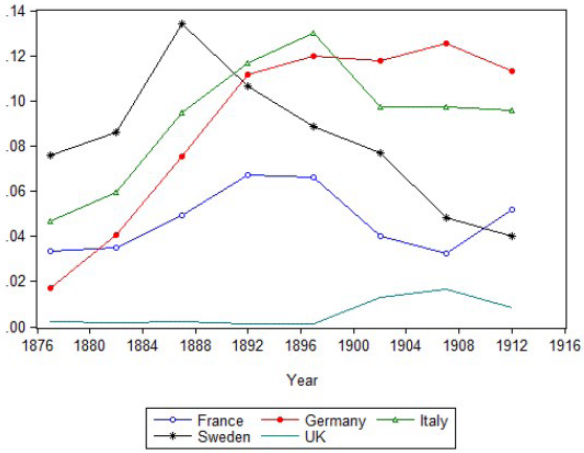


Figure 2

Persaud (2017) also finds support for the role of the price of stable foods in explaining migratory patterns in India. He uses data from Indian 19th century indentured servitude migration and looks at price changes and the migratory consequences of swings in the price of the food staple in India, rice. Likewise, he finds that instability in the price of the staple food, rice was a driving factor in increasing migration. He found this factor particularly strong for migratory patterns of the lowest caste. According to Persuad, this is because while many castes had formulated strong support networks which could weather price volatility the lowest castes often lacked these networks. This echoes Faini and Venturini s findings that the very poorest Italians were unlikely to move despite their financial

status.

Gray, Narciso, and Tortorici (submitted manuscript, 2017) greatly inform our argument finding Italian migration to be a function of agricultural prices. Their work studying the determinants of Italian migration from 1876- 1913 finds agricultural market integration and its resulting prices changes to be a major explanation of Italian migration along with other literature s findings on the importance of migrant networks and landholding structures. Essentially they posit that migration was possible due to rising agricultural incomes which released substantial portions of the population from a poverty trap at different times. Another key finding of theirs is that the increasing volatility of agricultural prices over time also increased emigration.

Conclusion

In conclusion, this paper has argued that the price of grain is a major explanatory factor in understanding the pattern of Italian migration from 1870-1913. Grain has proved to be a major export of the Italian economy up to the 1880s as well as a major source of income for the Italian economy. Thus, the onset of the Agrarian Crisis in the 1880s meant Italy was hit hard by the fall of the price of grain. With the cost of transport falling, the forces of globalization brought cheap new grain into Europe. Suddenly Italy found itself going from a net exporter of grain to a net importer of grain as a result of falling international prices. The Italian government began a major land reclamation project, as well a project of imposing duties and tariffs on the import of key grains like wheat (Cohen and Federico). As a result, protectionism created a higher grain price and thus a higher nominal wage, giving the poorest in the Italian economy a positive shock in their income which facilitated their migration. This particular narrative of Italian migration finds extensive empirical support in both neoclassical migration literature as well as more complex international theories on the impact of the changing price of food staples on migratory patterns. The fact that Italian grain price literature complements the mainstream Italian migration literature which draws heavily on income shocks, wage ratios between the region of origin and country of destination and the presence of Italian network only further strengthens its case.

It is important to investigate the role of food prices as a factor in migration today for three key reasons; to highlight the issue of prices, wages and employment security in acting as a push factor in migration, to demonstrate the need to promote diversification in a country s main products and exports, as well as to inform policy makers of the potential outcomes of price changes in major products in an economy. While today s major migrations are largely a product of war and

conflict we must be ready for future migration factors. Some scientists have posited that with climate change and increasingly severe climate patterns our ability to grow certain staple crops may change and there is potential for food prices to become a driving factor in the global economy and the decision to migrate. This makes it even more important to reflect on the role of the price of a food stable in past migratory flows.

Reference List:

1. Blinkhorn, Martin. Mussolini and Fascist Italy. London: Routledge, 2009. Print. pp. 22
2. Broadberry, Stephen, Claire Giordano, and Francesco Zollino. "A Sectoral Analysis of Italy's Development, 1861-2011." SSRN Electronic Journal (2011): n. pag. Web.
3. Cohen, J. and Federico, G. (2001). The growth of the Italian economy, 1820-1960. Cambridge: Cambridge University Press.
4. Faini, R. and Venturini, A. (1994). Development and Migration: Lessons from Southern Europe. Migration and Growth: The Experience of Southern Europe.
5. Federico, Giovanni, Alessandro Nuvolari, and Michelangelo Vasta. "The Origins of the Italian Regional Divide: Evidence from Real Wages, 1861-1913." VOX. CEPR, 6 Nov. 2017. Web. 8 Nov. 2017.
6. Federico, Giovanni, and Romeo Giannetti. "Italy: Stalling and Surpassing." European Industrial Policy. By Giovanni Federico and James Foreman-Peck. Oxford: Oxford UP, 1999. 124-51. Print
7. Gray, R., Narciso, G. and Tortorici, G. (2017). Globalization, Agricultural Markets and Mass Migration. Centre for Research and Analysis of Migration Discussion Paper Series, (13/17).
8. Gomellini, M. and O'Grada, C. (2011). Outward and Inward Migrations in Italy: A Historical Perspective. SSRN Electronic Journal.
9. Hatton, T. and Williamson, J. (1998). The age of mass migration. New York: Oxford University Press.
10. Honour, H. and Fleming, J. (2016). A world history of art. London: Laurence King Publishing.
11. Hsiao, C. (2006). Panel Data Analysis - Advantages and Challenges. SSRN Electronic Journal.
12. Istututo Nazionale di Statistica (ad annum). Annuario statistico italiano, Ministero dell'interno e Direzione generale di statistica. James, H. and O'Rourke, K. (2011). Italy and the First Age of Globalization, 1861-1940. SSRN Electronic Journal.

13. Kindleberger, C. (1996). World economic primacy. New York, N.Y.: Oxford University Press.
14. Lehmann, S. and O'Rourke, K. (2011). The Structure of Protection and Growth in the Late Nineteenth Century. Review of Economics and Statistics, 93(2), pp.606-616.
15. Luzzatto, G. (1969). An Economic History of Italy from the Fall of the Roman Empire to the Beginning of the Sixteen Century.. Routledge.
16. Moretti, E. (1999). Social Networks and Migrations: Italy 1876-1913. International Migration Review, 33(3), p.640.
17. O'Rourke, K. (1997). The European Grain Invasion, 18701913. The Journal of Economic History, 57(04), pp.775-801.
18. Pistoresi, Barbara, and Alberto Rinaldi. "Exports, Imports and Growth New Evidence on Italy: 18632004." Explorations in Economic History 241254 49.2 (2011): n. pag. Web.
19. Spitzer, Y. (2017). Pogroms, Networks, and Migration: The Jewish Migration from the Russian Empire to the United States 18811914. Ph.D. Northwestern University.
20. Schmidheiny, K. (2016). Panel Data: Fixed and Random Effects. [online] Schmidheiny.name. Available at: https://www.schmidheiny.name/teaching/panel2up.pdf [Accessed 1 Dec. 2017].
21. Stock, J. and Watson, M. (2012). Introduction to Econometrics. Boston: Pearson, pp.350-386.
22. Todaro, M. (1969). A Model of Labor Migration and Urban Unemployment in Less Developed Countries. The American Economic Review, 59(1), pp.138-148.
23. Toniolo, G. (2013). The Oxford handbook of the Italian economy since unification. New York: Oxford University Press.

Economic Policy

Touts Out: How A New Pricing System Could Solve Ticket Resale's Problems

Eoin Cambay, Senior Sophister

Eoin Cambay to analyse the market for tickets for popular events such as concerts by looking at all of the actions that the major actors in the market have taken in recent years that have caused such public attention, and explaining how the two-tiered nature of the market creates incentives for this behaviour. He/she then goes on to explain how these actions have impacted consumers, and outlines the main regulatory actions taken to remedy this. They then go on to propose a solution to the inefficiencies in the market by offering different options to consumers, while still satisfying the major actors in the market.

Introduction

Ticket resale is a contentious topic as public outcry concerning exorbitant prices has led to several ongoing investigations at home and abroad. This paper will begin by describing the interdependent nature of primary and secondary markets and the buyer uncertainties that define them. This will serve as a foundation to discuss the principal topic, recent developments in the secondary market and whether this sheds new light on previous investigations into potential anti-competitive behaviours. The current model of single-period fixed prices coupled with strategic capacity rationing to retain tickets for the secondary market, reduces consumer welfare and harms the overall ticketing market. This paper will go further, by reasoning that the current resale market is inefficient, and argue that the introduction of a more flexible approach using options pricing consumers will enjoy more efficient allocations. To achieve this, this paper will seek to amalgamate the approaches of Cui, Duenyas, Sahin (2013), and Leslie, Sorensen (2009,2013). Effective rationing is assumed as described by Svensson

(1980), accounting for the stochastic nature of primary market ticket availability.

Markets & Buyer Uncertainties

There are two ticket markets - primary and secondary - which are interdependent; outcomes in the former affect the latter and expectations of the latter affect the former. Within these two markets are three market players - producers, brokers and consumers - to whom economic surplus is unevenly reallocated. Brokers and consumers are buyers, but only consumers gain utility from attending the event as brokers are purely speculative.

Primary market:

In the primary market, tickets are sold at a fixed nominal value, plus charges. Each buyer has access to information on expected demand, approximate capacity, size of venue, and the number of players. The buyer is presented with a trade-off between advantages and disadvantages of early arrival, with higher quality seats likely to sell faster yet subject to time costs. The assumption of heterogeneity in both cost and benefit of early arrival presented by Leslie, Sorensen (2013) is maintained, as otherwise buyers would arrive according to their willingness to pay and the primary market would be efficient. As most artists are dependent on a loyal fan base whom they do not want to outprice, they are reluctant to set prices at market clearing levels.

Secondary market

In the secondary market, tickets previously sold are put up again for sale. The secondary market has several players; ticket resale marketplaces (e.g. StubHub), who facilitate resale and profit from a percentage fee of the resale price, consumer resellers, fair exchange platforms, general online platforms and speculative buyers. Currently, Ireland has no prohibition on ticket resale and no regulation regarding price of resale tickets with respect to their nominal value on secondary markets (DJEI,2017). Waterson (2016) states a 25-30% combined fee is levied against buyers and sellers on secondary market ticket platforms, higher than in the primary market. Many point to the mismatch between high demand and the limited supply of tickets priced below the market clearing price as the primary reason for the existence of a secondary market. Evidently the supply side is fixed, thus proponents argue for demand-based pricing. Yet this leads to a situation where consumers priced out of the secondary market would similarly be excluded from the primary market. Leslie, Sorensen (2013) showed that an inefficient primary market with resale opportunities, incubates rent-seeking and

transaction costs which diminish the allocative efficiency gains from a secondary market. Frictions, regulatory or self-imposed, which increase the transaction costs decrease total surplus.

Buyer Uncertainties

Primary market decisions are guided by expectations of the secondary, within which several buyer uncertainties play a role.

1. Stochastic nature of buyers' arrival in primary market
2. Unforeseen schedule conflicts: represented in the consumer decision path figures as a probability v' prime of a clash and a probability 1 - v' prime of no clash [Figure 1]. This is resolved between primary and secondary market under fixed pricing and between the first and second duration of the primary market under options pricing.
3. Randomness in secondary market buying
4. Event specific shock to demand: although popularity is apparent to buyers, the primary market price will not fully reflect this. The secondary market is where the full extent becomes evident.

Selling of tickets below nominal value occurs if consumers have purchased but are presented by uncertainty b) or if speculators have overestimated demand as per uncertainty d). Furthermore, event consumers are often asked to purchase tickets far in advance, such that accounting for scheduling conflicts is difficult. An efficient secondary market increases consumer surplus by allowing consumers who previously purchased a ticket and cannot attend to resell and providing consumers who did not participate in the early market access to tickets.

New Developments in Secondary Market & Closeness of Competitors

Although the Irish and U.K. markets are geographically distinct, they accommodate the same market players given their proximity, shared language and similar culture, with the exceptions of consumers and venues. Both markets have undergone large-scale consolidation and vertical integration with a handful of players dominating the market. Whilst the secondary market has always been characterised by high demand and limited supply, it has been altered by the rise of online selling. (DJEI,2017)

As many venues are now owned by ticket distributers, distributors have

gained further control over the primary market. Although artists still largely control ticket prices, the responsibility for distribution of tickets lies with the venue and promoter. An example of the pervasiveness of a single player's influence over the process is Live Nation (promoter), the parent company of the 3 arena (venue) for whom Ticketmaster (ticket distributer) allocates primary market tickets. The caveat to this is that whilst in theory all the activities, represented under the vertical integration of a market player such as Live Nation, are discrete. If inventory empties on a primary market site such as Ticketmaster, consumers are redirected to one of its secondary market sites. Through the anonymised settlement data presented by Waterson (2016), it is calculated that ticketing distributers used strategic capacity rationing to retain 4.96% primary market tickets to be sold on their own secondary market platforms. This is supported by Smith (2009) who states that Ticketmaster regularly lists hundreds of top tiered tickets on its secondary market resale site.

In 2002, at the time of the merger between Ticketmaster and Seatwave, the U.K.'s Competition and Markets Authority found there to be sufficient competition in the secondary market (CMA,2015). Specifically, the CMA looked at whether the merger would result in the realistic prospect of a substantial lessening of competition, and if it would subsequently lead to customer and input foreclosure. Both possibilities were dismissed on the basis of a small route to market, and limited incentives for producers to set price-floors on secondary market ticket prices (CMA,2015). Furthermore, the CMA did not find primary tickets to be a constraint on secondary market tickets. The merger was also investigated by the Irish Competition Authority under section 5 of Competition Act, 2002. Here, the relevant market was that of outsourced ticketing services for events with a national or international appeal (CA,2006). At the time, Ticketmaster held a monopoly market share of 100%, far more than it now holds. The CA found Ticketmaster not to be abusing its market dominance given two major promoters kept it from doing so.

This begs the question, do the CMA's and CA's conclusions remain valid now in a ticketing market which differs greatly from its standing in 2002?

Firstly, it is important to recall the current interdependent nature of ticketing's two markets, which has grown in recent years. Customer foreclosure is now apparent as primary market suppliers are reselling tickets directly on their secondary platforms, at a higher price with added revenue accruing to the now merged entities. This is indicative of coordinated effects. Input foreclosures are harder to demonstrate given that there are several other large players with similar

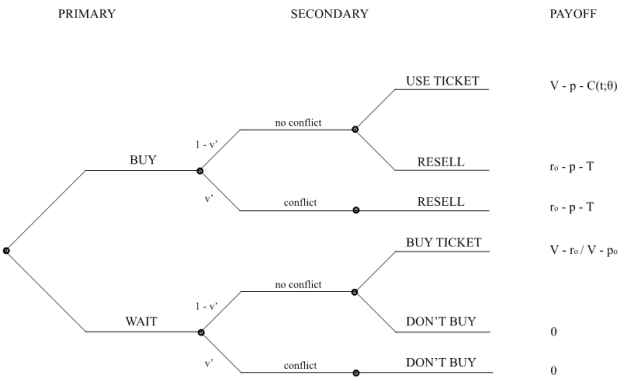
arrangements in the Irish and U.K. markets, and as each firm maintains its proprietary ticketing and data system, this points to existing competition. This might not be the case outside the markets considered here, given NYAG Schneiderman (2016) found NFL teams have implemented price floors on their official secondary platforms, even citing excessive service charges as potential evidence of abuse of monopoly power. The crucial difference between this and the market under study, lies with who sets the price.

The primary price-setting power resides with the artists themselves and, as such, the initial pricing power is outside the reach of the vertically merged entities. Additionally, as no player is dominant, the market remains competitive. This is further justified by the presence of other resale opportunities, be they via traditional street touts or online marketplaces. The presence of other opportunities also negates tacit coordination.

Consumer Welfare & A New Pricing System

If we assume the principal consumer interest is the ability to access events at a price that equates their realised valuation, Waterson (2016), then the current market conditions are adequate. However, ticket prices should look to reward long term supporters, rather than aim for short-term profit maximisation. In this aspect, the current resale market is insufficient. Given the interdependent nature of ticketing markets, actions to increase consumer welfare must take place in the primary market.

FIXED PRICING



The Call for Evidence survey (Waterson, 2016) proposes a 'cooling off period' where primary market consumers can resell their tickets to the seller, which thereafter can be resold. Additionally, prices below the market clearing rate is a magnet for touts, and without clear constraints, tickets will quickly migrate to the secondary market, resulting in reduced consumer welfare via higher prices and fees.

Consider the following. Options allow buyers to reserve a seat for a nominal fee, the option price (x), this gives the right but not the obligation to purchase the ticket, at a strike price (p). Both prices are readily available in the primary market, and selling of options by producers past capacity is not allowed and options are non-transferrable between buyers. Under fixed pricing the full ticket value is lost if the buyer is unable to attend or resell, however under options pricing only x is lost.

Consumer's exercise options if:

$$\max(V, (1-T)\gamma_0) > \rho$$

Thus, if either their realised valuation (V) is greater than the strike price (p) or the payoff from ticket resale is greater than the strike price.

Speculators exercise options if:

$$(1-T')\gamma_0 > \rho$$

Given speculators have no value in attending, the option is only exercised if the payoff from the ticket resale is greater than the strike price. If options reduce resale then they also reduce low-valuation buyers' incentives to purchase tickets, thus off-setting the costly effort of the arrival game presented under fixed pricing. Left unchecked arrival game costs erode gains from reallocation. The producers' optimal price occurs when:

$$x^* + \rho^* < \rho_0^*$$

where ρ_0^* represents the regular priced ticket in the secondary market. Producers should set x* at minimum level which incentivises buyers to purchase options, whilst setting a high ρ^*. The reason for a high strike price is twofold, it suppresses consumer resale while also ensuring a large pool of expired options, and thus tickets to sell in the second duration at a raised price. Options pricing by default allows strategic capacity rationing through control of the strike price. Importantly whilst under fixed pricing this would reduce consumer welfare the same cannot be said under options.

Figure 2 shows the consumer's decision path under this scenario, demon-

strating the reduction in the resale market. Here, resale opportunities are diminished and potential consumers losses reduced. The producers are now directly competing with speculators.

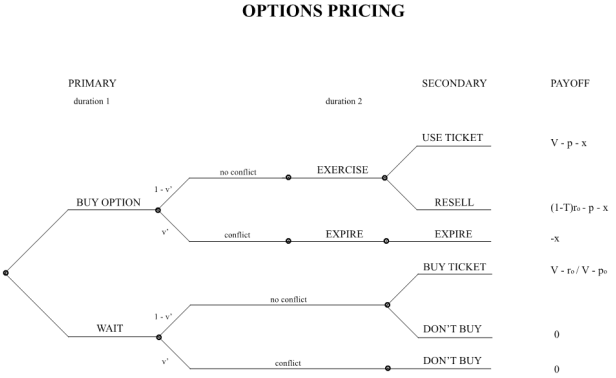


Figure 2: consumer decision path under options pricing

Conclusion

Despite ongoing investigations into the secondary ticket market, this paper does not find evidence of anti-competitive behaviour. However, it is apparent that consumers are being negatively impacted by both limited primary market availability and high secondary market prices. The ticketing industry stands at a crossroads, public anger is at boiling point, policy makers have threatened to use their powers to enact regulation and artists are being accosted by apoplectic fans. Although the players in the market are currently acting fairly, it is submitted that the current situation is unsustainable. To solve this an options pricing method should be adopted by all market players. This would reduce the resale market, and thus that of speculative opportunities. The advantages for producers and buyers, are that of maintaining producer surplus and accounting for buyer uncertainties, and increasing consumer welfare respectively.

Appendix

VARIABLE	EXPLANATION
V	Realisation of valuation, V=0 for speculators
x	Option price
p	Strike price
r_s	Resale price
T	Consumer transaction cost
T'	Speculator transaction cost
$C(t;\theta)$	Arrival cost under fixed pricing, t = time, θ= buyer type

Reference List:

1. CCPC. 2017. CCPC commences formal investigation into suspected anti-competitive conduct in the ticketing sector. Available at: https://www.ccpc.ie/business/ccpc-commences-formal-investigation-suspected-anti-competitive-conduct-ticketing-sector/
2. Competition Authority. 2016. Decision of the Competition Authority (Case COM/107/02)
3. Competitions & Markets Authority (CMA). 2015. Completed acquisition by Ticeketmaster Europe Holdco Limited of Seatwave.
4. Cui, Duenyas, Sahin. 2013. Should Event Organizers prevent Resale of Tickets.
5. Department of Jobs, Enterprise and Innovation, Department of Transport, Tourism and Sport. 2016. Consultation on the resale of tickets for entertainment and sporting events.
6. EU Commission. Guidelines on the assessment of non-horizontal mergers under the Council Regulation on the control of concentrations between undertakings.
7. Leslie, Sorensen. 2013. Resale and rent-Seeking: An Application to Ticket Markets, Review of Economic Studies.
8. Leslie, Sorensen. 2009. The Welfare Effects of Ticket Resale.
9. Schneiderman, New York State Attorney General. 2016. Obstructed view: What's blocking New Yorkers from Getting Tickets.
10. Smith, E,. 2009. Concert Tickets Get Set Aside, Marked up by Artists, Managers, Wall Street Journal. Available at: https://www.wsj.com/articles/SB123672740386088613
11. Svensson, L. 1980. Effective Demand and Stochastic Rationing, Review of Economic Studies.
12. Ticketmaster, Written Evidence submitted for the Digital Economy Bill (DEB 76).
13. Waterson, M. 2016. Independent Review of Consumer Protection Measure concerning Online Secondary Ticketing Facilities.

The War On Drugs: Worst Comedown Ever?

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Despite the infamous effects of the Prohibition of Alcoholic Beverages from 1920 to 1923, the world and in particular the United States has once again called for a complete prohibition or war on drugs. This paper presents a thorough examination of the economic implications of a drug-related prohibition and supply-side zero-tolerance policies. Yielding a comprehensive analysis conveying the obsolete nature of such a prohibition by considering funding and resource allocation, mortality of prohibition, the opportunities costs and subsequently the lack of achievements of prohibitions. Further, the paper goes onto discuss a variety of alternative strategies that countries such as Sweden and Portugal have enacted to combat this illicit industry.

Introduction

Every time [a drug dealer] is killed, a harder and more vicious version of him emerges to fill the space provided by prohibition for a global criminal industry It is Darwinian evolution armed with a machine gun and a baggie of crack (Hari, 2015: 58).

Ever since 1971, when Richard Nixon officially declared war on drugs , its effectiveness has been debated as well as compared to alternative policies such as treatment, rehabilitation and decriminalization. The aim of prohibition is to simply forbid drug use, due to its deleterious effects on society. However, economists argue that prohibition itself can have more damaging repercussions, such as, violence, crime, mortality and the futile allocation of valuable resources.

This essay examines the economic impacts of prohibition and supply-sided zero-tolerance policies, with a particular focus to the United States. In a global war, it is important to learn from the mistakes of others and to follow by example. As evidence demonstrates, the war on drugs has been an expensive and ineffective one. Crime and mortality are high unlike in countries that have adopted decriminalization. For example, Sweden and Portugal, which have benefitted from less HIV infections and new sources of tax revenue. In order to understand the economic significance of this war on drugs, one must first examine how and why the combat began.

Early Prohibition

The Godfather From 1930 to 1962, Harry J. Anslinger held the title of Commissioner of The Federal Bureau of Narcotics (McWilliams, 1990). Under his tenure, narcotics were progressively criminalized. An underlying racism motivated him and he employed dramatic fear mongering to gain support: Harry had tapped into the deepest fears of his time (Hari, 2015: 43). According to Anslinger, the blacks, Mexican and Chinese were using these chemicals, forgetting their place, and menacing white people . He went further in his use of propaganda to frighten the public. He fabricated sensational myths and false accounts about drug use. For example, he said that marijuana could cause people to fly into a delirious rage and commit violent crimes , such as rape and murder (McWilliams, 1990: 70).

Despite the race panics, fear mongering and criminalization, the drug market grew. Gangsters, such as Arnold Rothstein, identified large potential in dealing. Control of the market was now theirs after Anslinger s bureau shut down heroin clinics across the United States (Hari, 2015). Due to the fact that protection was not provided by the state, drug lords had no choice but to resort to extreme violence in order to protect their product and their power: you have to feed or you will be food (Hari, 2015: 63). Rothstein s success and power is best observed in monetary values. His wealth reportedly amounted to $125 million in 2016 Dollars (Pietrusza, 2011).

Anlsinger s solution to the drug problem was to crack-down with longer prison sentences and exceptionally harsh penalties (McWilliams, 1991). His most significant movement in the drug war was drafting the Marijuana Tax Act of 1937 which imposed penalties and regulations on the sale of marijuana for medicinal purposes (DiFonzo & Stern, 2015). This effort earned Anslinger the prestigious title of The Godfather of Marijuana Prohibition. Just as drug dealers over-fill their predecessor s shoes, Anslinger s loafers were bursting at the seams with a long line of even more powerful prohibitionists.

Supply Sided US Drug Policy

President Nixon was the first to coin the phrase war on drugs , referring to law enforcement directed against illegal recreational drug use (Bullington & Block, 1990). During his presidency he launched drug interdiction operations in Mexico in order to encourage the regulation of cannabis farming there. The border was closed in an expensive process that cost the U.S. hundreds of millions of dollars as well as all trade with Mexico. As a result, the flow of marijuana

ceased, however, Nixon was completely unsuccessful as Colombia quickly took over as America s new marijuana supplier (Rosenberger, 1996). The huge amount of money and effort spent on this operation simply resulted in a re-structuring or re-routing of the drug trade.

There is a lesson to be learned here that as long as demand exists, so will supply. However, history continued to repeat itself. In just the first term of Ronald Reagan s presidency, funding for interdiction and eradication schemes reached US$1.4 billion. While annual average funding for rehabilitation, prevention and education initiatives declined by US$24 million (Rosenberger, 1996). Bill Clinton continued with the Republican s supply sided policy: in the 1995 budget, funding for rehabilitative strategies and treatment programmes was only US$2.5 billion compared to US$7.8 billion on drug law enforcement (Rosenberger 1996).

Evidently, the prevailing mind-set of U.S. administrations during this period was a temperance view of addiction which suggested that the drug dealer was the source of the problem and that the drug itself is the only ingredient in addiction. In actuality, chemical hooks are only a minor part of addiction, according to Hari (2015), only 20% of individuals who try crack will become addicted in their life time. Instead of adopting a disease concept view in which addiction is a result of circumstantial factors, addicts were heavily fined and incarcerated. Instead of supporting recovery and integration into society, addicts were perceived as morally defective.

An Exorbitant War

Funding and Resource Allocation

Programmes and initiatives of interdiction and eradication have been costly and ineffective. Plan Colombia was an initiative signed into law in the U.S in 2000 by President Clinton, aimed at eradicating coca cultivation and reducing the supply of cocaine (Franz, 2016). Mejia and Restrepo (2015) found that this eradication policy, and all others like it, had limited effects on the supply of cocaine because markets adjust by increasing land productivity. In the five years following Plan Colombia s initiation, yields per hectare had increased by 40%. As a result, retail and wholesale markets in U.S. remained completely unaffected (Mejia and Restrepo, 2015). The model devised by Mejia and Restrepo estimates that the marginal cost to the U.S. of reducing the quantity of cocaine transacted in retail markets by just 1 kg, is about $940,360 for eradication initiatives and about US$175,273 for interdiction strategies, such as, that of Plan Colombia. This is exceptionally disquieting when compared to the cost of reducing consumption

by one kilogram using rehabilitation policies, which amounts to just US$8,250 per annum (Reuter, 2001).

Similar to interdiction schemes such as Plan Colombia, the punitive drug laws and zero tolerance policies initiated by President Clinton, were also costly and essentially ineffective. 75% of the drug law offences in 1995 were solely for drug use (Nadelmann, 1991) and in 1996, 59.6% of prisoners were drug related criminals (Miller, 1996). Convictions in this period consisted primarily of low-level marijuana offenses, costing the U.S. roughly $4 billion per annum on just minor misdemeanours (King and Mauer, 2006). The result of the crack-down on drug users and increase in punitive measures, contributed to prison over-crowding. And for the first time in America's history, state spending on prison construction ($2.6 billion) surpassed spending on university construction ($2.5 billion) in 1995 (Ahn-Redding, 2010). By 2002, the domestic law enforcement component of the federal drug control budget was $9.5 billion, resulting in a total increase of $4.9 billion since 1991 (King and Mauer, 2006). The allocation of valuable resources under these policies is questionable, especially due to the unintended consequences which ensue prohibition and punitive law enforcement.

Crime and Mortality

It is a common misconception that the majority of drug-related deaths are caused by over-dosing. However, in 1986, New York, over three quarters of drug related deaths were results of attacks/ murders (Hari, 2015). The genesis of these attacks remained this prohibition.

De Mello (2015) found that drug trafficking and crack cocaine have no impact on property crime, only homicides, and thus, drug-induced crime must be a product of the systematic violence induced by illegality itself. Prohibition manufactures the organized crime that is behind the violence. It is not repercussions of the necessity to maintain habitual drug use which causes the high drug-related mortality rates. Hari (2015) also believes that it is prohibition which creates a culture of terror. After Rothstein in the 1920s followed a chain of criminals and drug gang leaders, each more vicious because he was strong enough to kill the last. The system rewards violence with power. And accordingly, these criminals become the only beneficiaries of prohibition. However, with decriminalization, the profit motive is non-existential and the subculture dissipates.

The effects of decriminalization on death rates can be seen in Switzerland after the initiation of a harm-reduction policy in 1994. Drug related deaths were roughly 350 400 per annum in the early 1990s before the adoption of the new

anti-prohibition drug policy. This figure approximately halved to 150 200 per annum during the 2000s (Reuter and Schnoz, 2009). Before Switzerland s innovative policy, HIV rates were alarming. After a decade, the number of drug injectors with HIV had been reduced by over 50% (Nebehay, 2010). These positive results can also be seen in Portugal; before 2001 when it decriminalized all drugs, there was a soaring amount of drug-related AIDS deaths. Since 2001, drug-related HIV infections have reduced by 94%. There has also been a sharp decline in overdose deaths to 3 per million, relative to an alarming 185 per million in the U.S. (Miron, 2017).

Ribeaud (2004) found that the Swiss heroin prescription scheme has resulted in crime reduction due to the waning of acquisitive pressure on addicts. Attending the prescription centre multiple times daily stabilizes their routines, giving addicts purpose and psycho-social support. Vital bonds with society materialize and treated patients reintegrate into society. According to Hari (2015) an addict is formed when an individual experiences isolation and trauma. Bonds which should be derived from society and interaction, are replaced by the high or satisfaction gained from substance abuse.

Opportunity Costs

The cost of foregone alternatives under prohibition are significant. The two deadliest recreational drugs on earth are licensed and regulated right now. Regressive sin taxes on alcohol and tobacco raise enormous amounts of revenue for states across the globe. In 2014, the U.S. government collected $6.1 billion from excise taxes on alcohol, and a staggering $6.9 billion in cigarette taxes (Amadeo, 2018). From 1920 to 1933 in the United States, there was a prohibition on alcohol production and sale. One of the motives behind this policy was to reduce the tax burden created by prisons and poorhouses. The noble experiment was, in fact, a failure, and Franklin Roosevelt actually legalized alcohol again in 1933 in search of new sources of tax revenue (Thornton, 1991).

If drugs were legalized and taxed, the tax revenue collected could be used for treatment programmes to counteract the small increase in drug use that could result from legalization. Roumasset (1996) found that in the case of cocaine in the U.S., only 10.8% of the tax revenue would be required for rehabilitative schemes, in order to hold cocaine use constant after legalization. According to Jacobi and Sovinski (2016) marijuana legalization and taxification alone would raise a minimum of $77 million to $220 million per annum for Australia. A 2005 report funded by the Marijuana Policy Project estimated that $6 billion would be raised annually in the United States if marijuana were taxed similarly to alcohol

or tobacco. These are strong arguments in favour of legalization and there is more than just what s at face-value. The decrease in expenditure on expensive eradication and interdiction schemes would also generate a significant improvement in the government budget balance. However, there are also notable arguments for prohibition which should be reviewed.

The War on Drugs: a search for achievements

The most valuable research in arguing an anti-prohibitionist case, is to analyse whether the War on Drugs achieved its main goal or not; to prevent the use of drugs. The Office of National Drug Control Policy (ONDCP) stated, in their 2003 Strategy, that illicit drug use among teenagers was at its lowest level since a decade (Robinson and Scherlen, 2014). Although, this is a positive outcome, the ONDCP are actually admitting failure as it is their first significant downturn and they have only begun to reduce drug use. The positive outcome is thus unrepresentative of the long-term trends. The ONDCP s claims of short-term and irregular positive changes are representative of all of the benefits of the war on drugs. Reagan s punitive sentencing laws for drug offenders, led to a colossal increase in incarceration rates. This outcome can also be seen as a short-term positive effect of the war because for the short period of time before a drug dealer is replaced, he is locked up in prison. Despite these minute achievements, the policy was a failure leaving the supply and consumption of drugs was left unaffected.

Aside from domestic strategies, it is also important to review the effectiveness of foreign policies. The supply-sided eradication policies initiated under Plan Colombia were somewhat successful because cultivated coca decreased by 50%, from 160,000 hectares at the initiation of the scheme to 74,000 hectares 6 years later (Franz, 2016). However, the UNODC (2011) reported that cocaine production only increased by 5.3% due to the readjustment to a system of increased productivity per hectare. These results are indicative of the importance of not taking the effects of the drug war at face-value.

Concluding Convictions and Suggestions

Statistical evidence is testimony to the failures of the war on drugs. The wealth of research conducted on the results of the war and the possible alternative strategies, supports the argument against prohibition. The enormous cost of ineffective supply-sided interdiction and eradication schemes by the U.S., lends to the attraction of more worthwhile rehabilitative and preventative policies. These policies have been proven to be more successful and a more valuable allocation of resources, in countries such as Sweden and Portugal. As discussed, the results

were lower crime and death rates as well as a reduction in the spread of HIV. Under these schemes, addicts are reintegrated into society. Before, they were a cost to the government, now, they join the labour force and become valuable assets and resources. All governments must enact policies to follow in the steps of countries such as Sweden and Portugal. Policies of legalization and regulation would result in a dramatic reduction in the size of the black market for drugs, which thrives off of prohibition. The reduction in organized crime would reduce the mortality rate, improving security, health and productivity of citizens. Drugs would be prescribed by doctors on the basis of necessity. Use would increase slightly but harms would reduce drastically. Unlike drug dealers, licensed retailers would have no incentive to sell to teenagers as they would lose their licence. The significant increase in disposable government revenue would be accompanied by hefty tax revenues to boost economic activity. The research has been done, the effectiveness proven, now it is time to officially end the war on drugs and all of its unintended consequences, and to implement a new and more effective strategy across the globe; legalization.

References

1. Ahn-Redding, H., 2010. The "million dollar inmate": the financial and social burden of nonviolent offenders. Lexington Books/Rowman & Littlefield Publishers: Lanham, MD.
2. Amadeo, K. 2018. Sin Taxes, Their Pros and Cons, and Whether They Work . The Balance. [on-line], https://www.thebalance.com/sin-tax-definition-examples-4157476. [Accessed: 11 February 2018]
3. Bullington, B. and Block, A.A. 1990. A Trojan horse: Anti-communism and the war on drugs. Contemporary Crises 14:1:39-55.
4. De Mello, J.M.P. 2015. Does Drug Illegality Beget Violence? Evidence from the Crack-Cocaine Wave in Sao Paulo. Economia: Journal of the Latin American and Caribbean Economic Association 16:1:157-85
5. DiFonzo, J.H. and Stern, R.C. 2015. Divided we Stand: Medical Marijuana and Federalism . Health Lawyer 27:5:17-25.
6. Franz, T. 2016. Plan Colombia: Illegal Drugs, Economic Development and Counterinsurgency A Political Economy Analysis of Colombia s Failed War . Development Policy Review 34: 4:563-91.
7. Hari, J. 2015. Chasing the Scream. Great Britain: Bloomsbury.
8. Jacobi, L. and Sovinsky, M. 2016. Marijuana on Main Street? Estimating

Demand in Markets with Limited Access?. American Economic Review 106:8:2009-45.

9. King, R.S. and Mauer, M. 2006. The War on Marijuana: The transformation of the war on drugs in the 1990s. Harm Reduction Journal 3:6:6-17.

10. McWilliams, J.C. 1990. The Protectors: Harry J. Anslinger and the Federal Bureau Of Narcotics, 1930-1962. Newark: University of Delaware Press.

11. McWilliams, J.C. 1991. Drug Use in American History. Oxford Journal 6:2:3-5.

12. Mejia, D. and Restrepo, P. 2015. The Economics of the War on Illegal Drug Production ad Trafficking. SSRN Electronic Journal. [on-line], https://economics.mit.edu/files/11092. [Accessed: 10 February 2018].

13. Miller, J. 1996. Search and Destroy: African-American Males in the Criminal Justice System. Cambridge University Press, New York

14. Miron, J. 2017. Could Legalizing All Drugs Solve America s Opioid Epidemic?. Fortune. [on-line], http://fortune.com/2017/09/19/jeff-sessions-opioid-epidemic-legalize-all-drugs/. [Accessed:11 February 2018].

15. Nadelmann, E. (ed.) 1991. The Drug Legalization Debate. Newbury Park CA: Sage.

16. Nebehay, S. 2010. Swiss drug policy should serve as a model: experts. Reuters. [on-line],https://www.reuters.com/article/us-swiss-drugs/swiss-drug-policy-should-serve-as-model- experts-idUSTRE69O3VI20101025. [Accessed: 11 February 2018].

17. Pietrusza, D. 2011. Rothstein: The Life, Times, and Murder of the Criminal Genius Who Fixed the 1919 World Series. Basic Books.

18. Reuter, P. 2008. Can production and trafficking of illicit drugs be reduced or merely shifted? Washington: The World Bank.

19. Reuter, P. and Schnoz, D. 2009. Assessing Drug Problems and Policies in Switzerland, 1998-2007. Bern, Switzerland: Swiss Federal Office of Public Health.

20. Ribeaud, D. 2004. Long-term Impacts of the Swiss Heroin Prescription Trials on Crime of Treated Heroin Users,"Talahassee, FL: University of Florida Journal of Drug Issues.

21. Robinson, M.B., Scherlen, R.G. 2014. Lies, damned lies, and drug war statistics: a critical analysis of claims made by the Office of National Drug Con-

trol Policy. Albany: State University of New York Press.

22. Rosenberger, L.R. 1996. America s Drug War Debacle. Brookfield, VT: Ashgate Publishing Co.
23. Roumasset, J. 1996. Prohibition vs. Taxification: Drug Control Policy in the USA . University of Hawaii at Manoa, Department of Economics, Working Papers. [on-line], https://www.researchgate.net/publication/5082170_Prohibition_vs_Taxification_Drug_Control_Policy_in_the_USA [Accessed: 10 February 2018].
24. Thornton, M. 1991. Alcohol Prohibition Was a Failure . CATO Institute. [on-line], https://www.cato.org/publications/policy-analysis/alcohol-prohibition-was-failure. [Accessed: 11 February 2018]. UNODC (2011) World Drug Report 2011. Vienna: United Nations Office on Drugs and Crime.

Can Crowdsourcing Help Us Address Wicked Problems?

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Human ingenuity has continuously aided problem solving through time, yet the problem solving process gains complexity when encountering problems that present multiple participants with differing opinions and agendas – wicked problems. The onset of global integration through globalization has provided a platform for these problems to grow in volume and in intricacy, This is due to the added complexity of new participants added by various cultural and ethnic factors. This literature review aims to unearth whether the concept of crowdsourcing may be applied in combatting these wicked problems. This evaluation will explore how crowdsourcing can provide a means to solve wicked problems before discussing how best to organise and implement crowdsourcing to address wicked problems. An example using Hyperloop Transportation Technology will be presented - a company that currently leverages crowdsourcing capability to redefine space-time compression.

"Crowdsourcing harnesses the creative and competitive spirit of people all over the world, enabling them to solve big problems as well as small ones." Vivek Wadhwa (WSJ, 2017.)

Introduction

Throughout history, humans have proved to be ingenious problem solvers in a multitude of scenarios from taming wild animals to controlling fire and curing diseases. Scientific problems may be complex but they have a solution. Social problems are harder to define – the "solution" affects the problem in unexpected ways and they have multiple stakeholders with different opinions and objectives. Rittel coined these problems "wicked problems" (Rittel et al. 1973). With globalisation, the world is becoming increasingly interconnected: the problems we used to face as communities and towns now need to be tackled on a global scale. This increases the wickedness of problems by increasing the number and diversity of stakeholders. Crowdsourcing, defined as outsourcing tasks to the crowd, has been a topic of interest in innovation research in the last decade. As an approach,

crowdsourcing enables us to tackle all types of problems according to Wadhwa.

Can crowdsourcing help us address wicked problems?

In this literature review, I will define the concepts of crowdsourcing and wicked problems, look at the evolution of crowdsourcing, focus on idea crowdsourcing as a means to solve wicked problems before exploring how to organise crowdsourcing to address wicked problems. We will further illustrate the points made with the example of Hyperloop Transportation Technology, a company leveraging crowdsourcing to once again redefine our relationship to time and space.

Defining Wicked Problems and Crowdsourcing

Kolko defines a wicked problem as "a social or cultural problem that is difficult or impossible to solve for as many as four reasons: incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden, and the interconnected nature of these problems with other problems" (Kolko, 2012). Whilst Curtis talks about the six characteristics of wicked problems, Rittel gives the ten conditions that make a problem wicked (Curtis, 2016; Rittel et al., 1973). Due to the difficulty stakeholders have defining the wicked problem and the number of variables that affect it, there is no objective optimal solution to a wicked problem (Conklin, 2005). Solving wicked problems require a new problem-solving approach that is dynamic (Hautamäki et al. 2015).

Using the masses to solve complex problems is interesting as it limits individual biases and aggregates domain knowledge. Aristotle, the Greek philosopher, talked about the benefits of relying on the knowledge of the crowd when it comes to solving complex problems (Lord, 2013). However, before the internet, only local crowds could participate in solving problems, thus limiting the diversity of knowledge. Crowdsourcing, a term first coined by Howe in 2006, is defined as "taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call" (Howe, 2006). By dramatically lowering the cost of communication and enabling social interactions between strangers, the internet and social media have played a key role in the rise of crowdsourcing (Boncheck, 1995; Majchrzak et al., 2013; Brabham, 2008). Crowdsourcing has been successful across domains, industries and organisational sizes (Wilson et al.2017, Machado et al. 2014).

Despite Howe defining crowdsourcing only a decade ago, the definition of crowdsourcing has evolved. Due to social change and technological innovations, Kietzmann revisited and updated Howe's definition of crowdsourcing to "the use of IT to outsource any organisational function to a strategically defined popula-

tion of human and non-human actors in the form of an open call" (Kietzmann, 2017). This updated definition of crowdsourcing is broader than the previous and accounts for six changes that have occurred in the way we think of crowdsourcing (Kietzmann, 2017).

Despite recent efforts to define crowdsourcing, there is a lack of clarity between the terms "mass collaboration", "crowdsourcing", "open innovation" and "sustainable innovation". The overlap in the definitions of these concepts might be due to the fact that they are new and evolving.

The Evolution of the Concept of Crowdsourcing

Typology of Crowdsourcing

According to Prpic et al., four types of crowdsourcing exist based on two criteria: how the crowd contributes and how the organisation takes into account these contributions (Prpic et al., 2015). Lobre et al., have defined ten different applications of the crowdsourcing concept ranging from "crowdfunding" to "crowdcare", each having its strengths and weaknesses (Lobre et al., 2015). Ali-Hassan and Allam's work is more complete as it assesses the similarities, differences and overlap in the twelve sub-categories of crowdsourcing they discovered based on nine factors (Ali-Hassan et al, 2016). In this literature review, we are going to focus on idea crowdsourcing (when the crowd comes up with subjective solutions that the organisation filters), which we think is the most promising type of crowdsourcing to solve wicked problems (Prpic et al., 2015).

From Micro-Tasking to Idea Crowdsourcing

What we define as micro-tasking is what Howe called crowdsourcing: outsourcing to the crowd a task usually performed by employees. Micro-tasking is when the organisations break down processes into small repetitive tasks performed by the crowd and then aggregates the crowd's work. So far, micro-tasking is the most common form of crowdsourcing. It has mostly been used as a way to perform tasks faster, cheaper and more efficiently than employees can (Brabham, 2008). Micro-task crowdsourcing can "help firms access previously inaccessible resources to build a competitive advantage" (Prpic et al., 2015).

Our literature review has lead us to differentiate micro-tasks that are done intentionally by the crowd and those who are done unintentionally. To prove our point, we will take two examples: Duolingo and Wikipedia. When users decide to share their knowledge, they write an article and intentionally contribute to the free online encyclopaedia that is Wikipedia. Duolingo, is a language learning

app, however, by learning a new language, users are inadvertently participating in translating the internet (Garcia, 2013). Luis Von Ahn and his colleagues at Carnegie Mellon University have used this same model with reCAPTCHA, using the crowd to protect websites from spam robots while digitalising books (Von Ahn, 2008). While both of these types of crowdsourcing are extremely valuable, they currently do not tackle wicked problems. "Microtasking is well suited to problems that can be addressed by repeatedly applying the same simple process to each part of a larger data set. Microtasking alone, however, is inadequate for addressing wicked problems." (Michelucci and Dickison, 2015).

However, in the future, projects like Duoliongo, that use human computation which is defined as "the science that aims to combine the unique strengths of humans and computers to create new capabilities", could become a way to solve wicked problems if machines and humans manage to augment each other simultaneously (Michelucci and Dickison, 2015). "The human computation ecosystems of the future have huge potential to help address wicked problems, but are currently being explored in less wicked contexts" (Michelucci and Dickison, 2015).

While there is a lot of research around the types of crowdsourcing, a clearer differentiation between crowdsourcing as a social innovation and crowdsourcing as a means of social innovation is needed.

Literature review: Can crowdsourcing help us tackle wicked problems?

According to N. Roberts, there are three approaches to solve wicked problems: authority, competition and collaboration, each of them having their own advantages and disadvantages (Roberts, 2000). Human beings have a natural tendency of using authority or competition to solve problems, but it is collaboration that is the most suited for solving wicked problems (Roberts, 2000). Based on Roberts' work and the opportunity that collaboration represents in solving wicked problems, Denning and Yaholkovsky developed a five-stage process to allow for better collaboration (Denning et al., 2008). In 2000, Roberts urged research efforts to focus on the promising collaborative approach to wicked problem-solving. Her voice seems to have been heard. Indeed, since the turn of the millennium, there has been an emphasis on collaborative forms of innovation such as open innovation and networks in academic research with a (Hautamaki et al. 2015).

Idea crowdsourcing has advantages that make it the most promising collaborative approach to innovation in order to tackle wicked problems. Crowds cancel out personal biases, therefore leading to more rational results (Majchr-

zak et al., 2013). Furthermore, "the expertise [that] you need in dealing with a wicked problem is usually distributed over many people" (Rittel, 1972, p. 394). To tackle wicked problems, teams must be diverse and interdisciplinary (Surowiecki, 2004, Erickson et al., 2012; Hautamäki et al., 2015). Crowdsourcing, by involving many people with different backgrounds and expertise in the problem-solving process, is a promising way to address wicked problems. Thanks to crowdsourcing, organisations tap into groups with a unique skillset that can generate innovative solutions to wicked problems (Prpic et al., 2015).

In addition, stakeholders affected by the wicked problem should actively be involved in the problem-solving process (Rittel, 1972, p.394, Hautamäki et al., 2015). Whilst idea crowdsourcing does not, by default, include stakeholders affected by the problem, it allows for them to take part in the problem-solving process. Conklin adds that despite stakeholders usually having contradicting opinions, they can raise issues and are more likely to accept the solution if they have been included in the problem-solving process (Conklin, 2005). Local circumstances must be considered in order to effectively solve a wicked problem (Conklin, 2005). Brunswicker et al. argue that wicked civic problems can be tamed if the solutions are both integrated and contextualised (Brunswicker et al., 2017). Idea crowdsourcing allows for the integration the stakeholders and the local context in the wicked problem-solving process. Through hackathons, Techfugees, an NGO that promotes technological solutions to help refugees, has seen many refugees, who have integrated and contextualised knowledge, find solutions to help other refugees (techfugees.com).

Despite the numerous advantages we have found to crowdsourcing, there is a lack of research on idea crowdsourcing as a means to solve wicked problems. Despite the recent regain of interest in this field of study with the human computation concept (Von Ahn, 2013; Michelucci and Dickison, 2016), Rittel was already talking about the need for diverse knowledge and collaboration to tackle wicked problems back in 1972.

How to Best Organise Crowdsourcing to Tackle Wicked Problems

Now that we have proved that crowdsourcing can help us solve wicked problems, we are going to evaluate how we must organise crowdsourcing for wicked problem-solving.

The inherent difficulty that arises from tackling wicked problems is that stakeholders do not agree on the definition of the problem and there is no objective solution, therefore, the idea crowdsourcing process must be structured

(Roberts, 2000). While Roberts argues that collaboration is the best approach to tackling wicked problems, the Xprize approach uses a blend of collaboration and competition. Xprize is a foundation that aims at funding projects that have the potential to positively affect one billion people by 2020 (Xprize.org). While there is a sense of purpose that can arise from tackling a wicked problem, extrinsic motivation can be leveraged to tackle a wicked problem too. Through its open call competition system, Xprize sets clear deadlines and objectives, thus structuring the idea crowdsourcing process (Xprize.org). Furthermore, the Xprize approach leverages people's competitiveness with the winners of the competition getting press coverage and financial benefits. The approach to crowdsourcing that blends what Roberts defines as the collaborative and the competitive approaches seems to benefit from the advantages of both approaches while reducing each other's limits. This approach to organising idea crowdsourcing needs to be further researched.

When tackling wicked-problems, organisations should consider measures to limit the shortcomings of idea crowdsourcing. The difficulties that arises from working with experts who have knowledge in different fields is one of the main downside of idea crowdsourcing. "Participants often live in different intellectual worlds and have distinct technical languages. The gulfs between behavioural norms and values across industries and professions can be even wider" according to Edmondson (Edmondson, 2016). Another shortcoming of idea crowdsourcing is "crowd hijacking" when members of the crowd may push their own agenda over the organisation's agenda (Wilson et al. 2017).

Potter et al., argue that mass collaboration problem solving is an effective approach to address wicked problems (Potter et al. 2010). However, in recent years, idea crowdsourcing seems to have moved away from mass collaboration to go to a selected group of experts selected from the crowd for their domain knowledge (Hofsteller, 2017). Indeed, thanks to technological innovation, small teams of experts are able to do what only large organisations and governments could do in the past (Diamandis, 2012). The approach taken by Xprize is the following: organising an open call competition to get access to the most suitable talent from across the globe. By carefully selecting experts from different fields, the chances of "crowd hijacking" are lowered.

In 2004, Surowiecki said "If four basic conditions are met, a crowd's "collective intelligence" will produce better outcomes than a small group of experts"; these four conditions are independence among members, diversity in opinion, decentralization and aggregation of opinions (Surowiecki, 2004). Therefore,

crowdsourcing wicked-problem approaches should be organised in ways that respect these four conditions.

Due to the variety in the types of wicked problems that exist, the difficulty stakeholders have defining them and the number of variables that affect them, there probably is no generic "best approach" when it comes to organising crowdsourcing to solve wicked problems. However, more research should be conducted to define the drivers of success in the approach taken by successful crowdsourcing projects tackling wicked problems.

Crowdsourcing as a Means to Solve a Wicked Problem: The Hyperloop Transportation Technologies Example

Hyperloop may be the perfect example of crowdsourcing. Hyperloop is a system of "levitating pods that would travel in near-vacuum tubes at near the speed of sound" (wired.co.uk). In 2013, Elon Musk published HyperLoop Alpha a white paper explaining the engineering and physics behind what he coined the fifth mode of transportation (Hyperloop Alpha, 2013). Whilst Hyperloop could change our relationship to time and space, the development of the fifth transportation mode is a wicked problem according to Kolko's definition as the knowledge around the concept is incomplete, a great number of people with different skills and perspectives must be involved in the development of Hyperloop, building one route from San Francisco to Los Angeles would cost over six billion dollars and these problems are interconnected with other problems (Applegate et al., 2017).

Being too busy with Tesla and Space X, Elon Musk donated this concept to the world for the crowd to develop it. Despite not being directly involved in any company developing this technology prior to 2017, Elon Musk decided to support this project by hosting annual competitions on the pod design and providing a testing space for other features in his current companies (Tesla and Space X): he uses the same competition format as Xprize to incentivize teams to develop this technology (Applegate et al., 2017).

Hyperloop Transportation Technologies (HTT) is the only "crowd-powered" hyperloop company: "not just by crowdsourcing the design and early financing of new Hyper transportation system that HTT would build, but also in its development and launch" (Applegate et al., 2017). Indeed, with Hyperloop One, HTT is the most advanced hyperloop team despite the fact that, until recently, it had no full-time employees (Applegate et al., 2017). Hyperloop TT is being developed thanks to over 800 contributors from 38 countries who work at least ten hours a

week and are rewarded with stock options.

HTT even went further in the crowdsourcing aspect as they have used the crowd to raise funds through their Indiegogo crowdfunding campaign and are partnering with companies, leading universities and governments all over the globe to make hyperloop a reality (Applegate et al., 2017). Ahlborn and Gresta, the co-founders of Hyperloop TT, argue that crowdsourcing has enabled them to develop a great plan, to have access to strategic partners and to world-class performers (Applegate et al., 2017). "We believe that we are not only transforming the nature of transportation, we are also defining the future of work in the 21st century" says Dirk Alhborn (Applegate et al., 2017).

Conclusion

Discussing the case of Hyperloop TT has deepen our understanding of idea crowdsourcing and how organisation may wish to structure their approach to tackling wicked problems.

Over the past decade there has been a blurring of boundaries in many different contexts including how organisations conduct innovation. Due to the novelty of the concept of crowdsourcing, research must be constantly conducted to stay up to date with the evolution of the concept. As crowdsourcing becomes more main stream, research should shift from a case study approach to a broader use empirical data.

In this paper, we reviewed the types of crowdsourcing and differentiated micro-tasking and idea crowdsourcing by saying that the first was a social innovation in itself whilst the latter was a means to create social innovations. We discovered the advantages of idea crowdsourcing and its potential to tackle wicked problems. We identified the blend of the collaborative and the competitive approach as being of interest to address wicked problems. Finally, we determined that more research must be conducted to help us design the right crowdsourcing approach to address wicked problems.

Despite the fact that HTT has not yet reached its objective, a lot can be learnt from this case study as it is a good position to do radically redefine our relationship to time and space, thus proving Wadhwa right.

References

1. Ali-Hassan, H. and Allam, H. (2017). Comparing crowdsourcing initiatives: Toward a typology development. Canadian Journal of administrative sciences, [online] 33(4), pp.318–331. Available at: http://

onlinelibrary.wiley.com/doi/10.1002/cjas.1395/abstract [Accessed 6 Nov. 2017].

2. Applegate, L., Griffith, T. and Majchrzak, A. (2017). Hyperloop Transportation Technologies: Building Breakthrough Innovations in Crowd-Powered Ecosystems. Harvard Business School Case Study
3. Bonchek, M. (1995). Grassroots in Cyberspace: Using Computer Networks to Facilitate Political Participation. [online] Available at: https://fr.scribd.com/doc/82147418/Grass-Roots-in-Cyberspace-Bonchek-1995 [Accessed 2 Nov. 2017].
4. Brabham, C. (2008). Crowdsourcing as a Model for Problem Solving. Sage Journals, [online] 14(1), pp.75-90. Available at: http://journals.sagepub.com/doi/abs/10.1177/1354856507084420 [Accessed 29 Oct. 2017].
5. Brunswicker, S., Bilgram, V. and Fueller, J. (2017). Taming wicked civic challenges with an innovative crowd. Business Horizons, [online] 60(2), pp.167-177. Available at: http://www.sciencedirect.com/science/article/pii/S0007681316301239.
6. Conklin, J. (2005). Dialogue mapping: Building shared understanding of wicked problems. p. Chapter 1: Wicked Problems and Social Complexity.
7. Curtis, T. (2016). The essay "The challenge and risks of innovation in social enterprises" in the book "Social Entrepreneurship: the skills approach". pp.83-98.
8. Denning, P. and Yaholkovsky, P. (2008). Getting the "we." Communications of the ACM, [online] 51(4), pp.19-24. Available at: https://cacm.acm.org/magazines/2008/4/5424-getting-to-we/fulltext [Accessed 16 Nov. 2017].
9. Diamandis, P. and Kotler, S. (2012). Abundance: the future is better than you think.
10. Edmondson, A. (2017). Wicked problem solvers. Harvard Business Review. [online] Available at: https://hbr.org/2016/06/wicked-problem-solvers [Accessed 8 Nov. 2017].
11. Erickson, L., Petrick, I. and Trauth, E. (2012). Hanging with the right crowd: Matching crowdsourcing need to crowd characteristics. Americas Conference on Information Systems, pp.1-9.
12. Franklin-Wallis, O. (2016). An Italian rapper, a 'hangman's noose' and

a $250m lawsuit: the chaotic race to build Elon Musk's hyperloop. [online] Wired.co.uk. Available at: http://www.wired.co.uk/article/hyperloop-hype-machine [Accessed 6 Nov. 2017].

13. Garcia, I. (2013). Learning a Language for Free While Translating the Web. Does Duolingo Work? International Journal of English Linguistics, [online] 3, p.1. Available at: http://www.ccsenet.org/journal/index.php/ijel/article/view/24236 [Accessed 20 Nov. 2017].
14. Hautamäki, A. and Oksanen, K. (2015). Sustainable innovation: solving wicked problems through innovation. 5th ed. Technology Innovation Management Review.
15. Hofsteller, R. (2017). Rethinking Crowdsourcing. Harvard Business Review. [online] Available at: https://hbr.org/2017/11/rethinking-crowdsourcing [Accessed 23 Nov. 2017].
16. Howe, J. (2006). The rise of Crowdsourcing. Wired Magazine, (14.06).
17. Kietzmann, J. (2017). Crowdsourcing: A revised definition and introduction to new research. Business Horizons, [online] 60(2), pp.151-153. Available at: http://www.sciencedirect.com/science/article/pii/S0007681316301215 [Accessed 2 Nov. 2017].
18. Kolko, J. (2012). Wicked Problems: problems worth solving. Stanford Social Innovation Review. [online] Available at: https://ssir.org/articles/entry/wicked_problems_problems_worth_solving [Accessed 13 Oct. 2017].
19. Lobre, K. and Lebraty, J. (2015). Crowdsourcing porté par la foule. Système d'information et management, 20, pp.99-100.
20. Lord, C. (2013). Aristotle's politics. 2nd ed. Chicago: University of Chicago Press.
21. Machado, M., Verghese, G. and Peltola, T. (2014). Massive Open Online Research: An Approach to Deal with Wicked Problems. PICMET.
22. Majchrzak, A. and Malhotra, A. (2013). Towards an information systems perspective and research agenda on crowdsourcing for innovation. The Journal of Strategic Information Systems, [online] 22(4), pp.257-268. Available at: http://www.sciencedirect.com/science/article/pii/S0963868713000528 [Accessed 7 Nov. 2017].
23. Michelucci, P. and Dickinson, J. (2015). The power of crowds. Science, [online] 351(6268), pp.32-33. Available at: http://science.sciencemag.org/content/351/6268/32.full [Accessed 16 Nov. 2017].

24. Musk, E. (2013). Hyperloop Alpha. [online] Spacex.com. Available at:http://www.spacex.com/sites/spacex/files/hyperloop_alpha-20130812.pdf [Accessed 16 Nov. 2017].

25. Potter, A., McClure, M. and Sellers, K. (2010). Mass Collaboration Problem Solving: A New Approach to Wicked Problems. Conference: Collaborative Technologies and Systems (CTS). [online] Available at: https://www.researchgate.net/publication/224143326_Mass_Collaboration_Problem_Solving_A_New_Approach_to_Wicked_Problems [Accessed 5 Nov. 2017].

26. Prpic, J., Shukla, P., Kietzmann, J. and McCarthy, I. (2015). How to work a crowd: Developing crowd capital through crowdsourcing. Business Horizons, [online] 58(1), pp.77-85. Available at: https://ac.els-cdn.com/S0007681314001438/1-s2.0-S0007681314001438-main.pdf?_tid=5507b4e0-d374-11e7-b25d-00000aacb360&acdnat=1511788405_f4b375867a90f4cd0c8adaadf625fe6f [Accessed 3 Nov. 2017].

27. Rittel, H. (1972). On the planning crisis: Systems analysis of 'first and second generations'. Bedrifts Okonomen, pp. 390-396.

28. Rittel, H. and Webber, M. (1973). Dilemmas in a general theory of planning. Political Science, [online] 4(2), pp.155-169. Available at: https://link.springer.com/article/10.1007%2FBF01405730?LI=true [Accessed 2 Nov. 2017].

29. Roberts, N. (2000). Wicked Problems and Network Approaches to Resolution. International Public Management Review, 1(1).

30. Surowiecki, J. (2004). The wisdom of crowds. London [u.a.]: Abacus. Techfugees. (2017). Home. [online] Available at: http://www.techfugees.com [Accessed 8 Nov. 2017]. V

31. on Ahn, L., Maurer, B., McMillen, C., Abraham, D. and Blum, M. (2008). reCAPTCHA: Human-Based Character Recognition via Web Security Measures. Science, [online] 321(5895), pp.1465-1468. Available at: http://science.sciencemag.org/content/321/5895/1465 [Accessed 7 Nov. 2017].

32. Wadhwa, V. (2017). Benefits of Crowdsourcing. [online] Wall Street Journal. Available at: https://www.wsj.com/articles/benefits-of-crowdsourcing-1414625224 [Accessed 9 Nov. 2017].

33. Wilson, M., Robson, K. and Botha, E. (2017). Crowdsourcing in

the time of empowered stakeholders: Lessons from crowdsourcing campaigns. Business Horizons, [online] 60(2), pp.247-253. Available at: http://www.sciencedirect.com/science/article/pii/S0007681316301318?via%3Dihub [Accessed 14 Nov. 2017]. XPRIZE. (2017). XPRIZE. [online] Available at: http://www.xprize.org [Accessed 4 Nov. 2017].

Switching Costs and the Irish Mortgage Market

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Mortgage interest rates are determined by a number of factors; the credit risk associated with lending, operational costs of the bank, cost of capital and competitive environment all impact mortgage rates offered by banks. In this paper, we will evaluate, from an economics of competition policy perspective, the role of switching costs in improving competition in the Irish mortgage market. Mortgage switching has been identified as a 'key enabler' for unlocking greater competition and consumer mobility in the Irish market. At present, switching rates are very low, despite the potential benefits a consumer may obtain from switching their loan provider. Only 2% of Irish consumers switched between 2011 and 2016 (CCPC, 2017).

Introduction

Competition policy plays an influential role in the protection and elevation of consumer welfare under a free market structure. The Central Bank of Ireland and Competition and Consumer Protection Commission have a key role to play in ensuring the efficient functioning of the mortgage market. The CBI in 2017 noted that the competitive environment in the Irish mortgage market has weakened over the course of the last decade. This has allowed lenders to increase margins above the levels expected in a more competitive environment. If new market entrants continue to be rare, and there is a lack of effective competition, lenders will operate within an oligopoly (McQuinn & Morely, 2015). The CCPC in their report 'Options for Ireland's Mortgage Market' outline how a reduction in the cost of secured mortgage lending is possible through the improvement of lender competition. The lowering of switching costs in the market has been identified as one way in which regulators may increase competition.

Types of Switching Costs

In many markets, consumers who have previously purchased from one firm face costs in switching to a competitor's product, even if the two firms' products are identical (Klemperer, 1995). Klemperer (1995) identifies many different switching costs. Among them are 'transaction costs of switching suppliers', 'uncertainty about the quality of untested brands' and 'psychological costs', all of

which may be applied in the context of the Irish mortgage market.

As part of a report published in April 2017, the CBI examined consumer perceptions, attitudes and experiences of mortgage switching. In the same year, the CCPC carried out further research in this area. The results obtained from the consumer focus groups used in these studies can be used to identify distinct switching costs present in the Irish mortgage market.

(1) Transaction Costs

These studies showed that consumers find it difficult to evaluate the differences between mortgage offerings present in the market. Limited knowledge is compounded by the complexity of mortgage products. Besides the basic rate, term and bank-specific features of a product, effectively analysing a mortgage offering requires the consumer to think across multiple time and cost dimensions. The prevalence of variable rates in the Irish market adds to the complexity faced by consumers in effectively forecasting gains from switching. Consumers incur transaction costs in evaluating competing offers, closing their existing account and completing documentation. The hassle involved with moving data or files from one institution to another is an immediate consideration. Eldin and Harris (2013) call this 'data portability' and cite it as an important determinant of transaction costs.

(2) Uncertainty

Focus group discussion facilitators noted a general sense of consumer fear and uncertainty surrounding mortgage switching. Consumers are uncertain about the quality of untried lenders, and associate switching with financial risk. Consumers are risk averse and prefer to remain with a familiar loan provider. For many, the perceived risk outweighed any potential reward. Consumers were sceptical about new entrants, unsure of whether these banks were committed to the Irish market. It can be argued that the financial crisis, and the tracker mortgage scandal may have damaged consumer confidence in the Irish banking sector. This may add to consumer's apprehension in dealing with creditors.

(3) Psychological Costs

Klemperer (1995) outlined how consumer tastes evolve to favour the brand they are using. In behavioural economics, this is called ownership bias. Some customers cited the reason for doing business with a particular bank as linked to the fact that their parents use that bank (CCPC, 2017). A second bias which may serve as a switching cost is the observation that humans discount future gains (which here would be savings on mortgage repayments) hyperbolically (O'Donoghue &

Rabin, 1999). The cost of finding an improved mortgage offering is incurred by the consumer immediately. The benefits associated with switching accrue to the consumer slowly over a long future period. It has been shown that consumers discount these 'gains' at a very high rate, inconsistent with the standard economic assumption of rationality (O'Donoghue & Rabin, 1999). This significant consumer bias may partly explain why the average mortgage consumer is failing to accurately forecast gains from switching.

Switching Costs and Market Competition

Barriers to switching mean that banks face a trade-off between investing in market share (for example, by charging a low interest rate that attracts new customers) or harvesting profits by charging high rates, which allow them to capitalise on existing market share. Klemperer (1995) finds that a firm's incentive to exploit existing customers dominate their incentive to attract new ones. This leads to higher prices in markets with switching costs. High switching costs can create barriers to entry and barriers to expansion for rivals (Eldin & Harris, 2013). Furthermore, high switching costs may provide the conditions for firms to act as monopolists within their individual share of the market. McQuinn and Morely (2015) suggest that a lack of competition in the Irish mortgage market may be why decreased ECB rates have not been passed on to consumers.

Klemperer (1995) describes the mechanism by which a firm may act as a monopolist against its own customer base. He illustrates this using a duopolistic model. Let α represent the fraction of consumers that have previously taken out a mortgage with bank A. They incur switching costs in switching to bank B. The complementary fraction bought from bank B, $1 - \alpha = \beta$. If s is large enough, then the unique non-cooperative Nash equilibrium in price competition yields firms joint profit maximizing outcome. The reason is that bank A cannot attract any of B's customers without lowering prices below B's price. Large price cuts give up more profits on it's already captive customers than it gains by stealing B's customers. Bank A does better to act as a monopolist within its share of the market. The current conditions present in the Irish market make it more likely to observe this type of behaviour. The number of firms decreased following the financial crisis, and the Herfindahl-Hirshman Index has increased to just below 2200, surpassing the benchmark 1800 level (CCPC, 2017). Market concentration is high. As well, the pattern of market share is relatively symmetrical, which Klemperer (1995) cites as a condition facilitating monopolistic behaviour in a market with switching costs.

It is helpful to view every new cohort of 'first-time buyers' as a separate market. There may exist fierce competition to capture these customers, build up market share and use this expanded consumer base to increase profits. If we treat new mortgage customers as a separate sub-market, analysis of the competition mechanisms at work within the market become easier to distinguish.

In 2010, an American court ruled that Microsoft had 'acted anticompetitively to increase, maintain and exploit high switching costs' (Eldin & Harris, 2013). 'The Microsoft Case' is an important example of the application of anti-trust law in the context of switching costs. These legal findings suggest that perhaps switching costs are less of a 'grey area' than they may appear to be. Although no such case has come before Irish courts, it is likely that Irish banks are aware that high switching costs and monopolistic actions against their own consumer bases can indeed lead to legal penalties.

What is lacking in the CCPC's report is a discussion of the distinction between 'inherent' and 'strategic' switching costs. Inherent costs occur naturally in the market, whereas strategic costs are created or elevated by market players (Eldin & Harris, 2013). This distinction is important when analysing whether a firm has attempted to strategically raise switching costs to act as a monopolist against its own customer base. Firms can increase the complexity of their products to raise switching costs. The proliferation of 'loyalty discount' and 'cashback' offerings available on the Irish market may be viewed as sophisticated attempts by banks to manipulate consumer behaviour, making comparison and evaluation of competing offers an increasingly complex task. If Irish banks raise the complexity of their products to lock in market share, is it possible to equate this to indirectly collusive behaviour? Klemperer (1995) outlines how the existence of switching costs may lead firms to simultaneously and non-cooperatively raise those switching costs. Klemperer argues that switching costs facilitate collusion through the dividing-up of market share into defined sub-markets of consumers who bought from different firms. This provides 'focal points' for tacitly collusive division of the market. However, while it may appear that high switching costs are evidence of collusion, this intuition does not seem easy to formalise (Farrell & Klemperer, 2001). The CCPC makes no reference to this being an issue, and focuses on how regulation may be implemented that would encourage mortgage switching.

Considerations for Irish policy

Switching costs have been identified by both the CCPC and CBI as a significant barrier to effective competition in the Irish mortgage market. It has been shown that consumers face difficulty in accurately evaluating competing mort-

gage offerings. This is exacerbated by the complexity associated with additional product features. The Fair Mortgages Campaign and some politicians have called for cash incentives to be banned. However, it is difficult to see how this could be prevented without the introduction of new legislation, and whether this type of legislation would be capable of being implemented at all.

Cass Sunstein and Richard Thaler, in their influential book 'Nudge', attest to the power of behavioural economics and it's role within public policy. Acknowledging a general dislike (from both consumers and industry) of excessive government intervention, they advocate an approach they call 'liberal paternalism'. It is evident that consumers are often not behaving rationally in the market. One suggestion is to have specific nudge points over the course of the mortgage life cycle, where switching is presented as an option to the consumer. The 'hassle' factor linked to mortgage switching may be significantly reduced through the introduction of e-conveyancing. Costs associated with evaluation/learning may be reduced through informational campaigns and the promotion of mortgage comparison websites and use of independent financial advisers.

Even upon successful implementation of programs to encourage mortgage switching, it is unlikely that a dramatic increase in switching would be observed due to the prevalence of tracker mortgages. Although trackers are now no longer available on the market, they account for 48% of the credit advanced to Irish resident households for home purchases (CCPC, 2017). This significantly reduces the pool of potential switchers. Tracker mortgage customers pay less in mortgage repayments, as the ECB rate is at an historically low level. This is a drain on bank profitability. Higher rates are passed on to other customers, in to compensate for the losses banks are making on trackers. This should be kept in mind when evaluating competition in the Irish mortgage market.

Conclusion

A decrease in switching costs has the potential to elevate competition in the mortgage market. An increase in competition may facilitate a lowering of the cost of credit, encourage new market entrants and increase the quality of customer service. Switching costs come in many forms, and may act as a significant barrier to effective competition and consumer mobility in the market. It can be argued that the presence of switching costs in the Irish mortgage market leads to banks acting as monopolists against their own customer base, and a simultaneous raising of switching costs by Irish banks may equate to tacit collusion. The CBI, Department of Finance and CCPC have a key role in encouraging increased levels of mortgage switching. These organisations should consider exactly how to decipher

whether banks are engaging in a strategic, or a collusive raising of switching costs. Switching is a facet of Irish mortgage policy ripe for intervention, and should be an immediate target for policy-makers.

References

1. Central Bank of Ireland (2017). Mortgage Switching Research.
2. Competition and Consumer Protection Commission (2017). Options for Ireland's Mortgage Market.
3. Harris, R and Eldin, A. (2012). The Role of Switching Costs in Antitrust Analysis: A Comparison of Microsoft and Google. Yale Journal of Law and Technology, 15(169), pp. 171-200.
4. Klemperer, P. (1995). "Market With Consumer Switching Costs". Quarterly Journal of Economics, 102 (May), pp. 375-394.
5. Rabin, T and O'Donoghue, M. (1999). Doing It Now or Later. American Economic Review, 89(1), pp. 103-123.
6. The Economic and Social Research Institute (2015). Standard Variable Rate (SVR) Pass-Through in the Irish Mortgage Market: An Updated Assessment.

Developmental Economics

Should Ghana specialise in the production and export of cocoa beans?

Eimear Flynn, Senior Sophister

Ghana is the world's second largest producer of cocoa beans, with the commodity dominating its economy. Eimear Flynn explores the role of cocoa in the Ghanaian economy and questions the implication from the Ricardian model which suggests specialisation in cocoa due to comparative advantage will improve Ghana's terms of trade. She instead points out that cocoa production has failed to become more efficient and also has a destabalising effect on the wider economy, and that climate change, land shortages and youth migration threaten the sustainability of production. Instead Ghana should diversify its exports in order to encourage growth, stability and investment.

Introduction

Ghana is the world's second largest producer and exporter of cocoa beans (Kolavalli and Vigneri, 2011). The country, which earned middle-income status in 2011, has occupied a leading position in the market for raw cocoa beans since the 19th century. The cocoa sector employs over 800,000 individuals in Ghana alone (Ford, 2017). While much of Ghana's growth is attributable to global demand for its exports of cocoa beans, it is not to say that the country should continue to specialise in their production in the long term. Both the Heckscher-Ohlin and the Ricardian model advocate specialisation based on comparative advantage. Although policymakers have pursued policies based on the predictions of the Ricardian model, the role of specialisation in stimulating economic growth is much disputed. The question this essay attempts to answer is whether or not Ghana should deviate from the recommendations of the Ricardian model, and diversify exports.

A Theoretical Perspective

Classical theories of trade present models in which countries specialise

in the production of goods in which they have a comparative advantage and, by doing so, can derive gains from trade. A country is said to have a comparative advantage in the production of a good if the opportunity cost of production is lower than the opportunity cost of producing the same good in the other country (Feenstra and Taylor, 2014). While the sources of comparative advantage differ in the Ricardian and the Heckscher-Ohlin models, both models yield a similar result, namely that countries can derive benefits from trade by specialising in the production of the good in which they have a comparative advantage.

The Heckscher-Ohlin model predicts that a country will export the good that uses the abundant factor of production intensively (Feenstra and Taylor, 2014). Both countries can earn a higher relative price by opening up to trade (Feenstra and Taylor, 2014). The fundamental assumption underlying the Heckscher-Ohlin framework, that technology is constant across countries, is problematic and undermines the model s use in this analysis. Such an assumption is unreasonable when examining trade between developed and developing countries, in which significant disparities in terms of their technological capabilities are identifiable. Trade models must instead capture technology s role in motivating international trade. In the Ricardian model trade is driven by differences in the technological capabilities of countries. For this reason, the Ricardian model will be the focus of this paper.

Labour is the only factor of production in the model. There are two countries, each producing two goods, cocoa and cars say. Differences in technology allow for varying degrees of productivity across countries. These differences see countries specialise in the production of the good in which they are most efficient and trade for the remainder of their needs (Feenstra and Taylor, 2014). Both countries will experience gains from trade. Specialisation will lead to economic growth as the terms of trade improve (Singer, 1950). The wages paid to labour will rise in both countries as a result. The margin of income over subsistence needs generates savings to be invested in capital accumulation (Singer, 1950). However, the extent to which specialisation facilitates capital formation is dependent on a number of assumptions, including that of perfectly competitive markets and the assumption that favourable terms of trade are passed on to producers in the form of higher incomes (Feenstra and Taylor, 2014). These assumptions have been the subject of much debate and will be explored in greater detail in the following section.

Prebisch-Singer Hypothesis

While specialisation remains a popular policy approach among govern-

ments, consensus has yet to be reached on the effectiveness of this approach to generate growth. The Prebisch-Singer hypothesis presents a challenge to the fundamental finding of the Ricardian model, to the idea that countries that specialise in the production of the good in which they have a comparative advantage will experience an improvement in the terms of trade. Prebisch (1950) and Singer (1950) suggest that the gains from trade are unequally distributed. While industrialised countries will benefit from long run improvements in the terms of trade, the same is not true of developing countries that specialise in the production of primary commodities. Primary product producers will instead experience a deterioration in the terms of trade over time (Singer, 1950).

Prebisch (1950) differentiates between the centre, the industrialised countries, and the peripheral or developing countries in order to make his case. The centre produces sophisticated manufactured goods, cars say, while the periphery specialises in the production of primary products such as cocoa. The products produced face differing elasticities of demand (Prebisch, 1950). Primary products are price and income inelastic, while manufactures have a high income elasticity of demand. Rising incomes will result in a greater expansion of the demand for manufactures. Similarly, the low price elasticity of demand for primary products suggests that a decline in price will do little to improve the earnings of peripheral countries and may in fact lead to a decline in revenue (Gemmill, 1962). Differences in elasticities will ultimately result in a decline in the terms of trade for the periphery over time.

This deterioration in the terms of trade is partially attributable to differences in the degree of market power of the centre and the periphery. The Ricardian model assumes perfectly competitive markets (Feenstra and Taylor, 2014). This assumption is likely only to hold in the periphery. Ghana, for instance, is a small open economy that has partially specialised in the production of cocoa, a homogenous good. Producers cannot influence the world market price. The cocoa market is perfectly competitive. The world market for cars, by contrast, is imperfectly competitive. Product differentiation allows producers to exert a degree of market power and influence the world price. This has important implications for trade. The perfectly competitive cocoa market means that the benefits of technological progress will be passed on to consumers directly in the form of lower prices. Conversely, improvements in the terms of trade are passed on to producers in the centre in the form of higher incomes (Singer, 1950). While the market power of the centre allows industrialised countries to retain the benefits of technological progress, the same cannot be said for producers in the periphery (Singer, 1950). In order to truly experi-

ence long run gains from trade countries must industrialise (Prebisch, 1950). Specialisation in the production of primary products will simply see the short run gains from trade bargained away by the countries of the developed world (Evans, 1976).

Innovation and Growth

Innovation plays a significant role in determining the level of productivity and growth in an economy. Fu et al.'s (2017) study of Ghana s formal and informal sectors underlines the impact of technological innovation on productivity levels. The extent to which such innovation is possible will depend on the sectors in which an economy engages. Specialisation of production in primary products may strip countries of their entrepreneurial initiative, of their innovative capacity and domestic investment (Singer, 1950). This outcome has its roots in the structure of primary product markets and their inability to generate savings to be invested in capital accumulation. Ghana's middle-income status with its high educational and institutional quality provides fertile ground for investment and innovation (Fu et al., 2017). However, specialisation in the production of primary products such as cocoa limits the scope for technical progress and innovation. The positive impact of innovation provides further support for export diversification and policies that see resource-rich countries, such as Ghana, defy their comparative advantage. A study of Ghana's cocoa sector, its history and the current challenges it faces, and an analysis of its long-term sustainability provide further evidence in support of this conclusion.

Ghana: Theory in Practice

Ghana has a comparative advantage in the production of cocoa beans. The country, which has partially specialised in cocoa production for the past two centuries[1], is the world s second largest producer of cocoa beans. Specialisation in the cocoa sector has yielded positive results for the Ghanaian economy. Kolavalli and Vigneri (2011) note the quality premium Ghanaian cocoa earns on the world market. Similarly, the cocoa sector has provided employment in rural areas and has helped prevent the deepening of the rural-urban divide (Ford, 2017). Despite the positive consequences of specialisation, however, an exploration of Ghana s history of cocoa production and the world market for cocoa underlines the risks associated with specialisation in primary product production.

A Turbulent History

Ghana's history offers proof that its cocoa sector and the macro-economy are inextricably linked. Independence from Britain marked a turning point in

the nation s history, in that of the cocoa sector and the wider economy. A period of both economic and political uncertainty ensued. A series of economic shocks saw the government become increasingly reliant on the country s Cocoa Marketing Board, which had effectively become an instrument of public finance by the late 1950s (Kolavalli and Vigneri, 2011, p. 203). In 1964, world prices collapsed and drastically reduced producer prices. The decline in cocoa prices triggered an economic downturn that persisted until the early 1980s (Kolavalli and Vigneri, 2011). It is apparent that cocoa prices dictated public finance and essentially functioned as a macroeconomic indicator in Ghana in the decades following independence. This relationship is problematic. Reliance on the industry for public finance destabilized the economy. This period of decline occurred against a backdrop of significant political turmoil in Ghana, perhaps pointing to a relationship between the cocoa sector and the country s political structure.

There is a fundamental flaw in the Ricardian model. Ricardo's theory focuses solely on the economic consequences of trade. The model does not incorporate social or political considerations. Ghana s turbulent experience of cocoa production, however, offers proof that specialisation in the production of primary commodities has both macroeconomic and political implications.

Endogenous Comparative Advantage

Government intervention in the cocoa sector has proven essential for the industry s survival since its collapse in the 1980s. Cocobod played an important role in the cocoa sector throughout this period and continues to do so today. The board provides access to fertilisers and pesticides, suggests quality improvements, encourages the production of high-yielding varieties and determines producer prices (Wessel and Quist-Wessel, 2015). Their policies aim to address the sector s efficiency problem and increase cocoa yields (Ford, 2017). The cocoa sector, however, has become dependent on these policy measures. While Ghana s climate initially afforded it a natural comparative advantage in the production of cocoa, comparative advantage is now determined by Cocobod s policy. It is endogenous to policy. It is unlikely that Ghana would have maintained its position as the world s second largest producer of cocoa in the absence of this support.

Inefficiency and Low Producer Prices

While the evidence in support of the Prebisch-Singer hypothesis is mixed, an analysis of Ghana s cocoa industry points to adverse effects of specialisation. The inefficiency of the sector provides support for their hypothesis. The Ricardian model predicts that an improvement in the terms of trade will increase

producer incomes and encourage capital formation. In Ghana, however, producer prices remain low (Kolavalli and Vigneri, 2011). Specialisation has not resulted in an increase in producer incomes. It has not generated the savings required to invest in measures that would increase the sector s productivity and encourage the growth of the wider economy. Figure 1 highlights the lagged relationship between producer prices and cocoa output. Declining producers prices typically result in a decline in output levels. In 2013/14, a 40% increase in producer prices encouraged investment in cocoa plantations in Ivory Coast and resulted in a large increase in yields (Wessel and Quist-Wessel, 2015). The experience of Ivory Coast suggests that if the benefits of trade are not passed onto farmers in the form of higher incomes, specialisation in the production of cocoa will not encourage the growth of Ghana's economy.

Dormon et al (2004) cite pests and disease, poor farm management practices, smuggling and a failure to adopt research recommendations as the primary contributors to low yields per hectare. As increasing terms of trade have been passed on to consumers in the form of lower prices, producers have been unable to invest in the external inputs required to increase efficiency and output per hectare. Recent policy measures have targeted productivity and increased yields per hectare (Ford, 2017). The government s failure to increase efficiency to date, however, suggests that Ghana should not specialise in the production of cocoa beans. Specialisation would simply see the Ghanaian economy become increasingly reliant on a sector that is inefficient and incapable of lifting the country out of poverty.

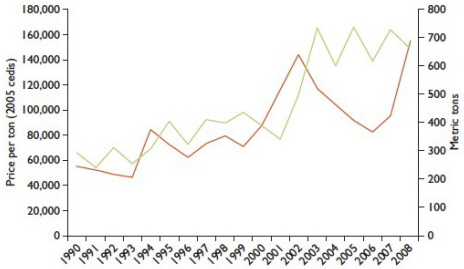

Figure 1: Ghana cocoa production and real producer price, 1990-2008, ICCO and World Bank in Kolavalli and Vigneri, 2011

While the Ricardian model predicts that specialisation will lead to an improvement in the terms of trade, a perfectly competitive world cocoa market prevents Ghana from retaining these benefits. The model s mechanism fails. Specialisation does not generate surplus income to be invested in capital accumulation and technological advancement. The result is an inefficient market

characterised by low cocoa yields. Downswings in commodity prices also have the potential to erode the gains from trade. Similarly dependence on the cocoa sector will exert significant influence on the country s economic and political structures. Continued specialisation, therefore, will not facilitate development but will instead result in the marginalisation of Ghana in the world market (Razzaque et al, 2007).

The Future of the Sector

An analysis of the future of Ghana s cocoa industry provides further support for this conclusion. The cocoa sector is unsustainable. The availability of land, rising labour costs and climate change pose a threat to the future of the sector. Such issues will likely prevent farmers from increasing cocoa yields per hectare and may see Ghana lose its comparative advantage in the production of cocoa.

The cocoa sector reached its target of 840,000 metric tonnes in 2016/17 (Cocobod, 2017). However, much of the expansion of Ghana s cocoa sector that has taken place since the 1980s is attributable to an expansion of the area under cultivation, rather than productivity increases (Wessel and Quist-Wessel, 2015). However, land is fixed and its availability limited. Many producers have already expanded their farms into some of the country s protected areas (Maclean, 2017). Deforestation has also increased rapidly in recent years. Ironically, farmers require the shade of these trees to protect their crops from dry seasons (Maclean, 2017). Lärach et al (2013) find that the positions of both Ghana and Ivory Coast are particularly susceptible to the impacts of climate change due to the limited shade and tree cover that has resulted from deforestation. Cocobod has implemented a number of measures that target efficiency and increased cocoa yields. It remains to be seen whether these measures will succeed in increasing output to 1.5 million metric tonnes in 2020/21 (Ford, 2017). If the measures fail to generate surplus incomes that will encourage capital accumulation and increased yields per hectare, as they have to date, the limited supply of land and rising global temperatures may force farmers to exit the cocoa industry.

Labour shortages also threaten the future of the sector. The cocoa industry in Ghana is labour-intensive and currently employs over 800,000 producers (Ford, 2017). Recent growth in Ghana has aided the development of strong institutions. Increased access to education, however, has resulted in rising youth migration from rural to urban areas as Ghana's young labour force seeks more sophisticated jobs. This has had a significant impact on the cocoa sector. The average age of farmers in Ghana is fifty-five. Young people are leaving cocoa growing areas and turning their backs on the country s traditional industries. Producers have been faced with rising labour costs as a result. If this upward pressure on

wages is not accompanied by a corresponding increase in producer prices cocoa farmers will be forced to exit the market.

Ghana's position as the world s second largest producer of cocoa beans is precarious. Climate change, migration and a shortage of land will likely see many of the country s farmers exit the sector over the coming decades. While Breisinger et al. (2008) attribute the growth and reduction in poverty levels that Ghana has experienced to date to its cocoa sector, specialisation in the production of cocoa will not have the same effect in the long run.

Conclusion

Ricardo's theory of comparative advantage identifies technological differences between countries as the drivers of trade. This assumption is particularly relevant to the analysis of trade relations between industrialised and developing countries, between countries such as Ghana and many of its export partners. Governments, the world over, have pursued policies based on the predictions of the Ricardian model. Ghana has partially specialised in the production of cocoa since the 19th century. Many critics, however, find fault with the Ricardian model, claiming that specialisation in the production of primary commodities will lead to a deterioration in the terms of trade over time and that it discourages innovation and results only in overdependence on sectors incapable of generating growth and alleviating poverty.

While the evidence in support of these theories is mixed, an analysis of the current state of Ghana's cocoa sector and its long-term sustainability suggest that the country should not specialise in the production of cocoa. Cocoa production in Ghana is tied to the country s economic and political structures. The sector is highly inefficient and its comparative advantage is now endogenous to government policy. Rising global temperatures, youth migration and land shortages will serve only to exacerbate the industry s imperfections. Specialisation in cocoa production, therefore, may simply result in the same fluctuations that hampered economic growth throughout the second half of the 20th century. Ghana will undoubtedly continue to produce cocoa beans. The country currently produces 20% of world cocoa output (WITS, World Bank). Ghana has attracted foreign investment to its cocoa-processing sector in recent years. The sector, however, only captures 5% of the global processing market (Mulangu et al, 2017). Expansion of the industry or of the country s wider manufacturing sector would encourage technological advancement and presents an opportunity for growth and development. Ghana might have been built on the back of the cocoa sector. Its future, however, ought not to be.

References

1. Breisinger, C, Diao, X, Kolavalli, S and Thurlow, J. 2008. The role of cocoa in Ghana s future development . Ghana Strategy Support Program Background Paper 11
2. Dormon, E.N.A., Van Huis, A., Leeuwis, C., Obeng-Ofori, D. and Sakyi-Dawson, O. 2004. Causes of low productivity in Ghana Farmers perspectives and insights from research and the socio-political establishment . Wageningen Journal of Life Sciences 52(3-4): 237-259
3. Evans, D. 1976. Unequal Exchange and Economic Policies: Some Implications of Neo-Ricardian Critique of Theory of Comparative Advantage . Economics and Political Weekly 11(5/7): 143-158
4. Feenstra, R. and Taylor, A. 2014. International Economics. New York: Worth Publishers.
5. Ford, N. 2017. Big Ambitions for Ghanaian Cocoa , African Business. [online], http://africanbusinessmagazine.com/region/west-africa/ghana-big-ambitions-cocoa-industry/ [Accessed: 23rd November 2017].
6. Fu, X, Mohnen, P and Zanello, G. 2017. Innovation and productivity in formal and informal firms in Ghana . Technological Forecasting and Social Change https://www.sciencedirect.com/science/article/pii/S0040162517310971 [Accessed: 28th November 2017].
7. Gemmill, R. 1962. Prebisch on Commercial Policy for LDCs . The Review of Economics and Statistics 44(2): 198-201
8. Ghoshray, A. 2011. A re-examination of trends in commodity prices . Journal of Development Economics 95(2): 242-251
9. Gunton, T. 2003. Natural Resources and Regional Development: An Assessment of Dependence and Comparative Advantage Paradigms . Economic Geography 79(1): 67-94.
10. IMF and World Bank. 1998. Ghana Enhanced Structural Assessment Facility Economic and Financial Policy Framework Paper, 1998-2000. [online], https://www.imf.org/external/np/pfp/ghana/ghana0.htm [Accessed: 6th December 2017].
11. Kolavalli, S. and Vigneri, M. 2011. Cocoa in Ghana: Shaping the success of an economy . in P. Chuhan-Pole (ed.) Yes, Africa can: success stories from a dynamic continent . World Bank Publications.
12. Krugman, P. and Obstfeld, M. 2003. International Economics: Theory and Policy. Pearson: Boston, MA.
13. Lärach, P., Martinez-Valle, A., Schroth G., and Castro, N. 2013. Predicting the future climatic suitability for cocoa farming of the world s leading pro-

ducer countries, Ghana and Cote d Ivoire . Climatic Change 118(2): 841-854
14. Lectard, P., and Rougier E. Forthcoming, 2018. Can developing countries gain from defying comparative advantage? Distance to comparative advantage, export diversification and sophistication and the dynamics of specialisation . World Development 102(1): 90-110
15. Maclean, R. 2017. Chocolate industry drives rainforest disaster in Ivory Coast . The Guardian. [online], https://www.theguardian.com/environment/2017/sep/13/chocolate-industry-drives-rainforest-disaster-in-ivory-coast [Accessed: 6th December 2017].
16. Oduro, A. and Offei, E. 2014. Investigating Ghana s Revealed Comparative Advantage in Agro-Processed products . Modern Economics 5: 384-390
17. Prebisch, R. 1950. The Economic Development of Latin America and its principal problems . Economic Bulletin for Latin America.
18. Razzaque, M., Osafa-Kwaako, P., and Grynberg, R. 1988. The Issue of Declining Commodity Prices . in R. Grynberg, and S. Newton (ed.) Commodity prices and development. Oxford: Oxford University Press.
19. Sapsford, D., and Bloch, H. 1997 Some estimates of Prebisch and Singer effects on the terms of trade between primary producers and manufacturers . World Development 25(11): 1873-1884
20. Singer, H. 1950. The Distributions of Gains between Investing and Borrowing Countries . The American Economic Review 40(2): 473-485
21. Tilton, J. 2013. The terms of trade debate and the policy implications for primary product producers . Resources Policy 38(2): 196-203
22. Wessel, M. and Quist-Wessel, P. 2015. Cocoa production in West Africa: A review and analysis of recent developments . Wageningen Journal of Life Sciences 74-75: 1-7

1 The cocoa sector accounts for 20% of Ghana's exports. The country also exports large quantities of gold, timber and oil (WITS, World Bank). Bloch and Sapsford (1997) find that the price of manufactures increases at a faster rate than the price of primary commodities. Conversely, Ghoshray (2011) finds that a majority of primary commodities examined do not demonstrate any trend over time, providing evidence against the Prebisch-Singer argument.

How Best to Invest: Human Capital in Economic Development

Mide Ni Ghriofa, Senior Sophister

Not many questions are of such importance, and arouse such debate as the question of where developing countries should direct investment. In this essay, Mide Ni Ghriofa outlines the merits of investment in human capital to spur development. She then provides us with a thorough description of best practice in human capital investment, as well as the trade offs involved. The value of human capital investment in a more general sense is then conveyed to the reader, leading to the conclusion that investment in people is crucial if we wish to see true development.

The importance of health and education seem perhaps intuitive. We grow up hearing that your health is your wealth and that education is the key to a better life. On a societal level, devoting resources to healthcare, education and training is investment in human capital; in people and their ability to lead fruitful lives. This human development leads to economic development and growth. However, the simplicity of this argument masks the complexities and substantial challenges of investing in human capital. This essay argues that the central question is of course not whether or not to invest in health and education, but how best to invest.

Furthermore, while investment in human capital is necessary for development, it is by no means sufficient. Investment in health and education must happen together with progress in other areas in order for it to achieve the best possible outcomes. This essay will begin by discussing the rationale behind investing in human capital. This will be followed by a discussion of how best to invest in human capital according to a number of criteria for successful policy-making, followed by an analysis of key demographics and trade-offs central to development and behavioural aspects in creating optimal outcomes from human capital investment. Finally there will be a discussion of the need for an integrated approach and human capital in the context of other key policy changes.

Achieving Our Potential

Human capital can be defined as 'productive investments embodied in human persons' (Todaro 2009: 826). While this may sound abstract, investing in people leads to concrete returns. There is much evidence that indicates a positive relationship between levels of human capital and economic development (Barro 1992). Causality can go both ways, with more developed countries having more to spend more on health and education, but theory and evidence show us that healthier and more educated people are more productive.

A clear economic incentive for governments to invest in human capital exists due to externalities. With the social benefit of both health and education being greater than the private benefit, and the quantity demanded being below the optimal level, it makes sense for the government to subsidise such goods and services or directly provide them. Furthermore, government intervention can break the poverty trap. If we assume a nutrition-based poverty trap, those living in abject poverty have just enough income to sustain themselves, but not enough to be healthy and work productively, and because they can't work productively and earn more, they can't afford the extra food they need to be healthier. Breaking this vicious cycle would allow for a much more productive work force and is a strong argument for investing in human capital.

Investing in health and education together is advantageous as many complementarities exist. Investment in health improves educational outcomes and vice versa. A famous study demonstrating this is that of Miguel and Kremer (2004) where treatment of worms was shown to decrease pupil absenteeism significantly. Furthermore the growth of human capital is cumulative meaning investing in health and education today will lead to improved outcomes for the next generation (WDR 2007: 4).

Providing citizens with a decent level of well-being and education empowers individuals and strengthens society. Skills, abilities and health facilitate people to have agency, defined as 'the socioeconomically, culturally, and politically determined ability to shape the world around oneself' (WDR 2006:5). This allows citizens to become better decision-makers and engage in the political process which can lead to stronger societies and better democracies. Giving people the opportunity to make the best of their life improves self-esteem and allows them to fulfil their potential (WDR 2006: 5). Clearly, equality of opportunity in education and health equity are desirable in and of themselves but are also necessary for development and growth. Investment in human capital allows individuals to achieve their potential and thus the economy can do the same.

How Best to Invest

Human capital undoubtedly plays a vital role in development and growth, however this assertion oversimplifies matters and glosses over the complexities challenges of investing in human capital. The question, of course, is not whether or not to invest in human capital or not, but rather how best to do so. This section begins by outlining some criteria which investments in human capital should fulfil; policies should be evidence-based, sensitive to context and equality, enable and empower and should build on progress.

Having discussed these requirements for fruitful investment in health and education, three approaches to how best to invest will be explored; targeting key demographics, balancing trade-offs, and behavioural aspects in health and education investment.

Evidence-Based Policy

The body of high-quality research into the impact of policy and causal effects of investments in education and healthcare is growing. Much of the evidence tallies with theory but we must be willing to accept when the empirical evidence means we need to reconsider our assumptions. Glewwe and Muralidharan explore a wealth of high-quality studies to see what exactly works to improve school enrolment, attendance and learning outcomes for students and emphasise 'the importance of theoretically-informed program design' (2015: 35). However, many interventions built on solid theoretic foundations fail to yield results. In these cases we must ask why.

One study into the effect of textbooks by Glewwe et al. (2002) highlights such a case. An input such as textbooks seems highly likely to improve classroom learning however their results on education outcomes are ambiguous. When we look however at what underlies behind this, the answer is relatively simple. Students could not make use of the textbook as they did not understand the language in which it was written. Thus we should not discount the value of textbooks themselves, but empirically testing theory can highlight key flaws in policy and is crucial to the process of choosing how best to invest.

When investing in healthcare for the poor, public sector provision of health may seem the obvious answer. However facilities are often very poor, absenteeism of personnel is prevalent and the quality of healthcare is low. The World Development Report 2006 argues that depending on 'traditional supply-side model' of public hospitals as the centre of the health system is bad for poor and marginalised groups and that policy-makers should focus on 'public provisioning or regulation that provides some insurance for all.' (WDR 2006: 12). When empirical evidence shows conventional ideas are failing, policy-makers must be willing to adjust policy accordingly. Decisions must not be made on the premise of supposed ben-

efits but rather on what will yield results. Only when policy-makers are willing to review programmes for their true impact and adjust them accordingly, will investment yield optimal outcomes.. Only then can investment in human capital yield the optimal outcomes.

Equality and Cultural Context

Lamentable as it may be, it can said that, 'In many developing countries, the actions of the state in providing services magnify—rather than attenuate—inequalities at birth' (WDR 2006: 11). Policy-makers must do their utmost to ensure this is not the case. Language was highlighted above as a barrier to using textbooks. Education systems particularly in linguistically diverse regions must make sure that language and cultural factors are not barriers to education. Dutcher (2001) argues that education in the mother tongue is essential to create equality of opportunity in education in developing countries. Ethnicity and gender can also be barriers to accessing education and health in many developing countries, but policy design can work around these issues, once they are identified. Kazianga et al. (2013) analysed the provision of 'girl friendly' schools in Burkina Faso and found significant effects on enrolment rates particularly among girls.

Ethnicity, language, and gender are just some of the grounds upon which many are discriminated. People should not be denied education and health care on these grounds. It is imperative that investment in human capital takes the reality of discrimination into account and tries to address it. In deciding how best to invest, this crucial cultural context simply cannot be ignored.

Enabling and Empowering

When investing in human capital, policy-makers take on a paternalistic role and must exercise caution. The provision of goods and services is certainly necessary but cash transfers allow people to decide to how best to improve their welfare according to their own preferences.

Increased income does not always translate into more investment in health and education, (Behrman and Deolalikar 1987) however sometimes it can have desirable effects. Baird et al. (2012) conducted a study on the effects of cash transfers on the prevalence of HIV and other STIs and in Malawi. They had two treatment groups, one of which received cash transfers conditional on attending school and another which received unconditional cash transfers. They found HIV was significantly lower in the combined treatment groups but no difference between the two and treatment groups indicating that staying in school longer wasn't the driving factor behind lower HIV prevalence. Rather the extra money empowered women meaning they were less likely to become sexually active at a younger age, to have older partners, and to engage in transactional sex. Women

now had more power in relationships and self-determination of their sexual behaviours.

This has important policy implications because it shows that people often would rather make better choices and are simply constrained by their lack of money. Poverty may indeed be the underlying issue and unconditional cash transfers which give women and girls the ability to make the choices they want leads to the desired outcome. Policy should aim to empower and help people make the best choices for themselves.

Building on Progress

Investment in human capital should be regarded as an ongoing process whereby it builds upon progress and reflect new targets. For example, in improving education outcomes, the focus at first was on increasing enrolment. Once universal primary school enrolment in many countries was achieved, the need was recognised to now increase school attendance. Now we must build upon that by improving teaching quality. It is imperative to find out "how to translate increases in student enrolment and attendance into improvements in skills and human capital" (Glewwe, Muralidharan 2015:10).

Countries might begin by investing the provision or supply of education and health, but once programmes are in place, this must be accompanied by policies to increase demand for education, preventative health care, training and skills. Demand for preventative health care remains low, but preventative can be vital in improving health outcomes. Similarly, it makes little sense for a country to invest in high-quality, accessible education if the take-up rate stays low. Jensen argues that educational attainment is low despite high returns to education, and therefore that providing information may be a cost-effective way to improve education outcomes (Jensen 2010: 515. This, combined with the aforementioned measures can help investment improve in its efficiency in getting results.

Approaches to Investment

Targeting Key Demographics

Given these considerations for best practice, where and how should investment be targeted in order to maximise the gains from it? The World Development Report 2007 makes a compelling case for focusing on young people as the future, and investing in their human capital. It emphasises the importance of early childhood intervention and of providing young people with the skills and health they need to be a productive workforce. The report argues this on two premises; firstly, that young people have a higher capacity to learn and adopt good behaviours and secondly, that young people's human capital outcomes will have a big effect

on those of their offspring (WDR 2007: 4). It speaks of a window of opportunity due to the sheer number of young people in the world today; 'If countries fail to invest in human capital—which is most profitable for the young—they cannot hope to reap this demographic dividend.' (WDR 2007: 4).

Much research has focused on women as a target group in development strategies. 'To achieve gender equality and empower all women and girls' is the fifth of the 17 SDGs and gender plays a big role in determining how best to invest in human capital. The majority of the world's poorest people are women. Not only is equality desirable in and of itself, it also has the potential to improve outcomes for the economy. Many studies have shown that 'educational discrimination against women hinders economic development' (Todaro: 384). Furthermore, research has shown that when women are more likely to spend their income, on their children and that improving the health education of women improves their children's health, so development policies focused on this bring benefits for the next generation, the importance of which was outlined above.

Policy-makers also face difficult decisions regarding investment in rural and urban areas. It might seem sensible to invest in human capital in urban areas as trends show that more and more people are migrating into cities, that there are serious problems with unemployment in urban areas, as well as other challenges of unsustainable population growth in cities. However creating more job opportunities and education will only encourage more people to move to the cities to fill those jobs, leaving cities with the same problem of inability to cater for such large numbers. Thus investment in human capital in rural regions and rural development in general is essential to keep cities from becoming unsustainable (Todaro 2009: 350). However it could also be argued cities promote economic development by aiding ammolgomation and improving productivity. We must be mindful of these kinds of trade offs when targeting investment. While targeting investment at particular groups can improve welfare of the whole population, in some cases investing in one group can mean neglect of another.

Balancing Trade-Offs

Like any other type of investment, improving health and education outcomes leads to a number of trade-offs. It is worth examining these when evaluating potential policies investing in human capital to come to an informed decision about how best to invest. In terms of health, much progress has been made by the Millennium Development Goals (MDGs). However the framework of the goal has been criticised for promoting 'vertical' programmes that target specific diseases as opposed to 'broader, cross-cutting investments in health systems that can deal with all health issues in a more integrated manner.' (WHO 2015: 7)

This presents a challenging trade-off. While there has been huge improvement in some health outcomes, health systems are very weak, and it is argued that this leaves these countries unable to 'respond to challenges, for example infectious disease outbreaks' citing the West Africa Ebola epidemic. (WHO 2015:7). As with many such questions, the answer is not clear cut and ideally we strive for a both. Oftentimes health crises have such devastating impact that, as a 'first things first' approach, disease-specific programmes to alleviate the worst of the damage are simply the only option.

When investing in the education system a somewhat similar problem is encountered. Todaro highlights the trade-off between deepening investments in human capital versus extending it to more people (2009: 394). On the premise that the quality of education drives increases in income and productivity, policy-makers should focus on improving current schools as opposed to extending education to more children but Todaro emphasises the questions that this raises around equity and equality of opportunity.

A further trade-off arises when deciding how to divide investment between primary, secondary and tertiary education. Providing free university tuition may seem like a step towards giving the disadvantaged access to the same educational opportunities as the rich but poorer children are often excluded from secondary education and thus tertiary, due to costs and credit constraints. The social cost of education is much higher for university students than primary school children, therefore the government should invest more in primary education and less in university. However strong universities can lead to important advances in development driven by less developed countries which should not be dismissed either. These trade-offs are not clear-cut investment necessitate nuanced answers, however examining them can help to deepen understanding of the situation.

Behavioural Aspects

Often the devil is in the detail. There is increasingly a focus on behavioural aspects to decision-making and how programme design can improve incentives to invest in education and health. The debate on the subsidising of bed nets to prevent malaria highlight this. The bed nets have a large positive externality which means there is a strong argument for the government to provide nets for free (Sachs 2005) however it is argued that due to the lack of a psychological sunk cost effect people will value the nets less highly, be less likely to use them, and due to entitlement effects, expect them for free in the future (Easterly 2006). There is a trade-off between providing the nets for free and risking waste, and charging for the nets, and so risking decreased coverage; so the challenge lies in finding the right middle ground.

Small incentives can have large impacts on the success of policies. One experiment examined the impact of small rewards for mothers bringing their children to be immunised in Udaipur, India (Banerjee et al. 2010). Small rewards such as a kilogram of lentils yielded very significant results in the amount of children being fully immunised, doubling the effectiveness of the immunisation camps. Families didn't necessarily need the beans but receiving them provided the extra behavioural push needed to make the programme much more effective. Barerra-Osorio et al. look at how conditional cash transfers can be designed with 'commitment devices' that incentivise re-enrolment and graduation and they find that these incentives have significant effects. (2011: 180). These examples highlight the importance of taking the complexities of human behaviour into account in policy and using them to our advantage.

Human Capital in the Broader Context

As previously stated, investing in human capital is necessary but not sufficient for development. Governments must ensure that this investment happens in conjunction with other kinds of social, economic and political progress. Investment in health and education on their own is of course limited in what it can achieve and does not exist in a vacuum. An integrated approach is increasingly seen as imperative for making strides in development, and this attitude is reflected in the Sustainable Development Goals (SDGs) which aim to be 'integrated and indivisible'[1].

The WHO Report 'Health in 2015: from MDGs to SDGs' highlights the connections between the goals for example how 'health affects, and is in turn affected by, many economic, social and environmental determinants' (WHO 2015: 9) and defines urbanisation, pollution, climate change as important determinants of health. The interrelatedness of these factors means that an integrated and multifaceted approach is vital to make investment in human capital fruitful. It makes little sense to be investing in treating pulmonary disorders for example if the underlying problem of pollution is not simultaneously addressed. It also advocates a 'Health in all Policies' approach, whereby government policies should always take health impacts into account in the transport and agriculture sectors for example (WHO 2015: 9).

Goal 16 of the SDGs is 'Peace, Justice and Strong Institutions'; promoting peace and reducing conflict are essential in achieving better health and education outcomes. Furthermore, differences in capital accumulation and productivity are driven by institutions and government policies, or social infrastructure (Hall, Jones 1991: 1). The rule of law and solid institutions are essential so that the returns to health and education can be realised.

Initiatives such as the MDGs and the SDGs can contribute hugely to a climate of sustainable investment in human capital. Not only did official development assistance increased by an astounding 66% between 2000 and 2014 (WHO 2015: 4), the SDG can also have impacts on aid and donor practices and on governments. In order for investment in health and education to yield optimal results we need international cooperation and a move towards equal relationships between developed and less developed countries. Indeed the SDGs seeks to be genuinely universal and relevant to all nations[2].

Investment in human capital is made possible by governments having adequate resources to devote to it. Oxfam's report 'Tax Battles' highlights how tax dodging by multinational corporations is depriving governments of their ability to provide for their citizens (Oxfam 2016: 2). Equitable taxation is essential to facilitate investment in human capital, and this investment must also be accompanied by policies to reduce inequality general. As previously discussed, this inequality of opportunity is both ethically and economically undesirable. A more equitable society will allow people and the economy to achieve their potential, thus leading to further development.

Conclusion

Investing in people is essential to allow them and economies to achieve their potential. While policy-makers face challenges in choosing on how best to invest, well-design policies can contribute greatly to development. Investment must be placed in a broader context of other goals. Only then can we reap the full rewards of investing in human capital investment and development.

Reference List

1. Baird, Sarah J, Richard S. Garfein, Craig T.McIntosh and Berk Özler (2012). "Effect of a cash transfer programme for schooling on prevalence of HIV and herpes simplex type 2 in Malawi: a cluster randomised trial". Lancet 2012; 379: 1320–29.
2. Banerjee, Abhijit Vinayak, Esther Duflo, Rachel Glennerster and Dhruva Kothari (2010). "Improving Immunisation Coverage in Rural India: Clustered Randomised Controlled Evaluation of Immunisation Campaigns with and without Incentives." BMJ 340-222.
3. Barro, Robert (1992). "Human Capital and Economic Growth". In: Policies for Long-Run Economic Growth. Federal Reserve Bank of Kansas City.
4. Barrera-Osorio, Marianne Bertrand, Leigh Linden and Francisco Perez-Calle (2011). "Improving the Design of Conditional Transfer Pro-

grams: Evidence from a Randomized Education Experiment in Colombia." American Economic Journal: Applied Economics Vol. 3, 167-195.

5. Behrman, Jere R. and Anil B. Deolalikar (1987). "Will Developing Country Nutrition Improve with Income? A Case Study for Rural South India". In: Journal of Political Economy 1987, Vol. 5, No.3. 492-507. Chicago.
6. Dutcher, Nadine (2001). "Expanding Educational Opportunities in Linguistically Diverse Societies". Washington DC: Centre for Applied Linguistics.
7. Easterly, W. (2006). "The White Man's Burden: Why the West's efforts to aid the rest have done so much ill and so little good". New York: Penguin Press.
8. Glewwe, Paul and Karthik Muralidharan (2015). "Improving School Education Outcomes in Developing Countries: Evidence, Knowledge Gaps, and Policy Implication". The Journal of Economic Perspectives, Vol. 30, No. 3, 109–132.
9. Glewwe, Paul, Michael Kremer and Sylvie Moulin (2002). "Textbooks and Test Scores: Evidence from a Prospective Evaluation in Kenya." Mimeo, Harvard University.
10. Jensen, Robert (2010). "The (Perceived) Returns to Education and the Demand for Schooling. The Quarterly Journal of Economics, Vol. 125, No.2, 515-548.
11. Kazianga, Harounan, Dan Levy, Leigh L. Linden and Matt Sloan (2013). "The effects of "girlfriendly" schools: evidence from the BRIGHT school construction program in Burkina Faso" American Economic Journal: Applied Economics Vol. 5 No.3, 41-62.
12. Miguel, Edward and Michael Kremer (2004). "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities" Econometrica. Vol. 72, No.1, 159-217.
13. Oxfam (2016): "Tax Battles: the dangerous global Race to the Bottom on Corporate Tax". (https://www.oxfam.org/en/pressroom/pressreleases/2016-12-12/worlds-worst-corporate-tax-havens-exposed-oxfam-report-reveals, Accessed 16 December 2016)
14. Sachs, Jeffrey (2005): "The End of Poverty: Economic Possibilities for Our Time. New York: Penguin.
15. Todaro, Michael P. and Stephen C Smith. (2009): "Economic Development" (Tenth Edition). London: Pearson Education. Transforming our world: the 2030 agenda for sustainable development. New York (NY):

United Nations; 2015 (https://sustainabledevelopment.un.org/post2015/transformingourworld, accessed 17 December 2016) WHO
16. Report (2015). "Health in 2015: from MDGs, Millennium Development Goals to SDGs, Sustainable Development Goals". Geneva: WHO.
17. WDR (2006). World Bank Group "World Development Report 2006: Equity and Development". New York: Oxford University Press for the World Bank.
18. WDR (2007). World Bank Group "World Development Report 2007: Development and the Next Generation". Washington DC: World Bank.

1 https://sustainabledevelopment.un.org/post2015/transformingourworld accessed 17 December 2016.

2 https://sustainabledevelopment.un.org/post2015/transformingourworld accessed 17 December 2016.

How Important is Directly Targeting Inequality for Economic Development?

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Inequality is perhaps the most topical and pressing issues in economics today. In this essay, Eilis O Brien examines the relationship between inequality and growth. She first considers the contrasting evidence regarding the relationship between income inequality and growth, citing the wealth theoretical and empirical which have come to seemingly contradictory results. Eilis finds however, that if inequality of opportunity is distinguished from inequality of outcome, then the relationship becomes a little clearer. She shows inequality of opportunity certainly is inefficient and has negative effects on growth. However, a certain degree of income inequality is needed for an economy to function, although excessive income inequality is associated with less equality of opportunity and lower growth. She concludes that a balance is needed to maximise efficiency, and that policymakers should exercise caution in pursuing policies which are untested and based solely on theory.

Introduction

The issue of inequality is a pivotal element of development economics, with income inequality in particular at a significantly high level today (Oecd.org, 2017). This calls for an examination of the importance of inequality and development. This essay will focus on national economic development, defined as the deviation of actual observed economic growth from potential growth. Inequality can be divided into three concepts following the definition by Marrero and Rodriguez (2013), where the combination of inequalities of opportunity and effort result in inequality of outcome. Inequality of opportunity is structural, ingrained in the

fabric of society a result of the human, social, political and economic resources an individual has access to depending on their geographical and social place of birth. Inequality of outcome, on the other hand, is a consequential inequality characterised by differences in individual accumulation of economic capital.

The importance of directly targeting income inequality to achieve full development is difficult to measure due to differences in analytical methods and countries analysed, and the difficulty in establishing causal relationships. Nonetheless, it would appear that although inequality of income may provide incentives for production, there is empirical support for the reduction of income inequality leading to redistributive policies which hinder economic growth. On the other hand, there appears to be more agreement regarding the detrimental effects of inequality of opportunity on efficient resource distribution and subsequent economic growth. It would seem that in order to experience full potential growth, a country should focus on reducing inequality of opportunity and on implementing policies which seek to reduce income inequality in such a way that the incentives provided by income inequality are not affected. Moreover, the inconclusivity of results highlights the fact that the design of policies which target inequality should take into account the political and economic context.

Income Inequality and Development

If inequality is defined as disparities in income, then the relationship between inequality and economic growth is difficult to establish, as results vary depending on the method of analysis, or the countries analysed (World Bank, 2006). Nonetheless, it would seem that both direct and indirect targeting of inequality are not necessary to achieve economic growth. However, although there is evidence that a certain level of inequality may promote growth in more developed countries, it would appear that the disruptive redistributive policies, which are implemented in political economies as a result of disparities in income, may support directly reducing income inequality.

Central to this debate is the focus on direct targeting of inequality as opposed to indirect targeting. To claim that direct targeting of inequality is unnecessary is to assume either that inequality will decrease as a result of economic growth, or that there is no relationship between inequality and growth in the first place. In contrast, empirical observations imply that direct targeting may be useful for economic development.

Indirect Targeting

It has been theorised that direct targeting of inequality is not necessary for economic growth, but rather that inequality will be indirectly influenced as a result of growth. One of the most influential concepts regarding the relation-

ship between inequality and economic growth was formulated by Simon Kuznets (1955). According to Kuznets, as a country experiences growth, income inequality first rises as a result of industrialisation and urbanisation (Kuznets, 1955, p.17) before falling as efficiency increases, as a greater proportion of the population is born in urban areas and a set of welfare policies are implemented. Kuznets did note the lack of solid empirical evidence to support his theory, and although this relationship between inequality and growth has been noted empirically, the causal interpretation that he established has been contested (Barro, 2000).

Similarly, a large cross-country study by Dollar and Kraay (2002) found that direct targeting of inequality was not a necessary prerequisite for economic growth. Their research supports the implication of Kuznets theory whereby indirect targeting of inequality is unnecessary for development. However, their interpretation differs from Kuznets theory since they find that growth influences the income of the poor at a rate equal to the rest of the population. More importantly, their research finds that direct targeting of inequality has no more influence on income distribution than it does on overall growth. According to their research, economic development does not require direct targeting of inequality, but rather that income equality will rise proportionately with economic growth.

Direct Targeting

However, significant inconsistencies have been noted with Kuznets theory. Stiglitz (1996) argues that the rapid growth in East Asia starting in the 1970s was a result of policies promoting growth combined with ones specifically targeting inequality. This implies that, contrary to Kuznets theory, inequality is not indirectly reduced as a result of economic growth, but rather that specific policy implementation seeking to reduce inequality directly may be one of the driving factors of economic growth.

Other relationships between income inequality and economic growth have been observed. Banerjee and Duflo (2000) found a non-linear relationship between inequality and growth where a change in inequality is associated with reduced growth in the short-run. They base their model on a political economy where redistributive policies are implemented when inequality arises. They note that their results may be due to the disruptive effects of a hold up (increased inequality) or redistributive policies (lower inequality) in the short-run, though they impress upon the difficulty in establishing a causal relationship. Barro (2000) states that the distortionary effect of redistributive policies is often considered to be an explanatory theory for the decrease in growth for less developed countries when high inequality is present. Marrero and Rodriguez (2013) also comment upon the potential detrimental effects of income-based redistributive policies on

growth. Considering the fact that pre-existing inequality is the reason for such disruptive policies, these findings could indicate the benefit of directly targeting income inequality, even if it leads to a short-term reduction in growth.

This notion is supported by Persson and Tabellini (1994) who claim that there is a negative relationship between inequality of income and economic growth as a result of decreased investment and reduced returns from investment due to disruptive redistributive policies. Moreover, they state that this is specifically the case in democratic countries, perhaps due to the higher concern with redistribution in democracies. These findings imply that direct targeting of inequality in democracies may be necessary to reduce the impact of redistribution and achieve greater economic development. Their research highlights the importance of taking the political context of a country into account when assessing the importance of inequality.

Barro (2000) further argues that there may be a negative relationship between inequality and economic growth, and in particular that variations in economic context should be taken into account. He finds that inequality prevents economic growth in developing countries but promotes growth in more developed countries. This has been noted in other research (Shin, 2012), which implies that policies seeking to promote economic development should take into account the current level of development of a country, and focus on reduction of inequality if they are less developed.

Although there seems to be support for the direct reduction of income inequality in order to promote economic development, it is important to note that a certain level of inequality of outcome may promote economic growth. Considering the importance of private property for the capitalist model, property rights can incentivise production and stimulate growth by creating a temporary monopoly which provides profits in order to promote innovation, production and growth if appropriately implemented (Kumar, 2003). Growth may therefore benefit from a certain level of inequality of outcome, and direct targeting of income inequality should be tailored to accommodate for this.

Overall, it would seem that inequality of income may be damaging for economic growth, although the extent to which this is the case is ambiguous. In a political economy or democracy, higher inequality often leads to redistributive policies which decrease capital accumulation and as a result decrease incentives for production. This change in inequality has been shown to lead to a short-term decrease in growth, and thus democracies may be more negatively affected by income inequality than more autocratic political economies. Income inequality has also been found to be a hindrance for growth in countries with lower levels

of development. Therefore, direct targeting of inequality may be necessary to promote economic growth as this would reduce the need for redistributive policies which diminish incentives for production, and this may be particularly important for less developed countries. However, property rights which guarantee inequality of outcome may also incentivise economic growth. The lack of a solid conclusion regarding this issue highlights the importance of taking current levels of development and political context into account when assessing the importance of inequality for development.

Equality as Participation in Economic Life

The difficulty of coming to a significant conclusion about the relationship between income inequality and economic development has not gone unnoticed. Marrero and Rodriguez (2013) argue that this is due to the use of disparities in income as a measure of inequality. They find that focusing on inequality of opportunity and effort as factors of income inequality provides a more complete understanding of the effects of inequality on development.

It would seem that full development can only be achieved if there is a reduction of inequality of opportunity with equal possibility for all individuals to participate in economic life. Inequality of opportunity is considerably more difficult to measure empirically than income inequality (World Bank, 2006). However, there is greater consensus regarding the importance of inequality of opportunity for development. Equality of opportunity promotes an efficient distribution of resources and enhanced institutional development which, combined, is a driving force for development.

Efficient Resource Distribution

There is much theoretical support for the importance of reduction of inequality of opportunity. The main reason is that of efficient resource distribution. The World Development Report (World Bank, 2006) highlights the fact that access to markets (and in particular credit markets) is often not as efficient as it is considered to be in economic theory. In theory, whether individuals invest or not is a function of the rental price of capital, potential returns and an investor s risk adversity. However, in practice, individual access to credit is dictated by moral hazards and imperfect information, and thus actors with higher return prospects, collateral insurance or political affiliations often have easier and cheaper access to credit. The report also notes that pre-existing stereotypes about certain individuals may lead to discrimination by lenders. This inequality of opportunity leads to capital being available to individuals on the basis of their economic, political or social background, rather than their expected social contribution. This leads to a certain amount of underinvestment. This inefficient distribution of resources

which is rooted in inequality of opportunity may therefore be translated as lost economic growth.

The importance of equal access to capital markets is supported by Barro (2000), who notes that profitable ventures are often not undertaken by individuals if they are poor. Indeed, the most profitable investments also tend to be the most risky ones. If an individual has limited access to credit then they will most likely not have access to capital for risky ventures, and thus a country will forego not just any investment, but a proportion of its most productive investment potential as a result of inequality of opportunity in the credit market. Inefficient resource distribution can also arise as a result of gender inequality. In some countries, female economic participation in the household is unequal to that of men (Duflo, 2003). In the case of what Sen calls missing women (Sen, 1992) there is a considerable proportion of women who, due to neglect in the early stages of their lives relative to their male siblings, undocumented female births, or selective abortion, never have the full opportunity of life to begin with. This discrepancy represents a reduction of the potential labour force, which entails a reduction of innovation, production and economic growth. Sen highlights the fact that policy implementation specifically targeting gender inequality could help reduce this inequality of opportunity, which implies that directly reducing gender-based inequality of opportunity may be necessary in order to achieve full economic development. Thus it would seem that, considering the inefficient resource distribution which arises as a result of inequality of opportunity to capital markets, education and full participation in economic life for women, directly targeting such areas may help promote full development.

Institutional Development

A thorough examination of development includes not only efficient access to markets, but equally non-market institutional development (World Bank, 2006). This too can be limited by inequality of opportunity. Indeed, the World Bank Report (2006) states that political, judicial and social institutions underpin the efficiency of markets, and that these are influenced by inequality of opportunity. The main concern regarding inequality of opportunity and institutions is that of unequal representation in the legal system. The World Bank provides notable examples such as slavery and apartheid, but this could also be applied to recent racial tensions and police brutality in the United States, for example. As long as there exists an imbalance of power in a society, there will be unequal opportunity of access to markets and resources such as capital or property rights, which leads to inefficient growth. This inequality of opportunity may become internalised by individuals and persist in the long run if policies seeking to tackle it are not

devised (World Bank, 2006).

Marrero and Rodriguez (2013) note the importance of evaluating not only inequality of opportunity, but also inequality of effort. If opportunity is to be held constant, then the main factor which influences outcome is effort. They argue that inequality of outcome as a result of effort rather than opportunity may be beneficial for an economy. This leads them to conclude that specifically targeting inequality of opportunity through tailored policy design may increase the possibility of individual effort without harming incentives for productivity.

Conclusion

Establishing the influence of inequality reduction on economic development is a complicated task. Much of the empirical data provides conflicting answers due to the varying nature of each model used. Nonetheless, the question can be assessed in two different manners. Firstly, there is conflicting evidence regarding income inequality and economic development. In theory, inequality of outcome may provide incentives for productivity and thus stimulate economic growth. Upon empirical examination, certain models find little evidence for any substantial relationship between income inequality and growth. Others observe a negative correlation between the two in the short run. However, there is some empirical evidence that income inequality may hinder economic development, in particular for less developed countries. This may be the result of the disruptive effects of redistributive policies which seek to reduce pre-existing income inequality.

Secondly, once the definition of inequality is nuanced, the answer becomes considerably clearer. Inequality of opportunity seems to be negatively correlated with economic development for countries regardless of their level of development. Theoretical arguments highlight the importance of equality of opportunity and efficient resource distribution for economic development. Therefore, it would seem that policies which seek to reduce inequality of opportunity may be necessary in order to achieve full development, and that this may be more important the further away from steady state growth a country is. A reduction of inequality of opportunity as a result of specifically tailored policies may enhance economic growth without damaging the incentives provided by outcome, since this would allow variations in effort to be the determining factor of outcome rather than opportunity.

Overall, it seems that directly targeting inequality may not be necessary in order for a country to experience economic growth, but that a certain discrepancy may exist between actual growth and potential economic growth if inequality of opportunity is not specifically targeted. Considering the conflicting data which

emanates from research depending on the research model and the political and economic context of the country under examination, it would seem unwise to implement policies that have been informed solely by generalised research. Differences in the structural context of individual economies, societies and political regimes should be taken into account, and specific research based upon tailored data and models should inform policies which seek to promote development.

Reference List:

1. Banerjee, A. and Duflo, E. 2000. Inequality And Growth: What Can The Data Say? . SSRN Electronic Journal 8:3:267-299.
2. Barro, R. 2000. Inequality, Growth and Investment . Journal of Economic Growth 5:1:5-32.
3. Dollar, D. and Kraay, A. 2002. Growth is good for the poor . The Journal of Economic Growth 7:3:195-225.
4. Duflo, E. 2003. Grandmothers and Granddaughters: Old Age Pension and Intra-Household Allocation in South Africa . World Bank Economic Review 17:1:1-25.
5. Kumar, N. 2003. Intellectual Property Rights, Technology and Economic Development: Experiences of Asian Countries . Economic and Political Weekly 38:3:209-215, 217-226.
6. Kuznets, S. 1955. Growth and Income Inequality . The American Economic Review 45:1:1-28.
7. Marrero, G. and Rodriguez, J. 2013. Inequality of opportunity and growth . Journal of Development Economics 104:1:107-122.
8. Oecd.org. (2017). Inequality - OECD. [on-line], http://www.oecd.org/social/inequality.htm#income. [Accessed 16 Dec. 2017].
9. Persson, T. and Tabellini, G. 1994. Is Inequality Harmful for Growth? Theory and Evidence . American Economic Review 84:3:600-621.
10. Sen, A. 1992. Missing Women, Social inequality outweighs women's survival advantage in Asia and north Africa . British Medical Journal 304:6827:507-588.
11. Shin, I. 2012. Income inequality and economic growth . Economic Modelling 29:5:2049-2057.
12. Stiglitz, J. 1996. Some Lessons From The East Asian Miracle. The World Bank Research Observer 11:2:151-177.
13. World Bank (2006). World Development Report 2006, Equity and Development. New York: Oxford University Press.

Behavioural Economics

"There are no seats in the Library!" Nudging Students Toward Efficient Seat Reservation Behaviour in Trinity Library

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This paper seeks to apply the theories and concepts of behavioural economics to solve a very simple problem faced by university students: the search for a seat in the library. This is done by examining the impact of both a formal and informal nudge to the student's choice architecture in the form of a sign on student behaviour within a standard library setting. The primary motivation for this study is the lack of seats in a library at any given time, primarily fuelled by students saving seats by placing their bags/books on the desk. The experiment showed that a formal nudge proved more effective in influencing student behaviour, however present reasoning to suggest an informal nudge may prove useful in a long term setting.

Introduction

Is an informal norm-based nudge more effective in influencing student seat reservation behaviour than a formal nudge based on official Trinity library policy?

The purpose of this research is to evaluate the impact of both formal and informal nudges on student behaviour within a library setting. By changing the student's choice architecture, we wished to test whether an informal norm based nudge is more effective in influencing student behaviour than a formal nudge. Our aim was to quantify the effectiveness of each nudge and compare the results.

This research was primarily driven by our observation of inefficient usage of seats in Trinity library. From our experience, it is common for students to place bags or books on library desks in order to save seats. During busy periods, there is a high demand for library seats and seats can therefore be considered a scarce resource. We believe that it is economically inefficient for students to reserve seats for extended periods of time because this creates a situation where seats are not being used and other students are precluded from using this resource. Consequently, this behaviour has a negative impact on the wider student community. We conducted this research in the hope that our findings may be of use to Trinity Library when considering how to frame signage in the future.

Literature Review

Nudge Theory

Behavioural economists recognise that people and the decisions they make can be greatly influenced by small changes in context (Thaler and Sunstein, 2008). Hahn and Metcalfe (2016) assert that in recent years, there has been an explosion in the use of field experiments to test and understand how humans respond to behavioural interventions in real world settings (Harrison and List, 2004; List and Metcalfe, 2014). There are many ways in which behaviour can be affected. One is to supply people with additional information relevant to making their decision. Another is to change the way in which the information is presented and framed (Hahn and Metcalfe, 2016). By using the above techniques, we attempted to influence student behaviour.

Nudges are about framing choices (John, Cotterill and Richardson, 2011). Thaler and Sunstein use the term choice architect to describe someone who has the ability to organise the context in which people make decisions. For our project, we became choice architects. We altered the way in which students thought about their decision to reserve a seat by directing them to consider either college library regulations or alternatively, the opinion of their peers. In both of our nudges, we provided additional information to the subjects (Hahn and Metcalfe, 2016).

The Focus Theory of Normative Conduct

There is widespread research on the behavioural influence of social norms. The findings are clear, an individual's actions are frequently guided by comparing themselves to what they see others doing or believe others to be doing (Cialdini et al, 1990; Cialdini,2003; Shultz et al, 2007; Slaunwhite et al, 2004). This idea underlies much of the marketing campaigns that currently exist designed to encourage people to take socially desirable actions. These are an alternative to campaigns which are based on information, moral pressure or sanctions (Donaldson et al, 1995;Newell & Siikamäki,2013). These methods are viewed as so effective that almost half of US colleges and universities in a 2002 study had used them in anti binge-drinking campaigns (Wechsler et al., 2003). However a lack of awareness of underlying social psychology and the theories behind them have, in some cases, increased the levels of undesirable behaviours that they intended to address (Perkins, Haines, & Rice, 2005;Cialdini, 2003).

This issue is addressed by Cialdini et al (1990) in the focus theory of normative conduct. This theory posits that individuals are persuaded by two different types of norms: descriptive norms and injunctive norms. Descriptive norms aim to change behaviour by describing what the typical person does, creating a perception of what behaviours are normal and describing an action which will help the individual to conform. Injunctive norms have a moral focus on what behaviours others approve of; the actions that people should be taking rather than those that others are taking. Critical to this is the finding that individuals are motivated by both types of norms. Cialdini (2003) also emphasises having norm based signs visible at the point-of-decision i.e. exactly where and when the decision is made) to increase the power of nudges.

Studies on Library Seating

In the western world, students behavioural patterns have been primarily considered with respect to attendance levels and the attractiveness of library spaces. Any studies addressing seat reservation behaviour were conducted in China. For example, Wang (2010) examined the idea of nudging students in university libraries in China. He proposed that students should be educated at the beginning of their freshman year to be considerate of others and that this would maximize library usage utility. University staff put up official posters in the library urging students not to reserve seats but this did not have the desired effect in the long run. At the beginning of the exam term, first year students were less likely to reserve library seats. In contrast, second and third-year students were more likely to reserve seats as they had seen the posters many times. According to Wang (2010), students argued that even if they themselves did not reserve any

seats, others would do so. Therefore, he concluded that nudging students by using simple education or posters is not effective in the long run.

Ding (2010) similarly empirically proved that it is inefficient to use official rules and sanctions to control student seat reservation behaviour in the library. In this study of Chinese universities, when seats were occupied by students bags or books over a certain length of time, librarians would clear the desk and let other students use the seat. This approach caused conflict between librarians and the students. It also required the librarians to have accurate time management as well as good communication skills. Thus Ding (2010) recommend introducing introduce seat management software.

Qu and Li (2008) suggest that a more efficient way to manage students seat usage in the library is to create an app that works as follows: firstly, if students wish to use the library between 7am 7pm, they need to reserve seats in the library on the app. Twenty minutes after the reservation, if the student doesn t make it to the seat, the seat will automatically become available to others. Students can use the seat for no longer than 8 hours during daytime from 7am 7pm. Once a student leaves the library and does not come back within half an hour, the seat will become available to others.

Method

a) Preparation

In preparation for our experiment we spoke to peers to identify whether they believed seat reservation to be an issue in Trinity library. We also researched the current Trinity College Dublin library regulations.

b) Obtain permission

We sent our proposal to the TCD librarians and asked for permission to conduct the experiment. In speaking to the librarians, they found it rather odd that students leave their belongings on seats as they could be stolen. We made a note of the disparity between the opinion of library staff and student perceptions; there is asymmetric information between library staff and students who are not aware of library regulations.

c) Survey Students

Subsequently, we created a survey on SurveyMonkey and distributed this to our peers through a class emailing list and social media. In total, we received 100 responses. 95 of these were from students currently studying at Trinity College Dublin. When designing our experiment, we were especially interested in the following information from our survey:

* 31% of students said that they had reserved a seat in the library in the previous 2 weeks.

* 50 minutes was the average amount of time that students believed to be fair to reserve a seat in the library. We included this information in our informal nudge.

* 50% of the survey participants believed that the seat reservation limit should be below the mean of 50 minutes

* 75% of students said that they believed there should be a time limit for reserving seats in the library.

d) The experiment

After reviewing the experiments by Wang (2010), Ding (2010), Slaunwhite (2008), Shultz et al (2007) and Nolan et al (2004), we designed an experiment that would investigate the effect of point-of-decision norm based nudges on students. We observed the seating reservation behaviour of students on two separate floors of the library. Firstly, we carried out a control observation without any intervention. Secondly, we altered students choice architecture by implementing two separate nudges in the form of PSA paper signs (a formal sign on one floor and an informal sign using normative based messaging on the other). We then compared the result that we obtained from each floor to the control result for that floor to see whether student behaviour had in fact changed. In addition, as it is a between-subject test, we compared the relative effect of each nudge.

Initially, we intended to record the amount of time that each student reserved their seat for. However, a test experiment was undertaken and demonstrated that this would be extremely difficult due to a lack of personnel. Thus it was decided that if we identified a) the number of students who reserved seats for at least an hour and b) the amount that reserved seats for over one hour, this would allow us to gain an insight into the effect of the nudges.

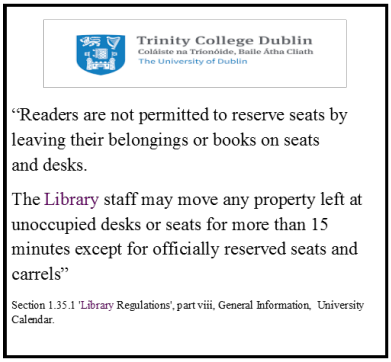
e) Procedure

Two members of our research team carried out the observation (one person on each floor).

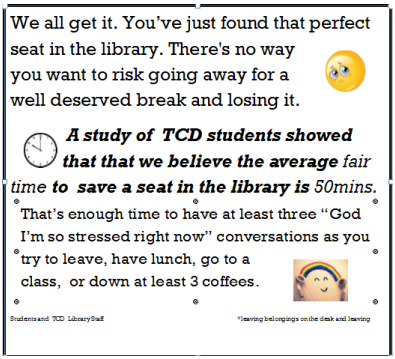
1. We sat in a central location where we could observe all of the subjects clearly
2. At 1pm we recorded:
    - All of the seats that were reserved (had possessions on them).

- All of the seats that had students sitting in them.

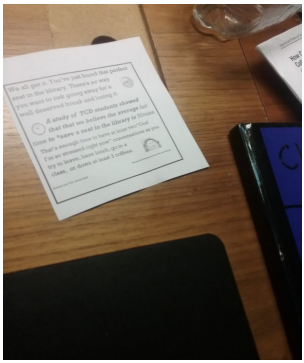
3. Between 1pm and 2pm we recorded:
   - The number of students who returned to the initially reserved seats.
   - The number of students who left and reserved their seat.
   - The number of these students who returned before 2pm i.e they reserved a seat for less than 1 hour.

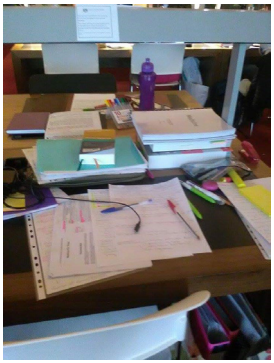


Ussher 2: Informal Sign



Ussher 1:Formal Sign





e) The signs

Precautions

We did not inform subjects that they were participating in an experiment. We put the signs in place early on the morning of the experiment when few people were in the library and returned at 1pm to carry out our observation. This was to reduce (or eliminate) the chances of subjects changing their behaviour due to being in an experiment (Hahn and Metcalfe, 2016).

time. Thus we posit that once students observe that the sanction is not imposed, this reduction in compliance due to the formal sign may be quite rapid.

Our study was consistent with the effects of normative nudges and the focus theory of normative conduct. Our descriptive-injunctive nudge informing students that their peers considered 50 minutes to be the maximum amount of time that students should reserve seats in the library resulted in a 16% decrease in the number of seats reserved for at least one hour. Nudge strategies work by recognizing that rationality is bounded and then nudging citizens in the right direction (John, Cotterill and Richardson, 2011). We believe that over time the observed effects of the formal nudge would wear off while the informal nudge could become more powerful in influencing student behaviour.

Conclusion

This study demonstrates the practical application of nudge theory and the focus theory of normative conduct in order to change the choice architecture of students in the library. Our experiment successfully nudged students to behave in a way that we believe benefited the wider college community. The data indicates that the formal nudge was more effective in influencing student seat reservation behaviour. However, following studies by Cialdini et al (1990), Cialdini (2003), Shultz et al (2007), Slaunwhite et al. (2004) and Ding (2010), we expect that the effect of strict sanction based nudges would diminish over time. In the long run, we believe that an informal norm-based nudge is a more powerful tool to change student behaviour in a library setting. If students see norm based signs that they themselves believe to be fair, they are more likely to change their behaviour in a positive way, influencing others and leading to a social contagion effect. This is in line with our initial expectations.

Finally, we recommend that Trinity library engages in active dialog with students and considers using norm-based signs to improve both efficiency of library seating and the use of librarian s time. However, due to the small scale of this research project and the limitations outlined above, we believe further research to be necessary in order to develop and clarify these claims.

Reference List:

1. Behavioural Insights Team, (2011). Annual update. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/60537/Behaviour-Change-Insight-Team-Annual-Update_acc.pdf. [Accessed 24 Nov. 2016]. Cai, J. and Qin, Z. (2008). Causes and Solutions of "Seat Occupied" in Universities and Colleges. Journal of China Institute of

We prevented the subjects from learning from experience by conducting the two tests simultaneously (on two different floors of the Ussher library). Subjects were only exposed to our nudge once. Thus, it was a between subject test. This enabled us to avoid students encountering across multiple signs. If this had occurred, we would not have been able to determine whether their apparent change in behaviour was due to the difference in sign or because they had seen two different signs on different occasions.

As far as students were concerned, it was a normal day at college and nothing changed apart from the introduction of our nudge. We did not interfere with the subjects in any other way thus we were confident that the subjects acted independently.

Results

	Usher 1 (124 seats) Formal			Usher 2 (148 seats) Informal			Total		
	Control	Expt	% Change	Control	Expt	% Change	Control	Expt	% change
Number of seats occupied at 1pm	116	120	3%	109	117	7%	225	237	5%
Total number of seats reserved when survey began at 13.00	59	51	-14%	42	46	10%	101	97	-4%
Number of these who returned before 14.00	17	21	24%	17	25	47%	34	46	35%
Percent of intial seats reserved that returned before 14.00	29%	41%	43%	40%	54%	34%	34%	47%	41%
Number reserved for the entire period between 13.00 and 14.00	42	30	-29%	25	21	-16%	67	51	-24%
Total number of students who left the library and reserved a seat between 13.00 and 14.00	25	23	-8%	24	20	-17%	49	43	-12%
Total number of seats reserved at any point between 13.00 and 14.00	84	74	-12%	66	66	0%	150	140	-7%
Percentage of total occupied seats reserved between 13.00 and 14.00	72%	62%	-15%	61%	56%	-7%	67%	59%	-11%

From our data, we can clearly see that both nudges influenced the seat reservation behaviour of students in the library. There was a 24% (overall) decrease in seats that were reserved for over an hour in comparison to the control and there was 7% (overall) decrease in total number of seats reserved. Our expectation based on the literature was that an informal norm based approach would be more effective in positively influencing student behaviour in the library. The assumption was that this would influence student behaviour by directing students to consider the social consequences of their choices. In actual fact, our results showed that the formal nudge had a greater impact on student behaviour than the informal nudge. When noting the percentage of occupied seats that were reserved at anytime between 13.00 and 14.00, the formal nudge resulted in a 15% reduction whilst the informal nudge resulted in only a 7% reduction.

In light of the literature, we believe that in the long term, this effect would reduce and might even wear off as people became used to the signs. This is seen in Walter and Knowles (2008) study of the effect of road signs. A second compounding factor is that the sanction of possession removal has rarely been implemented in the library. Fellner et.al (2011) found that compliance increases when the nudge is in the form of official threats because of the increased risk of detection. However they also found that threat of sanctions significantly reduces with

Industrial Relations.

2. Cialdini, R. (2003). Crafting normative messages to protect the environment. Current Directions in Psychological Science, 12(4), pp.105-109. Cialdini, R., Reno, R. and Kallgren, C. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. Journal of Personality and Social Psychology, 58(6), pp.1015-1026.
3. Donaldson, S. I., Graham, J. W., Piccinin, A. M., & Hansen, W. B. (1995). Resistance skills training and onset of alcohol use:Evidence for beneficial and potentially harmful effects in public schools and in private Catholic schools. Health Psychology, 14, 291-300.
4. Ding, Y. (2010). Analysis on the Phenomenon of Occupying Seat for Self-study in University Library. Sci-Tech Information Development & Economy 2010. pp.5-7/
5. Fellner, G., Sausgruber, R. and Traxler, C. (2013). Testing Enforcement Strategies in the field: Threat, Moral Appeal and Social Information. Journal of the European Economic Association, 11(3), pp.634-660.
6. Fishman, D. and Walitt, R. (1972). Seating and Area Preferences in a College Reserve Room. College & Research Libraries, 33(4), pp.284-297.
7. Given, L. and Leckie, G. (2003). Sweeping the library: Mapping the social activity space of the public library. Library & Information Science Research, 25(4), pp.365-385.
8. Gladwell, M. (2000). The tipping point. 1st ed. Boston: Little, Brown.
9. Hahn, R. and Metcalfe, R. (2016). The Impact of Behavioral Science Experiments on Energy Policy. Economics of Energy & Environmental Policy, 5(2).
10. Halpern, D., Service, O. and Thaler, R. (2015). Inside the nudge unit: How small changes can make a big difference.
11. John, P., Cotterill, S. and Richardson, L. (2011). Nudge, Nudge, Think, Think. 1st ed. London: Bloomsbury Pub. PLC.
12. Kerr, J., Eves, F. and Carroll, D. (2001). Can Posters Prompt Stair Use in a Worksite Environment?. Journal of Occupational Health, 43(4), pp.205-207. McNeil, B., Pauker, S., Sox, H. and Tversky, A. (1982). On the Elicitation of Preferences for Alternative Therapies. New England Journal of Medicine, 306(21), pp.1259-1262.
13. Morsella, E., Bargh, J. and Gollwitzer, P. (2009). Oxford handbook of hu-

man action. 1st ed. Oxford: Oxford University Press.

14. Nolan, J.M., Schultz, P.W., Cialdini, R.B., Goldstein, N.J. and Griskevicius, V. (2008). Normative social influence is underdetected. Personality and Social Psychology Bulletin. Vol. 34 No. 7. pp. 913-23.

15. Organ, M. and Jantti, M. (1997). Academic Library Seating: A Survey of Usage, with Implications for Space Utilisation. Australian Academic & Research Libraries, 28(3), pp.205-216.

16. Patel, M. and Volpp, K. (2015). Nudging Students Toward Healthier Food ChoicesApplying Insights From Behavioral Economics. JAMA Pediatrics, 169(5), p.425.

17. Perkins, H., Haines, M. and Rice, R. (2005). Misperceiving the college drinking norm and related problems: a nationwide study of exposure to prevention information, perceived norms and student alcohol misuse. Journal of Studies on Alcohol, 66(4), pp.470-478. Qu, Kui and Chunli Li. "Probing Of Computerized Management Of The Seats In Library". Library Tribune 2008: 75-76. Print. Schultz. (2007). The Constructive, Destructive and Reconstructive Power of Social Norm. Psychological Science.

18. Schultz, P., Nolan, J., Cialdini, R., Goldstein, N. and Griskevicius, V. (2007). The Constructive, Destructive, and Reconstructive Power of Social Norms. Psychological Science, 18(5), pp.429-434.

19. Slaunwhite, J., Smith, S., Fleming, M. and Fabrigar, L. (2009). Using normative messages to increase healthy behaviours. International Journal of Workplace Health Management, 2(3), pp.231-244.

20. Smith, S.M. and Petty, R.E. (1996). Message framing and persuasion: a message processing analysis . Personality and Social Psychology Bulletin. Vol. 22. pp. 257-68.

21. Thaler, R. and Sunstein, C. (2008). Nudge. 1st ed. New Haven, Conn.: Yale University Press.

22. Torgler, B. (2004). Moral suasion: An alternative tax policy strategy? Evidence from controlled field experiment in Switzerland. Economics of Governance, 5(3), pp.235-253. Toy, S., Tapp, A., Musselwhite, C. and Davis, A. (2014). Can social marketing make 20mph the new norm?. Journal of Transport & Health, 1(3), pp.165-173. Walters, L. and Knowles, J. (2008). Effectiveness of Speed Indicator Devices on reducing vehicle speeds in London. [online] Transport Research Lab-

oratory. Available at: http://content.tfl.gov.uk/effectiveness-of-sids.pdf [Accessed 27 Nov. 2016].

23. Zhang, B. (2010).Pareto Optimality for Utilization of University Library Seats. Journal of Dalian Nationalities University.

Homo Oeconomicus: Useful Abstraction or Perversion of Reality?

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Grounded upon a theoretical basis, this paper draws into a fundamental critique of a key assumption made in most economic theory, and that is the constructed homo oeconomicus or economic man. This paper conducts this evaluation by delving into the beginning of the economic man and its common applications in the field of economics. Then subsequently discussing its advance from its origins in the writings of Smith and Mill to the modern day. Following this the argument will considering two key criticisms of economic man through both behavioural and feminist economists, before lastly evaluating the potential alternatives we can use instead of the economic man in the context of an increasingly complex, diverse and globalised economic landscape.

Introduction

Nine years before The Wealth of Nations, the English economist Sir James Steuart wrote: Were everyone to act for the public, and neglect himself, the statesman would be bewildered (Steuart, 1767: 221; cited in Brockway, 1993: 26). In the same way that Steuart s statesman prefers self-centred constituents as he believes their behaviour to be predictable in any situation, so too do economists predict the behaviours of their most ubiquitous theoretical construct, economic man[1]. This self-maximising being, postulated initially by Adam Smith and fleshed out more thoroughly by Mill and his successors, was intended as a tool to generalise the complexity of human behaviour into a coherent economic science (Monbiot, 2016). Ha-Joon Chang articulates the common neoclassical conception of economics as a study of rational choice […] made on the basis of deliberate, systematic calculation of the maximum extent to which the ends can be met

by using the inevitably scarce means (2014: 20). The dual assumptions of rational choice and maximisation are encapsulated in the homo oeconomicus construct, and both have attracted much debate and criticism throughout the colourful history of economic thought.

Proponents of the homo oeconomicus construct assert that, far from representing an inappropriate simplification of reality, the model makes possible economic analysis and provides a necessary distillation of fundamental behavioural truths (Hinnant, 1998). Indeed, Robert Lucas stated that the assumption of homo oeconomicus rational choice capacities provide the only engine of truth we have in economics (1987, p. 108; Nelson, 1995). However, homo oeconomicus has long been a thorn in the side of the economic discipline with critics castigating its crass reduction of human nature to a single propensity for material betterment in the form of monetary gain (Hinnant, 1998). Throughout the twentieth century many academics began vocalising their doubts as to Economic Man s continued saliency, and entire schools of thought emerged to problematize its ontologisation and universalisation of behaviour (Brown, 2015). With the coming of the heterodox schools, behavioural economics, and global economic instability in the new millennium, this critical stream became a flood, and homo oeconomicus as traditionally conceived was widely discredited. It is broadly accepted, as this paper will demonstrate, that without a concerted revision, the traditional construct of homo oeconomicus leaves the economic discipline under threat of complete obsolescence.

This essay first establishes the traditional conception of economic man and how it is commonly applied in the field of economics. Then the development of the concept will be traced, from its origins in the writings of Smith and Mill to the modern day. Criticisms of economic man levelled by both behavioural and feminist economists will be considered, before finally assessing potential alternatives to homo oeconomicus in an increasingly complex, diverse and globalised economic landscape.

What is Homo Oeconomicus?

According to Screpanti, Zamagni, and others, homo oeconomicus is reducible to three basic axioms: atomism, egoism, and rationality. Atomism means that the economic agent is an individual whose preferences are formed without the external influence of others preferences. Egoism refers to the idea that individuals are steered exclusively by their own preferences, seeking to maximise only their own welfare. Subjective rationality means that the individual is endowed with perfect and complete knowledge, an unlimited capacity for calculating the

best means of achieving his ends (2005: 463). In this way, traditional economic theory de-emphasises the emotions, beliefs, and values that are not directly observable in human conduct, yet which arguably underpin all human experience. Brockway takes quite a dim view of economic man in the following passage:

"[Economic man] is possessed by one idea: his own material gain. He is a fanatic. He is a madman. He is selfishness incarnate. He is a self-contradictory role model for the newly liberated.Wherever standard economics faces a problem, it looks to economic man for the answer" (1993: 9).

Joseph Schumpeter characterised Economic Man as the hedonistic computer, […] fleeing from pain and seeking satisfaction (1914: 87; Roncaglia, 2006). Undoubtedly, homo oeconomicus has proven a useful heuristic in modelling market mechanisms, consumer behaviour, and broader schema of international trade, capital markets and investment decisions. However, it is also apparent that this framework of human behaviour omits the reality of flaws, imperfect information, and motivational complexity. A real-life embodiment of homo oeconomicus is an almost certain impossibility for no-one is perfectly omniscient, objective or judgement-free. Even the earliest economic thinkers acknowledged this fact. However, that homo oeconomicus is not reflective of reality did not deter countless thinkers from building, upon this foundational assumption, many comprehensive mainstream theories of political economy. Consequently, the economic discipline was left open to serious academic criticism and attack when its predictive capacity began to falter.

The Development of Homo Oeconomicus

The definition of Economic Man has changed considerably throughout the centuries, as traditional society, where man was merely a factor of production, evolved into a modern society that witnessed the birth of the individual (Brzezicka & Wisniewski, 2014)[2]. Roncaglia argues that the classical notion of economic man can trace its origins back to the Latin idea of paterfamilias, the male head of a Roman household (2006: 236). Hobbes, in Leviathan, formalises the idea of the individual as singularly self-advancing, motivated only by calculations of competitive positioning and survival (Brown, 2015).

Yet it was Adam Smith who provided the first broad articulation of human motivations in the context of political economy. Regarded as the first systematiser of economic principles (Morgan, 2006), Smith developed a simplified theory of human behaviour to underlie the theoretical advancements made in his treatises. In The Theory of Moral Sentiments, he wrote that:

"Every man is, no doubt, by nature, first and principally recommended to his own

care… (1759: 82).Yet Smith allows for two limits to the free pursuit of personal interest, namely the administration of justice, and crucially, sympathy for fellow human beings: Society […] cannot subsist among those who are at all times ready to hurt and injure one another." (1759: 86).

Thus Smith s Economic Man shows himself to be a complex mixture of instincts, motivations, and preferences, wherein self-interest is a necessary motivation but by no means a sufficient depiction. Smith s abstraction thereby does not constitute a fully-functional model man, from which rigid economic doctrines can be constructed. Certainly, individual motivations can be linked with particular outcomes (i.e. prudence and investment), but it is impossible to trace the full outcome of each of the character traits on their own because they interact with many other characteristics and circumstances. Smith s fictional character has economic motivations with causal power but lacks the determinative singularity that gives later iterations of Economic Man their rigor. (Morgan, 2006).

A far more conscious narrowing in the characterization of economic behaviour came with John Stuart Mill s creation of a character explicitly restricted in his emotional range to economic motivations and propensities (Morgan, 2006). In On the Definition of Political Economy, Mill describes economics as concerned with man solely as a being who desires to possess wealth, and who is capable of judging the comparative efficacy of means for obtaining that end (1836: 137). Yet even here Mill appears to express an aversion to reducing human motivation to the simple desire for wealth, hence his introduction of two antagonistic counter-motives: an aversion to labour, and the desire of… costly indulgences (1836: 138). Thus Mill limits the universality of his assumption of egoism. These allowances that enable his models to better reflect human behaviour foreshadow the weaknesses that would be highlighted in the humanoid abstraction, homo oeconomicus. Indeed, in a gesture that is prophetic of the later debates on Economic Man, Mill declares, "Not that any political economist was ever so absurd as to suppose that mankind are really thus constituted but because this is the mode in which science must necessarily proceed" (1836: 139).

Moving from the Classical to the Marginalist School, homo oeconomicus morphed into an abstraction increasingly remote from reality. The portraits of Bentham and, later, Jevons were inspired by the moral principle of utilitarianism. Their theories constitute a decisive shift away from Mill s Man s desire for monetary wealth, towards a computing machine that maximises a mono-dimensional magnitude of utility (Morgan, 2006; Roncaglia, 2006). While Bentham explicitly framed human motivation in terms of utility maximisation (hedonism) and

self-interest (egoism), Jevons stressed that utility is an abstract relation between object and person, rather than a property intrinsic to an object (prioritising marginal utility above total utility) (Screpanti & Zamagni, 2005; Roncaglia, 2006). Thus, Jevons paints economic man as a calculating consumer, […] defined in psychological terms that are fundamentally unobservable yet causally powerful in the larger economic system (Morgan, 2006: 10). The conceptualisation of utility was a significant advance in the development of homo oeconomicus never before had the motivations of human actions been mathematised in such a way, however intangibly. Jevons created a new portrait of calculating man who uses such mathematics to determine economic decisions concerning how best to maximise utility, thereby taking the characterisation of economic behaviour into the laboratory of mathematics (Morgan, 2006: 11).

It is this stage in the development of homo oeconomicus that Roncaglia highlights as a pivotal crossroads. He expresses concern that economic thought set a course of deviation from the laborious progress of a social science that endeavours to take into account the complex nature of human beings… forking off along the path of economics built on the model of physical sciences at the price of substituting the real world with a fictitious one-dimensional picture (2006: 292). In what could be considered as a wrong line in the history of economic thought, the abandonment of the rich subtlety of the Smithian notion of the economic subject in favour in favour of Jevons calculating actor represents a seachange in the conception of the individual in economics, the repercussions of which are still being felt to this day.

Economic Man in Neoclassical Thought

With the coming of the Neoclassical School and 20th century economists, the psychology of homo oeconomicus all but disappears, and his rational characteristic is used interchangeably with automated, computerized, and insensate (Morgan, 2006). Let us recall the definition of economics from this essays introduction: a study of rational choice […] made on the basis of deliberate, systematic calculation of the maximum extent to which the ends can be met by using the inevitably scarce means (Chang, 2014: 20). This definition is reflective of the dominant view in Neoclassical economics, that economics is the science of choice, and these choices are made by individuals assumed to be rational, omniscient, egoistic, and endowed with unbounded cognitive powers (Chang, 2014). Neoclassical economists such as John Bates Clark and Alfred Marshall attempted to model an ideal social order in terms of a general economic equilibrium, achieved through the interactions of atomistic, egoistic, and rational actors in a

marketplace (Screpanti & Zamagni, 2005).

Indeed, mid-20th century neoclassical economics stopped short of attempting to theorise individuals choice calculus or motivations, but supposed that, however arrived at, the choices of individual economic actors were uniformly rational. Thus, rational Economic Man becomes a tautology. Neoclassical economists focused almost exclusively on outcomes rather than causes, and rarely made claims about the underlying individuated preferences and cognitive processes that give rise to actions. This is seen in Samuelson s theory of revealed preferences, which concerns itself exclusively with revealed behaviour as opposed to the motivations thereof. (Morgan, 2006; Brzezicka & Wisniewski, 2014)

Ultimately, the ubiquity of homo oeconomicus as a theoretical abstraction peaked in neoclassical economic thought. Through Smith s model of human behaviour and Mill s articulation of a robust Economic Man , to Jevon s calculating Man and Neoclassicism s rational actor, portrayals of Economic Man became radically less reflective of reality.

Criticisms

For centuries, economists and social scientists have questioned the assumption of self-interested maximisers that forms the bedrock of conventional economic epistemologies (Chang, 2014). By reducing the totality of human experience to the desire for wealth (Hinnant, 1998) - be it monetary or utilitarian attempts to generalise choice motivations have been met with increasing dissent. At a fundamental level, the obvious diversity of human life across time, space, class, gender, occupation, etc. would imply the existence of an infinite number of rational goals beyond the mere accumulation of wealth (McMacken, 2016). In Human Action, Ludwig von Mises delivered the following damning assessment of homo oeconomicus:

"According to this doctrine traditional or orthodox economics does not deal with the behaviour of man as he really is and acts, but with a fictitious or hypothetical image. […]. Such a being does not have and never did a counterpart in reality; it is a phantom of a spurious armchair philosophy. No man is exclusively motivated by the desire to become as rich as possible; many are not at all influenced by this mean craving" (1949, Sect. I.II.130).

In this colourful passage, von Mises encapsulates much of the censure heaped upon homo oeconomicus as the construct grew in influence. Beyond this primary critique, heterodox schools of have emerged that more systematically invalidate conventional expositions of homo oeconomicus, rendering its usefulness almost completely beyond salvation.

The Behaviouralist Critique

In the late 20th century, behavioural economics introduced positive rather than a normative psychological model to explain economic phenomena (Brzezicka & Wisniewski, 2014). The emergence of behavioural economics as a robust sub-field can be primarily attributed to the work of Richard Thaler and Dan Ariely, who set about to explain anomalies in mainstream economics, for which Economic Man offered no explanation. Behavioural economists proposed that human nature is filled with countless inherent deviations from rational choice that prevent the optimisation of self-interest (Brzezicka & Wisniewski, 2014). For instance, they argue that commonly people demonstrate other-regarding behaviour beyond altruistic tendencies toward family members and basic principles of reciprocity. This contravenes the assumption of homo oeconomicus self-interest. Furthermore, humans often act irrationally when calculating odds or investment value, often with catastrophic consequences take the 2008 sub-prime mortgage crisis in the United States and the Irish property market crash - two of countless instances of economic irrationality (Thaler & Sunstein, 2008; Dubner, 2015). This leads the field of behavioural economics to delineate between homo oeconomicus (Thaler s Econ) and homo sapiens, arguing that the former is a relic of theoretical economics, unrelated to the real world (Thaler & Sunstein, 2008: 15; Brzezicka & Wisniewski, 2014: 359).

The Feminist Critique

Like any science developed within human communities, economics is, at least partly, socially constructed. It is a product not only of objective truths but of human limitations and biases. In her paper Feminism and Economics , Julie Nelson condemns the implicit male-gendering of Economic Man as a theoretical tool which privileges traditionally masculine characteristics of dispassionate reason, rationality, and self-interested calculation above more traditionally feminine traits of emotiveness, altruism, and dependence. Mainstream constructions of homo oeconomicus, she claims, neglect social and emotional dimensions of human behaviour, and this represents a serious limitation of mainstream economics rather than an indication of academic rigour. Instead, Nelson advocates a conception of human behaviour that encompasses traits associated with all genders (1995: 136).

Wendy Brown, in Undoing the Demos, draws attention to the family-individual conundrum presented by homo oeconomicus. Put simply, this is the question of whether the family or the individual is the proper unit of analysis of a human world conceived as competing units of self-subsistent capital - the world of homo oeconomicus. Brown claims that the individual freedom presumed by

Economic Man pertains only to those who freely operate in the domain of market freedom, and not those who perform unwaged work or activity within markets. Thus the story of homo oeconomicus is not one of families or women, but of a social positioning long associated with male breadwinners (2015: 101). According to Brown, homo oeconomicus is a subject portrayed from a masculinist, bourgeois viewpoint, one nourished by sources and qualities themselves not featured in the story (103).

It is clear from the two feminist critiques presented above that the generic homo oeconomicus is, indubitably, masculinist. Economic Man omits both the characteristics normatively associated with womankind, as well as the reality of the gendered division of labour and female lived experience. And so the question arises: when a theoretical construct, propounded as objectively universal, fails to account for the lives and labours of half humanity, can one continue to rely on its usefulness and applicability?

Conclusion: A Future for Economic Man?

For better or for worse, ours is not the world of homo oeconomicus, but of homo sapiens. The assumptions of human rationality, self-interest, and atomism were useful in the development of economic theory, but Economic Man s failure to keep pace with a rapidly changing world economy have rendered him, in his traditional form, a much-maligned relic of a bygone era (Brzezicka & Wisniewski, 2014). Off course, all theories require some degree of generalisation, but in their foundational assumption of Economic, the dominant economic theories have strayed too far in their simplification (Chang, 2014). As demonstrated by this paper, by shifting economics from a moral to a mathematical science, mainstream economists became the agents of their own academic destruction (Yoon, 2016). Economic Man s anthropological reductionism was unable to predict, grasp or theorise economic afflictions plaguing modern society, such as inequality, environmental decay, unemployment, exploitation, and alienation (Screpanti & Zamagni, 2005).

Nowadays, although the neoclassical model that emphasises the importance of homo oeconomicus remains a mainstay of undergraduate economics classes (Dubner, 2015), rational choice models more broadly are undergoing major revision. Thaler and, separately, Kahneman have considered the idea of bounded rationality , a school of thought which takes rational Economic Man as the benchmark ideal, and then analyses what might happen to model outcomes if he were not so perfectly rational (Morgan, 2006). In reducing homo oeconomicus boundless information processing capacity, introducing emotions and cognitive

limitations to account for anomalies, a more realistic understanding of human ability and motivation can be derived (Kahneman, 2003; Thaler & Sunstein, 2008).

Certainly, efforts are being made to adjust homo oeconomicus to contemporary environments (Brzezicka & Wisniewski, 2014), and gradually models are being formulated that may eventually result in Economic Man representing a realistic concept, as well as a useful theoretical archetype (Morgan, 2006). Yet, as it stands, it is without question that homo oeconomicus has long lost its validity. This paper has charted, through a historical assessment of its development, as well as a consideration of various critiques and expansions, how Economic Man can only be viewed as a perversion of reality, and how it has lost all semblance of functionality as an adequate theoretical shorthand. For the progression of economic inquiry, and the reputation of economics as a discipline, the outdated axioms of homo oeconomicus must either be drastically reformed or abandoned altogether.

To conclude with the remarks of Screpanti and Zamagni (2005: 514): We do not know where this scientific revolution will lead us. But we do know what we are leaving behind. And we believe that overcoming homo oeconomicus reductionism is a necessary step in anticipation of the reconstruction of an economic science of which we must not be ashamed.

Reference List:

1. Brockway, G. P., 1993. The End of Economic Man. Revised Edition ed. New York: W. W. Norton & Co. .
2. Brown, W., 2015. Undoing the Demos: Neoliberalism's Stealth Revolution. New York: Zone Books.
3. Brzezicka, J. & Wisniewski, R., 2014. Homo Oeconomicus and Behavioural Economics. Contemporary Economics, 8(4), pp. 353-365.
4. Chang, H. J., 2014. Economics: The User's Guide. London: Penguin Books.
5. Dubner, S. J., 2015. Should We Really Behave Like Economists Say We Do?, Chicago: s.n.
6. Hinnant, C. H., 1998. The invention of homo oeconomicus: A reading of John Stuart Mill's on the definition of political economy . Prose Studies, 21(3), pp. 51-68.
7. Kahneman, D., 2003. Maps of Bounded Rationality: Psychology for Behavioural Economics. American Economic Review, 93(5), pp. 1449-1475.
8. Lucas, R., 1987. Models of Business Cycles. Chicago: Wiley-Blackwell. McMacken, R., 2016. The Homo Economicus Straw Man. [Online] Available at: https://mises.org/blog/homo-economicus-straw-man [Accessed 25

November 2017].
9. Mill, J., 1836. On the Definition of Political Economy and on the Method of Investigation Proper to It. s.l.:s.n. Monbiot, G., 2016. The Age of Loneliness. [Online] Available at: https://www.newstatesman.com/politics/health/2016/10/age-loneliness [Accessed 30 November 2017].
10. Morgan, M. S., 2006. Economic Man as Model Man: Ideal Types, Idealisation and Caricatures. Journal of the History of Economic Thought, 28(1), pp. 1-25.
11. Nelson, J. A., 1995. Feminism and Economics. Journal of Economic Perspectives, 9(2), pp. 131-148.
12. Roncaglia, A., 2006. The Wealth of Ideas: A History of Economic Thought. s.l.:Cambridge University Press.
13. Schumpeter, J., 1914. Epochen der Dogmenund Methodengeschichte. London: George Allen & Unwin.
14. Screpanti, E. & Zamagni, S., 2005. An Outline of the History of Economic Thought. 2nd Edition ed. Oxford: Oxford University Press.
15. Smith, A., 1759. The Theory of Moral Sentiments. London: s.n. Steuart, S. J., 1767. An Inquiry into the Principles of Political Economy. London: A. Millar, T. Cadell.
16. Thaler, R. & Sunstein, C., 2008. Nudge. New Haven: Yale University Press. Von Mises, L., 1949. Human Action: A Treatise on Economics. New Haven: Yale University Press.
17. Yoon, Y., 2016. Newton developed his own calculus as a tool to accommodate the facts. [Online] Available at: https://search-proquest-com.elib.tcd.ie/publication/publications_35024?accountid=14404 [Accessed 1 December 2017].
18. Zouboulakis, M. S., 2001. From Mill to Weber: the meaning of the concept of economic rationality. The European Journal of the History of Economic Thought , 8(1), pp. 30-41

1 Hereafter referred to interchangeably as homo economicus

2 The demands of brevity necessitate limiting the discussion of the history of the development of homo oeconomicus to a small number of core scholars. Of course, other great economic theorists were instrumental in moulding this abstraction for their own purposes (not least Ricardo, Weber, and Knight), yet a full discussion of their interpretations of homo oeconomicus unfortunately fall beyond the scope of this paper.

Not-So-Rational: Reflections on the Homo Economicus

Juliette Weyand - Senior Sophister

The assumption of perfectly rational actors is perhaps the bedrock assumption for most modern economic theory. In this paper, Juliette Weyand examines the role of this assumption, homo economicus, in shaping the neo classical approach to economics which has dominated the field in the 20th Century. She then explains the flaws in this assumption and concludes displaying the perverse results which this approach yields.

Introduction

The homo economicus (HE), one of the pillars of the neoclassical system (England, 1993; Screpanti and Zamagni, 2005), is central to defining the neoclassical field of inquiry, in founding economists analysis and interpretation, and in determining the political and practical outlook of neoclassical thought (Screpanti and Zamagni, 2005). Recent years have seen HE rise to the centre of disputes. Whilst avidly defended by neoclassical economists, opponents view it as a perversion of reality. Heterodox approaches to economics have contributed to the debate with innovative material (see Ferber et al., 1993). In this essay, I seek to highlight one aspect in particular that emerges from heterodox work. The HE strikes as being both an emblem of a specific vision of reality, and an abstract device purposed to assure that this vision persists. This makes the HE an uncritical and non-scientific generalisation. The introduction of HE comes at the cost of undermining the scientific programme of studying economic reality. I first examine the notion of HE developed within the neoclassical theory. I look at the theoretical commitments with which neoclassical economists operated, and how these were connected through the HE (Screpanti and Zamagni, 2005). In the second section, I turn to criticism mainly moved by philosophers of economics. I consider arguments that show how HE limits the analysis of economic reality unduly, allowing for confusion, misinterpretation and harmful normative stances.

This shows how the vague abstraction of HE ended up shaping and justifying a specific (and maybe not properly real) reality. The last paragraph considers a possible objection to my line of argumentation, namely that an economist might choose to limit the scope of inquiry to this specific reality. In responding to the challenge, I examine the consequences of the HE for economics as a scientific discipline.

Neoclassical myths: How HE came about[1]

Colander (2000) characterises neoclassical theory (NCT) by 6 elements:

(1) Focus is set on the problem of efficient allocation at a given point in time. At odds with the Classics concern with growth, authors such as Walras and Jevons envisioned the problem of allocation of available resources as the central question of economic inquiry (Screpanti and Zamagni, 2005).

(2) A form of utilitarianism is adopted to found demand analysis. It holds that human behaviour is reducible to rational calculation oriented towards utility-maximisation (ibid.).

(3) Neoclassical analysis focuses on marginal tradeoffs. Individuals pick among available bundles of consumption or production (ibid.).

(4) It assumes farsighted rationality, such that it is consistent with constrained optimisation. This is relevant for neoclassical commitment to a constrained maximisation framework.

(5) It accepts methodological individualism (MI). The individual is doing the maximising (Colander, 2000, p.134). Individual rationality is then translated into social rationality.

Lastly, (6) NCT is structured around a general and unique equilibrium conception of the economy. This latter point summed up the idea of an economy left free to find the final levels of equilibrium determined by the factors available at any given moment of time (J.B. Clark, 1899, p.29; qtd. Screpanti and Zamagni, 2005), and constituted the core argument of NCT (Screpanti and Zamagni, 2005).

The notion of HE that emerged from neoclassical thought is embedded in these theoretical commitments. In particular, points (2), (3), and (4) define the HE, who becomes the key-actor that, according to (5), realises (6). Point (6) in turn proposes a solution for (1). Given this research structure, the HE is understood as: An idealised agent invested with complete and transitive (rational) preferences, who acts as to maximise his individual utility. His choices are optimal

in that he picks among available bundles combinations that maximise his utility function, and constrained since natural factors (scarcity) limit the availability of bundles.

NCT adopted a utilitarian vision of economic agents combined with marginal analysis to devise general equilibrium models. It derived conclusions about the real world economy from these models deductively (Colander, 2000). HE gave interpretative foundation to models, and allowed for a movement toward mathematical analysis (Drakopolous and Karayannis, 2004). Furthermore, it gave logical cohesion to the neoclassical system to the degree of determining a scientific turn in economic inquiry (Screpanti and Zamagni, 2005). The assumed rationality that was supposed to underlie all acts, matched with the omnipresence of scarcity in the world, seemed to allow for Economics [to be] likened to the natural sciences [] and economic laws finally assumed that absolute and objective characteristic of natural laws (ibid: 166-167). HE was seen as a fundamental generalisation for the neoclassical scientific programme.

The Dis-Functions of HE

Within heterodox and interdisciplinary thought, HE has found widespread contestation. In particular, opponents argue that NCT produces a world-vision that is apologetic of the status quo, and mute to power relations underlying economic reality (Krishnaraj, 2001). In what follows, I focus on three dimensions addressed by criticism: the first concerns wrong assumptions about HE s individualistic rationality, the second the ontological views about the self implied by HE (atomism and androcentrism), the third the way these ungrounded notions of HE shape a distorted view of reality. In virtue of conceptual and interpretative dis-functions, the conclusions and applications of HE fail to provide an adequate assessment of economic reality and individual acts.

HE is not universal: A problem with rationality Preferences are assumed of the individual, i.e. exogenous to the model. The only positive element HE rationality posits is that of consistency. Choosing alternative x over alternative y implies that the HE derives more personal utility from x than from y. Individual rationality is expressed by actions. Sen (1977) opposed this view with what he calls acts from commitment. People act out of commitment when they choose an alternative x which they expect to yield a lower utility than the available alternative y. Sen allows for the possibility of a genuine act out of duty, thus breaking down the equality between personal choice and personal utility (Sen, 1977). As a consequence, individual choices, which produce economic outcomes at an ag-

gregate level (MI), do not necessarily stem from individual utility maximisation. Acts can be done at odds with one s preferences. It would therefore be necessary to at least restrict the appropriateness of unregulated markets for producing a welfare optimal outcome (ibid.), a central concern of NCT (Screpanti and Zamagni, 2005).

Sen's commitment acts exemplify that individual preferences have more depth than the HE allows for. In his view, HE gives too little structure, resulting in the envisioned ideal economic actor close to being a social moron (Sen, 1977: 336).

HE becomes positive: Atomism and Androcentrism. If Sen (1977) argued that HE explains too little about human action, I now examine the claims that it explains too much. The HE paves the way for ontological, anthropological and normative conclusions that are unfounded. I first consider the problem of atomism (Heath, 2015). In a second step, I examine how the arising anthropological vision pertains to a specific and problematic philosophical tradition: Androcentrism2.

HE limits the scope of neoclassical analysis by excluding social relations as determining factors for individual agency (exogeneity of preferences). This gives rise to an ontological notion of a pre-social individual. The neoclassical narrative of the individual, even if used for illustration, evokes a non-trivial vision of humans. Menger describes pre-economic individuals as engaging in exchange only if their calculated benefits exceed the costs of doing so (Screpanti and Zamagni, 2005). Social interaction is viewed as subsequent and functional to this primitive form of human nature, given by calculative rationality directed at self-interest. Economic institutions arise as the rational development of individual utility-maximising acts. Pursuit of self-interest is understood as natural, standard and normatively correct. HE prepares the ground for an anthropological vision of humans as atomic actors, endowed with a socially independent psychology (here: self-interest; Heath, 2015). This simplistic understanding of human nature determines inferences on what is rational, normal and ethical for man to engage in. Acts dictated by self-interest are associated with the true natural form of humans. Social reality can at best facilitate self-interested acts. England argues that HE rests on a separative self, according to which humans are autonomous, impervious to social influences, and lack sufficient emotional connection to each other to make empathy possible (1993: 154). This vision, so England, is androcentric. Men s experiences are taken to be the norm, whilst women s experiences are either treated as invisible or as deviations (Rolin, 2012). In Western soci-

ety, self-interest, rationality and autonomy are typically male attributes, whilst altruism, irrationality and dependence are associated with the female. Further, male attributes are positively, female negatively connoted. HE becomes the personification of an ideal, the masculine. This ideal is then taken to be a universal and indeed natural model of human acts. The ontological, anthropological, and normative derivations from HE might not be inherent to the model. Rather, they stem from factually ungrounded associations, which lead from an abstract notion of self-interest, to a more substantive ontological vision, and culminate in a normative stance. These associations have repercussions on how economists interpret and evaluate individual acts and economic reality.

Women s experiences become invisible because neoclassical theory blanks how decisions are shaped under social constraints (Ferber et al., 1993). The HE fails to recognise how individual behaviour changes under social coercion (Krishnaraj, 2001). Social coercion stems from norms and values endorsed in a society, which lead individuals to choose certain acts out of fear of social punishment (ibid.). Women s economic choices are influenced by social constraints that apply to them insofar as they are women. This behaviour can still be subsumed under HE rationality, since perceived social concerns are integrated into the individual preference rankings, which are exogenous to the model. However, given that neoclassical economists focus on the analysis of the model, they tend to ignore an important factor that shapes economic reality, namely the tensions between social constraints and individual market actions (Ferber and Nelson, 1993). HE focuses exclusively on socially male attributes. The narrative that follows, and its acceptance are informed and made possible by widely held biases. In turn, this narrative helps perpetuate the underlying ideology by failing to detect the bias, and reinforcing it through scientific explanation. Economists are prone to misinterpret economic reality by not paying the necessary attention to how they define, apply and derive conclusions from certain concepts.

How HE Shapes the World: Neoclassicals in Action While in the previous section we have considered how HE gives rise to misleading conceptions, I now turn to the examination of how these ungrounded notions influence theoretical and normative conclusions neoclassical economists draw about reality. Studies have been conducted on students to test whether their behaviour maximises economic utility (Frank et al., 1993; Seguino et al., 1996). The findings indicated that economic students were likelier to engage in self-interested behaviour than any other group (Frank et al., 1993). Further, male participants acted in a more self-interested manner than female participants (Seguino et al., 1996). The find-

ings might hint at two broader mechanisms: (a) that women and men are socialised differently, making the latter more prone to behave in a self-interested way (Seguino et.al, 1996); (b) that an exposure to economic theory is linked to the rationalisation of a certain type of behaviour, namely self interest3.

Another erroneous application of HE is given in the field of New Household Economics that arose in the 1960. Krishnaraj (2001) argues that despite the novelty of Becker s approach (1971, qtd. Krishnaraj, 2001), the model he devised still ended up being apologetic of the status quo. The model takes households as productive units in which domestic labour is equal to home production (Krishnaraj, 2001). By exchanging market and home production, a man and a woman seek to maximise their personal and the household s utilities. The woman s returns from the market are lower, since she is less skilled in wage work. Her returns from domestic labour are higher, since she is better equipped for household work. The reverse holds for the man (ibid.). Households would therefore be better off if men and women specialised according to their expertise. The model completely fails in acknowledging a very important question: why do women have more expertise in the household, and less skills in wage jobs (ibid.)? NCT does not consider the larger socio-economic reality women face. According to HE, the conclusion is that both actors act rationally by specialising. The resulting socio-economic inequality is simply a consequence of women s rational choices (see Rolin, 2012 on Sexism). If not a direct fault of the definition of HE, these examples show that in its interpretation it can and in fact is misunderstood and wrongly applied by economists. Such misunderstandings result from the neoclassical tradition neglecting relevant questions about socio-economic reality in the moment of defining, interpreting and applying HE.

Where has HE gone?

Up to this point, I have left space for the neoclassical theorist s retort that he need not be concerned with these arguments. Economics is -or at least aspires to be- hard science, concerned with facts about human interaction with scarce resources, which are studied through mathematical methods (Screpanti and Zamagni, 2005). In this final paragraph, I consider 3 lines of defence against this argument.

First, economic activity does not happen in isolation (Krishnaraj, 2001). If neoclassical theorists have managed to define a clean-cut field of analysis, it is only because they have made assumptions about society and individuals pre-analytically. The burden is therefore on them to defend that these assumptions effectively

hold, either in practice or theoretically. The defence itself requires excursions into the fields of sociology, political science, and philosophy.

Second, if the neoclassical economist prefers his inquiry to take place in isolation, then he must envision a downsizing of its scope. The ad hoc assumptions must be made explicit, and appropriate settings must be sought out. The applicability of the neoclassical system would decrease considerably.

Finally, in absence of this critical work, neoclassical economics risks to turn into an ideological stance vested in pseudo-scientific clothing. It advances unfounded interpretations, often at the cost of grasping reality. The situation is further acerbated by neoclassical economics monopolisation of terms such as objectivity, factuality, rationality (Ferber and Nelson, 1993). This creates a stultification of the scientific aspirations of economics4. Neoclassical economics defeats its own project by not acknowledging and correcting its limitations.

Recent developments in economic theory show that a revision of NCT is taking place. In fact, by the 1970s neoclassical hegemony was in crisis (Colander, 2000). With the advances in Game Theory, Experimental Economics and Behavioural Economics within orthodoxy, the neoclassical horizon has been widened to include more realistic human behaviour5. Some of the ad hoc assumptions are loosened, and models are extended to provide a more useful narrative in view of understanding economic reality (Backhouse, 2000). Economics is starting to integrate work outside its traditional outlook, becoming increasingly eclectic (Backhouse, 2001; Colander, 2000; Screpanti and Zamagni 2005). Recent contributions have come to question the more fundamental ideals of economics as a discipline (see Rolin, 2012). Dichotomies of hard facts soft facts, rationality emotionality, objectivity subjectivity have been increasingly taken under attack (Screpanti and Zamagni, 2005). Rather than conclusively arguing for the abandonment of all scientific aspiration, these positions show that the attainment of an ideal is indeed very demanding, and often implies redefining what we take this ideal to be.

Conclusion

I have presented arguments that point to HE being a metaphysically heavy and pragmatically loaded theory. I have tried to show that its dis-functions become manifest (and to a certain extent corrigible) once we look at them from an ontological point of view, that is, when we realise that it obscures important elements of socio-economic reality, whilst highlighting others. It so winds up creating a distorted, incomplete and falsifying picture of what it set out to study

initially. Which is, ultimately, a self-limiting or even self-defeating strategy.

References

1. Backhouse, R.E. 2000. Progress in Heterodox Economics. Journal of the History of Economic Thought 22(2): 149-155.
2. Backhouse, R.E. 2001. How and Why Should We Write the History of Twentieth-Century Economics?. Journal of the History of Economic Thought 23(2):243-51.
3. Colander, D. 2000. The Death of Neoclassical Economics. Journal of the History of Economic Thought 22(2): 127-143.
4. D Agostini, F. 2013. Realismo? Una Questione non Controversa. Turin: Bollati Boringhieri.
5. Dodds, E.R. 1959. Plato, Gorgias. A Revised Text with Introduction and Commentary. Oxford: Oxford University Press.
6. Drakopolous, S.A. and Karayannis, A.D. 2004. The Historical Development of Hierarchical Behavior in Economic Thought. Journal of the History of Economic Thought 26(3): 363-378.
7. England, P. 1993. The separative self: Androcentric bias in neoclassical assumptions.. In M. Ferber and J. Nelson (eds.) Beyond economic man: Feminist theory and economics: 37-53.
8. Ferber, M. and Nelson, J. (eds) 2009. Introduction. Beyond economic man: Feminist theory and economics. Chicago: University of Chicago Press.
9. Frank, R., Gilovich, T. and Regan, D. 1993. Does studying economics inhibit cooperation?. The Journal of Economic Perspectives 7(2): 159-171.
10. Heath, J. 2015. Methodological Individualism. The Stanford Encyclopedia of Philosophy. Spring 2015 Edition. Edward N. Zalta (ed.). [on-line], <https://plato.stanford.edu/archives/spr2015/entries/methodological-individualism/>. [Accessed: 8/12/2017].
11. Krishnaraj, M. 2001. How Gender Figures in Economic Theorising and Philosophy. Economic and Political Weekly. 36 (17): 1425-1429+1431-1434.
12. Lawson, T. 2013. What is This School Called Neoclassical Econom-

ics? . Cambridge Journal of Economics 37: 947983.

13. Rolin, K. 2012. Feminist Philosophy of Economics . In Handbook of the Philosophy of Science. Volume 13: Philosophy of Economics. U. M , D.M. Gabbay, P. Thagard and J. Woods (eds.). Amsterdam: Elsevier BV.

14. Roncaglia, A. 2005. The Wealth of Ideas. A History of Economic Thought. New York: Cambridge University Press.

15. Seguino, S., Stevens, T. and Lutz, M. 1996. Gender and cooperative behavior: economic man rides alone . Feminist Economics 2(1): 1-21.

16. Sen, A. 1977. Rational Fools: A Critique of the Behavioral Foundations of Economic Theory . Philosophy & Public Affairs 6(4): 317-344.

17. Screpanti, E. and Zamagni, S. 2005. An Outline of the History of Economic Thought. 2nd Edition. New York: Oxford University Press.

1. Neoclassical is a historically dubitable term (Colander, 2000). Veblen first introduced it to characterise the marginalism proposed by Marshall, who considered his programme a continuation of the Classical tradition (Aspromorgous, 1986; qtd. Lawson, 2013). About the difficulty of determining which economists actually belonged to NCT, and the disparate use that has been made of this term especially in recent years, see Colander (2000), and Lawson (2013). Rather than a historical exact denomination, it can be understood as a categorisation that stresses a form of continuous common ground among certain economists between 1870 and the 1930s (Colander, 2000).

2. Dodds (1952) initially brought my attention to this tradition in philosophy. It consists in the view that noble, autonomous, strong men are tied down by social norms imposed by fellow humans. It was already present in ancient Athens, as testified by the figure of Kallikles in Plato s Gorgias, and object of fervent debate at the time. It pervades the works of many philosophers, in particular Nietzsche s idea of the ermensch. In economics, both Austrian and neoclassical atomism (Heath, 2015) is influenced by the main tenets of this tradition, partly motivated by their basic premises about human action. Among its opponents we find Plato and Feminism (Dodds, 1959; Ferber and Nelson, 1993).

3. As Frank et al. (1993) point out, economic students might be more

self-interested to begin with, and decide to study economics to pursue their vocation for money. In this case, NCT could still offer an apparent rationalisation for this vocation thanks to the argumentations described above.

4. D Agostini (2013) has brought the term stultification to my attention. She uses the term in a different context, but here it nevertheless provides a valuable intuition: Our understanding is stultified in the moment in which we cannot distinguish between what is true or false, because of false claims appropriating the vocabulary we normally use to assess truth and falsity.

5. This insight comes from M. Suesse s lectures held on the 4/12/2017 and 7/12/2017. Backhouse (2001), Roncaglia (2005), and Screpanti and Zamagni (2005) also discuss the modern developments in economic thought as moving beyond NCT.

European Economics

Eurozone Reform: Beyond Institutionalism

Conor Judge, Senior Sophister

The Eurozone, and the EU more generally, now stands at a crossroads with regard to its future as an economic union and political entity. Conor Judge examines the reforms needed for the Eurozone to effectively function as a stable and prosperous economic zone. He highlights the need for consideration regarding the political and social situations when analyzing possible economic solutions to the issues facing the Eurozone. He then proposes three possible policy responses, and evaluates them both in terms of economic impacts and political viability. He concludes with the insight that the key to reform is the generation of the desire and will to change, not only among officials, but more importantly among the wider population of the Eurozone.

Introduction

The rise of Macron, Merkel's coalition with the Social Democratic Party and the demise of Great Britain suggest that the EU is set to enter another period of integration. This integration must be juxtaposed against the recent Eurozone Crisis and the reforms it called for. While other European policies may fall in or out of political favour, the stability of the Eurozone remains central and any further integration must acknowledge this. In order to effectively analyse the reforms needed to improve the economic strength of the Eurozone project, we must first recognise that the economy does not function in a vacuum, but rather it is intrinsically linked with the political and sociological fabric of society. Society is not made up of rational actors, we do not have all the information and it would not only be naive but foolish to believe that a solution lies solely in the realm of economic theory. The structure of the paper is devoted firstly to explaining some of the key issues with the Eurozone's institutional framework both pre and post crisis. Building upon these concerns, various options are laid out and their implications made clear. Finally, the paper will conclude that the Eurozone and EU in general suffers from a defined, fully supported raison d'etre and without it,

whatever policy or institutions chosen are unquantifiably hamstrung.

The question of Eurozone reform would not be on the agenda were it not for the Eurozone crisis and therefore, some inspection of the causes is warranted. I have drawn heavily on the work of Baldwin and Giavazzi and their collection of pre-eminent critics with regards to the causes of the Eurozone crisis (Baldwin and Giavazzi, 2015). The consensus being that the Eurozone crisis began in the amalgamation of European currencies into one, which gave rise to no interest rate spread across national debts due to the combination of the elimination of currency risk and the ECB collateral policy for Euro denominated debt. This allowed certain nations, especially Greece, Ireland, Portugal and Spain to borrow at a rate that did not reflect macroeconomic principles on the correct pricing of risk by financial markets. This cheap borrowing allowed for cheap credit booms to induce highly leveraged private sector debt in the form of real estate in Spain and Ireland while contributing directly to public sector debt in Portugal and Greece (Feld, Schmidt, Schnabel and Wieland, 2015). Private sector debt grew to levels that were multiples of GDP but due to the Initial Stability and Growth Pact's focus on fiscal discipline, the Creditor Nations incurred no penalties before the crisis struck (Beck and Peydro, 2015).

However, when the Global financial system destabilised in 2008, and given the level of financial interdependence, the highly privately leveraged countries suffered liquidity issues in their financial institutions. In an effort to prevent insolvency, the governments of these Nations, Ireland in particular guaranteed the debt of their Banks in order to restore confidence to the markets. However, as the extent of the Balances became known, while congruently, no European institution existed to deal with a liquidity crisis which could become speculative and therefore an insolvency crisis, trust between lenders ebbed away. (Corsetti, 2015) Thus began a "Diabolic Loop" whereby Bank losses led to sovereign debt, which led to public accounts deficits and lower tax intake that prevented counter-cyclical fiscal policy, which compounded the situation further (Corsetti, 2015). The fact that nations who avoided the public debt crisis through being net lenders did not pursue an expansionary fiscal policy due to a lack of incentive also added to the ineffectiveness of fiscal policy at the depths of the recession and a deflationary bias in program countries (Bénnassy-Quéré, 2015). In addition to this, the lack of effective and timely action by institutional figures without a political consensus to act prevented speculative attacks on debt and allowed them to be self-fulfilling or in other terms, a 'sudden-stop' crisis (Baldwin and Giavazzi, 2015).

A Eurozone responded with expansionary monetary policy aimed at reversing the downturn but the ineffectiveness soon gave rise to unconventional meas-

ures that circumvented the zero lower bound. It was not truly until the political will became clear in the ECB to 'do whatever it takes' and Outright Monetary Transactions began that any type of turnaround became clear (Draghi, 2012). It must be remembered that this was an institutional action that if taken sooner, or if the mandate for it existed before the crisis would have had a significant benefit early in the Euro crisis. Given this success, the Eurozone has responded by introducing other institutional reform, or rather introduction of wholly new institutions. Financial regulation that formally existed at a national level is now ensured co-operation with the ECB in order for those who set monetary policy to have a better idea of the risk being shared across the financial institutions they affect. The DeLarosiere Report gave way to the European System of Financial Supervision that oversees financial firms in the Union and the Banking Union which sets baseline target for all banks to meet and the supervisory mechanism which keeps the largest institutions under surveillance (De Larosiére et al., 2009). In addition to this is the 'strengthening' of the Stability and Growth Pact yet again which allows for medium term balanced budgets over the business cycle, pivots towards debt-to-GDP ratios instead of deficits but also can fine countries for violation. As numerous commentators have pointed out, this is a narrow re-entrenchment of the earlier failed SGP's and is doomed to fail. Manasse argues that there exists no incentive to act correctly in 'good' times, the definitions of growth figures are vague and open to statistical failure and crucially, the imposition of fines remains counter cyclical which given the interconnected structure of the EU, only adds to further recessionary pressure (Manasse, 2010).

This is the crux of the paper EU leaders, ECB economists and European figureheads likely knew this in advance; so why are we left with inadequate institutions and what does the future hold? The answer lies in the complexities of political and sociological decision-making. The 'animal spirits' that govern the workings of the bond markets also govern the workings of democracy. Economists, as much as their belief institutions and policy is warranted, are always constrained by this. It is these social externalities of the decision that must be factored into the following policy concerns for they are worthless without it. I will begin by looking at what needs the Eurozone has after the crisis before evaluating methods of solving these issues.

Given that public debt was a 'consequence, not cause' of the crisis, a method of controlling private debt leverage is essential. The failure of nations to act in concert with each other when recession affected some but not others calls for a strong internal coordination mechanism (Beck and Peydro, 2015). This would seek to solve the divide of Debtor vs Creditor nations, and European interests vs

domestic interests. In order to do so, some shared sovereignty may be required in order to force fiscal transfers in times of asymmetric shocks without political consternation (Micossi, 2015). If fiscal transfers are not possible, then a framework for adjustment is also required one that would not be as severe or deflationary as the austerity programs in candidate countries. This should also include a framework for insolvency for, if for no other reason, to avoid uncertainty and speculation in times of crisis. Debt restructuring need also be accommodated in order to avoid the Transfer Problem that the debt itself changes the terms of trade and has a secondary impact on the heavily indebted (Pesenti, 2015).

What options exists to deal with these legacy issues of the Eurozone crisis? The obvious answer is a Political Union that has the advantage of a guaranteed common fiscal policy and eventual economic convergence. However as Wyplosz states, the fiscal union is intellectually lazy (Wyplosz, 2015). Economists cannot argue or exist in a vacuum outside of the reality of political forces against the European project. Scope exists for some type of shared sovereignty but at present, it will not be common to every member state nor will it be particularly viable given the position of the European Parliament.

A good start would be to strengthen the Stability and Growth Pact in the correct manner, not in terms of the narrow reliance on fiscal discipline but rather on the viability of sanctions particularly that of the 'No Bailouts Clause' as was envisaged in the initial Maastricht Treaty. This would require credibility at a European level and would need to also provide a framework for what exactly no bailouts mean in the context of the euro. It removes uncertainty to defaulting European Nations and protects against the moral hazard of ill-disciplined fiscal spending. This could allow some type of fiscal transfers as the largest political hurdle, especially in the North in regards to the South, is removed. However, reform of the SGP on its own is not enough, it does not protect against the mutual risk that private debt often brings as a by-product.

What is likely is a continuation of the neo-functionalist school of European co-operation whereby co-operation could be sought on smaller, more numerous issues with less political contention (Mitrany, 1948). These would address the structural imbalances that exist in European economies and allow for some form of economic convergence and eventual, fiscal convergence as a result but not aim. Papaioannou lays out some possibilities concerning investor protection, excess regulation and efficient judiciaries as some areas where economies in Europe greatly differ (Papaioannou, 2015). This has the advantage of slow but gradual highly probable reform but on the other hand, it is difficult to envisage an effect large enough to ever match the fiscal transfers required to garner true economic

convergence. It is also a rather weak way of bringing the Eurozone into the OCA criteria and will not entice a mandate on its own merits.

A possible compromise between the weakness of existing institutions and the political implausibility of Union is a system of weighted Fiscal transfers. This allows for the trilemma of financial integration, financial stability and national fiscal policy to be overcome without a guaranteed complete initial rejection (Obstfeld, 2013). This circumvents the issue of risk sharing but weighing the risk by country. It is a view advanced by some commentators (Tabellini, 2015). Claeys and Darvas (2015) who are cognizant of the issues of moral hazard between the net lenders and net borrowers of Europe. Claeys and Darvas for instance call for an easily managed system of tying public expenditure to GDP growth (excluding certain items) and public debt. This allows for counter cyclical fiscal policy when required while limiting excessive fiscal spending in inflationary periods. Tabellini's input is also useful in overcoming the opposition to public risk sharing. He states that even by virtue of the possibility of risk sharing, liquidity speculation is eradicated. Secondly, even if it were not and risk sharing is required, a mechanism can be devised that weights the riskiness of the country for those who support it. Here, the incentive (and subsequent answer to moral hazard) is for countries who are relatively riskier to lower this in the long term or pay a higher premium instead.

A further method that is relatively politically uncontentious is to merge banks so that national domestic risk is not concentrated so narrowly on the balance sheets of any one bank and the larger lenders are better able to suffer systemic shocks (Neumann, 2016). This helps to sever the sovereign-bank loop and thus allow for further weighted risk sharing. It also contributes to realize the effectiveness of the single financial services market but these are goals that private shareholders do not hold in high esteem (Gilbert, 2016). One possible option is an EU-led movement that causes Nationalized Banks to merge across international borders (Carletti, Hartmann and Spagnolo, 2003). This overcomes the lack of current reform and sets the tone for further mergers as competition is artificially distorted. However, the main issue is that any Banks currently Nationalized are most likely not in a position where a merger of their balance sheets would be a viable outcome due to legacy debt and may in fact lead to further systemic risk. However, this factor could be overcome through correct institutional guidance from either the ECB or the ESFC. Regardless of whether debt restructuring comes through fiscal agreement or private restructuring, it is essential for the continued stability of the Eurozone. At present, the highly leveraged European nations together with heavily domesticised banks will be unable to withstand an-

other asymmetric shock since once trust evaporates, lending will freeze due to no common fiscal policy, no confidence to counter failing monetary policy and default risk due to high debt making a bank and thus country potentially insolvent.

The above is perhaps one of the more politically feasible options concerning institutions and policy reforms that the EU will require in the coming years. A risk-weighted method of fiscal transfers allows for common fiscal policy and economic convergence which would bring the Eurozone into the OCA framework (Marelli and Signorelli, 2017). A merged financial sector delinks the sovereign from domestic banks and shares risk across national lines. This again forces economic convergence as there is less of a divide between national interests and European interests, and between creditors and debtors. The strengthening of the ECB's role to enforce banking regulation and correct oversight is also important but the current framework is not sufficient. It must decide whether bailouts are an option or not due to the financial risk pricing of such an eventuality is itself a key component of systemic risk. If they are, it must devise a clear and viable method for insolvency, including Euro exit as an option. Finally, it must build upon the instruments and institutions that were born in the crisis in order act efficiently next time.

All of these would be an economist's dream but they forget that the EU is not a textbook model but a real thriving population of 500 million with diverging views and outlooks. Reform based on solely on policies or institutions such as that of the Centre for European Reform miss ignoring reality. (Grant, 2013) I argue that the EU lacks a real and credible 'Why?' Economists forget that policies and reform do not engender action. It is difficult to endear voters to institutional reform where the needs are not overt and more difficult still were it to involve complicated risk weighting and financial interconnection. This may be possible but not as the sole propellant. The biggest barrier to Eurozone reform is that of conveying to voters why reform or integration is needed and overcoming divergent fears. The Eurozone lacks a reasoning that goes beyond economic theory or vague allusions to 'Europe'. It does not have the same clear goals that other integrative process had such as the CEEC's aim of distributing Marshall Aid, or the ECSC's goal of tying heavy industry for security or the wider allure of nationalism even where economic improvement is not assured. The EU exists in a vacuum somewhere between economic integration and political integration, it needs to decide where its goal is and allow citizens to decide also beyond the limit effectiveness of the European Parliament. This may envisage fragmentation and a two speed Europe (Maurice, 2017) and the further promulgation of Brexit era crises. A decision needs to be made, not just by European technocrats (Gillingham and

Tupy, 2016) but by European people (Evans, 2017) for without 'Why,' the 'What' of reform and policies lack the weight that they truly require.

In summary, this paper has laid out the problems that allowed the Eurozone crisis to happen before summarizing the responses and further issues that need resolution. It then provided three options with their benefits and barriers a neo-functionalist restructuring sector by sector, an outright political and fiscal Union and a compromise candidate of private risk sharing through interdependent financial institutions together with a risk weighted fiscal co-ordination of transfers. All of these seek to solve the issues that the Eurozone crisis has imparted before a final comment on the wider, immeasurable significance of externalities outside of economic thought.

Reference List:

1. Baldwin, R. and Giavazzi, F. 2015. The Eurozone Crisis: A Consensus View of the Causes and a Few Possible Solutions. 1st ed. London: Centre for Economic Policy Research.
2. Beck, T. and Peydro, J. 2015. Five years of crisis (resolution) some lessons. [online] Voxeu.org. http://voxeu.org/article/five-years-crisis-resolution-some-lessons [Accessed 31 Mar. 2017].
3. Bénassy-Quéré, A. 2015. Maastricht flaws and remedies. [online] Voxeu.org. http://voxeu.org/article/maastricht-flaws-and-remedies [Accessed 31 Mar. 2017].
4. Carletti, E., Hartmann, P. and Spagnolo, G. 2003. Working Paper No.292 Banker Mergers, Competition and Liquidity. Frankfurt: European Central Bank. 17-21.
5. Claeys, G. a--nd Darvas, Z. 2016. How to reform EU fiscal rules. [online] Bruegel.org. http://bruegel.org/2016/04/how-to-reform-eu-fiscal-rules/ [Accessed 31 Mar. 2017].
6. Corsetti, G. 2015. Roots of the EZ crisis. [online] Voxeu.org. http://voxeu.org/article/roots-ez-crisis [Accessed 31 Mar. 2017].
7. De Larosiére, J., Balcerowitz,L., Issing, O., Masera, R., Mc Carthy, C., Nyberg, L., Pérez, J., Ruding, O., The High Level Group on Financial Supervision in the EU- de Larosiere Report, Brussels, 2009.
8. Draghi, M. 2012. Speech by Mario Draghi, President of the European Central Bank at the Global Investment Conference in London 26 July 2012.
9. Evans, M. 2017. Why it's time to reform the EU, with or without Britain. [online] CBC News. http://www.cbc.ca/news/world/brexit-regrets-eu-reform-margaret-evans-1.3653531 [Accessed 31 Mar. 2017].

10. Feld, L., Schmidt, C., Schnabel, I. and Wieland, V. 2015. Divergence of liability and control as the source of over-indebtedness and moral hazard in the European monetary union. [online] Voxeu.org. http://voxeu.org/article/divergence-liability-and-control-source-over-indebtedness-and-moral-hazard-european-monetary-union [Accessed 31 Mar. 2017].
11. Gilbert, M. 2016. Europe's Broken Banks Need the Urge to Merge. [online] Bloomberg View. https://www.bloomberg.com/view/articles/2016-09-02/europe-s-broken-banks-need-to-feel-the-urge-to-merge-islnb4fe [Accessed 31 Mar. 2017].
12. Gillingham, J. and Tupy, M. 2016. Brexit Can Reform Europe and Perhaps Even Save the EU. [online] Cato Institute. https://www.cato.org/publications/commentary/brexit-can-reform-europe-perhaps-even-save-eu [Accessed 31 Mar. 2017].
13. Grant, C. 2013. How to build a modern European Union. 1st ed. [ebook] London: Centre for European Reform. https://www.cer.org.uk/publications/archive/report/2013/how-build-modern-european-union [Accessed 31 Mar. 2017].
14. Manasse, P. 2010. Stability and Growth Pact: Counterproductive proposals. [online] Voxeu.org. http://voxeu.org/article/stability-and-growth-pact-counterproductive-proposals [Accessed 31 Mar. 2017].
15. Marelli, E. and Signorelli, M. 2017. Europe and the euro: Integration, Crisis and Policies. 1st ed. London: Palgrave Macmillan. 15-43.
16. Maurice, E. 2017. Germany and France endorse multi-speed Europe. [online] Euobserver.com. https://euobserver.com/institutional/137080 [Accessed 31 Mar. 2017].
17. Micossi, S. 2015. The future of the Eurozone. [online] Voxeu.org. http://voxeu.org/article/future-eurozone-0 [Accessed 31 Mar. 2017].
18. Mitrany, D. 1948. The Functional Approach to World Organization. International Affairs, 24:3:350-363.
19. Neumann, M. 2016. Bank-Merger Drought Puts Europe in a Bind. [online] Wall Street Journal. https://www.wsj.com/articles/bank-merger-drought-puts-eu-in-a-bind-1482404547 [Accessed 31 Mar. 2017].
20. Obstfeld, M. 2013. Economic Papers 493 Finance at Center Stage: Some Lessons of the Euro Crisis. 1st ed. [ebook] Brussels: European Commission. http://ec.europa.eu/economy_finance/publications/economic_paper/2013/pdf/ecp493_en.pdf [Accessed 31 Mar. 2017].
21. Papaioannou, E. 2015. Nominal rather than institutional convergence in the EZ. [online] Voxeu.org. http://voxeu.org/article/nominal-rather-institu-

tional-convergence-ez [Accessed 31 Mar. 2017].
22. Pesenti, P. 2015. Structural reforms and monetary policy revisited. [online] Voxeu.org. http://voxeu.org/article/structural-reforms-and-monetary-policy-revisited [Accessed 31 Mar. 2017].
23. Tabellini, G. 2015. The main lessons to be drawn from the European financial crisis. [online] Voxeu.org. http://voxeu.org/article/main-lessons-be-drawn-european-financial-crisis [Accessed 31 Mar. 2017].
24. Wyplosz, C. 2015. The Eurozone crisis: Too few lessons learned. [online] Voxeu.org. http://voxeu.org/article/eurozone-crisis-too-few-lessons-learned [Accessed 31 Mar. 2017].

Applied Economics

Low Turnout: Reducing Demand for Income Redistribution and the Development of the Welfare State?

Doireann O'Brien

In this paper, Doireann examines the relationship between low voter turnout in elections and its impact on the demand for income redistribution policies, as well as the development of the welfare state. She outlines the existing literature, which draws on theories of political economy to explain this negative relationship between low turnout and income redistribution policies. She then critiques the main used, that of Meltzer-Richard, showing how the sample used means the findings can only be applied to developed countries, and finds assumptions regarding bureaucratic efficiency and governance quality are needed to apply their model to the developing world.

In this paper, I analyse the validity of the hypothesis that low voter turnout reduces the demand for income redistribution and the development of the welfare state as put forward by Meltzer and Richard (1981). I briefly trace the academic roots of this claim by seeing the Meltzer and Richard model as the culmination of a history of academic development from Hotelling (1929), through Black (1948) and Downs (1957) (and later adapted by scholars such as Lijphart (1997)). I analyse the validity of the Meltzer-Richard model against well-respected empirical evidence and find that, while econometric analyses offer support for the model, once overall government size is replaced with pure redistribution as the dependent variable, sampling issues render external validity questionable since developing countries are excluded from the literature. I develop two ar-

guments, related to bureaucratic quality and governance strength, as to why the Meltzer-Richard hypothesis and the title proposition may be invalidated when applied to developing regions. I conclude that additional assumptions capturing the fact that the model s success is contingent on the level of development of the context would heighten its predictive power and promote understanding of these mechanisms more clearly in developing regions, where welfare state development could arguably be in most urgent need.

The Meltzer-Richard model was not generated in a vacuum and understanding its debt to Black and Downs, and their academic antecedents, is useful. Hotelling initiated spatial economic theorisation and rejected the representation of the market as a "…point, without length, breadth or thickness" (Hotelling, 1929, p.44). The characterisation of markets as populated by a single, homogenous good and the treatment of markets as lacking in a spatial dimension prohibits insight into economic phenomenon that ought to be understood. Firstly, in terms of physical space, he demonstrates that sellers will strategically converge geographically to capture the demand of the maximum number of consumers by, if we conceptualise the phenomenon as one-dimensional, capturing the entire consumer-base to one side of the already stationed seller (Hotelling, 1929). Similarly, in terms of product characteristics, he explains that new entrants to a market make marginal adjustments to existing products to capture the proportion of the established sellers demand whose preferences will be marginally better matched by the slightly differentiated product. Briefly noting that a similar interpretation of political competition among parties could help understand tendencies for party platforms to converge, he paved the way for Duncan Black to develop the median voter theorem. This theorem states that with a decision taken on any topic by means of voting (Black, 1948, p.34) the median voter is decisive in determining the outcome due to their crucial position on the spectrum of preferences.

It is demonstrated mathematically that if preferences were ordered, the median voter's preference will consistently be a Condorcet winner among the group, and thus this determines the outcome (Black, 1948; Mueller, 2003.). Importantly this model only holds under strict assumptions of voters having single-peaked preferences over the ordering of policy alternatives in a single dimension, with majority rule in operation (Mueller, 2003). Downs applies this theory to the political domain, with his spatial theory of democracy being a crucial turning point within political economy s conceptualisation of electoral politics. Downs states that under the conditions of a unidimensional policy space, perfect information, majoritarian voting, rational utility maximising voters with single-peaked preferences, two-party competition between purely office-seeking candidates, the me-

dian voter theorem can be used to explain why party platforms tend to converge towards the median voter preference (Downs, 1957).

Informed by Black, Downs and the contributions of De Toqueville (1835), Romer (1975), and Roberts (1977), Meltzer and Richard developed their model to apply the median voter theorem of party competition to the issue of redistribution. By setting the single issue on which voters base their party preferences to the level of redistribution, Meltzer and Richard illustrate the impact of income inequality on the size of government with the important theoretical step of balancing the budget. By dismissing the assumption that voters suffer from a fiscal illusion which would lead to myopic demand for total redistribution from lower income voters, the predictive ability of the model was heightened significantly (Meltzer and Richard, 1981). Their central thesis is as follows: […the size of government is determined by the welfare maximising choice of the decisive individual…With majority rule the voter with median income among the enfranchised citizens is decisive The decisive voter chooses the tax share.] (Meltzer and Richard, 1981, p.924). They recognise that the expansion of the franchise to lower income citizens in the nineteenth and twentieth centuries in industrialized states caused the decisive voter to be in favour of higher levels of redistribution which would maximise their utility as welfare recipients.

Applying this theory to increased turnout among the already franchised, Lijphart, informed by a rigorous review of the empirical data on the income distribution of voters and non-voters, argues that since low voter turnout means unequal and socioeconomically biased turnout (Lijphart, 1997, p.2) increased political participation by voting should induce increased redistributive spending and welfare state development, aligning with the Richard-Meltzer model s predictions (Lijphart, 1997). By increasing voter turnout, the median voter moves down along the income distribution and the decisive preference becomes in favour of increased redistribution, to which office-seeking and pre-committing politicians respond, giving rise to the title hypothesis.

The credibility of the Meltzer-Richard model and the proposition up for discussion hinges on how their predictions align with empirical findings. Lindert (1996) provided early indirect support for the model by finding unconvincing evidence for the hypothesis that the deadweight losses (such as the accelerating costs of bureaucracies as proposed by Niskanen (1971)) is a key explanatory variable determining the level of social welfare expenditure. Instead, the key determinants of the level of redistribution within OECD countries were the relative sizes of age groups, electoral conditions, the income level, and most relevant here, the income distribution, providing an indication that the Meltzer-Richard

model was promising. Husted and Kenny (1997) acknowledge a general lack of empirical support for the model at that time (Pelzman, 1980; Inman, 1978; Murell, 1985) and address this by highlighting the importance of differentiating between policies of general public expenditure on government services and pure redistributive social policy. Those below the median income level are unambiguously predicted by the Richard-Meltzer hypothesis to demand increased pure redistribution. However, when it comes to government services, the expected preferences of those lower income voters are ambiguous, according to Husted and Kenny, due to conflicting income and price elasticities of demand for state services (Husted & Kenny, 1997).

By correcting for this and setting the model s dependent variable to a measure of redistribution, the results of an econometric analysis of the lifting of poll taxes and literacy tests in the US show strong support for the prediction that welfare spending rises as political power shifts from a state s richer citizens to its poorer citizens (Husted and Kenny, 1997, p.79), providing strong support for the title s proposition. Abrams and Settle use a quasi-experimental approach to analyse the effects of the enfranchisement of women in Switzerland in 1971 and validate the findings of Husted and Kenny (1997). Discovering that enfranchising women led to a surge of 28% in public social spending, they claim that the underlying mechanism was largely the median voter s income shifting down the distribution as women had, on average, lower incomes due to gender-specific obstacles within the labour market and the appropriation of their share of household wealth by their male counterparts (Abrams & Settle, 1999). Similarly, noting the importance of differentiating between total expenditure and redistributive expenditure, Borge and Rattso (2004) exploit variability across local government districts in Norway to test the impact of income inequality among voters on the relative levels of the poll tax (a non-redistributive compulsory tax on domestic services such as waste removal) and the property tax (a redistributive tax) set by local representatives. They find that increased income inequality, as predicted, shifts tax weighting away from non-redistributive taxes to more redistributive ones, joining the growing body of literature validating the Meltzer-Richard model convincingly.

This review of the empirical evidence is supportive of the theory that low turnout reduces the demand for income redistribution and the development of the welfare state, to the point that it seems almost conclusively proved. However, upon deeper analysis, I identify a key issue that causes doubt in relation to the validity of this hypothesis. The fact that each of these papers tested the predictions of the model against data from exclusively developed countries (OECD mem-

bers, the US, Switzerland and Norway respectively) means questions of external validity become pressing. Among the available empirical evidence, Larcinese s (2007) cross-country analysis is particularly insightful as he uniquely includes a substantial number of developing democratic countries in his sample. While the key objective of the paper is to explain why poorer countries do not have higher social spending levels by reiterating the importance of the distinction between income distribution of the population as a whole and that of the subset who vote, given the widely accepted evidence that turnout and income are strongly positively correlated, the significance of his results stretch far beyond what he claims. Importantly, Larcinese explains that the strength of his work does not lie so much in an innovative theory or specification, but in the comprehensiveness of his sample which covers longitudinal data for 41 countries, both developing and industrialised, for the period 1972-98 (Larcinese, 2007). He finds that while political participation is an important determinant of social spending levels across countries, country-specific features play a significant role in partially determining the size of the government and are decisive when the explanatory variable is income inequality of the population in its entirety rather than voters (Larcinese, 2007). The fact that the results are less conclusive than the studies mentioned above based solely on developed economies, it is worth exploring how the inclusion of less developed countries could be affecting the results.

In light of the absence of empirical tests focusing solely on the applicability of the Meltzer-Richard model to developing regions, paired with the literature highlighting the exceptionalism of welfare state development in developing democratic countries (Gough & Wood, 2004; Segura-Ubiergo, 2007), questions are raised that I will attempt to answer here - should we expect the Meltzer-Richard model to retain its predictive power when applied to developing regions, and if not, why not? I put forward two arguments as to why the Meltzer-Richard model is theoretically less credible for developing regions. The first relates to bureaucratic inefficiency and the second to poor governance, both of which are variables unaccounted for by Meltzer and Richard.

My first argument states that the assumptions of the Meltzer-Richard model allow for variability of bureaucratic efficiency, yet this can be shown to undermine its predictions when applied to developing contexts. The assumption that voters are sufficiently informed means they are aware of the labour substitution effects determining the tax base, and refrain from unsustainably demanding a 100% tax rate (Meltzer & Richard, 1981). A question left unaddressed by the model is whether voters are informed on the efficiency of their state's bureaucracy and the indirect welfare effects of market distortions through high taxes on

the upper half of the income distribution and how these are offset by the subset of tax revenue that will reach them as transfers or services. Inefficiency causes the quantity of tax revenue that reaches those lower-income groups in the form of welfare transfers to be much lower than the amount of tax collected.

A UN study on the income inequality and fiscal policies of developing countries provides evidence for this, finding that most developing countries do not have adequate redistributive programs to achieve a greater post-tax, post-transfer income equality comparative to those of industrial countries (Chu et al., 2000, p.31). For the sake of conceptualising my argument, it is helpful to imagine bureaucratic waste is 100%, meaning no tax revenue is effectively redistributed - government distortions to the market by way of high levels of tax extraction from those above the median income level, without that being offset by effective redistributive bureaucratic activity, causes lower-income voters to be made indirectly less well off. For example, prices are likely to be pushed up due to the enlargement of the tax wedge on the producer side and unemployment of low-skilled workers is likely to rise also (Varian, 2014).

Important to note is that bureaucratic waste levels lie largely outside the control of the electorate and representatives, since bureaucrats transcend electoral politics and so this factor arguably also lies outside of the domain of the assumptions of the Meltzer-Richard model. Candidates can follow through on their election platform exactly as they promised by implementing the redistributive policy; it is simply that the implementation can fail due to inefficiency. Thus, one of two additional assumptions would improve the rigour of the model - either the assumption of a perfectly efficient bureaucracy or the assumption that voters have perfect knowledge of the level of bureaucratic waste if non-zero.

The latter assumption intuitively seems too unrealistic to be useful given that inefficiency is, by definition, covert. Despite this, it could conceivably reverse the predictions of the Meltzer-Richard model, thus invalidating it, when applied to countries with sufficiently ineffective bureaucracies. The implication that low-income voters in countries with inefficient bureaucracies could demand less welfare spending might seem implausible, however its possibility is empirically supported. Segura-Ubiergo finds empirical evidence on Latin American democracies to suggest that a low-income voter may vote against social spending if the benefits to them are unclear: [If median income decreases but the median voters perceive that social spending does not benefit them sufficiently (in terms of the cost borne in the form of higher taxes), then support for social spending will decline.] (Segura-Ubiergo, 2007, p.108). Segura-Ubiergo uses this to invalidate the Meltzer-Richard model in terms of social spending failing to be effectively re-

distributive across all income levels, however it also provides empirical grounding to my claim that similar patterns could be observed in reaction to bureaucratic inefficiency.

For this reason, I propose that the addition of the assumption of insignificant bureaucratic waste would correct for this, however, this roughly restricts the domain of the model to developed democracies, since bureaucratic waste and degree of economic development are widely evidenced to be negatively correlated (for instance Kaufmann, 2003). Relating this back to the statement at hand - lower voter turnout, I argue, does not lower demand for redistributive policy universally. This relationship is contingent on the condition holding that an efficient bureaucracy can roll-out policy with minimal waste, and hence renders the hypothesised relationship between turnout and redistribution at best tenuous in developing regions.

My second argument extends my justification that the title hypothesis loses credibility in developing countries, now looking at the role of governance which is again unaddressed by the Meltzer-Richard model s assumptions. In the existing literature on the link between turnout and redistribution, it is taken for granted that the existence of a political will among representatives to roll out redistributive policy in accordance with the preference of the median voter is sufficient for and analogous to the realisation of those outcomes. A variety of factors can prevent the successful roll out of policies preferred by the median voter, even when satisfying all the assumptions of the Richard-Meltzer model such as pre-commitment to platforms and candidates being purely office-seeking. Illegal markets, and tax avoidance and evasion can have grave impacts on the dynamics predicted by the Meltzer-Richard model. An office-seeking political representative, according to the Meltzer-Richard model, will choose redistributive policy according to the demands of the median voter, but even when that policy is passed and legislated for as committed to by the representative, it may be the case that the forecasted rates of redistribution as demanded by the median voter will not be generated ex-post, thus invalidating the model even when satisfying each assumption.

This is particularly problematic in less developed countries where there is weaker enforcement of tax policy (Chu et al, 2000), lower rates of formalised/ taxable enterprise (Schneider & Enste, 2002), and more prevalent tax avoidance and evasion (Bird et al., 2008). Prevalent non-compliance with tax policy can be explained by a variety of factors but can be countered generally with effective enforcement accruing from strong governance, in which developing countries are characteristically lacking. Extensive evidence unsurprisingly supports this criticism - for example in the Italian and Canadian economies it was found by

Fugazza and Jean-François that increasing detection rates significantly decreases illegal economic activity (Fugazza & Jean-François, 2004) and Richardson, based on data from 47 countries finds that the lower levels of legal enforcement cause higher levels of tax evasion, after controlling for economic development (Richardson, 2008).

Therefore, I propose that an additional assumption is added to the Meltzer-Richard model of perfect tax compliance thus making the model especially non-applicable to developing countries where this is not achieved due to poor governance. The alternative is to interpret the implications of the model in a way that is stricter and less informative - that the shifting of the median voter down along the income distribution as a result of increased turnout can only go as far as to generate a political will or policy design for increased redistribution. In developed countries it is relatively unproblematic to make the leap from the emergence of a political will/policy design to predicted policy outcomes given relatively stronger governance, which ensures lower levels of illegal or informal economic activity, tax avoidance and evasion (Schneider & Enste, 2002). In developing regions however, it is crucial to peer inside that black box containing the sequence of events between policy support and implementation by representatives and the actual policy outcomes that are achieved.

There seems to be a general problem in the current literature of conflating ex-ante redistributive policy design and corresponding ex-post redistributive policy outcomes - while voters demand and can vote on variations of the former, it is less clear that those votes are guaranteed to relate to expected values of the latter, especially in developing regions. Thus, this critique joins my earlier argument in dismissing the title hypothesis as a universal law and roughly restricts its validity to industrialised states.

I conclude that predictions about the response of welfare state development to the income distribution and political participation levels, modelled by Meltzer and Richard, is not universally true nor universally false. Its accuracy is contingent on the level of development of the context to which it is applied. Alternatively, if the hypothesis, corrected for turnout, is intended to be evaluated across contexts as a sort of universal law, I argue that the semantics of the Meltzer-Richard model are critical - under its assumptions, can only go as far as to predict demand for redistribution and the attempt by politicians to implement policy in accordance with this demand. I maintain that, due to a lack of accounting for bureaucratic quality and public compliance as a function of governance in the Meltzer-Richard model, the prediction of the real level of redistribution generated is beyond its scope. I acknowledge that my critiques are in no way comprehensive, but simply

exploit a single issue in the literature - that of sampling - of which there are surely many, even related to its validity in developed regions. The arguments I have developed urgently call for empirical testing as the econometric analysis of the causal relationship between turnout and redistribution outside of industrialised states is essential if we are to vividly understand the complex mechanisms at play in developing regions, which all too often go overlooked.

Reference List:

1. Bird, R.M., Martinez-Vazquez, J. and Torgler, B., 2008. Tax effort in developing countries and high income countries: The impact of corruption, voice and accountability. Economic analysis and policy, 38 (1), pp.55-71.
2. Borge, L.E. and Rattsø, J., 2004. Income distribution and tax structure: Empirical test of the Meltzer–Richard hypothesis. European Economic Review, 48(4), pp.805-826.
3. Chu, M.K.Y., Davoodi, M.H.R. and Gupta, M.S., 2000. Income distribution and tax and government social spending policies in developing countries (No. 0-62). International Monetary Fund.
4. De Tocqueville, A., 2003. Democracy in America (Vol. 10). Regnery Publishing.
5. Downs, A., 1957. An Economic Theory of Democracy, pp.599-608.
6. Fugazza, Marco, and Jean-François Jacques. "Labor market institutions, taxation and the underground economy." Journal of Public Economics 88, no. 1 (2004): 395-418.
7. Gough, I. and Wood, G., 2004. Insecurity and welfare regimes in Asia, Africa and Latin America: Social policy in development contexts. Cambridge University Press.
8. Hotelling, H., 1929. Stability in competition. The economic journal, 39(153), pp.41-57.
9. Husted, T.A. and Kenny, L.W., 1997. The Effect of the Expansion of the Voting Franchise on the Size of Government. Journal of Political Economy, 105(1), pp.54-82.
10. Inman, R.P., 1978. Testing political economy's 'as if' proposition: is the median income voter really decisive?. Public Choice, 33(4), pp.45-65.
11. Kaufmann, D., 2003. Rethinking governance: empirical lessons challenge orthodoxy. The World Bank.
12. Larcinese, V., 2007. Voting over redistribution and the size of the welfare state: the role of turnout. Political Studies, 55(3), pp.568-585.
13. Lijphart, A., 1997. Unequal participation: Democracy's unresolved dilemma presidential address, American Political Science Association, 1996. American

political science review, 91(1), pp.1-14.
14. Lindert, P.H., 1996. What limits social spending?. Explorations in Economic History, 33(1), pp.1-34.
15. Meltzer, A.H. and Richard, S.F., 1981. A rational theory of the size of government. Journal of political Economy, 89(5), pp.914-927.
16. Murrell, P., 1985. The size of public employment: an empirical study. Journal of Comparative Economics, 9 (4), pp.424-437.
17. Niskanen, W.A., 1971. Bureaucracy and representative government. Transaction Publishers.
18. Peltzman, S., 1980. The growth of government. The Journal of Law and Economics, 23(2), pp.209-287.
19. Richardson, G., 2008. The relationship between culture and tax evasion across countries: Additional evidence and extensions. Journal of International Accounting, Auditing and Taxation, 17(2), pp.67-78
20. Roberts, K.W., 1977. Voting over income tax schedules. Journal of public Economics, 8(3), pp.329-340.
21. Romer, T., 1975. Individual welfare, majority voting, and the properties of a linear income tax. Journal of Public Economics, 4(2), pp.163-185.
22. Schneider, F. and Enste, D.H., 2002. The Shadow Economy: Theoretical Approaches, Empirical Studies, and Policy Implications. Cambridge University Press.
23. Segura-Ubiergo, A., 2007. The political economy of the welfare state in Latin America: globalization, democracy, and development. Cambridge University Press.
24. Varian, H.R., 2014. Intermediate Microeconomics: A Modern Approach: Ninth International Student Edition. WW Norton & Company.

Winning the Middle Ground: The Strategic Behaviour of Campaigners and Politicians on the Eighth Amendment Referendum

Mide Ni Ghriofa, Senior Sophister

The Issue of abortion and the upcoming referendum to determine the future of the Eighth Amendment to the constitution are perhaps the most current and pressing issue in Irish politics today. In this essay Mide Griffin examines the strategic interactions between pro-choice campaigners and politicians, whose preference is not known. Mide uses game theory to provide an in depth and comprehensive analysis of the optimal strategy politicians and campaigners should take in this strategic situation, and also highlights the important role of signalling and imperfect information in the interaction.

Introduction

Abortion is a contentious issue in Irish politics. A campaign is being led to repeal the Eighth Amendment of the constitution and liberalise abortion law. A Citizens' Assembly was conducted to discuss the issue and an Oireachtas Committee backed the majority of their recommendations (Irish Times, 2017a). While the government has agreed to hold a referendum in 2018, there is no consensus on the wording of this referendum, nor what would legislation would replace it. Both are deemed critical to the referendum outcome.

From a Repeal Campaign perspective, losing the referendum would be disastrous with the issue off the cards for another generation. While there is evidence that the majority are in favour of liberalisation, there is not the same support for fully unrestricted abortion (Irish Times, 2017b). Repeal advocates must carefully consider their campaign strategy to minimise the likelihood of losing while maximising their campaign objectives.

Game Setup

This essay considers the strategic interactions of campaigners and politicians during a Repeal lobbying campaign. The Dáil is under no obligation to follow the Oireachtas Committee's recommendations but will decide the wording of the referendum and will create draft legislation that would be implemented. Therefore, a crucial stage for a Repeal campaign is convincing TDs to vote for favourable wording and legislation. As parties are allowing open vote, alongside door-to-door campaigning, the Repeal Campaign needs to lobby TDs.

Politicians are assumed to be both policy-seeking and office-seeking. They a personal preference on abortion law but are also dependent on constituents for votes, and alter their policy stance to maximise their popularity. Some politicians may act purely on their principles taking a vocal stance for or against. Campaigners (and voters) are aware of these vocal candidates, but, in the early stages, do not know the preferences of many TDs. It is crucial for campaigners to target middle-ground TDs, who have not taken a strong stance, to swing the referendum in their favour. The Median Voter Theorem tells us that, under certain assumptions, the outcome preferred by the median voter will be decisive, so it is essential to target the middle-ground (Shepsle, 1997). Therefore, this essay deals with a signalling game between a Repeal campaigner and a middle-ground politician in a lobbying situation.

There are three stages to a signalling game. First, Nature chooses the sender's type. Second, the sender learns her type and chooses and action. Third, the Receiver observes the action, modifies her beliefs and chooses an action. Two types of middle-ground politician are assumed; one leans left of centre and the other right of centre. These are not extremes, but for convenience I will label the types of Player 1 (Politician) Conservative and Liberal. A campaigner (Player 2) approaches a politician to discuss the issue and the Politician can say she is decided on the matter and unwilling to discuss, or undecided and open to discussion. If the politician says she is unwilling to discuss the matter she is assumed to reveal her stance (for Repeal if liberal, against repeal if conservative) and the game ends. If the politician is undecided and open to debate the campaigner can take either a hardline stance or a moderate tone. The Politician can then choose to engage in

or withdraw from fruitful discussion, and the game ends.

The choice between decided and undecided is costly, as the politician may lose votes by revealing their stance. The cost is different for the different types of politician. A conservative politician has more to lose from saying she is decided, as this reveals a stance unwilling to relax laws even slightly, assumed to alienate more voters than the liberal candidate revealing a pro-repeal stance, as the majority of voters are in favour of some liberalisation (Irish Times, 2017c). Undecided is therefore the dominant strategy for the Conservative politician.

Payoffs

The conservative politician always prefers to choose undecided over decided. The best outcome is engaging in a moderate stance. If a hardline stance is put forward, it is better to withdraw, than to engage, but it is worse to not engage in a moderate stance because it makes her look more anti-repeal. The worst outcome is not engaging at all.

U(Undecide, Moderate, Engage)>U(Undecide, Hardline, Withdraw)>U(Undecided, Hardline, Engage)> U(Undecided, Moderate, Withdraw)>U(Decided)

If the politician is of the liberal type, (bearing in mind that these are middle-ground candidates, just left of centre), the best outcome is to engage with a moderate stance, and avoid hardline aspects. She prefers say undecided if the campaigner takes a moderate stance, however if the campaigner takes a hard-line stance, she would rather say he is decided in favour, to avoid debating the hardline aspects she would rather not address. Following this, it is best simply say decided (thus seeming pro-repeal without getting into the gritty details). After this, for the liberal politician it is better to engage in the hardline stance than withdraw from discussion as this seems anti-repeal and would alienate liberal voters.

U(Undecide, Moderate, Engage)>U(Decided)>U(Undecided, Hardline, Engage)>U(Undecide, Hardline, Withdraw)>U(Undecided, Moderate, Withdraw)

The campaigner prefers to play a hard-line stance if the politician is liberal, in order to get the message across strongly, but would rather take a moderate tone if the politician is conservative in order to win the middle-ground instead of alienating them. She would rather the politician engages than withdraws. However, if she takes the wrong approach with a politician, it would be better had the discussed not progressed and the politician had chosen decided.

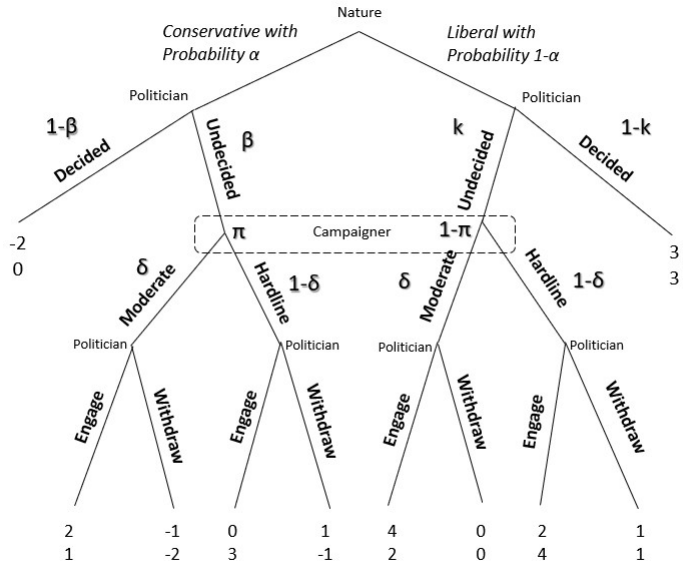
If politician is liberal:

U(Undecided, Hardline, Engage)>U(Decided)>U(Undecided, Moderate, Engage)>U(Undecided, Hardline, Withdraw)>U(Undecided, Moderate, Withdraw)

If politician is conservative:

U(Undecided, Hardline, Engage)>U(Undecided, Moderate, Engage)>U(Decided)>U(Undecided, Hardline, Withdraw)>U(Undecided, Moderate, Withdraw)

This is represented in the model below:



Scenario 1: $\alpha = {}^{3}/_{5}$, $1 - \alpha = {}^{2}/_{5}$

First consider a game with the property that a politician is conservative with probability 0.6 and liberal with probability 0.4. Using backward induction, we can move the payoffs from the lower nodes up (see appendix). We then work from the information set.

The solution concept is Perfect Bayesian Equilibrium. Sequential rationality and consistent beliefs are needed for this. The Campaigner prefers a hardline stance when the expected utility to this is greater than moderate, given their beliefs of where she is in the game. This occurs when $\pi < {}^{1}/_{2}$, i.e. when the probability of a campaigner being conservative given Undecided was observed is less than ${}^{1}/_{2}$. However, this yields an impossible value of k (probability of liberal politician choosing Undecided), meaning the only possibility is when $\pi > {}^{1}/_{2}$ and k equalling one, such that $\pi = {}^{3}/_{5}$. (See Appendix). This is a unique pooling equilibrium whereby the posterior probabilities equal the prior probabilities. No information is revealed by the signal of observing Undecided, as the liberal type of politician always chooses Undecided.

Perfect Bayesian Equilibrium:

The liberal politician plays Undecided at the first node after the initial node

where nature plays. Then if Moderate is played, choose Engage. If Hardline is played, choose Engage.

- The conservative politician plays Undecided, and then if Moderate is played, choose Engage and if Hardline is played, choose Withdraw.
- The Campaigner's Best response is to play Moderate.
- The Campaigner's beliefs are that Prob(conservative | Undecided) = $^3/_5$
- Due to imperfect information and no signal being given the campaigner can do no better than to play Moderate.

Scenario 2: $\alpha = {}^2/_5$, $1-\alpha = {}^3/_5$

Let us consider new underlying probabilities of the type of politician. This could be because the politician is from an urban, young constituency, or because voters' preferences become more liberal, thus making politicians more likely to be liberal. This yields a unique semi-separating equilibrium whereby the liberal type of politician mixes between choosing Decided and Undecided if the campaigner mixes between the hardline and moderate stance (see Appendix). If the campaigner mixes between M and H with probability ½, the liberal politician chooses UD with probability $^2/_3$ and D with probability $^2/_3$.

Perfect Bayesian Equilibrium:

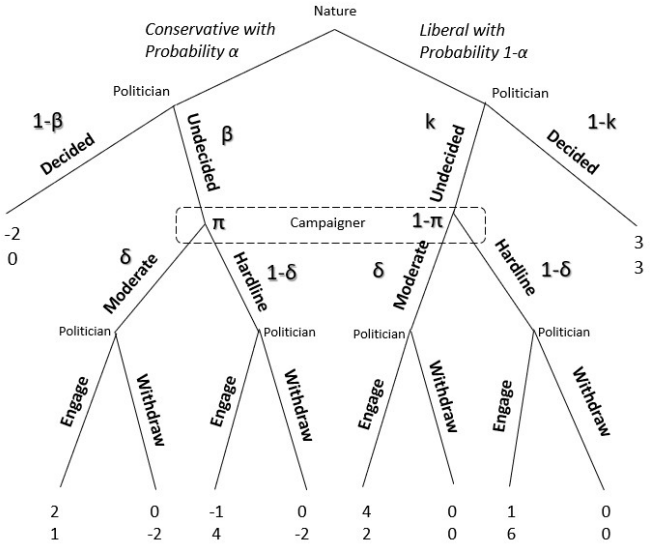
- The Conservative Politician plays Undecided. Then, when Moderate is played, she plays Engage. When Hardline is played, she plays Withdraw.
- The Liberal Politician plays Undecided with probability $^2/_3$, and Decided with probability $^1/_3$. When Moderate is played, she plays Engage. When Hardline is played, she plays Engage.
- The Campaigner plays Moderate with probability ½, and Hardline with probability $^1/_2$)
- The Campaigner's beliefs are that Prob(Conservative | Undecided) = 1/2.

Now the Campaigner's best response is to mix between the moderate and the hardline stance with equal probability. So even with an increased likelihood of a politician being of the liberal type, imperfect information means she can do no better than mix at probability ½.

Scenario 3: $\alpha = {}^1/_2$, $1-\alpha = {}^1/_2$, Altered Payoffs.

Let us imagine the lobbying situation is assumed to be tight. The politicians whose stances remain unknown are deemed likely to swing either way and so the probability of the politician being Liberal/Conservative is 50:50. Further, the stakes are now higher, such that the payoffs from a hardline stance change for both players (they remain in the same order). For the campaigner, it becomes more important to take a hardline stance with a liberal politician and more detrimental to take a hardline stance with a conservative politician i.e. the outcomes from

either politician engaging increase but the outcomes for withdrawing become worse. For the Politician, with a more heated debate and a more vigorous hardline stance, the payoffs to both types of politician from engaging in and withdrawing from the hardline stance become worse (again the order remains the same). The model with the adjusted payoffs is as follows.



Campaigner prefers Hardline if $\pi < {}^{4}/_{7}$. This is so when $k > {}^{3}/_{4}$. However, this is not a stable point (See appendix). The game yields a unique semi-separating equilibrium where the liberal politician chooses Undecided with probability ${}^{3}/_{4}$ and Decided with probability ${}^{1}/_{4}$ when the Campaigner mixes between the Moderate and Hardline stance, choosing Moderate with probability ${}^{2}/_{3}$ and Hardline with probability ${}^{1}/_{3}$.

Perfect Bayesian Equilibrium:

The Conservative Politician plays Undecided initially. Then, when Moderate is played, she plays Engage. When Hardline is played, she plays Withdraw.

The Liberal Politician plays Undecided with probability ${}^{3}/_{4}$, and Decided with probability ${}^{1}/_{4}$. When Moderate is played, she plays Engage. When Hardline is played, she plays Engage.

The Campaigner plays Moderate with probability ${}^{2}/_{3}$, and Hardline with

probability $^1/_3$.

The Campaigner's belief is that Prob(Conservative | Undecided) = $^4/_7$

The model predicts that the campaigner must choose moderate with probability 2/3 in order for the politician to be indifferent between Undecided and Decided. Despite the increase payoff to taking a hardline stance with a liberal politician, because it is worse to take a hardline with a conservative politician and because of the worse payoffs to the politician from engaging in the hardline stance, the campaigner must now play Moderate more often than before in equilibrium ($^2/_3$ as opposed to $^1/_2$).

Analysis and Extensions

Imperfect information leads to inefficiency in campaigning. If a campaigner had full information she would take a moderate stance with a conservative candidate and a hardline stance with a liberal candidate. The game with higher stakes reveals an equilibrium whereby the moderate stances must be played more often. From the politician's perspective, in the first scenario, a liberal politician does not need to reveal their stance i.e. can always play Undecided, taking advantage of the fact that the pooling equilibrium means the signal reveals nothing and the campaigner must play Moderate. In scenario 2 she must mix, choosing Undecided with probability $^2/_3$, and with probability $^3/_4$ in scenario 3.

I have looked at how the results change given different underlying probabilities and payoffs. In the first game, a cut off-point exists where the probability of conservative and liberal are the same. When $\alpha > 0.5$, i.e. the probability of a politician being conservative is high, there is a pooling equilibrium and the signal reveals nothing, whereas when $\alpha<0.5$ the equilibrium is semi-separating. Another thing which might change the game is if neither player had a dominant strategy, a possible extension of this model.

The model assumes politicians' stances are unknown. This is reasonable to assume this in the early stages at least but not in the later stages. Furthermore, for the politician to be possibly unwilling to reveal information and engage in debate, there must be a credible threat of punishment from voters. If these conversations happen behind closed doors, the incentives are wholly different and a reputation-based model of political accountability (see Besley and Case, 1995) would not hold. Another assumption is that politicians reveal must their stance after saying they are decided, which may not hold. A cheap talk game could be used to extend this analysis. Finally, the analysis assumes campaigners are willing to take a moderate stance. Given the principled nature of the issue, campaigners may not be willing to act strategically, and must hope that succeeds in winning the middle-ground to their cause.

Reference List:

1. Besley, T. and Case, A., 1995. Does electoral accountability affect economic policy choices? Evidence from gubernatorial term limits. The Quarterly Journal of Economics, 110(3), pp.769-798.
2. Irish Times 2017a: https://www.irishtimes.com/news/politics/how-the-eighth-amendment-committee-voted-1.3326580. [Accessed 22/12/2017].
3. Irish Times 2017b: https://www.irishtimes.com/news/politics/abortion-referendum-wording-should-ensure-it-passes-1.3237637 [Accessed 22/12/2017].
4. Irish Times 2017c: https://www.irishtimes.com/news/politics/large-majority-favours-changing-constitution-on-abortion-1.3320833 [Accessed 22/12/2017].
5. Irish Times 2017d: https://www.irishtimes.com/news/politics/oireachtas-committee-on-eighth-amendment-publishes-40-page-report-1.3333670 [Accessed 22/12/2017].
6. Osborne, M.J., 2004. An introduction to game theory (Vol. 3, No. 3). New York: Oxford university press.
7. Shepsle, K.A. and Bonchek, M.S., 1997. Analyzing Politics: Rationality. Behavior, and Institutions, New York, pp.166-196.

Appendix

Scenario 1: Prob(conservative $\pi=\frac{1(\frac{2}{5})}{1(\frac{2}{5})+k(\frac{3}{5})}$ ob(liberal)=0.4

We start with the parts of the ga n be easily solved using backward induction. At the lower nodes the $\pi=\frac{2}{2+3k}$ e Politician chooses Engage when moderate is played, withdraw when Hardline is played and. The liberal type chooses Engage when Moderate is $\frac{2}{2+3k}<\frac{1}{2}$ l Engage when Hardline is played. We can move these payoffs up. The on the information set.

The Campaigner prefers a hardline stance when the expected utility to this is greater than moderate, given his/her beliefs of where he/she is in the game.

$$EU_c(\text{Hardline}\,|\,\pi) > EU_c(\text{Moderate}\,|\,\pi)$$
$$EU_c(\text{Hardline}\,|\,\pi) = \pi(-1) + (1-\pi)(4) = 4-5\pi$$
$$EU_c(\text{Moderate}\,|\,\pi) = \pi(1) + (1-\pi)(2) = 2-\pi$$

Campaigner prefers Hardline if:

$$4-5\pi > 2-\pi$$
$$2 > 4\pi$$
$$\pi < {}^1/_2$$

- If $\pi < \frac{1}{2}$ Campaigner plays Hardline.
- If $\pi > \frac{1}{2}$ Campaigner plays Moderate.

• If $\pi = ½$ Campaigner is indifferent between playing Hardline and Moderate. However, the Campaigner's belief about which information set he/she is at must be consistent with the Politician's strategy and Bayes' Rule. Therefore, we consider the probability of the conservative type choosing Undecided. Let k represent this.

$$\pi = \text{Prob(Politician is Conservative} \mid \text{Undecided)}$$

$$= \frac{\text{Prob(Conservative).Prob(Conservative)}}{\text{Prob(Conservative).Prob(Conservative)+Prob(Liberal).Prob(Liberal)}}$$

$$\pi = \frac{1(\frac{3}{5})}{1(\frac{3}{5})+k(\frac{2}{5})}$$

$$\pi = \frac{3}{3+2k}$$

For what values of k will $\pi < ½$?

$$\frac{3}{3+2k} < ½$$

$$6 < 3 + 2k$$

$$3 < 2k$$

$$\frac{3}{2} < k$$

However, as k is a probability it must take a value between 0 and 1, therefore cannot be greater than $^3/_2$. There is no value of k for which $\pi < ½$. The only option is $\pi > {}^1/_2$.

If this is the case the campaigner plays Moderate. If this is so the liberal politician's best response is to play Undecided. This means $k = 1$. When this is so π equals:

$$\pi = \frac{3}{3+2(1)} = \frac{3}{5}$$

Thus, the probability of a politician being conservative given undecided was observed is the same as the probability of being conservative. No information is revealed by the signal as the liberal politician always chooses undecided. The posterior beliefs (after witnessing the signal) are equal to the prior beliefs (before witnessing the signal).

Perfect Bayesian Equilibrium:

Liberal Politician: (Undecided, Engage, Engage)
Conservative Politician: (Undecided, Engage, Withdraw)
Campaigner: (Moderate)
Beliefs: Prob(conservative | Undecided) = $^3/_5$

Scenario 2: Prob(conservative)= 0.4, Prob(liberal)=0.6

We start with the parts of the game that can be easily solved using backward induction. At the lower nodes the conservative Politician chooses Engage when moderate is played, withdraw when Hard-line is played and. The liberal type chooses Engage when Moderate is played and Engage when Hardline is played. We can move these payoffs up. Then we work on the information set.

The Campaigner prefers a hardline stance when the expected utility to this is greater than moderate, given his/her beliefs of where he/she is in the game.

$$EU_c(\text{Hardline} \mid \pi) > EU_c(\text{Moderate} \mid \pi)$$
$$EU_c(\text{Hardline} \mid \pi) = \pi(-1) + (1-\pi)(4) = 4-5\pi$$
$$EU_c(\text{Moderate} \mid \pi) = \pi(1) + (1-\pi)(2) = 2-\pi$$

Campaigner prefers Hardline if

$$4 - 5\pi > 2-\pi$$
$$2 > 4\pi$$
$$\pi < {}^1/_2$$

- If $\pi < ½$ Campaigner plays Hardline
- If $\pi > ½$ Campaigner plays Moderate
- If $\pi = ½$ Campaigner is indifferent between playing Hardline and Moderate.

Now, k is:

$$\pi = \frac{1(\frac{2}{5})}{1(\frac{2}{5})+k(\frac{3}{5})}$$

$$\pi = \frac{2}{2+3k}$$

For what values of k is $\pi < ½$?

$$\frac{2}{2+3k} < ½$$

$$4 < 2 + 3k$$
$$2 < 3k$$
$$k > {}^2/_3$$

Case 1: $k > {}^2/_3$, $\pi < ½$.

If $\pi < ½$, Campaigner plays Hardline. The liberal politician's best response is to play Decided, so therefore, k =0. However as $k > {}^2/_3$ this contradicts itself and cannot be an equilibrium.

Case 2: $k < {}^2/_3$, $\pi > ½$.

If $\pi > ½$, the Campaigner plays Moderate. The liberal politician's best response is to play Undecided. This means k=1. However as $k < {}^2/_3$ this contradicts itself and cannot be an equilibrium.

Case 3: $k = {}^2/_3$, $\pi = ½$.

If $\pi = ½$, the campaigner is indifferent between playing a moderate and hardline stance. This happens when the probability of a liberal politician playing undecided equals $^2/_3$. This is sufficiently high to make the hardline stance not necessarily bad and merit indifference.

We need to find the strategy of the campaigner that makes the politician indifferent between choosing decided and undecided.

The liberal politician mixes if

$$EU_{Pliberal}\,(\text{Undecided}) = \text{EUPLiberal (Decided)}$$
$$EU_{Pliberal}\,(\text{Undecided}) = \delta(4) + (1-\delta)(2) = 2\delta + 2$$
$$EU_{PLiberal}(\text{Decided}) = 3$$
$$2\delta + 2 = 3$$
$$2\delta = 1$$
$$\delta = ½$$

When the campaigner is equally likely to choose a moderate and a hardline stance, the liberal politician chooses Undecided with probability $^2/_3$, and Decided with Probability $^2/_3$. This a semi-separating equilibrium.

- Conservative Politician: (Undecided, Engage, Withdraw)
- Liberal Politician: (Undecided w.p. $^2/_3$ Decided w.p. $^1/_3$, Engage, Engage)
- Campaigner: (Moderate w.p. ½, Hardline w.p. ½)
- Beliefs: Prob (Conservative | Undecided) = ½

Scenario 3: Prob(Conservative)=0.5, Prob(Liberal)=0.5 with new payoffs.

The stakes are now higher as it is seen to be a tight campaign. In convincing those who remain on the fence, it now becomes even more critical not to take a hardline with a conservative politician who may be won over, but it becomes even more important to take a hardline stance with any liberal politician to forward the repeal agenda. The payoff for the campaigner given:

$$EU_c(\text{Hardline}\,|\,\pi) > \text{EUc(Moderate}\,|\,\pi)$$
$$EU_c(\text{Hardline}\,|\,\pi) = \pi(-2) + (1-\pi)(6) = 6 - 8\pi$$
$$EU_c(\text{Moderate}\,|\,\pi) = \pi(1) + (1-\pi)(2) = 2 - \pi$$

Campaigner prefers Hardline if:

$$6 - 8\pi > 2 - \pi$$
$$4 > 7\,\pi$$
$$\pi < {}^4/_7$$

- If $\pi < {}^4/_7$ Campaigner plays Hardline
- If $\pi > {}^4/_7$ Campaigner plays Moderate.

- If $\pi = {}^4/_7$ Campaigner is indifferent between playing Hardline and Moderate.

$$\pi = \text{Prob(Politician is Conservative} \mid \text{Undecided)}$$

$$= \frac{\text{Prob(Conservaive).Prob(Conservative)}}{\text{Prob(Conservaive).Prob(Conservative)+Prob(Liberal).Prob(Liberal)}}$$

$$= \frac{1(\frac{1}{2})}{1(\frac{1}{2})+k(\frac{1}{2})}$$

$$\pi = \frac{1}{1+k}$$

For what value of k is $\pi < {}^4/_7$?

$$\frac{1}{1+k} < \frac{4}{7}$$

$$7 < 4 + 4k$$

$$3 < 4k$$

$$¾ < k$$

Case 1: $k > {}^3/_4, \pi < {}^4/_7$

If $\pi < {}^4/_7$, then the campaigner plays Hardline. If this is so the best response of the liberal politician is Decided. This means k is 0, which contradicts the above so this cannot be an equilibrium.

Case 2: $k < {}^3/_4, \pi > {}^4/_7$

If $\pi > {}^4/_7$, the campaigner plays Moderate. If this is so the best response of the liberal politician is Undecided. This means k=1, which contradicts the above so this cannot be an equilibrium.

Case 3: $k = {}^3/_4, \pi = {}^4/_7$

If $\pi = {}^4/_7$, the campaigner is indifferent between playing hardline and moderate. We need to find the strategy of the campaigner that makes the politician indifferent between choosing decided and undecided.

The liberal politician mixes if

$$EU_{Pliberal}(\text{Undecided}) = EU_{PLiberal}(\text{Decided})$$

$$EU_{Pliberal}(\text{Undecided}) = \delta(4) + (1-\delta)(1) = 3\delta + 1$$

$$EU_{PLiberal}(\text{Decided}) = 3$$

$$3\delta + 1 = 3$$

$$3\delta = 2$$

$$\delta = {}^2/_3$$

When the campaigner plays moderate with probability $^2/_3$ and hardline with probability $^1/_3$ the liberal politician is indifferent between playing decided and undecided. They will play Undecided with probability ¾ and Decided with probability ¼. This is a semi-separating equilibrium.

Perfect Bayesian Equilibrium:

- Conservative Politician:(Undecided, Engage, Withdraw)
- Liberal Politician:(Undecided with probability ¾, Decided with probability ¼, Engage, Engage)
- Campaigner:(Moderate with probability $^{2}/_{3}$, Hardline with probability $^{1}/_{3}$
- Beliefs: Prob(Conservative | Undecided) = $^{4}/_{7}$

The Game Theory of Protective Governments and Airplane Manufacturers Introduction

India Healy O'Connor, Senior Sophistor

As the USA leans increasingly toward a protectionist stance, trade disputes have become an increasingly pressing issue. In this essay India Healy O'Connor analyses the strategic interactions of a trade dispute through the real-world example of the Bombardier-Boeing dispute. India clearly lays out each countries pay-offs from all possible outcomes and then deciphers the optimal strategy each should take. She then compares these strategies with the outcome which was observed in reality and analyses the policy implications of her results.

Introduction

The airplane manufacturing industry is an example of a high-technology industry that receives significant support from governments due to the fact that it produces positive externalities for the economy. There are multiple desirable spill-over effects from the industry, including high value add manufacturing, employment for a range of skill levels and production which is export orientated. This induces governments to provide state aid, which can give a strategic advantage to export firms operating in an imperfectly competitive market. The single-aisle plane market within this industry is dominated by Boeing and Airbus. However, the struggling Bombardier C series programme recently secured a $5.6 billion deal with Delta for 75 jets (Hollinger and Donnan, 2017). As can be inferred from Figure 1, Bombardier is a very small player in the industry.

The deal resulted in Boeing bringing a trade case to the US Department of Commerce, who decided to impose a 300% tariff on Bombardier jets imported

into the US (Hollinger and Donnan, 2017).

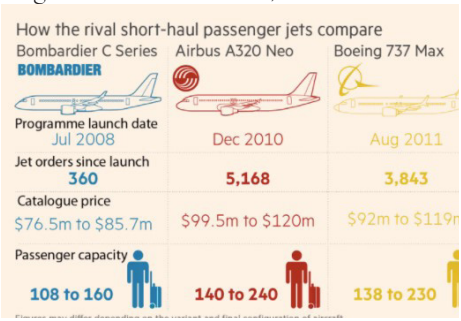
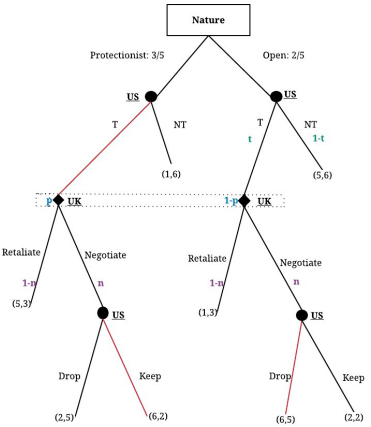


Figure 1: A comparison of Bombardier, Airbus and Boeing

The Department believed that Bombardier sold under-priced jets and received unfair state subsidies from the British and Canadian governments (Hollinger and Donnan, 2017). This is an accusation that Bombardier has strongly disputed and is ironic given that Boeing 'is among the top recipients of both federal, state and local subsidies in the U.S' (Alini, 2017). While the subject of the trade case is company-related, due to the evident investment and aid received from governments, the situation becomes a trade dispute between countries. In this paper, game theory is used to examine the decisions of the American and British governments during the development of this trade dispute. The model is presented below.

Figure 2: The double U trade dispute and negotiation process



Outline

The model above represents a Bayesian game in strategic form. The game has two players - the American government (US) and the British government (UK).

The US can be one of two types- Open or Protectionist. The US is Protectionist with a probability of $^{3}/_{5}$ and Open with a probability of $^{2}/_{5}$. In order to model this random variable, Nature moves first and determines the US type. After Nature moves, only the US is aware of its type. The US must choose between playing impose tariffs (T) or do not impose tariffs (NT). If the US plays NT, the game ends. If the US plays T, then the UK must choose to either retaliate or negotiate. If the UK retaliates, the game ends and both countries are embroiled in a trade war. If the UK plays negotiate then the US may decide to keep the tariffs (Keep) or drop them (Drop). If the US plays Drop, positive trade relations are maintained and if it plays Keep, a trade dispute ensues.

Assumptions

Several assumptions govern this sequential game with imperfect information. Firstly, it is assumed that the US is more protectionist than open. Research carried out on US trade policies revealed that the US has implemented 1,297 protectionist measures since the financial crisis compared to 206 liberalising policies (Figure 3) (Kirk, 2017). The protectionist stance adopted by the US has only been further exacerbated by President Trump (Kirk, 2017).

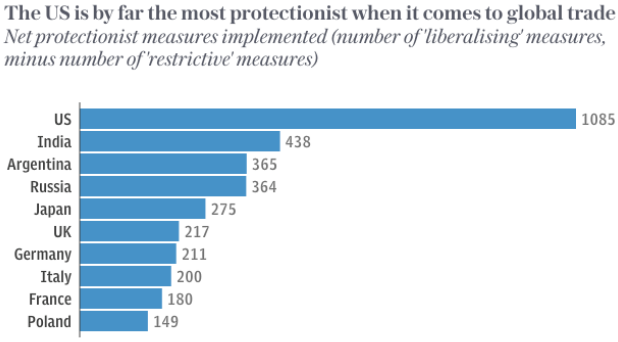


Figure 3: A ranking of countries in terms of level of protectionism

Secondly, this model assumes that there are only two players involved in this trade dispute. This is a simplification of the dispute as the Canadian government, who provided Bombardier with significant state aid, have already retaliated by stating that they won't buy Boeing jets while the tariffs are upheld (Wingrove, 2017). This assumption is not-overly constraining as the UK and Canada are on the same side of the argument and the UK are better off adopting a similar approach rather than diverge, as is reflected in the payoffs.

Finally, there are assumptions regarding the preferences of the US and the UK. The US is the most powerful nation in the world, thus while a trade dispute

with the UK is for the most part undesirable, it is a nation that can withstand such a battle. The UK is in a more vulnerable position as it attempts to navigate the country through Brexit. The UK want to punish the US for imposing these tariffs, yet they can't afford to lose the US as an alley in terms of negotiating post-Brexit trade deals. However, Prime Minister May relies on the votes of the DUP for her government majority. The DUP are dependent on many votes from the area in Northern Ireland where Bombardier employs over 4000 people. Thus the British government is under pressure to either negotiate a deal or alternatively, retaliate and align with Canada, who have already taken a hard line. The UK defence secretary has threatened that this case may prevent Boeing from winning lucrative British defence contracts in the future (Hollinger and Donnan, 2017). Furthermore, the UK would rather not reveal weakness in a negotiation process if the tariffs would ultimately be upheld.

U(a, b, c) can be defined as the case where the US chooses action a at its initial stage, the UK chooses action b and the US chooses action c at the final stage. Where b or c are missing, the game ends before reaching subsequent stages.

The outcomes of the Protectionist US are ranked as follows:

U(T, Negotiate, Keep) > U(T, Retaliate) > U(T, Negotiate, Drop) > U(NT)

Regardless of the actions of the UK, the Protectionist US will always prefer to impose tariffs. It has no regard for international relations and perceives a UK that will initially negotiate rather than retaliate as a weaker opponent.

The outcomes of the Open US are ranked as follows:

U(T, Negotiate, Drop) > U(NT) > U(T, Negotiate, Keep) > U(T, Retaliate)

The Open US is mindful of maintaining international relations, however it would still rather negotiate an attractive deal rather than impose no tariffs in the first place. If the UK chooses to retaliate, then the Open US has failed to negotiate a deal and caused further international upset. It would have been better off imposing no tariffs at all. The outcomes for the UK are ranked as follows:

U(NT) > U(T, Negotiate, Drop) > U(T, Retaliate) > U(T, Negotiate, Keep)

The best outcome for the UK involves no tariffs from the outset. It would rather not immediately engage in a war with a country that it needs to keep onside and will try to negotiate a deal. However, if the UK believes that the negotiations would ultimately be fruitless and the tariffs kept in place, they would be better off to retaliate immediately.

Equilibria

The extensive game yields three equilibria (Appendix 1). Starting at the end of the game, it is evident that the Protectionist US will choose Keep and the open

US will choose Drop (denoted by red lines). In addition, the Protectionist type has a pure strategy. The Protectionist US will always prefer to play T regardless of what the UK does later in the game. The Open US will randomize at its first information set, where it decides between T and NT.

t: represents the probability that the Open type chooses T

n: represents the probability that the UK chooses Negotiate

p: represents the probability that (US is Protectionist | T)

Equilibrium 1: Pooling PBE (Perfect Bayes Equilibrium)

o US strategy:

- Open US (T, Drop)
- Protectionist US (T, Keep)

o UK strategy: (Negotiate)

o UK beliefs:

- US is Protectionist with probability 0.6 and Open with probability 0.4

The UK's beliefs are consistent. Their posterior beliefs are equal to their prior beliefs as the actions of the US do not reveal any additional information. The UK strategy is optimal because the expected utility from negotiating is greater than that for retaliating when $p < 66.7\%$. The US strategy is also optimal. Since the UK always negotiates, the Protectionist US will play Keep and earn its highest payoff of 6. For the Open US, it will play Drop and similarly earn their highest payoff of 6.

Equilibrium 2: Separating PBE

o US strategy:

- Open US (NT)
- Protectionist US (T, Keep)

o UK strategy: (Retaliate)

o UK Beliefs:

- If US chooses T it is Protectionist with probability 1. If US chooses NT, it is Protectionist with probability 0.

The UK's beliefs are consistent because only a Protectionist US would play T, while only an Open US would play NT. Therefore, the UK adopts its optimal strategy of playing Retaliate. The US strategy is optimal because the Protectionist US adheres to its pure strategy of imposing tariffs. The Open US wants to avoid retaliation as this would result in its lowest payoff and thus will choose NT from the get go.

Equilibrium 3: Semi-separating PBE

o US strategy:

- Open US (T with probability 75%, NT with probability 25%, Drop)

- Protectionist US (T, Keep)

o UK strategy: (Negotiate with probability 80%, Retaliate with probability 20%)
o UK beliefs:

- Using Bayes' Rule the probability (US is Protectionist | T) = 66.7%

The US must play T with a probability of 75% for the UK to be willing to randomize. For this to be optimal for the US, there must be an 80% chance that the UK will negotiate. If the US plays T, the UK believes that there is a 66.7% chance that it is Protectionist. The PBE requires that both governments mix strategies.

It is also interesting to evaluate the game when the probabilities of the US types are changed. Perhaps 60% and 40% were too conservative and it would be more appropriate to assign an 80% probability to the US being Protectionist and 20% to the US being Open. When the game is recalculated with these probabilities one separating equilibrium is found (Appendix 2). As always, the Protectionist US will play (T, Keep). The Open US will choose (NT). The UK will always play (Retaliate). If the UK observes T it believes with certainty that it is facing the Protectionist type and will retaliate. If it observes NT it knows with certainty that it is facing the Open type and there is no need to do anything. The actions of the US perfectly reveal their type.

Analysis

The two separating equilibria, are interesting to consider. The separating PBE is becoming more of a reality under the Trump administration. The US is increasingly becoming more protectionist than open. So much so that WTO director general, Roberto Azevedo, stressed that trade wars were responsible for the destruction rather than the creation of jobs (Reuters, 2017). The only way that that the US can increase the value of p (as perceived by the UK) is by imposing tariffs less often when Open. This implies that as t tends to 0, p tends to 1. Under Trump, in order for other countries to credibly believe that the US is open, the US can't impose protectionist policies. With the US becoming increasingly closed and unlikely to negotiate any acceptable deal with the UK, immediate retaliation would be the best move for the UK government. The semi-separating equilibrium describes a situation whereby both governments are mixing strategies. In the real world, if the US does ultimately drop the tariffs then both governments achieve favourable payoffs. However, given how the situation has progressed this is unlikely.

The pooling equilibrium is the best indicator of what in fact occurred. While it is impossible to know UKs true beliefs regarding the US, it did try to negotiate.

However, the lobbying and pleas have thus far proved to be fruitless. The US has not dropped the tariffs although a final decision won't be made until February. The UK appears to be facing a Protectionist US and one would assume it will receive its worst payoff. However, an unexpected development occurred. This couldn't have been anticipated by either government and thus does not appear in the initial payoffs of the game. Airbus announced in October that it would be taking a majority stake in the C series. This venture provides Bombardier with the marketing expertise, distribution channels and seal of approval it was previously lacking. Airbus has a manufacturing plant in Alabama which means the partnership should be able to circumvent the high tariffs. The jobs in Northern Ireland are safe and the US has received a major blow. While this has not been modelled, a further possible extension would be to consider how the US and UK strategies change in light of this new information.

Policy Implications

Boeing is left in an even more vulnerable position with the prospect of its greatest competitor, Airbus gaining even more market share with its now superior jets. Furthermore, Boeing and the US government have damaged international relations. The US could still hopefully salvage their international relations by dropping the tariffs. Policy implications? Tariffs of 300% are the nail in the coffin for small companies and cause major international upset. No competitive industry can develop if entrants are constantly faced with this insurmountable hurdle. There ought to be stringent regulation which caps the level of tariff a government can place on such companies along with better implementation of the rules surrounding government aid. This would hopefully prevent the US from having to impose tariffs in the first place.

Reference List:

1. Alini E. (2017) 'Bombardier got subsidies? Boeing received $64B from the U.S. government'. Global News, 28 September. Available at: https://globalnews.ca/news/3773916/bombardier-boeing-subsidies/ [Accessed 14 December 2017]
2. Hollinger P. and Donnan S. (2017) 'US move against Bombardier risks reprisals'. The Financial Times, 27 September. Available at: https://www.ft.com/content/bfdb3f24-a379-11e7-9e4f-7f5e6a7c98a2 [Accessed 13 December 2017]
3. Kirk A. (2017) 'Mapped: Protectionism is on the rise as US and EU implement thousands of restrictive trade measures'. The Telegraph, 28 November. Available at: http://www.telegraph.co.uk/business/2017/11/28/mapped-protectionism-rise-us-eu-implement-thousands-restrictive/ [Ac-

cessed 14 December 2017]

4. Reuters (2017) 'World trade chief warns against 'talking ourselves into a crisis" Reuters, 20 January. Available at: https://www.reuters.com/article/us-davos-meeting-trade/world-trade-chief-warns-against-talking-ourselves-into-a-crisis-idUSKBN1541VL [Accessed 14 December 2017]
5. Wingrove J. (2017) 'Trudeau says Canada won't buy Boeing jets amid Bombardier fight'. Financial Post, 18 September. Available at: https://www.google.ie/amp/business.financialpost.com/transportation/trudeau-says-canada-wont-buy-boeing-jets-amid-bombardier-fight/amp [Accessed 14 December 2017]
6. Source taken from Hollinger and Donnan (2017) US move against Bombardier risks reprisals
7. Source taken from Kirk (2017) Mapped: Protectionism is on the rise as US and EU implement thousands of restrictive trade measures.

Appendix 1

Model 1:Probabilities 60% and 40%

Let t represent the probability that the Open US chooses Impose Tariffs (T). Let n represent the probability that the UK chooses Negotiate. Let p denote the probability that (US is Protectionist | T):

EU_{uk} (Negotiate | p) = 2p + 5(1−p) = 5−3p

EU_{uk} (Retaliate | p) = 3p + 3(1−p) = 3

UK will prefer to negotiate if:

$$5-3p > 3$$
$$-3p > -2$$
$$p < {}^{2}/_{3}$$

o If $p < {}^{2}/_{3}$, UK will play Negotiate.
o If $p > {}^{2}/_{3}$, UK will play Retaliate.
o If $p = {}^{2}/_{3}$, UK indifferent between playing Negotiate and Retaliate.

UK's beliefs have to be consistent with US strategy and Bayes' rule:

p = Probability (US is Protectionist | T) =

$$\frac{\text{Prob (T | US is Protectionist)*Prob (Protectionist)}}{\text{Prob(T | US is Protectionist)*Prob(Protectionist) + Prob(T | US is Open)*Prob(Open)}}$$

$$= [(1) * (3/5)] / [(1) * (3/5) + (t) * (2/5)]$$

$$= 3 / (3+2t)$$

Values of t where $p < {}^{2}/_{3}$:

$$p = 3 / (3+2t)$$
$$3 / (3 +2t) < {}^{2}/_{3}$$
$${}^{3}/_{4} < t$$
$$t > {}^{3}/_{4}$$

Case 1: $t > {}^{3}/_{4} \Rightarrow p < {}^{2}/_{3}$

- Since $p < {}^{2}/_{3}$, UK will always play Negotiate
- If UK always plays Negotiate, then the Open US should play T.
- Therefore, t= 1.
- Both players are playing the best response to one another, so this is an equilibrium.
- This is a pooling equilibrium where no information is revealed. The posterior beliefs are equal to the prior beliefs.

Equilibrium

- Protectionist US: (T, Keep)
- Open US: (T, Drop)
- UK: (Negotiate)
- Beliefs: Prob (US is Protectionist | T) = ${}^{3}/_{5}$

Case 2: $t < {}^{3}/_{4} \Rightarrow p > {}^{2}/_{3}$

o Since p > 2/3, UK will always play Retaliate

o If the UK always plays Retaliate, then the Open US should play NT

o Therefore, t= 0

o Both players are playing the best response to one another, so this is an equilibrium.

Equilibrium

- Protectionist US: (T, Keep)
- Open US: (NT)
- UK: (Retaliate)
- Beliefs: Prob (US is Protectionist | T) = 1

Case 3: $t = {}^{3}/_{4} \Rightarrow p = {}^{2}/_{3}$

o Since $p = {}^{2}/_{3}$, the UK is indifferent between playing Retaliate and Negotiate o If $t = {}^{3}/_{4}$, the Open US is mixing between T and NT.

o For the US to mix between these two strategies, the US must be indifferent between them. This can only happen if the UK is also mixing:

$$EU_{us} (T | n) = 6n + 1(1-n) = 5n + 1$$
$$EU_{us} (NT | n) = 5$$
$$5n + 1 = 5$$
$$5n = 4 \quad n = {}^{4}/_{5}$$

Equilibrium

Protectionist US: (T, Keep)

Open US: (T with probability $^3/_4$, NT with probability $^1/_4$, Drop)

UK: (Negotiate with probability $^4/_5$, Retaliate with probability $^1/_5$)

Beliefs: Prob (US is Protectionist | T) = $^2/_3$

Appendix 2

Model 2 – Probabilities 80% and 20%

The payoffs for the UK at the information set are the same as before. Therefore, the UK optimal strategy given beliefs remains the same.

- If $p < {}^2/_3$, UK will play Negotiate.
- If $p > {}^2/_3$, UK will play Retaliate.
- If $p = {}^2/_3$, UK indifferent between playing Negotiate and Retaliate.

UKs belief has to be consistent with US strategy and Bayes' rule

p = Prob (US is Protectionist | T) =

$$\frac{\text{Prob (T | US is Protectionist) * Prob (Protectionist)}}{\text{Prob (T | Protectionist) * Prob (Protectionist) + Prob (T| Open) * Prob (Open)}}$$

$$= [\ (1) * (4/5)\ ] / [\ (1) * (4/5) + (t) * (1/5)\ ]$$

$$= 4 / (4+t)$$

Values of t where $p < {}^2/_3$:

$$p = 4 / (4+t)$$

$$4 / (4+t) < {}^2/_3$$

$$t > 2$$

- This is not possible and therefore no value of t will result in $p\ T\ {}^2/_3$.
- This means that the only possibility is for $p > 2/3$.
- Therefore, since $p > {}^2/_3$, the UK will always play Retaliate.
- If the UK always plays Retaliate, then the Open US should always play NT.
- Therefore, t=0

If t = 0

$$p = 4 / (4+t)$$

$$p = {}^4/_4$$

$$p = 1$$

Separating Equilibrium

Protectionist US: (T, Keep)

Open US: (NT)

UK: (Retaliate)

Beliefs: Prob (US is Protectionist | T) = 1

Method to the Madness: A Game Theoretical Analysis of the USA and North Korea's Standoff

Marcel Jaensch – Senior Sophister

In the past year the world has been threatened with the prospect of nuclear war, by the seemingly impulsive behavior of the North Korean regime. In this paper, Marcel Jaensch opens the possibility that their behavior is in fact rational and is a key part of their survival strategy. Marcel uses game theory to display the value of uncertainty around their capabilities to strike the US and its allies, showing that the US will only attack if they can be almost certain of an inability to strike back. This insight gives rationale to the North's seemingly erratic behavior and strategy, showing that it may, from the regimes point of view, be optimal.

Intoduction

In the last months, the North Korean military launched numerous missile tests, leaving the world trembling, causing a rush to safe haven assets and giving rise to semi-humorous rhetoric by the US president. The strategy of North Korea is to develop an Intercontinental Ballistic Missile (ICBM) that is capable both in range and accuracy to reach a major American city. On November 28th, North Korea claims to have successfully tested for the first time such an ICBM, which however cannot be verified (Kong, 2017). Therefore, as the DPRK continues their missile tests, it is instructive to use game theory to analyse the options of the North Koreans and the resulting response by the United States. The US intelligence community will be fully aware of such further tests. However, the outcome of devel-

opment is uncertain to the United States. This information asymmetry sets the stage for a game theoretical analysis of the interactions between both players. The paper will start by outlining the model, its assumptions and the payoffs before representing it in diagrammatic form. The essay will the outline the equilibria of the game and analyse their significance, before discussing limitations and possible extensions to the model. The main insight of this paper is the absence of signalling by North Korea, and the fact that uncertainty is key to the regime's preservation. This value of uncertainty to the regime indicates that their seemingly reckless and impulsive behaviour is in fact calculated and strategic, and ultimately necessary for its survival.

Model

This paper models an extensive game with imperfect information involving the Democratic People's Republic of Korea (DPRK) and the United States as single players. The model represents a scenario in which the DPRK tests another Intercontinental Ballistic Missile. The outcome of the test will determine whether North Korea possess capabilities of attacking the United States mainland with nuclear missiles. Hence, a successful test will render the DPRK an ICBM capable type, and an unsuccessful test will make the DPRK an ICBM incapable type. The United States will be aware of such a test and will either play the same game with one of two probability distribution. If the US intelligence community deems the test as a failure, then nature will choose an ICBM success with probability 0.1 and an ICBM failure with probability 0.9. If, however, the US intelligence agencies categorise the test as a success, nature deems the ICBM test a success with probability 0.9 and a failure with probability 0.1.

Once the appropriate game has been selected given the intelligence analysis, nature moves first and determines the outcome of the test given the underlining probabilities. After nature's move, only the North Korean leadership themselves know the exact outcome of whether the test and, thus, the development of an ICBM was successful. The United States will only know the underlining discrete probability distribution and will never have complete information on whether North Korea possess ICBM capabilities. The United States will, however, form believes on the outcomes of the tests after observing North Korea's first move. Once the DPRK knows which type they are, they will choose whether to announce the development of such a threating weapon as a success or publicly claim it as a failure. After the announcement, the United States will react by either retreating and removing its military forces from the region, or by attacking North Korea. Hence, either the game will end in peace given the US retreats or in war, which might be a nuclear war leading to total annihilation. This assumption is

made to simplify the analysis.

Assumptions

The first assumption is that the international community and the United States will be aware of such a missile launch. This is credible as North Korea most likely will issue a notice to airmen, known as a NOTAM. Such a warning will be most likely used by the North Korean's to notify the international community to avoid risking starting a war. Even if no such warning is issued, the US military using space-based sensors in conjunction with ground-based radar can detect a missile launch, its type, bearing, range and lastly whether it failed or succeeded. However, sometimes information is lacking, and occasionally conflicting, or wrong. Therefore, even though the international community is aware of a launch and can predict to a high certainty whether it was successful or not, a small error term persists (Hanham, 2017). This error term is the basis for the second assumption, the two sets of discrete probabilities. If the US intelligence community deems a test a failure, the error term is incorporated in the game by the fact that the ICBM test is a success with a probability of 0.1. If the test is deemed successful by the intelligence agencies, there is still a probability of 0.1 that the ICBM test was a failure.

The third assumption is that North Korea will publicly announce the outcome of the tests, even when it failed. While this might not be reasonable, it adds a layer of complexity that creates a model which yields an interesting equilibria. Fourth, it is assumed that the United States can only either retreat or attack. This simplifies the game tree by reducing the number of branches, effectively ruling out the status quo whereby the United States takes no action.

Lastly, the payoffs, in the model also rely on a set of assumptions about the actions and preferences of each player. However, it is assumed that the payoffs to the DPRK do not depend on the outcome of the ICBM test only on the actions of the United States. The DPRK would prefer the United States to retreat and remove its forces from the region rather than being attacked. An attack by the United States would end in a complete loss with or without ICBM capabilities. As for the United States, it is assumed that it has two sets of preferences depending on the outcome of the ICBM test. If the test is a success, the US would prefer to retreat rather than attack and vice versa if the ICBM test is a failure.

Overall, the United States would prefer to attack North Korea when it does not possess ICBM capabilities, as it can win the war without incurring destruction at home. Then, the United States second most favoured outcome is to retreat when the ICBM test was a success, as it ensures that major US cities do not get attacked. However, the United States would prefer less to retreat when the

ICBM test is a failure as it would have seceded without a credible threat. Lastly, the United States would least prefer to start a nuclear war with a North Korea that has ICBM capabilities, as this would lead to complete destruction of the US homeland. The range of values attached to the payoffs for both parties is between zero and five. These assumptions are represented in the table below.

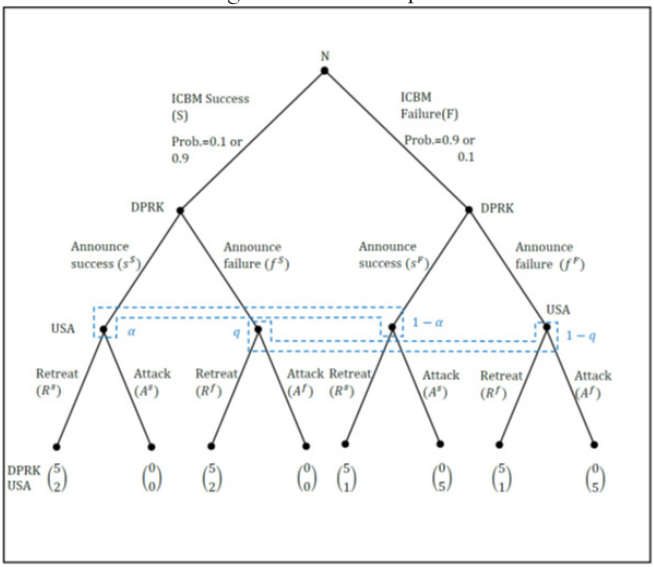
Table 1: Payoffs of the United States and DPRK in respect to outcomes

Outcome	USA Payoffs	DPRK Payoffs
Attack when ICBM test is a failure	5	0
Retreat when ICBM test is a success	2	5
Retreat when ICBM test is a failure	1	5
Attack when ICBM test is a success	0	0

Representation

The extensive form games with incomplete information described above are represented in the diagram below. As outlined earlier, the only difference between the two games are the two sets of underlining probabilities at the start of each game.

Figure 1: Extensive form games of nuclear politics between USA and DPRK



Equilibria

The first extensive Bayesian game, in which the US intelligence reports deem the ICBM test to have failed, yields two pure-strategy pooling equilibria. The first Perfect Bayesian Equilibrium (PBE) states that the DPRK will announce a successful ICBM test regardless of the actual outcome. The United States will in turn attack in both cases. This rest on parameters that the probability with which the USA believes the ICBM test was successful when the DPRK announces a success (a=Prob(S|s))is equal to the prior probability that the ICBM test was a success (α=0.1). It further rests on the assumption that the probability with which the USA believes the ICBM development was successful when the DPRK announces a failure (q=Prob(S|f)) is less than or equal to 0.67 (q[0,$^2/_3$]). The second Perfect Bayesian Equilibrium sets forth that the DPRK will announce a failure of the test irrespective of actual outcome and the United States will respond by attacking North Korea, given that q=0.1 and α[0, $^2/_3$]. These sets of PBE are summarized below,

Figure 2: Set of PBE of Game 1

$$PBE = \left\{\left(s^S s^F, A^s A^f\right), \alpha = 0.1, q\right) : \ q \in \left[0, \frac{2}{3}\right]\right\} \cup \left\{\left(f^S f^F, A^s A^f\right), \alpha, q = 0.1\right) : \ \alpha \in \left[0, \frac{2}{3}\right]\right\}$$

In the second extensive Bayesian game, when the US intelligence community deems the ICBM test to be successful, there are four pure-strategy pooling equilibria. In the set of the first two Perfect Bayesian Equilibria, the DPRK announces that the ICBM tests were successful regardless of its validity. In both equilibria, given α=0.9 the United States will retreat when observing an announcement of success. However, in one equilibrium the USA will retreat even when a failure is announced if q$\in$[$^2/_3$,1] and in the other equilibrium the USA will attack when failure is announced if q$\in$[0,$^2/_3$]. If q=$^2/_3$, the United States is indifferent between retreating or attacking when failure is announced. In the second set of the other two Perfect Bayesian Equilibria, the DPRK announces that the ICBM tests were a failure regardless of actual events. In both equilibria, given q=0.9 the United States will retreat when observing an announcement of failure. However, in one equilibrium, the USA will retreat even when a success is announced if $\alpha\in$[$^2/_3$,1] and in the other equilibrium the United States will attack when success is announced if $\alpha\in$[0,$^2/_3$]. If α=$^2/_3$, the United States is indifferent between retreating or attacking when success is announced. See the set of above described PBE on the next page (Figure 3: Set of PBE of Game 2)

$$U_{USA}(s^S s^F, R^f) = q(2) + (1-q)(1) = 1 + q$$

$$U_{USA}(s^S s^F, A^f) = q(0) + (1-q)(5) = 5 - 5q$$

$$U_{USA}(s^S s^F, R^f) \leq U_{USA}(s^S s^F, A^f) \text{ if and only if (iff)}$$

$$1 + q \leq 5 - 5q$$

$$6q \leq 4$$

$$q \leq \frac{2}{3}$$

Analysis and Extensions

The interesting fact about both games is that they yield exclusively pooling equilibria. In these equilibria, the sender, the DPRK, who observes the outcome of the ICBM tests chooses the same action, so that the sender's action gives the receiver, the United States, no information about the sender's type. Hence, the DPRK employs a pooling strategy to conceal whether it is an ICBM capable type or not. Intuitively, it is advantageous for the DPRK not to signal its type to the USA, as it would be inviting the US to attack in case it is incapable of launching nuclear ICBMs against the US mainland. Given that no signalling occurs, the United States uses the underlining probabilities of each game to form beliefs and best responses. As the one of underlining probabilities in each of the games is closest to one, the model approaches an extensive game of complete information. Hence, when it is extremely likely that the ICBM test failed, as in Game 1, the US will want to attack North Korea, which is the case in all PBE of Game 1. On the other hand, if it is very likely that North Korea possess ICBM capabilities, the US is better off retreating, as is evident in most of the PBE of Game 2. Hence, given the assumptions the predictions are realistic.

Nonetheless, the prior assumptions need to be assessed by their effect on the games' outcomes and how realistic they are. The first two assumptions, about the observance of a missile launch and the error term of an intelligence analysis, are both very much rooted in real-life scenarios as outlined above. The assumption that North Korea publicly announces a missile test failure is somewhat unrealistic, but adds a layer of complexity to the game.

However, the insightful pooling equilibrium is reached by assuming that the DPRK's payoff is equivalent when they announce success or failure of the ICBM, and only depends on the United States response. As the information transmission is costless and the interest between the DPRK and the US are not aligned, it is always more advantageous for North Korea to conceal their actual capabilities.

In the game theory literature, this is referred to as 'Cheap talk', first outlined in its basic form by Crawford and Sobel (1982). This type of game can be applied to any interaction in which an informed player, who is biased, advises a decision maker, where communication is direct, costless, non-binding and unverifiable. The standard example is that of a lobbyist informing a politician of the state of the industry they are representing (Munoz-Garcia and Toro-Gonzalez, 2016). Lastly, to limit the response of the USA to two options of either attack or retreat is too strong an assumption to make. It leaves out a third option of the US standing put, which would represent the status quo.

To model the game closer to reality, it can be amended by two aspects. First, the United States should be given the additional third option to stand firm, which should represent the status quo. The payoff for the status quo will have to be equal for both players. For the US, it has to take up a value which is greater than the payoff from retreating when the ICBM test is a success, but less than the payoff from attacking when the ICBM test is a failure (status quo$\in(2,5)$). Different from the original game, this third option would make retreating less reasonable for the US as the payoff from staying put is always higher. Additionally, to introduce signalling in this game it must be costly for North Korea to make the false announcement of a successful ICBM launch (s^F). This makes the game more realistic as it is extremely costly for the DPRK to maintain a façade of being ICBM capable. However, there will only be a separating equilibrium, indicative of signalling, if the costs of lying about a successful ICBM decrease the payoff of the status quo for North Korea equal to or below zero. This represents an equal or lower payoff than being attacked by the United States given North Korea announced a failure (f^F), which certainly is questionable.

Overall, the one key policy implication to take away from this analysis is that what allows the Pyongyang regime to survive is their ability to either provide a credible threat, or at least arouse enough certainty around their capabilities as to discourage a US attack. The more difficult North Koreas tests are to evaluate, and more generally, the more difficult their general capabilities are to determine, the more secure the regime is, as the US will presumably only attack when swift victory is assured.

Conclusion

This paper presents an extensive game which shows that North Korea would never signal to the world whether it is capable of deploying an ICBM against the US when there are no costs for North Korea to provide proof. Hence, the model has clear limitations as some assumptions are too strong or too far from real inter-

national political dynamics. Altering these assumptions would give rise to further work and hopefully further insight. However, the model does show the value of uncertainty to the North Korean regime. The uncertainty which surrounds their nuclear program and capabilities, and their country in general, is what allows their regime to survive. This perhaps gives insight into why the regime undertakes such erratic behavior, that this behavior preserves uncertainty around their capability to inflict disaster upon the US and its allies. This indicates that there may in fact be some strategic method behind Mr. Kim's apparent madness.

References List:

1. Crawford, V. and Sobel, J. 1982. 'Strategic Information Transmission'. Econometrica 50:6:1431-1451.
2. Hanham, H. 2017. 'What Happens When North Korea Tests a Missile That Could Reach the U.S.?'. The Atlantic. [on-line], https://www.theatlantic.com/international/archive/2017/04/north-korea-icbm/522042/. [Accessed: 26 November 2017].
3. Kong, K. 2017. 'North Korea Test-Fires ICBM That Could Put Entire U.S. in Range'. Bloomberg. [on-line], https://www.bloomberg.com/news/articles/2017-11-28/north-korea-launches-another-ballistic-missile-yonhap-says. [Accessed: 30 November 2017].
4. Munoz-Garcia, F. and Toro-Gonzalez, D. 2016. Strategy and Game Theory. Basel: Springer International Publishing.

Appendix

Game 1: US Intelligence community observes a failed DPRK ICBM test

- Probability ICBM development is successful: 0.1
- Probability ICBM development is unsuccessful: 0.9

Strategy Sets

The strategy sets are

$$S_{DPRK} = \{(s^S s^F), (s^S f^F), (f^S s^F), (f^S s^F)\}$$
$$S_{USA} = \{(R^s R^f), (R^s A^f), (A^s R^f), (A^s A^f)\}$$

Bi-Matrix

The game can be rewritten as a bi-matrix in which the numbers are weighted by the underlining probability chosen by nature. The bi-matrix is as follows with best responses underlined:

	R^sR^f	R^sA^f	A^sR^f	A^sA^f
s^Ss^F	5 , 1.1	5 , 1.1	0 , 4.5	0 , 4.5
s^Sf^F	5 , 1.1	0.5 , 4.7	4.5 , 0.9	0 , 4.5
f^Ss^F	5 , 1.1	4.5 , 0.9	0.5 , 4.7	0 , 4.5
f^Sf^F	5 , 1.1	0 , 4.5	5 , 1.1	0 , 4.5

The set of pure-strategy Nash equilibria, and hence (since the game has no proper subgames) the set of pure-strategy subgame perfect Nash equilibria, of the game are:

$$SPNE = \{(s^Ss^F, A^sA^f), (f^Sf^F, A^sA^f)\}$$

We know that any strategy profile which is part of a PBE assessment must be a SPNE, and so we can restrict our attention to the SPE strategy profiles found above.

Range of beliefs that those SPNE can be part of a PBE

Let α denote the probability with which the USA believes the ICBM development was successful when the DPRK announces a success (USA is at far left node),

$$\alpha = \text{Prob}(S \mid s)$$

Let q denote the probability with which the USA believes the ICBM development was successful when the DPRK announces a failure (USA is a second most furthest left node),

$$q = \text{Prob}(S \mid f)$$

First: Test SPNE=(s^Ss^F,A^sA^f)

After observing the announcement of success (s), the USA beliefs are:

$$\alpha = Prob(S|s) = \frac{p(s|S) * p(S)}{p(s|S) * p(S) + p(s|F) * p(F)} = \frac{1 * 0.1}{(1 * 0.1) + (1 * 0.9)} = 0.1$$

After observing the off-the-equilibrium message of failure (f), the USA beliefs are:

$$q = Prob(S|f) = \frac{p(f|S) * p(S)}{p(f|S) * p(S) + p(f|F) * p(F)} = \frac{0 * 0.1}{(0 * 0.1) + (0 * 0.9)} = \frac{0}{0}$$

Hence, belief consistency requires that α=0.1 and places no restriction on q (off-the equilibrium beliefs). Hence, we can have any $q \in [0,1]$.

In situations when success is announced (s), we have (using α=0.1) that:

$$U_{USA}(s^S s^F, R^s) = 0.1(2) + 0.9(1) = 1.1$$

$$U_{USA}(s^S s^F, A^s) = 0.1(0) + 0.9(5) = 4.5$$

$$U_{USA}(s^S s^F, R^s) < U_{USA}(s^S s^F, A^s)$$

So, it is optimal for the USA to attack when the DPRK announces a successful ICBM development.

When failure is announced (f), we have

$$U_{USA}(s^S s^F, R^f) = q(2) + (1-q)(1) = 1 + q$$

$$U_{USA}(s^S s^F, A^f) = q(0) + (1-q)(5) = 5 - 5q$$

$$U_{USA}(s^S s^F, R^f) \leq U_{USA}(s^S s^F, A^f) \text{ if and only if (iff)}$$

$$1 + q \leq 5 - 5q$$

$$6q \leq 4$$

$$q \leq \frac{2}{3}$$

Therefore, $s_{USA} = A^s A^f$ is only sequentially rational for the USA when $q \in [0, {}^2/_3]$. We need to check that $s_{DPRK} = s^S s^F$ is sequentially rational for the DPRK in this scenario. This is very straight forward, since $s_{USA} = A^s A^f$ implies that the USA will always attack. So, it doesn't matter what the DPRK does (they will receive a payoff of 0 irrespectively), making all strategies sequentially rational including $s_{DPRK} = s^S s^F$.

$$PBE = \left\{ (s^S s^F, A^s A^f), \alpha = 0.1, q) \; with \; q \in \left[0, \frac{2}{3}\right] \right\}$$

Second: Test SPNE = ($f^S f^F$, $A^s A^f$)

Belief consistency places no restrictions on α (off-the equilibrium beliefs- so we can have any $\alpha \in [0,1]$) and requires that q=0.1.

In situations when failure is announced (f), we have (using q=0.1) that

$$U_{USA}(f^S f^F, R^f) = 0.1(2) + 0.9(1) = 1.1$$

$$U_{USA}(f^S f^F, A^f) = 0.1(0) + 0.9(5) = 4.5$$

$$U_{USA}(f^S f^F, R^f) < U_{USA}(f^S f^F, A^f)$$

So, it is optimal for the USA to attack when the DPRK announces an unsuccessful ICBM development (f).

When success is announced (s), we have

$$U_{USA}(f^S f^F, R^s) = a(2) + (1-a)(1) = 1 + a$$

$$U_{USA}(f^S f^F, A^s) = a(0) + (1-a)(5) = 5 - 5a$$

$$U_{USA}(f^S f^F, A^s) \leq U_{USA}(f^S f^F, R^s) \text{ iff}$$

$$5 - 5a \leq 1 + a$$

$$a \geq \frac{2}{3}$$

Therefore, $s_{USA} = A^s A^f$ is only sequentially rational for the USA when $\alpha \in [0, {}^2/_3]$. We need to check that s_{DPRK} =\ f^Sf^F is sequentially rational for the DPRK in this scenario. This is very straight forward, since s_{USA} =\ A^sA^f implies that the USA will always attack. So, it doesn't matter what the DPRK does (they will receive a payoff of 0 irrespectively), making all strategies sequentially rational including $s_{DPRK} = s^S s^F$.

$$PBE = \left\{ (f^S f^F, A^s A^f), \alpha, q = 0.1) \; with \; \alpha \in \left[0, \frac{2}{3}\right] \right\}$$

To summarize, the set of PBE is:

$$PBE = \left\{ (s^S s^F, A^s A^f), \alpha = 0.1, q) : \; q \in \left[0, \frac{2}{3}\right] \right\} \cup \left\{ (f^S f^F, A^s A^f), \alpha, q = 0.1) : \; \alpha \in \left[0, \frac{2}{3}\right] \right\}$$

Game 2: US Intelligence community observes a successful DPRK ICBM test

- Probability ICBM development is successful: 0.9
- Probability ICBM development is unsuccessful: 0.1

Strategy Sets

The strategy sets are the same as above.

Bi-matrix

The new game can be rewritten as a bi-matrix in which the numbers are weighted by the changed underlining probability chosen by nature. The bi-matrix is as follows with best responses underlined:

	R^sR^f	R^sA^f	A^sR^f	A^sA^f
s^Ss^F	5 , 1.9	5 , 1.9	0 , 0.5	0 , 0.5
s^Sf^F	5 , 1.9	4.5 , 2.3	0.5 , 0.1	0 , 0.5
f^Ss^F	5 , 1.9	0.5 , 0.1	4.5 , 2.3	0 , 0.5
f^Sf^F	5 , 1.9	0 , 0.5	5 , 1.9	0 , 0.5

The set of pure-strategy Nash equilibria, and hence (since the game has no proper subgames) the set of pure-strategy subgame perfect Nash equilibria, of the game are

$$SPNE = \{(s^Ss^F, R^sR^f), (s^Ss^F, R^sA^f), (f^Sf^F, R^sR^f), (f^Sf^F, A^sR^f)\}$$

We know that any strategy profile which is part of a PBE assessment must be a SPNE, and so we can restrict our attention to the SPE strategy profiles found above.

Range of believes that those SPNE can be part of a PBE

The notation of the believes of the USA and their meaning are identical to the prior game.

First: Test SPNE=(s^Ss^F, R^sR^f)

Belief consistency requires that α=0.9 and places no restriction on q (off-the equilibrium beliefs). So, we can have any q∈[0,1].

In situations when success is announced (s), we have (using α=0.9) that

$$U_{USA}(s^Ss^F, R^s) = 0.9(2) + 0.1(1) = 1.9$$

$$U_{USA}(s^Ss^F, A^s) = 0.9(0) + 0.1(5) = 0.5$$

$$U_{USA}(s^Ss^F, A^s) < U_{USA}(s^Ss^F, R^s)$$

So, it is optimal for the USA to retreat when the DPRK announces a successful ICBM test.

When failure is announced (f), we have

$$U_{USA}(s^Ss^F, R^f) = q(2) + (1-q)(1) = 1 + q$$

$$U_{USA}(s^Ss^F, A^f) = q(0) + (1-q)(5) = 5 - 5q$$

$$U_{USA}(s^Ss^F, A^f) \leq U_{USA}(s^Ss^F, R^f) \text{ iff}$$

$$5 - 5q \leq 1 + q$$

$$q \geq \frac{2}{3}$$

Therefore, $s_{USA} = R^s R^f$ is only sequentially rational for the USA when $q \in [{}^2/_3, 1]$.

We need to check that $s_{DPRK} = s^S s^F$ is sequentially rational for the DPRK in this scenario. This is very straight forward, since $s_{USA} = R^s R^f$ implies that the USA will always retreat so it doesn't matter what the DPRK does (they will receive a payoff of 5 irrespectively), making all strategies sequentially rational including $s_{DPRK} = s^S s^F$.

$$PBE = \left\{ \left(s^S s^F, R^s R^f \right), \alpha = 0.9, q) \; with \; q \in \left[\frac{2}{3}, 1 \right] \right\}$$

Second: Test SPNE=($s^S s^F$, $R^s A^f$)

Belief consistency requires that α=0.9 and places no restriction on q (off-the equilibrium beliefs); so we can have any $q \in [0,1]$.

In situations when success is announced (s), we have (using α=0.9) proven above that

$$U_{USA}(s^S s^F, A^s) < U_{USA}(s^S s^F, R^s)$$

So it is optimal for the USA to retreat when the DPRK announces a successful ICBM development.

When failure is announced (f), we have

$$U_{USA}\left(s^S s^F, R^f\right) \leq U_{USA}\left(s^S s^F, A^f\right) \text{ iff}$$

$$1 + q \leq 5 - 5q$$

$$q \leq \frac{2}{3}$$

Therefore, $s_{USA} = R^s A^f$ is only sequentially rational for the USA when $q \in [0, {}^2/_3]$.

We need to check that $s_{DPRK} = s^S s^F$ is sequentially rational for the DPRK in this scenario. This is very straight forward, since $s_{DPRK} = s^S s^F$ yields DPRK the highest utility with respect to $s_{USA} = R^s A^f (U_{DPRK} = 5)$

$$U_{DPRK}\left(s^S s^F, R^s A^f\right) > U_{DPRK}\left(s^S s^{F'}, R^s A^f\right)$$

This makes $s_{DPRK} = s^S s^F$ sequentially rational for DPRK.

$$PBE = \left\{ \left(s^S s^F, R^s A^f \right), \alpha = 0.9, q) \; with \; q \in \left[0, \frac{2}{3} \right] \right\}$$

Third: Test SPNE=($f^S f^F$, $R^s R^f$)

Belief consistency places no restrictions on α (off-the equilibrium beliefs- so we

can have any $\alpha \in [0,1]$) and requires that q=0.9.

In situations when failure is announced (f), we have (using q=0.9) that

$$U_{USA}(f^S f^F, R^f) = 0.9(2) + 0.1(1) = 1.9$$

$$U_{USA}(f^S f^F, A^f) = 0.9(0) + 0.1(5) = 0.5$$

$$U_{USA}(f^S f^F, A^f) < U_{USA}(f^S f^F, R^f)$$

So, it is optimal for the USA to retreat when the DPRK announces an unsuccessful ICBM test (f).

When success is announced (s), we have

$$U_{USA}(f^S f^F, R^s) = a(2) + (1-a)(1) = 1 + a$$

$$U_{USA}(f^S f^F, A^s) = a(0) + (1-a)(5) = 5 - 5a$$

$$U_{USA}(f^S f^F, A^s) \leq U_{USA}(f^S f^F, R^s) \text{ iff}$$

$$5 - 5a \leq 1 + a$$

$$a \geq \frac{2}{3}$$

Therefore, $s_{USA} = R^s R^f$ is only sequentially rational for the USA when $\alpha \in [{}^2/_3, 1]$. We need to check that $s_{DPRK} = f^S f^F$ is sequentially rational for the DPRK in this scenario. This is very straight forward, since $s_{USA} = R^s R^f$ implies that the USA will always retreat so it doesn't matter what the DPRK does (they will receive a payoff of 5 irrespectively), making all strategies sequentially rational including $s_{DPRK} = f^S f^F$.

$$PBE = \left\{ \left(f^S f^F, R^s R^f\right), \alpha, q = 0.9) \text{ with } \alpha \in \left[\frac{2}{3}, 1\right] \right\}$$

Fourth: Test SPNE=($f^S f^F$, $A^s R^f$)

Belief consistency places no restrictions on α (off-the equilibrium beliefs- so we can have any $\alpha \in [0,1]$) and requires that q=0.9.

In situations when failure is announced (f), we have (using q=0.9) proven above that

$$U_{USA}(f^S f^F, A^f) < U_{USA}(f^S f^F, R^f)$$

So, it is optimal for the USA to retreat when the DPRK announces an unsuccessful ICBM test (f).

When success is announced (s), we have using the results obtained in step three

$$U_{USA}(f^S f^F, R^s) \leq U_{USA}(f^S f^F, A^s) \text{ iff}$$

$$1 + a \leq 5 - 5a$$

$$\alpha \leq \frac{2}{3}$$

Therefore, $s_{USA} = A^s R^f$ is only sequentially rational for the USA when $\alpha \in [0, {}^2/_3]$. We need to check that $s_{DPRK} = f^S f^F$ is sequentially rational for the DPRK in this scenario. This is very straight forward, since $s_{DPRK} = f^S f^F$ yields DPRK the highest utility with respect to $s_{USA} = A^s R^f$ ($U_{DPRK} = 5$).

$$U_{DPRK}(f^S f^F, A^s R^f) > U_{DPRK}(f^S f^{F'}, A^s R^f)$$

This makes $s_{DPRK} = f^S f^F$ sequentially rational for DPRK.

$$PBE = \left\{(f^S f^F, A^s R^f), \alpha, q = 0.9) \; with \; \alpha \in \left[0, \frac{2}{3}\right]\right\}$$

To summarize, the set of PBE is:

$$PBE = \left\{(s^S s^F, R^s R^f), \alpha = 0.9, q) : \; q \in \left[\frac{2}{3}, 1\right]\right\} \cup$$
$$\left\{(s^S s^F, R^s A^f), \alpha = 0.9, q) : \; q \in \left[0, \frac{2}{3}\right]\right\} \cup$$
$$\left\{(f^S f^F, R^s R^f), \alpha, q = 0.9) : \; \alpha \in \left[\tfrac{2}{3}, 1\right]\right\} \cup$$
$$\left\{(f^S f^F, A^s R^f), \alpha, q = 0.9) : \; \alpha \in \left[0, \frac{2}{3}\right]\right\}$$

Economic Research

Weed Money: How Fungibility affects Colorado's Education Funding Gap

Michael Howard, Junior Sophister

January of 2014 saw the legalization of the sale of recreational marijuana in Colorado, but further stipulated the first $40 million from a 10% excise tax on retail marijuana be reserved for public school capital construction. This draws upon the wider issues that Colorado's tax revenues are interchangeable, and as such taxes can be reallocated accordingly which may obstruct current federal education-based initiatives such as grants. Therein, aim of this paper remains to detect if the relationship between earmarked marijuana tax dollars and government grants to CPE is one of replacement or supplementation. This will be done by implementing a standard ordinary-least squares (OLS) method combined with a restricted and unrestricted model comparison. The econometric analysis concludes replacement, and subsequently goes onto consider possible policy implications and extensions to this study.

Introduction

In January of 2014, the sale of recreational marijuana became legal in Colorado. The amendment which accomplished this, Amendment 64, required that the first $40 million from a 10% excise tax on retail marijuana be earmarked for public school capital construction. Once it was clear that revenues from this tax would exceed $40 million inside a few years, lawmakers changed this policy to earmark revenues in excess of $40 million (from what was now a 15% excise tax) for the state public school fund. Therefore, the marijuana industry's funding of

Colorado public education (CPE) is explicitly made proportional to its own revenue by state law. This likely influenced certain demographics – namely parents and educators- in their stance on legalization and the growth of the recreational marijuana industry in general. These demographics are especially amenable to such measures due to Colorado's poor performance in many areas of public education finance.

However, if Colorado's tax revenues are fungible – that is, if monies can be easily reallocated from one sector to another, there is a possibility that hypothecations of tax revenue from the marijuana industry could replace some state and federal grants rather than supplement them. This would mean that these injections would fail to close Colorado's education funding gap. In general, the certainty of some future funding for a particular sector can encourage those in charge of fund distribution to direct generic monies away from that sector in the future or the present. This can cancel out the positive effects of new revenue sources or, if the average amount of money leaving a sector due to this phenomenon exceeds the amount of earmarked money coming in for a given period, cause total funding to decrease over time.

There is empirical evidence for this phenomenon. In Ohio, the hypothecation of casino revenues to public schools encourages lawmakers to reduce education funding on the grounds that schools have consistent revenue from other sources. These cuts are larger on average than the revenue coming in from casinos, resulting in an overall widening of the funding gap (Hollinger, 2015). Likewise, the presence of state lotteries, the revenues of which are allocated largely or entirely to education, is found to have no effect on the proportion of education expenditure due to the ineffectiveness of earmarking as a means of bolstering funding (Jones, 1994). However, there is also evidence that hypothecation can occur without significant displacement. For instance, while the introduction of earmarked gambling revenues in Illinois, Michigan and Missouri displaced a small amount of education funding, total funding was virtually unaffected and even stabilized following the emergence of these revenue sources (Ozurumba, 2009).

Clearly, it is not settled whether setting aside revenues for the reduction of specific funding gaps is a reliable strategy. The intricacies of local, state and federal budgetary politics make discussing this question in theoretical terms cumbersome. Until tax policy research unearths the characteristics which make a state's tax revenues fungible, empirical investigations of the financial effects after the fact are the most valuable resources for policymakers.

The avenues of funding between the retail marijuana industry and CPE have been open for four years. The aim of this paper is to detect whether the relation-

ship between earmarked marijuana tax dollars and government grants to CPE is one of replacement or supplementation. I find that the empirical evidence suggests replacement, and recommend that the earmarks be removed from excise tax dollars before Colorado's schools become dependent on revenues from the marijuana industry.

Data and Empirical Approach

This analysis conducts ordinary least squares (OLS) estimation using monthly multivariate data from March 2014 to November 2017 on the following variables:

- **grants:** State and federal grants to Colorado public schools and PK-12 education programs, collected from grant payment detail reports on 882 grants compiled by the Colorado Department of Education (CDE) (2017a).
- **salestax and extax:** Sales and excise tax revenues from retail marijuana, collected from tax reports compiled by the Colorado Department of Revenue (2018).
- **enrollment:** Public school enrollment numbers, collected from CDE files on pupil membership from pre-school to 12th grade (2017b).
- **propvoter40plus:** The proportion of registered voters over 40, collected from voter demographics reports compiled by the Colorado Secretary of State (Williams, 2017).

Observations are used in a linear regression of the form:

$$\Delta grants_i = \beta_0 + \beta_1 \Delta extax_i + \beta_2 \Delta salestax_i + u_i$$

where variables preceded by Δ are calculated as the change in dollars from last month, and u_i is the random error term. Due to the fact that excise tax dollars are earmarked and sales tax dollars are not, a regression which includes only total tax revenue as an explanatory variable fails to capture the effects of earmarked monies as opposed to generic monies. Likewise, a regression which includes only excise tax dollars fails to correct for the impact of generic tax dollars on the size of government coffers. Hence, I have decomposed tax revenue into excise tax and sales tax.

Under the assumption that earmarked monies are replacing state and federal grants, we would expect to estimate a negative value for β_1. This would indicate that an increase in excise tax revenue- a definite future injection into CPE- would accompany a decrease in state and federal grants. Revenue from sales tax is split between state and local government tax coffers, with 90% going to the former. Therefore, we would expect to estimate a positive value for β_2, as the monies described by $\Delta salestax_i$ should contribute by some amount to the monies described

by $\Delta grants_i$.

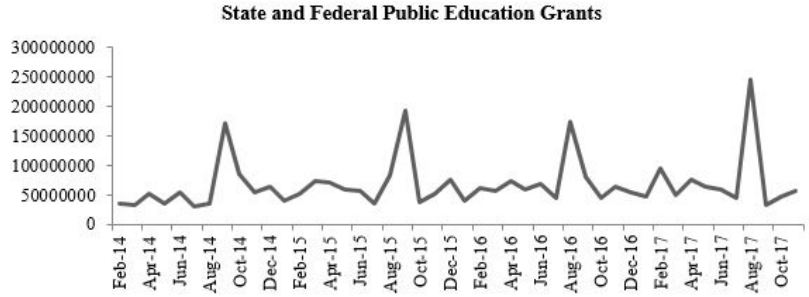
In order to detect changes in the electorate or in public schools across the state which might affect $\Delta grants_i$, I compare the explanatory power of the restricted model above with the unrestricted model

$$\Delta grants_i = \beta_0 + \beta_1 \Delta extax_i + \beta_2 \Delta salestax_i + \beta_3 enrollment_i + \beta_4 propvoter40plus_i + u_i$$

Limitations on Inference

The most severe limitation on inference from this paper is sample size. As mentioned, the avenues of funding between the retail marijuana industry and CPE have only existed for four years. It is reasonable to speculate that trends which emerge within four years of a change to tax policy may not persist on longer time scales, or that the most drastic effects have yet to emerge.

Additionally, there is some seasonality in grants which creates outliers in the data. Somewhat predictably, the sum of CPE grants jumps drastically following the beginning of the school year.



It is possible that more precise estimations of the coefficients in both models could be obtained by weighting observations in September. No effort has been made to do this here, as determining accurate values for these weights would require an estimation of the magnitude of this seasonal effect using large pools of data. Since the aim of this study is to determine which of two effects has occurred, not to produce accurate estimations of CPE funding based on marijuana tax revenue, it is assumed that neglecting to omit or weight these outliers will not significantly impact results.

Lastly, precise interpretation of the models is curtailed by multicollinearity between the predicators. Increases in excise tax revenue for a particular product are obviously related to increases in sales tax revenue for that same product. While the explanatory power of each model as a whole remains unaffected by

this characteristic, the variance of the coefficient estimates is higher due to correlation between the explanatory variables. However, this correlation is not as tight as one might expect, presumably due to sales tax rounding and variation between retail marijuana establishments. OLS regressions of each retail marijuana tax component on the other return values of R^2 less than 0.5, indicating that the variance inflation factor (VIF) of each of these variables is low enough that this characteristic can be safely ignored. Furthermore, I would reiterate that this study does not aim at precise estimates of the coefficients in either model but only at obtaining their signs and rough magnitudes.

Results

OLS estimation using the restricted model returns the following:

OLS estimation using the restricted model returns the following:

Multiple R	0.56925
R Square	0.324945426
Adjusted R Square	0.291857113

	Coefficients	**t Stat**	**P-value**
Intercept	-4231593	-0.49666	0.622021
Δsalestax	32.63757	4.289977	0.000103
Δextax	-30.7682	-2.59569	0.012951

Replacing the relevant parameters in the restricted model with their estimated values gives:

$$\Delta grants_i = -4231593 - 30.77\Delta extax_i + 32.64\Delta salestax_i$$

Including enrollment and propvoter40plus returns the following:

Multiple R	0.577855778
R Square	0.333917
Adjusted R Square	0.267309

	Coefficients	**t Stat**	**P-value**
Intercept	-1038495800	-0.419	0.677459
Δsalestax	32.76473418	4.200382	0.000145
Δextax	-31.28453693	-2.58028	0.013649
enrollment	346.7267869	0.224285	0.823677
propvoter40plus	1216076013	0.599512	0.552212

Neither of the variables unique to the unrestricted model is found to have significant explanatory power. Due to the fact that the adjusted R^2 of the restricted model is greater than its unrestricted counterpart, only the restricted model will be interpreted. Furthermore, the intercept term is found to be statistically insignificant and to vary wildly between models. This does not affect the restricted model's ability to be interpreted in the context of this study, as I am interested only in the information captured by the coefficients, but it precludes the possibility of using either model to forecast values for the dependent variable with any sort of accuracy.

Interpretation of Results

The signs and rough magnitudes of the coefficients in the restricted model suggest replacement and are significant at \propto=0.05. Again, not too much should be made of the exact estimations of \beta_1 and \beta_2 due to the inferential limitations discussed earlier, but even the 95% upper bound of \beta_1 in the restricted model, estimated to be -6.85, suggests a more than one-to-one degree of replacement of state and federal dollars by excise tax dollars in CPE funding.

Policy Implications

Based on the results of this study, Colorado's tax revenues are highly fungible, and this has allowed state and federal grants to CPE to be replaced by excise tax revenues rather than supplemented with them. It is recommended that earmarks be removed from excise tax dollars, as unmarked dollars from sales tax do not exhibit this replacement property. The fact that sales tax revenues exert a significant positive effect on CPE funding suggests that Colorado's education funding gap would be reduced more quickly if the stream of generic tax revenue from the retail marijuana sector to government coffers consisted of both sales and excise tax dollars.

These results should not be interpreted as evidence against earmarking in all cases. Hypothecation may be appropriate for specific projects and sectors, and may even be effective at closing education funding gaps in certain states, as suggested by Ozurumba (2009). However, it appears that the dynamics of financial politics pertaining to CPE funding are such that hypothecation is an inappropriate response to Colorado's poor performance in education finance.

It is worth noting that the demographics most concerned with education finance overlap strongly with the demographics most disapproving of recreational marijuana, and that the financial relationship between the two sectors is in danger of becoming one of dependence. If government funds are being taken out of CPE in expectation of compensating injections from the retail marijuana industry,

Colorado's schools may become financially dependent to some degree on that industry's success. Therefore, it is recommended that the earmarks be removed soon, before this relationship is given a chance to develop. Fortunately, the data used in this study suggests that tax revenues from retail marijuana currently make up only a small proportion- less than 2%- of total CPE funding, so the degree of dependence, if any exists, is likely to remain small for some time.

Further Investigation

The precision of policy research in this area increases with time. In the context of the method used in this paper, available data and sample size increase as policies sink in. It is recommended that similar investigations of Colorado's situation be made in the future. Additionally, some investigation into the effects of seasonality in the dependent variable grants may improve the accuracy of coefficient estimates. Lastly, as the legalization of recreational marijuana continues to crop up as a salient issue in many states, it is likely that there will be more opportunities- and perhaps obligations- in the coming years to conduct this sort of investigation in different political and economic environments. In the likely event that legalization laws pass in more states, it is imperative that the field of tax policy research provides sufficient advice on how to make the most of these new revenue sources.

Reference List:

1. Allison, P. 2012. 'When can you Safely Ignore Multicollinearity?' Statistical Horizons. [on-line], https://statisticalhorizons.com/multicollinearity. [Accessed: 24 January 2018].
2. Colorado Department of Education, 2017a. 'Grant Payment Detail Report.' [on-line], http://www.cde.state.co.us/cdefisgrant/grant_distribution_reports. [Accessed: January 1 2018].
3. Colorado Department of Education, 2017b. 'PK-12 Pupil Membership by Grade with Historical Data.' [on-line], https://www.cde.state.co.us/cdereval/pupilcurrent. [Accessed: January 26 2018].
4. Colorado Department of Education, 2017c. 'Dropout Statistics.' [on-line], https://www.cde.state.co.us/cdereval/dropoutcurrent. [Accessed: January 26 2018].
5. Colorado Department of Revenue, 2018. 'State of Colorado Marijuana Taxes, License, and Fee Revenue February 2014 to Date.' [on-line], https://www.colorado.gov/pacific/sites/default/files/1217_CalendarReport%20PUBLISH.pdf. [Accessed: January 1 2018].
6. Hollinger, M. 2015. 'The Fungibility of Sin Taxes: An Economic Analysis of the Effect on Our K-12 Public School System.' Malone University, Ohio-

LINK Electronic Theses and Dissertations Center. [on-line], https://etd.ohiolink.edu/pg_10?0::NO:10:P10_ACCESSION_NUM:ma1431083284 [Accessed 25 January 2018].

7. Jones, T. H. 1994. 'America's gamble: Lotteries and the Finance of Education.' Presented at the American Educational Studies Association annual meeting, Chapel Hill, NC. [on-line], https://archive.org/details/ERIC_ED380903. [Accessed 20 January 2018].
8. Ozurumba, C. 2009. 'The Impact of Legalized Casino Gambling on State Education Spending Displacement.' Journal of Public Budgeting, Accounting & Financial Management, 21:1: 84-104.
9. United States Census Bureau 2016. 'Public Education Finances: 2014.' G14-ASPEF, U.S. Government Printing Office, Washington, DC. [on-line], https://www.census.gov/content/dam/Census/library/publications/2016/econ/g14-aspef.pdf. [Accessed: January 26 2018].
10. Williams, W. W., 2017. 'Voter Registration Statistics.' Colorado Secretary of State. [on-line], http://www.sos.state.co.us/pubs/elections/VoterRegNumbers/VoterRegNumbers.html. [Accessed: January 1 2018].

A New Theory of Health and Consumption

Ryan Cleary, Senior Sophister

In this paper, Ryan Cleary proposes an original model for consumers' decisions when deciding how much to spend on healthcare rather than other forms of consumption. While most of the literature is based on the idea of healthcare as a part of human capital, Ryan offers a new view of health's effects on consumption, which illustrates the channels through which health spending affects utility. In conclusion, he proposes a reconciliation point between the two separate views of health from the consumer and health as a form of capital in order to understand the consumption decision of healthcare.

Much of the theory regarding decisions on health expenditure is derived from Michael Grossman's influential paper "On the Concept of Health Capital and the Demand for Health". This paper considers health as a part of human capital. People have a stock of health, which they then must maintain over the course of their lives through expenditure on healthcare. The treatment of health in this model is like other forms of human capital, such as a skill. People must maintain health to be fit to work, as they must maintain their skills to perform their work.

This way of viewing health has created its own branch of literature in the past decades (See Wagstaff, 1986, 1993; Jacobson, 2000). The work of Grossman has been the leading way of viewing health, however, as shall be argued, it only views health as a form of capital, and this is an incomplete view. The purpose of this paper is to develop a new model of health expenditure decisions facing individuals. It shifts the focus of health as a form of capital to health as something that affects utility. People improve their health, and this underlies the enjoyment of the rest of their consumption. Health, in this way, is more than a simple consumer good and this requires a special treatment.

Significance

This model deviates from the previous literature in its focus on health's relationship with utility. If someone is healthy, this model assumes he or she will enjoy

life much more than if he or she were not. Beginning with the idea of health affecting utility, the rest of the model emerges to illustrate the consumption tradeoffs for individuals. Health (or more appropriately, demand for health) will enter this model through spending on healthcare, which is simplified into a premium. This could be considered, for example, as a premium for health insurance.

Simple Model: Health and Length of Life

The first of the 2 models (summarised in Appendix A) which will be developed is a simple exposition of this model which is needed to illustrate the core ideas, establishing the groundwork needed to understand the more complex model. A person chooses their premium and consumption based on their lifetime income, which is known. Their expenditure on the premium affects the length of their life.

Assumptions

Length of Life

The representative person lives for L years if they remain disease-free.

Illness

This model will use a representative illness, which is contracted by a proportion, r, of people in the society.

$$0 < r < 1$$

The r people who contract the disease lose λ years of life. This means the representative person in a world before treatment the following determines life length:

$$Periods\ lived = (1 - r)L - r(L - \lambda) = L - r\lambda$$

Given that the disease will be contracted by a proportion of r people, (1−r) people will live the full L years.

Treatment

Treatment will be represented by variable T. If the agent becomes ill, they receive treatment based on the level of premium they selected. Treatment is a function of the premium. $T_{(P)}$ represents the number of periods gained back if a person gets sick. $T_{(P)}$ is related positively to P. Formally this is written as

$$\frac{dT}{dP} > 0$$

The more money a person spends on their healthcare, (P) the more effective their healthcare is. This means that those who contract the illness see a reduction in the years they lose. The following condition is imposed for simplicity:

$$\lambda > T_{(P)}$$

Alternatively, the loss of life from having the disease is higher than any recovery by treatment. This assumption means L is the upper limit on life. Someone cannot spend money on their Premium and extend their life years beyond L. This assumption is not crucial, but it simplifies the calculation and still allows the intuition to be displayed without the complicating cases of people extending their lives beyond L. This leaves the following expression for the length of life:

$$Years\ lived\ with\ health\ spending = (1-r)L + r(L + T_{(P)} - \lambda)$$

The person will live for L years with probability (1 – r). They contract the illness and lose λ years of life with probability r. In the event they do contract the illness, they regain $T_{(P)}$ years of life. As an aside, if

$$T_{(0)} = 0$$

This means if someone does not spend money on the health, they see no increase in their life in the event they become ill. If $T_{(0)}$ was some positive number, then this could be considered the social minimum healthcare offered through government or access to free clinics. This is not the case here, for simplicity, but it is not difficult to conceptualise and could have interesting implications for voting for socialised medicine and health spending vs consumption.

Money

A person has a budget of M. They can spend money on two things; consumption goods or the health. They will spend all their money in their lifetime. In this way, the following is true:

$$C + I = M$$

Income is simplified in this model and is equal to M. M represents a smoothed income in each period and C and P represent smoothed consumption and health expenditure in each period, as per the Permanent Income Hypothesis.

A person's income expenditure is governed by the Euler Equation where:

$$u'(c_t) = \beta^{t+1}u'(c_{t+1})(1+r) = \ldots = \beta^{t+n}u'(c_{t+n})(1+r)$$

$$for\ simplicity, \beta = 1 \text{ and } r = 0$$

$$u'(c_t) = u'(c_{t+1}) = \ldots = u'(c_{t+n})$$

$$which\ implies$$

$$c_t = c_{t+1} = \ldots = c_{t+n} = C$$

A level of C is not needed in every period because it smoothed. A single C, the smoothed value of consumption, is used in the model. This simplifies the

effects of transitory income, such as retirement.

Utility

Simplifying consumption will lead to utility from consumption being Log(C). This means that, before we add in the length of life, Utility will be:

$$U = Log(C), which\ means\ U'(c) = \frac{1}{C} > 0\ and U''(c) = -\frac{1}{C^2} < 0$$

The first order condition means changes in income have a positive effect on utility, and the second confirms diminishing marginal utility. Now we multiply the log of consumption by the length of life lived. Consumption smoothing will be in effect, so the person's utility will be the consumption each period multiplied by the number of periods:

$$U(C,P) = Log(C)[(1-r)L + r(L + T_{(P)} - \lambda)]$$

OR

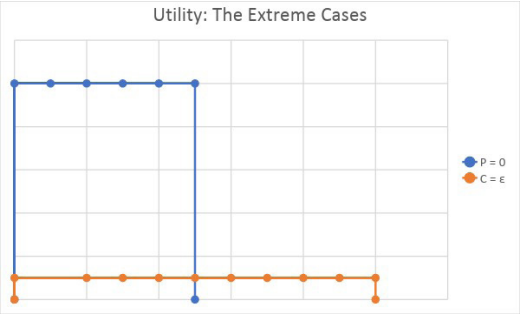
$$U(C,P) = Log(C)[L + rT_{(P)} - r\lambda)]$$

And the agent will maximise this subject to:

$$C + P = M$$

Interpretation

If an agent only consumes and does not pay for health, they will live for $L - r\lambda$ years and the highest consumption, but the lowest possible life length. By sacrificing some consumption, they increase their years lived but have little consumption, and little utility, in each period. The following stylised graph illustrates this:



In this graph, when P = 0, life is short however each period gives high utility. In the case where C = ε, and ε is small and positive, life stretches much further with each period granting little utility. The agent seeks to maximise the area under this curve, which is found geometrically. The same optimisation senti-

ment holds true with the following, more complex, model. This example has laid down the framework.

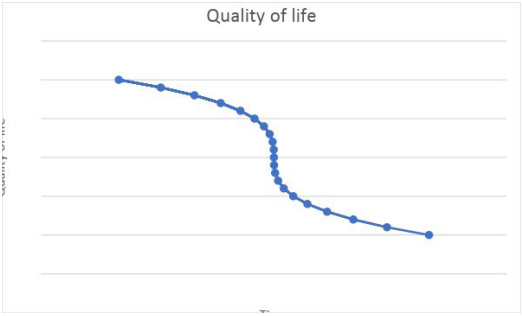
Model 2

Quality of Life

Up until now, Quality of Life is assumed constant throughout the agent's life. Therefore, the graphs given previously are angular. Quality of life, and utility, decline over time. People's quality of life is assumed to depreciate and their ability to experience joy depreciates as they age. For example, a young person would likely enjoy a cricket game much more than an older person who may struggle with deteriorating eyesight. The item they consume is the exact same at the same cost, but the younger person's experience will be better due to their higher quality of life.

Representing Quality of Life

To represent the progression of quality of life graphically, a type of equation must be chosen. For this analysis, the cubic equation has been selected as the closest representation of quality of life.



Mechanically, this will follow the following sort of system, using just an (x,y) space.

$$-x = y^3$$

Where x and y correspond to their corresponding axis. This will give the graph as presented above. Bringing this into the model, we replace x and y with what they represent in this model: Time and Quality of Life respectively.

$$-t = \text{Quality of Life}^3$$

Where the lower-case t represents time in this model. Lower case is used to differentiate time and the Treatment from earlier.

Intuition

Initially a person will have a relatively steady quality of life, which will decline with age. As they age, they suffer general deterioration. Very often an event

will happen which will drastically deteriorate the person's health. This could be a heart attack, a stroke, or car crash. This could even be something less severe, and then the downwards kink may be very gentle.

After the event, either the person will die, or they will continue to live at a much lower quality of life level. Their quality of life will then continue to deteriorate for the general wear and tear reasons as before. In this world, death is assumed to occur when quality of life becomes 0.

Factoring Quality of Life Into the Equation

In this case, a person will still seek to maximise their utility through consuming and living a long life, but now quality of life is also factored into the utility equation. This is done in the same way as length of life.

- A person who does not contract a disease will live with a Quality of life of q.

q is a function of time, with the condition that:

$$\frac{\partial q_{(t)}}{\partial t} < 0$$

- Or that quality of life declines over time as a person ages.
- Those who contract the disease will lose a quality of life equal to δ.

The insurance will return a quality of life of w, and this is a function of the premium P. As with treatment,

$$\frac{\partial w_{(p)}}{\partial P} > 0$$

Or that the return to quality of life depends positively on the premium. The more the agent pays, the more quality of life will be returned to them.

Quality of life will then be standardised by dividing it by q. This ensures that it is between 0 and 1.

$$Quality\ of\ Life = \frac{q_{(t)} - r\partial + rw_{(p)}}{q_{(t)}}$$

By dividing by q, a person with no chance of getting sick will live with a quality of life of 1, which represents a full quality of life. Any illness will then alter this to be a number between 0 and 1, representing a lower quality of life. Furthermore, this cannot be negative. To make this negative would imply a negative quality of life, and the person would die by construction.

In the event that a person were to live without becoming sick, then $r = 0$, which gives 1. This represents a full quality of life. q itself is a function of time, representing the deterioration of health, and therefore enjoyment of life, before death. If someone does get sick, his or her quality of life suffers based on δ, or the degradation caused by illness. They recover quality of life according to w, which is

a function of P. For simplicity, "security" is not considered in this model. People do not feel anxious for not choosing a high P, nor do people with a high P feel more secure and thus in better health without the worry.

Now that we have an expression for the quality of life, we can factor this into the model. A reduced quality of life will "dampen" the utility from consumption. It is because of this, it enters the equation as the coefficient of consumption. Finally, in this model, we have already established the intercept, which is the point of death. Mechanically, this enters on the right-hand side as it has been written previously.

We are left with this following equation:

$$-x = Log(C)(\frac{q_{(t)} - r\partial + rw_{(p)}}{q_{(t)}})^3 - [L + rT_{(P)} - r\lambda]$$

This follows the pattern of

$$-x = ay^3 - c$$

Which is needed to give the graphic form as depicted above. Breaking up the parts of the equation illustrates the role each plays.

$-x$	Time. The x-axis.
a	$Log(C)$, the coefficient of the y variable.
y	$\frac{q_{(t)} - r\partial + rw_{(p)}}{q_{(t)}}$ The y variable which is quality of life. A function of time.
c	$L + rT_{(P)} - r\lambda$ The intercept of the x axis. Represents the point of death, when quality of life is equal to 0.

Maximising Condition

Just as in the simpler example given previously, the agent seeks to maximise the area under the curve. Whereas the previous example had a simple geometric solution of length times height, this solution requires an integral.

Maximise

$$U(P, C) = \int_0^{L + rT_{(P)} - r\lambda} (Log(C)(\frac{q_{(t)} - r\partial + rw_{(p)}}{q_{(t)}})^3 - [L + rT_{(P)} - r\lambda]dt$$

Breaking down this integral, the function being maximised is the curve established earlier. The maximisation point starts at

$$t = 0$$

and this continues until

$$t = L + rT_{(P)} - r\lambda$$

This, as has already been established, is the length of the life. t = 0 can be considered birth and life runs until death, which was obtained from the previous model.

Constraint

As before, the agent is limited by money. Their income is assumed to be known. The individual chooses levels of P and C. These must be equal to their total income. It is assumed that the individual will spend all their income. This results in:

$$C + P = M$$

What we have now is the following:

$$Maximise\ U(C,P)$$
$$= \int_0^{L + rT_{(P)} - r\lambda} Log(C)\left(\frac{q_{(t)} - r\partial + rw_{(p)}}{q_{(t)}}\right)^3 - \left[L + rT_{(P)} - r\lambda\right]dt$$
$$subject\ to\ C + P = M$$

Through this, it is possible to see the interactions between the variables and the channels through which the choice variables and others affect Utility and, ultimately, the Consumption decision.

The best way to understand this model is to break it into its constituent parts; namely, the length of life equation, which appears as the intercept and the utility, gained from consumption, which is effected by quality of life.

The term r appears in both parts, and represents the proportion of people who contract the illness.

$$\frac{\delta(Length\ of\ life)}{\delta r} = T_{(P)} - \lambda$$

This means that if r increases, more people get the disease. This decreases the years someone expects to live given a level of P, which makes sense given that they are more likely to become sick. It also increases the benefits of T, as T is now more likely to be needed. For the representative agent, there is a greater reward to T given that r increases as it will recover more years of life should they become sick, which is more likely.

A very similar result is obtained when calculating using quality of life, which shows as r increases, representative quality of life declines but there is a greater return to w. This method of breaking apart the model into its constituent parts

works well to illustrate the dynamics for any variable.

Interpretation

If the person increases spending on P, then Log(C) falls. This will lower utility due to the restriction that C + P = M. An increase in P necessitates a fall in C. P appears twice in the equation. W and T are functions of P. By increasing spending on P, the agent will have a higher quality of life as $w_{(p)}' > 0$ and they will live longer as $T_{(P)}' > 0$. By living longer and experiencing a higher quality of life, the person will see an increase in their utility.

This suggests a balance between consumption and health expenditure is desirable, and there exists a balance, which maximises utility. Diminishing marginal utility prevents favouring only one of the two goods to the complete neglect of the other, in most cases. Eventually there will come a point where the agent would rather extend their life over consuming more, or vice versa.

Given that, this is a utility equation whereby the objective function is U(C,P), the optimality condition will be given by

$$U'(C) = U'(P)$$

The marginal gain in utility from increasing consumption is equal to the marginal gain in utility from increasing health spending.

Final Extension

The model still has scope for further development to deal with the limitations, which currently exist within the model. Income itself is related to well -being. Income is treated as exogenous above, however it could be incorporated into the model through developing the budget constraint to be dependent on health.

Conclusions

The model presented displays the interaction between the various variables in question. It not only illustrates how changes in expenditure affect utility of the agent, but also crucially illustrates the exact channels through which these changes occur, which is not something which has been illustrated previously. This is a necessary paper as it represents another element of health, which has not been considered in the literature thus far. The seminal paper in this area considered health to be a form of human capital.

This is a valid view of health; however, it is quite narrow and ignores the relationship between utility and being healthy. By viewing health as a good itself, the above model challenges the way people perceive health. It is not just capital to be maintained, but rather something which fundamentally alters the way we experience consumption.

The limitations of this model, specifically income's relationship to health,

provide scope for further development of this model. If done, this model would become a more complete model of healthcare and consumption, taking both the income and quality of life effects health has on overall utility. This paper does however illustrate the relationship between health and utility derived from consumption. Understanding this mechanism is important if we wish to truly understand the decisions agents face regarding health spending. I hope that by approaching the question in a unique manner, this paper has contributed to our understanding of how health-spending decisions are, and should be, made.

Reference List:

1. Grossman, M; On the Concept of Health Capital and the Demand for Health; Journal of Political Economy March-April 1972, the University of Chicago Press
2. Jacobson, L; The Family as a Producer of Health – an Extended Grossman Model; Journal of Health Economics: September 2000, Volume 9 Issue 5 Wagstaff, A; The Demand for Health: An Empirical Reformulation of the Grossman Model; 1993 http://onlinelibrary.wiley.com/doi/10.1002/hec.4730020211/full accessed 16/02/2018 Accessed 16/02/2018
3. Wagstaff, A; The Demand for Health, a Simplified Grossman Model; 1986 http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8586.1986.tb00206.x/full Accessed 16/02/2018

Appendix A

Model 1: Summary

The agent lives for L years. The agent contracts a representative disease with probability r, which will reduce their life by λ years.

The agent spends money on health and consumption, P and C, which must equal their budget, M.

Treatment is a function of the health expenditure and can partially offset their loss should they become ill.

People maximise their length of life times their consumption, or:

$$\text{Maximise } U(C,P) = Log(C)[L + rT_{(P)} - r\lambda]$$

Subject to:

$$P + C = M$$

Appendix B

Model 2: Summary Length of Life is determined as above, quality of life is no longer held constant. Quality of life is determined by q, which is a function of time, t, such that:

$$\frac{\partial q}{\partial t} < 0$$

A person loses quality of life of δ should they become ill but this if offset by treatment, represented by $w_{(p)}$

$$Quality\ of\ Life = q_{(t)} - r\partial + rw_{(p)}$$

This is divided by q to be between 0 and 1, with 1 (when r=0) representing a full quality of life as $w_{(P)} < \delta$.

$$0 < \frac{q_{(t)} - r\partial + rw_{(p)}}{q_{(t)}} < 1$$

A cubic function is used to represent the path of a person over the course of their life. After filling in the relevant variables, this gives the final integral to be maximised, subject to the same budget constraint as before:

$$(P, C) = \int_0^{L+\ rT_{(P)} - r\lambda} (Log(C)(\frac{(1-r)q_{(t)} + rw_{(p)} - \partial r}{q_{(t)}})^3 - [L + rT_{(P)} - r\lambda]$$

Subject to C + P = M

Survival of the Fittest? An Econometric Analysis in to the Effects of Military Spending on Olympic Success from 1996-2012.

Mark Frahill

The Olympics are the world's greatest sporting celebrations, seen as a celebration of sporting values and a unified spirit. However, what determines the winners? In this essay Mark Frahill takes a novel perspective and assesses the relationship between a country's militarisation and its medal haul, discussing the possible mechanisms of this relationship and carrying out a comprehensive econometric analysis of the relationship. He finds that while there is evidence of a relationship it is not conclusive, which shows awareness for the level of estimation and uncertainty in econometric analysis, something often overlooked.

Introduction

What does it take to produce an Olympic champion? A nation naturally needs significant economic resources to boost health outcomes and be capable of investing in long-term training and infrastructure. The determinants of success in the Olympic Games would be expected to be the wealth of a nation and its population size. However, the interaction between Olympic success and the militarization of nations is important in understanding issues in society and global context today.

The regression analysis I will use is dependent on the assumption that changes in military spending cause changes in the obtainment of Olympic medals. I will hypothesise that military spending will cause higher receipt of medals because those countries with higher military spending would see the Olympic Games as an opportunity to gain soft power, influence and an opportunity to raise

national pride. Militarised countries would have an interest in maximising this type of power and would inevitably see the Olympic Games as a way of obtaining this power. I propose that it would be difficult for the receipt of Olympic medals to increase military spending.

As an example, consider the fact that India, with a population of over 1.2 billion people has just 28 medals, while the USA (approximately 350 million people) has 2520 medals. We can see rich countries such as Monaco and Singapore that have gathered few medals and the massively populous India has less than even the small island of Ireland, while the United States overwhelmingly dominates. I will present this snapshot of the 1996 Summer Olympics in Atlanta in which the USA won 101 medals, Ireland won 4, while Cuba won 25 and India picked up a solitary medal. Here, again, Ireland won more than India and the US topped the board, but Cuba (which spends more than average on military) won 25 medals. This paper asks the question of whether countries can expect to win more medals by increasing military spending.

Literature Review

The Summer Olympic Games is, globally, the largest sporting event and a source of both national pride and lifetime success for its athletes. Bernard and Busse (2004) establish the link between economic strength and Olympic success. They used pooled data from 1960-1996 and found that population and income per capita are needed to generate high medal totals. Johnson and Ali (2004) examined the 1952-2000 Summer and Winter Olympic Games. They concluded that socioeconomic factors explain Olympic participation rates particularly well. Income is a key driver of success with wealthier more populous countries being more capable of sending athletics to compete and therefore succeed.

Of course, no econometric model can capture every political and economic factor involved in medal winning. Research from Ho man, Ging and Rama (2002) found that many inherent characteristics and cultural factors have an impact on the receipt of medals, although to a limit. These factors are very difficult to quantify in practice and this paper has strictly included only quantitative factors in its analysis.

Research about Olympic success has largely focused on the characteristic determinants of each economy such as GDP per capita and population, without considering the distribution of the spending. The research presented in this paper provides a fresh perspective on the Olympics, analysing data from recent games during 1996-2012, and adds to the literature by considering new variables of interest such as military and healthcare spending in terms of current US dollars. This paper seeks to prove that if medal distributions act in a way that is consistent

with countries that have a high proportion of military and healthcare spending.

Data and Expectations

The data for this paper, broadly speaking, consistent of two dimensions; Olympic Medal Counts and Economic Indicators. Five Olympic Games (1996, 2000, 2004, 2008, and 2012) and 190 countries were analysed.

The 2016 Olympic Games was excluded as 2016 economic data was not yet available for countries at the time of this study. Olympic Games prior to 1996 were not analysed as data was not available comprehensively or readily available for countries. In addition, due to the fall of Communism and breakup of communist countries such as the Soviet Union and Yugoslavia in the early 1990s, older currencies would be difficult to compare, and many newly created countries would be problematic to analyse.

Additionally, Olympic participants that are territories of countries were not included, for instance places such as Guam, Cayman Islands or Macao. Neither were countries with unreliable figures such as North Korea or Somalia. Countries that had no military or health expenditure were dropped from the dataset as they were not of interest to the study.[1]

The dependent variable of this examination was Olympic performance by total medals won per Olympics per participant country. This was taken from an aggregate number of bronze, silver and gold medals won by each country that year and treating each medal as worth the same. The data for each country was readily available online.

The independent variables were a range of economic indicators about each country. The data for military expenditure in current US dollars, healthcare expenditure in current US dollars, GDP in current US dollars, GDP per capita in current US dollars, population, and country area in total kilometres squared, were all readily available online and were taken from the World Bank and CIA World Factbook.

Empirical Approach

Using a simple regression model:

$$\text{medals} = \beta_0 + \beta_1 \text{armyVOL}$$

The variable "medals" represents the number of medals a country obtains at a given Olympic games, while the dependent variable "ArmyVOL" represents the volume of military spending in the country. This equation should estimate the gross effect of military spending on medal hauls through the coefficient β_1.

Military spending, however, is not the only factor affecting Olympic medal hauls, so it is highly probable that this model would suffer from omitted variable bias. Therefore, I will control for the other main likely determinants of Olympic

medals won using a multiple regression model:

$$\text{medals} = \beta_0 + \beta_1 \text{armyVOL} + \beta_2 \text{gdp} + \beta_3 \text{gdpcap} + \beta_4 \text{size} + \beta_5 \text{pop} + \beta_6 \text{healthVOL}$$

This model attempts to describe the net effects of each independent variable on Olympic medal hauls, controlling for the other variables. This model is much less likely to suffer from omitted variable bias, as most of the key factors influencing medals are controlled for in this way.

Panel data estimation methods were applied to this study's data. Its advantage over time series is that it controls for unobservable and time-invariant factors. It also overcomes the omitted variable bias that is likely to exist in the Olympics, for instance cultural and geographic influences, which Hoffman, Ging and Rama (2002) demonstrate have an influence.

Both fixed effects and random effects were considered. A Hausman Test was run to decide between fixed effects and random effects estimation, concluding that due to a p-value of 0.0035, fixed effects estimation was appropriate. Using FE estimation allows for correlation between the unobserved effects and the independent variables, as opposed to RE which requires these to be uncorrelated.

To test the quadratic relationship between what might cause an Olympic medal to be won and military spending the following initial model is specified:

$$\text{medal}_{it} = \beta_0 + \beta_1 \text{armyVOL}_{it} + \beta_2 \text{armyVOL}_{it}^2 + \alpha_i + u_{it}$$

Then a more comprehensive model is examined to try and incorporate a full examination using what has been learned from the background literature, such that:

$$\text{medals}_{it} = \beta_0 + \beta_1 \text{armyVOL}_{it} + \beta_2 \text{armyVOL}_{it}^2 + \beta_3 \text{gdp}_{it} + \beta_4 \text{gdp}_{it}^2 + \beta_5 \text{gdp}_{it} + \beta_6 \text{gdp}_{it}^2 + \beta_7 \text{size}_{it} + \beta_8 \text{size}_{it}^2 + \beta_9 \text{pop}_{it} + \beta_{10} \text{pop}_{it}^2 + \beta_{11} \text{healthVOL}_{it} + \beta_{12} \text{healthVOL}_{it}^2 + \alpha_i + u_{it}$$

Table 1 provides a breakdown of the summary statistics for the data and the number of observations.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
medals	716	6.072626	14.71407	0	111
gdp	716	23.98341	2.328683	16.32794	30.41327
gdp^2	716	580.619	112.4467	266.6016	924.9668
gdpcap	716	8.06341	1.651255	4.782983	11.63383
gdpcap^2	716	67.74142	26.98323	22.87692	135.3459
size	716	12.0322	2.0998	5.755742	16.65449
size^2	716	149.1769	48.32073	33.12857	277.3719
pop	716	16.12071	1.653799	11.24396	21.02389
pop^2	716	262.6084	53.48263	126.4266	442.0038
armyVOL	716	19.84806	2.472037	13.14339	26.69813
armyVOL^2	716	400.0477	98.57866	172.7487	712.7902
healthVOL	716	21.10588	2.444592	12.78831	27.81892
healthVOL^2	716	451.4257	104.4983	163.5408	773.8923

Descriptive Statistics

The variables are as follows:

Table 2: Variable Descriptions

medals	Number of Olympic Medals won by a country at an Olympic Games
gdp	GDP in current US Dollars (natural log)
gdp²	gdp squared
gdpcap	GDP per capita in current US Dollars (natural log)
gdpcap²	gdpcap squared
size	Total area of a country in km^2 (natural log)
size²	size squared
pop	Total population of a country (natural log)
pop²	pop squared
armyVOL	The volume of military expenditure in current US dollars (natural log)
armyVOL²	armyVOL squared
healthVOL	The volume of health expenditure in current US dollars (natural log)
healthVOL²	healthVOL squared

Table 3: Variable Correlations

	medals	gdp	gdp²	gdpcap	gdpcap²	size	size²	pop	pop²	armyVOL	armyVOL²	healthVOL	healthVOL²
medals	1.0000												
gdp	0.3941	1.00 00											
gdp²	0.4117	0.99 77	1.0000										
gdpcap	0.3191	0.44 60	0.4487	1.0000									
gdpcap²	0.3268	0.44 76	0.4508	0.9950	1.0000								
size	0.3585	0.24 45	0.2566	-0.1450	-0.1441	1.0000							
size²	0.4008	0.27 16	0.2840	-0.1154	-0.1151	0.9906	1.0000						
pop	0.4435	0.42 26	0.4359	-0.1203	-0.1157	0.7233	0.7230	1.0000					
pop²	0.4642	0.43 56	0.4498	-0.1121	-0.1083	0.7120	0.7176	0.9968	1.0000				
armyVOL	0.4100	0.92 71	0.9265	0.4510	0.4508	0.2757	0.3014	0.3974	0.4066	1.0000			
armyVOL²	0.4325	0.93 20	0.9360	0.4526	0.4530	0.2876	0.3138	0.4167	0.4273	0.9967	1.0000		
healthVOL	0.4236	0.98 63	0.9854	0.4764	0.4800	0.2371	0.2610	0.4018	0.4119	0.9155	0.9209	1.0000	
healthVOL²	0.4436	0.98 21	0.9865	0.4800	0.4844	0.2502	0.2742	0.4147	0.4257	0.9138	0.9245	0.9968	1.0000

The expected results are as follows:

armyVOL: Is expected to have a positive effect, as the Olympics are a display of national superiority which presumably is more important to countries that spend more on their military power.

gdp: The background literature establishes the significance, and it makes economic sense that countries with more resources can invest in sports programs and infrastructure and increase medals won.

gdpcap: Is expected to have a positive effect as richer countries can afford to invest more in individuals training and athletics career opportunities.

pop: Is expected to have a positive effect as countries have a greater talent pool from which to draw competitors.

size: Is expected to have a positive effect, as there is more area for infrastructure and diversity of sport.

healthVOL: Is expected to have a positive effect as citizens would presumably be healthier and in better physical form to compete in the Olympics

Empirical Results

Results of the simple regression were as follows:

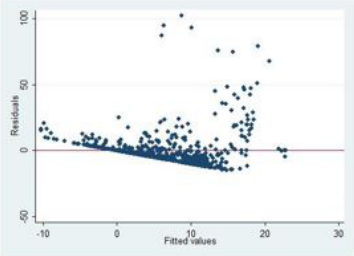
medals = 42.36894 + 2.44062armyVOL

Table 4: Simple Regression Results

Simple Regression Results	Medals
armyVOL	2.4406***
	(.2051)
Constant	-42.3689***
	(4.0636)
Observations	716
Number of countries	162
R-squared	0.1681
Standard errors in parentheses*** p<0.01, **p<0.05, *p<0.1	

The simple regression indicates that the relationship between a country's military expenditure and their Olympic success is statistically significant. An R-squared value of 0.1681 was obtained, implying that armyVOL can explain 16.81% of the variation in the model within a simple linear regression. According to the t-test, armyVOL is significant at the 1% level. This confirms this paper's working assumption that military expenditure influences Olympic success and that the relationship is positive. However, as we can see from a plot of the residuals against the fitted values in Figure 1 there is a clustered pattern which should not be true for linear data, implying there is violations of the least squares assumptions as the residuals are not homoskedastic. This opens the model up to further examination such as quadratic forms and heteroskedasticity analysis through robust tests.

Figure 1: Fitted values against residuals for Equation 5



Results of the multiple regression were as follows:

$$\text{medals} = 62.45367 + 1.0719\text{armyVOL} - 7.48\text{gdp} + 2.709\text{gdpcap} + 0.6439\text{size} + 6.612\text{healthVOL}$$

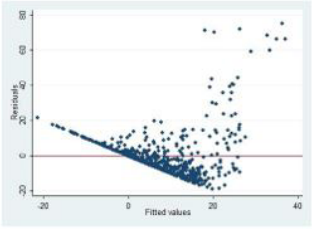
Table 5: Multiple Regression Results

Multiple Regression Results	medals
armyVOL	1.0729** (.4815)
Gdp	-7.4808*** (1.256)
gdpcap	2.7089*** (0.3305)
size	.6439** (.3076)
healthVOL	6.6129*** (1.115)
Constant	-62.454*** (7.06)
Observations	716
Number of countries	162
R-squared	0.3808

Standard errors in parentheses*** p<0.01, **p<0.05, *p<0.1

Exploring more independent variables in the multiple regression leads to new results as can be seen in Table 5, with an R-squared explaining 38.04% of the variation in medal-winning. Four variables (gdp, gdpcap, pop, healthVOL) were significant at the 1% level and two at the 5% level (size, armyVOL). The relationship between armyVOL and medals is still positive. All the other relationships are positive as expected, except for gdp which has a large negative coefficient which is strange as the background literature demonstrated a positive effect. Looking at a plot of the fitted values against the residuals we can see a clustered pattern, concluding the linear assumptions needed for OLS are not present which may explain this negative coefficient.

Figure 2: Fitted values against residuals for Equation 6



The results from the FE estimation are shown in Table 6. An R-squared of 0.2469 was obtained. 24.69% of the variation in medal winning is explained by the volume of military spending by a country. The armyVOL and armyVOL^2 are seen to be statistically significant at the 10% and 1% levels. The t-values are all significant. The Prob > F is 0.0057 which implies the model is alright and all the coefficients are statistically significant from zero. The coefficients of the independent variables are listed as -5.858 and 0.1604 such that:

$$medals=5.858+0.5208armyVOL$$

The (maximum) turning point for this value should be armyVOL=5.858/0.3208= 18.2606, which is equivalent to $86,318,076.43.2 This seems to confirm the working assumption that medal-winning can be function of only countries with high military spending, though naturally much more investigation is required. However, the rho value is 0.92944 implying that 93.94% of the variance is due to differences across panels. As we can see from Table 6, after running the robust fixed estimation each variable is no longer statistically significant.

Table 6: Fixed Effects and Robust Fixed Effects

	Fixed Estimation	Robust Fixed Estimation
armyVOL	-5.858*	-5.858
	(2.336)	(7.835)
armyVOL2	0.1604***	0.1604
	(0.593)	(0.2092)
Constant	58.190*	58.190
	(22.906)	(71.829)
Observations	716	716
Number of countries	162	162
R-squared	0.2469	0.2469

Standard errors in parentheses*** p<0.01, **p<0.05, *p<0.1

Extending our panel data analysis to our full range of chosen variables we get a full picture of the effects. The R-squared is 0.2842, implying the explanatory variables explain 28.42% of the variation. The Fixed Effects estimation showed only four variables to be statistically significant armyVOL, armyVOL^2, healthVOL and healthVOL^2, while using robust measures resulted in no statistically significant variables. This is different from what we expected. The Prob > F is 0.0135 which implies the model is not alright and all the coefficients are not statistically

significant from zero. The coefficients of the independent variables armyVOL and armyVOL2 are listed as -7.85391 and 0.2255 such that:

$$medals = 7.85391 + 0.451 armyVOL$$

The (maximum) turning point for this value should be armyVOL=7.85391/0.451= 17.41, which is equivalent to $36,558,877. This seems to confirm our working assumption that medal winning can be function of only countries with high military spending, though naturally much more investigation is required. However, the rho value is 0.9147 implying that 91.47% of the variance is due to differences across panels.

Table 7: Fixed vs Robust Estimation

	Fixed Effects Estimation	Robust Fixed Effects
armyVOL	-7.85391*	-7.85391
	(4.093)	(5.751)
armyVOL^2	.2255687**	.2255687
	(0.1081)	(0.1579)
gdp	17.27902	17.27902
	(11.254)	(23.228)
gdp^2	-.3873933	-.3873933
	(0.4210)	(0.5120)
gdpcap	2.276458	2.276458
	(2.078)	(3.695)
gdpcap^2	-.1794398	-.1794398
	(0.1336)	(0.2575)
pop	-13.56585	-13.56585
	(15.589)	(17.1883)
pop^2	.510821	.510821
	(0.5)	(0.6158)
healthVOL	-12.94962*	-12.94962
	(7.533)	(15.019)
healthVOL^2	.3218201*	.3218201
	(0.1820)	(0.376)
Constant	88.61725	88.61725
	(123.27)	(104.1906)
Observations	716	716
Number of countries	162	162
R-squared	0.2842	0.2842

Standard errors in parenthesis*** p<0.01, **p<0.05, *p<0.1

The variable size indicating a countries area in km^2 in naturally unchanged from year to year and so was run in a separate random effects regression to avoid collinearity within the fixed effects estimation results. The results were as expected. An R-squared of 0.2398 was obtained, therefore 23.98% of the variation in medal winning is explained by the landmass of a country. The size and size^2 are seen to be statistically significant at the 0.01% level, with a negative coefficient for the linear size -14.043 and a positive for the quadratic size^2 0.7191 (see Table 10).

An important point to consider is that after running the Woolridge test for autocorrelation in the panel data, it was concluded that there is first order autocorrelation within the panel data models.

Table 10:

Random Effects Estimation Results	medals
	-14.043***
Size	
	(3.41)
	.7191***
size^2	
	(.1481)
	67.5161***
Constant	
	(19.382
Observations	716
Number of countries	162
R-squared	0.2398
Standard errors in parenthesis	
*** p<0.01, **p<0.05, *p<0.1	

Possible Extensions

As the model presented does not account for all variables that create Olympic success there is much scope for extension. The dataset I used, though large at 716 observations, was limited to the games between 1996-2012. Data for 2016 was not yet available however should be to certain organisations, and to the future public. Perhaps extensions could include an entire analysis of every Olympic Games to get a complete picture.

There are also several outlier countries that may be influencing the data significantly such as United States, China, Great Britain, Russia, France, Germany and Australia and it might be useful to examine the data excluding these countries. Doing this however removes a significant proportion of medals won each year.

Conclusion

There may be a link between how much spending in terms of total volume in current US dollars on healthcare or military spending and Olympic success. However, depending on which statistical testing methods are used it is difficult to say for certain what is significant. A simple regression showed a positive link between military spending and medals won, and this relationship continued in the multiple regression. Using a panel data analysis with fixed effects regression also showed evidence of this relationship, though under robust conditions the chosen metrics for military spending were not statistically significant. This perhaps highlights the need for rigour in econometric analysis and conveys the need for caution when interpretation results.

Though the effect on medals was significant for both simple and multiple regression, it lost its significance in the more advanced panel data model. This is

a useful example of the need for correct model specification and an appreciation for the level of estimation involved in econometric results. Unfortunately, the specific effect of military spending on Olympic medal hauls remains somewhat unknown.

Reference List:

1. Bernard, A. and Busse, M. (2004). Who Wins the Olympic Games: Economic Resources and Medal Totals. Review of Economics and Statistics, 86(1), pp.413-417.
2. Hoffmann, R., Ging, L. and Ramasamy, B. (2002). Public Policy and Olympic Success. Applied Economics Letters, 9(8), pp.545-548.
3. Johnson, D. and Ali, A. (2004). A Tale of Two Seasons: Participation and Medal Counts at the Summer and Winter Olympic Games*. Social Science Quarterly, 85(4), pp.974-993.